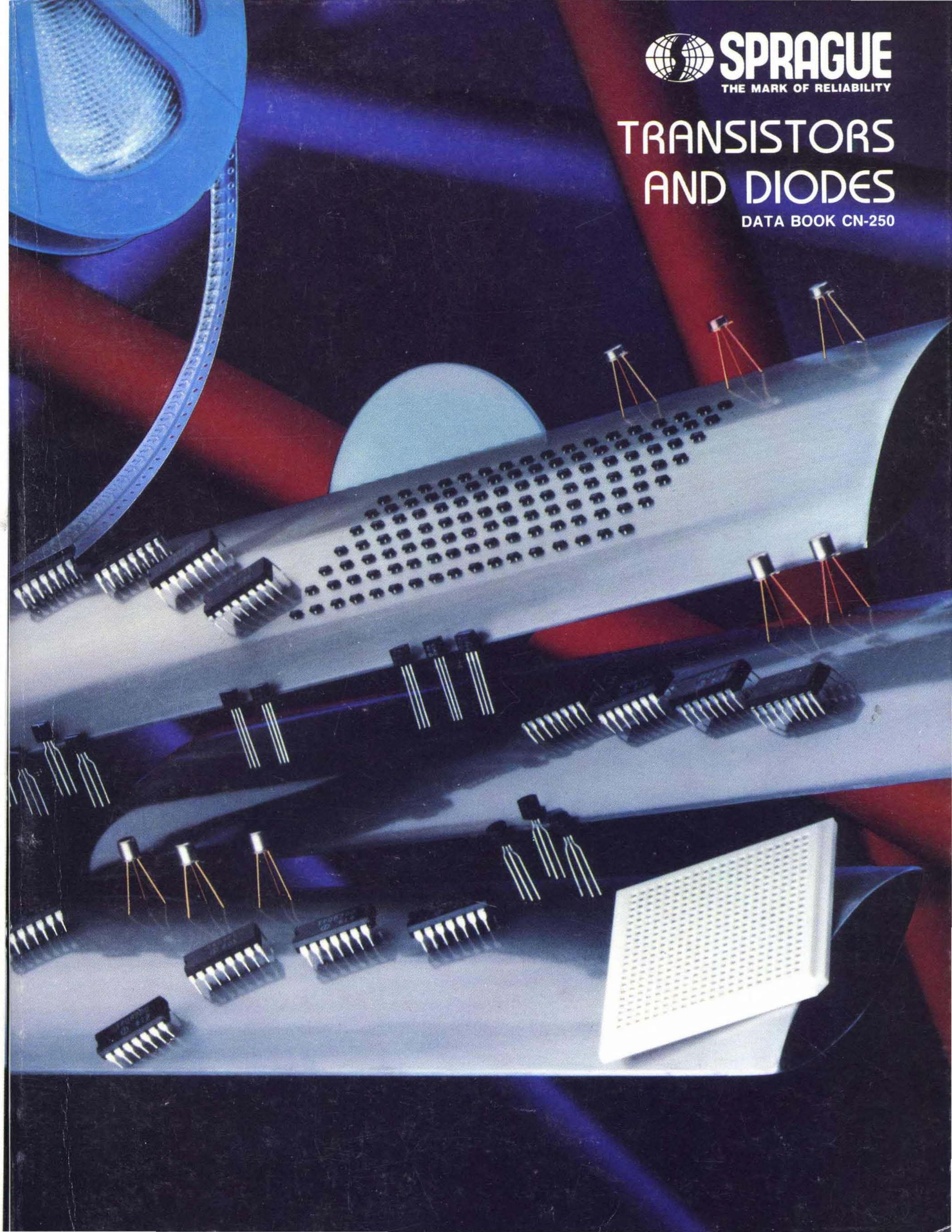
SPRAGUE
THE MARK OF RELIABILITY

TRANSISTORS AND DIODES

DATA BOOK CN-250



SPRAGUE
THE MARK OF RELIABILITY
TRANSISTORS AND DIODES
CN-250

SPRAGUE
THE MARK OF RELIABILITY

DISCRETE SEMICONDUCTORS

BIPOLAR TRANSISTORS
JFETS
DIODES
ZENERS
MOS CAPACITORS

Chips and Wafers
Plastic Packages
Small-Outline Packages
Transistor Arrays
Diode Arrays

SPRAGUE ELECTRIC COMPANY
A UNIT OF THE PENN CENTRAL CORPORATION

SEMICONDUCTOR DIVISION
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Our watchword is excellence. It is our standard in customer service and component quality, and we share the long-term Sprague commitment to it as The Mark of Reliability.

One of our goals is "to be our customer's most favored supplier." Our Commitment to Excellence program is one of the paths to that goal. It carries the message of quality and reliability to all of our people. It's everyone's job.

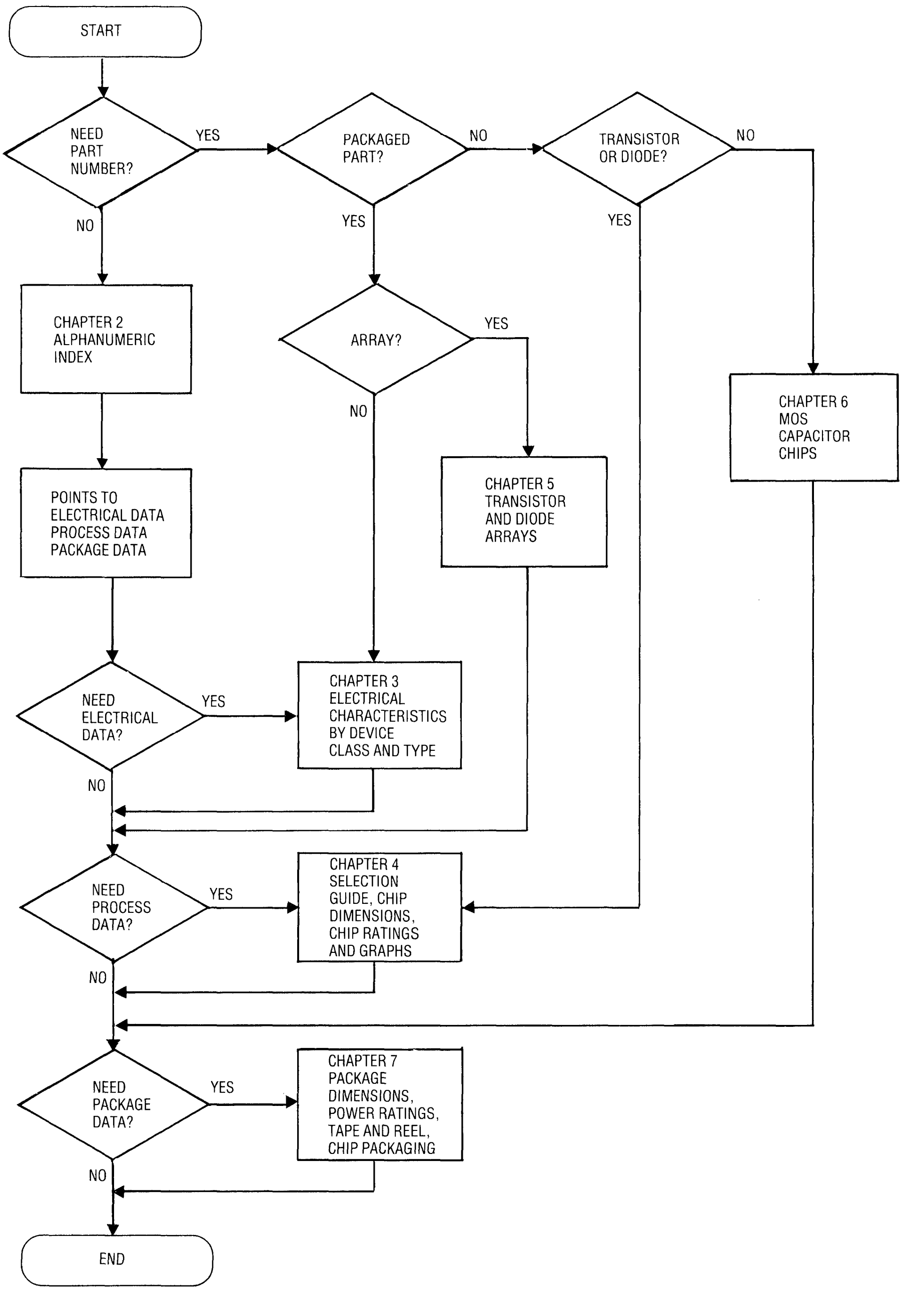
The Sprague Semiconductor Division uses statistical process control. It ships to stock. It has preferred vendor relationships with several of its customers. Our promise, however, runs deeper than top-notch tools, techniques and contracts. Commitment to Excellence delivers the backing of our entire organization in meeting your requirements.

We realize that only you, our customer, can be the judge of our effectiveness. We look forward to an opportunity to serve your needs.

Allan S. Kimball

Allan Kimball
General Manager

USING THE DATA BOOK



PART NUMBERING

THC 2222A

- **2222A** — **DEVICE TYPE.** THREE TO SIX DIGITS AND/OR LETTERS.
- **THC** — **DEVICE FAMILY.**
  - 2N = JEDEC-REGISTERED TRANSISTOR TYPE.
  - BAR = PRO-ELECTRON DIODE.
  - BAS = PRO-ELECTRON DIODE.
  - BAV = PRO-ELECTRON DIODE.
  - BAW = PRO-ELECTRON DIODE.
  - BZX = PRO-ELECTRON ZENER DIODE.
  - D = INDUSTRY STANDARD TRANSISTOR TYPE.
  - MPS = INDUSTRY STANDARD TRANSISTOR TYPE.
  - THBC = PRO-ELECTRON BIPOLAR TRANSISTOR CHIP.
  - THC = U.S. BIPOLAR TRANSISTOR CHIP.
  - THD = U.S. DIODE CHIP.
  - THJ = U.S. JUNCTION FIELD-EFFECT TRANSISTOR CHIP.
  - THJBF = PRO-ELECTRON JFET CHIP.
  - THZ = ZENER DIODE CHIP.
  - TMPD = DIODE IN SOT 23.
  - TMPF = JUNCTION FIELD-EFFECT TRANSISTOR IN SOT 23.
  - TMPT = BIPOLAR TRANSISTOR IN SOT 23.
  - TMPZ = ZENER DIODE IN SOT 23.
  - TND = DIODE ARRAY IN 14- OR 16-PIN PLASTIC DIP.
  - TP = TRANSISTOR IN TO-226AA/AB.
  - TPP = QUAD DARLINGTON ARRAY IN 14-PIN DIP.
  - TPQ = QUAD BIPOLAR TRANSISTOR ARRAY IN 14-PIN DIP.

MPS2222A C

- **C** — **AS SEMICONDUCTOR CHIP.**
- **MPS2222A** — **STANDARD INDUSTRY TYPE.**

UL N 2031 A

- **A** — **DUAL IN-LINE PLASTIC PACKAGE.**
- **2031** — **DEVICE TYPE.** FOUR DIGITS
- **N** — **OPERATING TEMPERATURE RANGE.**
  - N = COMMERCIAL/INDUSTRIAL. SEE DETAIL SPECIFICATIONS.
  - S = FULL MILITARY (−55°C TO +125°C).
- **UL** — **FAMILY.** MONOLITHIC TRANSISTOR OR DARLINGTON ARRAY.

CHIP COMPONENTS

The chip components group, located at the Concord, New Hampshire, headquarters of the Sprague Semiconductor Division, is dedicated to serving the hybrid circuit industry. We invite you to visit our manufacturing facility.

All semiconductors referenced in this data book are available in die or wafer form. Transistor and diode dice shown in Chapter 4 of this book are prime processes. Variations, using identical geometries, are produced by changing the epitaxial layers during wafer fabrication. The process modifications can be used to shift breakdown voltage and current-gain ratings to desired values. For additional information, call us in Concord.

Visual Inspection

All chips are visually inspected for flaws such as metallization or oxide defects, the presence of foreign material, and gold back-side or wafer-sawing defects.

Dice are subjected to visual inspections meeting, as a minimum, the criteria of MIL-STD-883 or MIL-STD-750, Methods 2072 and 2073.

Electrical Testing

State-of-the-art test equipment performs 100% die probe on wafers. Individual samples from each wafer are subjected to all ac and dc tests to guarantee an LPTD of 10% or a customer-specified LPTD or AQL.

Gold-Backed Chips

Appropriately doped gold is sputtered onto a sputter-etched surface and alloyed to form a back-side contact that accommodates epoxy or eutectic die-bonding methods.* N-type substrates receive sputtered arsenic-doped gold. P-type substrates receive sputtered gallium-doped gold. The standard gold backing is 3000 Å thick. Thicker gold backing can be furnished on request.

Silver-Backed Chips

Power devices can be furnished with an optional tri-metal silver back-side that is compatible with solder reflow bonding methods.

Packaging

Semiconductor dice are packaged in three ways:

1. As probed, unscribed wafers in separate wafer containers.
2. As probed and sawn wafers, mounted on PVC film in a steel frame and covered with protective plastic.
3. As individual dice, in a waffle or tray pack, with typically 400 devices per pack.

High-Reliability Products

We offer discrete semiconductor chips subjected to test requirements of MIL-STD-883, Method 5008, for Class S and Class B element evaluation, with the single exception of Group 4, Radiation Testing. Please contact the factory for detailed information on Sprague HYREL® processing.

NOTE

Parametric degradation, especially reduced low-current h_{FE} performance, often results if the base junction of a bipolar transistor is brought to breakdown conditions.

For this reason, Sprague Electric strongly recommends that you avoid subjecting the base junction of a transistor to breakdown tests such as those for $V_{(BR)CBO}$ or $V_{(BR)EBO}$. Those tests can be replaced by leakage tests, such as those for I_{EBO} and I_{CBO}, which safely confirm that devices are within specified limits. Tests for $V_{(BR)CEO}$ and $V_{(BR)CES}$ can be performed as standard procedures.

*Eutectic die-bonding temperatures should not exceed 450°C. A nitrogen/hydrogen (85/15) forming gas is recommended.

Device Type	Sprague Type	Ratings (Page)	Sprague Process	Package (Page)
1N457	THD457	3–63	TRB	7–26
1N458A	THD458A	3–63	TRR	7–26
1N459	THD459	3–63	TRO	7–26
	TMPD459	3–72	TRO	7–18
1N459A	THD459A	3–63	TRO	7–26
1N462	THD462	3–63	TRR	7–26
1N485	THD485	3–63	TRO	7–26
1N485B	THD485B	3–63	TRO	7–26
1N550	THD550	3–63	TRJ	7–26
1N645	THD645	3–63	TRJ	7–26
1N746	THZ3R3A05	3–65	ZAA	7–26
	THZ3R3A10	3–65	ZAA	7–26
1N747	THZ3R6A05	3–65	ZAA	7–26
	THZ3R6A10	3–65	ZAA	7–26
1N748	THZ3R9A05	3–65	ZAA	7–26
	THZ3R9A10	3–65	ZAA	7–26
1N749	THZ4R3A05	3–65	ZAA	7–26
	THZ4R3A10	3–65	ZAA	7–26
1N750	THZ4R7A05	3–65	ZAA	7–26
	THZ4R7A10	3–65	ZAA	7–26
1N751	THZ5R1A05	3–65	ZAA	7–26
	THZ5R1A10	3–65	ZAA	7–26
1N752	THZ5R6A05	3–65	ZCA	7–26
	THZ5R6A10	3–65	ZCA	7–26
1N753	THZ6R2A05	3–65	ZCA	7–26
	THZ6R2A10	3–65	ZCA	7–26
1N754	THZ6R8A05	3–65	ZCA	7–26
	THZ6R8A10	3–65	ZCA	7–26
1N755	THZ7R5A05	3–65	ZCA	7–26
	THZ7R5A10	3–65	ZCA	7–26
1N756	THZ8R2A05	3–65	ZCA	7–26
	THZ8R2A10	3–65	ZCA	7–26
1N757	THZ9R1A05	3–65	ZCA	7–26
	THZ9R1A10	3–65	ZCA	7–26
1N758	THZ010A05	3–65	ZCA	7–26
	THZ010A10	3–65	ZCA	7–26
1N759	THZ012A05	3–65	ZCA	7–26
	THZ012A10	3–65	ZCA	7–26
1N821	THZ821	3–70	ZHO	7–26
	TMPZ821	3–74	ZHO	7–18
1N821A	THZ821A	3–70	ZHO	7–26
	TMPZ821A	3–74	ZHO	7–18
1N823	THZ823	3–70	ZHO	7–26
	TMPZ823	3–74	ZHO	7–18
1N823A	THZ823A	3–70	ZHO	7–26
	TMPZ823A	3–74	ZHO	7–18
1N825	THZ825	3–70	ZHO	7–26
	TMPZ825	3–74	ZHO	7–18
1N825A	THZ825A	3–70	ZHO	7–26
	TMPZ825A	3–74	ZHO	7–18
1N827	THZ827	3–70	ZHO	7–26
	TMPZ827	3–74	ZHO	7–18
1N827A	THZ827A	3–70	ZHO	7–26
	TMPZ827A	3–74	ZHO	7–18

Device Type	Sprague Type	Ratings (Page)	Sprague Process	Package (Page)
1N914	THD914	3–63	TSB	7–26
	TMPD914	3–72	TSB	7–18
1N914A	THD914A	3–63	TSB	7–26
1N914B	THD914B	3–63	TSB	7–26
1N914NG	THD914NG	3–63	TRB	7–26
1N957	THZ6R8A05	3–65	ZCA	7–26
	THZ6R8A10	3–65	ZCA	7–26
1N958	THZ7R5A05	3–65	ZCA	7–26
	THZ7R5A10	3–65	ZCA	7–26
1N959	THZ8R2A05	3–65	ZCA	7–26
	THZ8R2A10	3–65	ZCA	7–26
1N960	THZ9R1A05	3–65	ZCA	7–26
	THZ9R1A10	3–65	ZCA	7–26
1N961	THZ010A05	3–65	ZCA	7–26
	THZ010A10	3–65	ZCA	7–26
1N962	THZ011A05	3–65	ZCA	7–26
	THZ011A10	3–65	ZCA	7–26
1N963	THZ012A05	3–65	ZCA	7–26
	THZ012A10	3–65	ZCA	7–26
1N964	THZ013A05	3–65	ZKA	7–26
	THZ013A10	3–65	ZKA	7–26
1N965	THZ015A05	3–65	ZKA	7–26
	THZ015A10	3–66	ZKA	7–26
1N966	THZ016A05	3–66	ZKA	7–26
	THZ016A10	3–66	ZKA	7–26
1N967	THZ018A05	3–66	ZKA	7–26
	THZ018A10	3–66	ZKA	7–26
1N968	THZ020A05	3–66	ZKA	7–26
	THZ020A10	3–66	ZKA	7–26
1N969	THZ022A05	3–66	ZKA	7–26
	THZ022A10	3–66	ZKA	7–26
1N970	THZ024A05	3–66	ZKA	7–26
	THZ024A10	3–66	ZKA	7–26
1N971	THZ027A05	3–66	ZEA	7–26
	THZ027A10	3–66	ZEA	7–26
1N972	THZ030A05	3–66	ZEA	7–26
	THZ030A10	3–66	ZEA	7–26
1N973	THZ033A05	3–66	ZEA	7–26
	THZ033A10	3–66	ZEA	7–26
1N974	THZ036A05	3–66	ZEA	7–26
	THZ036A10	3–66	ZEA	7–26
1N975	THZ039A05	3–66	ZEA	7–26
	THZ039A10	3–66	ZEA	7–26
1N976	THZ043A05	3–66	ZEA	7–26
	THZ043A10	3–66	ZEA	7–26
1N977	THZ047A05	3–66	ZEA	7–26
	THZ047A10	3–66	ZEA	7–26
1N978	THZ051A05	3–66	ZEA	7–26
	THZ051A10	3–66	ZEA	7–26
1N979	THZ056A05	3–66	ZEA	7–26
	THZ056A10	3–66	ZEA	7–26
1N3070	THD3070	3–63	TSO	7–26
1N3595	THD3595	3–63	TRR	7–26
1N3600	THD3600	3–63	TSS	7–26

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Device Type	Sprague Type	Ratings (Page)	Sprague Process	Package (Page)
	TMPZ4572	3–74	ZHQ	7–18
1N4572A	THZ4572A	3–70	ZHQ	7–26
	TMPZ4572A	3–74	ZHQ	7–18
1N4573	THZ4573	3–70	ZHQ	7–26
	TMPZ4573	3–74	ZHQ	7–18
1N4573A	THZ4573A	3–70	ZHQ	7–26
	TMPZ4573A	3–74	ZHQ	7–18
1N4575	THZ4575	3–70	ZHP	7–26
	TMPZ4575	3–74	ZHP	7–18
1N4575A	THZ4575A	3–70	ZHP	7–26
	TMPZ4575A	3–74	ZHP	7–18
1N4576	THZ4576	3–70	ZHP	7–26
	TMPZ4576	3–74	ZHP	7–18
1N4576A	THZ4576A	3–70	ZHP	7–26
	TMPZ4576A	3–74	ZHP	7–18
1N4577	THZ4577	3–70	ZHP	7–26
	TMPZ4577	3–74	ZHP	7–18
1N4577A	THZ4577A	3–70	ZHP	7–26
	TMPZ4577A	3–74	ZHP	7–18
1N4578	THZ4578	3–70	ZHP	7–26
	TMPZ4578	3–74	ZHP	7–18
1N4578A	THZ4578A	3–70	ZHP	7–26
	TMPZ4578A	3–74	ZHP	7–18
1N4610	THD4610	3–63	TSU	7–26
1N4614	THZ1R8B05	3–67	ZAA	7–26
	THZ1R8B10	3–67	ZAA	7–26
1N4615	THZ2R0B05	3–67	ZAA	7–26
	THZ2R0B10	3–67	ZAA	7–26
1N4616	THZ2R2B05	3–67	ZAA	7–26
	THZ2R2B10	3–67	ZAA	7–26
1N4617	THZ2R4B05	3–67	ZAA	7–26
	THZ2R4B10	3–67	ZAA	7–26
1N4618	THZ2R7B05	3–67	ZAA	7–26
	THZ2R7B10	3–67	ZAA	7–26
1N4619	THZ3R0B05	3–67	ZAA	7–26
	THZ3R0B10	3–67	ZAA	7–26
1N4620	THZ3R3B05	3–67	ZAA	7–26
	THZ3R3B10	3–67	ZAA	7–26
1N4621	THZ3R6B05	3–67	ZAA	7–26
	THZ3R6B10	3–67	ZAA	7–26
1N4622	THZ3R9B05	3–67	ZAA	7–26
	THZ3R9B10	3–67	ZAA	7–26
1N4623	THZ4R3B05	3–67	ZAA	7–26
	THZ4R3B10	3–67	ZAA	7–26
1N4624	THZ4R7B05	3–67	ZAA	7–26
	THZ4R7B10	3–67	ZAA	7–26
1N4625	THZ5R1B05	3–67	ZAA	7–26
	THZ5R1B10	3–67	ZAA	7–26
1N4626	THZ5R6B05	3–67	ZCA	7–26
	THZ5R6B10	3–67	ZCA	7–26
1N4627	THZ6R2B05	3–67	ZCA	7–26
	THZ6R2B10	3–67	ZCA	7–26
1N4734	THZ5R6W05	3–69	ZCD	7–26
	THZ5R6W10	3–69	ZCD	7–26
1N4735	THZ6R2W05	3–69	ZCD	7–26
	THZ6R2W10	3–69	ZCD	7–26
1N4736	THZ6R8W05	3–69	ZCD	7–26
	THZ6R8W10	3–69	ZCD	7–26
1N4737	THZ7R5W05	3–69	ZCD	7–26
	THZ7R5W10	3–69	ZCD	7–26
1N4738	THZ8R2W05	3–69	ZCD	7–26
	THZ8R2W10	3–69	ZCD	7–26
1N4739	THZ9R1W05	3–69	ZCD	7–26
	THZ9R1W10	3–69	ZCD	7–26
1N4740	THZ010W05	3–69	ZCD	7–26
	THZ010W10	3–69	ZCD	7–26
1N4741	THZ011W05	3–69	ZCD	7–26
	THZ011W10	3–69	ZCD	7–26
1N4742	THZ012W05	3–69	ZCD	7–26
	THZ012W10	3–69	ZCD	7–26
1N4743	THZ013W05	3–69	ZKD	7–26
	THZ013W10	3–69	ZKD	7–26
1N4744	THZ015W05	3–69	ZKD	7–26
	THZ015W10	3–69	ZKD	7–26
1N4745	THZ016W05	3–69	ZKD	7–26
	THZ016W10	3–69	ZKD	7–26
1N4746	THZ018W05	3–69	ZKD	7–26
	THZ018W10	3–69	ZKD	7–26
1N4747	THZ020W05	3–69	ZKD	7–26
	THZ020W10	3–69	ZKD	7–26
1N4748	THZ022W05	3–69	ZKD	7–26
	THZ022W10	3–69	ZKD	7–26
1N4749	THZ024W05	3–69	ZKD	7–26
	THZ024W10	3–69	ZKD	7–26
1N4750	THZ027W05	3–69	ZED	7–26
	THZ027W10	3–69	ZED	7–26
1N4751	THZ030W05	3–69	ZED	7–26
	THZ030W10	3–69	ZED	7–26
1N4752	THZ033W05	3–69	ZED	7–26
	THZ033W10	3–69	ZED	7–26
1N4753	THZ036W05	3–69	ZED	7–26
	THZ036W10	3–69	ZED	7–26
1N4754	THZ039W05	3–69	ZED	7–26
	THZ039W10	3–69	ZED	7–26
1N4755	THZ043W05	3–69	ZED	7–26
	THZ043W10	3–69	ZED	7–26
1N4756	THZ047W05	3–69	ZED	7–26
	THZ047W10	3–69	ZED	7–26
1N4757	THZ051W05	3–69	ZED	7–26
	THZ051W10	3–69	ZED	7–26
1N5223	THZ2R7A05	3–65	ZAA	7–26
	THZ2R7A10	3–65	ZAA	7–26
1N5224	THZ2R8A05	3–65	ZAA	7–26
	THZ2R8A10	3–65	ZAA	7–26
1N5225	THZ3R0A05	3–65	ZAA	7–26
	THZ3R0A10	3–65	ZAA	7–26
1N5226	THZ3R3A05	3–65	ZAA	7–26
	THZ3R3A10	3–65	ZAA	7–26

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Device Type	Sprague Type	Ratings (Page)	Sprague Process	Package (Page)
1N5227	THZ3R6A05	3–65	ZAA	7–26
	THZ3R6A10	3–65	ZAA	7–26
1N5228	THZ3R9A05	3–65	ZAA	7–26
	THZ3R9A10	3–65	ZAA	7–26
1N5229	THZ4R3A05	3–65	ZAA	7–26
	THZ4R3A10	3–65	ZAA	7–26
	TMPZ5229	3–73	ZAA	7–18
1N5230	THZ4R7A05	3–65	ZAA	7–26
	THZ4R7A10	3–65	ZAA	7–26
	TMPZ5230	3–73	ZAA	7–18
1N5231	THZ5R1A05	3–65	ZAA	7–26
	THZ5R1A10	3–65	ZAA	7–26
	TMPZ5231	3–73	ZAA	7–18
1N5232	THZ5R6A05	3–65	ZCA	7–26
	THZ5R6A10	3–65	ZCA	7–26
	TMPZ5232	3–73	ZCA	7–18
1N5233	THZ6R0A05	3–65	ZCA	7–26
	THZ6R0A10	3–65	ZCA	7–26
	TMPZ5233	3–65	ZCA	7–18
1N5234	THZ6R2A05	3–65	ZCA	7–26
	THZ6R2A10	3–65	ZCA	7–26
	TMPZ5234	3–73	ZCA	7–18
1N5235	THZ6R8A05	3–65	ZCA	7–26
	THZ6R8A10	3–65	ZCA	7–26
	TMPZ5235	3–73	ZCA	7–18
1N5236	THZ7R5A05	3–65	ZCA	7–26
	THZ7R5A10	3–65	ZCA	7–26
	TMPZ5236	3–73	ZCA	7–18
1N5237	THZ8R2A05	3–65	ZCA	7–26
	THZ8R2A10	3–65	ZCA	7–26
	TMPZ5237	3–73	ZCA	7–18
1N5238	THZ8R7A05	3–65	ZCA	7–26
	THZ8R7A10	3–65	ZCA	7–26
	TMPZ5238	3–73	ZCA	7–18
1N5239	THZ9R1A05	3–65	ZCA	7–26
	THZ9R1A10	3–65	ZCA	7–26
	TMPZ5239	3–73	ZCA	7–18
1N5240	THZ010A05	3–65	ZCA	7–26
	THZ010A10	3–65	ZCA	7–26
	TMPZ5240	3–73	ZCA	7–18
1N5241	THZ011A05	3–65	ZCA	7–26
	THZ011A10	3–65	ZCA	7–26
	TMPZ5241	3–73	ZCA	7–18
1N5242	THZ012A05	3–65	ZCA	7–26
	THZ012A10	3–65	ZCA	7–26
	TMPZ5242	3–73	ZCA	7–18
1N5243	THZ013A05	3–65	ZKA	7–26
	THZ013A10	3–65	ZKA	7–26
	TMPZ5243	3–73	ZKA	7–18
1N5244	THZ014A05	3–65	ZKA	7–26
	THZ014A10	3–65	ZKA	7–26
	TMPZ5244	3–73	ZKA	7–18
1N5245	THZ015A05	3–65	ZKA	7–26
	THZ015A10	3–66	ZKA	7–26
	TMPZ5245	3–73	ZKA	7–18
1N5246	THZ016A05	3–66	ZKA	7–26
	THZ016A10	3–66	ZKA	7–26
	TMPZ5246	3–73	ZKA	7–18
1N5247	THZ017A05	3–66	ZKA	7–26
	THZ017A10	3–66	ZKA	7–26
	TMPZ5247	3–73	ZKA	7–18
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	THZ018A10	3–66	ZKA	7–26
	TMPZ5248	3–73	ZKA	7–18
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	THZ019A10	3–66	ZKA	7–26
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1N5250	THZ020A05	3–66	ZKA	7–26
	THZ020A10	3–66	ZKA	7–26
	TMPZ5250	3–73	ZKA	7–18
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	THZ024A10	3–66	ZKA	7–26
	TMPZ5252	3–73	ZKA	7–18
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	THZ025A10	3–66	ZEA	7–26
	TMPZ5253	3–73	ZEA	7–18
1N5254	THZ027A05	3–66	ZEA	7–26
	THZ027A10	3–66	ZEA	7–26
	TMPZ5254	3–73	ZEA	7–18
1N5255	THZ028A05	3–66	ZEA	7–26
	THZ028A10	3–66	ZEA	7–26
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1N5256	THZ030A05	3–66	ZEA	7–26
	THZ030A10	3–66	ZEA	7–26
	TMPZ5256	3–73	ZEA	7–18
1N5257	THZ033A05	3–66	ZEA	7–26
	THZ033A10	3–66	ZEA	7–26
	TMPZ5257	3–73	ZEA	7–18
1N5258	THZ036A05	3–66	ZEA	7–26
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1N5259	THZ039A05	3–66	ZEA	7–26
	THZ039A10	3–66	ZEA	7–26
1N5260	THZ043A05	3–66	ZEA	7–26
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1N5261	THZ047A05	3–66	ZEA	7–26
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	THZ051A10	3–66	ZEA	7–26
1N5263	THZ056A05	3–66	ZEA	7–26
	THZ056A10	3–66	ZEA	7–26
1N5264	THZ060A05	3–66	ZEA	7–26
	THZ060A10	3–66	ZEA	7–26
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	TMPD5711	3–72	BKD	7–18
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2N760A	THC760A	3–3	BAA	7–26
2N915	THC915	3–3	BAA	7–26
2N916	THC916	3–3	BAA	7–26
2N917	THC917	3–3	DMA	7–26
2N918	THC918	3–3	DMA	7–26
	TMPT918	3–50	DMA	7–16
	TP918	3–30	DMA	7–8
2N929	THC929	3–3	BAA	7–26
2N929A	THC929A	3–3	BAA	7–26
2N930	THC930	3–3	BAA	7–26
	TP930	3–30	FEE	7–8
2N930A	THC930A	3–3	BAA	7–26
2N956	THC956	3–3	BBC	7–26
2N981	THC981	3–3	BAA	7–26
2N1420	THC1420	3–3	BBC	7–26
2N1566	THC1566	3–3	BAA	7–26
2N1613	THC1613	3–3	BBC	7–26
2N1711	THC1711	3–3	BBC	7–26
2N2017	THC2017	3–3	DAC	7–26
2N2102	THC2102	3–3	DAC	7–26
2N2192	THC2192	3–3	DAC	7–26
2N2192A	THC2192A	3–3	DAC	7–26
2N2195	THC2195	3–3	DAC	7–26
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2N2218	THC2218	3–3	BBC	7–26
	TP2218	3–30	JGA	7–8
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	TP2218A	3–30	DCA	7–8
2N2219	THC2219	3–3	BBC	7–26
	TP2219	3–30	JGA	7–8
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	TP2219A	3–30	DCA	7–8
2N2221	THC2221	3–3	BBC	7–26
	TMPT2221	3–50	JGA	7–16
	TP2221	3–30	JGA	7–8
	TPQ2221	5–5	TNL	7–24
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	TMPT2221A	3–51	DCA	7–16
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	TPQ2221A	5–5	TNL	7–24
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	TMPT2222	3–51	JGA	7–16
	TP2222	3–30	JGA	7–8
	TPQ2222	5–5	TNL	7–24
2N2222A	THC2222A	3–3	DCA	7–26
	TMPT2222A	3–51	DCA	7–16
	TP2222A	3–30	DCA	7–8
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2N2270	THC2270	3–3	DAC	7–26
2N2386	2N2386	3–62	PJ32	7–3
2N2483	TPQ2483	5–5	FEE	7–24
2N2484	THC2484	3–3	BAA	7–26
	TMPT2484	3–51	FEE	7–16
	TP2484	3–30	FEE	7–8
	TPQ2484	5–5	FEE	7–24
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2N2498	2N2498	3–62	PJ32	7–3
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2N2605	THC2605	3–15	BCA	7–26
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	TMPF2608	3–57	PJ32	7–17
	TP2608	3–48	PJ32	7–11
	2N2608	3–62	PJ32	7–2
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	TMPF2609	3–57	PJ32	7–17
	TP2609	3–48	PJ32	7–11
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2N2696	THC2696	3–15	BDA	7–26
2N2712	THC2712	3–4	BBC	7–26
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	TP2904A	3–39	DDA	7–8
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	TP2905	3–39	DDA	7–8
2N2905A	THC2905A	3–15	BDA	7–26
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	TMPT2906	3–52	DDA	7–16
	TP2906	3–39	DDA	7–8
	TPQ2906	5–5	TQL	7–24
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	TMPT2906A	3–52	DDA	7–16
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	TPQ2906A	5–5	TQL	7–24
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	TP2907	3–39	DDA	7–8
	TPQ2907	5–5	TQL	7–24
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2N3444	THC3444	3–5	BHB	7–26
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2N3458	THJ3458	3–24	NJ32	7–26
	TMPF3458	3–54	NJ32	7–17
	TP3458	3–45	NJ32	7–11
	2N3458	3–58	NJ32	7–2
2N3459	THJ3459	3–24	NJ16	7–26
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	TP3459	3–45	NJ16	7–11
	2N3459	3–58	NJ16	7–2
2N3460	THJ3460	3–24	NJ16	7–26
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	TP3460	3–45	NJ16	7–11
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2N3505	THC3505	3–16	BDA	7–26
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2N3550	THC3550	3–16	BXE	7–26
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2N3646	THC3646	3–5	BJB	7–26
2N3691	THC3691	3–5	BAA	7–26
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2N3692	THC3692	3–5	BAA	7–26
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2N3693	THC3693	3–5	FFB	7–26
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2N3708	THC3708	3–5	BAA	7–26
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2N3709	THC3709	3–5	BAA	7–26
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	TMPF3971	3–54	NJ132	7–17
	TP3971	3–45	NJ132	7–11
	2N3971	3–60	NJ132	7–2
2N3972	THJ3972	3–24	NJ132	7–26
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	TP3972	3–45	NJ132	7–11
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2N3976	THC3976	3–6	BBC	7–26
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	TP3993	3–48	PJ99	7–11
	2N3993	3–62	PJ99	7–6
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2N4062	THC4062	3–17	BXE	7–26
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	TMPF4091	3–54	NJ132	7–17
	TP4091	3–45	NJ132	7–11
	2N4091	3–60	NJ132	7–2
2N4092	THJ4092	3–24	NJ132	7–26
	TMPF4092	3–54	NJ132	7–17
	TP4092	3–45	NJ132	7–11
	2N4092	3–60	NJ132	7–2
2N4093	THJ4093	3–24	NJ132	7–26
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	TP4093	3–45	NJ132	7–11
	2N4093	3–60	NJ132	7–2
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2N4124	THC4124	3–6	BAA	7–26
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	TMPT4125	3–53	BXE	7–16
	2N4125	3–40	BXE	7–8
2N4126	THC4126	3–17	BXE	7–26
	TMPT4126	3–53	BXE	7–16
	2N4126	3–40	BXE	7–8
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	2N4140	3–32	DCA	7–8
2N4141	THC4141	3–6	DCA	7–26
	2N4141	3–32	DCA	7–8
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	2N4143	3–40	BJB	7–8
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	TP4856A	3–45	NJ132	7–11
	2N4856A	3–60	NJ132	7–2
2N4857	THJ4857	3–25	NJ132	7–26
	TMPF4857	3–54	NJ132	7–17
	TP4857	3–45	NJ132	7–11
	2N4857	3–60	NJ132	7–2
2N4857A	THJ4857A	3–25	NJ132	7–26
	TMPF4857A	3–54	NJ132	7–17
	TP4857A	3–45	NJ132	7–11
	2N4857A	3–60	NJ132	7–2
2N4858	THJ4858	3–25	NJ132	7–26
	TMPF4858	3–54	NJ132	7–17
	TP4858	3–45	NJ132	7–11
	2N4858	3–60	NJ132	7–2
2N4858A	THJ4858A	3–25	NJ132	7–26
	TMPF4858A	3–55	NJ132	7–17
	TP4858A	3–46	NJ132	7–11
	2N4858A	3–60	NJ132	7–2
2N4859	THJ4859	3–25	NJ132	7–26
	TMPF4859	3–55	NJ132	7–17
	TP4859	3–46	NJ132	7–11
	2N4859	3–60	NJ132	7–2
2N4859A	THJ4859A	3–25	NJ132	7–26
	TMPF4859A	3–55	NJ132	7–17
	TP4859A	3–46	NJ132	7–11
	2N4859A	3–60	NJ132	7–2
2N4860	THJ4860	3–25	NJ132	7–26
	TMPF4860	3–55	NJ132	7–17
	TP4860	3–46	NJ132	7–11
	2N4860	3–60	NJ132	7–2
2N4860A	THJ4860A	3–25	NJ132	7–26
	TMPF4860A	3–55	NJ132	7–17
	TP4860A	3–46	NJ132	7–11
	2N4860A	3–60	NJ132	7–2
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	TMPF4861	3–55	NJ132	7–17
	TP4861	3–46	NJ132	7–11
	2N4861	3–60	NJ132	7–2
2N4861A	THJ4861A	3–25	NJ132	7–26
	TMPF4861A	3–55	NJ132	7–17
	TP4861A	3–46	NJ132	7–11
	2N4861A	3–60	NJ132	7–2
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	TMPF4867	3–55	NJ16	7–17
	TP4867	3–46	NJ16	7–11
2N4868	THJ4868	3–25	NJ16	7–26
	TMPF4868	3–55	NJ16	7–17
	TP4868	3–46	NJ16	7–11
2N4869	THJ4869	3–25	NJ16	7–26
	TMPF4869	3–55	NJ16	7–17
	TP4869	3–46	NJ16	7–11
2N4916	THC4916	3–17	BTB	7–26
	2N4916	3–40	BTB	7–8
2N4917	THC4917	3–17	BTB	7–26
	2N4917	3–40	BTB	7–8
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	TP4926	3–32	BLA	7–8
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	2N4945	3–32	DCA	7–8
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	2N4951	3–32	DCA	7–9
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	TP5373	3–41	JFA	7–8
2N5374	THC5374	3–18	BDA	7–26
	TP5374	3–41	JFA	7–8
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	TP5375	3–41	JFA	7–8
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	TP5376	3–33	JGA	7–8
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	TP5377	3–33	JGA	7–8
2N5378	THC5378	3–18	BDA	7–26
	TP5378	3–41	JFA	7–8
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2N5380	THC5380	3–8	FFB	7–26
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	TMPF5458	3–55	NJ32	7–17
	2N5458	3–46	NJ32	7–11
2N5459	THJ5459	3–26	NJ32	7–26
	TMPF5459	3–55	NJ32	7–17
	2N5459	3–46	NJ32	7–11
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	TMPF5460	3–57	PJ32	7–17
	2N5460	3–49	PJ32	7–11
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	TMPF5461	3–57	PJ32	7–17
	2N5461	3–49	PJ32	7–11
2N5462	THJ5462	3–28	PJ32	7–26
	TMPF5462	3–57	PJ32	7–17
	2N5462	3–49	PJ32	7–11
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	TMPF5484	3–55	NJ26	7–17
	2N5484	3–46	NJ26	7–11
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	TMPF5485	3–55	NJ26	7–17
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BCW31	BCW31	3–50	FEE	7–16
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BCW33	BCW33	3–50	FEE	7–16
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THJ2608	THJ2608	3–28	PJ32	7–26
THJ2609	THJ2609	3–28	PJ32	7–26
THJ3329	THJ3329	3–28	PJ32	7–26
THJ3330	THJ3330	3–28	PJ32	7–26
THJ3331	THJ3331	3–28	PJ32	7–26
THJ3332	THJ3332	3–28	PJ32	7–26
THJ3369	THJ3369	3–24	NJ16	7–26
THJ3370	THJ3370	3–24	NJ16	7–26
THJ3458	THJ3458	3–24	NJ32	7–26
THJ3459	THJ3459	3–24	NJ16	7–26
THJ3460	THJ3460	3–24	NJ16	7–26
THJ3819	THJ3819	3–24	NJ32	7–26
THJ3820	THJ3820	3–28	PJ32	7–26
THJ3821	THJ3821	3–24	NJ16	7–26
THJ3822	THJ3822	3–24	NJ32	7–26
THJ3823	THJ3823	3–24	NJ32	7–26
THJ3824	THJ3824	3–24	NJ32	7–26
THJ3954	THJ3954	3–24	NJ35D	7–26
THJ3955	THJ3955	3–24	NJ35D	7–26
THJ3956	THJ3956	3–24	NJ35D	7–26
THJ3957	THJ3957	3–24	NJ35D	7–26
THJ3966	THJ3966	3–24	NJ26	7–26
THJ3967	THJ3967	3–24	NJ26	7–26
THJ3967A	THJ3967A	3–24	NJ26	7–26
THJ3968	THJ3968	3–24	NJ26	7–26
THJ3968A	THJ3968A	3–24	NJ26	7–26
THJ3969	THJ3969	3–24	NJ16	7–26
THJ3969A	THJ3969A	3–24	NJ16	7–26
THJ3970	THJ3970	3–24	NJ132	7–26
THJ3971	THJ3971	3–24	NJ132	7–26
THJ3972	THJ3972	3–24	NJ132	7–26
THJ3993	THJ3993	3–28	PJ99	7–26
THJ3994	THJ3994	3–28	PJ99	7–26
THJ4091	THJ4091	3–24	NJ132	7–26
THJ4092	THJ4092	3–24	NJ132	7–26
THJ4093	THJ4093	3–24	NJ132	7–26
THJ4117	THJ4117	3–24	NJ01	7–26
THJ4118	THJ4118	3–24	NJ01	7–26
THJ4119	THJ4119	3–24	NJ01	7–26
THJ4220	THJ4220	3–24	NJ16	7–26
THJ4221	THJ4221	3–24	NJ32	7–26
THJ4222	THJ4222	3–24	NJ32	7–26
THJ4223	THJ4223	3–24	NJ32	7–26
THJ4224	THJ4224	3–24	NJ32	7–26
THJ4302	THJ4302	3–24	NJ26	7–26
THJ4303	THJ4303	3–24	NJ26	7–26
THJ4304	THJ4304	3–24	NJ26	7–26
THJ4338	THJ4338	3–24	NJ16	7–26
THJ4339	THJ4339	3–24	NJ16	7–26
THJ4340	THJ4340	3–24	NJ16	7–26
THJ4341	THJ4341	3–24	NJ16	7–26
THJ4381	THJ4381	3–28	PJ32	7–26
THJ4391	THJ4391	3–24	NJ132	7–26
THJ4392	THJ4392	3–24	NJ132	7–26
THJ4393	THJ4393	3–24	NJ132	7–26
THJ4416	THJ4416	3–24	NJ26	7–26
THJ4416A	THJ4416A	3–25	NJ26	7–26
THJ4856	THJ4856	3–25	NJ132	7–26
THJ4856A	THJ4856A	3–25	NJ132	7–26
THJ4857	THJ4857	3–25	NJ132	7–26
THJ4857A	THJ4857A	3–25	NJ132	7–26
THJ4858	THJ4858	3–25	NJ132	7–26
THJ4858A	THJ4858A	3–25	NJ132	7–26
THJ4859	THJ4859	3–25	NJ132	7–26
THJ4859A	THJ4859A	3–25	NJ132	7–26
THJ4860	THJ4860	3–25	NJ132	7–26
THJ4860A	THJ4860A	3–25	NJ132	7–26
THJ4861	THJ4861	3–25	NJ132	7–26
THJ4861A	THJ4861A	3–25	NJ132	7–26
THJ4867	THJ4867	3–25	NJ16	7–26
THJ4868	THJ4868	3–25	NJ16	7–26
THJ4869	THJ4869	3–25	NJ16	7–26

Device Type	Sprague Type	Ratings (Page)	Sprague Process	Package (Page)	Device Type	Sprague Type	Ratings (Page)	Sprague Process	Package (Page)
THZ8R2B05	THZ8R2B05	3–67	ZCA	7–26	THZ017A05	THZ017A05	3–66	ZKA	7–26
THZ8R2B10	THZ8R2B10	3–67	ZCA	7–26	THZ017A10	THZ017A10	3–66	ZKA	7–26
THZ8R2W05	THZ8R2W05	3–69	ZCD	7–26	THZ017B05	THZ017B05	3–68	ZKA	7–26
THZ8R2W10	THZ8R2W10	3–69	ZCD	7–26	THZ017B10	THZ017B10	3–68	ZKA	7–26
THZ8R7A05	THZ8R7A05	3–65	ZCA	7–26	THZ018A05	THZ018A05	3–66	ZKA	7–26
THZ8R7A10	THZ8R7A10	3–65	ZCA	7–26	THZ018A10	THZ018A10	3–66	ZKA	7–26
THZ8R7B05	THZ8R7B05	3–67	ZCA	7–26	THZ018B05	THZ018B05	3–68	ZKA	7–26
THZ8R7B10	THZ8R7B10	3–67	ZCA	7–26	THZ018B10	THZ018B10	3–68	ZKA	7–26
THZ9R1A05	THZ9R1A05	3–65	ZCA	7–26	THZ018W05	THZ018W05	3–69	ZKD	7–26
THZ9R1A10	THZ9R1A10	3–65	ZCA	7–26	THZ018W10	THZ018W10	3–69	ZKD	7–26
THZ9R1B05	THZ9R1B05	3–67	ZCA	7–26	THZ019A05	THZ019A05	3–66	ZKA	7–26
THZ9R1B10	THZ9R1B10	3–67	ZCA	7–26	THZ019A10	THZ019A10	3–66	ZKA	7–26
THZ9R1W05	THZ9R1W05	3–69	ZCD	7–26	THZ019B05	THZ019B05	3–68	ZKA	7–26
THZ9R1W10	THZ9R1W10	3–69	ZCD	7–26	THZ019B10	THZ019B10	3–68	ZKA	7–26
THZ010A05	THZ010A05	3–65	ZCA	7–26	THZ020A05	THZ020A05	3–66	ZKA	7–26
THZ010A10	THZ010A10	3–65	ZCA	7–26	THZ020A10	THZ020A10	3–66	ZKA	7–26
THZ010B05	THZ010B05	3–67	ZCA	7–26	THZ020B05	THZ020B05	3–68	ZKA	7–26
THZ010B10	THZ010B10	3–67	ZCA	7–26	THZ020B10	THZ020B10	3–68	ZKA	7–26
THZ010W05	THZ010W05	3–69	ZCD	7–26	THZ020W05	THZ020W05	3–69	ZKD	7–26
THZ010W10	THZ010W10	3–69	ZCD	7–26	THZ020W10	THZ020W10	3–69	ZKD	7–26
THZ011A05	THZ011A05	3–65	ZCA	7–26	THZ022A05	THZ022A05	3–66	ZKA	7–26
THZ011A10	THZ011A10	3–65	ZCA	7–26	THZ022A10	THZ022A10	3–66	ZKA	7–26
THZ011B05	THZ011B05	3–67	ZCA	7–26	THZ022B05	THZ022B05	3–68	ZKA	7–26
THZ011B10	THZ011B10	3–67	ZCA	7–26	THZ022B10	THZ022B10	3–68	ZKA	7–26
THZ011W05	THZ011W05	3–69	ZCD	7–26	THZ022W05	THZ022W05	3–69	ZKD	7–26
THZ011W10	THZ011W10	3–69	ZCD	7–26	THZ022W10	THZ022W10	3–69	ZKD	7–26
THZ012A05	THZ012A05	3–65	ZCA	7–26	THZ024A05	THZ024A05	3–66	ZKA	7–26
THZ012A10	THZ012A10	3–65	ZCA	7–26	THZ024A10	THZ024A10	3–66	ZKA	7–26
THZ012B05	THZ012B05	3–67	ZCA	7–26	THZ024B05	THZ024B05	3–68	ZKA	7–26
THZ012B10	THZ012B10	3–67	ZCA	7–26	THZ024B10	THZ024B10	3–68	ZKA	7–26
THZ012W05	THZ012W05	3–69	ZCD	7–26	THZ024W05	THZ024W05	3–69	ZKD	7–26
THZ012W10	THZ012W10	3–69	ZCD	7–26	THZ024W10	THZ024W10	3–69	ZKD	7–26
THZ013A05	THZ013A05	3–65	ZKA	7–26	THZ025A05	THZ025A05	3–66	ZEA	7–26
THZ013A10	THZ013A10	3–65	ZKA	7–26	THZ025A10	THZ025A10	3–66	ZEA	7–26
THZ013B05	THZ013B05	3–67	ZKA	7–26	THZ025B05	THZ025B05	3–68	ZEA	7–26
THZ013B10	THZ013B10	3–68	ZKA	7–26	THZ025B10	THZ025B10	3–68	ZEA	7–26
THZ013W05	THZ013W05	3–69	ZKD	7–26	THZ027A05	THZ027A05	3–66	ZEA	7–26
THZ013W10	THZ013W10	3–69	ZKD	7–26	THZ027A10	THZ027A10	3–66	ZEA	7–26
THZ014A05	THZ014A05	3–65	ZKA	7–26	THZ027B05	THZ027B05	3–68	ZEA	7–26
THZ014A10	THZ014A10	3–65	ZKA	7–26	THZ027B10	THZ027B10	3–68	ZEA	7–26
THZ014B05	THZ014B05	3–68	ZKA	7–26	THZ027W05	THZ027W05	3–69	ZED	7–26
THZ014B10	THZ014B10	3–68	ZKA	7–26	THZ027W10	THZ027W10	3–69	ZED	7–26
THZ015A05	THZ015A05	3–65	ZKA	7–26	THZ028A05	THZ028A05	3–66	ZEA	7–26
THZ015A10	THZ015A10	3–66	ZKA	7–26	THZ028A10	THZ028A10	3–66	ZEA	7–26
THZ015B05	THZ015B05	3–68	ZKA	7–26	THZ028B05	THZ028B05	3–68	ZEA	7–26
THZ015B10	THZ015B10	3–68	ZKA	7–26	THZ028B10	THZ028B10	3–68	ZEA	7–26
THZ015W05	THZ015W05	3–69	ZKD	7–26	THZ030A05	THZ030A05	3–66	ZEA	7–26
THZ015W10	THZ015W10	3–69	ZKD	7–26	THZ030A10	THZ030A10	3–66	ZEA	7–26
THZ016A05	THZ016A05	3–66	ZKA	7–26	THZ030B05	THZ030B05	3–68	ZEA	7–26
THZ016A10	THZ016A10	3–66	ZKA	7–26	THZ030B10	THZ030B10	3–68	ZEA	7–26
THZ016B05	THZ016B05	3–68	ZKA	7–26	THZ030W05	THZ030W05	3–69	ZED	7–26
THZ016B10	THZ016B10	3–68	ZKA	7–26	THZ030W10	THZ030W10	3–69	ZED	7–26
THZ016W05	THZ016W05	3–69	ZKD	7–26	THZ033A05	THZ033A05	3–66	ZEA	7–26
THZ016W10	THZ016W10	3–69	ZKD	7–26	THZ033A10	THZ033A10	3–66	ZEA	7–26

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TMPD459	TMPD459	3–72	TRO	7–18
TMPD914	TMPD914	3–72	TSB	7–18
TMPD2835	TMPD2835	3–72	DOB	7–21
TMPD2836	TMPD2836	3–72	DOB	7–21
TMPD2837	TMPD2837	3–72	DBA	7–19
TMPD2838	TMPD2838	3–72	DBA	7–19
TMPD4148	TMPD4148	3–72	TSB	7–18
TMPD4150	TMPD4150	3–72	TSS	7–18
TMPD4153	TMPD4153	3–72	TSB	7–18
TMPD4154	TMPD4154	3–72	TSB	7–18
TMPD4447	TMPD4447	3–72	TSB	7–18
TMPD4448	TMPD4448	3–72	TSS	7–18
TMPD5711	TMPD5711	3–72	BKA	7–18
TMPD6050	TMPD6050	3–72	TSB	7–18
TMPD6100	TMPD6100	3–72	DBA	7–19
TMPD6916	TMPD6916	3–72	BKA	7–18
TMPD6919	TMPD6919	3–72	BKF	7–18
TMPD6924	TMPD6924	3–72	BKD	7–18
TMPD7000	TMPD7000	3–72	TSB	7–20
TMPF2608	TMPF2608	3–57	PJ32	7–17
TMPF2609	TMPF2609	3–57	PJ32	7–17
TMPF3329	TMPF3329	3–57	PJ32	7–17
TMPF3330	TMPF3330	3–57	PJ32	7–17
TMPF3331	TMPF3331	3–57	PJ32	7–17
TMPF3332	TMPF3332	3–57	PJ32	7–17
TMPF3369	TMPF3369	3–54	NJ16	7–17
TMPF3370	TMPF3370	3–54	NJ16	7–17
TMPF3458	TMPF3458	3–54	NJ132	7–17
TMPF3459	TMPF3459	3–54	NJ16	7–17
TMPF3460	TMPF3460	3–54	NJ16	7–17
TMPF3819	TMPF3819	3–54	NJ32	7–17
TMPF3820	TMPF3820	3–57	PJ32	7–17
TMPF3821	TMPF3821	3–54	NJ32	7–17
TMPF3822	TMPF3822	3–54	NJ32	7–17
TMPF3823	TMPF3823	3–54	NJ32	7–17
TMPF3824	TMPF3824	3–54	NJ32	7–17
TMPF3966	TMPF3966	3–54	NJ26	7–17
TMPF3967	TMPF3967	3–54	NJ26	7–17
TMPF3967A	TMPF3967A	3–54	NJ26	7–17
TMPF3968	TMPF3968	3–54	NJ26	7–17
TMPF3968A	TMPF3968A	3–54	NJ26	7–17
TMPF3969	TMPF3969	3–54	NJ16	7–17
TMPF3969A	TMPF3969A	3–54	NJ16	7–17
TMPF3970	TMPF3970	3–54	NJ132	7–17
TMPF3971	TMPF3971	3–54	NJ132	7–17
TMPF3972	TMPF3972	3–54	NJ132	7–17
TMPF3993	TMPF3993	3–57	PJ99	7–17
TMPF3994	TMPF3994	3–57	PJ99	7–17
TMPF4091	TMPF4091	3–54	NJ132	7–17
TMPF4092	TMPF4092	3–54	NJ132	7–17
TMPF4093	TMPF4093	3–54	NJ132	7–17
TMPF4117	TMPF4117	3–54	NJ01	7–17
TMPF4118	TMPF4118	3–54	NJ01	7–17
TMPF4119	TMPF4119	3–54	NJ01	7–17

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TMPF4220	TMPF4220	3–54	NJ16	7–17
TMPF4221	TMPF4221	3–54	NJ32	7–17
TMPF4222	TMPF4222	3–54	NJ32	7–17
TMPF4223	TMPF4223	3–54	NJ32	7–17
TMPF4224	TMPF4224	3–54	NJ32	7–17
TMPF4302	TMPF4302	3–54	NJ26	7–17
TMPF4303	TMPF4303	3–54	NJ26	7–17
TMPF4304	TMPF4304	3–54	NJ26	7–17
TMPF4338	TMPF4338	3–54	NJ16	7–17
TMPF4339	TMPF4339	3–54	NJ16	7–17
TMPF4340	TMPF4340	3–54	NJ16	7–17
TMPF4341	TMPF4341	3–54	NJ16	7–17
TMPF4381	TMPF4381	3–57	PJ32	7–17
TMPF4391	TMPF4391	3–54	NJ132	7–17
TMPF4392	TMPF4392	3–54	NJ132	7–17
TMPF4393	TMPF4393	3–54	NJ132	7–17
TMPF4416	TMPF4416	3–54	NJ26	7–17
TMPF4416A	TMPF4416A	3–54	NJ26	7–17
TMPF4856	TMPF4856	3–54	NJ132	7–17
TMPF4856A	TMPF4856A	3–54	NJ132	7–17
TMPF4857	TMPF4857	3–54	NJ132	7–17
TMPF4857A	TMPF4857A	3–54	NJ132	7–17
TMPF4858	TMPF4858	3–54	NJ132	7–17
TMPF4858A	TMPF4858A	3–55	NJ132	7–17
TMPF4859	TMPF4859	3–55	NJ132	7–17
TMPF4859A	TMPF4859A	3–55	NJ132	7–17
TMPF4860	TMPF4860	3–55	NJ132	7–17
TMPF4860A	TMPF4860A	3–55	NJ132	7–17
TMPF4861	TMPF4861	3–55	NJ132	7–17
TMPF4861A	TMPF4861A	3–55	NJ132	7–17
TMPF4867	TMPF4867	3–55	NJ16	7–17
TMPF4868	TMPF4868	3–55	NJ16	7–17
TMPF4869	TMPF4869	3–55	NJ16	7–17
TMPF5018	TMPF5018	3–57	PJ99	7–17
TMPF5019	TMPF5019	3–57	PJ99	7–17
TMPF5020	TMPF5020	3–57	PJ32	7–17
TMPF5021	TMPF5021	3–57	PJ32	7–17
TMPF5033	TMPF5033	3–57	PJ32	7–17
TMPF5078	TMPF5078	3–55	NJ26	7–17
TMPF5103	TMPF5103	3–55	NJ26	7–17
TMPF5104	TMPF5104	3–55	NJ26	7–17
TMPF5105	TMPF5105	3–55	NJ26	7–17
TMPF5114	TMPF5114	3–57	PJ99	7–17
TMPF5115	TMPF5115	3–57	PJ99	7–17
TMPF5116	TMPF5116	3–57	PJ99	7–17
TMPF5163	TMPF5163	3–55	NJ26	7–17
TMPF5245	TMPF5245	3–55	NJ26	7–17
TMPF5246	TMPF5246	3–55	NJ26	7–17
TMPF5247	TMPF5247	3–55	NJ26	7–17
TMPF5248	TMPF5248	3–55	NJ26	7–17
TMPF5358	TMPF5358	3–55	NJ16	7–17
TMPF5359	TMPF5359	3–55	NJ16	7–17
TMPF5360	TMPF5360	3–55	NJ16	7–17
TMPF5361	TMPF5361	3–55	NJ16	7–17

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TMPF5362	TMPF5362	3–55	NJ32	7–17	TMPFJ114	TMPFJ114	3–57	NJ99	7–17
TMPF5363	TMPF5363	3–55	NJ32	7–17	TMPFJ174	TMPFJ174	3–57	PJ99	7–17
TMPF5364	TMPF5364	3–55	NJ32	7–17	TMPFJ175	TMPFJ175	3–57	PJ99	7–17
TMPF5397	TMPF5397	3–55	NJ26L	7–17	TMPFJ176	TMPFJ176	3–57	PJ99	7–17
TMPF5398	TMPF5398	3–55	NJ26L	7–17	TMPFJ177	TMPFJ177	3–57	PJ99	7–17
TMPF5457	TMPF5457	3–55	NJ32	7–17	TMPFJ201	TMPFJ201	3–56	NJ16	7–17
TMPF5458	TMPF5458	3–55	NJ32	7–17	TMPFJ202	TMPFJ202	3–56	NJ16	7–17
TMPF5459	TMPF5459	3–55	NJ32	7–17	TMPFJ203	TMPFJ203	3–56	NJ32	7–17
TMPF5460	TMPF5460	3–57	PJ32	7–17	TMPFJ210	TMPFJ210	3–56	NJ26L	7–17
TMPF5461	TMPF5461	3–57	PJ32	7–17	TMPFJ211	TMPFJ211	3–56	NJ26L	7–17
TMPF5462	TMPF5462	3–57	PJ32	7–17	TMPFJ212	TMPFJ212	3–56	NJ26L	7–17
TMPF5484	TMPF5484	3–55	NJ26	7–17	TMPFJ230	TMPFJ230	3–56	NJ16	7–17
TMPF5485	TMPF5485	3–55	NJ26	7–17	TMPFJ231	TMPFJ231	3–56	NJ16	7–17
TMPF5486	TMPF5486	3–55	NJ26	7–17	TMPFJ232	TMPFJ232	3–56	NJ16	7–17
TMPF5555	TMPF5555	3–55	NJ26	7–17	TMPFJ270	TMPFJ270	3–57	PJ99	7–17
TMPF5556	TMPF5556	3–55	NJ16	7–17	TMPFJ271	TMPFJ271	3–57	PJ99	7–17
TMPF5557	TMPF5557	3–55	NJ16	7–17	TMPFJ300A	TMPFJ300A	3–56	NJ26L	7–17
TMPF5558	TMPF5558	3–55	NJ16	7–17	TMPFJ300B	TMPFJ300B	3–56	NJ26L	7–17
TMPF5638	TMPF5638	3–55	NJ132	7–17	TMPFJ300C	TMPFJ300C	3–56	NJ26L	7–17
TMPF5639	TMPF5639	3–55	NJ99	7–17	TMPFJ304	TMPFJ304	3–56	NJ26	7–17
TMPF5640	TMPF5640	3–55	NJ99	7–17	TMPFJ305	TMPFJ305	3–56	NJ26	7–17
TMPF5653	TMPF5653	3–55	NJ99	7–17	TMPFJ308	TMPFJ308	3–56	NJ99	7–17
TMPF5654	TMPF5654	3–55	NJ99	7–17	TMPFJ309	TMPFJ309	3–56	NJ99	7–17
TMPF5668	TMPF5668	3–55	NJ16	7–17	TMPFJ310	TMPFJ310	3–56	NJ99	7–17
TMPF5669	TMPF5669	3–55	NJ32	7–17	TMPFP1086	TMPFP1086	3–57	PJ99	7–17
TMPF5670	TMPF5670	3–55	NJ32	7–17	TMPFP1087	TMPFP1087	3–57	PJ99	7–17
TMPF5949	TMPF5949	3–55	NJ32	7–17	TMPFU1897	TMPFU1897	3–56	NJ132	7–17
TMPF5950	TMPF5950	3–55	NJ32	7–17	TMPFU1898	TMPFU1898	3–56	NJ132	7–17
TMPF5951	TMPF5951	3–56	NJ32	7–17	TMPFU1899	TMPFU1899	3–56	NJ132	7–17
TMPF5952	TMPF5952	3–56	NJ32	7–17	TMPFU304	TMPFU304	3–57	PJ99	7–17
TMPF5953	TMPF5953	3–56	NJ32	7–17	TMPFU305	TMPFU305	3–57	PJ99	7–17
TMPF6451	TMPF6451	3–56	NJ132L	7–17	TMPFU306	TMPFU306	3–57	PJ99	7–17
TMPF6452	TMPF6452	3–56	NJ132L	7–17	TMPFU308	TMPFU308	3–56	NJ99	7–17
TMPF6453	TMPF6453	3–56	NJ132L	7–17	TMPFU309	TMPFU309	3–56	NJ99	7–17
TMPF6454	TMPF6454	3–56	NJ132L	7–17	TMPFU310	TMPFU310	3–56	NJ99	7–17
TMPFBC264A	TMPFBC264A	3–56	NJ26	7–17	TMPT404	TMPT404	3–52	SHF	7–16
TMPFBC264B	TMPFBC264B	3–56	NJ26	7–17	TMPT404A	TMPT404A	3–52	SHF	7–16
TMPFBC264C	TMPFBC264C	3–56	NJ26	7–17	TMPT918	TMPT918	3–50	DMA	7–16
TMPFBC264D	TMPFBC264D	3–56	NJ26	7–17	TMPT2221	TMPT2221	3–50	JGA	7–16
TMPFBF244A	TMPFBF244A	3–56	NJ26	7–17	TMPT2221A	TMPT2221A	3–51	DCA	7–16
TMPFBF244B	TMPFBF244B	3–56	NJ26	7–17	TMPT2222	TMPT2222	3–51	JGA	7–16
TMPFBF244C	TMPFBF244C	3–56	NJ26	7–17	TMPT2222A	TMPT2222A	3–51	DCA	7–16
TMPFBF246A	TMPFBF246A	3–56	NJ99	7–17	TMPT2484	TMPT2484	3–51	FEE	7–16
TMPFBF246B	TMPFBF246B	3–56	NJ132	7–17	TMPT2906	TMPT2906	3–52	DDA	7–16
TMPFBF246C	TMPFBF246C	3–56	NJ132	7–17	TMPT2906A	TMPT2906A	3–52	DDA	7–16
TMPFBF256A	TMPFBF256A	3–56	NJ26	7–17	TMPT2907	TMPT2907	3–52	DDA	7–16
TMPFBF256B	TMPFBF256B	3–56	NJ26	7–17	TMPT2907A	TMPT2907A	3–52	DDA	7–16
TMPFBF256C	TMPFBF256C	3–56	NJ26	7–17	TMPT3638	TMPT3638	3–53	DDA	7–16
TMPFJ111	TMPFJ111	3–56	NJ132	7–17	TMPT3638A	TMPT3638A	3–53	DDA	7–16
TMPFJ111A	TMPFJ111A	3–56	NJ132	7–17	TMPT3798	TMPT3798	3–53	BXE	7–16
TMPFJ112	TMPFJ112	3–56	NJ99	7–17	TMPT3798A	TMPT3798A	3–53	BXE	7–16
TMPFJ112A	TMPFJ112A	3–56	NJ99	7–17	TMPT3903	TMPT3903	3–51	FFB	7–16
TMPFJ113	TMPFJ113	3–56	NJ99	7–17	TMPT3904	TMPT3904	3–51	FFB	7–16
TMPFJ113A	TMPFJ113A	3–56	NJ99	7–17	TMPT3905	TMPT3905	3–53	BTB	7–16

Device Type	Sprague Type	Ratings (Page)	Sprague Process	Package (Page)
TMPT3906	TMPT3906	3–53	BTB	7–16
TMPT4124	TMPT4124	3–51	FEE	7–16
TMPT4125	TMPT4125	3–53	BXE	7–16
TMPT4126	TMPT4126	3–53	BXE	7–16
TMPT4401	TMPT4401	3–51	DCA	7–16
TMPT4402	TMPT4402	3–53	DDA	7–16
TMPT4403	TMPT4403	3–53	DDA	7–16
TMPT5086	TMPT5086	3–53	BXE	7–16
TMPT5087	TMPT5087	3–53	BXE	7–16
TMPT5088	TMPT5088	3–51	FEE	7–16
TMPT5089	TMPT5089	3–51	FEE	7–16
TMPT5401	TMPT5401	3–53	BCA	7–16
TMPT5550	TMPT5550	3–51	VXA	7–16
TMPT5551	TMPT5551	3–51	VXA	7–16
TMPT6427	TMPT6427	3–51	TPM	7–16
TMPT6428	TMPT6428	3–51	FEE	7–16
TMPT6429	TMPT6429	3–51	FEE	7–16
TMPTA05	TMPTA05	3–51	JLA	7–16
TMPTA06	TMPTA06	3–51	JLA	7–16
TMPTA12	TMPTA12	3–51	TPM	7–16
TMPTA13	TMPTA13	3–51	TPM	7–16
TMPTA14	TMPTA14	3–51	TPM	7–16
TMPTA20	TMPTA20	3–51	VRB	7–16
TMPTA42	TMPTA42	3–51	BLA	7–16
TMPTA43	TMPTA43	3–51	BLA	7–16
TMPTA55	TMPTA55	3–53	JMA	7–16
TMPTA56	TMPTA56	3–53	JMA	7–16
TMPTA63	TMPTA63	3–53	SRB	7–16
TMPTA64	TMPTA64	3–53	SRB	7–16
TMPTA70	TMPTA70	3–53	BXE	7–16
TMPTA92	TMPTA92	3–53	BMA	7–16
TMPTA93	TMPTA93	3–53	BMA	7–16
TMPTH81	TMPTH81	3–53	JYA	7–16
TMPZ821	TMPZ821	3–74	ZHO	7–22
TMPZ821A	TMPZ821A	3–74	ZHO	7–22
TMPZ823	TMPZ823	3–74	ZHO	7–22
TMPZ823A	TMPZ823A	3–74	ZHO	7–22
TMPZ825	TMPZ825	3–74	ZHO	7–22
TMPZ825A	TMPZ825A	3–74	ZHO	7–22
TMPZ827	TMPZ827	3–74	ZHO	7–22
TMPZ827A	TMPZ827A	3–74	ZHO	7–22
TMPZ4565	TMPZ4565	3–74	ZHR	7–22
TMPZ4565A	TMPZ4565A	3–74	ZHR	7–22
TMPZ4566	TMPZ4566	3–74	ZHR	7–22
TMPZ4566A	TMPZ4566A	3–74	ZHR	7–22
TMPZ4567	TMPZ4567	3–74	ZHR	7–22
TMPZ4567A	TMPZ4567A	3–74	ZHR	7–22
TMPZ4568	TMPZ4568	3–74	ZHR	7–22
TMPZ4568A	TMPZ4568A	3–74	ZHR	7–22
TMPZ4570	TMPZ4570	3–74	ZHQ	7–22
TMPZ4570A	TMPZ4570A	3–74	ZHQ	7–22
TMPZ4571	TMPZ4571	3–74	ZHQ	7–22
TMPZ4571A	TMPZ4571A	3–74	ZHQ	7–22
TMPZ4572	TMPZ4572	3–74	ZHQ	7–22
TMPZ4572A	TMPZ4572A	3–74	ZHQ	7–22
TMPZ4573	TMPZ4573	3–74	ZHQ	7–22
TMPZ4573A	TMPZ4573A	3–74	ZHQ	7–22
TMPZ4575	TMPZ4575	3–74	ZHP	7–22
TMPZ4575A	TMPZ4575A	3–74	ZHP	7–22
TMPZ4576	TMPZ4576	3–74	ZHP	7–22
TMPZ4576A	TMPZ4576A	3–74	ZHP	7–22
TMPZ4577	TMPZ4577	3–74	ZHP	7–22
TMPZ4577A	TMPZ4577A	3–74	ZHP	7–22
TMPZ4578	TMPZ4578	3–74	ZHP	7–22
TMPZ4578A	TMPZ4578A	3–74	ZHP	7–22
TMPZ5229	TMPZ5229	3–73	ZAA	7–18
TMPZ5230	TMPZ5230	3–73	ZAA	7–18
TMPZ5231	TMPZ5231	3–73	ZAA	7–18
TMPZ5232	TMPZ5232	3–73	ZCA	7–18
TMPZ5233	TMPZ5233	3–73	ZCA	7–18
TMPZ5234	TMPZ5234	3–73	ZCA	7–18
TMPZ5235	TMPZ5235	3–73	ZCA	7–18
TMPZ5236	TMPZ5236	3–73	ZCA	7–18
TMPZ5237	TMPZ5237	3–73	ZCA	7–18
TMPZ5238	TMPZ5238	3–73	ZCA	7–18
TMPZ5239	TMPZ5239	3–73	ZCA	7–18
TMPZ5240	TMPZ5240	3–73	ZCA	7–18
TMPZ5241	TMPZ5241	3–73	ZCA	7–18
TMPZ5242	TMPZ5242	3–73	ZCA	7–18
TMPZ5243	TMPZ5243	3–73	ZKA	7–18
TMPZ5244	TMPZ5244	3–73	ZKA	7–18
TMPZ5245	TMPZ5245	3–73	ZKA	7–18
TMPZ5246	TMPZ5246	3–73	ZKA	7–18
TMPZ5247	TMPZ5247	3–73	ZKA	7–18
TMPZ5248	TMPZ5248	3–73	ZKA	7–18
TMPZ5249	TMPZ5249	3–73	ZKA	7–18
TMPZ5250	TMPZ5250	3–73	ZKA	7–18
TMPZ5251	TMPZ5251	3–73	ZKA	7–18
TMPZ5252	TMPZ5252	3–73	ZKA	7–18
TMPZ5253	TMPZ5253	3–73	ZEA	7–18
TMPZ5254	TMPZ5254	3–73	ZEA	7–18
TMPZ5255	TMPZ5255	3–73	ZEA	7–18
TMPZ5256	TMPZ5256	3–73	ZEA	7–18
TMPZ5257	TMPZ5257	3–73	ZEA	7–18
TND903	TND903	5–3	TSS	7–25
TND905	TND905	5–3	TSB	7–25
TND907	TND907	5–3	TRO	7–25
TND908	TND908	5–3	TSS	7–25
TND918	TND918	5–3	TSS	7–25
TND921	TND921	5–3	TSS	7–25
TND933	TND933	5–3	TSS	7–24
TND938	TND938	5–3	TTU	7–24
TND939	TND939	5–3	TTU	7–24
TND940	TND940	5–3	TSS	7–24
TND942	TND942	5–3	TTU	7–25
TP918	TP918	3–30	DMA	7–8
TP930	TP930	3–30	FEE	7–8
TP2218	TP2218	3–30	JGA	7–8

Device Type	Sprague Type	Ratings (Page)	Sprague Process	Package (Page)
TP2218A	TP2218A	3–30	DCA	7–8
TP2219	TP2219	3–30	JGA	7–8
TP2219A	TP2219A	3–30	DCA	7–8
TP2221	TP2221	3–30	JGA	7–8
TP2221A	TP2221A	3–30	DCA	7–8
TP2222	TP2222	3–30	JGA	7–8
TP2222A	TP2222A	3–30	DCA	7–8
TP2484	TP2484	3–30	FEE	7–8
TP2608	TP2608	3–48	PJ32	7–11
TP2609	TP2609	3–48	PJ32	7–11
TP2904	TP2904	3–39	DAA	7–8
TP2904A	TP2904A	3–39	DAA	7–8
TP2905	TP2905	3–39	DAA	7–8
TP2905A	TP2905A	3–39	DAA	7–8
TP2906	TP2906	3–39	DAA	7–8
TP2906A	TP2906A	3–39	DAA	7–8
TP2907	TP2907	3–39	DAA	7–8
TP2907A	TP2907A	3–39	DAA	7–8
TP2944	TP2944	3–39	SHF	7–8
TP2945	TP2945	3–39	SHF	7–8
TP2946	TP2946	3–39	SHF	7–8
TP3250	TP3250	3–39	BTB	7–8
TP3251	TP3251	3–39	BTB	7–8
TP3252	TP3252	3–30	BHB	7–8
TP3253	TP3253	3–30	BHB	7–8
TP3299	TP3299	3–30	DCA	7–8
TP3300	TP3300	3–30	DCA	7–8
TP3301	TP3301	3–30	DCA	7–8
TP3302	TP3302	3–30	DCA	7–8
TP3329	TP3329	3–48	PJ32	7–11
TP3330	TP3330	3–48	PJ32	7–11
TP3331	TP3331	3–48	PJ32	7–11
TP3332	TP3332	3–48	PJ32	7–11
TP3369	TP3369	3–45	NJ16	7–11
TP3370	TP3370	3–45	NJ16	7–11
TP3444	TP3444	3–31	BHB	7–8
TP3458	TP3458	3–45	NJ32	7–11
TP3459	TP3459	3–45	NJ32	7–11
TP3460	TP3460	3–45	NJ32	7–11
TP3564	TP3564	3–31	DMA	7–8
TP3565	TP3565	3–31	FEE	7–8
TP3566	TP3566	3–31	JGA	7–8
TP3567	TP3567	3–31	JLA	7–8
TP3568	TP3568	3–31	JLA	7–8
TP3569	TP3569	3–31	JLA	7–8
TP3638	TP3638	3–39	JFA	7–8
TP3638A	TP3638A	3–39	JFA	7–8
TP3641	TP3641	3–31	JGA	7–8
TP3642	TP3642	3–31	JGA	7–8
TP3643	TP3643	3–31	JGA	7–8
TP3644	TP3644	3–40	JFA	7–8
TP3691	TP3691	3–31	FEE	7–8
TP3692	TP3692	3–31	FEE	7–8
TP3693	TP3693	3–31	FFB	7–8
TP3694	TP3694	3–31	FFB	7–8
TP3700	TP3700	3–31	JLA	7–8
TP3701	TP3701	3–31	DID	7–8
TP3724	TP3724	3–31	BHB	7–8
TP3724A	TP3724A	3–31	BHB	7–8
TP3798	TP3798	3–40	BXE	7–8
TP3798A	TP3798A	3–40	BXE	7–8
TP3799	TP3799	3–40	BXE	7–8
TP3799A	TP3799A	3–40	BXE	7–8
TP3821	TP3821	3–45	NJ32	7–11
TP3822	TP3822	3–45	NJ32	7–11
TP3823	TP3823	3–45	NJ32	7–11
TP3824	TP3824	3–45	NJ32	7–11
TP3966	TP3966	3–45	NJ26	7–11
TP3967	TP3967	3–45	NJ26	7–11
TP3967A	TP3967A	3–45	NJ26	7–11
TP3968	TP3968	3–45	NJ26	7–11
TP3968A	TP3968A	3–45	NJ26	7–11
TP3969	TP3969	3–45	NJ16	7–11
TP3969A	TP3969A	3–45	NJ16	7–11
TP3970	TP3970	3–45	NJ132	7–11
TP3971	TP3971	3–45	NJ132	7–11
TP3972	TP3972	3–45	NJ132	7–11
TP3993	TP3993	3–48	PJ99	7–11
TP3994	TP3994	3–49	PJ99	7–11
TP4013	TP4013	3–32	BHB	7–8
TP4014	TP4014	3–32	BHB	7–8
TP4091	TP4091	3–45	NJ132	7–11
TP4092	TP4092	3–45	NJ132	7–11
TP4093	TP4093	3–45	NJ132	7–11
TP4117	TP4117	3–45	NJ01	7–11
TP4118	TP4118	3–45	NJ01	7–11
TP4119	TP4119	3–45	NJ01	7–11
TP4220	TP4220	3–45	NJ16	7–11
TP4221	TP4221	3–45	NJ32	7–11
TP4222	TP4222	3–45	NJ32	7–11
TP4223	TP4223	3–45	NJ32	7–11
TP4224	TP4224	3–45	NJ32	7–11
TP4302	TP4302	3–45	NJ26	7–11
TP4303	TP4303	3–45	NJ26	7–11
TP4304	TP4304	3–45	NJ26	7–11
TP4314	TP4314	3–40	DJC	7–8
TP4338	TP4338	3–45	NJ16	7–11
TP4339	TP4339	3–45	NJ16	7–11
TP4340	TP4340	3–45	NJ16	7–11
TP4341	TP4341	3–45	NJ16	7–11
TP4354	TP4354	3–40	DJC	7–8
TP4355	TP4355	3–40	DJC	7–8
TP4356	TP4356	3–40	DJC	7–8
TP4381	TP4381	3–49	PJ32	7–11
TP4384	TP4384	3–32	JGA	7–8
TP4386	TP4386	3–32	JGA	7–8
TP4391	TP4391	3–45	NJ132	7–11
TP4392	TP4392	3–45	NJ132	7–11

SECTION 3—ELECTRICAL CHARACTERISTICS

NPN Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@ I_C (mA)	f_T Min. (MHz)	@ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC697	500	60	45	5.0	1.0[2]	30	40	120	150	10	1.5	150	50	50	35	—	—	BBC
THC699	800	120	80	5.0	2.0[2]	60	40	120	150	10	5.0	150	50	50	20	—	—	DAC
THC718	500	60	40	5.0	1.0[2]	30	40	120	150	10	1.5	150	50	50	35	—	—	BBC
THC760	100	45	45	8.0	200	30	76	300	1.0	5.0	1.0	10	50	1.0	8.0	—	—	BAA
THC760A	100	60	60	8.0	100	30	76	333	1.0	5.0	1.0	10	50	1.0	8.0	—	—	BAA
THC915	100	70	50	5.0	10	60	50	200	10	5.0	1.0	10	—	—	3.5	—	—	BAA
THC916	100	45	25	5.0	10	30	50	200	10	1.0	0.5	10	—	—	6.0	—	—	BAA
THC917	50	30	15	3.0	1.0	15	20	—	3.0	1.0	0.5	3.0	500	4.0	3.0	—	—	DMA
THC918	50	30	15	3.0	10	15	20	—	3.0	1.0	0.4	10	600	4.0	1.7	—	—	DMA
THC929	100	45	45	5.0	10	45	40	120	0.01	5.0	1.0	10	30	0.5	8.0	—	4.0	BAA
THC929A	100	60	45	6.0	2.0	45	40	120	0.01	5.0	0.5	10	45	0.5	6.0	—	4.0	BAA
THC930	100	45	45	5.0	10	45	100	300	0.01	5.0	1.0	10	30	0.5	8.0	—	3.0	BAA
THC930A	100	60	60	6.0	2.0	45	100	300	0.01	5.0	0.5	10	45	0.5	6.0	—	3.0	BAA
THC956	500	75	35	7.0	10	60	100	300	150	10	1.5	150	70	50	25	—	8.0	BBC
THC981	100	80	80	8.0	1.0	30	36	100	1.0	5.0	3.0	10	50	1.0	5.0	—	—	BAA
THC1420	500	60	30	5.0	1.0[2]	30	100	300	150	10	1.5	150	50	50	35	—	—	BBC
THC1566	100	80	60	5.0	1.0[2]	40	80	200	5.0	5.0	1.0	10	60	5.0	10	—	—	BAA
THC1613	500	75	35	7.0	10	60	40	120	150	10	1.5	150	60	50	25	—	12	BBC
THC1711	500	75	35	7.0	10	60	100	300	150	10	1.5	150	60	50	25	—	8.0	BBC
THC2017	800	60	60	8.0	10[2]	30	50	200	200	10	2.0	200	—	—	—	—	—	DAC
THC2102	800	120	65	7.0	2.0	60	40	120	150	10	0.5	150	60	50	15	—	6.0	DAC
THC2192	800	60	40	5.0	10	30	100	300	150	10	0.35	150	50	50	10	—	—	DAC
THC2192A	800	60	40	5.0	10	30	100	300	150	10	0.25	150	50	50	20	—	—	DAC
THC2195	800	45	25	5.0	100	30	20	—	150	10	0.35	150	50	50	20	—	—	DAC
THC2195A	800	45	25	5.0	100	30	20	—	150	10	0.25	150	50	50	20	—	—	DAC
THC2218	500	60	30	5.0	10	50	40	120	150	10	0.4	150	250	20	8.0	—	—	BBC
THC2218A	500	75	40	6.0	10	60	40	120	150	10	0.3	150	250	20	8.0	225	—	DCA
THC2219	500	60	30	5.0	10	50	100	300	150	10	0.4	150	250	20	8.0	—	—	BBC
THC2219A	500	75	40	6.0	10	60	100	300	150	10	0.3	150	300	20	8.0	225	—	DCA
THC2221	500	60	30	5.0	10	50	40	120	150	10	0.4	150	250	20	8.0	—	—	BBC
THC2221A	500	75	40	6.0	10	60	40	120	150	10	0.3	150	250	20	8.0	225	—	DCA
THC2222	500	60	30	5.0	10	50	100	300	150	10	0.4	150	250	20	8.0	—	—	BBC
THC2222A	500	75	40	6.0	10	60	100	300	150	10	0.3	150	250	20	8.0	225	—	DCA
THC2243	800	120	80	7.0	10	60	40	120	150	10	0.35	150	50	50	15	—	—	DAC
THC2243A	800	120	80	7.0	10	60	40	120	150	10	0.25	150	50	50	15	—	—	DAC
THC2270	800	60	45	7.0	50	60	50	200	150	10	0.9	150	100	50	15	—	6.0	DAC
THC2484	100	60	60	6.0	10	45	100	500	10[2]	5.0	0.35	1.0	15	0.05	6.0	—	3.0	BAA
THC2504	100	60	45	6.0	2.0	45	100	300	10[2]	5.0	0.5	10	45	0.5	7.0	—	3.0	BAA
THC2509	100	125	80	7.0	5.0	100	40	—	10	5.0	1.0	5.0	45	5.0	6.0	—	7.0	BAA

NOTES:
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2) µA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC2510	100	100	65	7.0	5.0	80	150	500	10	5.0	1.0	5.0	45	5.0	6.0	—	4.0	BAA
THC2511	100	80	50	7.0	5.0	60	240	750	10	5.0	1.0	5.0	45	5.0	6.0	—	4.0	BAA
THC2586	100	60	45	6.0	2.0	45	120	360	0.01	5.0	0.5	10	45	0.5	7.0	—	3.0	BAA
THC2712	500	18	18	5.0	500	18	75	225	2.0	4.5	—	—	80	2.0	12	—	—	BBC
THC2714	500	18	18	5.0	500	18	75	225	2.0	4.5	0.3	50	—	—	—	—	—	BBC
THC2923	500	25	25	5.0	100	25	90	180	2.0	10	—	—	—	—	10	—	—	BBC
THC2924	500	25	25	5.0	100	25	150	300	2.0	10	—	—	—	—	10	—	—	BBC
THC2925	500	25	25	5.0	100	25	235	470	2.0	10	—	—	—	—	10	—	—	BBC
THC2926	500	18	18	5.0	500	18	35	470	2.0	10	—	—	—	—	10	—	—	BBC
THC3009	300	40	15	4.0	500[3]	20	30	120	30	0.4	0.18	30	350	30	5.0	25	—	BJB
THC3013	300	40	15	5.0	300[3]	20	30	120	30	0.4	0.18	30	350	30	5.0	25	—	BJB
THC3019	800	140	80	7.0	10	90	100	300	150	10	0.2	150	100	50	12	—	4.0	DAC
THC3020	1000	140	80	7.0	10	90	30	100	500	10	0.2	150	80	50	12	—	—	DSA
THC3053	800	60	40	5.0	250	30	50	250	150	10	1.4	150	100	50	15	—	—	DAC
THC3107	800	100	60	7.0	10	60	100	300	150	1.0	0.25	150	70	50	20	1000	7.0	DAC
THC3108	800	100	60	7.0	10	60	40	120	150	10	0.25	150	60	50	20	600	7.0	DAC
THC3109	800	80	40	7.0	10[3]	60	100	300	150	1.0	0.25	150	70	50	25	1000	7.0	DAC
THC3110	800	80	40	7.0	10[3]	60	40	120	150	1.0	0.25	150	60	50	25	600	7.0	DAC
THC3114	—	150	150	5.0	10	100	30	120	30	10	1.0	50	40	30	9.0	—	—	AJA
THC3115	500	60	20	5.0	25	50	40	120	150	10	0.5	150	250	20	8.0	500	—	BBC
THC3116	500	60	20	5.0	25	50	100	300	150	10	0.5	150	250	20	8.0	500	—	BBC
THC3117	100	60	60	6.0	10	45	250	500	0.01	5.0	0.35	1.0	60	0.5	4.5	—	15	BAA
THC3252	800	60	30	5.0	500	40	30	90	500	1.0	0.5	500	200	50	12	70	—	BHB
THC3253	800	75	40	5.0	500	60	25	75	375	1.0	0.6	500	175	50	12	70	—	BHB
THC3299	500	60	30	5.0	10[3]	50	40	120	150	10	0.22	150	250	50	8.0	150	—	DCA
THC3300	500	60	30	5.0	10[3]	50	100	300	150	10	0.22	150	250	50	8.0	150	—	DCA
THC3301	500	60	30	5.0	10[3]	50	40	120	150	10	0.22	150	250	50	8.0	150	—	DCA
THC3302	500	60	30	5.0	10[3]	50	100	300	150	10	0.22	150	250	50	8.0	150	—	DCA
THC3390	500	25	25	5.0	100	18	400	800	2.0	4.5	—	—	—	—	10	—	—	BBC
THC3391	500	25	25	5.0	100	18	250	500	2.0	4.5	—	—	—	—	10	—	—	BBC
THC3391A	500	25	25	5.0	100	18	250	500	2.0	4.5	—	—	—	—	10	—	5.0	BBC
THC3392	500	25	25	5.0	100	18	150	300	2.0	4.5	—	—	—	—	10	—	—	BBC
THC3393	500	25	25	5.0	100	18	90	180	2.0	4.5	—	—	—	—	10	—	—	BBC
THC3394	500	25	25	5.0	100	18	55	110	2.0	4.5	—	—	—	—	10	—	—	BBC
THC3395	500	25	25	5.0	100	18	150	500	2.0	4.5	—	—	—	—	10	—	—	BBC
THC3396	500	25	25	5.0	100	18	90	500	2.0	4.5	—	—	—	—	10	—	—	BBC
THC3397	500	25	25	5.0	100	18	55	500	2.0	4.5	—	—	—	—	10	—	—	BBC
THC3398	500	25	25	5.0	100	18	55	800	2.0	4.5	—	—	—	—	10	—	—	BBC
THC3402	500	25	25	5.0	100	25	75	225	2.0	4.5	0.3	50	—	—	—	—	—	BBC
THC3403	500	25	25	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	BBC
THC3404	500	50	50	5.0	100	50	75	225	2.0	4.5	0.3	50	—	—	—	—	—	BBC
THC3405	500	50	50	5.0	100	50	180	540	2.0	4.5	0.3	50	—	—	—	—	—	BBC

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2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @ I_C (mA)	DC Current Gain @ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC3414	500	25	25	5.0	100	25	75	225	2.0	4.5	0.3	50	—	—	—	—	—	BBC
THC3415	500	25	25	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	BBC
THC3416	500	50	50	5.0	100	50	75	225	2.0	4.5	0.3	50	—	—	—	—	—	BBC
THC3417	500	50	50	5.0	100	50	180	540	2.0	4.5	0.3	50	—	—	—	—	—	BBC
THC3444	800	80	50	5.0	500	60	20	60	500	1.0	0.6	500	150	50	12	70	—	BHB
THC3498	500	100	100	6.0	50	50	40	120	150	10	0.6	300	150	20	10	—	—	AJA
THC3499	500	100	100	6.0	50	50	100	300	150	10	0.6	300	150	20	10	—	—	AJA
THC3500	300	150	150	6.0	50	75	40	120	150	10	0.4	150	150	20	8.0	—	—	AJA
THC3501	300	150	150	6.0	50	75	100	300	150	10	0.4	150	150	30	8.0	—	—	AJA
THC3563	50	30	15	2.0	50	15	20	200	15	10	—	—	600	8.0	1.7	—	—	DMA
THC3564	50	30	15	4.0	50	15	20	500	15	10	0.3	20	400	15	3.5	—	—	DMA
THC3565	100	30	25	6.0	50	25	150	600	1.0	10	0.35	1.0	40	1.0	4.0	—	—	BAA
THC3566	500	40	30	5.0	50	20	150	600	10	10	1.0	100	—	—	25	—	—	BBC
THC3567	800	80	40	5.0	50	40	40	120	150	1.0	0.25	150	60	50	20	—	—	DAC
THC3568	800	80	60	5.0	50	40	40	120	150	1.0	0.25	150	60	50	20	—	—	DAC
THC3569	800	80	40	5.0	50	40	100	300	150	1.0	0.25	150	60	50	20	—	—	DAC
THC3641	500	60[3]	30	5.0	50[3]	50	40	120	150	10	0.22	150	250	50	8.0	—		BBC
THC3642	500	60	45	5.0	50[3]	50	40	120	150	10	0.22	150	250	50	8.0	—		BBC
THC3643	500	60	30	5.0	50[3]	50	100	300	150	10	0.22	150	250	50	8.0	—		BBC
THC3646	300	40[3]	15	5.0	500[3]	20	30	120	30	0.4	0.2	30	350	30	5.0	28		BJB
THC3691	100	35	20	4.0	50	15	40	160	10	1.0	0.7	10	200	10	3.5	—		BAA
THC3692	100	35	20	4.0	50	15	100	400	10	1.0	0.7	10	200	10	3.5	—		BAA
THC3693	100	45	45	4.0	50	35	40	160	10	10	—	—	200	10	3.5	—	4.0	FFB
THC3694	100	45	45	4.0	50	30	100	400	10	1.0	—	—	200	10	6.0	—		FFB
THC3700	800	140	80	7.0	10	90	100	300	150	10	0.2	150	100	50	12	—	4.0	DAC
THC3701	800	140	80	7.0	10	90	40	120	150	10	0.2	150	80	50	12	—		DSA
THC3704	500	50	30	5.0	100	20	100	300	50	2.0	0.6	100	100	50	12	—		BBC
THC3705	500	50	30	5.0	100	20	50	150	50	2.0	0.8	100	100	50	12	—		BBC
THC3706	500	40	20	5.0	100	20	30	600	50	2.0	1.0	100	100	50	12	—	—	BBC
THC3707	100	30	30	6.0	100	20	100	400	0.1	5.0	1.0	10	—	—	—	—	5.0	BAA
THC3708	100	30	30	6.0	100	20	45	660	1.0	5.0	1.0	10	—	—	—	—	—	BAA
THC3709	100	30	30	6.0	100	20	45	165	1.0	5.0	1.0	10	—	—	—	—	—	BAA
THC3710	100	30	30	6.0	100	20	90	330	1.0	5.0	1.0	10	—	—	—	—	—	BAA
THC3711	100	30	30	6.0	100	20	180	660	1.0	5.0	1.0	10	—	—	—	—	—	BAA
THC3721	500	18	18	5.0	500	18	60	660	2.0	10	—	—	—	—	12	—	—	BBC
THC3724	800	50	30	6.0	1700	40	60	150	100	1.0	0.32	300	300	50	12	60	—	BHB
THC3724A	800	50	30	6.0	500	40	60	150	100	1.0	0.32	300	300	50	12	50	—	BHB
THC3725	800	80	50	6.0	1700	60	60	150	100	1.0	0.4	300	300	50	10	60	—	BHB
THC3725A	800	80	50	6.0	500	60	60	150	100	1.0	0.4	300	300	50	10	50	—	BHB
THC3742	500	300	300	7.0	200	200	20	200	30	10	0.75	10	60	10	6.0	—	—	BLA
THC3793	800	40	20	5.0	500	15	20	120	10	10	0.4	10	100	10	10	—	—	DAC
THC3794	800	40	20	5.0	500	15	100	600	10	10	0.6	10	100	10	10	—	—	DAC

NOTES:
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4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

NPN Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@ I_C (mA)	f_T Min. (MHz)	@ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC3825	50	30	15	4.0	100	15	20	—	2.0	10	0.25	2.0	200	2.0	3.5	—	5.5	DMA
THC3827	100	60	45	4.0	100	30	100	400	10	10	—	—	200	10	3.5	—	—	BAA
THC3858	100	30	30	4.0	500	18	60	120	2.0	4.5	—	—	90	2.0	4.0	—	—	BAA
THC3858A	100	60	60	6.0	500	18	60	120	10	1.0	—	—	90	2.0	4.0	—	—	BAA
THC3859	100	30	30	4.0	500	18	100	200	2.0	4.5	—	—	90	2.0	4.0	—	—	BAA
THC3859A	100	60	60	6.0	500	18	100	200	10	1.0	—	—	90	2.0	4.0	—	—	BAA
THC3860	100	30	30	4.0	500	18	150	300	2.0	4.5	—	—	90	2.0	4.0	—	—	BAA
THC3877	100	70	70	4.0	500	70	20	250	2.0	4.5	—	—	—	—	—	—	—	BAA
THC3877A	100	85	85	4.0	500	70	20	250	2.0	4.5	—	—	—	—	—	—	—	BAA
THC3900	100	18	18	5.0	100	18	250	500	2.0	4.5	—	—	—	—	12	—	—	BAA
THC3901	100	18	18	5.0	100	15	350	700	2.0	4.5	—	—	—	—	—	—	5.0	BAA
THC3903	100	60	40	6.0	50	30	50	150	10	1.0	0.2	10	250	10	4.0	—	6.0	FFB
THC3904	100	60	40	6.0	50	30	100	300	10	1.0	0.2	10	300	10	4.0	—	5.0	FFB
THC3923	100	150	150	6.0	10	100	30	120	25	10	1.0	25	40	10	3.5	—	—	VXA
THC3945	800	70	50	8.0	40	60	40	250	150	10	0.5	150	60	50	12	—	—	DAC
THC3946	100	60	40	6.0	—	—	50	150	10	1.0	0.2	10	250	10	4.0	375	5.0	FFB
THC3947	100	60	40	6.0	—	—	100	300	10	1.0	0.2	10	300	10	4.0	450	5.0	FFB
THC3974	500	60	30	5.0	500	40	55	200	10	1.0	0.3	150	—	—	—	—	—	BBC
THC3976	500	60	30	5.0	500	40	55	200	10	1.0	0.3	150	—	—	—	—	7.0	BBC
THC4013	800	50	30	6.0	1700	40	60	150	100	1.0	0.2	100	300	50	12	60	—	BHB
THC4014	800	80	50	6.0	1700	60	60	150	100	1.0	0.26	100	300	50	10	60	—	BHB
THC4047	800	80	50	6.0	1700	60	40	150	100	1.0	0.4	300	250	50	10	60	—	BHB
THC4123	100	40	30	5.0	50	20	50	150	2.0	1.0	0.3	50	250	10	4.0	—	6.0	BAA
THC4124	100	30	25	5.0	50	20	120	360	2.0	1.0	0.3	50	300	10	4.0	—	5.0	BAA
THC4140	500	60	30	5.0	—	—	40	120	150	10	0.4	150	250	20	8.0	310	—	DCA
THC4141	500	60	30	5.0	—	—	100	300	150	10	0.4	150	250	20	8.0	310	—	DCA
THC4252	50	30	18	4.0	50	15	50	—	2.0	10	—	—	600	2.0	—	—	—	DLA
THC4286	100	30	25	6.0	50	25	150	600	1.0	5.0	0.35	1.0	40	1.0	6.0	—	—	BAA
THC4287	100	45	45	7.0	10	30	150	600	1.0	5.0	0.35	1.0	40	1.0	6.0	—	5.0	BAA
THC4292	50	30	15	3.0	500	15	20	—	3.0	1.0	0.6	10	600	4.0	3.5	—	6.0	DMA
THC4293	50	30	15	3.0	500	15	20	—	3.0	1.0	0.6	10	600	4.0	3.5	—	6.0	DMA
THC4384	500	40	30	5.0	10	30	100	500	0.01	5.0	0.2	10	30	0.5	8.0	—	2.0	BBC
THC4386	500	40	30	5.0	10	30	40	500	0.01	5.0	0.2	10	30	0.5	8.0	—	3.0	BBC
THC4400	500	60	40	6.0	100	30	50	150	150	1.0	0.4	150	200	20	6.5	225	—	DCA
THC4401	500	60	40	6.0	100	30	100	300	150	1.0	0.4	150	250	20	6.5	225	—	DCA
THC4409	100	80	50	5.0	10	60	60	400	10	1.0	0.2	1.0	60	10	12	—	—	BAA
THC4410	100	120	80	5.0	10	100	60	400	10	1.0	0.2	1.0	60	10	12	—	—	BAA
THC4424	500	40	40	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	BBC
THC4924	500	100	100	5.0	100	50	40	120	150	10	0.25	10	10	20	10	—	—	AJA
THC4926	500	200	200	7.0	100	100	20	200	30	10	—	—	30	20	6.0	—	—	DVA
THC4927	500	250	250	7.0	100	100	20	200	30	10	—	—	30	20	6.0	—	—	DVA
THC4944	500	75	40	6.0	10	60	100	300	150	10	0.3	150	300	20	8.0	225	—	DCA

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4) mA.
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'TH' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @ I_C (mA)	DC Current Gain @ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC4945	500	75	40	6.0	10	60	100	300	150	10	0.3	150	300	20	8.0	225	—	DCA
THC4946	500	75	40	6.0	10	60	100	300	150	10	0.3	150	300	20	8.0	225	—	DCA
THC4951	500	60	30	5.0	50	40	60	200	150	10	0.3	150	250	20	8.0	400	—	DCA
THC4952	500	60	30	5.0	50	40	100	300	150	10	0.3	150	250	20	8.0	400	—	DCA
THC4953	500	60	30	5.0	50	40	200	600	150	10	0.3	150	250	20	8.0	400	—	DCA
THC4954	500	40	30	5.0	50	30	60	600	150	10	0.3	150	250	20	8.0	400	—	DCA
THC4966	100	50	50	—	50	35	100	300	0.1	5.0	0.7	10	30	0.5	4.0	—	4.0	BAA
THC4967	100	50	50	—	50	35	200	600	0.1	5.0	0.7	10	30	0.5	4.0	—	3.0	BAA
THC4968	100	50	50	—	50	35	100	300	0.1	5.0	0.7	10	30	0.5	4.0	—	4.0	BAA
THC4969	500	60	30	5.0	10	50	40	120	150	10	0.4	150	250	20	8.0	—	—	BBC
THC4970	500	60	30	5.0	10	50	100	300	150	10	0.4	150	250	20	8.0	—	—	BBC
THC5058	150	300	300	7.0	50	100	35	150	30	25	1.0	30	30	10	10	—	—	BLA
THC5059	150	250	250	6.0	50	100	30	150	30	25	1.0	30	30	10	10	—	—	BLA
THC5088	100	35	30	—	50	20	300	900	0.1	5.0	0.5	10	—	—	4.0	—	3.0	BAA
THC5089	100	30	25	—	50	15	400	1200	0.1	5.0	0.5	10	—	—	4.0	—	2.0	BAA
THC5127	100	20	12	3.0	50	10	15	300	2.0	10	0.3	10	150	2.0	3.5	—	—	FFB
THC5128	500	15	12	3.0	50	10	35	350	50	10	0.25	150	200	50	10	—	—	BBC
THC5129	500	15	12	3.0	50	10	35	350	50	10	0.25	150	200	50	10	—	—	BBC
THC5130	50	30	12	1.0	50	10	15	250	8.0	10	0.6	10	450	8.0	1.7	—	—	DMA
THC5131	100	20	15	3.0	50	10	35	500	10	1.0	1	10	100	10	6.0	—	—	BAA
THC5132	100	20	20	3.0	50	10	30	400	10	10	2.0	10	200	10	3.5	—	—	BAA
THC5133	100	20	18	3.0	50	15	60	1000	1.0	5.0	0.4	1.0	40	1.0	5.0	—	—	BAA
THC5135	800	30	25	4.0	300	15	50	600	10	10	1.0	100	40	30	25	—	—	DAC
THC5136	800	30	20	3.0	100	20	20	400	150	1.0	0.25	150	40	50	35	—	—	DAC
THC5137	800	30	20	3.0	100	20	20	400	150	1.0	0.25	150	40	50	35	—	—	DAC
THC5172	500	25	25	5.0	100	25	100	500	10	10	0.25	10	—	—	10	—	—	BBC
THC5174	100	90	75	5.0	500	60	40	600	10	5.0	0.95	10	—	—	5.0	—	—	BAA
THC5189	800	60	35	5.0	500	30	35	—	500	1.0	1	1000	250	50	12	70	—	BHB
THC5209	100	50	50	—	50	35	100	300	0.1	5.0	0.7	10	30	0.5	4.0	—	4.0	BAA
THC5210	100	50	50	—	50	35	200	600	0.1	5.0	0.7	10	30	0.5	4.0	—	3.0	BAA
THC5219	100	20	15	3.0	100	10	35	500	2.0	10	0.4	10	150	10	4.0	—	—	FFB
THC5220	500	15	15	3.0	100	10	30	600	50	10	0.5	150	100	20	10	—	—	BBC
THC5223	100	25	20	3.0	100	10	50	800	2.0	10	0.7	10	150	10	4.0	—	—	FFB
THC5225	100	25	25	4.0	300	15	30	600	50	10	0.8	100	50	20	20	—	—	BAA
THC5232	100	70	50	5.0	30	50	250	500	2.0	5.0	0.125	10	—	—	4.0	—	—	BAA
THC5232A	100	70	50	5.0	30	50	250	500	2.0	5.0	0.125	10	—	—	4.0	—	5.0	BAA
THC5249	100	70	50	5.0	30	50	400	800	2.0	5.0	0.125	10	—	—	—	—	—	BAA
THC5249A	100	70	50	5.0	30	50	400	800	2.0	5.0	0.125	10	—	—	—	—	3.0	BAA
THC5305	500	25	25	12	100	25	2k	20k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
THC5306	500	25	25	12	100	25	7k	70k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
THC5307	500	40	40	12	100	40	2k	20k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
THC5308	500	40	40	12	100	40	7k	70k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC5310	100	70	50	5.0	10	50	100	300	0.01	5.0	0.125	10	—	—	—	—	—	BAA
THC5368	500	60	30	5.0	50	40	60	200	150	10	0.3	150	250	20	8.0	350	—	DCA
THC5369	500	60	30	5.0	50	40	100	300	150	10	0.3	150	250	20	8.0	350	—	DCA
THC5370	500	60	30	5.0	50	40	200	600	150	10	0.3	150	250	20	8.0	400	—	DCA
THC5371	500	40	30	5.0	50	30	60	600	150	10	0.3	150	250	20	8.0	400	—	DCA
THC5376	500	60	30	5.0	10	30	120	—	1.0	5.0	—	—	—	—	8.0	—	—	BBC
THC5377	500	60	30	5.0	10	30	100	—	1.0	5.0	—	—	—	—	8.0	—	—	BBC
THC5380	100	60	40	6.0	50	30	50	150	10	1.0	0.2	10	250	10	4.0	225	6.0	FFB
THC5381	100	60	40	6.0	50	30	100	300	10	1.0	0.2	10	300	10	4.0	250	5.0	FFB
THC5418	500	25	25	4.0	100	25	40	120	50	1.0	0.25	50	—	—	6.0	—	—	BBC
THC5419	500	25	25	4.0	100	25	100	300	50	1.0	0.25	50	—	—	6.0	—	—	BBC
THC5420	500	25	25	4.0	100	25	250	500	50	1.0	0.25	50	—	—	6.0	—	—	BBC
THC5449	500	50	30	5.0	100	20	100	300	50	2.0	0.6	100	100	50	12	—	—	BBC
THC5450	500	50	30	5.0	100	20	50	150	50	2.0	0.8	100	100	50	12	—	—	BBC
THC5451	500	40	20	5.0	100	20	30	600	50	2.0	1.0	100	100	50	12	—	—	BBC
THC5550	600	160	140	6.0	100	100	60	250	10	5.0	0.15	10	100	10	6.0	—	10	VXA
THC5551	600	180	160	6.0	50	120	80	250	10	5.0	0.15	10	100	10	6.0	—	8.0	VXA
THC5655	500	275	250	6.0	10	275	30	250	100	10	1.0	100	10	50	25	—	—	DVA
THC5656	500	325	300	6.0	10	350	30	250	100	10	1.0	100	10	50	25	—	—	DVA
THC5770	50	30	15	4.5	10	15	50	200	8.0	10	0.4	10	90	8.0	1.1	—	6.0	DMA
THC5772	500	40	15	5.0	500	20	30	120	30	0.4	0.2	30	350	30	5.0	28	—	BJB
THC5810	800	35	25	5.0	100	25	60	200	2.0	2.0	0.75	500	100	50	15	—	—	DAC
THC5812	800	35	25	5.0	100	25	150	500	2.0	2.0	0.75	500	135	50	15	—	—	DAC
THC5814	800	50	40	5.0	100	25	60	120	2.0	2.0	0.75	500	100	50	15	—	—	DAC
THC5816	800	50	40	5.0	100	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	DAC
THC5818	800	50	40	5.0	100	25	150	300	2.0	2.0	0.75	500	135	50	15	—	—	DAC
THC5820	800	70	60	5.0	100	25	60	120	2.0	2.0	0.75	500	100	50	15	—	—	DAC
THC5822	800	70	60	5.0	100	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	DAC
THC5824	100	50	40	5.0	50	40	60	120	2.0	5.0	0.125	10	90	2.0	4.0	—	—	FFB
THC5825	100	50	40	5.0	50	40	100	200	2.0	5.0	0.125	10	90	2.0	4.0	—	—	BAA
THC5826	100	50	40	5.0	50	40	150	300	2.0	5.0	0.125	10	90	2.0	4.0	—	—	BAA
THC5827	100	50	40	5.0	50	40	250	500	2.0	5.0	0.125	10	90	2.0	4.0	—	—	BAA
THC5828	100	50	40	5.0	50	40	400	800	2.0	5.0	0.125	10	90	2.0	4.0	—	—	BAA
THC5830	600	120	100	5.0	50	100	80	500	10	5.0	0.2	10	100	10	4.0	—	—	VAB
THC5831	600	160	140	5.0	50	120	80	250	10	5.0	0.2	10	100	10	4.0	—	—	VAB
THC5832	600	160	140	5.0	50	120	175	500	10	5.0	0.2	10	100	10	4.0	—	—	VAB
THC5856	1000	60	60	5.0	100	40	50	300	150	10	0.4	150	100	50	15	—	—	DSA
THC5858	1000	80	80	5.0	100	60	50	300	150	10	0.4	150	100	50	15	—	—	DSA
THC5961	100	60	60	8.0	2.0	45	150	700	10	5.0	0.2	10	100	10	4.0	—	—	BAA
THC5962	100	45	45	8.0	2.0	30	600	1400	10	5.0	0.2	10	100	10	4.0	—	—	BAA
THC5998	500	35	25	5.0	30	25	150	300	10	2.0	0.25	50	140	10	—	—	1.5	BBC
THC6008	500	35	25	5.0	30	25	250	500	10	2.0	0.25	50	140	10	—	—	1.5	BBC

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

NPN Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	@V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC6222	100	60	60	5.0	50	60	75	200	2.0	5.0	0.125	10	—	—	4.0	—	—	BAA
THC6224	100	60	60	5.0	50	60	150	300	2.0	5.0	0.125	10	—	—	4.0	—	—	BAA
THC6426	500	40	40	12	50	30	20k	200k	10	5.0	1.2	50	150	10	7.0	—	10	TPM
THC6427	500	40	40	12	50	30	10k	100k	10	5.0	1.2	50	130	10	7.0	—	10	TPM
THC6428	100	60	50	6.0	10	30	250	650	0.1	5.0	0.2	10	100	1.0	3.0	—	—	BAA
THC6429	100	55	45	6.0	10	30	500	1250	0.1	5.0	0.2	10	100	1.0	3.0	—	—	BAA
THC6714	2000	40	30	5.0	100	40	50	—	1000	1.0	—	—	50	—	—	—	—	FBB

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R=10\Omega$.

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	@V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
MPS2712C	200	18	18	5.0	500	18	75	225	2.0	4.5	—	—	—	—	4.0	—	—	BAA
MPS2714C	200	18	18	5.0	500	18	75	225	2.0	4.5	—	—	—	—	—	—	—	BAA
MPS2716C	200	18	18	5.0	500	18	75	225	2.0	4.5	—	—	—	—	3.5	—	—	BAA
MPS2923C	500	25	25	5.0	500	25	90	180	2.0	10	—	—	—	—	12	—	—	BBC
MPS2924C	500	25	25	5.0	500	25	150	300	2.0	10	—	—	—	—	12	—	—	BBC
MPS2925C	500	25	25	5.0	500	25	235	470	2.0	10	—	—	—	—	12	—	—	BBC
MPS2926C	500	25	25	5.0	500	18	35	470	2.0	10	—	—	—	—	12	—	—	BBC
MPS3390C	500	25	25	5.0	100	18	400	800	2.0	4.5	—	—	—	—	10	—	—	BBC
MPS3391C	500	25	25	5.0	100	18	250	500	2.0	4.5	—	—	—	—	10	—	—	BBC
MPS3392C	500	25	25	5.0	100	18	150	300	2.0	4.5	—	—	—	—	10	—	—	BBC
MPS3393C	500	25	25	5.0	100	18	90	180	2.0	4.5	—	—	—	—	10	—	—	BBC
MPS3394C	500	25	25	5.0	100	18	55	110	2.0	4.5	—	—	—	—	10	—	—	BBC
MPS3395C	500	25	25	5.0	100	18	150	500	2.0	4.5	—	—	—	—	10	—	—	BBC
MPS3396C	500	25	25	5.0	100	18	90	500	2.0	4.5	—	—	—	—	10	—	—	BBC
MPS3397C	500	25	25	5.0	100	18	55	500	2.0	4.5	—	—	—	—	10	—	—	BBC
MPS3398C	500	25	25	5.0	100	18	55	800	2.0	4.5	—	—	—	—	10	—	—	BBC
MPS3402C	500	25	25	5.0	100	18	75	225	2.0	4.5	0.3	50	—	—	—	—	—	BBC
MPS3403C	500	25	25	5.0	100	18	180	540	2.0	4.5	0.3	50	—	—	—	—	—	BBC
MPS3404C	500	50	50	5.0	100	18	75	225	2.0	4.5	0.3	50	—	—	—	—	—	BBC

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R=10\Omega$.

NPN Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
MPS3405C	500	50	50	5.0	100	18	180	540	2.0	4.5	0.3	50	—	—	—	—	—	BBC
MPS3414C	500	25	25	5.0	100	25	75	225	2.0	4.5	0.3	50	—	—	—	—	—	BBC
MPS3415C	500	25	25	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	BBC
MPS3416C	500	50	50	5.0	100	25	75	225	2.0	4.5	0.3	50	—	—	—	—	—	BBC
MPS3417C	500	50	50	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	BBC
MPS3563C	50	30	15	2.0	50	15	20	200	8.0	10	—	—	600	8.0	1.7	—	—	DMA
MPS3565C	200	30	25	6.0	50	25	150	600	1.0	10	0.35	1.0	40	1.0	4.0	—	—	BAA
MPS3566C	800	40	30	5.0	50	20	150	600	10	10	1.0	100	40	30	25	—	—	DAC
MPS3567C	800	80	40	5.0	50	40	40	120	150	1.0	0.25	150	60	50	20	—	—	DAC
MPS3568C	800	80	60	5.0	50	40	40	120	150	1.0	0.25	150	60	50	20	—	—	DAC
MPS3569C	800	80	40	5.0	50	40	100	300	150	1.0	0.25	150	60	50	20	—	—	DAC
MPS3642C	500	60	45	5.0	50[2]	50	40	120	150	10	0.22	150	250	50	8.0	—	—	BBC
MPS3646C	300	40	15	5.0	500[3]	20	30	120	30	0.4	0.2	30	350	30	5.0	18	—	BJB
MPS3693C	100	45	45	4.0	50	35	40	160	10	10	—	—	200	10	3.5	—	4.0	FFB
MPS3694C	100	45	45	4.0	50	35	100	400	10	10	—	—	200	10	3.5	—	4.0	FFB
MPS3704C	500	50	30	5.0	100	20	100	300	50	2.0	0.6	100	100	50	12	—	—	BBC
MPS3705C	500	50	30	5.0	100	20	50	150	50	2.0	0.8	100	100	50	12	—	—	BBC
MPS3706C	500	40	20	5.0	100	20	30	600	50	2.0	1.0	100	100	50	12	—	—	BBC
MPS3707C	200	30	30	6.0	100	20	100	400	0.1	5.0	1.0	10	—	—	—	—	5.0	BAA
MPS3708C	200	30	30	6.0	100	20	45	660	1.0	5.0	1.0	10	—	—	—	—	—	BAA
MPS3709C	200	30	30	6.0	100	20	45	165	1.0	5.0	1.0	10	—	—	—	—	—	BAA
MPS3710C	200	30	30	6.0	100	20	90	330	1.0	5.0	1.0	10	—	—	—	—	—	BAA
MPS3711C	200	30	30	6.0	100	20	180	660	1.0	5.0	1.0	10	—	—	—	—	—	BAA
MPS3721C	500	—	—	—	500	18	60	660	2.0	10	—	—	—	—	—	—	—	BBC
MPS3826C	200	60	45	4.0	100	30	40	160	10	10	—	—	200	10	3.5	—	—	BAA
MPS3827C	200	60	45	4.0	100	30	100	400	10	10	—	—	200	10	3.5	—	—	BAA
MPS5127C	100	20	12	3.0	50	10	15	300	2.0	10	0.3	10	—	—	—	—	—	FFB
MPS5131C	200	20	15	3.0	50	10	30	500	10	1.0	1.0	10	—	—	—	—	—	BAA
MPS5132C	200	20	20	3.0	50	10	20	—	10	10	2.0	10	200	10	—	—	—	BAA
MPS5133C	200	20	18	3.0	50	15	60	1000	1.0	5.0	—	—	—	—	—	—	—	BAA
MPS5135C	800	30	25	4.0	300	15	50	600	10	10	1.0	100	40	30	25	—	—	DAC
MPS5136C	800	30	20	3.0	100	20	20	400	150	1.0	0.25	150	40	50	35	—	—	DAC
MPS5137C	800	30	20	3.0	100	20	20	400	150	1.0	0.25	150	40	50	35	—	—	DAC
MPS5172C	500	25	25	5.0	100	25	100	500	10	10	0.25	10	—	—	10	—	—	BBC
MPS5305C	500	25	25	12	100	25	2k	20k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
MPS5306C	500	25	25	10	100	25	7k	70k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
MPS6512C	200	40	30	4.0	50	30	50	100	2.0	10	0.5	50	—	—	3.5	—	—	BAA
MPS6513C	200	40	30	4.0	50	30	90	180	2.0	10	0.5	50	—	—	3.5	—	—	BAA
MPS6514C	200	40	25	4.0	50	30	150	300	2.0	10	0.5	50	—	—	3.5	—	—	BAA
MPS6515C	200	40	25	4.0	50	30	250	500	2.0	10	0.5	50	—	—	3.5	—	—	BAA
MPS6520C	200	40	25	4.0	50	30	200	400	2.0	10	0.5	50	—	—	3.5	—	3.0	BAA

NOTES:
1) Maximum at typical JEDEC conditions.
2) µA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

NPN Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
MPS6521C	200	40	25	4.0	50	30	300	600	2.0	10	0.5	50	—	—	3.5	—	3.0	BAA
MPS6530C	500	60	40	5.0	50	40	40	120	100	1.0	0.5	100	—	—	5.0	—	—	DCA
MPS6531C	500	60	40	5.0	50	40	90	270	100	1.0	0.5	100	—	—	5.0	—	—	DCA
MPS6532C	500	50	30	5.0	100	30	30	—	100	1.0	0.5	100	—	—	5.0	—	—	DCA
MPS6541C	50	30[3]	20	4.0	50	15	25	—	4.0	10	—	—	600	4.0	1.7	—	—	DMA
MPS6560C	1000	25	25	5.0	100	20	50	200	500	1.0	0.5	500	—	—	30	—	—	DSA
MPS6561C	1000	25	20	5.0	100	20	50	200	350	1.0	0.5	350	—	—	30	—	—	DSA
MPS6564C	200	—	45	5.0	500	40	25	—	10	5.0	0.5	10	—	—	4.0	—	—	BAA
MPS6565C	200	60	45	4.0	100	30	40	160	10	10	0.4	10	200	10	3.5	—	—	BAA
MPS6566C	200	60	45	4.0	100	30	100	400	10	10	0.4	10	200	10	3.5	—	—	BAA
MPS6571C	200	20	20	3.0	50	20	250	1000	0.1	5.0	0.5	10	100	0.5	4.5	—	—	BAA
MPS6573C	200	—	35	—	100	35	200	500	10	5.0	0.5	10	100	10	12	—	—	BAA
MPS6574C	200	—	35	—	100	35	100	300	1.0	5.0	0.5	10	100	10	12	—	—	BAA
MPS6575C	200	—	45	—	100	45	200	500	10	5.0	0.5	10	100	10	12	—	—	BAA
MPS6576C	200	—	45	—	100	45	100	300	1.0	5.0	0.5	10	100	10	12	—	—	BAA
MPS6601C	1000	25	25	4.0	100	25	50	—	500	1.0	0.6	1000	100	50	30	250	—	DSA
MPS6602C	1000	30	40	4.0	100	25	50	—	500	1.0	0.6	1000	100	50	30	250	—	DSA
MPS6714C	1000	40	30	5.0	100	40	50	250	1000	1.0	0.5	1000	50	50	30	—	—	DSA
MPS6715C	1000	50	40	5.0	100	50	50	250	1000	1.0	0.5	1000	50	50	30	—	—	DSA
MPS6716C	1000	60	60	5.0	100	40	50	250	250	1.0	0.5	250	50	200	30	—	—	DSA
MPS6717C	1000	80	80	5.0	100	60	50	250	250	1.0	0.5	250	50	200	30	—	—	DSA
MPS6733C	500	200	200	6.0	100	160	40	200	10	10	2.0	20	50	10	4.0	—	—	BLA
MPS6734C	500	250	250	6.0	100	200	40	200	10	10	2.0	20	50	10	4.0	—	—	BLA
MPS6735C	500	300	300	6.0	100	260	40	200	10	10	2.0	20	50	10	4.0	—	—	BLA
MPS8097C	200	60	40	6.0	30	40	250	700	0.1	5.0	—	—	—	—	4.0	—	2.0	BAA
MPS8098C	800	60	60	6.0	100	60	100	300	1.0	5.0	0.3	100	150	10	8.0	—	—	DAC
MPS8099C	800	80	80	5.0	100	80	100	300	1.0	5.0	0.3	100	150	10	8.0	—	—	DAC
MPSA05C	800	60	60	4.0	100	60	50	—	100	1.0	0.25	100	100	10	—	—	—	DAC
MPSA06C	800	80	80	4.0	100	80	50	—	100	1.0	0.25	100	100	10	—	—	—	DAC
MPSA09C	200	50	50	—	100	30	100	600	0.1	5.0	0.9	10	30	0.5	5.0	—	—	BAA
MPSA10C	200	—	40	4.0	100	30	40	400	5.0	10	—	—	125	5.0	4.0	—	—	VRB
MPSA12C	500	20[3]	—	10	100	15	20k	—	10	5.0	1.0	10	—	—	—	—	—	TPM
MPSA13C	500	30[3]	—	10	100	30	10k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA14C	500	30[3]	—	10	100	30	20k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA18C	200	45	45	6.5	50	30	500	1500	10	5.0	0.2	10	100	1.0	3.0	—	1.5	BAA
MPSA20C	200	40	40	4.0	100	30	40	400	5.0	10	0.25	10	125	5.0	4.0	—	—	VRB
MPSA25C	500	40[3]	—	10	100	30	10k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA26C	500	50[3]	—	10	100	40	10k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA27C	500	60[3]	—	10	100	50	10k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA28C	500	80[3]	—	12	100	60	10k	—	100	5.0	1.2	10	125	10	8.0	—	—	JEA
MPSA29C	500	100[3]	—	12	100	80	10k	—	100	5.0	1.2	10	125	10	8.0	—	—	JEA
MPSA42C	500	300	300	6.0	100	200	40	—	30	10	0.5	20	50	10	3.0	—	—	BLA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

					I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T					
Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
MPSA43C	500	200	200	6.0	100	160	40	—	30	10	0.5	20	50	10	4.0	—	—	BLA
MPSD01C	500	200	200	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	BLA
MPSD02C	600	140	140	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	VXA
MPSD03C	600	100	100	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	VXA
MPSD04C	500	25[3]	—	10	1000	20	2k	—	100	5.0	1.0	100	100	10	—	—	—	SQL
MPSD05C	800	25	25	4.0	1000	20	80	—	100	5.0	0.5	100	100	50	—	—	—	DAC
MPSD06C	500	25	25	4.0	1000	20	50	—	10	5.0	0.3	50	100	10	—	—	—	BBC
MPSL01C	600	140	120	5.0	1000	75	50	300	10	5.0	0.2	10	60	10	8.0	—	—	VXA
MPSU45C	1000	50	40	12	100	30	25k	150k	200	5.0	1.5	1000	100	200	6.0	—	—	BNB

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

'D' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

					I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T					
Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
D16P1C	500	18	12	12	100	18	6K	—	100	5.0	1.4	200	60	2.0	10	—	—	TPM
D33D21C	800	35[3]	25	5.0	100[3]	25	60	200	2.0	2.0	0.75	500	100	50	15	—	—	DAC
D33D22C	800	35[3]	25	5.0	100[3]	25	150	500	2.0	2.0	0.75	500	135	50	15	—	—	DAC
D33D24C	800	50[3]	40	5.0	100[3]	25	60	120	2.0	2.0	0.75	500	80	50	15	—	—	DAC
D33D25C	800	50[3]	40	5.0	100[3]	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	DAC
D33D26C	800	50[3]	40	5.0	100[3]	25	150	300	2.0	2.0	0.75	500	135	50	15	—	—	DAC
D33D27C	800	50[3]	40	5.0	100[3]	25	250	500	2.0	2.0	0.75	500	150	50	15	—	—	DAC
D33D29C	800	70[3]	60	5.0	100[3]	25	60	120	2.0	2.0	0.75	500	80	50	15	—	—	DAC
D33D30C	800	70[3]	60	5.0	100[3]	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	DAC
D40D4C	1000	60[3]	45	5.0	100[3]	60	50	150	100	2.0	0.5	500	—	—	—	—	—	DID
D40D5C	1000	60[3]	45	5.0	100[3]	60	120	360	100	2.0	0.5	500	—	—	—	—	—	DID
D40D10C	1000	90[3]	75	5.0	100[3]	90	50	150	100	2.0	1.0	500	—	—	—	—	—	DID
D40D11C	1000	90[3]	75	5.0	100[3]	90	120	360	100	2.0	1.0	500	—	—	—	—	—	DID

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

NPN Transistors

Pro-Electron Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THBC107	500	50[3]	45	6.0	15[3]	50	120	800	2.0	5.0	0.6	100	85	0.5	7.0	—	10	BBC
THBC107A	500	50[3]	45	6.0	15[3]	50	120	220	2.0	5.0	0.6	100	85	0.5	7.0	—	10	BBC
THBC107B	500	50[3]	45	6.0	15[3]	50	180	460	2.0	5.0	0.6	100	85	0.5	7.0	—	10	BBC
THBC108	500	30[3]	20	5.0	15[3]	30	120	800	2.0	5.0	0.6	100	85	0.5	7.0	—	10	BBC
THBC108A	500	30[3]	20	5.0	15[3]	30	120	220	2.0	5.0	0.6	100	85	0.5	7.0	—	10	BBC
THBC108B	500	30[3]	20	5.0	15[3]	30	180	460	2.0	5.0	0.6	100	85	0.5	7.0	—	10	BBC
THBC108C	500	30[3]	20	5.0	15[3]	30	380	800	2.0	5.0	0.6	100	85	0.5	7.0	—	—	BBC
THBC109	500	30[3]	20	5.0	15[3]	30	180	800	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	BBC
THBC109B	500	30[3]	20	5.0	15[3]	30	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	BBC
THBC109C	500	30[3]	20	5.0	15[3]	30	380	800	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	BBC
THBC167	500	50[3]	45	5.0	15[3]	50	120	800	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC167A	500	50[3]	45	5.0	15[3]	50	120	220	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC167B	500	50[3]	45	5.0	15[3]	50	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC168	500	30[3]	20	5.0	15[3]	30	120	800	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC168A	500	30[3]	20	5.0	15[3]	30	120	220	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC168B	500	30[3]	20	5.0	15[3]	30	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC168C	500	30[3]	20	5.0	15[3]	30	380	800	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC169	500	30[3]	20	5.0	15[3]	30	180	800	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	BBC
THBC169B	500	30[3]	20	5.0	15[3]	30	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	BBC
THBC169C	500	30[3]	20	5.0	15[3]	30	380	800	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	BBC
THBC182	500	60	50	6.0	15	50	120	800	2.0	5.0	0.25	10	150	10	7.0	—	10	BBC
THBC182A	500	60	50	6.0	15	50	120	220	2.0	5.0	0.25	10	150	10	7.0	—	10	BBC
THBC182B	500	60	50	6.0	15	50	180	460	2.0	5.0	0.25	10	150	10	7.0	—	10	BBC
THBC183	500	45	30	6.0	15	30	120	800	2.0	5.0	0.25	10	150	10	7.0	—	10	BBC
THBC183A	500	45	30	6.0	15	30	120	220	2.0	5.0	0.25	10	150	10	7.0	—	10	BBC
THBC183B	500	45	30	6.0	15	30	180	460	2.0	5.0	0.25	10	150	10	7.0	—	10	BBC
THBC183C	500	45	30	6.0	15	30	380	800	2.0	5.0	0.25	10	150	10	7.0	—	10	BBC
THBC184	500	45	30	5.0	15	30	240	900	2.0	5.0	0.25	10	150	10	7.0	—	4.0	BBC
THBC184B	500	45	30	5.0	15	30	240	500	2.0	5.0	0.25	10	150	10	7.0	—	4.0	BBC
THBC184C	500	45	30	5.0	15	30	450	900	2.0	5.0	0.25	10	150	10	7.0	—	4.0	BBC
THBC237	500	50[3]	45	6.0	15[3]	50	120	460	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC237A	500	50[3]	45	6.0	15[3]	50	120	220	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC237B	500	50[3]	45	6.0	15[3]	50	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC238	500	30[3]	20	5.0	15[3]	30	120	800	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC238A	500	30[3]	20	5.0	15[3]	30	120	220	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC238B	500	30[3]	20	5.0	15[3]	30	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC238C	500	30[3]	20	5.0	15[3]	30	380	800	2.0	5.0	0.2	10	85	0.5	7.0	—	10	BBC
THBC239	500	30[3]	20	5.0	15[3]	30	180	800	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	BBC
THBC239B	500	30[3]	20	5.0	15[3]	30	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	BBC
THBC239C	500	30[3]	20	5.0	15[3]	30	380	800	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	BBC
THBC317	500	50	45	6.0	30	20	110	450	2.0	5.0	0.2	10	—	—	7.0	—	6.0	BBC
THBC317A	500	50	45	6.0	30	20	110	220	2.0	5.0	0.2	10	—	—	7.0	—	6.0	BBC

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

NPN Transistors

Pro-Electron Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THBC317B	500	50	45	6.0	30	20	200	450	2.0	5.0	0.2	10	—	—	7.0	—	6.0	BBC
THBC318	500	30	20	5.0	30	20	110	800	2.0	5.0	0.2	10	—	—	7.0	—	6.0	BBC
THBC318A	500	30	20	5.0	30	20	110	220	2.0	5.0	0.2	10	—	—	7.0	—	6.0	BBC
THBC318B	500	30	20	5.0	30	20	200	450	2.0	5.0	0.2	10	—	—	7.0	—	6.0	BBC
THBC318C	500	30	20	5.0	30	20	450	800	2.0	5.0	0.2	10	—	—	7.0	—	6.0	BBC
THBC319	500	30	20	5.0	30	20	200	800	2.0	5.0	0.2	10	—	—	7.0	—	4.0	BBC
THBC319B	500	30	20	5.0	30	20	200	450	2.0	5.0	0.2	10	—	—	7.0	—	4.0	BBC
THBC319C	500	30	20	5.0	30	20	420	800	2.0	5.0	0.2	10	—	—	7.0	—	4.0	BBC
THBC337	1000	50[3]	45	5.0	100[3]	45	100	630	100	1.0	0.7	500	100	10	12	—	—	DID
THBC33716	1000	50[3]	45	5.0	100[3]	45	100	250	100	1.0	0.7	500	100	10	12	—	—	DID
THBC33725	1000	50[3]	45	5.0	100[3]	45	160	400	100	1.0	0.7	500	100	10	12	—	—	DID
THBC338	1000	30[3]	25	5.0	100[3]	25	100	630	100	1.0	0.7	500	100	10	12	—	—	DID
THBC33816	1000	30[3]	25	5.0	100[3]	25	100	250	100	1.0	0.7	500	100	10	12	—	—	DID
THBC33825	1000	30[3]	25	5.0	100[3]	25	160	400	100	1.0	0.7	500	100	10	12	—	—	DID
THBC368	1000	25	20	5.0	10[2]	25	85	375	500	1.0	0.5	100	65	10	—	—	—	DID
THBC413	200	45	30	5.0	15	30	180	800	2.0	5.0	0.25	10	250	10	4.0	—	2.5	BAA
THBC413B	200	45	30	5.0	15	30	180	460	2.0	5.0	0.25	10	250	10	4.0	—	2.5	BAA
THBC413C	200	45	30	5.0	15	30	380	800	2.0	5.0	0.25	10	250	10	4.0	—	2.5	BAA
THBC414	200	50	45	5.0	15	30	180	800	2.0	5.0	0.25	10	250	10	4.0	—	2.5	BAA
THBC414B	200	50	45	5.0	15	30	180	460	2.0	5.0	0.25	10	250	10	4.0	—	2.5	BAA
THBC414C	200	50	45	5.0	15	30	380	800	2.0	5.0	0.25	10	250	10	4.0	—	2.5	BAA
THBC485	800	45	45	5.0	100	30	60	400	100	2.0	0.5	500	—	—	10	—	—	DAC
THBC485A	800	45	45	5.0	100	30	100	250	100	2.0	0.5	500	—	—	10	—	—	DAC
THBC485B	800	45	45	5.0	100	30	160	400	100	2.0	0.5	500	—	—	10	—	—	DAC
THBC517	500	40	30	10	100	30	30k	—	20	2.0	1.0	100	220	10	—	—	—	TPM
THBC546	500	80	65	6.0	15	30	110	800	2.0	5.0	0.25	10	300	10	7.0	—	10	BBC
THBC546A	500	80	65	6.0	15	30	110	220	2.0	5.0	0.25	10	300	10	7.0	—	10	BBC
THBC546B	500	80	65	6.0	15	30	200	450	2.0	5.0	0.25	10	300	10	7.0	—	10	BBC
THBC547	500	50	45	6.0	15	30	110	800	2.0	5.0	0.25	10	300	10	7.0	—	10	BBC
THBC547A	500	50	45	6.0	15	30	110	220	2.0	5.0	0.25	10	300	10	7.0	—	10	BBC
THBC547B	500	50	45	6.0	15	30	200	450	2.0	5.0	0.25	10	300	10	7.0	—	10	BBC
THBC548	500	30	30	5.0	15	30	110	800	2.0	5.0	0.25	10	300	10	7.0	—	10	BBC
THBC548A	500	30	30	5.0	15	30	110	220	2.0	5.0	0.25	10	300	10	7.0	—	10	BBC
THBC548B	500	30	30	5.0	15	30	200	450	2.0	5.0	0.25	10	300	10	7.0	—	10	BBC
THBC635	800	45[3]	45	5.0	100	30	40	250	150	2.0	0.5	500	130	10	—	—	—	DAC
THBC637	800	60[3]	60	5.0	100	30	40	160	150	2.0	0.5	500	130	10	—	—	—	DAC
THBC639	800	100[3]	80	5.0	100	30	40	160	150	2.0	0.5	500	130	10	—	—	—	DAC

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

NPN Transistors

Power Devices

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@ I_C (mA)	f_T Min. (MHz)	@ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC2908	5000	80	80	10	—	—	12	—	1000	10	—	—	1.0	1000	—	—	—	FBB
THC5069	5000	80	80	5.0	1.0[4]	80	20	80	1000	2.0	0.4	1000	4.0	1000	—	—	—	FBB
THC5190	4000	40	40	5.0	100	40	25	100	1500	2.0	0.6	1500	2.0	1000	—	—	—	FCB
THC5191	4000	60	60	5.0	100	60	25	100	1500	2.0	0.6	1500	2.0	1000	—	—	—	FCB
THC5192	4000	80	80	5.0	100	80	20	80	1500	2.0	0.6	1500	2.0	1000	—	—	—	FCB
THC6037	4000	40	40	5.0	0.5[4]	40	750	15k	2000	3.0	2.0	2000	25	750	100	—	—	YFA
THC6038	4000	60	60	5.0	0.5[4]	60	750	15k	2000	3.0	2.0	2000	25	750	100	—	—	YFA
THC6039	4000	80	80	5.0	0.5[4]	80	750	15k	2000	3.0	2.0	2000	25	750	100	—	—	YFA
THC6315	7000	60	60	5.0	0.3[4]	60	20	100	2500	4.0	1.0	4000	4.0	250	200	1000	—	FBB
THC6316	7000	80	80	5.0	0.3[4]	80	20	100	2500	4.0	1.0	4000	4.0	250	200	1000	—	FBB

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

PNP Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@ I_C (mA)	f_T Min. (MHz)	@ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC2604	100	60	45	6.0	10	45	40	120	0.01	5.0	0.5	10	30	0.5	6.0	—	4.0	BXE
THC2605	100	60	45	6.0	10	45	100	300	0.01	5.0	0.5	10	30	0.5	6.0	—	3.0	BCA
THC2696	500	25	25	—	25	10	30	130	50	1.0	0.25	50	100	50	20	—	—	BDA
THC2904	500	60	40	5.0	20	50	40	120	150	10	0.4	150	200	50	8.0	100	—	BDA
THC2904A	500	60	60	5.0	10	50	40	120	150	10	0.4	150	200	50	8.0	100	—	BDA
THC2905	500	60	40	5.0	20	50	100	300	150	10	0.4	150	200	50	8.0	100	—	BDA
THC2905A	500	60	60	5.0	10	50	100	300	150	10	0.4	150	200	50	8.0	100	—	BDA
THC2906	500	60	40	5.0	20	50	40	120	150	10	0.4	150	200	50	8.0	100	—	BDA
THC2906A	500	60	60	5.0	10	50	40	120	150	10	0.4	150	200	50	8.0	100	—	BDA
THC2907	500	60	40	5.0	20	50	100	300	150	10	0.4	150	200	50	8.0	100	—	BDA
THC2907A	500	60	60	5.0	10	50	100	300	150	10	0.4	150	200	50	8.0	100	—	BDA
THC2944	50	15	10	15	100	15	80	—	1.0	0.5	—	—	10	1.0	10	—	25	SHF
THC2945	50	25	20	25	200	25	40	—	1.0	0.5	—	—	5.0	1.0	10	—	25	SHF

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

PNP Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

					I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T					
Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC2946	50	40	35	40	500	40	30	—	1.0	0.5	—	—	3.0	1.0	10	—	25	SHF
THC3072	500	60	60	4.0	10	30	30	130	50	1.0	0.25	50	130	50	10	100	—	BDA
THC3073	500	60	60	4.0	10	30	30	130	50	1.0	0.25	50	130	50	10	100	—	BDA
THC3120	500	45	45	4.0	10	30	30	130	50	1.0	0.25	50	130	50	10	100	—	BDA
THC3121	500	45	45	4.0	10	30	30	130	50	1.0	0.25	50	130	50	10	100	—	BDA
THC3133	500	50	35	4.0	50	30	40	120	150	10	0.6	150	200	50	10	150	—	BDA
THC3134	500	50	35	4.0	50	30	100	300	150	10	0.6	150	200	50	10	150	—	BDA
THC3135	500	50	35	4.0	50	30	40	120	150	10	0.6	150	200	50	10	150	—	BDA
THC3136	500	50	35	4.0	50	30	100	300	150	10	0.6	150	200	50	10	157	—	BDA
THC3250	200	50	40	5.0	—	—	50	150	10	1.0	0.25	10	250	10	6.0	225	6.0	BTB
THC3251	200	50	40	5.0	—	—	100	300	10	1.0	0.25	10	300	20	6.0	250	6.0	BTB
THC3502	500	45	45	5.0	10	30	100	300	150	10	0.25	50	200	50	8.0	100	4.0	BDA
THC3503	500	60	60	5.0	10	50	100	300	150	10	0.25	50	200	50	8.0	100	4.0	BDA
THC3504	500	45	45	5.0	10	30	100	300	150	10	0.25	50	200	50	8.0	100	4.0	BDA
THC3505	500	60	60	5.0	10	50	100	300	150	10	0.25	50	200	50	8.0	100	4.0	BDA
THC3547	100	60	60	6.0	25	45	100	500	1.0	5.0	1.0	10	45	1.0	8.0	—	5.0	BXE
THC3548	100	60	45	6.0	10	45	100	300	0.01	5.0	1.0	10	60	1.0	8.0	—	4.0	BXE
THC3549	100	60	60	6.0	10	45	100	500	0.01	5.0	1.0	10	60	1.0	8.0	—	4.0	BXE
THC3550	100	60	45	8.0	5.0	45	200	600	0.01	5.0	0.5	5.0	60	1.0	8.0	—	4.0	BXE
THC3634	1000	140	140	5.0	100	100	50	150	50	10	0.3	10	150	30	10	600	3.0	AKA
THC3635	1000	140	140	5.0	100	100	100	300	50	10	0.3	10	200	30	10	600	3.0	AKA
THC3638	500	25	25	4.0	35	15	20	—	50	1.0	0.25	50	100	50	20	170	—	BDA
THC3638A	500	25	25	4.0	25	15	100	—	50	1.0	0.25	50	150	50	10	170	—	BDA
THC3644	500	45	45	5.0	35	30	100	300	50	10	0.25	50	200	20	8.0	100	—	BDA
THC3702	500	40	25	5.0	100	20	60	300	50	0.5	0.25	50	100	50	12	—	—	BDA
THC3703	500	50	30	5.0	100	20	30	150	50	5.0	0.25	50	100	50	12	—	—	BDA
THC3743	100	300	300	5.0	300	200	25	250	30	10	—	—	25	30	15	—	—	BMA
THC3798	100	60	60	5.0	10	50	150	450	0.5	5.0	0.25	1.0	100	1.0	4.0	—	3.5	STL
THC3798A	100	90	90	5.0	10	50	150	450	0.5	5.0	0.25	1.0	100	1.0	4.0	—	3.5	STL
THC3799	100	60	60	5.0	10	50	300	900	0.5	5.0	0.25	1.0	100	1.0	4.0	—	2.5	STL
THC3799A	100	90	90	5.0	10	50	300	900	0.5	5.0	0.25	1.0	100	1.0	4.0	—	2.5	STL
THC3905	200	40	40	5.0	—	—	50	150	10	1.0	0.25	10	200	10	4.5	260	5.0	BTB
THC3906	200	40	40	5.0	—	—	100	300	10	1.0	0.25	10	250	10	4.5	300	4.0	BTB
THC3962	100	60	60	6.0	10	50	100	450	1.0	5.0	0.25	10	40	0.5	6.0	—	3.0	BXE
THC3963	100	80	80	6.0	10	70	100	450	1.0	5.0	0.25	10	40	0.5	6.0	—	3.0	BXE
THC3964	100	45	45	6.0	10	40	250	600	1.0	5.0	0.25	10	50	0.5	6.0	—	2.0	BXE
THC3965	100	60	60	6.0	10	50	250	600	1.0	5.0	0.25	10	50	0.5	6.0	—	2.0	BXE
THC4030	1000	60	60	5.0	50	50	40	120	100	5.0	0.15	150	100	50	20	400	—	DJC
THC4031	1000	80	80	5.0	50	60	40	120	100	5.0	0.15	150	100	50	20	400	—	DJC
THC4032	1000	60	60	5.0	50	50	100	300	100	5.0	0.15	150	150	50	20	400	—	DJC
THC4033	1000	80	80	5.0	50	60	100	300	100	5.0	0.15	150	150	50	20	400	—	DJC
THC4036	1000	90	65	7.0	20	60	40	140	150	10	0.6	150	60	50	30	700	—	DJC

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

					I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T					
Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC4037	1000	60	40	7.0	250	60	50	250	150	10	1.4	150	60	50	30	—	—	DJC
THC4058	100	30	30	6.0	100	20	100	400	0.1	5.0	0.7	10	—	—	—	—	5.0	BXE
THC4059	100	30	30	6.0	100	20	45	660	1.0	5.0	0.7	10	—	—	—	—	—	BXE
THC4060	500	30	30	6.0	100	20	45	165	1.0	5.0	0.7	10	—	—	—	—	—	BDA
THC4061	100	30	30	6.0	100	20	90	330	1.0	5.0	0.7	10	—	—	—	—	—	BXE
THC4062	100	30	30	6.0	100	20	180	660	1.0	5.0	0.7	10	—	—	—	—	—	BXE
THC4121	200	40	40	5.0	25[3]	30	70	200	10	1.0	0.14	10	400	10	4.5	150	4.0	BTB
THC4122	200	40	40	5.0	25[3]	30	150	300	10	1.0	0.14	10	450	10	4.5	150	4.0	BTB
THC4125	100	30	30	4.0	50	20	50	150	2.0	1.0	0.4	50	200	10	4.5	—	5.0	BXE
THC4126	100	25	25	4.0	50	20	120	360	2.0	1.0	0.4	50	250	10	4.5	—	4.0	BXE
THC4142	200	60	40	5.0	—	—	40	120	150	10	0.4	150	200	50	8.0	100	—	BTB
THC4143	200	60	40	5.0	—	—	100	300	150	10	0.4	150	200	50	8.0	100	—	BTB
THC4248	100	40	40	5.0	10	40	50	—	0.1	5.0	0.25	10	—	—	6.0	—	—	BXE
THC4249	100	60	60	5.0	10	40	100	300	0.1	5.0	0.25	10	—	—	6.0	—	3.0	BXE
THC4250	100	40	40	5.0	10	40	250	700	0.1	5.0	0.25	10	—	—	6.0	—	2.0	BXE
THC4250A	100	60	60	5.0	10	50	250	700	0.1	5.0	0.25	10	—	—	6.0	—	2.0	BXE
THC4288	100	30	25	6.0	50	25	150	600	1.0	5.0	0.35	1.0	40	1.0	8.0	—	—	BXE
THC4289	100	60	45	7.0	10	45	150	600	1.0	5.0	0.35	1.0	40	1.0	8.0	—	4.0	BXE
THC4290	500	30	20	5.0	500	20	50	300	100	10	0.4	100	100	10	10	—	—	BDA
THC4291	500	40	30	6.0	200	30	100	300	100	10	0.4	100	100	10	10	—	—	BDA
THC4314	1000	90	65	—	250	60	50	250	150	10	1.4	150	60	50	30	—	—	DJC
THC4354	1000	60	60	5.0	50	50	50	500	10	10	0.15	150	100	50	30	400	3.0	DJC
THC4355	1000	60	60	5.0	50	50	100	400	10	10	0.15	150	100	50	30	400	3.0	DJC
THC4356	1000	80	80	5.0	50	50	50	250	10	10	0.15	150	100	50	30	400	3.0	DJC
THC4402	500	40	40	5.0	—	—	50	150	150	2.0	0.4	150	150	20	10	225	—	DDA
THC4403	500	40	40	5.0	—	—	100	300	150	2.0	0.4	150	200	20	10	225	—	DDA
THC4413	500	40	30	5.0	10	30	120	—	1.0	5.0	0.2	1.0	20	—	8.0	—	—	BDA
THC4415	500	40	20	5.0	10	30	100	—	1.0	5.0	0.2	1.0	20	—	8.0	—	—	BDA
THC4916	200	30	30	5.0	25[3]	15	70	200	10	1.0	0.14	10	400	10	4.5	150	4.0	BTB
THC4917	200	30	30	5.0	25[3]	15	150	300	10	1.0	0.14	10	450	10	4.5	150	4.0	BTB
THC4964	100	—	40	4.0	100	30	40	400	5.0	10	0.25	10	125	5.0	4.0	—	—	BXE
THC4965	100	50	50	—	50	35	150	300	0.1	5.0	0.3	10	40	0.5	4.0	—	3.0	BXE
THC4971	500	60	40	5.0	20	50	40	120	150	10	0.4	150	200	50	8.0	100	—	BDA
THC4972	500	60	40	5.0	20	50	100	300	150	10	0.4	150	200	50	8.0	100	—	BDA
THC5086	100	50	50	—	50	35	150	500	0.1	5.0	0.3	10	40	0.5	4.0	—	3.0	BXE
THC5087	100	50	50	—	50	35	250	800	0.1	5.0	0.3	10	40	0.5	4.0	—	2.0	BXE
THC5138	100	30	30	5.0	50	20	50	800	0.1	10	0.3	10	30	0.5	7.0	—	—	BXE
THC5139	200	20	20	5.0	50[3]	15	30	—	0.1	10	0.2	10	300	10	5.0	200	—	BTB
THC5142	500	20	20	4.0	50[3]	12	30	—	50	1.0	0.5	50	100	50	10	200	—	BDA
THC5221	500	15	15	3.0	100	10	30	600	50	10	0.5	150	100	20	15	—	—	BDA
THC5226	500	25	25	4.0	300	15	30	600	50	10	0.8	100	50	20	20	—	—	BDA
THC5227	100	30	30	3.0	100	10	50	700	2.0	10	0.4	10	100	10	5.0	—	—	BXE

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

'TH' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC5354	500	25	25	4.0	100	25	40	120	50	1.0	0.25	50	250	2.0	8.0	—	—	BDA
THC5355	500	25	25	4.0	100	25	100	300	50	1.0	0.25	50	250	2.0	8.0	—	—	BDA
THC5356	500	25	25	4.0	100	25	250	500	50	1.0	0.25	50	250	2.0	8.0	—	—	BDA
THC5365	500	40	40	4.0	100	40	40	120	50	1.0	0.25	50	250	2.0	8.0	—	—	BDA
THC5366	500	40	40	4.0	100	40	100	300	50	1.0	0.25	50	250	2.0	8.0	—	—	BDA
THC5367	500	40	40	4.0	100	40	250	500	50	1.0	0.25	50	250	2.0	8.0	—	—	BDA
THC5372	500	60	30	5.0	50	40	40	120	150	10	0.3	150	150	20	10	150	—	BDA
THC5373	500	60	30	5.0	50	40	100	300	150	10	0.3	150	150	20	10	150	—	BDA
THC5374	500	60	30	5.0	50	40	200	400	150	10	0.3	150	150	20	10	175	—	BDA
THC5375	500	40	30	5.0	50	30	40	400	150	10	0.3	150	150	20	10	175	—	BDA
THC5378	500	40	30	5.0	10	30	120	—	1.0	5.0	—	—	—	—	10	—	—	BDA
THC5379	500	40	30	5.0	10	30	100	500	0.1	5.0	0.2	10	200	0.5	—	—	3.0	BDA
THC5382	200	40	40	5.0	50	30	50	—	10	1.0	0.25	10	200	10	4.5	—	5.0	BTB
THC5383	200	40	40	5.0	50	30	100	300	10	1.0	0.25	10	250	10	4.5	—	4.0	BTB
THC5400	500	130	120	5.0	50	100	40	180	10	5.0	0.2	10	100	10	6.0	—	8.0	BCA
THC5401	500	160	150	5.0	50	120	60	240	10	5.0	0.2	10	100	10	6.0	—	8.0	BCA
THC5447	500	40	25	5.0	100	20	60	300	50	5.0	0.25	50	100	50	12	—	—	BDA
THC5448	500	50	30	5.0	100	20	30	150	50	5.0	0.25	50	100	50	12	—	—	BDA
THC5811	800	35	25	5.0	100	25	60	200	2.0	2.0	0.75	500	100	50	15	—	—	BFA
THC5813	800	35	25	5.0	100	25	150	500	2.0	2.0	0.75	500	135	50	15	—	—	BFA
THC5815	800	50	40	5.0	100	25	60	120	2.0	2.0	0.75	500	100	50	15	—	—	BFA
THC5817	800	50	40	5.0	100	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	DFA
THC5819	800	50	40	5.0	100	25	150	300	2.0	2.0	0.75	500	135	50	15	—	—	DFA
THC5821	800	70	60	5.0	100	25	60	120	2.0	2.0	0.75	500	100	50	15	—	—	BFA
THC5823	800	70	60	5.0	100	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	BFA
THC5855	1000	60	60	5.0	100	40	50	300	150	10	0.4	150	100	50	15	—	—	DJC
THC5857	1000	80	80	5.0	100	60	50	300	150	10	0.4	150	100	50	15	—	—	DJC
THC5999	500	35	25	5.0	30	25	150	300	10	2.0	0.25	50	140	10	—	—	1.5	BDA
THC6009	500	35	25	5.0	30	25	250	500	10	2.0	0.25	50	140	10	—	—	1.5	BDA
THC6076	500	25	25	5.0	100	25	100	500	10	10	0.25	10	—	—	13	—	—	BDA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
MPS404C	150	25	24	12	100	10	30	400	12	0.15	0.15	12	4.0	1.0	20	—	—	SHF
MPS404AC	150	40	35	25	100	10	30	400	12	0.15	0.15	12	4.0	1.0	20	—	—	SHF
MPS3638C	500	25	25	4.0	35	15	30	—	50	1.0	0.25	50	100	50	20	140	—	BDA
MPS3638AC	500	25	25	4.0	35	15	100	—	50	1.0	0.25	50	150	50	10	140	—	BDA
MPS3702C	500	40	25	5.0	100	20	60	300	50	5.0	0.25	50	100	50	12	—	—	BDA
MPS3703C	500	50	30	5.0	100	20	30	150	50	5.0	0.25	50	100	50	12	—	—	BDA
MPS4248C	100	40	40	5.0	10	40	50	—	0.1	5.0	0.25	10	40	0.5	6.0	—	2.0	BXE
MPS4249C	100	60	60	5.0	10	40	100	300	0.1	5.0	0.25	10	40	0.5	6.0	—	3.0	BXE
MPS4250C	100	40	40	5.0	10	50	250	700	0.1	5.0	0.25	10	40	0.5	6.0	—	2.0	BXE
MPS4250AC	100	60	60	5.0	10	40	250	700	0.1	5.0	0.25	10	40	0.5	6.0	—	2.0	BXE
MPS4354C	1000	60	60	5.0	50	50	50	500	10	10	0.15	150	100	50	30	—	3.0	DJC
MPS4355C	1000	60	60	5.0	50	50	100	400	10	10	0.15	150	100	50	30	—	3.0	DJC
MPS4356C	1000	80	80	5.0	50	50	50	250	10	10	0.15	150	100	50	30	—	3.0	DJC
MPS5138C	100	30	30	5.0	50	20	50	800	0.1	10	0.3	10	30	0.5	7.0	—	—	BXE
MPS5139C	100	20	20	5.0	50[3]	15	40	—	1.0	10	0.15	1.0	300	10	5.0	200	—	BTB
MPS6516C	100	40	40	4.0	50	30	50	100	2.0	10	0.5	50	—	—	3.5	—	—	BTB
MPS6517C	100	40	40	4.0	50	30	90	180	2.0	10	0.5	50	—	—	3.5	—	—	BXE
MPS6518C	100	40	40	4.0	50	30	150	300	2.0	10	0.5	50	—	—	3.5	—	—	BXE
MPS6519C	100	25	25	4.0	50	20	250	500	2.0	10	0.5	50	—	—	4.0	—	—	BXE
MPS6522C	100	25	25	4.0	50	30	200	600	2.0	10	0.5	50	—	—	3.5	—	3.0	BXE
MPS6523C	100	25	25	4.0	50	20	300	—	2.0	10	0.5	50	—	—	3.5	—	3.0	BXE
MPS6533C	500	40	40	4.0	50	30	40	120	100	1.0	0.5	100	—	—	5.0	—	—	DDA
MPS6534C	500	40	40	4.0	50	30	90	270	100	1.0	0.5	100	—	—	5.0	—	—	DDA
MPS6535C	500	30	30	4.0	50	30	30	—	100	1.0	0.5	100	—	—	7.0	—	—	DDA
MPS6562C	500	25	25	5.0	100	20	50	500	500	1.0	0.5	500	60	10	30	—	—	DJC
MPS6563C	1000	25	25	5.0	100	20	50	200	350	1.0	0.5	350	60	10	30	—	—	DJC
MPS6651C	1000	25	25	4.0	100	25	50	—	500	1.0	0.6	1000	100	50	30	250	—	DJC
MPS6652C	1000	40	40	4.0	100	30	50	—	500	1.0	0.6	1000	100	50	30	250	—	DJC
MPS6728C	500	60	60	5.0	100	40	50	250	250	1.0	0.5	250	50	200	30	—	—	BFA
MPS6729C	500	80	80	5.0	100	60	50	250	250	1.0	0.5	250	50	200	30	—	—	BFA
MPS8093C	200	40	40	5.0	100	20	100	300	50	2.0	0.25	50	—	—	—	—	—	BDA
MPS8598C	800	60	60	6.0	100	60	100	300	1.0	5.0	0.3	100	150	10	8.0	—	—	BFA
MPS8599C	800	80	80	5.0	100	80	100	300	1.0	5.0	0.3	100	150	10	8.0	—	—	BFA
MPSA55C	800	60	60	4.0	100	60	50	—	100	1.0	0.25	100	50	100	—	—	—	BFA
MPSA56C	800	80	80	4.0	100	80	50	—	100	1.0	0.25	100	50	100	—	—	—	BFA
MPSA62C	500	20	20	10	100	15	5k	—	10	5.0	1.0	10	125	100	—	—	—	SRB
MPSA63C	500	30	30	10	100	30	10k	—	10	5.0	2.0	100	125	100	—	—	—	SRB
MPSA64C	500	30	30	10	100	30	20k	—	10	5.0	2.0	100	125	100	—	—	—	SRB
MPSA70C	100	—	40	4.0	100	30	40	100	5.0	10	0.25	10	125	5.0	4.0	—	—	BXE
MPSA75C	500	—	40[3]	10	100	30	10k	—	10	5.0	1.5	100	125	10	—	—	—	BOB
MPSA76C	500	—	50[3]	10	100	40	10k	—	10	5.0	1.5	100	125	10	—	—	—	BOB
MPSA77C	500	—	60[3]	10	100	50	10k	—	10	5.0	1.5	100	125	10	—	—	—	BOB

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T		C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
					Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)				
MPSA92C	500	300	300	5.0	250	200	25	—	30	10	0.5	20	50	10	6.0	—	—	BMA
MPSA93C	500	200	200	5.0	250	160	25	—	30	10	0.5	20	50	10	8.0	—	—	BMA
MPSD51C	500	200	200	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	BMA
MPSD52C	300	140	140	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	VHB
MPSD53C	300	100	100	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	VHB
MPSD54C	500	25	25[3]	10	1000	20	2k	—	100	5.0	1.0	100	100	10	—	—	—	SRB
MPSD55C	800	25	25	—	1000	20	80	—	100	5.0	0.5	100	100	50	—	—	—	BFA
MPSD56C	800	25	25	4.0	1000	20	50	—	10	5.0	0.3	50	100	10	—	—	—	BFA
MPSH81C	—	20	20	3.0	100	10	60	—	5.0	10	0.5	5.0	600	5.0	0.85	—	—	JYA
MPSL51C	300	100	100	4.0	1000	50	40	250	50	5.0	0.25	10	60	10	8.0	—	—	VHB
MPSU95C	1000	50	40	10	100	200	25k	150k	200	5.0	1.5	1000	50	200	12	—	—	BOB

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

'D' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T		C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
					Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)				
D29A4C	500	35	25	4.0	10	25	40	120	50	4.5	—	—	—	—	8.0	—	—	BDA
D29A5C	500	35	25	4.0	10	25	100	300	50	4.5	—	—	—	—	8.0	—	—	BDA
D29E1C	800	35[3]	25	5.0	100[3]	25	60	200	2.0	2.0	0.75	500	100	50	15	—	—	BFA
D29E2C	800	35[3]	25	5.0	100[3]	25	150	500	2.0	2.0	0.75	500	135	50	15	—	—	BFA
D29E4C	800	50[3]	40	5.0	100[3]	25	60	120	2.0	2.0	0.75	500	80	50	15	—	—	BFA
D29E5C	800	50[3]	40	5.0	100[3]	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	BFA
D29E6C	800	50[3]	40	5.0	100[3]	25	150	300	2.0	2.0	0.75	500	135	50	15	—	—	BFA
D29E7C	800	50[3]	40	5.0	100[3]	25	250	500	2.0	2.0	0.75	500	150	50	15	—	—	BFA
D29E9C	800	70[3]	60	5.0	100[3]	25	60	120	2.0	2.0	0.75	500	80	50	15	—	—	BFA
D29E10C	800	70[3]	60	5.0	100[3]	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	BFA
D41D4C	1000	60[3]	45	5.0	100[3]	60	50	150	100	2.0	0.5	500	—	—	—	—	—	DJC
D41D5C	1000	60[3]	45	5.0	100[3]	60	120	360	100	2.0	0.5	500	—	—	—	—	—	DJC
D41D10C	1000	90[3]	75	5.0	100[3]	90	50	150	100	2.0	1.0	500	—	—	—	—	—	DJC
D41D11C	1000	90[3]	75	5.0	100[3]	90	120	360	100	2.0	1.0	500	—	—	—	—	—	DJC

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

PNP Transistors

Pro-Electron Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@ I_C (mA)	f_T Min. (MHz)	@ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THBC177	500	50[3]	45	5.0	100[3]	20	120	460	2.0	5.0	0.1	10	130	10	10	—	10	BDA
THBC177A	500	50[3]	45	5.0	100[3]	20	120	220	2.0	5.0	0.1	10	130	10	10	—	10	BDA
THBC177B	500	50[3]	45	5.0	100[3]	20	180	460	2.0	5.0	0.1	10	130	10	10	—	10	BDA
THBC178	500	30[3]	25	5.0	100[3]	20	120	800	2.0	5.0	0.1	10	130	10	10	—	10	BDA
THBC178A	500	30[3]	25	5.0	100[3]	20	120	220	2.0	5.0	0.1	10	130	10	10	—	10	BDA
THBC178B	500	30[3]	25	5.0	100[3]	20	180	460	2.0	5.0	0.1	10	130	10	10	—	10	BDA
THBC178C	500	30[3]	25	5.0	100[3]	20	380	800	2.0	5.0	0.1	10	130	10	10	—	10	BDA
THBC179	500	25[3]	20	5.0	100[3]	20	180	800	2.0	5.0	0.1	10	130	10	10	—	4.0	BDA
THBC179B	500	25[3]	20	5.0	100[3]	20	180	460	2.0	5.0	0.1	10	130	10	10	—	4.0	BDA
THBC179C	500	25[3]	20	5.0	100[3]	20	380	800	2.0	5.0	0.1	10	130	10	10	—	4.0	BDA
THBC212	500	60	50	5.0	15	30	120	800	2.0	5.0	0.6	100	200	10	10	—	10	BDA
THBC212A	500	60	50	5.0	15	30	120	220	2.0	5.0	0.6	100	200	10	10	—	10	BDA
THBC212B	500	60	50	5.0	15	30	180	460	2.0	5.0	0.6	100	200	10	10	—	10	BDA
THBC213	500	45	30	6.0	15	30	120	800	2.0	5.0	0.6	100	200	10	10	—	10	BDA
THBC213A	500	45	30	6.0	15	30	120	220	2.0	5.0	0.6	100	200	10	10	—	10	BDA
THBC213B	500	45	30	6.0	15	30	180	460	2.0	5.0	0.6	100	200	10	10	—	10	BDA
THBC213C	500	45	30	6.0	15	30	380	800	2.0	5.0	0.6	100	200	10	10	—	10	BDA
THBC214	500	45	30	5.0	15	30	140	600	2.0	5.0	0.6	100	200	10	10	—	2.0	BDA
THBC214A	500	45	30	5.0	15	30	100	300	2.0	5.0	0.6	100	200	10	10	—	2.0	BDA
THBC214B	500	45	30	5.0	15	30	200	400	2.0	5.0	0.6	100	200	10	10	—	2.0	BDA
THBC214C	500	45	30	5.0	15	30	350	600	2.0	5.0	0.6	100	200	10	10	—	2.0	BDA
THBC257	500	50[3]	45	5.0	100[3]	20	120	800	2.0	5.0	0.6	100	130	10	10	—	10	BDA
THBC257A	500	50[3]	45	5.0	100[3]	20	120	220	2.0	5.0	0.6	100	130	10	10	—	10	BDA
THBC257B	500	50[3]	45	5.0	100[3]	20	180	460	2.0	5.0	0.6	100	130	10	10	—	10	BDA
THBC258	500	30[3]	25	5.0	100[3]	20	120	800	2.0	5.0	0.6	100	130	10	10	—	10	BDA
THBC258A	500	30[3]	25	5.0	100[3]	20	120	220	2.0	5.0	0.6	100	130	10	10	—	10	BDA
THBC258B	500	30[3]	25	5.0	100[3]	20	180	460	2.0	5.0	0.6	100	130	10	10	—	10	BDA
THBC258C	500	30[3]	25	5.0	100[3]	20	380	800	2.0	5.0	0.6	100	130	10	10	—	10	BDA
THBC259	500	25[3]	20	5.0	100[3]	20	180	800	2.0	5.0	0.2	10	130	10	10	—	4.0	BDA
THBC259B	500	25[3]	20	5.0	100[3]	20	180	460	2.0	5.0	0.2	10	130	10	10	—	4.0	BDA
THBC259C	500	25[3]	20	5.0	100[3]	20	380	800	2.0	5.0	0.2	10	130	10	10	—	4.0	BDA
THBC307	500	50[3]	45	5.0	15[3]	50	120	800	2.0	5.0	0.2	10	200	10	10	—	10	BDA
THBC307A	500	50[3]	45	5.0	15[3]	50	120	220	2.0	5.0	0.2	10	200	10	10	—	10	BDA
THBC307B	500	50[3]	45	5.0	15[3]	50	180	460	2.0	5.0	0.2	10	200	10	10	—	10	BDA
THBC308	500	30[3]	25	5.0	15[3]	30	120	800	2.0	5.0	0.2	10	200	10	10	—	10	BDA
THBC308A	500	30[3]	25	5.0	15[3]	30	120	220	2.0	5.0	0.2	10	200	10	10	—	10	BDA
THBC308B	500	30[3]	25	5.0	15[3]	30	180	460	2.0	5.0	0.2	10	200	10	10	—	10	BDA
THBC308C	500	30[3]	25	5.0	15[3]	30	380	800	2.0	5.0	0.2	10	200	10	10	—	10	BDA
THBC309	500	25[3]	20	5.0	15[3]	25	180	800	2.0	5.0	0.2	10	200	10	10	—	4.0	BDA
THBC309B	500	25[3]	20	5.0	15[3]	25	180	460	2.0	5.0	0.2	10	200	10	10	—	4.0	BDA
THBC309C	500	25[3]	20	5.0	15[3]	25	380	800	2.0	5.0	0.2	10	200	10	10	—	4.0	BDA
THBC327	1000	50[3]	45	5.0	100[3]	45	100	630	100	1.0	0.7	500	100	10	12	—	—	DJC

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

Pro-Electron Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@ I_C (mA)	f_T Min. (MHz)	@ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THBC32716	1000	50[3]	45	5.0	100[3]	45	100	250	100	1.0	0.7	500	100	10	12	—	—	DJC
THBC32725	1000	50[3]	45	5.0	100[3]	45	160	400	100	1.0	0.7	500	100	10	12	—	—	DJC
THBC328	1000	30[3]	25	5.0	100[3]	25	100	630	100	1.0	0.7	500	100	10	12	—	—	DJC
THBC32816	1000	30[3]	25	5.0	100[3]	25	100	250	100	1.0	0.7	500	100	10	12	—	—	DJC
THBC32825	1000	30[3]	25	5.0	100[3]	25	160	400	100	1.0	0.7	500	100	10	12	—	—	DJC
THBC369	1000	25[3]	20	5.0	10[2]	25	85	375	500	1.0	0.5	1000	65	10	—	—	—	DJC
THBC415	100	45	35	5.0	15	30	120	800	2.0	5.0	0.25	10	200	10	4.5	—	2.0	BXE
THBC415A	100	45	35	5.0	15	30	120	220	2.0	5.0	0.25	10	200	10	4.5	—	2.0	BXE
THBC415B	100	45	35	5.0	15	30	180	460	2.0	5.0	0.25	10	200	10	4.5	—	2.0	BXE
THBC415C	100	45	35	5.0	15	30	380	800	2.0	5.0	0.25	10	200	10	4.5	—	2.0	BXE
THBC416	100	50	45	5.0	15	30	120	800	2.0	5.0	0.25	10	200	10	4.5	—	2.0	BXE
THBC416A	100	50	45	5.0	15	30	120	220	2.0	5.0	0.25	10	200	10	4.5	—	2.0	BXE
THBC416B	100	50	45	5.0	15	30	180	460	2.0	5.0	0.25	10	200	10	4.5	—	2.0	BXE
THBC416C	100	50	45	5.0	15	30	380	800	2.0	5.0	0.25	10	200	10	4.5	—	2.0	BXE
THBC516	500	40	30	10	100	30	30k	—	20	2.0	1.0	100	220	10	—	—	—	BOB
THBC556	500	80	65	5.0	15	30	110	800	2.0	5.0	0.3	10	150	10	10	—	—	BDA
THBC556A	500	80	65	5.0	15	30	110	220	2.0	5.0	0.3	10	150	10	10	—	—	BDA
THBC556B	500	80	65	5.0	15	30	200	450	2.0	5.0	0.3	10	150	10	10	—	—	BDA
THBC557	500	50	45	5.0	15	30	110	800	2.0	5.0	0.3	10	150	10	10	—	—	BDA
THBC557A	500	50	45	5.0	15	30	110	220	2.0	5.0	0.3	10	150	10	10	—	—	BDA
THBC557B	500	50	45	5.0	15	30	200	450	2.0	5.0	0.3	10	150	10	10	—	—	BDA
THBC558	500	30	30	5.0	15	30	110	800	2.0	5.0	0.3	10	150	10	10	—	—	BDA
THBC558A	500	30	30	5.0	15	30	110	220	2.0	5.0	0.3	10	150	10	10	—	—	BDA
THBC558B	500	30	30	5.0	15	30	200	450	2.0	5.0	0.3	10	150	10	10	—	—	BDA
THBC636	800	45[3]	45	5.0	100	30	40	250	150	2.0	0.5	500	130	10	—	—	—	BFA
THBC638	800	60[3]	60	5.0	100	30	40	160	150	2.0	0.5	500	130	10	—	—	—	BFA
THBC640	800	100[3]	80	5.0	100	30	40	160	150	2.0	0.5	500	130	10	—	—	—	BFA

NOTES:
1) Maximum at typical JEDEC conditions.
2) µA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

Power Devices

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @ I_C (mA)	DC Current Gain @ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
THC3719	3000	40	40	4.0	10[2]	40	25	180	1000	1.5	0.75	1000	60	500	120	400	—	FAA
THC3720	3000	60	60	4.0	10[2]	60	25	180	1000	1.5	0.75	1000	60	500	120	400	—	FAA
THC3867	3000	40	40	4.0	1000	40	40	200	1500	2.0	0.5	500	60	100	120	325	—	FAA
THC3868	3000	60	60	4.0	1000	60	30	150	1500	2.0	0.5	500	60	100	120	325	—	FAA
THC5193	5000	—	40	—	100	40	25	100	1500	2.0	0.6	1500	2.0	1000	—	—	—	FDB
THC5194	5000	—	60	—	100	60	25	100	1500	2.0	0.6	1500	2.0	1000	—	—	—	FDB
THC5195	5000	—	80	—	100	80	20	80	1500	2.0	0.6	1500	2.0	1000	—	—	—	FDB
THC5333	3000	80	80	4.0	1000	80	30	150	1500	2.0	0.75	1500	60	100	120	—	—	FAA
THC6034	4000	40	40	5.0	500[2]	40	750	15k	2000	3.0	2.0	2000	25	750	200	—	—	YJA
THC6035	4000	60	60	5.0	500[2]	60	750	15k	2000	3.0	2.0	2000	25	750	200	—	—	YJA
THC6036	4000	80	80	5.0	500[2]	80	750	15k	2000	3.0	2.0	2000	25	750	200	—	—	YJA
THC6303	3000	80	80	4.0	1000	80	30	150	1500	2.0	0.75	1500	60	100	120	325	—	FAA
THC6317	7000	60	60	5.0	250[2]	60	20	100	2500	4.0	1.0	4000	4.0	250	300	1000	—	FDB
THC6318	7000	80	80	5.0	250[2]	80	20	100	2500	4.0	1.0	4000	4.0	250	300	1000	—	FDB

NOTES:
1) Maximum at typical JEDEC conditions.
2) µA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	@I_G (μA)	I_{GSS} Max. (nA)	@V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Limits Max. (V)	Conditions V_{DS} (V)	Conditions I_D (nA)	I_{DSS} Min. (mA)	I_{DSS} Max. (mA)	@V_{DS} (V)	g_{fs} Min. (mS)	g_{fs} Max. (mS)	@V_{DS} (V)	C_{ISS}[1] Max. (pF)	@V_{DS} (V)	C_{RSS}[1] Max. (pF)	@V_{DS} (V)	r_{DS} Max. (Ω)	Process
THJ3369	−40	−1.0	−1.0	−30	—	−6.5	20	1.0[2]	0.5	2.5	30	0.6	2.5	30	20	8.0	3.0	30	—	NJ16
THJ3370	−40	−1.0	−1.0	−30	—	−3.2	20	1.0[2]	0.1	0.6	30	0.3	2.5	30	20	8.0	3.0	30	—	NJ16
THJ3458	−50	−10	−0.25	−30	—	−7.8	20	1.0[2]	3.0	15	20	2.5	10	20	18	−10[3]	5.0	30	—	NJ32
THJ3459	−50	−10	−0.25	−30	—	−3.4	20	1.0[2]	0.8	4.0	20	1.5	6.0	20	18	−6.0[3]	5.0	30	—	NJ16
THJ3460	−50	−1.0	−0.25	−30	—	−1.8	20	1.0[2]	0.2	1.0	20	0.8	4.5	20	18	−4.0[3]	5.0	30	—	NJ16
THJ3819	−25	−1.0	−2.0	−15	—	−8.0	15	2.0	2.0	20	15	2.0	6.5	15	8.0	15	4.0	15	—	NJ32
THJ3821	−50	−1.0	−0.1	−30	—	−4.0	10	1.0	0.5	2.5	15	1.5	4.5	15	6.0	15	2.0	15	—	NJ16
THJ3822	−50	−1.0	−0.1	−30	—	−6.0	10	1.0	2.0	10	15	3.0	6.5	15	6.0	15	2.0	15	—	NJ32
THJ3823	−30	−1.0	−0.5	−20	—	−8.0	10	1.0	4.0	20	15	3.5	6.5	15	6.0	15	2.0	15	—	NJ32
THJ3824	−50	−1.0	−0.1	−30	—	−8.0	15	0.1	—	—	—	—	—	—	6.0	15	3.0	8.0[3]	250	NJ32
THJ3954[6]	−50	−1.0	−0.1	−30	−1.0	−4.5	20	1.0	0.5	5.0	20	1.0	3.0	20	4.0	20	1.2	20	—	NJ35D
THJ3955[6]	−50	−1.0	−0.1	−30	−1.0	−4.5	20	1.0	0.5	5.0	20	1.0	3.0	20	4.0	20	1.2	20	—	NJ35D
THJ3956[6]	−50	−1.0	−0.1	−30	−1.0	−4.5	20	1.0	0.5	5.0	20	1.0	3.0	20	4.0	20	1.2	20	—	NJ35D
THJ3957[6]	−50	−1.0	−0.1	−30	−1.0	−4.5	20	1.0	0.5	5.0	20	1.0	3.0	20	4.0	20	1.2	20	—	NJ35D
THJ3966	−30	−1.0	−0.1	−20	−4.0	−6.0	10	10	2.0	—	20	—	—	—	6.0	20	1.5	−7.0[3]	220	NJ32
THJ3967	−30	−1.0	−0.1	−20	−2.0	−5.0	20	1.0	2.5	10	20	2.5	—	20	5.0	20[7]	1.3	20[8]	—	NJ26
THJ3967A	−30	−1.0	−0.1	−20	−2.0	−5.0	20	1.0	2.5	10	20	2.5	—	20	5.0	20[7]	1.3	20[8]	—	NJ26
THJ3968	−30	−1.0	−0.1	−20	—	−3.0	20	1.0	1.0	5.0	20	2.0	—	20	5.0	20[9]	1.3	20[10]	—	NJ26
THJ3968A	−30	−1.0	−0.1	−20	—	−3.0	20	1.0	1.0	5.0	20	2.0	—	20	5.0	20[9]	1.3	20[10]	—	NJ26
THJ3969	−30	−1.0	−0.1	−20	—	−1.7	20	1.0	0.4	2.0	20	1.3	—	20	5.0	20[11]	1.3	20[7]	—	NJ16
THJ3969A	−30	−1.0	−0.1	−20	—	−1.7	20	1.0	0.4	2.0	20	1.3	—	20	5.0	20[11]	1.3	20[7]	—	NJ16
THJ3970	−40	−1.0	−0.3	−20	−4.0	−10	20	1.0	50	150	20	—	—	—	25	20	6.0	−12[3]	30	NJ132
THJ3971	−40	−1.0	−0.3	−20	−2.0	−5.0	20	1.0	25	75	20	—	—	—	25	20	6.0	−12[3]	60	NJ132
THJ3972	−40	−1.0	−0.3	−20	−0.5	−3.0	20	1.0	5.0	30	20	—	—	—	25	20	6.0	−12[3]	100	NJ132
THJ4091	−40	−1.0	−0.5	−20	−5.0	−10	20	1.0	30	—	20	—	—	—	16	20	5.0	−20[3]	30	NJ132
THJ4092	−40	−1.0	−0.5	−20	−2.0	−7.0	20	1.0	15	—	20	—	—	—	16	20	5.0	−20[3]	50	NJ132
THJ4093	−40	−1.0	−0.5	−20	−1.0	−5.0	20	1.0	8.0	—	20	—	—	—	16	20	5.0	−20[3]	80	NJ132
THJ4117	−40	−1.0	−0.01	−20	−0.6	−1.8	10	1.0	0.03	0.09	10	0.07	0.21	10	3.0	10	1.5	10	—	NJ01
THJ4118	−40	−1.0	−0.01	−20	−1.0	−3.0	10	1.0	0.08	0.24	10	0.08	0.25	10	3.0	10	1.5	10	—	NJ01
THJ4119	−40	−1.0	−0.01	−20	−2.0	−6.0	10	1.0	0.2	0.6	10	0.10	0.33	10	3.0	10	1.5	10	—	NJ01
THJ4220	−30	−10	−0.1	−15	—	−4.0	15	1.0	0.5	3.0	15	1.0	4.0	15	6.0	15	2.0	15	—	NJ16
THJ4221	−30	−10	−0.1	−15	—	−6.0	15	1.0	2.0	6.0	15	2.0	5.0	15	6.0	15	2.0	15	—	NJ32
THJ4222	−30	−10	−0.1	−15	—	−8.0	15	1.0	5.0	15	15	2.5	6.0	15	6.0	15	2.0	15	—	NJ32
THJ4223	−30	−10	−0.25	−20	—	−8.0	15	1.0	3.0	18	15	3.0	7.0	15	6.0	15	2.0	15	—	NJ32
THJ4224	−30	−10	−0.5	−20	—	−8.0	15	1.0	2.0	20	15	2.0	7.5	15	6.0	15	2.0	15	—	NJ32
THJ4302	−30	−1.0	−1.0	−15	—	−4.0	20	10	0.5	5.0	20	1.0	—	20	6.0	20	3.0	20	—	NJ26
THJ4303	−30	−1.0	−1.0	−15	—	−6.0	20	10	4.0	10	20	2.0	—	20	6.0	20	3.0	20	—	NJ26
THJ4304	−25	−1.0	−1.0	−15	—	−10	20	10	0.5	15	20	1.0	—	20	6.0	20	3.0	20	—	NJ26
THJ4338	−50	−1.0	−0.1	−30	−0.3	−1.0	15	100	0.2	0.6	15	0.6	1.8	15	7.0	15	3.0	15	2500	NJ16
THJ4339	−50	−1.0	−0.1	−30	−0.6	−1.8	15	100	0.5	1.5	15	0.8	2.4	15	7.0	15	3.0	15	1700	NJ16
THJ4340	−50	−1.0	−0.1	−30	−1.0	−3.0	15	100	1.2	3.6	15	1.3	3.0	15	7.0	15	3.0	15	1500	NJ16
THJ4341	−50	−1.0	−0.1	−30	−2.0	−6.0	15	100	3.0	9.0	15	2.0	4.0	15	7.0	15	3.0	15	800	NJ16
THJ4391	−40	−1.0	−0.1	−20	−4.0	−10	20	1.0	50	150	20	—	—	—	16	20	5.0	−12[3]	30	NJ132
THJ4392	−40	−1.0	−0.1	−20	−2.0	−5.0	20	1.0	25	75	20	—	—	—	16	20	5.0	−7.0[3]	60	NJ132
THJ4393	−40	−1.0	−0.1	−20	−0.5	−3.0	20	1.0	5.0	30	20	—	—	—	16	20	5.0	−5.0[3]	100	NJ132
THJ4416	−30	−1.0	−0.1	−20	—	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	4.5	15	1.2	15	—	NJ26

NOTES:
1) V_{GS} = 0 V.
2) I_D in μA.
3) V_{DS} = 0 V, V_{GS} in volts.
4) I_D = 10 μA.
5) I_D = 5.0 mA.
6) Monolithic Dual, V_{GS1}-V_{GS2} = 50mV, max.
7) I_D = 250 μA.
8) I_D = 1.0 mA.
9) I_D = 100 μA.
10) I_D = 500 μA.
11) I_D = 40 μA.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	$V_{(BR)GSS}$ Min. (V)	@I_G (µA)	I_{GSS} Max. (nA)	@V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Max. (V)	Conditions V_{DS} (V)	I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@V_{DS} (V)	C_{iss}[1] Max. (pF)	@V_{DS} (V)	C_{rss}[1] Max. (pF)	@V_{DS} (V)	r_{DS} Max. (Ω)	Process
THJ4416A	−35	−1.0	−0.1	−20	−2.5	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	4.5	15	1.2	15	—	NJ26
THJ4856	−40	−1.0	−0.25	−20	−4.0	−10	15	1.0	50	—	15	—	—	—	18	−10[3]	8.0	−10[3]	25	NJ132
THJ4856A	−40	−1.0	−0.25	−20	−4.0	−10	15	1.0	50	—	15	—	—	—	10	−10[2]	4.0	−10[3]	25	NJ132
THJ4857	−40	−1.0	−0.25	−20	−2.0	−6.0	15	1.0	20	100	15	—	—	—	18	−10[3]	8.0	−10[3]	40	NJ132
THJ4857A	−40	−1.0	−0.25	−20	−2.0	−6.0	15	1.0	20	100	15	—	—	—	10	−10[2]	3.5	−10[3]	40	NJ132
THJ4858	−40	−1.0	−0.25	−20	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	18	−10[3]	8.0	−10[3]	40	NJ132
THJ4858A	−40	−1.0	−0.25	−20	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	10	−10[3]	3.5	−10[3]	60	NJ132
THJ4859	−30	−1.0	−0.25	−15	−4.0	−10	15	1.0	50	—	15	—	—	—	18	−10[3]	8.0	−10[3]	25	NJ132
THJ4859A	−30	−1.0	−0.25	−15	−4.0	−10	15	1.0	50	—	15	—	—	—	10	−10[3]	4.0	−10[3]	25	NJ132
THJ4860	−30	−1.0	−0.25	−15	−2.0	−6.0	15	1.0	20	100	15	—	—	—	18	−10[3]	8.0	−10[3]	40	NJ132
THJ4860A	−30	−1.0	−0.25	−15	−2.0	−6.0	15	1.0	20	100	15	—	—	—	10	−10[3]	3.5	−10[3]	40	NJ132
THJ4861	−30	−1.0	−0.25	−15	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	18	−10[3]	8.0	−10[3]	60	NJ132
THJ4861A	−30	−1.0	−0.25	−15	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	10	−10[3]	3.5	−10[3]	60	NJ132
THJ4867	−40	−1.0	−0.25	−30	−0.7	−2.0	20	1.0[2]	0.4	1.2	20	0.7	2.0	20	25	20	5.0	20	—	NJ16
THJ4868	−40	−1.0	−0.25	−30	−1.0	−3.0	20	1.0[2]	1.0	3.0	20	1.0	3.0	20	25	20	5.0	20	—	NJ16
THJ4869	−40	−1.0	−0.25	−30	−1.8	−5.0	20	1.0[2]	2.5	7.5	20	1.3	4.0	20	25	20	5.0	20	—	NJ16
THJ5045[6]	−50	−1.0	−0.25	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	8.0	15	4.0	15	—	NJ35D
THJ5046[6]	−50	−1.0	−0.25	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	8.0	15	4.0	15	—	NJ35D
THJ5047[6]	−50	−1.0	−0.25	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	8.0	15	4.0	15	—	NJ35D
THJ5078	−30	−1.0	−0.25	−20	−0.5	−8.0	15	1.0	4.0	25	15	4.0	—	15	6.0	15	2.0	15	—	NJ26
THJ5103	−25	−1.0	−0.1	−15	−0.5	−4.0	15	1.0	1.0	8.0	15	2.0	8.0	15	5.0	15	1.2	15	—	NJ26
THJ5104	−25	−1.0	−0.1	−15	−0.5	−4.0	15	1.0	2.0	6.0	15	3.5	7.5	15	5.0	15	1.2	15	—	NJ26
THJ5105	−25	−1.0	−0.1	−15	−0.5	−4.0	15	1.0	5.0	15	15	5.0	10	15	5.0	15	1.2	15	—	NJ26
THJ5163	−25	−1.0	−10	−15	−0.4	−8.0	15	1.0[2]	1.0	40	15	2.0	9.0	15	12	15	3.0	15	—	NJ26
THJ5196[6]	−50	−1.0	−0.1	−30	−0.7	−4.0	20	1.0	0.7	7.0	20	1.0	4.0	20	6.0	20	2.0	20	—	NJ35D
THJ5197[6]	−50	−1.0	−0.1	−30	−0.7	−4.0	20	1.0	0.7	7.0	20	1.0	4.0	20	6.0	20	2.0	20	—	NJ35D
THJ5198[6]	−50	−1.0	−0.1	−30	−0.7	−4.0	20	1.0	0.7	7.0	20	1.0	4.0	20	6.0	20	2.0	20	—	NJ35D
THJ5199[6]	−50	−1.0	−0.1	−30	−0.7	−4.0	20	1.0	0.7	7.0	20	1.0	4.0	20	6.0	20	2.0	20	—	NJ35D
THJ5245	−30	−1.0	−1.0	−20	−1.0	−6.0	15	10	5.0	15	15	4.0	—	15	4.5	15	1.5	15	—	NJ26
THJ5246	−30	−1.0	−1.0	−20	−0.5	−4.0	15	10	1.5	7.0	15	2.5	—	15	4.5	15	1.5	15	—	NJ26
THJ5247	−30	−1.0	−1.0	−20	−1.5	−8.0	15	10	8.0	24	15	4.0	—	15	4.5	15	1.5	15	—	NJ26
THJ5248	−30	−1.0	−5.0	−20	−1.0	−8.0	15	10	4.0	20	15	3.0	—	15	6.0	15	2.0	15	—	NJ26
THJ5358	−40	−1.0	−0.1	−20	−0.5	−3.0	15	100	0.5	1.0	15	1.0	3.0	15	6.0	15	2.0	15	—	NJ16
THJ5359	−40	−1.0	−0.1	−20	−0.8	−4.0	15	100	0.6	1.6	15	1.2	3.6	15	6.0	15	2.0	15	—	NJ16
THJ5360	−40	−1.0	−0.1	−20	−0.8	−4.0	15	100	1.5	3.0	15	1.4	4.2	15	6.0	15	2.0	15	—	NJ16
THJ5361	−40	−1.0	−0.1	−20	−1.0	−6.0	15	100	2.5	5.0	15	1.5	4.5	15	6.0	15	2.0	15	—	NJ16
THJ5362	−40	−1.0	−0.1	−20	−2.0	−7.0	15	100	4.0	8.0	15	2.0	5.5	15	6.0	15	2.0	15	—	NJ32
THJ5363	−40	−1.0	−0.1	−20	−2.5	−8.0	15	100	7.0	14	15	2.5	6.0	15	6.0	15	2.0	15	—	NJ32
THJ5364	−40	−1.0	−0.1	−20	−2.5	−8.0	15	100	9.0	18	15	2.7	6.5	15	6.0	15	2.0	15	—	NJ32
THJ5397	−25	−1.0	−0.1	−15	−1.0	−6.0	10	1.0	10	30	10	6.0	10	10[4]	5.0	10[4]	1.2	10[4]	—	NJ26L
THJ5398	−25	−1.0	−0.1	−15	−1.0	−6.0	10	1.0	5.0	40	10	5.5	10	10	5.5	10	1.3	10	—	NJ26L
THJ5432	−25	−1.0	−0.2	−15	−4.0	−10	5.0	3.0	150	—	15	—	—	—	30	−10[3]	15	−10[3]	5.0	NJ903
THJ5433	−25	−1.0	−0.2	−15	−3.0	−9.0	5.0	3.0	100	—	15	—	—	—	30	−10[3]	15	−10[3]	7.0	NJ903
THJ5434	−25	−1.0	−0.2	−15	−1.0	−4.0	5.0	3.0	30	—	15	—	—	—	30	−10[3]	15	−10[3]	10	NJ903
THJ5457	−25	−10	−1.0	−15	−0.5	−6.0	15	10	1.0	5.0	15	1.0	5.0	15	7.0	15	3.0	15	—	NJ32
THJ5458	−25	−10	−1.0	−15	−1.0	−7.0	15	10	2.0	9.0	15	1.5	5.5	15	7.0	15	3.0	15	—	NJ32

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in µA.
3) $V_{DS} = 0$ V, V_{GS} in volts.
4) $I_D = 10$ µA.
5) $I_D = 5.0$ mA.
6) Monolithic Dual, V_{GS1}-V_{GS2} = 50mV, max.
7) $I_D = 250$ µA.
8) $I_D = 1.0$ mA.
9) $I_D = 100$ µA.
10) $I_D = 500$ µA.
11) $I_D = 40$ µA.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$		I_{GSS}		$V_{GS(off)}$ Limits		$V_{GS(off)}$ Conditions		I_{DSS}			g_{fs}			C_{ISS}[1]		C_{RSS}[1]		r_{DS}	Process
	Min. (V)	@I_G (µA)	Max. (nA)	@V_{GS} (V)	Min. (V)	Max. (V)	V_{DS} (V)	I_D (nA)	Min. (mA)	Max. (mA)	@V_{DS} (V)	Min. (mS)	Max. (mS)	@V_{DS} (V)	Max. (pF)	@V_{DS} (V)	Max. (pF)	@V_{DS} (V)	Max. (Ω)	
THJ5459	−25	−10	−1.0	−15	−2.0	−8.0	15	10	4.0	16	15	2.0	6.0	15	7.0	15	3.0	15	—	NJ32
THJ5484	−25	−1.0	−1.0	−20	−0.3	−3.0	15	10	1.0	5.0	15	3.0	6.0	15	5.0	15	1.0	15	—	NJ26
THJ5485	−25	−1.0	−1.0	−20	−0.5	−4.0	15	10	4.0	10	15	3.5	7.0	15	5.0	15	1.0	15	—	NJ26
THJ5486	−25	−1.0	−1.0	−20	−2.0	−6.0	15	10	8.0	20	15	4.0	8.0	15	5.0	15	1.0	15	—	NJ26
THJ5545[6]	−50	−1.0	−0.1	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	6.0	15	2.0	15	—	NJ35D
THJ5546[6]	−50	−1.0	−0.1	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	6.0	15	2.0	15	—	NJ35D
THJ5547[6]	−50	−1.0	−0.1	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	6.0	15	2.0	15	—	NJ35D
THJ5555	−25	−10	−1.0	−15	—	−12	12	10	15	—	15	—	—	—	5.0	15	1.2	10[3]	150	NJ26
THJ5556	−30	−1.0	−0.1	−15	−0.2	−4.0	15	1.0	0.5	2.5	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
THJ5557	−30	−1.0	−0.1	−15	−0.8	−5.0	15	1.0	2.0	5.0	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
THJ5558	−30	−1.0	−0.1	−15	−1.5	−6.0	15	1.0	4.0	10	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
THJ5638	−30	−10	−1.0	−15	—	−12	15	1.0	50	—	20	—	—	—	10	−12[3]	4.0	−12[3]	30	NJ132
THJ5639	−30	−10	−1.0	−15	—	−8.0	15	1.0	25	—	20	—	—	—	10	−12[3]	4.0	−12[3]	60	NJ99
THJ5640	−30	−10	−1.0	−15	—	−6.0	15	1.0	5.0	—	20	—	—	—	10	−12[3]	4.0	−12[3]	100	NJ99
THJ5653	−30	−10	−1.0	−15	—	−12	15	1.0	40	—	20	—	—	—	10	−12[3]	3.5	−12[3]	50	NJ99
THJ5654	−25	−10	−10	−15	—	−8.0	15	1.0	15	—	20	—	—	—	10	−8.0[3]	3.5	−8.0[3]	100	NJ99
THJ5668	−25	−10	−1.0	−15	−0.2	−4.0	15	10	1.0	5.0	15	1.0	—	15	7.0	15	3.0	15	—	NJ16
THJ5669	−25	−10	−1.0	−15	−1.0	−6.0	15	10	4.0	10	15	1.6	—	15	7.0	15	3.0	15	—	NJ32
THJ5670	−25	−10	−1.0	−15	−2.0	−8.0	15	10	8.0	20	15	2.0	—	15	7.0	15	3.0	15	—	NJ32
THJ5911	−25	−1.0	−0.1	−15	−1.0	−5.0	10	1.0	7.0	40	10	5.0	10	10[5]	5.0	10[5]	1.2	10[5]	—	NJ28D
THJ5912	−25	−1.0	−0.1	−15	−1.0	−5.0	10	1.0	7.0	40	10	5.0	10	10[5]	5.0	10[5]	1.2	10[5]	—	NJ28D
THJ5949	−30	−1.0	−1.0	−15	−3.0	−7.0	15	100	12	18	15	3.0	—	15	6.0	15	2.0	15	—	NJ32
THJ5950	−30	−1.0	−1.0	−15	−2.5	−6.0	15	100	10	15	15	3.0	—	15	6.0	15	2.0	15	—	NJ32
THJ5951	−30	−1.0	−1.0	−15	−2.0	−5.0	15	100	7.0	13	15	3.0	—	15	6.0	15	2.0	15	—	NJ32
THJ5952	−30	−1.0	−1.0	−15	−1.3	−3.5	15	100	4.0	8.0	15	1.0	—	15	6.0	15	2.0	15	—	NJ32
THJ5953	−30	−1.0	−1.0	−15	−0.8	−3.0	15	100	2.5	5.0	15	1.0	—	15	6.0	15	2.0	15	—	NJ32
THJ6449	−300	−10	100	−150	−2.0	−15	30	4.0	2.0	10	30	0.5	3.0	30	10	30	5.0	30	—	NJ42
THJ6450	−200	−10	100	−100	−2.0	−15	30	4.0	2.0	10	30	0.5	3.0	30	10	30	5.0	30	—	NJ42
THJ6451	−20	−1.0	−0.1	−10	−0.5	−3.5	10	1.0	5.0	20	10	—	—	—	25	10	5.0	10	—	NJ132L
THJ6452	−25	−1.0	−0.5	−15	−0.5	−3.5	10	1.0	5.0	20	10	—	—	—	25	10	5.0	10	—	NJ132L
THJ6453	−20	−1.0	−0.1	−10	−0.75	−5.0	10	1.0	15	50	10	—	—	—	25	10	5.0	10	—	NJ132L
THJ6454	−25	−1.0	−0.5	−15	−0.75	−5.0	10	1.0	15	50	10	—	—	—	25	10	5.0	10	—	NJ132L

NOTES:
1) V_{GS} = 0 V.
2) I_D in µA.
3) V_{DS} = 0 V, V_{GS} in volts.
4) I_D = 10 µA.
5) I_D = 5.0 mA.
6) Monolithic Dual, V_{GS1}-V_{GS2} = 50mV, max.
7) I_D = 250 µA.
8) I_D = 1.0 mA.
9) I_D = 100 µA.
10) I_D = 500 µA.
11) I_D = 40 µA.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	$V_{(BR)GSS}$ Min. (V)	@ I_G (μA)	I_{GSS} Max. (nA)	@ V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Limits Max. (V)	Conditions V_{DS} (V)	Conditions I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@ V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@ V_{DS} (V)	C_{iss}[1] Max. (pF)	@ V_{DS} (V)	C_{rss}[1] Max. (pF)	@ V_{DS} (V)	r_{DS} Max. (Ω)	Process
THJBC264A	−30	−1.0	−1.0	−20	−0.5	—	15	10	2.0	4.5	15	2.5	—	15	4.5	15	1.2	15	—	NJ26
THJBC264B	−30	−1.0	−1.0	−20	−0.5	—	15	10	3.5	6.5	15	3.0	—	15	4.5	15	1.2	15	—	NJ26
THJBC264C	−30	−1.0	−1.0	−20	−0.5	—	15	10	5.0	8.0	15	3.5	—	15	4.5	15	1.2	15	—	NJ26
THJBC264D	−30	−1.0	−1.0	−20	−0.5	—	15	10	7.0	12	15	4.0	—	15	4.5	15	1.2	15	—	NJ26
THJBF244A	−30	−1.0	−5.0	−20	−0.5	−8.0	15	10	2.0	6.5	15	3.0	6.5	15	—	—	—	—	—	NJ26
THJBF244B	−30	−1.0	−5.0	−20	−0.5	−8.0	15	10	6.0	15	15	3.0	6.5	15	—	—	—	—	—	NJ26
THJBF244C	−30	−1.0	−5.0	−20	−0.5	−8.0	15	10	12	25	15	3.0	6.5	15	—	—	—	—	—	NJ26
THJBF246A	−25	−1.0	−5.0	−15	−0.6	−14.5	15	10	30	80	15	—	—	—	—	—	—	—	65	NJ132
THJBF246B	−25	−1.0	−5.0	−15	−0.6	−14.5	15	10	60	140	15	—	—	—	—	—	—	—	50	NJ132
THJBF246C	−25	−1.0	−5.0	−15	−0.6	−14.5	15	10	110	250	15	—	—	—	—	—	—	—	35	NJ132
THJBF256A	−30	−1.0	−5.0	−20	−0.5	−7.5	15	10	3.0	7.0	15	4.5	—	15	4.5	15	1.2	15	—	NJ26
THJBF256B	−30	−1.0	−5.0	−20	−0.5	−7.5	15	10	6.0	13	15	4.5	—	15	4.5	15	1.2	15	—	NJ26
THJBF256C	−30	−1.0	−5.0	−20	−0.5	−7.5	15	10	11	18	15	4.5	—	15	4.5	15	1.2	15	—	NJ26
THJJ105	−25	−1.0	−3.0	−15	−4.5	−10	5.0	1.0[2]	500	—	15	—	—	—	50	−10[3]	25	−10[3]	3.0	NJ903
THJJ106	−25	−1.0	−3.0	−15	−2.0	−6.0	5.0	1.0[2]	200	—	15	—	—	—	50	−10[3]	25	−10[3]	6.0	NJ903
THJJ107	−25	−1.0	−3.0	−15	−0.5	−4.5	5.0	1.0[2]	100	—	15	—	—	—	50	−10[3]	25	−10[3]	8.0	NJ903
THJJ108	−25	−1.0	−3.0	−15	−3.0	−10	5.0	1.0[2]	80	—	15	—	—	—	50	−10[3]	25	−10[3]	8.0	NJ903
THJJ109	−25	−1.0	−3.0	−15	−2.0	−6.0	5.0	1.0[2]	40	—	15	—	—	—	50	−10[3]	25	−10[3]	12	NJ903
THJJ110	−25	−1.0	−3.0	−15	−0.5	−4.5	5.0	1.0[2]	10	—	15	—	—	—	50	−10[3]	25	−10[3]	18	NJ903
THJJ111	−35	−1.0	−1.0	−15	−3.0	−10	5.0	1.0[2]	20	—	15	—	—	—	16	15	5.0	−10[3]	30	NJ132
THJJ111A	−40	−1.0	−0.2	−15	−5.0	−10	5.0	1.0[2]	30	—	15	—	—	—	16	15	5.0	−10[3]	30	NJ132
THJJ112	−35	−1.0	−1.0	−15	−1.0	−5.0	5.0	1.0[2]	5.0	—	15	—	—	—	16	15	5.0	−10[3]	50	NJ99
THJJ112A	−40	−1.0	−0.2	−15	−2.0	−7.0	5.0	1.0[2]	15	—	15	—	—	—	16	15	5.0	−10[3]	50	NJ99
THJJ113	−35	−1.0	−1.0	−15	—	−3.0	5.0	1.0[2]	2.0	—	15	—	—	—	16	15	5.0	−10[3]	100	NJ99
THJJ113A	−40	−1.0	−0.2	−15	−1.0	−5.0	5.0	1.0[2]	8.0	—	15	—	—	—	16	15	5.0	−10[3]	80	NJ99
THJJ201	−40	−1.0	−0.1	−20	−0.3	−1.5	20	10	0.2	1.0	20	0.5	—	20	4.0	20	1.0	20	—	NJ16
THJJ202	−40	−1.0	−0.1	−20	−0.8	−4.0	20	10	0.9	4.5	20	1.0	—	20	4.0	20	1.0	20	—	NJ16
THJJ203	−40	−1.0	−0.1	−20	−2.0	−10	20	10	4.0	20	20	1.5	—	20	6.0	20	1.2	20	—	NJ32
THJJ210	−25	−1.0	−0.1	−15	−1.0	−3.0	15	1.0	2.0	15	15	4.0	12	15	—	—	—	—	—	NJ26L
THJJ211	−25	−1.0	−0.1	−15	−2.5	−4.5	15	1.0	7.0	20	15	6.0	12	15	—	—	—	—	—	NJ26L
THJJ212	−25	−1.0	−0.1	−15	−4.0	−6.0	15	1.0	15	40	15	7.0	12	15	—	—	—	—	—	NJ26L
THJJ230	−40	−1.0	−0.25	−30	−0.5	−3.0	20	1.0[2]	0.7	3.0	20	1.0	3.5	20	—	—	—	—	—	NJ16
THJJ231	−40	−1.0	−0.25	−30	−1.5	−5.0	20	1.0[2]	2.0	6.0	20	1.5	4.0	20	—	—	—	—	—	NJ16
THJJ232	−40	−1.0	−0.25	−30	−3.0	−6.0	20	1.0[2]	5.0	10	20	2.5	5.0	20	—	—	—	—	—	NJ16
THJJ300A	−25	−1.0	−0.5	−15	−1.5	−3.0	10	1.0	4.0	9.0	10	4.5	9.0	10[5]	5.5	10[5]	1.7	10[5]	—	NJ26L
THJJ300B	−25	−1.0	−0.5	−15	−2.0	−4.0	10	1.0	7.0	15	10	4.5	9.0	10[5]	5.5	10[5]	1.7	10[5]	—	NJ26L
THJJ300C	−25	−1.0	−0.5	−15	−2.5	−5.0	10	1.0	12	25	10	4.5	9.0	10[5]	5.5	10[5]	1.7	10[5]	—	NJ26L
THJJ304	−30	−1.0	−0.1	−20	−2.0	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	—	—	—	—	—	NJ26
THJJ305	−30	−1.0	−0.1	−20	−0.5	−3.0	15	1.0	1.0	8.0	15	3.0	—	15	—	—	—	—	—	NJ26
THJJ308	−25	−1.0	−1.0	−15	−1.0	−6.5	10	1.0	12	60	10	8.0	—	10[4]	7.5	−10[3]	3.5	−10[3]	—	NJ99
THJJ309	−25	−1.0	−1.0	−15	−1.0	−4.0	10	1.0	12	30	10	10	—	10[4]	7.5	−10[3]	3.5	−10[3]	—	NJ99
THJJ310	−25	−1.0	−1.0	−15	−2.0	−6.5	10	1.0	24	60	10	8.0	—	10[4]	7.5	−10[3]	3.5	−10[3]	—	NJ99
THJU290	−30	−1.0	−1.0	−15	−4.0	−10	15	3.0	500	—	10	—	—	—	50	−10[3]	25	−10[3]	3.0	NJ903
THJU291	−30	−1.0	−1.0	−15	−1.5	−4.5	15	3.0	200	—	10	—	—	—	50	−10[3]	25	−10[3]	7.0	NJ903
THJU308	−25	−1.0	−0.15	−15	−1.0	−6.0	10	1.0	12	60	10	—	—	—	7.5	−10[3]	3.5	−10[3]	—	NJ99
THJU309	−25	−1.0	−0.15	−15	−1.0	−4.0	10	1.0	12	30	10	—	—	—	7.5	−10[3]	3.5	−10[3]	—	NJ99
THJU310	−25	−1.0	−0.15	−15	−2.5	−6.0	10	1.0	24	60	10	—	—	—	7.5	−10[3]	3.5	−10[3]	—	NJ99
THJU401	−50	−1.0	−0.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	15[6]	3.0	15[6]	—	NJ35D
THJU402	−50	−1.0	−0.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	15[6]	3.0	15[6]	—	NJ35D
THJU403	−50	−1.0	−0.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	15[6]	3.0	15[6]	—	NJ35D

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in μA.
3) $V_{DS} = 0$ V, V_{GS} in volts.
4) $I_D = 10$ μA.
5) $I_D = 5.0$ mA.
6) $I_D = 200$ μA.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	@ I_G (µA)	I_{GSS} Max. (nA)	@ V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Limits Max. (V)	Conditions V_{DS} (V)	Conditions I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@ V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@ V_{DS} (V)	C_{ISS}[1] Max. (pF)	@ V_{DS} (V)	C_{RSS}[1] Max. (pF)	@ V_{DS} (V)	r_{DS} Max. (Ω)	Process
THJU404	−50	−1.0	−0.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	15[6]	3.0	15[6]	—	NJ35D
THJU405	−50	−1.0	−0.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	15[6]	3.0	15[6]	—	NJ35D
THJU406	−50	−1.0	−0.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	15[6]	3.0	15[6]	—	NJ35D
THJU1897	−40	−1.0	−0.4	−20	−5.0	−10	20	1.0	30	—	20	—	—	—	16	20	3.5	20	30	NJ132
THJU1898	−40	−1.0	−0.4	−20	−2.0	−7.0	20	1.0	15	—	20	—	—	—	16	20	3.5	20	50	NJ132
THJU1899	−40	−1.0	−0.4	−20	−1.0	−5.0	20	1.0	8.0	—	20	—	—	—	16	20	3.5	20	20	NJ132

NOTES:
1) V_{GS} = 0 V.
2) I_D in µA.
3) V_{DS} = 0 V, V_{GS} in volts.
4) I_D = 10 µA.
5) I_D = 5.0 mA.
6) I_D = 200 µA.

P-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	@ I_G (µA)	I_{GSS} Max. (nA)	@ V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Limits Max. (V)	Conditions V_{DS} (V)	Conditions I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@ V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@ V_{DS} (V)	C_{ISS}[1] Max. (pF)	@ V_{DS} (V)	C_{RSS}[1] Max. (pF)	@ V_{DS} (V)	r_{DS} Max. (Ω)	Process
THJ2608	30	1.0	10	5.0	1.0	4.0	−5.0	−1.0[2]	−0.9	−4.5	−5.0	1.0	—	−5.0	17	5.0[4]	—	—	—	PJ32
THJ2609	30	1.0	10	5.0	1.0	4.0	−5.0	−1.0[2]	−2.0	−10	−5.0	2.5	—	−5.0	30	5.0[4]	—	—	—	PJ32
THJ3329	20	10	10	10	—	5.0	−15	−10[2]	−1.0	−3.0	−10	—	—	—	20	−10	—	—	—	PJ32
THJ3330	20	10	10	10	—	6.0	−15	−10[2]	−2.0	−6.0	−10	—	—	—	20	−10	—	—	—	PJ32
THJ3331	20	10	10	10	—	8.0	−15	−10[2]	−5.0	−15	−10	—	—	—	20	−10	—	—	—	PJ32
THJ3332	20	10	10	10	—	6.0	−15	−10[2]	−1.0	−6.0	−10	—	—	—	20	−10	—	—	—	PJ32
THJ3820	20	10	20	10	—	8.0	−10	−10[2]	−0.3	−15	−10	0.8	5.0	−10	32	−10	16	−10	—	PJ32
THJ3993	25	1.0	1.0	15	4.0	9.5	−10	−1.0[2]	−10	—	−10	6.0	12	−10	16	−10	4.5	10[3]	150	PJ99
THJ3994	25	1.0	1.0	15	1.0	5.5	−10	−1.0[2]	−2.0	—	−10	4.0	10	−10	16	−10	4.5	10[3]	300	PJ99
THJ4381	25	1.0	1.0	15	1.0	5.0	−15	−1.0[2]	−3.0	−12	−15	2.0	6.0	−15	20	−15	5.0	−15	—	PJ32
THJ5018	30	1.0	2.0	15	—	10	−15	−1.0[2]	−10	—	−20	—	—	—	45	−15	10	12[3]	75	PJ99
THJ5019	30	1.0	2.0	15	—	5.0	−15	−1.0[2]	−5.0	—	−20	—	—	—	45	−15	10	7.0[3]	150	PJ99
THJ5020	25	1.0	1.0	15	0.3	1.5	−15	−1.0[2]	−0.3	−1.2	−15	1.0	3.5	−15	25	−15	7.0	−15	—	PJ32
THJ5021	25	1.0	1.0	15	0.5	2.5	−15	−1.0[2]	−1.0	−3.5	−15	1.5	6.0	−15	25	−15	7.0	−15	—	PJ32
THJ5033	20	10	10	15	0.3	2.5	−15	−1.0[2]	0.3	3.5	−15	1.0	5.0	−10	25	−15	7.0	−15	—	PJ32
THJ5114	30	1.0	0.5	20	5.0	10	−15	−1.0	−30	−90	−15	—	—	—	25	−15	7.0	12[3]	75	PJ99
THJ5115	30	1.0	0.5	20	3.0	6.0	−15	−1.0	−16	−60	−15	—	—	—	25	−15	7.0	7.0[3]	100	PJ99
THJ5116	30	1.0	0.5	20	1.0	4.0	−15	−1.0	−5.0	−25	−15	—	—	—	25	−15	7.0	5.0[3]	150	PJ99
THJ5460	40	10	5.0	20	0.75	6.0	−15	−1.0	−1.0	−5.0	−15	1.0	5.0	−15	7.0	−15	3.0	−15	—	PJ32
THJ5461	40	10	5.0	20	1.0	7.5	−15	−1.0	−2.0	−9.0	−15	1.5	5.5	−15	7.0	−15	3.0	−15	—	PJ32
THJ5462	40	10	5.0	20	1.8	9.0	−15	−1.0	−4.0	−16	−15	2.0	6.0	−15	7.0	−15	3.0	−15	—	PJ32

NOTES:
1) V_{GS} = 0 V.
2) I_D in µA.
3) V_{DS} = 0 V, V_{GS} in volts.
4) V_{GS} = 1.0 V.

P-Channel JFETs

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

	$V_{(BR)GSS}$		I_{GSS}		$V_{GS(off)}$ Limits		$V_{GS(off)}$ Conditions		I_{DSS}			g_{fs}			C_{iss}[1]		C_{rss}[1]		r_{DS}	
Device Type	Min. (V)	@ I_G (µA)	Max. (nA)	@ V_{GS} (V)	Min. (V)	Max. (V)	V_{DS} (V)	I_D (nA)	Min. (mA)	Max. (mA)	@ V_{DS} (V)	Min. (mS)	Max. (mS)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (Ω)	Process
THJJ174	30	1.0	1.0	20	5.0	10	−15	−10	−20	−135	−15	—	—	—	—	—	—	—	85	PJ99
THJJ175	30	1.0	1.0	20	3.0	6.0	−15	−10	−7.0	−70	−15	—	—	—	—	—	—	—	125	PJ99
THJJ176	30	1.0	1.0	20	1.0	4.0	−15	−10	−2.0	−35	−15	—	—	—	—	—	—	—	250	PJ99
THJJ177	30	1.0	1.0	20	0.8	2.25	−15	−10	−1.5	−20	−15	—	—	—	—	—	—	—	300	PJ99
THJJ270	30	1.0	0.2	20	0.5	2.0	−15	−1.0	−2.0	−15	−15	6.0	15	−15	—	—	—	—	—	PJ99
THJJ271	30	1.0	0.2	20	1.5	4.5	−15	−1.0	−6.0	−50	−15	8.0	18	−15	—	—	—	—	—	PJ99
THJP1086	30	1.0	2.0	15	—	10	−15	−1.0[2]	−10	—	−20	—	—	—	45	−15	10	12[3]	75	PJ99
THJP1087	30	1.0	2.0	15	—	5.0	−15	−1.0[2]	−5.0	—	−20	—	—	—	45	−15	10	7.0[3]	150	PJ99
THJU304	30	1.0	1.5	20	5.0	10	−15	−1.0[2]	−30	−90	−15	—	—	—	27	−15	7.0	12[3]	85	PJ99
THJU305	30	1.0	1.5	20	3.0	6.0	−15	−1.0[2]	−15	−60	−15	—	—	—	27	−15	7.0	7.0[3]	110	PJ99
THJU306	30	1.0	.5	20	1.0	4.0	−15	−1.0[2]	−5.0	−25	−15	—	—	—	27	−15	7.0	5.0[3]	175	PJ99

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in µA.
3) $V_{DS} = 0$ V, V_{GS} in volts.

NPN Transistors

'2N' and 'TP' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @ I_C (mA)	DC Current Gain @ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
TP918	50	30	15	3.0	10	15	20	—	3.0	1.0	0.4	10	600	4.0	1.7	—	—	DMA
TP930	100	45	45	5.0	10	45	100	300	0.01	5.0	1.0	10	30	0.5	8.0	—	3.0	FEE
TP2218	500	60	30	5.0	10	50	40	120	150	10	0.4	150	250	20	8.0	—	—	JGA
TP2218A	500	75	40	6.0	10	60	40	120	150	10	0.3	150	250	20	8.0	225	—	DCA
TP2219	500	60	30	5.0	10	50	100	300	150	10	0.4	150	250	20	8.0	—	—	JGA
TP2219A	500	75	40	6.0	10	60	100	300	150	10	0.3	150	300	20	8.0	225	—	DCA
TP2221	500	60	30	5.0	10	50	40	120	150	10	0.4	150	250	20	8.0	—	—	JGA
TP2221A	500	75	40	6.0	10	60	40	120	150	10	0.3	150	250	20	8.0	225	—	DCA
TP2222	500	60	30	5.0	10	50	100	300	150	10	0.4	150	250	20	8.0	—	—	JGA
TP2222A	500	75	40	6.0	10	60	100	300	150	10	0.3	150	250	20	8.0	225	—	DCA
TP2484	100	60	60	6.0	10	45	100	500	10[2]	5.0	0.35	1.0	15	0.05	6.0	—	3.0	FEE
2N2712	500	18	18	5.0	500	18	75	225	2.0	4.5	—	—	80	2.0	12	—	—	JGA
2N2714	500	18	18	5.0	500	18	75	225	2.0	4.5	0.3	50	—	—	—	—	—	JGA
2N2923	500	25	25	5.0	100	25	90	180	2.0	10	10	1000	—	—	10	—	—	JGA
2N2924	500	25	25	5.0	100	25	150	300	2.0	10	—	—	—	—	10	—	—	JGA
2N2925	500	25	25	5.0	100	25	235	470	2.0	10	—	—	—	—	10	—	—	JGA
2N2926	500	18	18	5.0	500	18	35	470	2.0	10	—	—	—	—	10	—	—	JGA
TP3252	800	60	30	5.0	500	40	30	90	500	1.0	0.5	500	200	50	12	70	—	BHB
TP3253	800	75	40	5.0	500	60	25	75	375	1.0	0.6	500	175	50	12	70	—	BHB
TP3299	500	60	30	5.0	10[3]	50	40	120	150	10	0.22	150	250	50	8.0	150	—	DCA
TP3300	500	60	30	5.0	10[3]	50	100	300	150	10	0.22	150	250	50	8.0	150	—	DCA
TP3301	500	60	30	5.0	10[3]	50	40	120	150	10	0.22	150	250	50	8.0	150	—	DCA
TP3302	500	60	30	5.0	10[3]	50	100	300	150	10	0.22	150	250	50	8.0	150	—	DCA
2N3390	500	25	25	5.0	100	18	400	800	2.0	4.5	—	—	—	—	10	—	—	JGA
2N3391	500	25	25	5.0	100	18	250	500	2.0	4.5	—	—	—	—	10	—	—	JGA
2N3391A	500	25	25	5.0	100	18	250	500	2.0	4.5	—	—	—	—	10	—	5.0	JGA
2N3392	500	25	25	5.0	100	18	150	300	2.0	4.5	—	—	—	—	10	—	—	JGA
2N3393	500	25	25	5.0	100	18	90	180	2.0	4.5	—	—	—	—	10	—	—	JGA
2N3394	500	25	25	5.0	100	18	55	110	2.0	4.5	—	—	—	—	10	—	—	JGA
2N3395	500	25	25	5.0	100	18	150	500	2.0	4.5	—	—	—	—	10	—	—	JGA
2N3396	500	25	25	5.0	100	18	90	500	2.0	4.5	—	—	—	—	10	—	—	JGA
2N3397	500	25	25	5.0	100	18	55	500	2.0	4.5	—	—	—	—	10	—	—	JGA
2N3398	500	25	25	5.0	100	18	55	800	2.0	4.5	—	—	—	—	10	—	—	JGA
2N3402	500	25	25	5.0	100	25	75	225	2.0	4.5	0.3	50	—	—	—	—	—	JGA
2N3403	500	25	25	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	JGA
2N3404	500	50	50	5.0	100	50	75	225	2.0	4.5	0.3	50	—	—	—	—	—	JGA
2N3405	500	50	50	5.0	100	50	180	540	2.0	4.5	0.3	50	—	—	—	—	—	JGA
2N3414	500	25	25	5.0	100	25	75	225	2.0	4.5	0.3	50	—	—	—	—	—	JGA
2N3415	500	25	25	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	JGA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

NPN Transistors

'2N' and 'TP' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @ I_C (mA)	DC Current Gain @ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
2N3416	500	50	50	5.0	100	50	75	225	2.0	4.5	0.3	50	—	—	—	—	—	JGA
2N3417	500	50	50	5.0	100	50	180	540	2.0	4.5	0.3	50	—	—	—	—	—	JGA
TP3444	800	80	50	5.0	500	60	20	60	500	1.0	0.6	500	150	50	12	70	—	BHB
TP3564	50	30	15	4.0	50	15	20	500	15	10	0.3	20	400	15	3.5	—	—	DMA
TP3565	100	30	25	6.0	50	25	150	600	1.0	10	0.35	1.0	40	1.0	4.0	—	—	FEE
TP3566	500	40	30	5.0	50	20	150	600	10	10	1.0	100	—	—	25	—	—	JGA
TP3567	800	80	40	5.0	50	40	40	120	150	1.0	0.25	150	60	50	20	—	—	JLA
TP3568	800	80	60	5.0	50	40	40	120	150	1.0	0.25	150	60	50	20	—	—	JLA
TP3569	800	80	40	5.0	50	40	100	300	150	1.0	0.25	150	60	50	20	—	—	JLA
TP3641	500	60[3]	30	5.0	50[3]	50	40	120	150	10	0.22	150	250	50	8	—		JGA
TP3642	500	60	45	5.0	50[3]	50	40	120	150	10	0.22	150	250	50	8	—		JGA
TP3643	500	60	30	5.0	50[3]	50	100	300	150	10	0.22	150	250	50	8	—		JGA
TP3691	100	35	20	4.0	50	15	40	160	10	1.0	0.7	10	200	10	3.5	—		FEE
TP3692	100	35	20	4.0	50	15	100	400	10	1.0	0.7	10	200	10	3.5	—		FEE
TP3693	100	45	45	4.0	50	35	40	160	10	10	—	—	200	10	3.5	—	4.0	FFB
TP3694	100	45	45	4.0	50	30	100	400	10	1.0	—	—	200	10	6.0	—		FFB
TP3700	800	140	80	7.0	10	90	100	300	150	10	0.2	150	100	50	12	—	4.0	JLA
TP3701	800	140	80	7.0	10	90	40	120	150	10	0.2	150	80	50	12	—		DID
2N3704	500	50	30	5.0	100	20	100	300	50	2.0	0.6	100	100	50	12	—		JGA
2N3705	500	50	30	5.0	100	20	50	150	50	2.0	0.8	100	100	50	12	—		JGA
2N3706	500	40	20	5.0	100	20	30	600	50	2.0	1.0	100	100	50	12	—	—	JGA
2N3707	100	30	30	6.0	100	20	100	400	0.1	5.0	1.0	10	—	—	—	—	5.0	FEE
2N3708	100	30	30	6.0	100	20	45	660	1.0	5.0	1.0	10	—	—	—	—	—	FEE
2N3709	100	30	30	6.0	100	20	45	165	1.0	5.0	1.0	10	—	—	—	—	—	FEE
2N3710	100	30	30	6.0	100	20	90	330	1.0	5.0	1.0	10	—	—	—	—	—	FEE
2N3711	100	30	30	6.0	100	20	180	660	1.0	5.0	1.0	10	—	—	—	—	—	FEE
2N3721	500	18	18	5.0	500	18	60	660	2.0	10	—	—	—	—	12	—	—	JGA
TP3724	800	50	30	6.0	1700	40	60	150	100	1.0	0.32	300	300	50	12	60	—	BHB
TP3724A	800	50	30	6.0	500	40	60	150	100	1.0	0.32	300	300	50	12	50	—	BHB
2N3825	50	30	15	4.0	100	15	20	—	2.0	10	0.25	2.0	200	2.0	3.5	—	5.5	DMA
2N3827	100	60	45	4.0	100	30	100	400	10	10	—	—	200	10	3.5	—	—	FEE
2N3858	100	30	30	4.0	500	18	60	120	2.0	4.5	—	—	90	2.0	4.0	—	—	FEE
2N3858A	100	60	60	6.0	500	18	60	120	10	1.0	—	—	90	2.0	4.0	—	—	FEE
2N3859	100	30	30	4.0	500	18	100	200	2.0	4.5	—	—	90	2.0	4.0	—	—	FEE
2N3859A	100	60	60	6.0	500	18	100	200	10	1.0	—	—	90	2.0	4.0	—	—	FEE
2N3860	100	30	30	4.0	500	18	150	300	2.0	4.5	—	—	90	2.0	4.0	—	—	FEE
2N3877	100	70	70	4.0	500	70	20	250	2.0	4.5	—	—	—	—	—	—	—	FEE
2N3877A	100	85	85	4.0	500	70	20	250	2.0	4.5	—	—	—	—	—	—	—	FEE
2N3900	100	18	18	5.0	100	18	250	500	2.0	4.5	—	—	—	—	12	—	—	FEE
2N3901	100	18	18	5.0	100	15	350	700	2.0	4.5	—	—	—	—	—	—	5.0	FEE
2N3903	100	60	40	6.0	50	30	50	150	10	1.0	0.2	10	250	10	4.0	—	6.0	FFB

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'2N' and 'TP' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
2N3904	100	60	40	6.0	50	30	100	300	10	1.0	0.2	10	300	10	4.0	—	5.0	FFB
2N3974	500	60	30	5.0	500	40	55	200	10	1.0	0.3	150	—	—	—	—	—	JGA
2N3976	500	60	30	5.0	500	40	55	200	10	1.0	0.3	150	—	—	—	—	7.0	JGA
TP4013	800	50	30	6.0	1700	40	60	150	100	1.0	0.2	100	300	50	12	60	—	BHB
TP4014	800	80	50	6.0	1700	60	60	150	100	1.0	0.26	100	300	50	10	60	—	BHB
2N4123	100	40	30	5.0	50	20	50	150	2.0	1.0	0.3	50	250	10	4.0	—	6.0	FEE
2N4124	100	30	25	5.0	50	20	120	360	2.0	1.0	0.3	50	300	10	4.0	—	5.0	FEE
2N4140	500	60	30	5.0	—	—	40	120	150	10	0.4	150	250	20	8.0	310	—	DCA
2N4141	500	60	30	5.0	—	—	100	300	150	10	0.4	150	250	20	8.0	310	—	DCA
2N4286	100	30	25	6.0	50	25	150	600	1.0	5.0	0.35	1.0	40	1.0	6.0	—	—	FEE
2N4287	100	45	45	7.0	10	30	150	600	1.0	5.0	0.35	1.0	40	1.0	6.0	—	5.0	FEE
2N4292	50	30	15	3.0	500	15	20	—	3.0	1.0	0.6	10	600	4.0	3.5	—	6.0	DMA
2N4293	50	30	15	3.0	500	15	20	—	3.0	1.0	0.6	10	600	4.0	3.5	—	6.0	DMA
TP4384	500	40	30	5.0	10	30	100	500	0.01	5.0	0.2	10	30	0.5	8.0	—	2.0	JGA
TP4386	500	40	30	5.0	10	30	40	500	0.01	5.0	0.2	10	30	0.5	8.0	—	3.0	JGA
2N4400	500	60	40	6.0	100	30	50	150	150	1.0	0.4	150	200	20	6.5	225	—	DCA
2N4401	500	60	40	6.0	100	30	100	300	150	1.0	0.4	150	250	20	6.5	225	—	DCA
2N4409	100	80	50	5.0	10	60	60	400	10	1.0	0.2	1.0	60	10	12	—	—	FEE
2N4410	100	120	80	5.0	10	100	60	400	10	1.0	0.2	1.0	60	10	12	—	—	FEE
2N4424	500	40	40	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	JGA
TP4926	500	200	200	7.0	100	100	20	200	30	10	—	—	30	20	6.0	—	—	BLA
TP4927	500	250	250	7.0	100	100	20	200	30	10	—	—	30	20	6.0	—	—	BLA
2N4944	500	75	40	6.0	10	60	100	300	150	10	0.3	150	300	20	8.0	225	—	DCA
2N4945	500	75	40	6.0	10	60	100	300	150	10	0.3	150	300	20	8.0	225	—	DCA
2N4946	500	75	40	6.0	10	60	100	300	150	10	0.3	150	300	20	8.0	225	—	DCA
2N4951	500	60	30	5.0	50	40	60	200	150	10	0.3	150	250	20	8.0	400	—	DCA
2N4952	500	60	30	5.0	50	40	100	300	150	10	0.3	150	250	20	8.0	400	—	DCA
2N4953	500	60	30	5.0	50	40	200	600	150	10	0.3	150	250	20	8.0	400	—	DCA
2N4954	500	40	30	5.0	50	30	60	600	150	10	0.3	150	250	20	8.0	400	—	DCA
2N4966	100	50	50	—	50	35	100	300	0.1	5.0	0.7	10	30	0.5	4.0	—	4.0	FEE
2N4967	100	50	50	—	50	35	200	600	0.1	5.0	0.7	10	30	0.5	4.0	—	3.0	FEE
2N4968	100	50	50	—	50	35	100	300	0.1	5.0	0.7	10	30	0.5	4.0	—	4.0	FEE
2N4969	500	60	30	5.0	10	50	40	120	150	10	0.4	150	250	20	8.0	—	—	JGA
2N4970	500	60	30	5.0	10	50	100	300	150	10	0.4	150	250	20	8.0	—	—	JGA
TP5058	150	300	300	7.0	50	100	35	150	30	25	1.0	30	30	10	10	—	—	BLA
TP5059	150	250	250	6.0	50	100	30	150	30	25	1.0	30	30	10	10	—	—	BLA
2N5088	100	35	30	—	50	20	300	900	0.1	5.0	0.5	10	—	—	4.0	—	3.0	FEE
2N5089	100	30	25	—	50	15	400	1200	0.1	5.0	0.5	10	—	—	4.0	—	2.0	FEE
TP5127	100	20	12	3.0	50	10	15	300	2.0	10	0.3	10	150	2.0	3.5	—	—	FFB
2N5128	500	15	12	3.0	50	10	35	350	50	10	0.25	150	200	50	10	—	—	JGA
2N5129	500	15	12	3.0	50	10	35	350	50	10	0.25	150	200	50	10	—	—	JGA
2N5130	50	30	12	1.0	50	10	15	250	8.0	10	0.6	10	450	8.0	1.7	—	—	DMA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'2N' and 'TP' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
TP5131	100	20	15	3.0	50	10	35	500	10	1.0	1.0	10	100	10	6.0	—	—	FEE
TP5132	100	20	20	3.0	50	10	30	400	10	10	2.0	10	200	10	3.5	—	—	FEE
TP5133	100	20	18	3.0	50	15	60	1000	1.0	5.0	0.4	1.0	40	1.0	5.0	—	—	FEE
2N5135	800	30	25	4.0	300	15	50	600	10	10	1.0	100	40	30	25	—	—	JLA
2N5136	800	30	20	3.0	100	20	20	400	150	1.0	0.25	150	40	50	35	—	—	JLA
TP5137	800	30	20	3.0	100	20	20	400	150	1.0	0.25	150	40	50	35	—	—	JLA
2N5172	500	25	25	5.0	100	25	100	500	10	10	0.25	10	—	—	10	—	—	JGA
2N5174	100	90	75	5.0	500	60	40	600	10	5.0	0.95	10	—	—	5.0	—	—	FEE
TP5189	800	60	35	5.0	500	30	35	—	500	1.0	1.0	1000	250	50	12	70	—	BHB
2N5209	100	50	50	—	50	35	100	300	0.1	5.0	0.7	10	30	0.5	4.0	—	4.0	FEE
2N5210	100	50	50	—	50	35	200	600	0.1	5.0	0.7	10	30	0.5	4.0	—	3.0	FEE
2N5219	100	20	15	3.0	100	10	35	500	2.0	10	0.4	10	150	10	4.0	—	—	FFB
2N5220	500	15	15	3.0	100	10	30	600	50	10	0.5	150	100	20	10	—	—	JGA
2N5223	100	25	20	3.0	100	10	50	800	2.0	10	0.7	10	150	10	4.0	—	—	FFB
2N5225	100	25	25	4.0	300	15	30	600	50	10	0.8	100	50	20	20	—	—	FEE
2N5232	100	70	50	5.0	30	50	250	500	2.0	5.0	0.125	10	—	—	4.0	—	—	FEE
2N5232A	100	70	50	5.0	30	50	250	500	2.0	5.0	0.125	10	—	—	4.0	—	5.0	FEE
2N5249	100	70	50	5.0	30	50	400	800	2.0	5.0	0.125	10	—	—	—	—	—	FEE
2N5249A	100	70	50	5.0	30	50	400	800	2.0	5.0	0.125	10	—	—	—	—	3.0	FEE
2N5305	500	25	25	12	100	25	2k	20k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
2N5306	500	25	25	12	100	25	7k	70k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
2N5307	500	40	40	12	100	40	2k	20k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
2N5308	500	40	40	12	100	40	7k	70k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
2N5310	100	70	50	5.0	10	50	100	300	0.01	5.0	0.125	10	—	—	—	—	—	FEE
TP5368	500	60	30	5.0	50	40	60	200	150	10	0.3	150	250	20	8.0	350	—	DCA
TP5369	500	60	30	5.0	50	40	100	300	150	10	0.3	150	250	20	8.0	350	—	DCA
TP5370	500	60	30	5.0	50	40	200	600	150	10	0.3	150	250	20	8.0	400	—	DCA
TP5371	500	40	30	5.0	50	30	60	600	150	10	0.3	150	250	20	8.0	400	—	DCA
TP5376	500	60	30	5.0	10	30	120	—	1.0	5.0	—	—	—	—	8.0	—	—	JGA
TP5377	500	60	30	5.0	10	30	100	—	1.0	5.0	—	—	—	—	8.0	—	—	JGA
TP5380	100	60	40	6.0	50	30	50	150	10	1.0	0.2	10	250	10	4.0	225	6.0	FFB
TP5381	100	60	40	6.0	50	30	100	300	10	1.0	0.2	10	300	10	4.0	250	5.0	FFB
2N5418	500	25	25	4.0	100	25	40	120	50	1.0	0.25	50	—	—	6.0	—	—	JGA
2N5419	500	25	25	4.0	100	25	100	300	50	1.0	0.25	50	—	—	6.0	—	—	JGA
2N5420	500	25	25	4.0	100	25	250	500	50	1.0	0.25	50	—	—	6.0	—	—	JGA
TP5449	500	50	30	5.0	100	20	100	300	50	2.0	0.6	100	100	50	12	—	—	JGA
TP5450	500	50	30	5.0	100	20	50	150	50	2.0	0.8	100	100	50	12	—	—	JGA
TP5451	500	40	20	5.0	100	20	30	600	50	2.0	1.0	100	100	50	12	—	—	JGA
2N5550	600	160	140	6.0	100	100	60	250	10	5.0	0.15	10	100	10	6.0	—	10	VXA
2N5551	600	180	160	6.0	50	120	80	250	10	5.0	0.15	10	100	10	6.0	—	8.0	VXA
2N5770	50	30	15	4.5	10	15	50	200	8.0	10	0.4	10	90	8.0	1.1	—	6.0	DMA
2N5772	500	40	15	5.0	500	20	30	120	30	0.4	0.2	30	350	30	5.0	28	—	BJB

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'2N' and 'TP' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
TP5810	800	35	25	5.0	100	25	60	200	2.0	2	0.75	500	100	50	15	—	—	JLA
TP5812	800	35	25	5.0	100	25	150	500	2.0	2	0.75	500	135	50	15	—	—	JLA
TP5814	800	50	40	5.0	100	25	60	120	2.0	2	0.75	500	100	50	15	—	—	JLA
TP5816	800	50	40	5.0	100	25	100	200	2.0	2	0.75	500	120	50	15	—	—	JLA
TP5818	800	50	40	5.0	100	25	150	300	2.0	2	0.75	500	135	50	15	—	—	JLA
TP5820	800	70	60	5.0	100	25	60	120	2.0	2	0.75	500	100	50	15	—	—	JLA
TP5822	800	70	60	5.0	100	25	100	200	2.0	2	0.75	500	120	50	15	—	—	JLA
TP5824	100	50	40	5.0	50	40	60	120	2.0	5.0	0.125	10	90	2.0	4.0	—	—	FFB
TP5825	100	50	40	5.0	50	40	100	200	2.0	5.0	0.125	10	90	2.0	4.0	—	—	FEE
TP5826	100	50	40	5.0	50	40	150	300	2.0	5.0	0.125	10	90	2.0	4.0	—	—	FEE
TP5827	100	50	40	5.0	50	40	250	500	2.0	5.0	0.125	10	90	2.0	4.0	—	—	FEE
TP5828	100	50	40	5.0	50	40	400	800	2.0	5.0	0.125	10	90	2.0	4.0	—	—	FEE
2N5830	300	120	100	5.0	50	100	80	500	10	5.0	0.2	10	100	10	4.0	—	—	VAB
2N5831	300	160	140	5.0	50	120	80	250	10	5.0	0.2	10	100	10	4.0	—	—	VAB
2N5832	300	160	140	5.0	50	120	175	500	10	5.0	0.2	10	100	10	4.0	—	—	VAB
TP5856	1000	60	60	5.0	100	40	50	300	150	10	0.4	150	100	50	15	—	—	DID
TP5858	1000	80	80	5.0	100	60	50	300	150	10	0.4	150	100	50	15	—	—	DID
TP5961	100	60	60	8.0	2.0	45	150	700	10	5.0	0.2	10	100	10	4.0	—	—	FEE
TP5962	100	45	45	8.0	2.0	30	600	1400	10	5.0	0.2	10	100	10	4.0	—	—	FEE
2N5998	500	35	25	5.0	30	25	150	300	10	2.0	0.25	50	140	10	—	—	1.5	JGA
2N6008	500	35	25	5.0	30	25	250	500	10	2.0	0.25	50	140	10	—	—	1.5	JGA
TP6222	100	60	60	5.0	50	60	75	200	2.0	5.0	0.125	10	—	—	4.0	—	—	FEE
TP6224	100	60	60	5.0	50	60	150	300	2.0	5.0	0.125	10	—	—	4.0	—	—	FEE
2N6426	500	40	40	12	50	30	20k	200k	10	5.0	1.2	50	150	10	7.0	—	10	TPM
2N6427	500	40	40	12	50	30	10k	100k	10	5.0	1.2	50	130	10	7.0	—	10	TPM
2N6428	100	60	50	6.0	10	30	250	650	0.1	5.0	0.2	10	100	1.0	3.0	—	—	FEE
2N6429	100	55	45	6.0	10	30	500	1250	0.1	5.0	0.2	10	100	1.0	3.0	—	—	FEE

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob} [1] (pF)	t_s [1] (ns)	NF [1] (dB)	Process
MPS2712	200	18	18	5.0	500	18	75	225	2.0	4.5	—	—	—	—	4.0	—	—	FEE
MPS2714	200	18	18	5.0	500	18	75	225	2.0	4.5	—	—	—	—	—	—	—	FEE
MPS2716	200	18	18	5.0	500	18	75	225	2.0	4.5	—	—	—	—	3.5	—	—	FEE
MPS2923	500	25	25	5.0	500	25	90	180	2.0	10	—	—	—	—	12	—	—	JGA
MPS2924	500	25	25	5.0	500	25	150	300	2.0	10	—	—	—	—	12	—	—	JGA
MPS2925	500	25	25	5.0	500	25	235	470	2.0	10	—	—	—	—	12	—	—	JGA
MPS2926	500	25	25	5.0	500	18	35	470	2.0	10	—	—	—	—	12	—	—	JGA
MPS3390	500	25	25	5.0	100	18	400	800	2.0	4.5	—	—	—	—	10	—	—	JGA
MPS3391	500	25	25	5.0	100	18	250	500	2.0	4.5	—	—	—	—	10	—	—	JGA
MPS3392	500	25	25	5.0	100	18	150	300	2.0	4.5	—	—	—	—	10	—	—	JGA
MPS3393	500	25	25	5.0	100	18	90	180	2.0	4.5	—	—	—	—	10	—	—	JGA
MPS3394	500	25	25	5.0	100	18	55	110	2.0	4.5	—	—	—	—	10	—	—	JGA
MPS3395	500	25	25	5.0	100	18	150	500	2.0	4.5	—	—	—	—	10	—	—	JGA
MPS3396	500	25	25	5.0	100	18	90	500	2.0	4.5	—	—	—	—	10	—	—	JGA
MPS3397	500	25	25	5.0	100	18	55	500	2.0	4.5	—	—	—	—	10	—	—	JGA
MPS3398	500	25	25	5.0	100	18	55	800	2.0	4.5	—	—	—	—	10	—	—	JGA
MPS3402	500	25	25	5.0	100	18	75	225	2.0	4.5	0.3	50	—	—	—	—	—	JGA
MPS3403	500	25	25	5.0	100	18	180	540	2.0	4.5	0.3	50	—	—	—	—	—	JGA
MPS3404	500	50	50	5.0	100	18	75	225	2.0	4.5	0.3	50	—	—	—	—	—	JGA
MPS3405	500	50	50	5.0	100	18	180	540	2.0	4.5	0.3	50	—	—	—	—	—	JGA
MPS3414	500	25	25	5.0	100	25	75	225	2.0	4.5	0.3	50	—	—	—	—	—	JGA
MPS3415	500	25	25	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	JGA
MPS3416	500	50	50	5.0	100	25	75	225	2.0	4.5	0.3	50	—	—	—	—	—	JGA
MPS3417	500	50	50	5.0	100	25	180	540	2.0	4.5	0.3	50	—	—	—	—	—	JGA
MPS3563	50	30	15	2.0	50	15	20	200	8.0	10	—	—	600	8.0	1.7	—	—	DMA
MPS3565	200	30	25	6.0	50	25	150	600	1.0	10	0.35	1.0	40	1.0	4.0	—	—	FEE
MPS3566	800	40	30	5.0	50	20	150	600	10	10	1.0	100	40	30	25	—	—	JLA
MPS3567	800	80	40	5.0	50	40	40	120	150	1.0	0.25	150	60	50	20	—	—	JLA
MPS3568	800	80	60	5.0	50	40	40	120	150	1.0	0.25	150	60	50	20	—	—	JLA
MPS3569	800	80	40	5.0	50	40	100	300	150	1.0	0.25	150	60	50	20	—	—	JLA
MPS3642	500	60	45	5.0	50[2]	50	40	120	150	10	0.22	150	250	50	8.0	—	—	JGA
MPS3693	100	45	45	4.0	50	35	40	160	10	10	—	—	200	10	3.5	—	4.0	FFB
MPS3694	100	45	45	4.0	50	35	100	400	10	10	—	—	200	10	3.5	—	4.0	FFB
MPS3704	500	50	30	5.0	100	20	100	300	50	2.0	0.6	100	100	50	12	—	—	JGA
MPS3705	500	50	30	5.0	100	20	50	150	50	2.0	0.8	100	100	50	12	—	—	JGA
MPS3706	500	40	20	5.0	100	20	30	600	50	2	1.0	100	100	50	12	—	—	JGA
MPS3707	200	30	30	6.0	100	20	100	400	0.1	5	1.0	10	—	—	—	—	5.0	FEE
MPS3708	200	30	30	6.0	100	20	45	660	1.0	5	1.0	10	—	—	—	—	—	FEE
MPS3709	200	30	30	6.0	100	20	45	165	1.0	5	1.0	10	—	—	—	—	—	FEE
MPS3710	200	30	30	6.0	100	20	90	330	1.0	5	1.0	10	—	—	—	—	—	FEE
MPS3711	200	30	30	6.0	100	20	180	660	1.0	5	1.0	10	—	—	—	—	—	FEE

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

NPN Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
MPS3721	500	—	—	—	500	18	60	660	2.0	10	—	—	—	—	—	—	—	JGA
MPS3826	200	60	45	4.0	100	30	40	160	10	10	—	—	200	10	3.5	—	—	FEE
MPS3827	200	60	45	4.0	100	30	100	400	10	10	—	—	200	10	3.5	—	—	FEE
MPS5127	100	20	12	3.0	50	10	15	300	2.0	10	0.3	10	—	—	—	—	—	FFB
MPS5131	200	20	15	3.0	50	10	30	500	10	1.0	1.0	10	—	—	—	—	—	FEE
MPS5132	200	20	20	3.0	50	10	20	—	10	10	2.0	10	200	10	—	—	—	FEE
MPS5133	200	20	18	3.0	50	15	60	1000	1.0	5.0	—	—	—	—	—	—	—	FEE
MPS5135	800	30	25	4.0	300	15	50	600	10	10	1.0	100	40	30	25	—	—	JLA
MPS5136	800	30	20	3.0	100	20	20	400	150	1.0	0.25	150	40	50	35	—	—	JLA
MPS5137	800	30	20	3.0	100	20	20	400	150	1.0	0.25	150	40	50	35	—	—	JLA
MPS5172	500	25	25	5.0	100	25	100	500	10	10	0.25	10	—	—	10	—	—	JGA
MPS5305	500	25	25	12	100	25	2k	20k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
MPS5306	500	25	25	10	100	25	7k	70k	2.0	5.0	1.4	200	60	2.0	10	—	—	TPM
MPS6512	200	40	30	4.0	50	30	50	100	2.0	10	0.5	50	—	—	3.5	—	—	FEE
MPS6513	200	40	30	4.0	50	30	90	180	2.0	10	0.5	50	—	—	3.5	—	—	FEE
MPS6514	200	40	25	4.0	50	30	150	300	2.0	10	0.5	50	—	—	3.5	—	—	FEE
MPS6515	200	40	25	4.0	50	30	250	500	2.0	10	0.5	50	—	—	3.5	—	—	FEE
MPS6520	200	40	25	4.0	50	30	200	400	2.0	10	0.5	50	—	—	3.5	—	3.0	FEE
MPS6521	200	40	25	4.0	50	30	300	600	2.0	10	0.5	50	—	—	3.5	—	3.0	FEE
MPS6530	500	60	40	5.0	50	40	40	120	100	1.0	0.5	100	—	—	5.0	—	—	DCA
MPS6531	500	60	40	5.0	50	40	90	270	100	1.0	0.5	100	—	—	5.0	—	—	DCA
MPS6532	500	50	30	5.0	100	30	30	—	100	1.0	0.5	100	—	—	5.0	—	—	DCA
MPS6541	50	30[3]	20	4.0	50	15	25	—	4.0	10	—	—	600	4.0	1.7	—	—	DMA
MPS6560	1000	25	25	5.0	100	20	50	200	500	1.0	0.5	500	—	—	30	—	—	DID
MPS6561	1000	25	20	5.0	100	20	50	200	350	1.0	0.5	350	—	—	30	—	—	DID
MPS6564	200	—	45	5.0	500	40	25	—	10	5.0	0.5	10	—	—	4.0	—	—	FEE
MPS6565	200	60	45	4.0	100	30	40	160	10	10	0.4	10	200	10	3.5	—	—	FEE
MPS6566	200	60	45	4.0	100	30	100	400	10	10	0.4	10	200	10	3.5	—	—	FEE
MPS6571	200	20	20	3.0	50	20	250	1000	0.1	5.0	0.5	10	100	0.5	4.5	—	—	FEE
MPS6573	200	—	35	—	100	35	200	500	10	5.0	0.5	10	100	10	12	—	—	FEE
MPS6574	200	—	35	—	100	35	100	300	1.0	5.0	0.5	10	100	10	12	—	—	FEE
MPS6575	200	—	45	—	100	45	200	500	10	5.0	0.5	10	100	10	12	—	—	FEE
MPS6576	200	—	45	—	100	45	100	300	1.0	5.0	0.5	10	100	10	12	—	—	FEE
MPS6601	1000	25	25	4.0	100	25	50	—	500	1.0	0.6	1000	100	50	30	250	—	DID
MPS6602	1000	30	40	4.0	100	25	50	—	500	1.0	0.6	1000	100	50	30	250	—	DID
MPS8097	200	60	40	6.0	30	40	250	700	0.1	5.0	—	—	—	—	4.0	—	2.0	FEE
MPS8098	800	60	60	6.0	100	60	100	300	1.0	5.0	0.3	100	150	10	8.0	—	—	JLA
MPS8099	800	80	80	5.0	100	80	100	300	1.0	5.0	0.3	100	150	10	8.0	—	—	JLA
MPSA05	800	60	60	4.0	100	60	50	—	100	1.0	0.25	100	100	10	—	—	—	JLA
MPSA06	800	80	80	4.0	100	80	50	—	100	1.0	0.25	100	100	10	—	—	—	JLA
MPSA09	200	50	50	—	100	30	100	600	0.1	5.0	0.9	10	30	0.5	5.0	—	—	FEE
MPSA10	200	—	40	4.0	100	30	40	400	5.0	10	—	—	125	5.0	4.0	—	—	VRB

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
MPSA12	500	20[3]	—	10	100	15	20k	—	10	5.0	1.0	10	—	—	—	—	—	TPM
MPSA13	500	30[3]	—	10	100	30	10k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA14	500	30[3]	—	10	100	30	20k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA18	200	45	45	6.5	50	30	500	1500	10	5.0	0.2	10	100	1.0	3.0	—	1.5	FEE
MPSA20	200	40	40	4.0	100	30	40	400	5.0	10	0.25	10	125	5.0	4.0	—	—	VRB
MPSA25	500	40[3]	—	10	100	30	10k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA26	500	50[3]	—	10	100	40	10k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA27	500	60[3]	—	10	100	50	10k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
MPSA28	500	80[3]	—	12	100	60	10k	—	100	5.0	1.2	10	125	10	8.0	—	—	JEA
MPSA29	500	100[3]	—	12	100	80	10k	—	100	5.0	1.2	10	125	10	8.0	—	—	JEA
MPSA42	500	300	300	6.0	100	200	40	—	30	10	0.5	20	50	10	3.0	—	—	BLA
MPSA43	500	200	200	6.0	100	160	40	—	30	10	0.5	20	50	10	4.0	—	—	BLA
MPSD01	500	200	200	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	BLA
MPSD02	600	140	140	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	VXA
MPSD03	600	100	100	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	VXA
MPSD04	500	25[3]	—	10	1000	20	2k	—	100	5.0	1.0	100	100	10	—	—	—	SQL
MPSD05	800	25	25	4.0	1000	20	80	—	100	5.0	0.5	100	100	50	—	—	—	JLA
MPSD06	500	25	25	4.0	1000	20	50	—	10	5.0	0.3	50	100	10	—	—	—	JGA
MPSL01	600	140	120	5.0	1000	75	50	300	10	5.0	0.2	10	60	10	8.0	—	—	VXA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

'D' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
D16P1	500	18	12	12	100	18	6k	—	100	5.0	1.4	200	60	2.0	10	—	—	TPM
D33D21	800	35[3]	25	5.0	100[3]	25	60	200	2.0	2.0	0.75	500	100	50	15	—	—	JLA
D33D22	800	35[3]	25	5.0	100[3]	25	150	500	2.0	2.0	0.75	500	135	50	15	—	—	JLA
D33D24	800	50[3]	40	5.0	100[3]	25	60	120	2.0	2.0	0.75	500	80	50	15	—	—	JLA
D33D25	800	50[3]	40	5.0	100[3]	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	JLA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

'D' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T		C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
					Max. (nA)	@ V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	Max. (V)	@ I_C (mA)	Min. (MHz)	@ I_C (mA)				
D33D26	800	50[3]	40	5.0	100[3]	25	150	300	2.0	2.0	0.75	500	135	50	15	—	—	JLA
D33D27	800	50[3]	40	5.0	100[3]	25	250	500	2.0	2.0	0.75	500	150	50	15	—	—	JLA
D33D29	800	70[3]	60	5.0	100[3]	25	60	120	2.0	2.0	0.75	500	80	50	15	—	—	JLA
D33D30	800	70[3]	60	5.0	100[3]	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	JLA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

Pro-Electron Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T		C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
					Max. (nA)	@ V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@ I_C (mA)	@ V_{CE} (V)	Max. (V)	@ I_C (mA)	Min. (MHz)	@ I_C (mA)				
BC167	500	50[3]	45	5.0	15[3]	50	120	800	2.0	5.0	0.2	10	85	0.5	7.0	—	10	JGA
BC167A	500	50[3]	45	5.0	15[3]	50	120	220	2.0	5.0	0.2	10	85	0.5	7.0	—	10	JGA
BC167B	500	50[3]	45	5.0	15[3]	50	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	10	JGA
BC168	500	30[3]	20	5.0	15[3]	30	120	800	2.0	5.0	0.2	10	85	0.5	7.0	—	10	JGA
BC168A	500	30[3]	20	5.0	15[3]	30	120	220	2.0	5.0	0.2	10	85	0.5	7.0	—	10	JGA
BC168B	500	30[3]	20	5.0	15[3]	30	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	10	JGA
BC168C	500	30[3]	20	5.0	15[3]	30	380	800	2.0	5.0	0.2	10	85	0.5	7.0	—	10	JGA
BC169	500	30[3]	20	5.0	15[3]	30	180	800	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	JGA
BC169B	500	30[3]	20	5.0	15[3]	30	180	460	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	JGA
BC169C	500	30[3]	20	5.0	15[3]	30	380	800	2.0	5.0	0.2	10	85	0.5	7.0	—	4.0	JGA
BC182L	500	60	50	6.0	15	50	120	800	2.0	5.0	0.25	10	150	10	7.0	—	10	JGA
BC182LA	500	60	50	6.0	15	50	120	220	2.0	5.0	0.25	10	150	10	7.0	—	10	JGA
BC182LB	500	60	50	6.0	15	50	180	460	2.0	5.0	0.25	10	150	10	7.0	—	10	JGA
BC183L	500	45	30	6.0	15	30	120	800	2.0	5.0	0.25	10	150	10	7.0	—	10	JGA
BC183LA	500	45	30	6.0	15	30	120	220	2.0	5.0	0.25	10	150	10	7.0	—	10	JGA
BC183LB	500	45	30	6.0	15	30	180	460	2.0	5.0	0.25	10	150	10	7.0	—	10	JGA
BC183LC	500	45	30	6.0	15	30	380	800	2.0	5.0	0.25	10	150	10	7.0	—	10	JGA
BC184L	500	45	30	5.0	15	30	240	900	2.0	5.0	0.25	10	150	10	7.0	—	4.0	JGA
BC184LB	500	45	30	5.0	15	30	240	500	2.0	5.0	0.25	10	150	10	7.0	—	4.0	JGA
BC184LC	500	45	30	5.0	15	30	450	900	2.0	5.0	0.25	10	150	10	7.0	—	4.0	JGA
BC317	500	50	45	6.0	30	20	110	450	2.0	5.0	0.2	10	—	—	7.0	—	6.0	JGA
BC317A	500	50	45	6.0	30	20	110	220	2.0	5.0	0.2	10	—	—	7.0	—	6.0	JGA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

Pro-Electron Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

					I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T					
Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
BC317B	500	50	45	6.0	30	20	200	450	2.0	5.0	0.2	10	—	—	7.0	—	6.0	JGA
BC318	500	30	20	5.0	30	20	110	800	2.0	5.0	0.2	10	—	—	7.0	—	6.0	JGA
BC318A	500	30	20	5.0	30	20	110	220	2.0	5.0	0.2	10	—	—	7.0	—	6.0	JGA
BC318B	500	30	20	5.0	30	20	200	450	2.0	5.0	0.2	10	—	—	7.0	—	6.0	JGA
BC318C	500	30	20	5.0	30	20	450	800	2.0	5.0	0.2	10	—	—	7.0	—	6.0	JGA
BC319	500	30	20	5.0	30	20	200	800	2.0	5.0	0.2	10	—	—	7.0	—	4.0	JGA
BC319B	500	30	20	5.0	30	20	200	450	2.0	5.0	0.2	10	—	—	7.0	—	4.0	JGA
BC319C	500	30	20	5.0	30	20	420	800	2.0	5.0	0.2	10	—	—	7.0	—	4.0	JGA

NOTES:
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2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

'2N' and 'TP' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

					I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T					
Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
TP2904	500	60	40	5.0	20	50	40	120	150	10	0.4	150	200	50	8.0	100	—	DDA
TP2904A	500	60	60	5.0	10	50	40	120	150	10	0.4	150	200	50	8.0	100	—	DDA
TP2905	500	60	40	5.0	20	50	100	300	150	10	0.4	150	200	50	8.0	100	—	DDA
TP2905A	500	60	60	5.0	10	50	100	300	150	10	0.4	150	200	50	8.0	100	—	DDA
TP2906	500	60	40	5.0	20	50	40	120	150	10	0.4	150	200	50	8.0	100	—	DDA
TP2906A	500	60	60	5.0	10	50	40	120	150	10	0.4	150	200	50	8.0	100	—	DDA
TP2907	500	60	40	5.0	20	50	100	300	150	10	0.4	150	200	50	8.0	100	—	DDA
TP2907A	500	60	60	5.0	10	50	100	300	150	10	0.4	150	200	50	8.0	100	—	DDA
TP2944	50	15	10	15	100	15	80	—	1.0	0.5	—	—	10	1.0	10	—	25	SHF
TP2945	50	25	20	25	200	25	40	—	1.0	0.5	—	—	5.0	1.0	10	—	25	SHF
TP2946	50	40	35	40	500	40	30	—	1.0	0.5	—	—	3.0	1.0	10	—	25	SHF
TP3250	200	50	40	5.0	—	—	50	150	10	1.0	0.25	10	250	10	6.0	225	6.0	BTB
TP3251	200	50	40	5.0	—	—	100	300	10	1.0	0.25	10	300	20	6.0	250	6.0	BTB
TP3638	500	25	25	4.0	35[3]	15	20	—	50	1.0	0.25	50	100	50	20	170	—	DDA
TP3638A	500	25	25	4.0	25[3]	15	100	—	50	1.0	0.25	50	150	50	10	170	—	DDA

NOTES:
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2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

'2N' and 'TP' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain h_{FE} Max.	DC Current Gain @I_C (mA)	DC Current Gain @V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	$V_{CE(sat)}$ @I_C (mA)	f_T Min. (MHz)	f_T @I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
TP3644	500	45	45	5.0	35[3]	30	100	300	50	10	0.25	50	200	20	8.0	100	—	JFA
2N3702	500	40	25	5.0	100	20	60	300	50	5.0	0.25	50	100	50	12	—	—	JFA
2N3703	500	50	30	5.0	100	20	30	150	50	5.0	0.25	50	100	50	12	—	—	JFA
TP3798	50	60	60	5.0	10	50	150	450	0.5	5.0	0.2	0.1	100	1.0	4.0	—	3.5	BXE
TP3798A	50	90	90	5.0	10	50	150	450	0.5	5.0	0.2	0.1	100	1.0	4.0	—	3.5	BXE
TP3799	50	60	60	5.0	10	50	300	900	0.5	5.0	0.2	0.1	100	1.0	4.0	—	2.5	BXE
TP3799A	50	90	90	5.0	10	50	300	900	0.5	5.0	0.2	0.1	100	1.0	4.0	—	2.5	BXE
2N3905	200	40	40	5.0	—	—	50	150	10	1.0	0.25	10	200	10	4.5	260	5.0	BTB
2N3906	200	40	40	5.0	—	—	100	300	10	1.0	0.25	10	250	10	4.5	300	4.0	BTB
2N4058	100	30	30	6.0	100	20	100	400	0.1	5.0	0.7	10	—	—	—	—	5.0	BXE
2N4059	100	30	30	6.0	100	20	45	660	1.0	5.0	0.7	10	—	—	—	—	—	BXE
2N4060	500	30	30	6.0	100	20	45	165	1.0	5.0	0.7	10	—	—	—	—	—	JFA
2N4061	100	30	30	6.0	100	20	90	330	1.0	5.0	0.7	10	—	—	—	—	—	BXE
2N4062	100	30	30	6.0	100	20	180	660	1.0	5.0	0.7	10	—	—	—	—	—	BXE
2N4121	200	40	40	5.0	25[3]	30	70	200	10	1.0	0.14	10	400	10	4.5	150	4.0	BTB
2N4122	200	40	40	5.0	25[3]	30	150	300	10	1.0	0.14	10	450	10	4.5	150	4.0	BTB
2N4125	100	30	30	4.0	50	20	50	150	2.0	1.0	0.4	50	200	10	4.5	—	5.0	BXE
2N4126	100	25	25	4.0	50	20	120	360	2.0	1.0	0.4	50	250	10	4.5	—	4.0	BXE
2N4142	200	60	40	5.0	—	—	40	120	150	10	0.4	150	200	50	8.0	100	—	BTB
2N4143	200	60	40	5.0	—	—	100	300	150	10	0.4	150	200	50	8.0	100	—	BTB
2N4249	100	60	60	5.0	10	40	100	300	0.1	5.0	0.25	10	—	—	6.0	—	3.0	BXE
2N4250	100	40	40	5.0	10	40	250	700	0.1	5.0	0.25	10	—	—	6.0	—	2.0	BXE
2N4250A	100	60	60	5.0	10	50	250	700	0.1	5.0	0.25	10	—	—	6.0	—	2.0	BXE
2N4288	100	30	25	6.0	50	25	150	600	1.0	5.0	0.35	1.0	40	1.0	8.0	—	—	BXE
2N4289	100	60	45	7.0	10	45	150	600	1.0	5.0	0.35	1.0	40	1.0	8.0	—	4.0	BXE
2N4290	500	30	20	5.0	500	20	50	300	100	10	0.4	100	100	10	10	—	—	JFA
2N4291	500	40	30	6.0	200	30	100	300	100	10	0.4	100	100	10	10	—	—	JFA
TP4314	1000	90	65	—	250	60	50	250	150	10	1.4	150	60	50	30	—	—	DJC
TP4354	1000	60	60	5.0	50	50	50	500	10	10	0.15	150	100	50	30	400	3.0	DJC
TP4355	1000	60	60	5.0	50	50	100	400	10	10	0.15	150	100	50	30	400	3.0	DJC
TP4356	1000	80	80	5.0	50	50	50	250	10	10	0.15	150	100	50	30	400	3.0	DJC
2N4402	500	40	40	5.0	—	—	50	150	150	2.0	0.4	150	150	20	10	225	—	DDA
2N4403	500	40	40	5.0	—	—	100	300	150	2.0	0.4	150	200	20	10	225	—	DDA
TP4413	500	40	30	5.0	10	30	120	—	1.0	5.0	0.2	1.0	20	—	8.0	—	—	JFA
TP4415	500	40	20	5.0	10	30	100	—	1.0	5.0	0.2	1.0	20	—	8.0	—	—	JFA
2N4916	200	30	30	5.0	25[3]	15	70	200	10	1.0	0.14	10	400	10	4.5	150	4.0	BTB
2N4917	200	30	30	5.0	25[3]	15	150	300	10	1.0	0.14	10	450	10	4.5	150	4.0	BTB
2N4964	100	—	40	4.0	100	30	40	400	5.0	10	0.25	10	125	5.0	4.0	—	—	BXE
2N4965	100	50	50	—	50	35	150	300	0.1	5.0	0.3	10	40	0.5	4.0	—	3.0	BXE
2N4971	500	60	40	5.0	20	50	40	120	150	10	0.4	150	200	50	8.0	100	—	JFA
2N4972	500	60	40	5.0	20	50	100	300	150	10	0.4	150	200	50	8.0	100	—	JFA
2N5086	100	50	50	—	50	35	150	500	0.1	5.0	0.3	10	40	0.5	4.0	—	3.0	BXE

NOTES:
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2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

'2N' and 'TP' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
2N5087	100	50	50	—	50	35	250	800	0.1	5.0	0.3	10	40	0.5	4.0	—	2.0	BXE
TP5138	100	30	30	5.0	50	20	50	800	0.1	10	0.3	10	30	0.5	7.0	—	—	BXE
TP5139	200	20	20	5.0	50[3]	15	30	—	0.1	10	0.2	10	300	10	5.0	200	—	BTB
2N5142	500	20	20	4.0	50[3]	12	30	—	50	1.0	0.5	50	100	50	10	200	—	JFA
2N5221	500	15	15	3.0	100	10	30	600	50	10	0.5	150	100	20	15	—	—	JFA
2N5226	500	25	25	4.0	300	15	30	600	50	10	0.8	100	50	20	20	—	—	JFA
2N5227	100	30	30	3.0	100	10	50	700	2.0	10	0.4	10	100	10	5.0	—	—	BXE
2N5354	500	25	25	4.0	100	25	40	120	50	1.0	0.25	50	250	2.0	8.0	—	—	JFA
2N5355	500	25	25	4.0	100	25	100	300	50	1.0	0.25	50	250	2.0	8.0	—	—	JFA
2N5356	500	25	25	4.0	100	25	250	500	50	1.0	0.25	50	250	2.0	8.0	—	—	JFA
2N5365	500	40	40	4.0	100	40	40	120	50	1.0	0.25	50	250	2.0	8.0	—	—	JFA
2N5366	500	40	40	4.0	100	40	100	300	50	1.0	0.25	50	250	2.0	8.0	—	—	JFA
2N5367	500	40	40	4.0	100	40	250	500	50	1.0	0.25	50	250	2.0	8.0	—	—	JFA
TP5372	500	60	30	5.0	50	40	40	120	150	10	0.3	150	150	20	10	150	—	JFA
TP5373	500	60	30	5.0	50	40	100	300	150	10	0.3	150	150	20	10	150	—	JFA
TP5374	500	60	30	5.0	50	40	200	400	150	10	0.3	150	150	20	10	175	—	JFA
TP5375	500	40	30	5.0	50	30	40	400	150	10	0.3	150	150	20	10	175	—	JFA
TP5378	500	40	30	5.0	10	30	120	—	1.0	5.0	—	—	—	—	10	—	—	JFA
TP5379	500	40	30	5.0	10	30	100	500	0.1	5.0	0.2	10	200	0.5	—	—	3.0	JFA
TP5382	200	40	40	5.0	50	30	50	—	10	1.0	0.25	10	200	10	4.5	—	5.0	BTB
TP5383	200	40	40	5.0	50	30	100	300	10	1.0	0.25	10	250	10	4.5	—	4.0	BTB
2N5400	300	130	120	5.0	50	100	40	180	10	5.0	0.2	10	100	10	6.0	—	8.0	VHB
2N5401	300	160	150	5.0	50	120	60	240	10	5.0	0.2	10	100	10	6.0	—	8.0	VHB
TP5447	500	40	25	5.0	100	20	60	300	50	5.0	0.25	50	100	50	12	—	—	JFA
TP5448	500	50	30	5.0	100	20	30	150	50	5.0	0.25	50	100	50	12	—	—	JFA
TP5811	800	35	25	5.0	100	25	60	200	2.0	2.0	0.75	500	100	50	15	—	—	JMA
TP5813	800	35	25	5.0	100	25	150	500	2.0	2.0	0.75	500	135	50	15	—	—	JMA
TP5815	800	50	40	5.0	100	25	60	120	2.0	2.0	0.75	500	100	50	15	—	—	JMA
TP5817	800	50	40	5.0	100	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	JMA
TP5819	800	50	40	5.0	100	25	150	300	2.0	2.0	0.75	500	135	50	15	—	—	JMA
TP5821	800	70	60	5.0	100	25	60	120	2.0	2.0	0.75	500	100	50	15	—	—	JMA
TP5823	800	70	60	5.0	100	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	JMA
TP5855	1000	60	60	5.0	100	40	50	300	150	10	0.4	150	100	50	15	—	—	DJC
TP5857	1000	80	80	5.0	100	60	50	300	150	10	0.4	150	100	50	15	—	—	DJC
2N5999	500	35	25	5.0	30	25	150	300	10	2.0	0.25	50	140	10	—	—	1.5	JFA
2N6009	500	35	25	5.0	30	25	250	500	10	2.0	0.25	50	140	10	—	—	1.5	JFA
2N6076	500	25	25	5.0	100	25	100	500	10	10	0.25	10	—	—	13	—	—	JFA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
MPS404	150	25	24	12	100	10	30	400	12	0.15	0.15	12	4.0	1.0	20	—	—	SHF
MPS404A	150	40	35	25	100	10	30	400	12	0.15	0.15	12	4.0	1.0	20	—	—	SHF
MPS3638	500	25	25	4.0	35	15	30	—	50	1.0	0.25	50	100	50	20	140	—	DDA
MPS3638A	500	25	25	4.0	35	15	100	—	50	1.0	0.25	50	150	50	10	140	—	DDA
MPS3702	500	40	25	5.0	100	20	60	300	50	5.0	0.25	50	100	50	12	—	—	JFA
MPS3703	500	50	30	5.0	100	20	30	150	50	5.0	0.25	50	100	50	12	—	—	JFA
MPS4248	100	40	40	5.0	10	40	50	—	0.1	5.0	0.25	10	40	0.5	6.0	—	2.0	BXE
MPS4249	100	60	60	5.0	10	40	100	300	0.1	5.0	0.25	10	40	0.5	6.0	—	3.0	BXE
MPS4250	100	40	40	5.0	10	50	250	700	0.1	5.0	0.25	10	40	0.5	6.0	—	2.0	BXE
MPS4250A	100	60	60	5.0	10	40	250	700	0.1	5.0	0.25	10	40	0.5	6.0	—	2.0	BXE
MPS4354	1000	60	60	5.0	50	50	50	500	10	10	0.15	150	100	50	30	—	3.0	DJC
MPS4355	1000	60	60	5.0	50	50	100	400	10	10	0.15	150	100	50	30	—	3.0	DJC
MPS4356	1000	80	80	5.0	50	50	50	250	10	10	0.15	150	100	50	30	—	3.0	DJC
MPS5138	100	30	30	5.0	50	20	50	800	0.1	10	0.3	10	30	0.5	7.0	—	—	BXE
MPS5139	100	20	20	5.0	50[3]	15	40	—	1.0	10	0.15	1.0	300	10	5.0	200	—	BTB
MPS6516	100	40	40	4.0	50	30	50	100	2.0	10	0.5	50	—	—	3.5	—	—	BTB
MPS6517	100	40	40	4.0	50	30	90	180	2.0	10	0.5	50	—	—	3.5	—	—	BXE
MPS6518	100	40	40	4.0	50	30	150	300	2.0	10	0.5	50	—	—	3.5	—	—	BXE
MPS6519	100	25	25	4.0	50	20	250	500	2.0	10	0.5	50	—	—	4.0	—	—	BXE
MPS6522	100	25	25	4.0	50	30	200	600	2.0	10	0.5	50	—	—	3.5	—	3.0	BXE
MPS6523	100	25	25	4.0	50	20	300	—	2.0	10	0.5	50	—	—	3.5	—	3.0	BXE
MPS6533	500	40	40	4.0	50	30	40	120	100	1.0	0.5	100	—	—	5.0	—	—	DDA
MPS6534	500	40	40	4.0	50	30	90	270	100	1.0	0.5	100	—	—	5.0	—	—	DDA
MPS6535	500	30	30	4.0	50	30	30	—	100	1.0	0.5	100	—	—	7.0	—	—	DDA
MPS6562	500	25	25	5.0	100	20	50	500	500	1.0	0.5	500	60	10	30	—	—	DJC
MPS6563	1000	25	25	5.0	100	20	50	200	350	1.0	0.5	350	60	10	30	—	—	DJC
MPS6651	1000	25	25	4.0	100	25	50	—	500	1.0	0.6	1000	100	50	30	250	—	DJC
MPS6652	1000	40	40	4.0	100	30	50	—	500	1.0	0.6	1000	100	50	30	250	—	DJC
MPS8093	200	40	40	5.0	100	20	100	300	50	2.0	0.25	50	—	—	—	—	—	JFA
MPS8598	800	60	60	6.0	100	60	100	300	1.0	5.0	0.3	100	150	10	8.0	—	—	JMA
MPS8599	800	80	80	5.0	100	80	100	300	1.0	5.0	0.3	100	150	10	8.0	—	—	JMA
MPSA55	800	60	60	4.0	100	60	50	—	100	1.0	0.25	100	50	100	—	—	—	JMA
MPSA56	800	80	80	4.0	100	80	50	—	100	1.0	0.25	100	50	100	—	—	—	JMA
MPSA62	500	20	20	10	100	15	5K	—	10	5.0	1.0	10	125	100	—	—	—	SRB
MPSA63	500	30	30	10	100	30	10K	—	10	5.0	2.0	100	125	100	—	—	—	SRB
MPSA64	500	30	30	10	100	30	20K	—	10	5.0	2.0	100	125	100	—	—	—	SRB
MPSA70	100	—	40	4.0	100	30	40	100	5.0	10	0.25	10	125	5.0	4.0	—	—	BXE
MPSA75	500	—	40[3]	10	100	30	10K	—	10	5.0	1.5	100	125	10	—	—	—	BOB
MPSA76	500	—	50[3]	10	100	40	10K	—	10	5.0	1.5	100	125	10	—	—	—	BOB
MPSA77	500	—	60[3]	10	100	50	10K	—	10	5.0	1.5	100	125	10	—	—	—	BOB
MPSA92	500	300	300	5.0	250	200	25	—	30	10	0.5	20	50	10	6.0	—	—	BMA
MPSA93	500	200	200	5.0	250	160	25	—	30	10	0.5	20	50	10	8.0	—	—	BMA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

PNP Transistors

'MPS' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
MPSD51	500	200	200	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	BMA
MPSD52	300	140	140	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	VHB
MPSD53	300	100	100	4.0	100	80	25	—	10	10	—	—	40	10	—	—	—	VHB
MPSD54	500	25	25[3]	10	1000	20	2K	—	100	5.0	1.0	100	100	10	—	—	—	SRB
MPSD55	800	25	25	—	1000	20	80	—	100	5.0	0.5	100	100	50	—	—	—	JMA
MPSD56	800	25	25	4.0	1000	20	50	—	10	5.0	0.3	50	100	10	—	—	—	JMA
MPSH81	—	20	20	3.0	100	10	60	—	5.0	10	0.5	5.0	600	5.0	0.85	—	—	JYA
MPSL51	500	100	100	4.0	1000	50	40	250	50	5.0	0.25	10	60	10	8.0	—	—	VHB

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

'D' Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
D29A4	500	35	25	4.0	10	25	40	120	50	4.5	—	—	—	—	8.0	—	—	JFA
D29A5	500	35	25	4.0	10	25	100	300	50	4.5	—	—	—	—	8.0	—	—	JFA
D29E1	800	35[3]	25	5.0	100[3]	25	60	200	2.0	2.0	0.75	500	100	50	15	—	—	JMA
D29E2	800	35[3]	25	5.0	100[3]	25	150	500	2.0	2.0	0.75	500	135	50	15	—	—	JMA
D29E4	800	50[3]	40	5.0	100[3]	25	60	120	2.0	2.0	0.75	500	80	50	15	—	—	JMA
D29E5	800	50[3]	40	5.0	100[3]	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	JMA
D29E6	800	50[3]	40	5.0	100[3]	25	150	300	2.0	2.0	0.75	500	135	50	15	—	—	JMA
D29E7	800	50[3]	40	5.0	100[3]	25	250	500	2.0	2.0	0.75	500	150	50	15	—	—	JMA
D29E9	800	70[3]	60	5.0	100[3]	25	60	120	2.0	2.0	0.75	500	80	50	15	—	—	JMA
D29E10	800	70[3]	60	5.0	100[3]	25	100	200	2.0	2.0	0.75	500	120	50	15	—	—	JMA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

PNP Transistors

Pro-Electron Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_C Max. (mA)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
BC212L	500	60	50	5.0	15	30	120	800	2.0	5.0	0.6	100	200	10	10	—	10	JFA
BC212LA	500	60	50	5.0	15	30	120	220	2.0	5.0	0.6	100	200	10	10	—	10	JFA
BC212LB	500	60	50	5.0	15	30	180	460	2.0	5.0	0.6	100	200	10	10	—	10	JFA
BC213L	500	45	30	6.0	15	30	120	800	2.0	5.0	0.6	100	200	10	10	—	10	JFA
BC213LA	500	45	30	6.0	15	30	120	220	2.0	5.0	0.6	100	200	10	10	—	10	JFA
BC213LB	500	45	30	6.0	15	30	180	460	2.0	5.0	0.6	100	200	10	10	—	10	JFA
BC213LC	500	45	30	6.0	15	30	380	800	2.0	5.0	0.6	100	200	10	10	—	10	JFA
BC214L	500	45	30	5.0	15	30	140	600	2.0	5.0	0.6	100	200	10	10	—	2.0	JFA
BC214LA	500	45	30	5.0	15	30	100	300	2.0	5.0	0.6	100	200	10	10	—	2.0	JFA
BC214LB	500	45	30	5.0	15	30	200	400	2.0	5.0	0.6	100	200	10	10	—	2.0	JFA
BC214LC	500	45	30	5.0	15	30	350	600	2.0	5.0	0.6	100	200	10	10	—	2.0	JFA
BC257	500	50[3]	45	5.0	100[3]	20	120	800	2.0	5.0	0.6	100	130	10	10	—	10	JFA
BC257A	500	50[3]	45	5.0	100[3]	20	120	220	2.0	5.0	0.6	100	130	10	10	—	10	JFA
BC257B	500	50[3]	45	5.0	100[3]	20	180	460	2.0	5.0	0.6	100	130	10	10	—	10	JFA
BC258	500	30[3]	25	5.0	100[3]	20	120	800	2.0	5.0	0.6	100	130	10	10	—	10	JFA
BC258A	500	30[3]	25	5.0	100[3]	20	120	220	2.0	5.0	0.6	100	130	10	10	—	10	JFA
BC258B	500	30[3]	25	5.0	100[3]	20	180	460	2.0	5.0	0.6	100	130	10	10	—	10	JFA
BC258C	500	30[3]	25	5.0	100[3]	20	380	800	2.0	5.0	0.6	100	130	10	10	—	10	JFA
BC259	500	25[3]	20	5.0	100[3]	20	180	800	2.0	5.0	0.2	10	130	10	10	—	4.0	JFA
BC259B	500	25[3]	20	5.0	100[3]	20	180	460	2.0	5.0	0.2	10	130	10	10	—	4.0	JFA
BC259C	500	25[3]	20	5.0	100[3]	20	380	800	2.0	5.0	0.2	10	130	10	10	—	4.0	JFA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R=10Ω.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	@ I_G (μA)	I_{GSS} Max. (nA)	@ V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Limits Max. (V)	Conditions V_{DS} (V)	Conditions I_D (nA)	I_{DSS} Min. (mA)	I_{DSS} Max. (mA)	@ V_{DS} (V)	g_{fs} Min. (mS)	g_{fs} Max. (mS)	@ V_{DS} (V)	C_{iss}[1] Max. (pF)	@ V_{DS} (V)	C_{rss}[1] Max. (pF)	@ V_{DS} (V)	r_{DS} Max. (Ω)	Process
TP3369	−40	−1.0	−1.0	−30	—	−6.5	20	1.0[2]	0.5	2.5	30	0.6	2.5	30	20	8.0	3.0	30	—	NJ16
TP3370	−40	−1.0	−1.0	−30	—	−3.2	20	1.0[2]	0.1	0.6	30	0.3	2.5	30	20	8.0	3.0	30	—	NJ16
TP3458	−50	−10	−1.0	−30	—	−7.8	20	1.0[2]	3.0	15	20	2.5	10	20	18	−10[3]	5.0	30	—	NJ32
TP3459	−50	−10	−1.0	−30	—	−3.4	20	1.0[2]	0.8	4.0	20	1.5	6.0	20	18	−8.0[3]	5.0	30	—	NJ16
TP3460	−50	−1.0	−1.0	−30	—	−1.8	20	1.0[2]	0.2	1.0	20	0.8	4.5	20	18	−4.0[3]	5.0	30	—	NJ16
2N3819	−25	−1.0	−2.0	−15	—	−8.0	15	2.0	2.0	20	15	2.0	6.5	15	8.0	15	4.0	15	—	NJ32
TP3821	−50	−1.0	−1.0	−30	—	−4.0	10	1.0	0.5	2.5	15	1.5	4.5	15	6.0	15	2.0	15	—	NJ16
TP3822	−50	−1.0	−1.0	−30	—	−6.0	10	1.0	2.0	10	15	3.0	6.5	15	6.0	15	2.0	15	—	NJ32
TP3823	−30	−1.0	−1.0	−20	—	−8.0	10	1.0	4.0	20	15	3.5	6.5	15	6.0	15	2.0	15	—	NJ32
TP3824	−50	−1.0	−1.0	−30	—	−8.0	15	0.5	4.0	20	15	3.5	6.5	15	6.0	15	2.0	15	250	NJ32
TP3966	−30	−1.0	−1.0	−20	−4.0	−6.0	10	10	2.0	—	20	—	—	—	6.0	20	1.5	−7.0[3]	220	NJ32
TP3967	−30	−1.0	−1.0	−20	−2.0	−5.0	20	1.0	2.5	10	20	2.5	—	20	5.0	20[6]	1.3	20[6]	—	NJ26
TP3967A	−30	−1.0	−1.0	−20	−2.0	−5.0	20	1.0	2.5	10	20	2.5	—	20	5.0	20[6]	1.3	20[6]	—	NJ26
TP3968	−30	−1.0	−1.0	−20	—	−3.0	20	1.0	1.0	5.0	20	2.0	—	20	5.0	20[7]	1.3	20[7]	—	NJ26
TP3968A	−30	−1.0	−1.0	−20	—	−3.0	20	1.0	1.0	5.0	20	2.0	—	20	5.0	20[7]	1.3	20[7]	—	NJ26
TP3969	−30	−1.0	−1.0	−20	—	−1.7	20	1.0	0.4	2.0	20	1.3	—	20	5.0	20[8]	1.3	20[8]	—	NJ16
TP3969A	−30	−1.0	−1.0	−20	—	−1.7	20	1.0	0.4	2.0	20	1.3	—	20	5.0	20[8]	1.3	20[8]	—	NJ16
TP3970	−40	−1.0	−1.0	−20	−4.0	−10	20	1.0	50	150	20	—	—	—	25	20	6.0	−12[3]	30	NJ132
TP3971	−40	−1.0	−1.0	−20	−2.0	−5.0	20	1.0	25	75	20	—	—	—	25	20	6.0	−12[3]	60	NJ132
TP3972	−40	−1.0	−1.0	−20	−0.5	−3.0	20	1.0	5.0	30	20	—	—	—	25	20	6.0	−12[3]	100	NJ132
TP4091	−40	−1.0	−1.0	−20	−5.0	−10	20	1.0	30	—	20	—	—	—	16	20	5.0	−20[3]	30	NJ132
TP4092	−40	−1.0	−1.0	−20	−2.0	−7.0	20	1.0	15	—	20	—	—	—	16	20	5.0	−20[3]	50	NJ132
TP4093	−40	−1.0	−1.0	−20	−1.0	−5.0	20	1.0	8.0	—	20	—	—	—	16	20	5.0	−20[3]	80	NJ132
TP4117	−40	−1.0	−0.01	−20	−0.6	−1.8	10	1.0	0.03	0.09	10	0.07	0.21	10	3.0	10	1.5	10	—	NJ01
TP4118	−40	−1.0	−0.01	−20	−1.0	−3.0	10	1.0	0.08	0.24	10	0.08	0.25	10	3.0	10	1.5	10	—	NJ01
TP4119	−40	−1.0	−0.01	−20	−2.0	−6.0	10	1.0	0.2	0.6	10	0.10	0.33	10	3.0	10	1.5	10	—	NJ01
TP4220	−30	−1.0	−10	−15	—	−4.0	15	1.0	0.5	3.0	15	1.0	4.0	15	6.0	15	2.0	15	—	NJ16
TP4221	−30	−1.0	−10	−15	—	−6.0	15	1.0	2.0	6.0	15	2.0	5.0	15	6.0	15	2.0	15	—	NJ32
TP4222	−30	−1.0	−10	−15	—	−8.0	15	1.0	5.0	15	15	2.5	6.0	15	6.0	15	2.0	15	—	NJ32
TP4223	−30	−1.0	−10	−20	—	−8.0	15	1.0	3.0	18	15	3.0	7.0	15	6.0	15	2.0	15	—	NJ32
TP4224	−30	−1.0	−10	−20	—	−8.0	15	1.0	2.0	20	15	2.0	7.5	15	6.0	15	2.0	15	—	NJ32
TP4302	−30	−1.0	−1.0	−15	—	−4.0	20	10	0.5	5.0	20	1.0	—	20	6.0	20	3.0	20	—	NJ26
TP4303	−30	−1.0	−1.0	−15	—	−6.0	20	10	4.0	10	20	2.0	—	20	6.0	20	3.0	20	—	NJ26
TP4304	−30	−1.0	−1.0	−15	—	−10	20	10	0.5	15	20	1.0	—	20	6.0	20	3.0	20	—	NJ26
TP4338	−50	−1.0	−1.0	−30	−0.3	−1.0	15	100	0.2	0.6	15	0.6	1.8	15	7.0	15	3.0	15	2500	NJ16
TP4339	−50	−1.0	−1.0	−30	−0.6	−1.8	15	100	0.5	1.5	15	0.8	2.4	15	7.0	15	3.0	15	1700	NJ16
TP4340	−50	−1.0	−1.0	−30	−1.0	−3.0	15	100	1.2	3.6	15	1.3	3.0	15	7.0	15	3.0	15	1500	NJ16
TP4341	−50	−1.0	−1.0	−30	−2.0	−6.0	15	100	3.0	9.0	15	2.0	4.0	15	7.0	15	3.0	15	800	NJ16
TP4391	−40	−1.0	−1.0	−20	−4.0	−10	20	1.0	50	150	20	—	—	—	16	20	5.0	−12[3]	30	NJ132
TP4392	−40	−1.0	−1.0	−20	−2.0	−5.0	20	1.0	25	100	20	—	—	—	16	20	5.0	−7.0[3]	60	NJ132
TP4393	−40	−1.0	−1.0	−20	−0.5	−3.0	20	1.0	5.0	30	20	—	—	—	16	20	5.0	−5.0[3]	100	NJ132
TP4416	−30	−1.0	−1.0	−20	—	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	4.5	15	1.2	15	—	NJ26
TP4416A	−35	−1.0	−1.0	−20	−2.5	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	4.5	15	1.2	15	—	NJ26
TP4856	−40	−1.0	−1.0	−20	−4.0	−10	15	1.0	50	—	15	—	—	—	18	−10[3]	8.0	−10[3]	25	NJ132
TP4856A	−40	−1.0	−1.0	−20	−4.0	−10	15	1.0	50	—	15	—	—	—	10	−10[3]	4.0	−10[3]	25	NJ132
TP4857	−40	−1.0	−1.0	−20	−2.0	−6.0	15	1.0	20	100	15	—	—	—	18	−10[3]	8.0	−10[3]	40	NJ132
TP4857A	−40	−1.0	−1.0	−20	−2.0	−6.0	15	1.0	20	100	15	—	—	—	10	−10[3]	3.5	−10[3]	40	NJ132
TP4858	−40	−1.0	−1.0	−20	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	18	−10[3]	8.0	−10[3]	60	NJ132

NOTES:
1) V_{GS} = 0 V.
2) I_D in μA.
3) V_{DS} = 0 V, V_{GS} in volts.
4) I_D = 10 mA.
5) I_D = 5.0 mA.
6) I_D = 1.0 mA.
7) I_D = 500 μA.
8) I_D = 200 μA.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	@I_G (µA)	I_{GSS} Max. (nA)	@V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Max. (V)	Conditions V_{DS} (V)	I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@V_{DS} (V)	C_{iss}[1] Max. (pF)	@V_{DS} (V)	C_{rss}[1] Max. (pF)	@V_{DS} (V)	r_{DS} Max. (Ω)	Process
TP4858A	−40	−1.0	−1.0	−20	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	10	−10[3]	3.5	−10[3]	60	NJ132
TP4859	−30	−1.0	−1.0	−15	−4.0	−10	15	1.0	50	—	15	—	—	—	18	−10[3]	8.0	−10[3]	25	NJ132
TP4859A	−30	−1.0	−1.0	−15	−4.0	−10	15	1.0	50	—	15	—	—	—	10	−10[3]	4.0	−10[3]	25	NJ132
TP4860	−30	−1.0	−1.0	−15	−2.0	−6.0	15	1.0	20	100	15	—	—	—	18	−10[3]	8.0	−10[3]	40	NJ132
TP4860A	−30	−1.0	−1.0	−15	−2.0	−6.0	15	1.0	20	100	15	—	—	—	10	−10[3]	3.5	−10[3]	40	NJ132
TP4861	−30	−1.0	−1.0	−15	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	18	−10[3]	8.0	−10[3]	60	NJ132
TP4861A	−30	−1.0	−1.0	−15	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	10	−10[3]	3.5	−10[3]	60	NJ132
TP4867	−40	−1.0	−1.0	−30	−0.7	−2.0	20	1.0[2]	0.4	1.2	20	0.7	2.0	20	25	20	5.0	20	—	NJ16
TP4868	−40	−1.0	−1.0	−30	−1.0	−3.0	20	1.0[2]	1.0	3.0	20	1.0	3.0	20	25	20	5.0	20	—	NJ16
TP4869	−40	−1.0	−1.0	−30	−1.8	−5.0	20	1.0[2]	2.5	7.5	20	1.3	4.0	20	25	20	5.0	20	—	NJ16
TP5078	−30	−1.0	−1.0	−20	−0.5	−8.0	15	1.0	4.0	25	15	4.0	—	15	6.0	15	2.0	15	—	NJ26
TP5103	−25	−1.0	−1.0	−15	−0.5	−4.0	15	1.0	1.0	8.0	15	2.0	8.0	15	5.0	15	1.2	15		NJ26
TP5104	−25	−1.0	−1.0	−15	−0.5	−4.0	15	1.0	2.0	6.0	15	3.5	7.5	15	5.0	15	1.2	15	—	NJ26
TP5105	−25	−1.0	−1.0	−15	−0.5	−4.0	15	1.0	5.0	15	15	5.0	10	15	5.0	15	1.2	15		NJ26
TP5163	−25	−1.0	−10	−15	−0.4	−8.0	15	1.0[2]	1.0	40	15	2.0	9.0	15	12	15	3.0	15	—	NJ26
TP5245	−30	−1.0	−1.0	−20	−1.0	−6.0	15	10	5.0	15	15	4.0	—	15	4.5	15	1.5	15	—	NJ26
TP5246	−30	−1.0	−1.0	−20	−0.5	−4.0	15	10	1.5	7.0	15	2.5	—	15	4.5	15	1.5	15	—	NJ26
TP5247	−30	−1.0	−1.0	−20	−1.5	−8.0	15	10	8.0	24	15	4.0	—	15	4.5	15	1.5	15	—	NJ26
TP5248	−30	−1.0	−5.0	−20	−1.0	−8.0	15	10	4.0	20	15	3.0	—	15	6.0	15	2.0	15	—	NJ26
TP5358	−40	−1.0	−1.0	−20	−0.5	−3.0	15	100	0.5	1.0	15	1.0	3.0	15	6.0	15	2.0	15	—	NJ16
TP5359	−40	−1.0	−1.0	−20	−0.8	−4.0	15	100	0.6	1.6	15	1.2	3.6	15	6.0	15	2.0	15	—	NJ16
TP5360	−40	−1.0	−1.0	−20	−0.8	−4.0	15	100	1.5	3.0	15	1.4	4.2	15	6.0	15	2.0	15	—	NJ16
TP5361	−40	−1.0	−1.0	−20	−1.0	−6.0	15	100	2.5	5.0	15	1.5	4.5	15	6.0	15	2.0	15	—	NJ16
TP5362	−40	−1.0	−1.0	−20	−2.0	−7.0	15	100	4.0	8.0	15	2.0	5.5	15	6.0	15	2.0	15	—	NJ32
TP5363	−40	−1.0	−1.0	−20	−2.5	−8.0	15	100	7.0	14	15	2.5	6.0	15	6.0	15	2.0	15	—	NJ32
TP5364	−40	−1.0	−1.0	−20	−2.5	−8.0	15	100	9.0	18	15	2.7	6.5	15	6.0	15	2.0	15	—	NJ32
TP5397	−25	−1.0	−1.0	−15	−1.0	−6.0	10	1.0	10	30	10	6.0	10	10[4]	5.0	10[4]	1.2	10[4]	—	NJ26L
TP5398	−25	−1.0	−1.0	−15	−1.0	−6.0	10	1.0	5.0	40	10	5.5	10	10	5.5	10	1.3	10	—	NJ26L
2N5457	−25	−10	−1.0	−15	−0.5	−6.0	15	10	1.0	5.0	15	1.0	5.0	15	7.0	15	3.0	15	—	NJ32
2N5458	−25	−10	−1.0	−15	−1.0	−7.0	15	10	2.0	9.0	15	1.5	5.5	15	7.0	15	3.0	15	—	NJ32
2N5459	−25	−10	−1.0	−15	−2.0	−8.0	15	10	4.0	16	15	2.0	6.0	15	7.0	15	3.0	15	—	NJ32
2N5484	−25	−1.0	−1.0	−20	−0.3	−3.0	15	10	1.0	5.0	15	3.0	6.0	15	5.0	15	1.2	15	—	NJ26
2N5485	−25	−1.0	−1.0	−20	−0.5	−4.0	15	10	4.0	10	15	3.5	7.0	15	5.0	15	1.2	15	—	NJ26
2N5486	−25	−1.0	−1.0	−20	−2.0	−6.0	15	10	8.0	20	15	4.0	8.0	15	5.0	15	1.2	15	—	NJ26
2N5555	−25	−10	−1.0	−15	—	−12	12	10	15	—	15	—	—	—	5.0	15	1.2	10[3]	150	NJ26
TP5556	−30	−1.0	−1.0	−15	−0.2	−4.0	15	1.0	0.5	2.5	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
TP5557	−30	−1.0	−1.0	−15	−0.8	−5.0	15	1.0	2.0	5.0	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
TP5558	−30	−1.0	−1.0	−15	−1.5	−6.0	15	1.0	4.0	10	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
2N5638	−30	−1.0	−10	−15	—	−12	15	1.0	50	—	20	—	—	—	10	−12[3]	4.0	−12[3]	30	NJ132
2N5639	−30	−1.0	−10	−15	—	−8.0	15	1.0	25	—	20	—	—	—	10	−12[3]	4.0	−12[3]	60	NJ99
2N5640	−30	−1.0	−10	−15	—	−6.0	15	1.0	5.0	—	20	—	—	—	10	−12[3]	4.0	−12[3]	100	NJ99
2N5653	−30	−1.0	−10	−15	—	−12	15	1.0	40	—	20	—	—	—	10	−12[3]	3.5	−12[3]	50	NJ99
2N5654	−25	−1.0	−10	−15	—	−8.0	15	1.0	15	—	20	—	—	—	10	−8.0[3]	3.5	−8.0[3]	100	NJ99
TP5668	−25	−10	−1.0	−15	−0.2	−4.0	15	10	1.0	5.0	15	1.0	—	15	7.0	15	3.0	15	—	NJ16
TP5669	−25	−10	−1.0	−15	−1.0	−6.0	15	10	4.0	10	15	1.6	—	15	7.0	15	3.0	15	—	NJ32
TP5670	−25	−10	−1.0	−15	−2.0	−8.0	15	10	8.0	20	15	2.0	—	15	7.0	15	3.0	15	—	NJ32
TP5949	−30	−1.0	−1.0	−15	−3.0	−7.0	15	100	12	18	15	3.0	—	15	6.0	15	2.0	15	—	NJ32
TP5950	−30	−1.0	−1.0	−15	−2.5	−6.0	15	100	10	15	15	3.0	—	15	6.0	15	2.0	15	—	NJ32

NOTES:

1) V_{GS} = 0 V.
2) I_D in µA.
3) V_{DS} = 0 V, V_{GS} in volts.
4) I_D = 10 mA.
5) I_D = 5.0 mA.
6) I_D = 1.0 mA.
7) I_D = 500 µA.
8) I_D = 200 µA.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

	$V_{(BR)GSS}$		I_{GSS}		$V_{GS(off)}$ Limits		$V_{GS(off)}$ Conditions		I_{DSS}			g_{fs}			C_{iss}[1]		C_{rss}[1]		r_{DS}	
Device Type	Min. (V)	@ I_G (µA)	Max. (nA)	@ V_{GS} (V)	Min. (V)	Max. (V)	V_{DS} (V)	I_D (nA)	Min. (mA)	Max. (mA)	@ V_{DS} (V)	Min. (mS)	Max. (mS)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (Ω)	Process
TP5951	−30	−1.0	−1.0	−15	−2.0	−5.0	15	100	7.0	13	15	3.0	—	15	6.0	15	2.0	15	—	NJ32
TP5952	−30	−1.0	−1.0	−15	−1.3	−3.5	−15	100	4.0	8.0	15	1.0	—	15	6.0	15	2.0	15	—	NJ32
TP5953	−30	−1.0	−1.0	−15	−0.8	−3.0	15	100	2.5	5.0	15	1.0	—	15	6.0	15	2.0	15	—	NJ32
TP6449	−300	−10	100	−150	−2.0	−15	30	4.0	2.0	10	30	0.5	3.0	30	10	30	5.0	30	—	NJ42
TP6450	−200	−10	100	−100	−2.0	−15	30	4.0	2.0	10	30	0.5	3.0	30	10	30	5.0	30	—	NJ42
TP6451	−20	−1.0	−1.0	−10	−0.5	−3.5	10	1.0	5.0	20	10	—	—	—	25	10	5.0	10	—	NJ132L
TP6452	−25	−1.0	−1.0	−15	−0.5	−3.5	10	1.0	5.0	20	10	—	—	—	25	10	5.0	10	—	NJ132L
TP6453	−20	−1.0	−1.0	−10	−0.75	−5.0	10	1.0	15	50	10	—	—	—	25	10	5.0	10	—	NJ132L
TP6454	−25	−1.0	−1.0	−15	−0.75	−5.0	10	1.0	15	50	10	—	—	—	25	10	5.0	10	—	NJ132L
BF244A	−30	−1.0	−5	−20	−0.5	−8.0	15	10	2.0	6.5	15	3.0	6.5	15	—	—	—	—	—	NJ26
BF244B	−30	−1.0	−5	−20	−0.5	−8.0	15	10	6.0	15	15	3.0	6.5	15	—	—	—	—	—	NJ26
BF244C	−30	−1.0	−5	−20	−0.5	−8.0	15	10	12	25	15	3.0	6.5	15	—	—	—	—	—	NJ26
BF246A	−25	−1.0	−5	−15	−0.6	−14.5	15	10	30	80	15	—	—	—	—	—	—	—	65	NJ132
BF246B	−25	−1.0	−5	−15	−0.6	−14.5	15	10	60	140	15	—	—	—	—	—	—	—	50	NJ132
BF246C	−25	−1.0	−5	−15	−0.6	−14.5	15	10	110	250	15	—	—	—	—	—	—	—	35	NJ132
BF256A	−30	−1.0	−5	−20	−0.5	−7.5	15	10	3.0	7.0	15	4.5	—	15	4.5	15	1.2	15	—	NJ26
BF256B	−30	−1.0	−5	−20	−0.5	−7.5	15	10	6.0	13	15	4.5	—	15	4.5	15	1.2	15	—	NJ26
BF256C	−30	−1.0	−5	−20	−0.5	−7.5	15	10	11	18	15	4.5	—	15	4.5	15	1.2	15	—	NJ26
BFR30	−25	−1.0	−0.2	−10	—	−5.0	10	0.5	4.0	10	10	1.0	4.0	10[6]	5.0	10[6]	1.5	10[6]	—	NJ26
BFR31	−25	−1.0	−0.2	−10	—	−2.5	10	0.5	1.0	5.0	10	1.5	4.5	10[6]	5.0	10[6]	1.5	10[6]	—	NJ26
J111	−35	−1.0	−1.0	−15	−3.0	−10	5.0	1.0[2]	20	—	15	—	—	—	16	15	5	−10[3]	30	NJ132
J111A	−40	−1.0	−0.2	−15	−5.0	−10	5.0	1.0[2]	30	—	15	—	—	—	16	15	5	−10[3]	30	NJ132
J112	−35	−1.0	−1.0	−15	−1.0	−5.0	5.0	1.0[2]	5.0	—	15	—	—	—	16	15	5	−10[3]	50	NJ99
J112A	−40	−1.0	−0.2	−15	−2.0	−7.0	5.0	1.0[2]	15	—	15	—	—	—	16	15	5	−10[3]	50	NJ99
J113	−35	−1.0	−1.0	−15	—	−3.0	5.0	1.0[2]	2.0	—	15	—	—	—	16	15	5	−10[3]	100	NJ99
J113A	−40	−1.0	−0.2	−15	−1.0	−5.0	5.0	1.0[2]	8.0	—	15	—	—	—	16	15	5	−10[3]	80	NJ99
J201	−40	−1.0	−0.1	−20	−0.3	−1.5	20	10	0.2	1.0	20	0.5	—	20	4.0	20	1.0	20	—	NJ16
J202	−40	−1.0	−0.1	−20	−0.8	−4.0	20	10	0.9	4.5	20	1.0	—	20	4.0	20	1.0	20	—	NJ16
J203	−40	−1.0	−0.1	−20	−2.0	−10	20	10	4.0	20	20	1.5	—	20	6.0	20	1.2	20	—	NJ32
J210	−25	−1.0	−0.1	−15	−1.0	−3.0	15	1.0	2.0	15	15	4.0	12	15	—	—	—	—	—	NJ26L
J211	−25	−1.0	−0.1	−15	−2.5	−4.5	15	1.0	7.0	20	15	6.0	12	15	—	—	—	—	—	NJ26L
J212	−25	−1.0	−0.1	−15	−4.0	−6.0	15	1.0	15	40	15	7.0	12	15	—	—	—	—	—	NJ26L
J230	−40	−1.0	−0.2	−30	−0.5	−3.0	20	1.0[2]	0.7	3.0	20	1.0	3.5	20	—	—	—	—	—	NJ16
J231	−40	−1.0	−0.2	−30	−1.5	−5.0	20	1.0[2]	2.0	6.0	20	1.5	4.0	20	—	—	—	—	—	NJ16
J232	−40	−1.0	−0.2	−30	−3.0	−6.0	20	1.0[2]	5.0	10	20	2.5	5.0	20	—	—	—	—	—	NJ16
J300A	−25	−1.0	−0.5	−15	−1.5	−3.0	10	1.0	4.0	9.0	10	4.5	9.0	10[5]	5.5	10[5]	1.7	10[5]	—	NJ26L
J300B	−25	−1.0	−0.5	−15	−2.0	−4.0	10	1.0	7.0	15	10	4.5	9.0	10[5]	5.5	10[5]	1.7	10[5]	—	NJ26L
J300C	−25	−1.0	−0.5	−15	−2.5	−5.0	10	1.0	12	25	10	4.5	9.0	10[5]	5.5	10[5]	1.7	10[5]	—	NJ26L
J304	−30	−1.0	−0.1	−20	−2.0	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	—	—	—	—	—	NJ26
J305	−30	−1.0	−0.1	−20	−0.5	−3.0	15	1.0	1.0	8.0	15	3.0	—	15	—	—	—	—	—	NJ26
MPF102	−25	−10	−2.0	−15	—	−8.0	15	2.0	2.0	20	15	2.0	7.5	15	7.0	15	3.0	15	—	NJ26
MPF103	−25	−1.0	−1.0	−15	—	−6.0	15	1.0	1.0	5.0	15	1.0	5.0	15	7.0	15	3.0	15	—	NJ32
MPF104	−25	−1.0	−1.0	−15	—	−7.0	15	1.0	2.0	9.0	15	1.5	5.5	15	7.0	15	3.0	15	—	NJ32
MPF105	−25	−1.0	−1.0	−15	—	−8.0	15	1.0	4.0	16	15	2.0	6.0	15	7.0	15	3.0	15	—	NJ26
MPF106	−25	−1.0	−1.0	−20	−0.5	−4.0	15	0.5	4.0	10	15	2.5	—	15	5.0	15	2.0	15	—	NJ26
MPF107	−25	−1.0	−1.0	−20	−2.0	−6.0	15	0.5	8.0	20	15	4.0	—	15	5.0	15	1.2	15	—	NJ26
MPF108	−25	−10	−1.0	−15	−0.5	−8.0	15	10[2]	1.5	24	15	2.0	7.5	15	6.5	15	2.5	15	—	NJ26
MPF109	−25	−1.0	−1.0	−15	−0.2	−8.0	15	10[2]	0.5	24	15	0.8	6.0	15	7.0	15	3.0	15	—	NJ32

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in µA.
3) $V_{DS} = 0$ V, V_{GS} in volts.
4) $I_D = 10$ mA.
5) $I_D = 5.0$ mA.
6) $I_D = 1.0$ mA.
7) $I_D = 500$ µA.
8) $I_D = 200$ µA.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	@I_G (µA)	I_{GSS} Max. (nA)	@V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Max. (V)	Conditions V_{DS} (V)	I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@V_{DS} (V)	C_{ISS}[1] Max. (pF)	@V_{DS} (V)	C_{RSS}[1] Max. (pF)	@V_{DS} (V)	r_{DS} Max. (Ω)	Process
MPF110	−20	−10	−100	−10	−0.5	−10	10	10[2]	0.5	20	10	0.5	—	10	—	—	—	—	—	NJ32
MPF111	−20	−10	−100	−10	−0.5	−10	10	10[2]	0.5	20	10	0.5	—	10	—	—	—	—	—	NJ32
MPF112	−25	−10	−100	−10	−0.5	−10	10	10[2]	1.0	20	10	1.0	7.5	10	—	—	—	—	—	NJ26
MPF820	−25	−10	−5.0	15	—	−5.0	10	200[2]	10	—	15	—	—	—	—	—	—	—	—	NJ26
TPBC264A	−30	−1.0	−10	−20	−0.5	—	15	10	2.0	4.5	15	2.5	—	15	4.0	15	1.2	15	—	NJ26
TPBC264B	−30	−1.0	−10	−20	−0.5	—	15	10	3.5	6.5	15	3.0	—	15	4.0	15	1.2	15	—	NJ26
TPBC264C	−30	−1.0	−10	−20	−0.5	—	15	10	5.0	8.0	15	3.5	—	15	4.0	15	1.2	15	—	NJ26
TPBC264D	−30	−1.0	−10	−20	−0.5	—	15	10	7.0	12	15	4.0	—	15	4.0	15	1.2	15	—	NJ26
TPJ105	−25	−1.0	−3.0	−15	−4.5	−10	5.0	1.0[2]	500	—	15	—	—	—	50	−10[3]	25	−10[3]	3.0	NJ903
TPJ106	−25	−1.0	−3.0	−15	−2.0	−6.0	5.0	1.0[2]	200	—	15	—	—	—	50	−10[3]	25	−10[3]	6.0	NJ903
TPJ107	−25	−1.0	−3.0	−15	−0.5	−4.5	5.0	1.0[2]	100	—	15	—	—	—	50	−10[3]	25	−10[3]	8.0	NJ903
TPJ108	−25	−1.0	−3.0	−15	−3.0	−10	5.0	1.0[2]	80	—	15	—	—	—	50	−10[3]	25	−10[3]	8.0	NJ903
TPJ109	−25	−1.0	−3.0	−15	−2.0	−6.0	5.0	1.0[2]	40	—	15	—	—	—	50	−10[3]	25	−10[3]	12	NJ903
TPJ110	−25	−1.0	−3.0	−15	−0.5	−4.5	5.0	1.0[2]	10	—	15	—	—	—	50	−10[3]	25	−10[3]	18	NJ903
TPJ308	−25	−1.0	−1.0	−15	−1.0	−6.5	10	1.0	12	60	10	8.0	—	10[4]	7.5	−10[3]	3.5	−10[3]	—	NJ99
TPJ309	−25	−1.0	−1.0	−15	−1.0	−4.0	10	1.0	12	30	10	10	—	10[4]	7.5	−10[3]	3.5	−10[3]	—	NJ99
TPJ310	−25	−1.0	−1.0	−15	−2.0	−6.5	10	1.0	24	60	10	8.0	—	10[4]	7.5	−10[3]	3.5	−10[3]	—	NJ99
TPU290	−30	−1.0	−1.0	−15	−4.0	−10	15	3.0	500	—	10	—	—	—	50	−10[3]	25	−10[3]	3.0	NJ903
TPU291	−30	−1.0	−1.0	−15	−1.5	−4.5	15	3.0	200	—	10	—	—	—	50	−10[3]	25	−10[3]	7.0	NJ903
TPU308	−25	−1.0	−1.0	−15	−1.0	−6.0	10	1.0	12	60	10	—	—	—	7.5	−10[3]	3.5	−10[3]	—	NJ99
TPU309	−25	−1.0	−1.0	−15	−1.0	−4.0	10	1.0	12	30	10	—	—	—	7.5	−10[3]	3.5	−10[3]	—	NJ99
TPU310	−25	−1.0	−1.0	−15	−2.5	−6.0	10	1.0	24	60	10	—	—	—	7.5	−10[3]	3.5	−10[3]	—	NJ99
TPU1897	−40	−1.0	−0.4	−20	−5.0	−10	20	1.0	30	—	20	—	—	—	16	20	3.5	20	30	NJ132
TPU1898	−40	−1.0	−0.4	−20	−2.0	−7.0	20	1.0	15	—	20	—	—	—	16	20	3.5	20	50	NJ132
TPU1899	−40	−1.0	−0.4	−20	−1.0	−5.0	20	1.0	8.0	—	20	—	—	—	16	20	3.5	20	80	NJ132

NOTES:
1) $V_{GS}=0$ V.
2) I_D in µA.
3) $V_{DS}=0$ V, V_{GS} in volts.
4) $I_D=10$ mA.
5) $I_D=5.0$ µA.
6) $I_D=1.0$ mA.

P-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	@I_G (µA)	I_{GSS} Max. (nA)	@V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Max. (V)	Conditions V_{DS} (V)	I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@V_{DS} (V)	C_{ISS}[1] Max. (pF)	@V_{DS} (V)	C_{RSS}[1] Max. (pF)	@V_{DS} (V)	r_{DS} Max. (Ω)	Process
TP2608	30	1.0	10	5.0	1.0	4.0	−5	−1[2]	−0.9	−4.5	−5	1.0	—	−5.0	17	5.0[4]	—	—	—	PJ32
TP2609	30	1.0	10	5.0	1.0	4.0	−5	−1[2]	−2.0	−10	−5	2.5	—	−5.0	30	5.0[4]	—	—	—	PJ32
TP3329	20	10	10	10	—	5.0	−15	−10[2]	−1.0	−3.0	−10	—	—	—	20	−10	—	—	—	PJ32
TP3330	20	10	10	10	—	6.0	−15	−10[2]	−2.0	−6.0	−10	—	—	—	20	−10	—	—	—	PJ32
TP3331	20	10	10	10	—	8.0	−15	−10[2]	−5.0	−15	−10	—	—	—	20	−10	—	—	—	PJ32
TP3332	20	10	10	10	—	6.0	−15	−10[2]	−1.0	−6.0	−10	—	—	—	20	−10	—	—	—	PJ32
2N3820	20	10	20	10	—	8.0	−10	−10[2]	−0.3	−15	−10	0.8	5.0	−10	32	−10	16	−10	—	PJ32
TP3993	25	1.0	1.0	15	4.0	9.5	−10	−1[2]	−10	—	−10	6.0	12	−10	16	−10	4.5	10[3]	150	PJ99

NOTES:
1) $V_{GS}=0$ V.
2) I_D in µA.
3) $V_D=0$ V, V_{GS} in volts.
4) $V_{GS}=1.0$ V.

P-Channel JFETs

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	$V_{(BR)GSS}$		I_{GSS}		$V_{GS(off)}$ Limits		$V_{GS(off)}$ Conditions		I_{DSS}			g_{fs}			C_{ISS}[1]		C_{RSS}[1]		r_{DS}	Process
	Min. (V)	@ I_G (μA)	Max. (nA)	@ V_{GS} (V)	Min. (V)	Max. (V)	V_{DS} (V)	I_D (nA)	Min. (mA)	Max. (mA)	@ V_{DS} (V)	Min. (mS)	Max. (mS)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (Ω)	
TP3994	25	1.0	1.0	15	1.0	5.5	−10	−1[2]	−2.0	—	−10	4.0	10	−10	16	−10	4.5	10[3]	300	PJ99
TP4381	25	1.0	1.0	15	1.0	5.0	−15	−1.0[2]	−3.0	−12	−15	2.0	6.0	−15	20	−15	5.0	−15	—	PJ32
TP5018	30	1.0	2.0	15	—	10	−15	−1[2]	−10	—	−20	—	—	—	45	−15	10	12[3]	75	PJ99
TP5019	30	1.0	2.0	15	—	5.0	−15	−1[2]	−5.0	—	−20	—	—	—	45	−15	10	7.0[3]	150	PJ99
TP5020	25	1.0	1.0	15	0.3	1.5	−15	−1[2]	−0.3	−1.2	−15	1.0	3.5	−15	25	−15	7.0	−15	—	PJ32
TP5021	25	1.0	1.0	15	0.5	2.5	−15	−1[2]	−1.0	−3.5	−15	1.5	6.0	−15	25	−15	7.0	−15	—	PJ32
TP5033	20	10	10	15	0.3	2.5	−15	−1.0[2]	0.3	3.5	−15	1.0	5.0	−10	25	−15	7.0	−15	—	PJ32
TP5114	30	1.0	1.0	20	5.0	10	−15	−1.0	−30	−90	−15	—	—	—	25	−15	7.0	12[3]	75	PJ99
TP5115	30	1.0	1.0	20	3.0	6.0	−15	−1.0	−16	−60	−15	—	—	—	25	−15	7.0	7.0[3]	100	PJ99
TP5116	30	1.0	1.0	20	1.0	4.0	−15	−1.0	−5.0	−25	−15	—	—	—	25	−15	7.0	5.0[3]	150	PJ99
2N5460	40	10	5.0	20	0.75	6.0	−15	−1.0	−1.0	−5.0	−15	1.0	5.0	−15	7.0	−15	3.0	−15	—	PJ32
2N5461	40	10	5.0	20	1.0	7.5	−15	−1.0	−2.0	−9.0	−15	1.5	5.5	−15	7.0	−15	3.0	−15	—	PJ32
2N5462	40	10	5.0	20	1.8	9.0	−15	−1.0	−4.0	−16	−15	2.0	6.0	−15	7.0	−15	3.0	−15	—	PJ32
J174	30	1.0	1.0	20	5.0	10	−15	−10	−20	−135	−15	—	—	—	—	—	—	—	85	PJ99
J175	30	1.0	1.0	20	3.0	6.0	−15	−10	−7.0	−70	−15	—	—	—	—	—	—	—	125	PJ99
J176	30	1.0	1.0	20	1.0	4.0	−15	−10	−2.0	−35	−15	—	—	—	—	—	—	—	250	PJ99
J177	30	1.0	1.0	20	0.8	2.25	−15	−10	−1.5	−20	−15	—	—	—	—	—	—	—	300	PJ99
J270	30	1.0	0.2	20	0.5	2.0	−15	−1.0	−2.0	−15	−15	6.0	15	−15	—	—	—	—	—	PJ99
J271	30	1.0	0.2	20	1.5	4.5	−15	−1.0	−6.0	−50	−15	8.0	18	−15	—	—	—	—	—	PJ99
P1086	30	1.0	2.0	15	—	10	−15	−1[2]	−10	—	−20	—	—	—	45	−15	10	12[3]	75	PJ99
P1087	30	1.0	2.0	15	—	5.0	−15	−1[2]	−5.0	—	−20	—	—	—	45	−15	10	7.0[3]	150	PJ99
TPU304	30	1.0	1.0	20	5.0	10	−15	−1[2]	−30	−90	−15	—	—	—	27	−15	7.0	12[3]	85	PJ99
TPU305	30	1.0	1.0	20	3.0	6.0	−15	−1[2]	−15	−60	−15	—	—	—	27	−15	7.0	7.0[3]	110	PJ99
TPU306	30	1.0	1.0	20	1.0	4.0	−15	−1[2]	−5.0	−25	−15	—	—	—	27	−15	7	5.0[3]	175	PJ99

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in μA.
3) $V_{DS} = 0$ V, V_{GS} in volts.
4) $V_{GS} = 1.0$ V.

NPN Transistors

ELECTRICAL CHARACTERISTICS at T_A = 25°C

					I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T					
Device Type	Marking	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
BCW31	D1	30	20	5.0	100	20	110	220	2.0	5.0	0.25	10	—	—	4.0	—	10	FEE
BCW32	D2	30	20	5.0	100	20	200	450	2.0	5.0	0.25	10	—	—	4.0	—	10	FEE
BCW33	D3	30	20	5.0	100	20	420	800	2.0	5.0	0.25	10	—	—	4.0	—	10	FEE
BCW60A	AA	32[3]	32	5.0	20	32	120	220	2.0	5.0	0.35	10	125	10	4.5	—	6.0	FEE
BCW60B	AB	32[3]	32	5.0	20	32	180	310	2.0	5.0	0.35	10	125	10	4.5	—	6.0	FEE
BCW60C	AC	32[3]	32	5.0	20	32	250	460	2.0	5.0	0.35	10	125	10	4.5	—	6.0	FEE
BCW60D	AD	32[3]	32	5.0	20	32	380	630	2.0	5.0	0.35	10	125	10	4.5	—	6.0	FEE
BCW65A	EA	60[3]	32	5.0	20	32	100	250	100	1.0	—	—	100	20	12	—	10	JLA
BCW65B	EB	60[3]	32	5.0	20	32	160	400	100	1.0	—	—	100	20	12	—	10	JLA
BCW66F	EF	75[3]	45	5.0	20	45	100	250	100	1.0	—	—	100	20	12	—	10	JLA
BCW66G	EG	75[3]	45	5.0	20	45	160	400	100	1.0	—	—	100	20	12	—	10	JLA
BCW71	K1	50	45	5.0	100	20	110	220	2.0	5.0	0.25	10	—	—	4.0	—	10	FEE
BCW72	K2	50	45	5.0	100	20	200	450	2.0	5.0	0.25	10	—	—	4.0	—	10	FEE
BCX19	U1	50[3]	45	5.0	100	20	100	600	100	1.0	0.62	500	—	—	5.0	—	—	JLA
BCX20	U2	30[3]	25	5.0	100	20	100	600	100	1.0	0.62	500	—	—	5.0	—	—	JLA
BCX70G	AG	45[3]	45	5.0	20	45	120	220	2.0	5.0	0.35	10	125	10	4.5	—	6.0	FEE
BCX70H	AH	45[3]	45	5.0	20	45	180	310	2.0	5.0	0.35	10	125	10	4.5	—	6.0	FEE
BCX70J	AJ	45[3]	45	5.0	20	45	250	460	2.0	5.0	0.35	10	125	10	4.5	—	6.0	FEE
BCX70K	AK	45[3]	45	5.0	20	45	380	630	2.0	5.0	0.35	10	125	10	4.5	—	6.0	FEE
BSR13	U7	60	30	5.0	30	50	100	300	150	10	0.4	150	250	20	8.0	—	—	DCA
TMPC1009	F1	50	25	5.0	100	15	30	60	0.5	3.0	0.3	10	150	1.0	—	—	—	DMA
TMPC1009	F2	50	25	5.0	100	15	40	80	0.5	3.0	0.3	10	150	1.0	—	—	—	DMA
TMPC1009	F3	50	25	5.0	100	15	60	120	0.5	3.0	0.3	10	150	1.0	—	—	—	DMA
TMPC1009	F4	50	25	5.0	100	15	90	180	0.5	3.0	0.3	10	150	1.0	—	—	—	DMA
TMPC1009	F5	50	25	5.0	100	15	135	270	0.5	3.0	0.3	10	150	1.0	—	—	—	DMA
TMPC1622	D6	40	35	5.0	50	25	200	400	0.5	3.0	0.5	100	100	1.0	—	—	—	FEE
TMPC1622	D7	40	35	5.0	50	25	300	600	0.5	3.0	0.5	100	100	1.0	—	—	—	FEE
TMPC1622	D8	40	35	5.0	50	25	450	900	0.5	3.0	0.5	100	100	1.0	—	—	—	FEE
TMPC1623	L3	50	40	5.0	100	40	60	120	0.5	3.0	0.5	100	100	1.0	—	—	—	FEE
TMPC1623	L4	50	40	5.0	100	40	90	180	0.5	3.0	0.5	100	100	1.0	—	—	—	FEE
TMPC1623	L5	50	40	5.0	100	40	135	270	0.5	3.0	0.5	100	100	1.0	—	—	—	FEE
TMPC1623	L6	50	40	5.0	100	40	200	400	0.5	3.0	0.5	100	100	1.0	—	—	—	FEE
TMPC1623	L7	50	40	5.0	100	40	300	600	0.5	3.0	0.5	100	100	1.0	—	—	—	FEE
TMPC1653	N2	150	130	5.0	100	100	50	130	15	3.0	0.5	10	—	—	—	—	—	VXA
TMPC1653	N3	150	130	5.0	100	100	100	220	15	3.0	0.5	10	—	—	—	—	—	VXA
TMPC1653	N4	150	130	5.0	100	100	150	330	15	3.0	0.5	10	—	—	—	—	—	VXA
TMPC1654	N5	180	160	5.0	100	100	50	130	15	3.0	0.5	10	—	—	—	—	—	VXA
TMPC1654	N6	180	160	5.0	100	100	100	220	15	3.0	0.5	10	—	—	—	—	—	VXA
TMPC1654	N7	180	160	5.0	100	100	150	330	15	3.0	0.5	10	—	—	—	—	—	VXA
TMPT918	3B	30	15	3.0	10	15	20	—	3.0	1.0	0.4	10	600	4.0	1.7	—	—	DMA
TMPT2221	N12	60	30	5.0	10	50	40	120	150	10	0.4	150	250	20	8.0	—	—	JGA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

NPN Transistors

ELECTRICAL CHARACTERISTICS at T_A = 25°C

					I_{CBO}		DC Current Gain				$V_{CE(sat)}$		f_T					
Device Type	Marking	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	Max. (nA)	@V_{CB} (V)	h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	Max. (V)	@I_C (mA)	Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Pro-cess
TMPT2221A	N54	75	40	6.0	10	60	40	120	150	10	0.3	150	250	20	8.0	225	—	DCA
TMPT2222	1B	60	30	5.0	10	50	100	300	150	10	0.4	150	250	20	8.0	—	—	JGA
TMPT2222A	1P	75	40	6.0	10	60	100	300	150	10	0.3	150	250	20	8.0	225	—	DCA
TMPT2484	1U	60	60	6.0	10	45	100	500	10[2]	5.0	0.35	1.0	15	0.05	10	—	3.0	FEE
TMPT3903	N72	60	40	6.0	50	30	50	150	10	1.0	0.2	10	250	10	4.0	—	6.0	FFB
TMPT3904	1A	60	40	6.0	50	30	100	300	10	1.0	0.2	10	300	10	4.0	—	5.0	FFB
TMPT4124	ZC	30	25	5.0	50	20	120	360	2.0	1.0	0.3	50	300	10	4.0	—	5.0	FEE
TMPT4401	2X	60	40	6.0	100	30	100	300	150	1.0	0.4	150	250	20	6.5	225	—	DCA
TMPT5088	1Q	35	30	—	50	20	300	900	0.1	5.0	0.5	10	—	—	4.0	—	3.0	FEE
TMPT5089	1R	30	25	—	50	15	400	1200	0.1	5.0	0.5	10	—	—	4.0	—	2.0	FEE
TMPT5550	1F	160	140	6.0	100	100	60	250	10	5.0	0.15	10	100	10	6.0	—	10	VXA
TMPT5551	1FF	180	160	6.0	50	120	80	250	10	5.0	0.15	10	100	10	6.0	—	8.0	VXA
TMPT6427	1V	40	40	12	50	30	10k	100k	10	5.0	1.2	50	130	10	7	—	10	TPM
TMPT6428	1K	60	50	6.0	10	30	250	650	0.1	5.0	0.2	10	100	1.0	3.0	—	—	FEE
TMPT6429	1L	55	45	6.0	10	30	500	1250	0.1	5.0	0.2	10	100	1.0	3.0	—	—	FEE
TMPTA05	1H	60	60	4.0	100	60	50	—	100	1.0	0.25	100	100	10	—	—	—	JLA
TMPTA06	1G	80	80	4.0	100	80	50	—	100	1.0	0.25	100	100	10	—	—	—	JLA
TMPTA12	3W	20[3]	—	10	100	15	20k	—	10	5.0	1.0	10	—	—	—	—	—	TPM
TMPTA13	1M	30[3]	—	10	100	30	10k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
TMPTA14	1N	30[3]	—	10	100	30	20k	—	100	5.0	1.5	100	125	10	—	—	—	TPM
TMPTA20	1C	40	40	4.0	100	30	40	400	5.0	10	0.25	10	125	5.0	4.0	—	—	VRB
TMPTA42	1D	300	300	6.0	100	200	40	—	30	10	0.5	20	50	10	3.0	—	—	BLA
TMPTA43	1E	200	200	6.0	100	160	40	—	30	10	0.5	20	50	10	4.0	—	—	BLA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

PNP Transistors

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Marking	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	@V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
BCW29	C1	30[3]	20	5.0	100	20	120	260	2.0	5.0	0.3	10	—	—	7.0	—	10	BXE
BCW30	C2	30[3]	20	5.0	100	20	215	500	2.0	5.0	0.3	10	—	—	7.0	—	10	BXE
BCW61A	BA	32[3]	32	5.0	20	32	120	220	2.0	5.0	0.25	10	—	—	6.0	800	6.0	BXE
BCW61B	BB	32[3]	32	5.0	20	32	180	310	2.0	5.0	0.25	10	—	—	6.0	800	6.0	BXE
BCW61C	BC	32[3]	32	5.0	20	32	250	460	2.0	5.0	0.25	10	—	—	6.0	800	6.0	BXE
BCW61D	BD	32[3]	32	5.0	20	32	380	630	2.0	5.0	0.25	10	—	—	6.0	800	6.0	BXE
BCW67A	DA	45[3]	32	5.0	20	32	100	250	100	1.0	0.7	500	100	20	18	—	10	JMA
BCW67B	DB	45[3]	32	5.0	20	32	160	400	100	1.0	0.7	500	100	20	18	—	10	JMA
BCW68F	DF	60[3]	45	5.0	20	45	100	250	100	1.0	0.7	500	100	20	18	—	10	JMA
BCW68G	DG	60[3]	45	5.0	20	45	160	400	100	1.0	0.7	500	100	20	18	—	10	JMA
BCW69	H1	50[3]	45	5.0	100	20	120	260	2.0	5.0	0.3	10	—	—	7.0	—	10	BXE
BCW70	H2	50[3]	45	5.0	100	20	215	500	2.0	5.0	0.3	10	—	—	7.0	—	10	BXE
BCX17	T1	50[3]	45	5.0	100	20	100	600	100	1.0	0.62	500	—	—	8.0	—	—	JMA
BCX18	T2	30[3]	45	5.0	100	20	100	600	100	1.0	0.62	500	—	—	8.0	—	—	JMA
BCX71G	BG	45[3]	45	5.0	20	45	120	220	2.0	5.0	0.25	10	—	—	6.0	—	—	BXE
BCX71H	BH	45[3]	45	5.0	20	45	180	310	2.0	5.0	0.25	10	—	—	6.0	—	—	BXE
BCX71J	BJ	45[3]	45	5.0	20	45	250	460	2.0	5.0	0.25	10	—	—	6.0	—	—	BXE
BCX71K	BK	45[3]	45	5.0	20	45	380	630	2.0	5.0	0.25	10	—	—	6.0	—	—	BXE
BSR18	T9	40	40	5.0	100	40	50	150	10	1.0	0.95	50	—	—	—	260	—	BTB
BSS63	T3	110	100	6.0	100	90	30	—	25	1.0	0.25	25	50	25	—	—	—	BCA
TMPA811	C5	50	45	5.0	50	40	135	270	0.5	30	0.3	20	50	1.0	—	—	—	JFA
TMPA811	C6	50	45	5.0	50	40	200	400	0.5	30	0.3	20	50	1.0	—	—	—	JFA
TMPA811	C7	50	45	5.0	50	40	300	600	0.5	30	0.3	20	50	1.0	—	—	—	JFA
TMPA811	C8	50	45	5.0	50	40	450	900	0.5	30	0.3	20	50	1.0	—	—	—	JFA
TMPA812	M3	50	40	5.0	100	40	60	120	1.0	6.0	0.5	30	150	10	—	—	—	BXE
TMPA812	M4	50	40	5.0	100	40	90	180	1.0	6.0	0.5	30	150	10	—	—	—	BXE
TMPA812	M5	50	40	5.0	100	40	135	270	1.0	6.0	0.5	30	150	10	—	—	—	BXE
TMPA812	M6	50	40	5.0	100	40	200	400	1.0	6.0	0.5	30	150	10	—	—	—	BXE
TMPA812	M7	50	40	5.0	100	40	300	600	1.0	6.0	0.5	30	150	10	—	—	—	BXE
TMPA813	S2	60	45	5.0	100	45	50	100	50	1.0	0.5	150	100	10	—	—	—	JFA
TMPA813	S3	60	45	5.0	100	45	75	150	50	1.0	0.5	150	100	10	—	—	—	JFA
TMPA813	S4	60	45	5.0	100	45	100	200	50	1.0	0.5	150	100	10	—	—	—	JFA
TMPA956	H3	60	30	5.0	50	30	80	130	10	1.0	0.3	10	150	10	5.0	270	—	BTB
TMPA956	H4	60	30	5.0	50	30	110	170	10	1.0	0.3	10	150	10	5.0	270	—	BTB
TMPA956	H5	60	30	5.0	50	30	150	240	10	1.0	0.3	10	150	10	5.0	270	—	BTB
TMPT404	2M	25	24	12	100	10	30	400	12	0.15	0.15	12	4.0	1.0	20	—	—	SHF
TMPT404A	2N	40	35	25	100	10	30	400	12	0.15	0.15	12	4.0	1.0	20	—	—	SHF
TMPT2906	P01	60	40	5.0	20	50	40	120	150	10	0.4	150	200	50	8.0	100	—	DDA
TMPT2906A	P12	60	60	5.0	10	50	40	120	150	10	0.4	150	200	50	8.0	100	—	DDA
TMPT2907	2B	60	40	5.0	20	50	100	300	150	10	0.4	150	200	50	8.0	100	—	DDA
TMPT2907A	2F	60	60	5.0	10	50	100	300	150	10	0.4	150	200	50	8.0	100	—	DDA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at R = 10Ω.

PNP Transistors

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	Marking	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @V_{CB} (V)	DC Current Gain h_{FE} Min.	h_{FE} Max.	@I_C (mA)	@V_{CE} (V)	$V_{CE(sat)}$ Max. (V)	@I_C (mA)	f_T Min. (MHz)	@I_C (mA)	C_{ob}[1] (pF)	t_s[1] (ns)	NF[1] (dB)	Process
TMPT3638	AM	25	25	4.0	35	15	30	—	50	1.0	0.25	50	100	50	20	140	—	DDA
TMPT3638A	BN	25	25	4.0	35	15	100	—	50	1.0	0.25	50	150	50	10	140	—	DDA
TMPT3798	ABB	60	60	5.0	10	50	150	450	0.5	5.0	0.25	1.0	100	1.0	4.0	—	3.5	BXE
TMPT3798A	98A	90	90	5.0	10	50	150	450	0.5	5.0	0.25	1.0	100	1.0	4.0	—	3.5	BXE
TMPT3905	P26	40	40	5.0	—	—	50	150	10	1.0	0.25	10	200	10	4.5	260	5.0	BTB
TMPT3906	2A	40	40	5.0	—	—	100	300	10	1.0	0.25	10	250	10	4.5	300	4.0	BTB
TMPT4125	ZD	30	30	4.0	50	20	50	150	2.0	1.0	0.4	50	200	10	4.5	—	5.0	BXE
TMPT4126	ABF	25	25	4.0	50	20	120	360	2.0	1.0	0.4	50	250	10	4.5	—	4.0	BXE
TMPT4402	2W	40	40	5.0	—	—	50	150	150	2.0	0.4	150	150	20	10	225	—	DDA
TMPT4403	2T	40	40	5.0	—	—	100	300	150	2.0	0.4	150	200	20	10	225	—	DDA
TMPT5086	2P	50	50	—	50	35	150	500	0.1	5.0	0.3	10	40	0.5	4.0	—	3.0	BXE
TMPT5087	2Q	50	50	—	50	35	250	800	0.1	5.0	0.3	10	40	0.5	4.0	—	2.0	BXE
TMPT5401	2L	160	150	5.0	50	120	60	240	10	5.0	0.2	10	100	10	6.0	—	8.0	BCA
TMPTA55	2H	60	60	4.0	100	60	50	—	100	1.0	0.25	100	50	100	—	—	—	JMA
TMPTA56	2G	80	80	4.0	100	80	50	—	100	1.0	0.25	100	50	100	—	—	—	JMA
TMPTA63	2U	30	30	10	100	30	10K	—	10	5.0	2.0	100	125	100	—	—	—	SRB
TMPTA64	2V	30	30	10	100	30	20K	—	10	5.0	2.0	100	125	100	—	—	—	SRB
TMPTA70	2C	—	40	4.0	100	30	40	100	5.0	10	0.25	10	125	5.0	4.0	—	—	BXE
TMPTA92	2D	300	300	5.0	250	200	25	—	30	10	0.5	20	50	10	6.0	—	—	BMA
TMPTA93	2E	200	200	5.0	250	160	25	—	30	10	0.5	20	50	10	8.0	—	—	BMA
TMPTH81	3D	20	20	3.0	100	10	60	—	5.0	10	0.5	5.0	600	5.0	0.85	—	—	JYA

NOTES:
1) Maximum at typical JEDEC conditions.
2) μA.
3) $V_{(BR)CES}/I_{CES}$, as applicable.
4) mA.
5) $V_{(BR)CER}$ at $R = 10\Omega$.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	$V_{(BR)GSS}$ @I_G (µA)	I_{GSS} Max. (nA)	I_{GSS} @V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	$V_{GS(off)}$ Limits Max. (V)	$V_{GS(off)}$ Conditions V_{DS} (V)	$V_{GS(off)}$ Conditions I_D (nA)	I_{DSS} Min. (mA)	I_{DSS} Max. (mA)	I_{DSS} @V_{DS} (V)	g_{fs} Min. (mS)	g_{fs} Max. (mS)	g_{fs} @V_{DS} (V)	C_{iss}[1] Max. (pF)	C_{iss}[1] @V_{DS} (V)	C_{rss}[1] Max. (pF)	C_{rss}[1] @V_{DS} (V)	r_{DS} Max. (Ω)	Process
TMPF3369	−40	−1.0	−1.0	−30	—	−6.5	20	1.0[2]	0.5	2.5	30	0.6	2.5	30	20	8.0	3.0	30	—	NJ16
TMPF3370	−40	−1.0	−1.0	−30	—	−3.2	20	1.0[2]	0.1	0.6	30	0.3	2.5	30	20	8.0	3.0	30	—	NJ16
TMPF3458	−50	−10	−1.0	−30	—	−7.8	20	1.0[2]	3.0	15	20	2.5	10	20	18	−10[3]	5.0	30	—	NJ32
TMPF3459	−50	−10	−1.0	−30	—	−3.4	20	1.0[2]	0.8	4.0	20	1.5	6.0	20	18	−8.0[3]	5.0	30	—	NJ16
TMPF3460	−50	−1.0	−1.0	−30	—	−1.8	20	1.0[2]	0.2	1.0	20	0.8	4.5	20	18	−4.0[3]	5.0	30	—	NJ16
TMPF3819	−25	−1.0	−2.0	−15	—	−8.0	15	2.0	2.0	20	15	2.0	6.5	15	8.0	15	4.0	15	—	NJ32
TMPF3821	−50	−1.0	−1.0	−30	—	−4.0	10	1.0	0.5	2.5	15	1.5	4.5	15	6.0	15	2.0	15	—	NJ16
TMPF3822	−50	−1.0	−1.0	−30	—	−6.0	10	1.0	2.0	10	15	3.0	6.5	15	6.0	15	2.0	15	—	NJ32
TMPF3823	−30	−1.0	−1.0	−20	—	−8.0	10	1.0	4.0	20	15	3.5	6.5	15	6.0	15	2.0	15	—	NJ32
TMPF3824	−50	−1.0	−1.0	−30	—	−8.0	15	0.5	4.0	20	15	3.5	6.5	15	6.0	15	2.0	15	250	NJ32
TMPF3966	−30	−1.0	−1.0	−20	−4.0	−6.0	10	10	2.0	—	20	—	—	—	6.0	20	1.5	−7.0[3]	220	NJ32
TMPF3967	−30	−1.0	−1.0	−20	−2.0	−5.0	20	1.0	2.5	10	20	2.5	—	20	5.0	20[6]	1.3	20[6]	—	NJ26
TMPF3967A	−30	−1.0	−1.0	−20	−2.0	−5.0	20	1.0	2.5	10	20	2.5	—	20	5.0	20[6]	1.3	20[6]	—	NJ26
TMPF3968	−30	−1.0	−1.0	−20	—	−3.0	20	1.0	1.0	5.0	20	2.0	—	20	5.0	20[7]	1.3	20[7]	—	NJ26
TMPF3968A	−30	−1.0	−1.0	−20	—	−3.0	20	1.0	1.0	5.0	20	2.0	—	20	5.0	20[7]	1.3	20[7]	—	NJ26
TMPF3969	−30	−1.0	−1.0	−20	—	−1.7	20	1.0	0.4	2.0	20	1.3	—	20	5.0	20[8]	1.3	20[8]	—	NJ16
TMPF3969A	−30	−1.0	−1.0	−20	—	−1.7	20	1.0	0.4	2.0	20	1.3	—	20	5.0	20[8]	1.3	20[8]	—	NJ16
TMPF3970	−40	−1.0	−1.0	−20	−4.0	−10	20	1.0	50	150	20	—	—	—	25	20	6.0	−12[3]	30	NJ132
TMPF3971	−40	−1.0	−1.0	−20	−2.0	−5.0	20	1.0	25	75	20	—	—	—	25	20	6.0	−12[3]	60	NJ132
TMPF3972	−40	−1.0	−1.0	−20	−0.5	−3.0	20	1.0	5.0	30	20	—	—	—	25	20	6.0	−12[3]	100	NJ132
TMPF4091	−40	−1.0	−1.0	−20	−5.0	−10	20	1.0	30	—	20	—	—	—	16	20	5.0	−20[3]	30	NJ132
TMPF4092	−40	−1.0	−1.0	−20	−2.0	−7.0	20	1.0	15	—	20	—	—	—	16	20	5.0	−20[3]	50	NJ132
TMPF4093	−40	−1.0	−1.0	−20	−1.0	−5.0	20	1.0	8.0	—	20	—	—	—	16	20	5.0	−20[3]	80	NJ132
TMPF4117	−40	−1.0	−0.01	−20	−0.6	−1.8	10	1.0	0.03	0.09	10	0.07	0.21	10	3.0	10	1.5	10	—	NJ01
TMPF4118	−40	−1.0	−0.01	−20	−1.0	−3.0	10	1.0	0.08	0.24	10	0.08	0.25	10	3.0	10	1.5	10	—	NJ01
TMPF4119	−40	−1.0	−0.01	−20	−2.0	−6.0	10	1.0	0.2	0.6	10	0.10	0.33	10	3.0	10	1.5	10	—	NJ01
TMPF4220	−30	−10	−1.0	−15	—	−4.0	15	1.0	0.5	3.0	15	1.0	4.0	15	6.0	15	2.0	15	—	NJ16
TMPF4221	−30	−10	−1.0	−15	—	−6.0	15	1.0	2.0	6.0	15	2.0	5.0	15	6.0	15	2.0	15	—	NJ32
TMPF4222	−30	−10	−1.0	−15	—	−8.0	15	1.0	5.0	15	15	2.5	6.0	15	6.0	15	2.0	15	—	NJ32
TMPF4223	−30	−10	−1.0	−20	—	−8.0	15	1.0	3.0	18	15	3.0	7.0	15	6.0	15	2.0	15	—	NJ32
TMPF4224	−30	−10	−1.0	−20	—	−8.0	15	1.0	2.0	20	15	2.0	7.5	15	6.0	15	2.0	15	—	NJ32
TMPF4302	−30	−1.0	−1.0	−15	—	−4.0	20	10	0.5	5.0	20	1.0	—	20	6.0	20	3.0	20	—	NJ26
TMPF4303	−30	−1.0	−1.0	−15	—	−6.0	20	10	4.0	10	20	2.0	—	20	6.0	20	3.0	20	—	NJ26
TMPF4304	−30	−1.0	−1.0	−15	—	−10	20	10	0.5	15	20	1.0	—	20	6.0	20	3.0	20	—	NJ26
TMPF4338	−50	−1.0	−1.0	−30	−0.3	−1.0	15	100	0.2	0.6	15	0.6	1.8	15	7.0	15	3.0	15	2500	NJ16
TMPF4339	−50	−1.0	−1.0	−30	−0.6	−1.8	15	100	0.5	1.5	15	0.8	2.4	15	7.0	15	3.0	15	1700	NJ16
TMPF4340	−50	−1.0	−1.0	−30	−1.0	−3.0	15	100	1.2	3.6	15	1.3	3.0	15	7.0	15	3.0	15	1500	NJ16
TMPF4341	−50	−1.0	−1.0	−30	−2.0	−6.0	15	100	3.0	9.0	15	2.0	4.0	15	7.0	15	3.0	15	800	NJ16
TMPF4391	−40	−1.0	−1.0	−20	−4.0	−10	20	1.0	50	150	20	—	—	—	16	20	5.0	−12[3]	30	NJ132
TMPF4392	−40	−1.0	−1.0	−20	−2.0	−5.0	20	1.0	25	100	20	—	—	—	16	20	5.0	−7.0[3]	60	NJ132
TMPF4393	−40	−1.0	−1.0	−20	−0.5	−3.0	20	1.0	5.0	30	20	—	—	—	16	20	5.0	−5.0[3]	100	NJ132
TMPF4416	−30	−1.0	−1.0	−20	—	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	4.5	15	1.2	15	—	NJ26
TMPF4416A	−35	−1.0	−1.0	−20	−2.5	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	4.5	15	1.2	15	—	NJ26
TMPF4856	−40	−1.0	−1.0	−20	−4.0	−10	15	1.0	50	—	15	—	—	—	18	−10[3]	8.0	−10[3]	25	NJ132
TMPF4856A	−40	−1.0	−1.0	−20	−4.0	−10	15	1.0	50	—	15	—	—	—	10	−10[3]	4.0	−10[3]	25	NJ132
TMPF4857	−40	−1.0	−1.0	−20	−2.0	−6.0	15	1.0	20	100	15	—	—	—	18	−10[3]	8.0	−10[3]	40	NJ132
TMPF4857A	−40	−1.0	−1.0	−20	−2.0	−6.0	15	1.0	20	100	15	—	—	—	10	−10[3]	3.5	−10[3]	40	NJ132
TMPF4858	−40	−1.0	−1.0	−20	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	18	−10[3]	8.0	−10[3]	60	NJ132

NOTES:
1) V_{GS} = 0 V.
2) I_D in µA.
3) V_{DS} = 0 V, V_{GS} in volts.
4) I_D = 10 µA.
5) I_D = 5.0 µA.
6) I_D = 1.0 mA.
7) I_D = 500 µA.
8) I_D = 200 µA.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	$V_{(BR)GSS}$ Min. (V)	@ I_G (µA)	I_{GSS} Max. (nA)	@ V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Max. (V)	Conditions V_{DS} (V)	I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@ V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@ V_{DS} (V)	C_{ISS}[1] Max. (pF)	@ V_{DS} (V)	C_{RSS}[1] Max. (pF)	@ V_{DS} (V)	r_{DS} Max. (Ω)	Process
TMPF4858A	−40	−1.0	−1.0	−20	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	10	−10[3]	3.5	−10[3]	60	NJ132
TMPF4859	−30	−1.0	−1.0	−15	−4.0	−10	15	1.0	50	—	15	—	—	—	18	−10[3]	8.0	−10[3]	25	NJ132
TMPF4859A	−30	−1.0	−1.0	−15	−4.0	−10	15	1.0	50	—	15	—	—	—	10	−10[3]	4.0	−10[3]	25	NJ132
TMPF4860	−30	−1.0	−1.0	−15	−2.0	−6.0	15	1.0	20	100	15	—	—	—	18	−10[3]	8.0	−10[3]	40	NJ132
TMPF4860A	−30	−1.0	−1.0	−15	−2.0	−6.0	15	1.0	20	100	15	—	—	—	10	−10[3]	3.5	−10[3]	40	NJ132
TMPF4861	−30	−1.0	−1.0	−15	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	18	−10[3]	8.0	−10[3]	60	NJ132
TMPF4861A	−30	−1.0	−1.0	−15	−0.8	−4.0	15	1.0	8.0	80	15	—	—	—	10	−10[3]	3.5	−10[3]	60	NJ132
TMPF4867	−40	−1.0	−1.0	−30	−0.7	−2.0	20	1.0[2]	0.4	1.2	20	0.7	2.0	20	25	20	5.0	20	—	NJ16
TMPF4868	−40	−1.0	−1.0	−30	−1.0	−3.0	20	1.0[2]	1.0	3.0	20	1.0	3.0	20	25	20	5.0	20	—	NJ16
TMPF4869	−40	−1.0	−1.0	−30	−1.8	−5.0	20	1.0[2]	2.5	7.5	20	1.3	4.0	20	25	20	5.0	20	—	NJ16
TMPF5078	−30	−1.0	−1.0	−20	−0.5	−8.0	15	1.0	4.0	25	15	4.0	—	15	6.0	15	2.0	15	—	NJ26
TMPF5103	−25	−1.0	−1.0	−15	−0.5	−4.0	15	1.0	1.0	8.0	15	2.0	8.0	15	5.0	15	1.2	15		NJ26
TMPF5104	−25	−1.0	−1.0	−15	−0.5	−4.0	15	1.0	2.0	6.0	15	3.5	7.5	15	5.0	15	1.2	15		NJ26
TMPF5105	−25	−1.0	−1.0	−15	−0.5	−4.0	15	1.0	5.0	15	15	5.0	10	15	5.0	15	1.2	15		NJ26
TMPF5163	−25	−1.0	−10	−15	0.4	8.0	15	1.0[2]	1.0	40	15	2.0	9.0	15	12	15	3.0	15	—	NJ26
TMPF5245	−30	−1.0	−1.0	−20	−1.0	−6.0	15	10	5.0	15	15	4.0	—	15	4.5	15	1.5	15	—	NJ26
TMPF5246	−30	−1.0	−1.0	−20	−0.5	−4.0	15	10	1.5	7.0	15	2.5	—	15	4.5	15	1.5	15	—	NJ26
TMPF5247	−30	−1.0	−1.0	−20	−1.5	−8.0	15	10	8.0	24	15	4.0	—	15	4.5	15	1.5	15	—	NJ26
TMPF5248	−30	−1.0	−5.0	−20	−1.0	−8.0	15	10	4.0	20	15	3.0	—	15	6.0	15	2.0	15	—	NJ26
TMPF5358	−40	−1.0	−1.0	−20	−0.5	−3.0	15	100	0.5	1.0	15	1.0	3.0	15	6.0	15	2.0	15	—	NJ16
TMPF5359	−40	−1.0	−1.0	−20	−0.8	−4.0	15	100	0.6	1.6	15	1.2	3.6	15	6.0	15	2.0	15	—	NJ16
TMPF5360	−40	−1.0	−1.0	−20	−0.8	−4.0	15	100	1.5	3.0	15	1.4	4.2	15	6.0	15	2.0	15	—	NJ16
TMPF5361	−40	−1.0	−1.0	−20	−1.0	−6.0	15	100	2.5	5.0	15	1.5	4.5	15	6.0	15	2.0	15	—	NJ16
TMPF5362	−40	−1.0	−1.0	−20	−2.0	−7.0	15	100	4.0	8.0	15	2.0	5.5	15	6.0	15	2.0	15	—	NJ32
TMPF5363	−40	−1.0	−1.0	−20	−2.5	−8.0	15	100	7.0	14	15	2.5	6.0	15	6.0	15	2.0	15	—	NJ32
TMPF5364	−40	−1.0	−1.0	−20	−2.5	−8.0	15	100	9.0	18	15	2.7	6.5	15	6.0	15	2.0	15	—	NJ32
TMPF5397	−25	−1.0	1.0	−15	−1.0	−6.0	10	1.0	10	30	10	6.0	10	10[4]	5.0	10[4]	1.2	10[4]	—	NJ26L
TMPF5398	−25	−1.0	−1.0	−15	−1.0	−6.0	10	1.0	5.0	40	10	5.5	10	10	5.5	10	1.3	10	—	NJ26L
TMPF5457	−25	−10	−1.0	−15	−0.5	−6.0	15	10	1.0	5.0	15	1.0	5.0	15	7.0	15	3.0	15	—	NJ32
TMPF5458	−25	−10	−1.0	−15	−1.0	−7.0	15	10	2.0	9.0	15	1.5	5.5	15	7.0	15	3.0	15	—	NJ32
TMPF5459	−25	−10	−1.0	−15	−2.0	−8.0	15	10	4.0	16	15	2.0	6.0	15	7.0	15	3.0	15	—	NJ32
TMPF5484	−25	−1.0	−1.0	−20	−0.3	−3.0	15	10	1.0	5.0	15	3.0	6.0	15	5.0	15	1.0	15	—	NJ26
TMPF5485	−25	−1.0	−1.0	−20	−0.5	−4.0	15	10	4.0	10	15	3.5	7.0	15	5.0	15	1.0	15	—	NJ26
TMPF5486	−25	−1.0	−1.0	−20	−2.0	−6.0	15	10	8.0	20	15	4.0	8.0	15	5.0	15	1.2	15	—	NJ26
TMPF5555	−25	−1.0	−1.0	−15	—	−12	12	10	15	—	15	—	—	—	5.0	15	1.2	−10[3]	—	NJ26
TMPF5556	−30	−1.0	−1.0	−15	−0.2	−4.0	15	1.0	0.5	2.5	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
TMPF5557	−30	−1.0	−1.0	−15	−0.8	−5.0	15	1.0	2.0	5.0	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
TMPF5558	−30	−1.0	−1.0	−15	−1.5	−6.0	15	1.0	4.0	10	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
TMPF5638	−30	−10	−1.0	−15	—	−12	15	1.0	50	—	20	—	—	—	10	−12[3]	4.0	−12[3]	30	NJ132
TMPF5639	−30	−10	−1.0	−15	—	−8.0	15	1.0	25	—	20	—	—	—	10	−12[3]	4.0	−12[3]	60	NJ99
TMPF5640	−30	−10	−1.0	−15	—	−6.0	15	1.0	5.0	—	20	—	—	—	10	−12[3]	4.0	−12[3]	100	NJ99
TMPF5653	−30	−10	−1.0	−15	—	−12	15	1.0	40	—	20	—	—	—	10	−12[3]	3.5	−12[3]	50	NJ99
TMPF5654	−25	−10	−10	−15	—	−8.0	15	1.0	15	—	20	—	—	—	10	−8.0[3]	3.5	−8.0[3]	100	NJ99
TMPF5668	−25	−10	−1.0	−15	−0.2	−4.0	15	10	1.0	5.0	15	1.0	—	15	7.0	15	3.0	15	—	NJ32
TMPF5669	−25	−10	−1.0	−15	−1.0	−6.0	15	10	4.0	10	15	1.6	—	15	7.0	15	3.0	15	—	NJ32
TMPF5670	−25	−10	−1.0	−15	−2.0	−8.0	15	10	8.0	20	15	2.0	—	15	7.0	15	3.0	15	—	NJ32
TMPF5949	−30	−1.0	−1.0	−15	−3.0	−7.0	15	100	12	18	15	3.0	—	15	6.0	15	2.0	15	—	NJ32
TMPF5950	−30	−1.0	−1.0	−15	−2.5	−6.0	15	100	10	15	15	3.0	—	15	6.0	15	2.0	15	—	NJ32

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in µA.
3) $V_{DS} = 0$ V, V_{GS} in volts.
4) $I_D = 10$ µA.
5) $I_D = 5.0$ µA.
6) $I_D = 1.0$ mA.
7) $I_D = 500$ µA.
8) $I_D = 200$ µA.

N-Channel JFETs

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	$V_{(BR)GSS}$ Min. (V)	$V_{(BR)GSS}$ @I_G (μA)	I_{GSS} Max. (nA)	I_{GSS} @V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	$V_{GS(off)}$ Limits Max. (V)	$V_{GS(off)}$ Conditions V_{DS} (V)	$V_{GS(off)}$ Conditions I_D (nA)	I_{DSS} Min. (mA)	I_{DSS} Max. (mA)	I_{DSS} @V_{DS} (V)	g_{fs} Min. (mS)	g_{fs} Max. (mS)	g_{fs} @V_{DS} (V)	C_{ISS}[1] Max. (pF)	C_{ISS}[1] @V_{DS} (V)	C_{RSS}[1] Max. (pF)	C_{RSS}[1] @V_{DS} (V)	r_{DS} Max. (Ω)	Process
TMPF5951	−30	−1.0	−1.0	−15	−2.0	−5.0	15	100	7.0	13	15	3.0	—	15	6.0	15	2.0	15	—	NJ32
TMPF5952	−30	−1.0	−1.0	−15	−1.3	−3.5	15	100	4.0	8.0	15	1.0	—	15	6.0	15	2.0	15	—	NJ32
TMPF5953	−30	−1.0	−1.0	−15	−0.8	−3.0	15	100	2.5	5.0	15	1.0	—	15	6.0	15	2.0	15	—	NJ32
TMPF6451	−20	−1.0	−1.0	−10	−0.5	−3.5	10	1.0	5.0	20	10	—	—	—	25	10	5.0	10	—	NJ132L
TMPF6452	−25	−1.0	−1.0	−15	−0.5	−3.5	10	1.0	5.0	20	10	—	—	—	25	10	5.0	10	—	NJ132L
TMPF6453	−20	−1.0	−1.0	−10	−0.75	−5.0	10	1.0	15	50	10	—	—	—	25	10	5.0	10	—	NJ132L
TMPF6454	−25	−1.0	−1.0	−15	−0.75	−5.0	10	1.0	15	50	10	—	—	—	25	10	5.0	10	—	NJ132L
TMPFBC264A	−30	−1.0	−10	−20	−0.5	—	15	10	2.0	4.5	15	2.5	—	15	4.0	15	1.2	15	—	NJ26
TMPFBC264B	−30	−1.0	−10	−20	−0.5	—	15	10	3.5	6.5	15	3.0	—	15	4.0	15	1.2	15	—	NJ26
TMPFBC264C	−30	−1.0	−10	−20	−0.5	—	15	10	5.0	8.0	15	3.5	—	15	4.0	15	1.2	15	—	NJ26
TMPFBC264D	−30	−1.0	−10	−20	−0.5	—	15	10	7.0	12	15	4.0	—	15	4.0	15	1.2	15	—	NJ26
TMPFBF244A	−30	−1.0	−5.0	−20	−0.5	−8.0	15	10	2.0	6.5	15	3.0	6.5	15	—	—	—	—	—	NJ26
TMPFBF244B	−30	−1.0	−5.0	−20	−0.5	−8.0	15	10	6.0	15	15	3.0	6.5	15	—	—	—	—	—	NJ26
TMPFBF244C	−30	−1.0	−5.0	−20	−0.5	−8.0	15	10	12	25	15	3.0	6.5	15	—	—	—	—	—	NJ26
TMPFBF246A	−25	−1.0	−5.0	−15	−0.6	−14.5	15	10	30	80	15	—	—	—	—	—	—	—	65	NJ132
TMPFBF246B	−25	−1.0	−5.0	−15	−0.6	−14.5	15	10	60	140	15	—	—	—	—	—	—	—	50	NJ132
TMPFBF246C	−25	−1.0	−5.0	−15	−0.6	−14.5	15	10	110	250	15	—	—	—	—	—	—	—	35	NJ132
TMPFBF256A	−30	−1.0	−5.0	−20	−0.5	−7.5	15	10	3.0	7.0	15	4.5	—	15	4.5	15	1.2	15	—	NJ26
TMPFBF256B	−30	−1.0	−5.0	−20	−0.5	−7.5	15	10	6.0	13	15	4.5	—	15	4.5	15	1.2	15	—	NJ26
TMPFBF256C	−30	−1.0	−5.0	−20	−0.5	−7.5	15	10	11	18	15	4.5	—	15	4.5	15	1.2	15	—	NJ26
TMPFJ111	−35	−1.0	−1.0	−15	−3.0	−10	5.0	1.0	20	—	15	—	—	—	16	15	5	−10[3]	30	NJ132
TMPFJ111A	−40	−1.0	−0.2	−1.0	−5.0	−10	5.0	1.0	30	—	15	—	—	—	16	15	5	−10[3]	30	NJ132
TMPFJ112	−35	−1.0	−1.0	−15	−1.0	−5.0	5.0	1.0	5.0	—	15	—	—	—	16	15	5	−10[3]	50	NJ99
TMPFJ112A	−40	−1.0	−0.2	−1.0	−2.0	−7.0	5.0	1.0	15	—	15	—	—	—	16	15	5	−10[3]	50	NJ99
TMPFJ113	−35	−1.0	−1.0	−15	—	−3.0	5.0	1.0	2.0	—	15	—	—	—	16	15	5	−10[3]	100	NJ99
TMPFJ113A	−40	−1.0	−0.2	−1.0	−1.0	−5.0	5.0	1.0	8.0	—	15	—	—	—	16	15	5	−10[3]	80	NJ99
TMPFJ201	−40	−1.0	−1.0	−20	−0.3	−1.5	20	10	0.2	1.0	20	0.5	—	20	4.0	20	1.0	20	—	NJ16
TMPFJ202	−40	−1.0	−1.0	−20	−0.8	−4.0	20	10	0.9	4.5	20	1.0	—	20	4.0	20	1.0	20	—	NJ16
TMPFJ203	−40	−1.0	−1.0	−20	−2.0	−10	20	10	4.0	20	20	1.5	—	20	6.0	20	1.2	20	—	NJ32
TMPFJ210	−25	−1.0	−1.0	−15	−1.0	−3.0	15	1.0	2.0	15	15	4.0	12	15	—	—	—	—	—	NJ26L
TMPFJ211	−25	−1.0	−1.0	−15	−2.5	−4.5	15	1.0	7.0	20	15	6.0	12	15	—	—	—	—	—	NJ26L
TMPFJ212	−25	−1.0	−1.0	−15	−4.0	−6.0	15	1.0	15	40	15	7.0	12	15	—	—	—	—	—	NJ26L
TMPFJ230	−40	−1.0	−1.0	−30	−0.5	−3.0	20	1[2]	0.7	3.0	20	1.0	3.5	20	—	—	—	—	—	NJ16
TMPFJ231	−40	−1.0	−1.0	−30	−1.5	−5.0	20	1[2]	2.0	6.0	20	1.5	4.0	20	—	—	—	—	—	NJ16
TMPFJ232	−40	−1.0	−1.0	−30	−3.0	−6.0	20	1[2]	5.0	10	20	2.5	5.0	20	—	—	—	—	—	NJ16
TMPFJ300A	−25	−1.0	−1.0	−15	−1.5	−3.0	10	1.0	4.0	9.0	10	4.5	9.0	10[5]	5.5	10[5]	1.7	10[5]	—	NJ26L
TMPFJ300B	−25	−1.0	−1.0	−15	−2.0	−4.0	10	1.0	7.0	15	10	4.5	9.0	10[5]	5.5	10[5]	1.7	10[5]	—	NJ26L
TMPFJ300C	−25	−1.0	−1.0	−15	−2.5	−5.0	10	1.0	12	25	10	4.5	9.0	10[5]	5.5	10[5]	1.7	10[5]	—	NJ26L
TMPFJ304	−30	−1.0	−1.0	−20	−2.0	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	—	—	—	—	—	NJ26
TMPFJ305	−30	−1.0	−1.0	−20	−0.5	−3.0	15	1.0	1.0	8.0	15	3.0	—	15	—	—	—	—	—	NJ26
TMPFJ308	−25	−1.0	−1.0	−15	−1.0	−6.5	10	1.0	12	60	10	8.0	—	10[4]	7.5	−10[3]	3.5	−10[3]	—	NJ99
TMPFJ309	−25	−1.0	−1.0	−15	−1.0	−4.0	10	1.0	12	30	10	10	—	10[4]	7.5	−10[3]	3.5	−10[3]	—	NJ99
TMPFJ310	−25	−1.0	−1.0	−15	−2.0	−6.5	10	1.0	24	60	10	8.0	—	10[4]	7.5	−10[3]	3.5	−10[3]	—	NJ99
TMPFU308	−25	−1.0	−1.0	−15	−1.0	−6.0	10	1.0	12	60	10	—	—	—	7.5	−10[3]	3.5	−10[3]	—	NJ99
TMPFU309	−25	−1.0	−1.0	−15	−1.0	−4.0	10	1.0	12	30	10	—	—	—	7.5	−10[3]	3.5	−10[3]	—	NJ99
TMPFU310	−25	−1.0	−1.0	−15	−2.5	−6.0	10	1.0	24	60	10	—	—	—	7.5	−10[3]	3.5	−10[3]	—	NJ99
TMPFU1897	−40	−1.0	−1.0	−20	−5.0	−10	20	1.0	30	—	20	—	—	—	16	20	3.5	20	30	NJ132
TMPFU1898	−40	−1.0	−1.0	−20	−2.0	−7.0	20	1.0	15	—	20	—	—	—	16	20	3.5	20	50	NJ132
TMPFU1899	−40	−1.0	−1.0	−20	−1.0	−5.0	20	1.0	8.0	—	20	—	—	—	16	20	3.5	20	80	NJ132

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in μA.
3) $V_{DS} = 0$ V, V_{GS} in volts.
4) $I_D = 10$ mA.
5) $I_D = 5.0$ μA.

P-Channel JFETs

ELECTRICAL CHARACTERISTICS at T_A = 25°C

	$V_{(BR)GSS}$		I_{GSS}		$V_{GS(off)}$ Limits		$V_{GS(off)}$ Conditions		I_{DSS}			g_{fs}			C_{iss} [1]		C_{rss} [1]		r_{DS}	
Device Type	Min. (V)	@ I_G (µA)	Max. (nA)	@ V_{GS} (V)	Min. (V)	Max. (V)	V_{DS} (V)	I_D (nA)	Min. (mA)	Max. (mA)	@ V_{DS} (V)	Min. (mS)	Max. (mS)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (Ω)	Process
TMPF2608	30	1.0	10	5.0	1.0	4.0	−5.0	−1.0[2]	−0.9	−4.5	−5.0	1.0	—	−5.0	17	−5.4	—	—	—	PJ32
TMPF2609	30	1.0	10	5.0	1.0	4.0	−5.0	−1.0[2]	−2.0	−10	−5.0	2.5	—	−5.0	30	−5.4	—	—	—	PJ32
TMPF3329	20	10	10	10	—	6.0	−15	−10[2]	−1.0	−3.0	−10	—	—	—	20	−10	—	—	—	PJ32
TMPF3330	20	10	10	10	—	6.0	−15	−10[2]	−2.0	−6.0	−10	—	—	—	20	−10	—	—	—	PJ32
TMPF3331	20	10	10	10	—	8.0	−15	−10[2]	−5.0	−15	−10	—	—	—	20	−10	—	—	—	PJ32
TMPF3332	20	10	10	10	—	6.0	−15	−10[2]	−1.0	−6.0	−10	—	—	—	20	−10	—	—	—	PJ32
TMPF3820	20	10	20	10	—	8.0	−10	−10[2]	−0.3	−15	−10	0.8	5.0	−10	32	−10	16	−10	—	PJ32
TMPF3993	25	1.0	1.0	15	4.0	9.5	−10	−1.0[2]	−10	—	−10	6.0	12	−10	16	−10	4.5	10[3]	150	PJ99
TMPF3994	25	1.0	1.0	15	1.0	5.5	−10	−1.0[2]	−2.0	—	−10	4.0	10	−10	16	−10	4.5	10[3]	300	PJ99
TMPF4381	25	1.0	1.0	15	1.0	5.0	−15	−1.0[2]	−3.0	−12	−15	2.0	6.0	−15	20	−15	5.0	−15	—	PJ32
TMPF5018	30	1.0	2.0	15	—	10	−15	−1.0[2]	−10	—	−20	—	—	—	45	−15	10	12[3]	75	PJ99
TMPF5019	30	1.0	2.0	15	—	5.0	−15	−1.0[2]	−5.0	—	−20	—	—	—	45	−15	10	7.0[3]	150	PJ99
TMPF5020	25	1.0	1.0	15	0.3	1.5	−15	−1.0[2]	−0.3	−1.2	−15	1.0	3.5	−15	25	−15	7.0	−15	—	PJ32
TMPF5021	25	1.0	1.0	15	0.5	2.5	−15	−1.0[2]	−1.0	−3.5	−15	1.5	6.0	−15	25	−15	7.0	−15	—	PJ32
TMPF5033	20	10	10	15	0.3	2.5	−15	−1.0[2]	−0.3	3.5	−15	1.0	5.0	−10	25	−15	7.0	−15	—	PJ32
TMPF5114	30	1.0	1.0	20	5.0	10	−15	−1.0	−30	−90	−15	—	—	—	25	−15	7.0	12[3]	75	PJ99
TMPF5115	30	1.0	1.0	20	3.0	6.0	−15	−1.0	−16	−60	−15	—	—	—	25	−15	7.0	7.0[3]	100	PJ99
TMPF5116	30	1.0	1.0	20	1.0	4.0	−15	−1.0	−5.0	−25	−15	—	—	—	25	−15	7.0	5.0[3]	150	PJ99
TMPF5460	40	10	5.0	20	0.75	6.0	−15	−1.0	−1.0	−5.0	−15	1.0	5.0	−15	7.0	−15	3.0	−15	—	PJ32
TMPF5461	40	10	5.0	20	1.0	7.5	−15	−1.0	−2.0	−9.0	−15	1.5	5.5	−15	7.0	−15	3.0	−15	—	PJ32
TMPF5462	40	10	5.0	20	1.8	9.0	−15	−1.0	−4.0	−16	−15	2.0	6.0	−15	7.0	−15	3.0	−15	—	PJ32
TMPFJ174	30	1.0	1.0	20	5.0	10	−15	−10	−20	−135	−15	—	—	—	—	—	—	—	85	PJ99
TMPFJ175	30	1.0	1.0	20	3.0	6.0	−15	−10	−7.0	−70	−15	—	—	—	—	—	—	—	125	PJ99
TMPFJ176	30	1.0	1.0	20	1.0	4.0	−15	−10	−2.0	−35	−15	—	—	—	—	—	—	—	250	PJ99
TMPFJ177	30	1.0	1.0	20	0.8	2.25	−15	−10	−1.5	−20	−15	—	—	—	—	—	—	—	300	PJ99
TMPFJ270	30	1.0	1.0	20	0.5	2.0	−15	−1.0	−2.0	−15	−15	6.0	15	−15	—	—	—	—	—	PJ99
TMPFJ271	30	1.0	1.0	20	1.5	4.5	−15	−1.0	−6.0	−50	−15	8.0	18	−15	—	—	—	—	—	PJ99
TMPFP1086	30	1.0	2.0	15	—	10	−15	−1.0[2]	−10	—	−20	—	—	—	45	−15	10	12[3]	75	PJ99
TMPFP1087	30	1.0	2.0	15	—	5.0	−15	−1.0[2]	−5.0	—	−20	—	—	—	45	−15	10	7.0[3]	150	PJ99
TMPFU304	30	1.0	1.0	20	5.0	10	−15	−1.0[2]	−30	−90	−15	—	—	—	27	−15	7.0	12[3]	85	PJ99
TMPFU305	30	1.0	1.0	20	3.0	6.0	−15	−1.0[2]	−15	−60	−15	—	—	—	27	−15	7.0	7.0[3]	110	PJ99
TMPFU306	30	1.0	1.0	20	1.0	4.0	−15	−1.0[2]	−5.0	−25	−15	—	—	—	27	−15	7.0	5.0[3]	175	PJ99

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in µA.
3) $V_{DS} = 0$ V, V_{GS} in volts.
4) $V_{GS} = 1.0$ V.

N-Channel JFETs

General-Purpose Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

	$V_{(BR)GSS}$		I_{GSS}		$V_{GS(off)}$ Limits		$V_{GS(off)}$ Conditions		I_{DSS}			g_{fs}			C_{iss}[1]		C_{rss}[1]		r_{DS}	
Device Type	Min. (V)	@ I_G (µA)	Max. (nA)	@ V_{GS} (V)	Min. (V)	Max. (V)	V_{DS} (V)	I_D (nA)	Min. (mA)	Max. (mA)	@ V_{DS} (V)	Min. (mS)	Max. (mS)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (Ω)	Process
2N3369	−40	−1.0	−5.0	−30	—	−6.5	20	1.0[2]	0.5	2.5	30	0.6	2.5	30	20	8.0	3.0	30	—	NJ16
2N3370	−40	−1.0	−5.0	−30	—	−3.2	20	1.0[2]	0.1	0.6	30	0.3	2.5	30	20	8.0	3.0	30	—	NJ16
2N3458	−50	−1.0	−0.25	−30	—	−7.8	20	1.0[2]	3.0	15	20	2.5	10	20	18	−10[3]	5.0	30	—	NJ16
2N3459	−50	−1.0	−0.25	−30	—	−3.4	20	1.0[2]	0.8	4.0	20	1.5	6.0	20	18	−6[3]	5.0	30	—	NJ16
2N3460	−50	−1.0	−0.25	−30	—	−1.8	20	1.0[2]	0.2	1.0	20	0.8	4.5	20	18	−4[3]	5.0	30	—	NJ16
2N3821	−50	−1.0	−0.1	−30	—	−4.0	10	1.0	0.5	2.5	15	1.5	4.5	15	6.0	15	2.0	15	—	NJ16
2N3822	−50	−1.0	−0.1	−30	—	−6.0	10	1.0	2.0	10	15	3.0	6.5	15	6.0	15	2.0	15	—	NJ32
2N3967	−30	−1.0	−0.1	−20	−2.0	−5.0	20	1.0	2.5	10	20	2.5	—	20	5.0	20[4]	1.3	20[4]	—	NJ26
2N3967A	−30	−1.0	−0.1	−20	−2.0	−5.0	20	1.0	2.5	10	20	2.5	—	20	5.0	20[4]	1.3	20[4]	—	NJ26
2N3968	−30	−1.0	−0.1	−20	—	−3.0	20	1.0	1.0	5.0	20	2.0	—	20	5.0	20[5]	1.3	20[5]	—	NJ26
2N3968A	−30	−1.0	−0.1	−20	—	−3.0	20	1.0	1.0	5.0	20	2.0	—	20	5.0	20[5]	1.3	20[5]	—	NJ26
2N3969	−30	−1.0	−0.1	−20	—	−1.7	20	1.0	0.4	2.0	20	1.3	—	20	5.0	20[6]	1.3	20[6]	—	NJ26
2N3969A	−30	−1.0	−0.1	−20	—	−1.7	20	1.0	0.4	2.0	20	1.3	—	20	5.0	20[6]	1.3	20[6]	—	NJ26
2N4220	−30	−1.0	−0.1	−15	—	−4.0	15	1.0	0.5	3.0	15	1.0	4.0	15	6.0	15	2.0	15	—	NJ16
2N4220A	−30	−1.0	−0.1	−15	—	−4.0	15	1.0	0.5	3.0	15	1.0	4.0	15	6.0	15	2.0	15	—	NJ16
2N4221	−30	−1.0	−0.1	−15	—	−6.0	15	1.0	2.0	6.0	15	2.0	5.0	15	6.0	15	2.0	15	—	NJ32
2N4221A	−30	−1.0	−0.1	−15	—	−6.0	15	1.0	2.0	6.0	15	2.0	5.0	15	6.0	15	2.0	15	—	NJ32
2N4222	−30	−1.0	−0.1	−15	—	−8.0	15	1.0	5.0	15	15	2.5	6.0	15	6.0	15	2.0	15	—	NJ32
2N4222A	−30	−1.0	−0.1	−15	—	−8.0	15	1.0	5.0	15	15	2.5	6.0	15	6.0	15	2.0	15	—	NJ32
2N4338	−50	−1.0	−0.1	−30	−0.3	−1.0	15	100	0.2	0.6	15	0.6	1.8	15	7.0	15	3.0	15	2500	NJ16
2N4339	−50	−1.0	−0.1	−30	−0.6	−1.8	15	100	0.5	1.5	15	0.8	2.4	15	7.0	15	3.0	15	1700	NJ16
2N4340	−50	−1.0	−0.1	−30	−1.0	−3.0	15	100	1.2	3.6	15	1.3	3.0	15	7.0	15	3.0	15	1500	NJ16
2N4341	−50	−1.0	−0.1	−30	−2.0	−6.0	15	100	3.0	9.0	15	2.0	4.0	15	7.0	15	3.0	15	800	NJ16
2N5103	−25	−1.0	−0.1	−15	−0.5	−4.0	15	1.0	1.0	8.0	15	2.0	8.0	15	5.0	15	1.0	15	—	NJ26
2N5104	−25	−1.0	−0.1	−15	−0.5	−4.0	15	1.0	2.0	6.0	15	3.5	7.5	15	5.0	15	1.0	15	—	NJ26
2N5105	−25	−1.0	−0.1	−15	−0.5	−4.0	15	1.0	5.0	15	15	5.0	10	15	5.0	15	1.0	15	—	NJ26
2N5358	−40	−1.0	−0.1	−20	−0.5	−3.0	15	100	0.5	1.0	15	1.0	3.0	15	6.0	15	2.0	15	—	NJ16
2N5359	−40	−1.0	−0.1	−20	−0.8	−4.0	15	100	0.6	1.6	15	1.2	3.6	15	6.0	15	2.0	15	—	NJ16
2N5360	−40	−1.0	−0.1	−20	−0.8	−4.0	15	100	1.5	3.0	15	1.4	4.2	15	6.0	15	2.0	15	—	NJ16
2N5361	−40	−1.0	−0.1	−20	−1.0	−6.0	15	100	2.5	5.0	15	1.5	4.5	15	6.0	15	2.0	15	—	NJ16
2N5362	−40	−1.0	−0.1	−20	−2.0	−7.0	15	100	4.0	8.0	15	2.0	5.5	15	6.0	15	2.0	15	—	NJ32
2N5363	−40	−1.0	−0.1	−20	−2.5	−8.0	15	100	7.0	14	15	2.5	6.0	15	6.0	15	2.0	15	—	NJ32
2N5364	−40	−1.0	−0.1	−20	−2.5	−8.0	15	100	9.0	18	15	2.7	6.5	15	6.0	15	2.0	15	—	NJ32

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in µA.
3) $V_{DS} = 0$ V, V_{GS} in volts.
4) $I_D = 1.0$ mA.
5) $I_D = 500$ µA.
6) $I_D = 200$ µA.

N-Channel JFETs

Low-Noise Amplifiers

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	$V_{(BR)GSS}$ Min. (V)	@ I_G (µA)	I_{GSS} Max. (nA)	@ V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Limits Max. (V)	Conditions V_{DS} (V)	Conditions I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@ V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@ V_{DS} (V)	C_{ISS}[1] Max. (pF)	@ V_{DS} (V)	C_{RSS}[1] Max. (pF)	@ V_{DS} (V)	r_{DS} Max. (Ω)	Process
2N5556	−30	−1.0	−0.1	−15	−0.2	−4.0	15	1.0	0.5	2.5	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
2N5557	−30	−1.0	−0.1	−15	−0.8	−5.0	15	1.0	2.0	5.0	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
2N5558	−30	−1.0	−0.1	−15	−1.5	−6.0	15	1.0	4.0	10	15	1.5	6.5	15	6.0	15	3.0	15	—	NJ16
2N6451	−20	−1.0	−0.1	−10	−0.5	−3.5	10	1.0	5.0	20	10	—	—	—	25	10	5.0	10	—	NJ132L
2N6452	−25	−1.0	−0.5	−15	−0.5	−3.5	10	1.0	5.0	20	10	—	—	—	25	10	5.0	10	—	NJ132L
2N6453	−20	−1.0	−0.1	−10	−0.75	−5.0	10	1.0	15	50	10	—	—	—	25	10	5.0	10	—	NJ132L
2N6454	−25	−1.0	−0.5	−15	−0.75	−5.0	10	1.0	15	50	10	—	—	—	25	10	5.0	10	—	NJ132L
NF5101	−40	−1.0	−0.2	−15	−0.5	−1.1	15	1.0	1.0	12	15	3.5	—	15	12	15	4.0	15	—	NJ99
NF5102	−40	−1.0	−0.2	−15	−0.7	−1.6	15	1.0	4.0	20	15	7.5	—	15	12	15	4.0	15	—	NJ99
NF5103	−40	−1.0	−0.2	−15	−1.2	−2.7	15	1.0	10	40	15	7.5	—	15	12	15	4.0	15	—	NJ99

NOTE:
1) $V_{GS} = 0$ V.

Low-Leakage Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	$V_{(BR)GSS}$ Min. (V)	@ I_G (µA)	I_{GSS} Max. (pA)	@ V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Limits Max. (V)	Conditions V_{DS} (V)	Conditions I_D (nA)	I_{DSS} Min. (µA)	Max. (µA)	@ V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@ V_{DS} (V)	C_{ISS}[1] Max. (pF)	@ V_{DS} (V)	C_{RSS}[1] Max. (pF)	@ V_{DS} (V)	r_{DS} Max. (Ω)	Process
2N4117	−40	−1.0	−10	−20	−0.6	−1.8	10	1.0	30	90	10	70	210	10	3.0	10	1.5	10	—	NJ01
2N4117A	−40	−1.0	−1.0	−20	−0.6	−1.8	10	1.0	30	90	10	70	210	10	3.0	10	1.5	10	—	NJ01
2N4118	−40	−1.0	−10	−20	−1.0	−3.0	10	1.0	80	240	10	80	250	10	3.0	10	1.5	10	—	NJ01
2N4118A	−40	−1.0	−1.0	−20	−1.0	−3.0	10	1.0	80	240	10	80	250	10	3.0	10	1.5	10	—	NJ01
2N4119	−40	−1.0	−10	−20	−2.0	−6.0	10	1.0	200	600	10	100	330	10	3.0	10	1.5	10	—	NJ01
2N4119A	−40	−1.0	−1.0	−20	−2.0	−6.0	10	1.0	200	600	10	100	330	10	3.0	10	1.5	10	—	NJ01
NF5301	−30	−1.0	−1.0	−15	−0.6	−3.0	10	1.0	30	500	10	70	300	10	3.0	10	1.5	10	—	NJ01
NF5301−1	−30	−1.0	−1.0	−15	−0.6	−1.8	10	1.0	30	500	10	70	300	10	3.0	10	1.5	10	—	NJ01
NF5301−2	−30	−1.0	−1.0	−15	−1.7	−3.0	10	1.0	30	500	10	70	300	10	3.0	10	1.5	10	—	NJ01
NF5301−3	−30	−1.0	−1.0	−15	−1.0	−3.4	10	1.0	30	500	10	70	300	10	3.0	10	1.5	10	—	NJ01

NOTE:
1) $V_{GS} = 0$ V.

High-Voltage Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	$V_{(BR)GSS}$ Min. (V)	@ I_G (µA)	I_{GSS} Max. (nA)	@ V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	Limits Max. (V)	Conditions V_{DS} (V)	Conditions I_D (nA)	I_{DSS} Min. (mA)	Max. (mA)	@ V_{DS} (V)	g_{fs} Min. (mS)	Max. (mS)	@ V_{DS} (V)	C_{ISS}[1] Max. (pF)	@ V_{DS} (V)	C_{RSS}[1] Max. (pF)	@ V_{DS} (V)	r_{DS} Max. (Ω)	Process
2N6449	−300	−10	100	−150	−2.0	−15	30	4.0	2.0	10	30	0.5	3.0	30	10	30	5.0	30	—	NJ42
2N6450	−200	−10	100	−100	−2.0	−15	30	4.0	2.0	10	30	0.5	3.0	30	10	30	5.0	30	—	NJ42

NOTE:
1) $V_{GS} = 0$ V.

N-Channel JFETs

Switches

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	$V_{(BR)GSS}$ @I_G (μA)	I_{GSS} Max. (nA)	I_{GSS} @V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	$V_{GS(off)}$ Limits Max. (V)	$V_{GS(off)}$ Conditions V_{DS} (V)	$V_{GS(off)}$ Conditions I_D (nA)	I_{DSS} Limits Min. (mA)	I_{DSS} Limits Max. (mA)	I_{DSS} Conditions @V_{DS} (V)	C_{ISS}[1] Max. (pF)	C_{ISS}[1] @V_{DS} (V)	C_{RSS}[1] Max. (pF)	C_{RSS}[1] @V_{DS} (V)	r_{DS} Max. (Ω)	Process
2N3824	−50	−1.0	−0.1	−30	—	−8.0	15	1.0	—	—	—	6.0	15	3.0	−8.0[3]	250	NJ32
2N3966	−30	−1.0	−0.1	−20	−4.0	−6.0	10	10	2.0	—	20	6.0	20	1.5	−7.0[3]	220	NJ32
2N3970	−40	−1.0	−0.3	−20	−4.0	−10	20	1.0	50	150	20	25	20	6.0	−12[3]	30	NJ132
2N3971	−40	−1.0	−0.3	−20	−2.0	−5.0	20	1.0	25	75	20	25	20	6.0	−12[3]	60	NJ132
2N3972	−40	−1.0	−0.3	−20	−0.5	−3.0	20	1.0	5.0	30	20	25	20	6.0	−12[3]	100	NJ132
2N4091	−40	−1.0	−0.5	−20	−5.0	−10	20	1.0	30	—	20	16	20	5.0	−20[3]	30	NJ132
2N4092	−40	−1.0	−0.5	−20	−2.0	−7.0	20	1.0	15	—	20	16	20	5.0	−20[3]	50	NJ132
2N4093	−40	−1.0	−0.5	−20	−1.0	−5.0	20	1.0	8.0	—	20	16	20	5.0	−20[3]	80	NJ132
2N4391	−40	−1.0	−0.1	−20	−4.0	−10	20	1.0	50	150	20	16	20	5.0	−12[3]	30	NJ132
2N4392	−40	−1.0	−0.1	−20	−2.0	−5.0	20	1.0	25	75	20	16	20	5.0	−7.0[3]	60	NJ132
2N4393	−40	−1.0	−0.1	−20	−0.5	−3.0	20	1.0	5.0	30	20	16	20	5.0	−5.0[3]	100	NJ132
2N4856	−40	−1.0	−0.25	−20	−4.0	−10	15	1.0	50	—	15	18	−10[3]	8.0	−10[3]	25	NJ132
2N4856A	−40	−1.0	−0.25	−20	−4.0	−10	15	1.0	50	—	15	10	−10[3]	4.0	−10[3]	25	NJ132
2N4857	−40	−1.0	−0.25	−20	−2.0	−6.0	15	1.0	20	100	15	18	−10[3]	8.0	−10[3]	40	NJ132
2N4857A	−40	−1.0	−0.25	−20	−2.0	−6.0	15	1.0	20	100	15	10	−10[3]	3.5	−10[3]	40	NJ132
2N4858	−40	−1.0	−0.25	−20	−0.8	−4.0	15	1.0	8.0	80	15	18	−10[3]	8.0	−10[3]	40	NJ132
2N4858A	−40	−1.0	−0.25	−20	−0.8	−4.0	15	1.0	8.0	80	15	10	−10[3]	3.5	−10[3]	60	NJ132
2N4859	−30	−1.0	−0.25	−15	−4.0	−10	15	1.0	50	—	15	18	−10[3]	8.0	−10[3]	25	NJ132
2N4859A	−30	−1.0	−0.25	−15	−4.0	−10	15	1.0	50	—	15	10	−10[3]	4.0	−10[3]	25	NJ132
2N4860	−30	−1.0	−0.25	−15	−2.0	−6.0	15	1.0	20	100	15	18	−10[3]	8.0	−10[3]	40	NJ132
2N4860A	−30	−1.0	−0.25	−15	−2.0	−6.0	15	1.0	20	100	15	10	−10[3]	3.5	−10[3]	40	NJ132
2N4861	−30	−1.0	−0.5	−15	−0.8	−4.0	15	1.0	8.0	80	15	18	−10[3]	8.0	−10[3]	60	NJ132
2N4861A	−30	−1.0	−0.5	−15	−0.8	−4.0	15	1.0	8.0	80	15	10	−10[3]	3.5	−10[3]	60	NJ132
2N5432	−25	−1.0	−0.2	−15	−4.0	−10	5.0	3.0	150	—	15	30	−10[3]	15	−10[3]	5.0	NJ903
2N5433	−25	−1.0	−0.2	−15	−3.0	−9.0	5.0	3.0	100	—	15	30	−10[3]	15	−10[3]	7.0	NJ903
2N5434	−25	−1.0	−0.2	−15	−1.0	−4.0	5.0	3.0	30	—	15	30	−10[3]	15	−10[3]	10	NJ903

NOTES:
1) V_{GS} = 0 V.
2) I_D in μA.
3) V_{DS} = 0 V, V_{GS} in volts.

RF Amplifiers

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	$V_{(BR)GSS}$ @I_G (μA)	I_{GSS} Max. (nA)	I_{GSS} @V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	$V_{GS(off)}$ Limits Max. (V)	$V_{GS(off)}$ Conditions V_{DS} (V)	$V_{GS(off)}$ Conditions I_D (nA)	I_{DSS} Min. (mA)	I_{DSS} Max. (mA)	I_{DSS} @V_{DS} (V)	g_{fs} Min. (mS)	g_{fs} Max. (mS)	g_{fs} @V_{DS} (V)	C_{ISS}[1] Max. (pF)	C_{ISS}[1] @V_{DS} (V)	C_{RSS}[1] Max. (pF)	C_{RSS}[1] @V_{DS} (V)	r_{DS} Max. (Ω)	Process
2N3823	−30	−1.0	−0.5	−20	—	−8.0	10	1.0	4.0	20	15	3.5	6.5	15	6.0	15	2.0	15	—	NJ32
2N4223	−30	−10	−0.25	−20	—	−8.0	15	1.0	3.0	18	15	3.0	7.0	15	6.0	15	2.0	15	—	NJ32
2N4224	−30	−10	−0.5	−20	—	−8.0	15	1.0	2.0	20	15	2.0	7.5	15	6.0	15	2.0	15	—	NJ32
2N4416	−30	−1.0	−0.1	−20	—	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	4.0	15	0.8	15	—	NJ26
2N4416A	−35	−1.0	−0.1	−20	−2.5	−6.0	15	1.0	5.0	15	15	4.5	7.5	15	4.0	15	0.8	15	—	NJ26
2N5078	−30	−1.0	−0.25	−20	−0.5	−8.0	15	1.0	4.0	25	15	4.0	—	15	6.0	15	2.0	15	—	NJ26
2N5397	−25	−1.0	−0.1	−15	−1.0	−6.0	10	1.0	10	30	10	6.0	10	10[2]	5.0	10[2]	1.2	10[2]	—	NJ26L
2N5398	−25	−1.0	−0.1	−15	−1.0	−6.0	10	1.0	5.0	40	10	5.5	10	10	5.5	10	1.3	10	—	NJ26L

NOTES:
1) V_{GS} = 0 V.
2) I_D = 10 μA.

N-Channel JFETs

Monolithic Dual Devices

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	$V_{(BR)GSS}$ Min. (V)	$V_{(BR)GSS}$ @ I_G (μA)	I_{GSS} Max. (nA)	I_{GSS} @ V_{GS} (V)	$V_{GS(off)}$ Limits Min. (V)	$V_{GS(off)}$ Limits Max. (V)	$V_{GS(off)}$ Conditions V_{DS} (V)	$V_{GS(off)}$ Conditions I_D (nA)	I_{DSS} Limits Min. (mA)	I_{DSS} Limits Max. (mA)	I_{DSS} Conditions @ V_{DS} (V)	g_{fs} Limits Min. (mS)	g_{fs} Limits Max. (mS)	g_{fs} Conditions @ V_{DS} (V)	C_{iss}[1] Max. (pF)	C_{iss}[1] @ V_{DS} (V)	C_{rss}[1] Max. (pF)	C_{rss}[1] @ V_{DS} (V)	V_{GS1} $-V_{GS2}$ Max. (mV)	Process
2N3954	−50	−1.0	−0.1	−30	−1.0	−4.5	20	1.0	0.5	5.0	20	1.0	3.0	20	4.0	20	1.2	20	5.0	NJ35D
2N3955	−50	−1.0	−0.1	−30	−1.0	−4.5	20	1.0	0.5	5.0	20	1.0	3.0	20	4.0	20	1.2	20	10	NJ35D
2N3956	−50	−1.0	−0.1	−30	−1.0	−4.5	20	1.0	0.5	5.0	20	1.0	3.0	20	4.0	20	1.2	20	15	NJ35D
2N3957	−50	−1.0	−0.1	−30	−1.0	−4.5	20	1.0	0.5	5.0	20	1.0	3.0	20	4.0	20	1.2	20	20	NJ35D
2N5045	−50	−1.0	−0.25	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	8.0	15	4.0	15	5.0	NJ35D
2N5046	−50	−1.0	−0.25	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	8.0	15	4.0	15	10	NJ35D
2N5047	−50	−1.0	−0.25	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	8.0	15	4.0	15	15	NJ35D
2N5196	−50	−1.0	−0.1	−30	−0.7	−4.0	20	1.0	0.7	7.0	20	1.0	4.0	20	6.0	20	2.0	20	5.0	NJ35D
2N5197	−50	−1.0	−0.1	−30	−0.7	−4.0	20	1.0	0.7	7.0	20	1.0	4.0	20	6.0	20	2.0	20	5.0	NJ35D
2N5198	−50	−1.0	−0.1	−30	−0.7	−4.0	20	1.0	0.7	7.0	20	1.0	4.0	20	6.0	20	2.0	20	10	NJ35D
2N5199	−50	−1.0	−0.1	−30	−0.7	−4.0	20	1.0	0.7	7.0	20	1.0	4.0	20	6.0	20	2.0	20	15	NJ35D
2N5545	−50	−1.0	−0.1	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	6.0	15	2.0	15	5.0	NJ35D
2N5546	−50	−1.0	−0.1	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	6.0	15	2.0	15	10	NJ35D
2N5547	−50	−1.0	−0.1	−30	−0.5	−4.5	15	0.5	0.5	8.0	15	1.5	6.0	15	6.0	15	2.0	15	15	NJ35D
2N5561	−50	−1.0	−0.1	−30	−0.8	−3.0	20	1.0	1.0	10	20	—	—	—	15	20	4.0	20	5.0	NJ35D
2N5562	−50	−1.0	−0.1	−30	−0.8	−3.0	20	1.0	1.0	10	20	—	—	—	15	20	4.0	20	10	NJ35D
2N5563	−50	−1.0	−0.1	−30	−0.8	−3.0	20	1.0	1.0	10	20	—	—	—	15	20	4.0	20	15	NJ35D
2N5911	−25	−1.0	−0.1	−15	−1.0	−5.0	10	1.0	7.0	40	10	5.0	10	10[2]	5.0	10[2]	1.2	10[2]	10	NJ28D
2N5912	−25	−1.0	−0.1	−15	−1.0	−5.0	10	1.0	7.0	40	10	5.0	10	10[4]	5.0	10[2]	1.2	10[2]	15	NJ28D
U231	−50	−1.0	−0.1	−30	−0.5	−4.5	20	1.0	0.5	5.0	20	1.0	5.0	20	6.0	20	2.0	20	5.0	NJ35D
U232	−50	−1.0	−0.1	−30	−0.5	−4.5	20	1.0	0.5	5.0	20	1.0	5.0	20	6.0	20	2.0	20	10	NJ35D
U233	−50	−1.0	−0.1	−30	−0.5	−4.5	20	1.0	0.5	5.0	20	1.0	5.0	20	6.0	20	2.0	20	15	NJ35D
U234	−50	−1.0	−0.1	−30	−0.5	−4.5	20	1.0	0.5	5.0	20	1.0	5.0	20	6.0	20	2.0	20	20	NJ35D
U235	−50	−1.0	−0.1	−30	−0.5	−4.5	20	1.0	0.5	5.0	20	1.0	5.0	20	6.0	20	2.0	20	25	NJ35D
U257	−25	−1.0	−0.1	−15	−1.0	−5.0	10	1.0	5.0	40	10	4.5	10	10[2]	5.0	10[2]	1.2	10[2]	100	NJ35D
U401	−50	−1.0	−.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	10[3]	3.0	10[3]	5.0	NJ35D
U402	−50	−1.0	−.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	10[3]	3.0	10[3]	10	NJ35D
U403	−50	−1.0	−.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	10[3]	3.0	10[3]	10	NJ35D
U404	−50	−1.0	−.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	10[3]	3.0	10[3]	15	NJ35D
U405	−50	−1.0	−.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	10[3]	3.0	10[3]	20	NJ35D
U406	−50	−1.0	−.025	−30	−0.5	−2.5	15	1.0	0.5	10	10	2.0	7.0	10	8.0	10[3]	3.0	10[3]	40	NJ35D
U410	−40	−1.0	−0.2	−30	−0.5	−3.5	20	1.0	0.5	5.0	20	1.0	4.0	20	4.5	20	1.2	20	10	NJ35D
U411	−40	−1.0	−0.2	−30	−0.5	−3.5	20	1.0	0.5	5.0	20	1.0	4.0	20	4.5	20	1.2	20	20	NJ35D
U412	−40	−1.0	−0.2	−30	−0.5	−3.5	20	1.0	0.5	5.0	20	1.0	4.0	20	4.5	20	1.2	20	40	NJ35D

NOTES:
1) V_{GS} = 0 V.
2) I_D = 5 mA.
3) I_D = 200 μA.

P-Channel JFETs

General-Purpose Device Types

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

	$V_{(BR)GSS}$		I_{GSS}		$V_{GS(off)}$ Limits		$V_{GS(off)}$ Conditions		I_{DSS}			g_{fs}			C_{iss}[1]		C_{rss}[1]		r_{DS}	
Device Type	Min. (V)	@ I_G (µA)	Max. (nA)	@ V_{GS} (V)	Min. (V)	Max. (V)	V_{DS} (V)	I_D (nA)	Min. (mA)	Max. (mA)	@ V_{DS} (V)	Min. (mS)	Max. (mS)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (Ω)	Process
2N2386	20	10	10	10	—	8.0	−12	−10[2]	—	—	—	1.0	—	−10	50	−10	—	—	—	PJ32
2N2497	20	10	10	10	—	5.0	−15	−10[2]	−1.0	−3.0	−10	1.0	2.0	−10	32	−10	—	—	1000	PJ32
2N2498	20	10	10	10	—	6.0	−15	−10[2]	−2.0	−6.0	−10	1.5	3.0	−10	32	−10	—	—	800	PJ32
2N2499	20	10	10	10	—	8.0	−15	−10[2]	−5.0	−15	−10	2.0	4.0	−10	32	−10	—	—	600	PJ32
2N2500	20	10	10	10	—	6.0	−15	−10[2]	−1.0	−6.0	−10	1.0	2.2	−10	32	−10	—	—	—	PJ32
2N2608	30	1.0	10	5.0	1.0	4.0	−5	−1.0[2]	−0.9	−4.5	−5	1.0	—	−5.0	17	5.0[3]	—	—	—	PJ32
2N2609	30	1.0	10	5.0	1.0	4.0	−5	−1.0[2]	−2.0	−10	−5	2.5	—	−5.0	30	5.0[3]	—	—	—	PJ32
2N3329	20	10	10	10	—	5.0	−15	−10[2]	−1.0	−3.0	−10	—	—	—	20	−10	—	—	—	PJ32
2N3330	20	10	10	10	—	6.0	−15	−10[2]	−2.0	−6.0	−10	—	—	—	20	−10	—	—	—	PJ32
2N3331	20	10	10	10	—	8.0	−15	−10[2]	−5.0	−15	−10	—	—	—	20	−10	—	—	—	PJ32
2N3332	20	10	10	10	—	6.0	−15	−10[2]	−1.0	−6.0	−10	—	—	—	20	−10	—	—	—	PJ32
2N4381	25	1.0	1.0	15	1.0	5.0	−15	−1.0[2]	−3.0	−12	−15	2.0	6.0	−15	20	−15	5.0	−15	—	PJ32
2N5020	25	1.0	1.0	15	0.3	1.5	−15	−1.0[2]	−0.3	−1.2	−15	1.0	3.5	−15	25	−15	7.0	−15	—	PJ32
2N5021	25	1.0	1.0	15	0.5	2.5	−15	−1.0[2]	−1.0	−3.5	−15	1.5	6.0	−15	25	−15	7.0	−15	—	PJ32

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in µA.
3) $V_{GS} = 1.0$ V.

Switches

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

	$V_{(BR)GSS}$		I_{GSS}		$V_{GS(off)}$ Limits		$V_{GS(off)}$ Conditions		I_{DSS}			g_{fs}			C_{iss}[1]		C_{rss}[1]		r_{DS}	
Device Type	Min. (V)	@ I_G (µA)	Max. (nA)	@ V_{GS} (V)	Min. (V)	Max. (V)	V_{DS} (V)	I_D (nA)	Min. (mA)	Max. (mA)	@ V_{DS} (V)	Min. (mS)	Max. (mS)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (pF)	@ V_{DS} (V)	Max. (Ω)	Process
2N3993	25	1.0	1.0	15	4.0	9.5	−10	−1.0[2]	−10	—	−10	6.0	12	−10	16	−10	4.5	10[3]	150	PJ99
2N3994	25	1.0	1.0	15	1.0	5.5	−10	−1.0[2]	−2.0	—	−10	4.0	10	−10	16	−10	4.5	10[3]	300	PJ99
2N5018	30	1.0	2.0	15	—	10	−15	−1.0[2]	−10	—	−20	—	—	—	45	−15	10	12[3]	75	PJ99
2N5019	30	1.0	2.0	15	—	5.0	−15	−1.0[2]	−5.0	—	−20	—	—	—	45	−15	10	7.0[3]	150	PJ99
2N5114	30	1.0	0.5	20	5.0	10	−15	−1.0	−30	−90	−15	—	—	—	25	−15	7.0	12[3]	75	PJ99
2N5115	30	1.0	0.5	20	3.0	6.0	−15	−1.0	−16	−60	−15	—	—	—	25	−15	7.0	7.0[3]	100	PJ99
2N5116	30	1.0	0.5	20	1.0	4.0	−15	−1.0	−5.0	−25	−15	—	—	—	25	−15	7.0	5.0[3]	150	PJ99
U304	30	1.0	0.5	20	5.0	10	−15	−1.0[2]	−30	−90	−15	—	—	—	27	−15	7.0	12[3]	85	PJ99
U305	30	1.0	0.5	20	3.0	6.0	−15	−1.0[2]	−15	−60	−15	—	—	—	27	−15	7.0	7.0[3]	110	PJ99
U306	30	1.0	0.5	20	1.0	4.0	−15	−1.0[2]	−5.0	−25	−15	—	—	—	27	−15	7.0	5.0[3]	175	PJ99

NOTES:
1) $V_{GS} = 0$ V.
2) I_D in µA.
3) $V_{DS} = 0$ V, V_{GS} in volts.

'THD' Rectifiers and General-Purpose Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Description	I_F Max. (mA)	V_{BR} Min. (V)	V_F Max. (V)	V_F @ I_F (mA)	I_R Max. (nA)	t_{rr} Max. (ns)	C_0 Max. (pF)	Process
THD457	Low-Leakage	500	70	1.0	20	25	—	6.0	TRB
THD458A	Low-Leakage	500	150	1.0	100	5.0	—	6.0	TRR
THD459	Low-Leakage	500	200	1.0	3.0	25	—	6.0	TRO
THD459A	Low-Leakage	500	200	1.0	100	25	—	6.0	TRO
THD462	General-Purpose	500	70	1.0	5.0	500	—	8.0	TRR
THD485	General-Purpose	650	200	1.1	100	250	—	6.0	TRO
THD485B	General-Purpose	650	300	1.0	100	25	—	6.0	TRO
THD550	Rectifier	1000	100	1.5	500	50	—	5.0	TRJ
THD645	Rectifier	1000	225	1.0	400	—	—	5.0	TRJ
THD914	General-Purpose	600	100	1.0	10	25	4.0	6.0	TSB
THD914A	General-Purpose	600	100	1.0	20	25	4.0	6.0	TSB
THD914B	General-Purpose	600	100	1.0	100	25	4.0	6.0	TSB
THD914NG	No Gold Doping	600	50	1.0	10	1.0	100	5.0	TRB
THD3070	High Voltage	1000	200	1.0	100	100	500	5.0	TSO
THD3595	Low-Leakage	500	150	0.8	10	1.0	3000	8.0	TRR
THD3600	General-Purpose	600	75	0.62	1.0	100	4.0	2.5	TSS
THD3600NG	No Gold Doping	600	50	1.0	10	1.0	100	7.0	TRS
THD4001	Rectifier	1000	50	1.1	1000	10	—	5.0	TRJ
THD4002	Rectifier	1000	100	1.1	1000	10	—	5.0	TRJ
THD4003	Rectifier	1000	200	1.1	1000	10	—	5.0	TRJ
THD4004	Rectifier	1000	400	1.1	1000	10	—	7.0	TRL
THD4148	General-Purpose	600	100	1.0	10	25	4.0	4.0	TSB
THD4149	General-Purpose	600	100	1.0	10	25	4.0	2.0	TSB
THD4150	General-Purpose	600	75	0.62	1.0	100	4.0	2.5	TSB
THD4151	General-Purpose	600	75	1.0	50	50	4.0	4.0	TSB
THD4152	General-Purpose	600	40	0.67	1.0	50	4.0	4.0	TSB
THD4153	General-Purpose	600	75	0.67	1.0	50	4.0	4.0	TSB
THD4154	General-Purpose	600	35	1.0	30	100	4.0	4.0	TSB
THD4447	General-Purpose	600	100	1.0	20	25	4.0	4.0	TSB
THD4448	General-Purpose	600	100	1.0	100	25	4.0	4.0	TSB
THD4610	General-Purpose	600	80	0.62	1.0	100	4.0	2.0	TSU

'THD' Schottky Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_F Max. (mA)	V_{BR} Min. (V)	V_F Max. @ I_F = 1mA (V)	V_F Max. @ I_F = 10mA (V)	I_R Max. @ V_R = 1V (nA)	I_R Max. @ V_R = 20V (nA)	I_R Max. @ V_R = 50V (nA)	C_0 Max. (pF)	Process
THD5711	200	70	0.41	0.75	—	50	200	1.7	BKD
THD6916	200	40	0.34	0.47	100	200	—	5.0	BKA
THD6919	200	50	0.45	0.80	—	200	—	1.2	BKF
THD6924	200	70	0.41	0.75	—	—	200	1.7	BKD

'THD' Photodiodes

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	V_{BR} Min. (V)	V_{BR} @I_R (μA)	I_D Max. (nA)	I_D @V_R (V)	I_L* Min. (μA)	I_L* @V_R (V)	Process
THD9751	60	10	10	2.0	30	2.0	AWA
THD9752	60	10	10	2.0	7.5	2.0	AYA

*E_e = 20 mW/sq. cm

'TH' Power Diodes

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	Description	I_F Max. (A)	V_{BR} Min. (V)	V_F Max. (V)	V_F @I_F (A)	I_R Max. (μA)	I_R @V_R (V)	C_0 Max. (pF)	Process
THYA01	P/N Diode	3.0	120	1.20	1.0	5.0	80	—	YAA
THYA02	P/N Diode	3.0	100	1.20	1.0	5.0	70	—	YAA
THYB01	P/N Diode	5.0	100	1.20	3.0	1.0	70	—	YBA
THYB02	P/N Diode	5.0	80	1.20	3.0	1.0	60	—	YBA
THYI01	N/P Diode	5.0	100	1.20	3.0	1.0	70	—	YIA
THYI02	N/P Diode	5.0	80	1.20	3.0	1.0	60	—	YIA
THBQ01	Schottky	1.0	40	0.60	1.0	200	20	250	BQB
THBQ02	Schottky	1.0	40	0.57	1.0	200	20	250	BQB
THBG01	Schottky	3.0	60	0.40	1.0	200	40	350	BGA
THBG02	Schottky	3.0	60	0.45	1.0	200	40	350	BGA

'THZ' Series 'A' Zener Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Zener Voltage Min. (V)	Nom. (V)	Max. (V)	@I_{ZT} (mA)	Leakage Current Max. (μA)	@V_R (V)	Zener Impedance Max. Z_{ZT} (Ω)	@I_{ZT} (mA)	Max. Zener Voltage-Temp. Coefficient (For Ref. Only) (%/°C)	Process
THZ2R7A05	2.57	2.7	2.84	19	75.0	1.00	52	19	−0.080	ZAA
THZ2R7A10	2.43	2.7	2.97	19	75.0	0.95	52	19	−0.080	ZAA
THZ2R8A05	2.66	2.8	2.94	18	75.0	1.00	51	18	−0.080	ZAA
THZ2R8A10	2.52	2.8	3.08	18	75.0	0.95	51	18	−0.080	ZAA
THZ3R0A05	2.85	3.0	3.15	17	50.0	1.00	50	17	−0.075	ZAA
THZ3R0A10	2.70	3.0	3.30	17	50.0	0.95	50	17	−0.075	ZAA
THZ3R3A05	3.14	3.3	3.47	15	25.0	1.00	47	15	−0.070	ZAA
THZ3R3A10	2.97	3.3	3.63	15	25.0	0.95	47	15	−0.070	ZAA
THZ3R6A05	3.42	3.6	3.78	14	15.0	1.00	43	14	−0.065	ZAA
THZ3R6A10	3.24	3.6	3.96	14	15.0	0.95	43	14	−0.065	ZAA
THZ3R9A05	3.71	3.9	4.10	13	10.0	1.00	35	13	−0.060	ZAA
THZ3R9A10	3.51	3.9	4.29	13	10.0	0.95	35	13	−0.060	ZAA
THZ4R3A05	4.09	4.3	4.52	12	5.0	1.00	29	12	±0.055	ZAA
THZ4R3A10	3.87	4.3	4.73	12	5.0	0.95	29	12	±0.055	ZAA
THZ4R7A05	4.47	4.7	4.94	11	5.0	2.00	24	11	±0.030	ZAA
THZ4R7A10	4.23	4.7	5.17	11	5.0	1.90	24	11	±0.030	ZAA
THZ5R1A05	4.85	5.1	5.36	9.8	5.0	2.00	21	9.8	±0.030	ZAA
THZ5R1A10	4.59	5.1	5.61	9.8	5.0	1.90	21	9.8	±0.030	ZAA
THZ5R6A05	5.32	5.6	5.88	8.9	5.0	3.0	25	8.9	+0.038	ZCA
THZ5R6A10	5.04	5.6	6.16	8.9	5.0	2.9	25	8.9	+0.038	ZCA
THZ6R0A05	5.70	6.0	6.30	8.3	5.0	3.5	30	8.3	+0.038	ZCA
THZ6R0A10	5.40	6.0	6.60	8.3	5.0	3.3	30	8.3	+0.038	ZCA
THZ6R2A05	5.89	6.2	6.51	8.1	5.0	4.0	31	8.1	+0.045	ZCA
THZ6R2A10	5.58	6.2	6.82	8.1	5.0	3.8	31	8.1	+0.045	ZCA
THZ6R8A05	6.46	6.8	7.14	7.3	3.0	5.0	38	7.3	+0.050	ZCA
THZ6R8A10	6.12	6.8	7.48	7.3	3.0	4.8	38	7.3	+0.050	ZCA
THZ7R5A05	7.13	7.5	7.88	6.7	3.0	6.0	43	6.7	+0.058	ZCA
THZ7R5A10	6.75	7.5	8.25	6.7	3.0	5.7	43	6.7	+0.058	ZCA
THZ8R2A05	7.79	8.2	8.61	6.1	3.0	6.5	49	6.1	+0.062	ZCA
THZ8R2A10	7.38	8.2	9.02	6.1	3.0	6.2	49	6.1	+0.062	ZCA
THZ8R7A05	8.26	8.7	9.14	5.7	3.0	6.5	52	5.7	+0.065	ZCA
THZ8R7A10	7.83	8.7	9.57	5.7	3.0	6.2	52	5.7	+0.065	ZCA
THZ9R1A05	8.65	9.1	9.56	5.5	3.0	7.0	54	5.5	+0.068	ZCA
THZ9R1A10	8.19	9.1	10.0	5.5	3.0	6.7	54	5.5	+0.068	ZCA
THZ010A05	9.50	10	10.5	5.0	3.0	8.0	60	5.0	+0.075	ZCA
THZ010A10	9.00	10	11.0	5.0	3.0	7.6	60	5.0	+0.075	ZCA
THZ011A05	10.5	11	11.6	4.5	2.0	8.4	66	4.5	+0.076	ZCA
THZ011A10	9.90	11	12.1	4.5	2.0	8.0	66	4.5	+0.076	ZCA
THZ012A05	11.4	12	12.6	4.2	1.0	9.1	71	4.2	+0.077	ZCA
THZ012A10	10.8	12	13.2	4.2	1.0	8.7	71	4.2	+0.077	ZCA
THZ013A05	12.4	13	13.7	3.8	0.5	9.9	74	3.8	+0.079	ZKA
THZ013A10	11.7	13	14.3	3.8	0.5	9.4	74	3.8	+0.079	ZKA
THZ014A05	13.3	14	14.7	3.6	0.1	10.0	33	3.6	+0.082	ZKA
THZ014A10	12.6	14	15.4	3.6	0.1	9.5	33	3.6	+0.082	ZKA
THZ015A05	14.3	15	15.8	3.3	0.1	11.0	37	3.3	+0.082	ZKA

Consult factory for special selections or alternate chip sizes.

'THZ' Series 'A' Zener Diodes

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	Zener Voltage Min. (V)	Nom. (V)	Max. (V)	$@I_{ZT}$ (mA)	Leakage Current Max. (μA)	$@V_R$ (V)	Zener Impedance Max. Z_{ZT} (Ω)	$@I_{ZT}$ (mA)	Max. Zener Voltage-Temp. Coefficient (For Ref. Only) (%/°C)	Process
THZ015A10	13.5	15	16.5	3.3	0.1	10.5	37	3.3	+0.082	ZKA
THZ016A05	15.2	16	16.8	3.1	0.1	12.0	42	3.1	+0.083	ZKA
THZ016A10	14.4	16	17.6	3.1	0.1	11.4	42	3.1	+0.083	ZKA
THZ017A05	16.2	17	17.9	2.9	0.1	13.0	47	2.9	+0.084	ZKA
THZ017A10	15.3	17	18.7	2.9	0.1	12.4	47	2.9	+0.084	ZKA
THZ018A05	17.1	18	18.9	2.8	0.1	14.0	52	2.8	+0.085	ZKA
THZ018A10	16.2	18	19.8	2.8	0.1	13.3	52	2.8	+0.085	ZKA
THZ019A05	18.1	19	20.0	2.6	0.1	14.0	58	2.6	+0.086	ZKA
THZ019A10	17.1	19	20.9	2.6	0.1	13.3	58	2.6	+0.086	ZKA
THZ020A05	19.0	20	21.0	2.5	0.1	15.0	65	2.5	+0.086	ZKA
THZ020A10	18.0	20	22.0	2.5	0.1	14.3	65	2.5	+0.086	ZKA
THZ022A05	20.9	22	23.1	2.3	0.1	17.0	70	2.3	+0.087	ZKA
THZ022A10	19.8	22	24.2	2.3	0.1	16.2	70	2.3	+0.087	ZKA
THZ024A05	22.8	24	25.2	2.1	0.1	18.0	92	2.1	+0.088	ZKA
THZ024A10	21.6	24	26.4	2.1	0.1	17.1	92	2.1	+0.088	ZKA
THZ025A05	23.8	25	26.3	2.0	0.1	19.0	100	2.0	+0.089	ZEA
THZ025A10	22.5	25	27.5	2.0	0.1	18.1	100	2.0	+0.089	ZEA
THZ027A05	25.7	27	28.4	1.9	0.1	21.0	115	1.9	+0.090	ZEA
THZ027A10	24.3	27	29.7	1.9	0.1	20.0	115	1.9	+0.090	ZEA
THZ028A05	26.6	28	29.4	1.8	0.1	21.0	120	1.8	+0.091	ZEA
THZ028A10	25.2	28	30.8	1.8	0.1	20.0	120	1.8	+0.091	ZEA
THZ030A05	28.5	30	31.5	1.7	0.1	23.0	140	1.7	+0.091	ZEA
THZ030A10	27.0	30	33.0	1.7	0.1	22.0	140	1.7	+0.091	ZEA
THZ033A05	31.4	33	34.7	1.5	0.1	25.0	170	1.5	+0.092	ZEA
THZ033A10	29.7	33	36.3	1.5	0.1	24.0	170	1.5	+0.092	ZEA
THZ036A05	34.2	36	37.8	1.4	0.1	27.0	200	1.4	+0.093	ZEA
THZ036A10	32.4	36	39.6	1.4	0.1	26.0	200	1.4	+0.093	ZEA
THZ039A05	37.1	39	41.0	1.3	0.1	30.0	230	1.3	+0.094	ZEA
THZ039A10	35.1	39	42.9	1.3	0.1	29.0	230	1.3	+0.094	ZEA
THZ043A05	40.9	43	45.2	1.2	0.1	33.0	280	1.2	+0.095	ZEA
THZ043A10	38.7	43	47.3	1.2	0.1	31.0	280	1.2	+0.095	ZEA
THZ047A05	44.7	47	49.4	1.1	0.1	36.0	330	1.1	+0.095	ZEA
THZ047A10	42.3	47	51.7	1.1	0.1	34.0	330	1.1	+0.095	ZEA
THZ051A05	48.5	51	53.6	0.98	0.1	39.0	390	0.98	+0.096	ZEA
THZ051A10	45.9	51	56.1	0.98	0.1	37.0	390	0.98	+0.096	ZEA
THZ056A05	53.2	56	58.8	0.89	0.1	43.0	460	0.89	+0.096	ZEA
THZ056A10	50.4	56	61.6	0.89	0.1	41.0	460	0.89	+0.096	ZEA
THZ060A05	57.0	60	63.0	0.83	0.1	46.0	530	0.83	+0.097	ZEA
THZ060A10	54.0	60	66.0	0.83	0.1	44.0	530	0.83	+0.097	ZEA

Consult factory for special selections or alternate chip sizes.

'THZ' Series 'B' Zener Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Zener Voltage				Leakage Current		Zener Impedance		Process
	Min. (V)	Nom. (V)	Max. (V)	@I_{ZT} (mA)	Max. I_R (μA)	@V_R (V)	Max. Z_{ZT} (Ω)	@I_{ZT} (mA)	
THZ1R8B05	1.71	1.8	1.89	0.25	7.5	1.0	1200	0.25	ZAA
THZ1R8B10	1.62	1.8	1.98	0.25	7.5	0.9	1200	0.25	ZAA
THZ2R0B05	1.90	2.0	2.10	0.25	5.0	1.0	1250	0.25	ZAA
THZ2R0B10	1.80	2.0	2.20	0.25	5.0	0.9	1250	0.25	ZAA
THZ2R2B05	2.09	2.2	2.31	0.25	4.0	1.0	1300	0.25	ZAA
THZ2R2B10	1.98	2.2	2.42	0.25	4.0	0.9	1300	0.25	ZAA
THZ2R4B05	2.28	2.4	2.52	0.25	2.0	1.0	1400	0.25	ZAA
THZ2R4B10	2.16	2.4	2.64	0.25	2.0	0.9	1400	0.25	ZAA
THZ2R7B05	2.57	2.7	2.84	0.25	1.0	1.0	1500	0.25	ZAA
THZ2R7B10	2.43	2.7	2.97	0.25	1.0	0.9	1500	0.25	ZAA
THZ3R0B05	2.85	3.0	3.15	0.25	0.8	1.0	1600	0.25	ZAA
THZ3R0B10	2.70	3.0	3.30	0.25	0.8	0.9	1600	0.25	ZAA
THZ3R3B05	3.14	3.3	3.47	0.25	7.5	1.5	1650	0.25	ZAA
THZ3R3B10	2.97	3.3	3.63	0.25	7.5	1.0	1650	0.25	ZAA
THZ3R6B05	3.42	3.6	3.78	0.25	7.5	2.0	1700	0.25	ZAA
THZ3R6B10	3.24	3.6	3.96	0.25	7.5	1.5	1700	0.25	ZAA
THZ3R9B05	3.71	3.9	4.10	0.25	5.0	2.0	1650	0.25	ZAA
THZ3R9B10	3.51	3.9	4.29	0.25	5.0	1.5	1650	0.25	ZAA
THZ4R3B05	4.09	4.3	4.52	0.25	4.0	2.0	1600	0.25	ZAA
THZ4R3B10	3.87	4.3	4.73	0.25	4.0	1.5	1600	0.25	ZAA
THZ4R7B05	4.47	4.7	4.94	0.25	10	3.0	1550	0.25	ZAA
THZ4R7B10	4.23	4.7	5.17	0.25	10	2.5	1550	0.25	ZAA
THZ5R1B05	4.85	5.1	5.36	0.25	10	3.0	1500	0.25	ZAA
THZ5R1B10	4.59	5.1	5.61	0.25	10	2.5	1500	0.25	ZAA
THZ5R6B05	5.32	5.6	5.88	0.25	10	4.0	1400	0.25	ZCA
THZ5R6B10	5.04	5.6	6.16	0.25	10	3.5	1400	0.25	ZCA
THZ6R2B05	5.89	6.2	6.51	0.25	10	4.0	1200	0.25	ZCA
THZ6R2B10	5.58	6.2	6.82	0.25	10	4.5	1200	0.25	ZCA
THZ6R8B05	6.46	6.8	7.14	0.25	10	5.2	200	0.25	ZCA
THZ6R8B10	6.12	6.8	7.48	0.25	10	4.8	200	0.25	ZCA
THZ7R5B05	7.13	7.5	7.88	0.25	10	5.7	200	0.25	ZCA
THZ7R5B10	6.75	7.5	8.25	0.25	10	5.5	200	0.25	ZCA
THZ8R2B05	7.79	8.2	8.61	0.25	1.0	6.3	200	0.25	ZCA
THZ8R2B10	7.38	8.2	9.02	0.25	1.0	6.0	200	0.25	ZCA
THZ8R7B05	8.26	8.7	9.14	0.25	1.0	6.6	200	0.25	ZCA
THZ8R7B10	7.83	8.7	9.57	0.25	1.0	6.2	200	0.25	ZCA
THZ9R1B05	8.65	9.1	9.56	0.25	1.0	6.9	300	0.25	ZCA
THZ9R1B10	8.19	9.1	10.0	0.25	1.0	6.7	300	0.25	ZCA
THZ010B05	9.50	10	10.5	0.25	1.0	7.6	400	0.25	ZCA
THZ010B10	9.00	10	11.0	0.25	1.0	7.0	400	0.25	ZCA
THZ011B05	10.5	11	11.6	0.25	0.05	8.5	400	0.25	ZCA
THZ011B10	9.90	11	12.1	0.25	0.05	8.0	400	0.25	ZCA
THZ012B05	11.4	12	12.6	0.25	0.05	9.1	300	0.25	ZCA
THZ012B10	10.8	12	13.2	0.25	0.05	8.7	300	0.25	ZCA
THZ013B05	12.4	13	13.7	0.25	0.05	9.9	200	0.25	ZKA

Consult factory for special selections

'THZ' Series 'B' Zener Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Zener Voltage Min. (V)	Nom. (V)	Max. (V)	@I_{ZT} (mA)	Leakage Current Max. I_R (μA)	@V_R (V)	Zener Impedance Max. Z_{ZT} (Ω)	@I_{ZT} (mA)	Process
THZ013B10	11.7	13	14.3	0.25	0.05	9.4	200	0.25	ZKA
THZ014B05	13.3	14	14.7	0.25	0.05	10.7	200	0.25	ZKA
THZ014B10	12.6	14	15.4	0.25	0.05	9.5	200	0.25	ZKA
THZ015B05	14.3	15	15.8	0.25	0.05	11.4	200	0.25	ZKA
THZ015B10	13.5	15	16.5	0.25	0.05	10.5	200	0.25	ZKA
THZ016B05	15.2	16	16.8	0.25	0.05	12.2	200	0.25	ZKA
THZ016B10	14.4	16	17.6	0.25	0.05	11.4	200	0.25	ZKA
THZ017B05	16.2	17	17.9	0.25	0.05	12.9	200	0.25	ZKA
THZ017B10	15.3	17	18.7	0.25	0.05	12.4	200	0.25	ZKA
THZ018B05	17.1	18	18.9	0.25	0.05	13.7	200	0.25	ZKA
THZ018B10	16.2	18	19.8	0.25	0.05	13.3	200	0.25	ZKA
THZ019B05	18.1	19	20.0	0.25	0.05	14.5	200	0.25	ZKA
THZ019B10	17.1	19	20.9	0.25	0.05	13.3	200	0.25	ZKA
THZ020B05	19.0	20	21.0	0.25	0.01	15.2	200	0.25	ZKA
THZ020B10	18.0	20	22.0	0.25	0.01	14.3	200	0.25	ZKA
THZ022B05	20.9	22	23.1	0.25	0.01	16.7	200	0.25	ZKA
THZ022B10	19.8	22	24.2	0.25	0.01	16.2	200	0.25	ZKA
THZ024B05	22.8	24	25.2	0.25	0.01	18.5	200	0.25	ZKA
THZ024B10	21.6	24	26.4	0.25	0.01	17.1	200	0.25	ZKA
THZ025B05	23.8	25	26.3	0.25	0.01	19.0	200	0.25	ZEA
THZ025B10	22.5	25	27.5	0.25	0.01	18.1	200	0.25	ZEA
THZ027B05	25.7	27	28.4	0.25	0.01	20.5	200	0.25	ZEA
THZ027B10	24.3	27	29.7	0.25	0.01	20.0	200	0.25	ZEA
THZ028B05	26.6	28	29.4	0.25	0.01	21.3	200	0.25	ZEA
THZ028B10	25.2	28	30.8	0.25	0.01	20.0	200	0.25	ZEA
THZ030B05	28.5	30	31.5	0.25	0.01	22.6	200	0.25	ZEA
THZ030B10	27.0	30	33.0	0.25	0.01	22.0	200	0.25	ZEA
THZ033B05	31.4	33	34.7	0.25	0.01	25.1	200	0.25	ZEA
THZ033B10	29.7	33	36.3	0.25	0.01	24.0	200	0.25	ZEA
THZ036B05	34.2	36	37.8	0.25	0.01	27.4	200	0.25	ZEA
THZ036B10	32.4	36	39.6	0.25	0.01	26.0	200	0.25	ZEA
THZ039B05	37.1	39	41.0	0.25	0.01	29.7	200	0.25	ZEA
THZ039B10	35.1	39	42.9	0.25	0.01	29.0	200	0.25	ZEA
THZ043B05	40.9	43	45.2	0.25	0.01	32.7	250	0.25	ZEA
THZ043B10	38.7	43	47.3	0.25	0.01	31.0	250	0.25	ZEA
THZ047B05	44.7	47	49.4	0.25	0.01	35.8	250	0.25	ZEA
THZ047B10	42.3	47	51.7	0.25	0.01	34.0	250	0.25	ZEA
THZ051B05	48.5	51	53.6	0.25	0.01	38.8	300	0.25	ZEA
THZ051B10	45.9	51	56.1	0.25	0.01	37.0	300	0.25	ZEA
THZ056B05	53.2	56	58.8	0.25	0.01	42.6	300	0.25	ZEA
THZ056B10	50.4	56	61.6	0.25	0.01	41.0	300	0.25	ZEA
THZ060B05	57.0	60	63.0	0.25	0.01	45.6	400	0.25	ZEA
THZ060B10	54.0	60	66.0	0.25	0.01	44.0	400	0.25	ZEA

Consult factory for special selections

'THZ' Series 'W' Zener Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Zener Voltage Min. (V)	Nom. (V)	Max. (V)	@ I_{ZT} (mA)	Leakage Current Max. (μA)	@ V_R (V)	Zener Impedance Max. Z_{ZT} (Ω)	@ I_{ZT} (mA)	Max. Surge Current (mA)	Process
THZ5R6W05	5.32	5.6	5.88	45.0	10	2.0	5.0	45.0	810	ZCD
THZ5R6W10	5.04	5.6	6.16	45.0	10	2.0	5.0	45.0	810	ZCD
THZ6R2W05	5.89	6.2	6.51	41.0	10	3.0	2.0	41.0	730	ZCD
THZ6R2W10	5.58	6.2	6.82	41.0	10	3.0	2.0	41.0	730	ZCD
THZ6R8W05	6.46	6.8	7.14	37.0	10	4.0	3.5	37.0	660	ZCD
THZ6R8W10	6.12	6.8	7.48	37.0	10	4.0	3.5	37.0	660	ZCD
THZ7R5W05	7.13	7.5	7.88	34.0	10	5.0	4.0	34.0	605	ZCD
THZ7R5W10	6.75	7.5	8.25	34.0	10	5.0	4.0	34.0	605	ZCD
THZ8R2W05	7.79	8.2	8.61	31.0	10	6.0	4.5	31.0	550	ZCD
THZ8R2W10	7.38	8.2	9.02	31.0	10	6.0	4.5	31.0	550	ZCD
THZ9R1W05	8.65	9.1	9.56	28.0	10	7.0	5.0	28.0	500	ZCD
THZ9R1W10	8.19	9.1	10.0	28.0	10	7.0	5.0	28.0	500	ZCD
THZ010W05	9.50	10	10.5	25.0	10	7.6	7.0	25.0	454	ZCD
THZ010W10	9.00	10	11.0	25.0	10	7.6	7.0	25.0	454	ZCD
THZ011W05	10.5	11	11.6	23.0	5.0	8.4	8.0	23.0	414	ZCD
THZ011W10	9.90	11	12.1	23.0	5.0	8.4	8.0	23.0	414	ZCD
THZ012W05	11.4	12	12.6	21.0	5.0	9.1	9.0	21.0	380	ZCD
THZ012W10	10.8	12	13.2	21.0	5.0	9.1	9.0	21.0	380	ZCD
THZ013W05	12.4	13	13.7	19.0	5.0	9.9	10	19.0	344	ZKD
THZ013W10	11.7	13	14.3	19.0	5.0	9.9	10	19.0	344	ZKD
THZ015W05	14.3	15	15.8	17.0	5.0	11.4	14	17.0	304	ZKD
THZ015W10	13.5	15	16.5	17.0	5.0	11.4	14	17.0	304	ZKD
THZ016W05	15.2	16	16.8	15.5	5.0	12.2	16	15.5	285	ZKD
THZ016W10	14.4	16	17.6	15.5	5.0	12.2	16	15.5	285	ZKD
THZ018W05	17.1	18	18.9	14.0	5.0	13.7	20	14.0	250	ZKD
THZ018W10	16.2	18	19.8	14.0	5.0	13.7	20	14.0	250	ZKD
THZ020W05	19.0	20	21.0	12.5	5.0	15.2	22	12.5	225	ZKD
THZ020W10	18.0	20	22.0	12.5	5.0	15.2	22	12.5	225	ZKD
THZ022W05	20.9	22	23.1	11.5	5.0	16.7	23	11.5	205	ZKD
THZ022W10	19.8	22	24.2	11.5	5.0	16.7	23	11.5	205	ZKD
THZ024W05	22.8	24	25.2	10.5	5.0	18.2	25	10.5	190	ZKD
THZ024W10	21.6	24	26.4	10.5	5.0	18.2	25	10.5	190	ZKD
THZ027W05	25.7	27	28.4	9.5	5.0	20.6	35	9.5	170	ZED
THZ027W10	24.3	27	29.7	9.5	5.0	20.6	35	9.5	170	ZED
THZ030W05	28.5	30	31.5	8.5	5.0	22.8	40	8.5	150	ZED
THZ030W10	27.0	30	33.0	8.5	5.0	22.8	40	8.5	150	ZED
THZ033W05	31.4	33	34.7	7.5	5.0	25.1	45	7.5	135	ZED
THZ033W10	29.7	33	36.3	7.5	5.0	25.1	45	7.5	135	ZED
THZ036W05	34.2	36	37.8	7.0	5.0	27.4	50	7.0	125	ZED
THZ036W10	32.4	36	39.6	7.0	5.0	27.4	50	7.0	125	ZED
THZ039W05	37.1	39	41.0	6.5	5.0	29.7	60	6.5	115	ZED
THZ039W10	35.1	39	42.9	6.5	5.0	29.7	60	6.5	115	ZED
THZ043W05	40.9	43	45.2	6.0	5.0	32.7	70	6.0	110	ZED
THZ043W10	38.7	43	47.3	6.0	5.0	32.7	70	6.0	110	ZED
THZ047W05	44.7	47	49.4	5.5	5.0	35.8	80	5.5	95	ZED
THZ047W10	42.3	47	51.7	5.5	5.0	35.8	80	5.5	95	ZED
THZ051W05	48.5	51	53.6	5.0	5.0	38.8	95	5.0	90	ZED
THZ051W10	45.9	51	56.1	5.0	5.0	38.8	95	5.0	90	ZED

'THZ' Temperature-Compensated Zener Diodes

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	I_{ZT} (mA)	V_Z Nom. (V)	Z_{ZT} Max. (Ω)	Temp. Coefficient (±ppm/°C)	ΔV_Z Max. (±mV/°C)	Test Temperature (°C)	Process
THZ821	7.5	6.2	15	100	0.64	−55 / +25 / +100	ZHO
THZ821A	7.5	6.2	10	100	0.64	−55 / +25 / +100	ZHO
THZ823	7.5	6.2	15	50	0.32	−55 / +25 / +100	ZHO
THZ823A	7.5	6.2	10	50	0.32	−55 / +25 / +100	ZHO
THZ825	7.5	6.2	15	20	0.128	−55 / +25 / +100	ZHO
THZ825A	7.5	6.2	10	20	0.128	−55 / +25 / +100	ZHO
THZ827	7.5	6.2	15	10	0.064	−55 / +25 / +100	ZHO
THZ827A	7.5	6.2	10	10	0.064	−55 / +25 / +100	ZHO
THZ4565	0.5	6.4	200	100	0.64	0 / +25 / +75	ZHR
THZ4565A	0.5	6.4	200	100	0.64	−55 / +25 / +100	ZHR
THZ4566	0.5	6.4	200	50	0.32	0 / +25 / +75	ZHR
THZ4566A	0.5	6.4	200	50	0.32	−55 / +25 / +100	ZHR
THZ4567	0.5	6.4	200	20	0.128	0 / +25 / +75	ZHR
THZ4567A	0.5	6.4	200	20	0.128	−55 / +25 / +100	ZHR
THZ4568	0.5	6.4	200	10	0.064	0 / +25 / +75	ZHR
THZ4568A	0.5	6.4	200	10	0.064	−55 / +25 / +100	ZHR
THZ4570	1.0	6.4	100	100	0.64	0 / +25 / +75	ZHQ
THZ4570A	1.0	6.4	100	100	0.64	−55 / +25 / +100	ZHQ
THZ4571	1.0	6.4	100	50	0.32	0 / +25 / +75	ZHQ
THZ4571A	1.0	6.4	100	50	0.32	−55 / +25 / +100	ZHQ
THZ4572	1.0	6.4	100	20	0.128	0 / +25 / +75	ZHQ
THZ4572A	1.0	6.4	100	20	0.128	−55 / +25 / +100	ZHQ
THZ4573	1.0	6.4	100	10	0.064	0 / +25 / +75	ZHQ
THZ4573A	1.0	6.4	100	10	0.064	−55 / +25 / +100	ZHQ
THZ4575	2.0	6.4	50	100	0.64	0 / +25 / +75	ZHP
THZ4575A	2.0	6.4	50	100	0.64	−55 / +25 / +100	ZHP
THZ4576	2.0	6.4	50	50	0.32	0 / +25 / +75	ZHP
THZ4576A	2.0	6.4	50	50	0.32	−55 / +25 / +100	ZHP
THZ4577	2.0	6.4	50	20	0.128	0 / +25 / +75	ZHP
THZ4577A	2.0	6.4	50	20	0.128	−55 / +25 / +100	ZHP
THZ4578	2.0	6.4	50	10	0.064	0 / +25 / +75	ZHP
THZ4578A	2.0	6.4	50	10	0.064	−55 / +25 / +100	ZHP

'BZX55' Pro-Electron Zener Diodes

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$

Device Type	Zener Voltage Min. (V)	Nom. (V)	Max. (V)	@I_{ZT} (mA)	Leakage Current Max. I_R (μA)	@V_R (V)	Zener Impedance Max. Z_{ZT} (Ω)	@I_{ZT} (mA)	Max. Z_{ZK} (Ω)	@I_{ZK} (mA)	Process
BZX55-C3V9	3.7	3.9	4.1	5.0	2.0	1.0	85	5.0	600	1.0	ZAB
BZX55-C4V3	4.0	4.3	4.6	5.0	1.0	1.0	75	5.0	600	1.0	ZAB
BZX55-C4V7	4.4	4.7	5.0	5.0	0.5	1.0	60	5.0	600	1.0	ZAB
BZX55-C5V1	4.8	5.1	5.4	5.0	0.1	1.0	35	5.0	550	1.0	ZAB
BZX55-C5V6	5.2	5.6	6.0	5.0	0.1	1.0	25	5.0	450	1.0	ZCB
BZX55-C6V2	5.8	6.2	6.6	5.0	0.1	2.0	10	5.0	200	1.0	ZCB
BZX55-C6V8	6.4	6.8	7.2	5.0	0.1	3.0	8.0	5.0	150	1.0	ZCB
BZX55-C7V5	7.0	7.5	7.9	5.0	0.1	5.0	7.0	5.0	50	1.0	ZCB
BZX55-C8V2	7.7	8.2	8.7	5.0	0.1	6.2	7.0	5.0	50	1.0	ZCB
BZX55-C9V1	8.5	9.1	9.6	5.0	0.1	6.8	10	5.0	50	1.0	ZCB
BZX55-C10	9.4	10.0	10.6	5.0	0.1	7.5	15	5.0	70	1.0	ZCB
BZX55-C11	10.4	11.0	11.6	5.0	0.1	8.2	20	5.0	70	1.0	ZCB
BZX55-C12	11.4	12.0	12.7	5.0	0.1	9.1	20	5.0	90	1.0	ZCB
BZX55-C13	12.4	13.0	14.1	5.0	0.1	10.0	26	5.0	110	1.0	ZKB
BZX55-C15	13.8	15.0	15.6	5.0	0.1	11.0	30	5.0	110	1.0	ZKB
BZX55-C16	15.3	16.0	17.1	5.0	0.1	12.0	40	5.0	170	1.0	ZKB
BZX55-C18	16.8	18.0	19.1	5.0	0.1	13.0	50	5.0	170	1.0	ZKB
BZX55-C20	18.8	20.0	21.2	5.0	0.1	15.0	55	5.0	220	1.0	ZKB
BZX55-C22	20.8	22.0	23.3	5.0	0.1	16.0	55	5.0	220	1.0	ZKB
BZX55-C24	22.8	24.0	25.6	5.0	0.1	18.0	80	5.0	220	1.0	ZKB
BZX55-C27	25.1	27.0	28.9	5.0	0.1	20.0	80	5.0	220	1.0	ZEB
BZX55-C30	28.0	30.0	32.0	5.0	0.1	22.0	80	5.0	220	1.0	ZEB
BZX55-C33	31.0	33.0	35.0	5.0	0.1	24.0	80	5.0	220	1.0	ZEB
BZX55-C36	34.0	36.0	38.0	5.0	0.1	27.0	80	5.0	220	1.0	ZEB
BZX55-C39	37.0	39.0	41.0	2.5	0.1	30.0	90	2.5	500	0.5	ZEB
BZX55-C43	40.0	43.0	46.0	2.5	0.1	33.0	90	2.5	600	0.5	ZEB
BZX55-C47	44.0	47.0	50.0	2.5	0.1	36.0	110	2.5	700	0.5	ZEB
BZX55-C51	48.0	51.0	54.0	2.5	0.1	39.0	125	2.5	700	0.5	ZEB
BZX55-C56	52.0	56.0	60.0	2.5	0.1	43.0	135	2.5	1000	0.5	ZEB

'TMPD' General-Purpose and Low-Leakage Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Description	Marking	I_F Max. (mA)	V_{BR} Min. (V)	V_F Max. (V)	V_F @ I_F (mA)	I_R Max. (nA)	t_{rr} Max. (ns)	C_0 Max. (pF)	Process
TMPD459	Low-Leakage	459	500	200	1.0	3.0	25	—	6.0	TRO
TMPD914	General-Purpose	5D	600	100	1.0	10	25	4.0	6.0	TSB
TMPD2835	Common Anode	A3	500	35	1.0	10	0.10	6.0	4.0	DOB
TMPD2836	Common Anode	A2	500	75	1.0	10	0.10	6.0	4.0	DOB
TMPD2837	Common Cathode	A5	500	35	1.0	10	0.10	6.0	4.0	DBA
TMPD2838	Common Cathode	A6	500	75	1.0	10	0.10	6.0	4.0	DBA
TMPD4148	General-Purpose	5D	600	100	1.0	10	25	4.0	4.0	TSB
TMPD4150	General-Purpose	ABA	600	75	0.62	1.0	100	4.0	2.5	TSB
TMPD4153	General-Purpose	AAR	600	75	0.67	1.0	50	4.0	4.0	TSB
TMPD4154	General-Purpose	ABC	600	35	1.0	30	100	4.0	4.0	TSB
TMPD4448	General-Purpose	AAD	600	100	1.0	100	25	4.0	4.0	TSB
TMPD6050	Single Diode	5A	600	70	1.1	100	0.10	10	2.5	TSB
TMPD6100	Common Cathode	5B	500	70	1.1	100	0.10	15	2.5	DBA
TMPD7000	Dual In-Series	5C	600	100	1.1	100	0.30	15	1.5	TSB

'TMPD' Schottky Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	V_{BR} Min. (V)	V_F Max. I_F=1mA (V)	V_F Max. I_F=10mA (V)	I_R Max. V_R=1V (nA)	I_R Max. V_R=20V (nA)	I_R Max. V_R=50V (nA)	C_0 Max. (pF)	Process
TMPD5711	70	0.41	0.75	—	50	200	2.0	BKD
TMPD6916	40	0.34	0.47	100	200	—	5.0	BKA
TMPD6919	50	0.45	0.80	—	200	—	1.2	BKF
TMPD6924	70	0.41	0.75	—	—	200	2.0	BKD

'TMPZ' Zener Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Marking	Zener Voltage Min. (V)	Zener Voltage Nom. (V)	Zener Voltage Max. (V)	Zener Voltage @I_{ZT} (mA)	Leakage Current Max. (μA)	Leakage Current @V_R (V)	Zener Impedance Max. Z_{ZT} (Ω)	Zener Impedance @I_{ZT} (mA)	Process
TMPZ5229	8D	4.08	4.3	4.52	20	5.0	1.0	22	20	ZAA
TMPZ5230	8E	4.47	4.7	4.94	20	5.0	2.0	19	20	ZAA
TMPZ5231	8F	4.85	5.1	5.36	20	5.0	2.0	17	20	ZAA
TMPZ5232	8G	5.32	5.6	5.88	20	5.0	3.0	11	20	ZCA
TMPZ5233	8H	5.70	6.0	6.30	20	5.0	3.5	7.0	20	ZCA
TMPZ5234	8J	5.89	6.2	6.51	20	3.0	4.0	7.0	20	ZCA
TMPZ5235	8K	6.46	6.8	7.14	20	3.0	5.0	5.0	20	ZCA
TMPZ5236	8L	7.13	7.5	7.88	20	3.0	6.0	6.0	20	ZCA
TMPZ5237	8M	7.79	8.2	8.61	20	3.0	6.5	8.0	20	ZCA
TMPZ5238	8N	8.26	8.7	9.14	20	3.0	6.5	8.0	20	ZCA
TMPZ5239	8P	8.65	9.1	9.56	20	3.0	7.0	10	20	ZCA
TMPZ5240	8Q	9.50	10	10.5	20	3.0	8.0	17	20	ZCA
TMPZ5241	8R	10.5	11	11.6	20	2.0	8.4	22	20	ZCA
TMPZ5242	8S	11.4	12	12.6	20	1.0	9.1	30	20	ZKA
TMPZ5243	8T	12.4	13	13.7	9.5	0.5	9.9	13	9.5	ZKA
TMPZ5244	8U	13.3	14	14.7	9.0	0.1	10.0	15	9.0	ZKA
TMPZ5245	8V	14.3	15	15.8	8.5	0.1	11.0	16	8.5	ZKA
TMPZ5246	8W	15.2	16	16.8	7.8	0.1	12.0	17	7.8	ZKA
TMPZ5247	8X	16.2	17	17.9	7.4	0.1	13.0	19	7.4	ZKA
TMPZ5248	8Y	17.1	18	18.9	7.0	0.1	14.0	21	7.0	ZKA
TMPZ5249	8Z	18.1	19	20.0	6.6	0.1	14.0	23	6.6	ZKA
TMPZ5250	81A	19.0	20	21.0	6.2	0.1	15.0	25	6.2	ZKA
TMPZ5251	81B	20.9	22	23.1	5.5	0.1	17.0	29	5.5	ZKA
TMPZ5252	81C	22.8	24	25.2	5.2	0.1	18.0	33	5.2	ZEA
TMPZ5253	81D	23.8	25	26.3	5.0	0.1	19.0	35	5.0	ZEA
TMPZ5254	81E	25.7	27	28.4	4.6	0.1	21.0	41	4.6	ZEA
TMPZ5255	81F	26.6	28	29.4	4.5	0.1	21.0	44	4.5	ZEA
TMPZ5256	81G	28.5	30	31.5	4.2	0.1	23.0	49	4.2	ZEA
TMPZ5257	81H	31.4	33	34.7	3.8	0.1	25.0	58	3.8	ZEA

'TMPZ' Temperature-Compensated Zener Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	I_{ZT} (mA)	V_Z Nom. (V)	Z_{ZT} Max. (Ω)	Temp. Coefficient (± ppm/°C)	ΔV_Z Max. (± mV/°C)	Test Temperature (°C)	Process
TMPZ821	7.5	6.2	15	100	0.64	−55 / +25 / +100	ZHO
TMPZ821A	7.5	6.2	10	100	0.64	−55 / +25 / +100	ZHO
TMPZ823	7.5	6.2	15	50	0.32	−55 / +25 / +100	ZHO
TMPZ823A	7.5	6.2	10	50	0.32	−55 / +25 / +100	ZHO
TMPZ825	7.5	6.2	15	20	0.128	−55 / +25 / +100	ZHO
TMPZ825A	7.5	6.2	10	20	0.128	−55 / +25 / +100	ZHO
TMPZ827	7.5	6.2	15	10	0.064	−55 / +25 / +100	ZHO
TMPZ827A	7.5	6.2	10	10	0.064	−55 / +25 / +100	ZHO
TMPZ4565	0.5	6.4	200	100	0.64	0 / +25 / +75	ZHR
TMPZ4565A	0.5	6.4	200	100	0.64	−55 / +25 / +100	ZHR
TMPZ4566	0.5	6.4	200	50	0.32	0 / +25 / +75	ZHR
TMPZ4566A	0.5	6.4	200	50	0.32	−55 / +25 / +100	ZHR
TMPZ4567	0.5	6.4	200	20	0.128	0 / +25 / +75	ZHR
TMPZ4567A	0.5	6.4	200	20	0.128	−55 / +25 / +100	ZHR
TMPZ4568	0.5	6.4	200	10	0.064	0 / +25 / +75	ZHR
TMPZ4568A	0.5	6.4	200	10	0.064	−55 / +25 / +100	ZHR
TMPZ4570	1.0	6.4	100	100	0.64	0 / +25 / +75	ZHQ
TMPZ4570A	1.0	6.4	100	100	0.64	−55 / +25 / +100	ZHQ
TMPZ4571	1.0	6.4	100	50	0.32	0 / +25 / +75	ZHQ
TMPZ4571A	1.0	6.4	100	50	0.32	−55 / +25 / +100	ZHQ
TMPZ4572	1.0	6.4	100	20	0.128	0 / +25 / +75	ZHQ
TMPZ4572A	1.0	6.4	100	20	0.128	−55 / +25 / +100	ZHQ
TMPZ4573	1.0	6.4	100	10	0.064	0 / +25 / +75	ZHQ
TMPZ4573A	1.0	6.4	100	10	0.064	−55 / +25 / +100	ZHQ
TMPZ4575	2.0	6.4	50	100	0.64	0 / +25 / +75	ZHP
TMPZ4575A	2.0	6.4	50	100	0.64	−55 / +25 / +100	ZHP
TMPZ4576	2.0	6.4	50	50	0.32	0 / +25 / +75	ZHP
TMPZ4576A	2.0	6.4	50	50	0.32	−55 / +25 / +100	ZHP
TMPZ4577	2.0	6.4	50	20	0.128	0 / +25 / +75	ZHP
TMPZ4577A	2.0	6.4	50	20	0.128	−55 / +25 / +100	ZHP
TMPZ4578	2.0	6.4	50	10	0.064	0 / +25 / +75	ZHP
TMPZ4578A	2.0	6.4	50	10	0.064	−55 / +25 / +100	ZHP

Pro-Electron Device Types

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Description	Marking	I_F Max. (mA)	V_{BR} Min. (V)	V_F Max. (V)	V_F @I_F (mA)	I_R Max. (nA)	t_{rr} Max. (ns)	C_0 Max. (pF)	Process
BAR18	Schottky	D76	—	70	0.41	1.0	200	—	1.7	BKD
BAS16	General-Purpose	A6	600	75	0.72	1.0	1000	6.0	2.0	TSS
BAS19	General-Purpose	A8	200	100	1.25	200	100	50	5.0	TSB
BAS21	General-Purpose	A82	200	200	1.0	100	100	50	5.0	TSO
BAV70[1]	Common Cathode	A4	100	70	0.86	10	5000	6.0	1.5	DBA
BAV74[1]	Common Cathode	JA	70	50	1.0	100	100	4.0	2.0	DBA
BAV99[2]	Dual In-Series	A1	70	70	1.1	50	2500	6.0	2.0	TSB
BAW56[1]	Common Anode	A7	70	70	1.1	50	2500	6.0	2.0	DOB

[1]Dual device.
[2]Pinout: 1 = anode, 2 = cathode, 3 = cathode/anode.

'BZX84' Zener Diodes

ELECTRICAL CHARACTERISTICS at T_A = 25°C

Device Type	Marking	Zener Voltage Min. (V)	Zener Voltage Nom. (V)	Zener Voltage Max. (V)	Zener Voltage @I_{ZT} (mA)	Leakage Current Max. (μA)	Leakage Current @V_R (V)	Zener Impedance Max. Z_{ZT} (Ω)	Zener Impedance @I_{ZT} (mA)	Process
BZX84-C4V7	Z1	4.4	4.7	5.0	5.0	3.0	2.0	80	5.0	ZAA
BZX84-C5V1	Z2	4.8	5.1	5.4	5.0	2.0	2.0	60	5.0	ZAA
BZX84-C5V6	Z3	5.2	5.6	6.0	5.0	1.0	2.0	40	5.0	ZCA
BZX84-C6V2	Z4	5.8	6.2	6.6	5.0	3.0	4.0	10	5.0	ZCA
BZX84-C6V8	Z5	6.4	6.8	7.2	5.0	2.0	4.0	15	5.0	ZCA
BZX84-C7V5	Z6	7.0	7.5	7.9	5.0	1.0	5.0	15	5.0	ZCA
BZX84-C8V2	Z7	7.7	8.2	8.7	5.0	0.7	5.0	15	5.0	ZCA
BZX84-C9V1	Z8	8.5	9.1	9.6	5.0	0.5	6.0	15	5.0	ZCA
BZX84-C10	Z9	9.4	10.0	10.6	5.0	0.2	7.0	20	5.0	ZCA
BZX84-C11	Y1	10.4	11.0	11.6	5.0	0.1	8.0	20	5.0	ZCA
BZX84-C12	Y2	11.4	12.0	12.7	5.0	0.1	8.0	25	5.0	ZCA
BZX84-C13	Y3	12.4	13.0	14.1	5.0	0.1	8.0	30	5.0	ZKA
BZX84-C15	Y4	13.8	15.0	15.6	5.0	0.05	10.5	30	5.0	ZKA
BZX84-C16	Y5	15.3	16.0	17.1	5.0	0.05	11.2	40	5.0	ZKA
BZX84-C18	Y6	16.8	18.0	19.1	5.0	0.05	12.6	45	5.0	ZKA
BZX84-C20	Y7	18.8	20.0	21.2	5.0	0.05	14.0	55	5.0	ZKA
BZX84-C22	Y8	20.8	22.0	23.3	5.0	0.05	15.4	55	5.0	ZKA
BZX84-C24	Y9	22.8	24.0	25.6	5.0	0.05	16.8	70	5.0	ZKA
BZX84-C27	Y10	25.1	27.0	28.9	2.0	0.05	21.0	80	2.0	ZEA
BZX84-C30	Y11	28.0	30.0	32.0	2.0	0.05	18.9	80	2.0	ZEA
BZX84-C33	Y12	31.0	33.0	35.0	2.0	0.05	23.1	80	2.0	ZEA

NOTES

NOTES

SECTION 4—PROCESS DATA

Semiconductor dice shown in this section are products of prime manufacturing processes. Variations, with identical geometries, are produced by changing the epitaxial layers during wafer fabrication. The process modifications can be used to shift breakdown voltage, current gain, and other electrical characteristics to desired values. For additional information, contact our Customer Service Center in Concord, NH.

BIPOLAR TRANSISTOR SELECTION GUIDE

In order: (1) Polarity (2) I_c Max. (3) $V_{(BR)CEO}$

Process	Polarity	I_c Max. (mA)	$V_{(BR)CEO}$ (V)
DMA	NPN	50	27
DLA	NPN	50	28
VXA	NPN	150	185
SKL	NPN	200	45
FFB	NPN	200	50
TVO	NPN	200	50
VRB	NPN	200	50
BAA	NPN	200	80
FEE	NPN	200	85
BJB	NPN	300	20
VAB	NPN	300	180
SQL[1]	NPN	500	45
JGA	NPN	500	50
SPL	NPN	500	50
BBC	NPN	500	55
DCA	NPN	500	55
TNL	NPN	500	55
TPM[1]	NPN	500	55
JEA[1]	NPN	500	110
DVA	NPN	500	300
BLA	NPN	500	320
JLA	NPN	800	95
DAC	NPN	800	100
BHB	NPN	1000	50
BNB[1]	NPN	1000	80
YCA	NPN	1000	80
DSA	NPN	1000	90
DID	NPN	1000	95
AJA	NPN	1000	150

[1]Darlington.

continued

BIPOLAR TRANSISTOR SELECTION GUIDE
(continued)

In order: (1) Polarity (2) I_c Max. (3) $V_{(BR)CEO}$

Process	Polarity	I_c Max. (mA)	$V_{(BR)CEO}$ (V)
FCB	NPN	5000	90
FBB	NPN	5000	100
YFA[1]	NPN	7000	100
JYA	PNP	50	27
SHF	PNP	50	95
STL	PNP	100	95
BCA	PNP	150	170
BTB	PNP	200	60
SMN	PNP	200	65
SLL	PNP	200	70
BXE	PNP	200	100
VHB	PNP	300	210
DDA	PNP	500	50
BDA	PNP	500	65
JFA	PNP	500	75
SRB[1]	PNP	500	75
TQL	PNP	500	75
BMA	PNP	500	400
DFC	PNP	800	90
BFA	PNP	800	100
JMA	PNP	800	100
BOB[1]	PNP	1000	85
YDA	PNP	1000	90
DJC	PNP	1000	105
AKA	PNP	1000	170
FAA	PNP	3000	100
FDB	PNP	5000	100
YJA[1]	PNP	7000	100

[1]Darlington.

JUNCTION FIELD-EFFECT TRANSISTOR SELECTION GUIDE

In order: (1) Polarity (2) $V_{(BR)GSS}$ (3) I_{DSS}

Process	Polarity	$V_{(BR)GSS}$ (V)	I_{DSS} Min. (mA)	I_{DSS} Max. (mA)
NJ26L	N	30	2.0	40
NJ28D[1]	N	35	5.0	40
NJ26	N	40	2.0	22
NJ99	N	40	5.0	90
NJ132	N	45	10	150
NJ01	N	50	0.03	0.6
NJ32	N	50	1.0	22
NJ903	N	50	100	900
NJ16	N	60	0.2	9.0
NJ35D[1]	N	60	1.0	15
NJ42	N	400	2.0	8.0
PJ99	P	40	5.0	60
PJ32	P	50	1.0	15

[1]Dual device.

DIODE SELECTION GUIDE

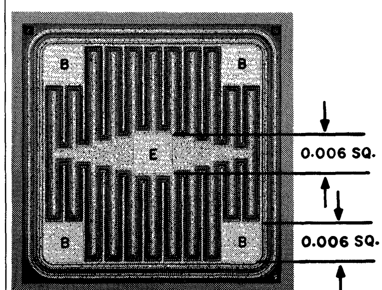
In order: (1) V_{BR} (2) Max. (Surge) I_F (3) V_F

Process	V_{BR} (V)	I_F Max. (A)	V_F Typ. (V)	V_F @I_F (mA)
TSP	40	0.5	0.83	10
BQB[1]	45	1.0	0.65	1000
BKA[1]	60	0.2	0.44	10
BGA[1]	60	3.0	0.49	1000
BKF[1]	70	0.2	0.40	1.0
TRS	75	1.0	0.83	10
BKD[1]	80	0.2	0.35	1.0
TRB	80	0.5	0.82	10
DBA	85	0.5	0.86	100
DOB[2]	90	0.5	0.86	100
TTU[2]	110	0.5	0.65	10
TSS	110	1.0	0.69	10
TSU	110	1.0	0.70	10
YIA[2]	110	5.0	1.40	3000
TSB	130	0.5	0.78	10
YAA	140	3.0	1.00	1000
YBA	140	5.0	1.40	3000
TRR	170	0.5	0.84	100
TRO	210	1.0	0.88	100
TSO	250	1.0	0.91	100
TRJ	350	2.0	0.82	100
TRL	480	2.0	0.98	1000

[1]Schottky diode.
[2]N/P diode.

Process AJA
NPN Small-Signal Transistor

Process AJA is a double-diffused epitaxial silicon transistor designed for use in medium-power, general-purpose amplifiers and as a switch for line voltage applications.



AJA 0.045″ × 0.045″

ABSOLUTE MAXIMUM RATINGS

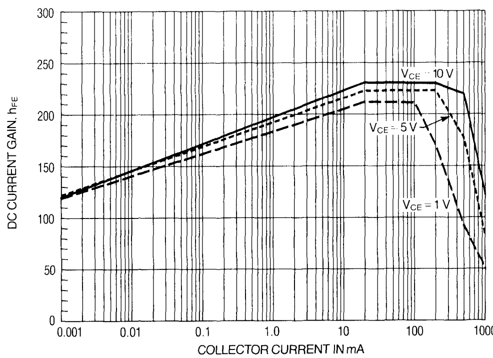
Collector Current, I_C .... 1000 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	100	150	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	150	280	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 120\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 10\,V$, $I_C = 10\,mA$	—	210	—	—
		$V_{CE} = 10\,V$, $I_C = 100\,mA$	80	220	360	—
		$V_{CE} = 10\,V$, $I_C = 500\,mA$	—	220	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.04	0.1	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.12	0.25	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.85	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 50\,mA$	100	180	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	11	17	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	210	300	pF

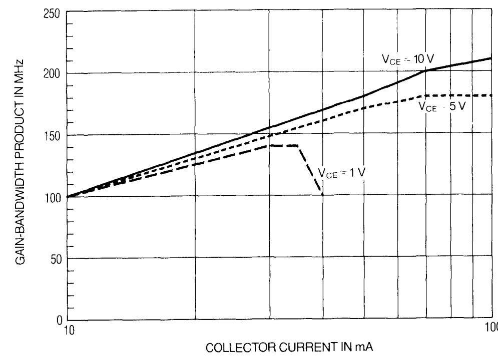
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



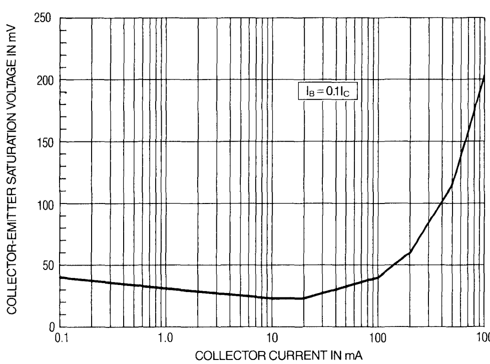
Dwg. No. A-13, 688

f_T AS A FUNCTION OF COLLECTOR CURRENT



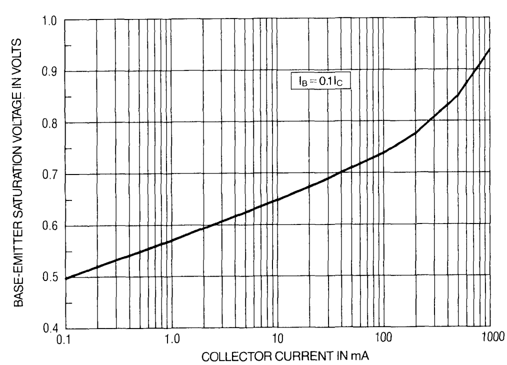
Dwg. No. A-13, 687

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



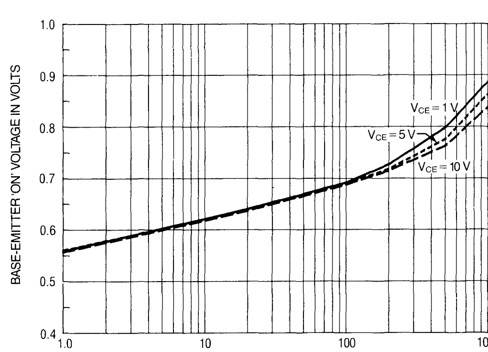
Dwg. No. A-13, 690

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



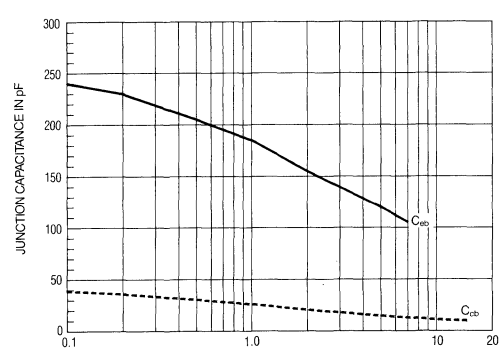
Dwg. No. A-13, 691

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg No. A-13, 692

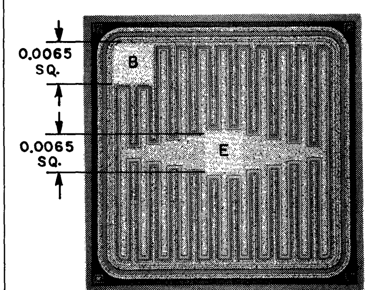
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No A-13, 689

Process AKA
PNP Small-Signal Transistor

Process AKA is a PNP silicon epitaxial planar device designed for use as a high-voltage switch or a low-power amplifier.



AKA 0.045″ × 0.045″

ABSOLUTE MAXIMUM RATINGS

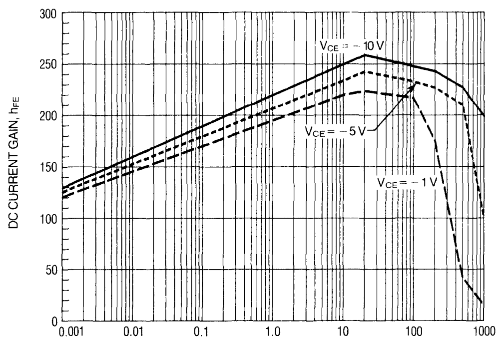
Collector Current, I_C .... 1000 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	140	170	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	5.0	7.6	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	140	240	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 120\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 10\,V$, $I_C = 1.0\,mA$	—	230	—	—
		$V_{CE} = 10\,V$, $I_C = 100\,mA$	—	230	—	—
		$V_{CE} = 10\,V$, $I_C = 200\,mA$	—	225	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.04	0.3	V
		$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.08	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.75	0.9	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 20\,mA$	100	140	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	20	—	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	230	—	pF

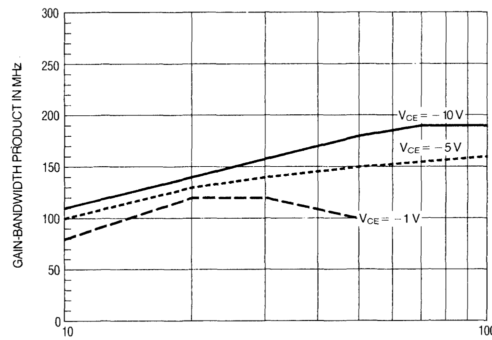
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



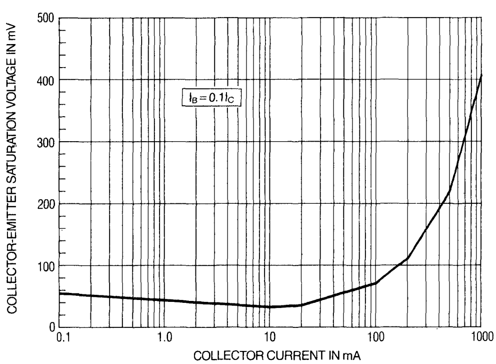
Dwg. No. A-13, 693

f_T AS A FUNCTION OF COLLECTOR CURRENT



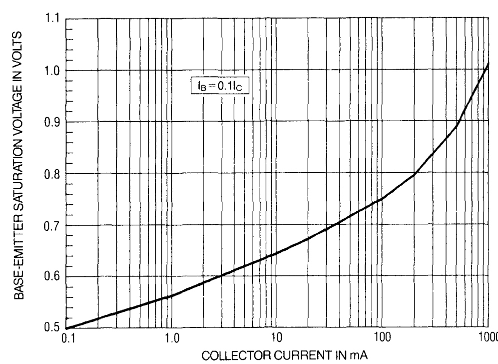
Dwg. No. A-13, 695

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



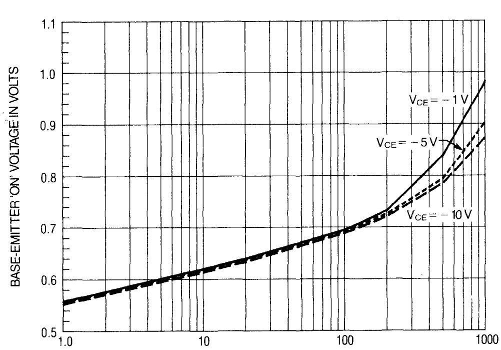
Dwg. No. A-13, 696

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



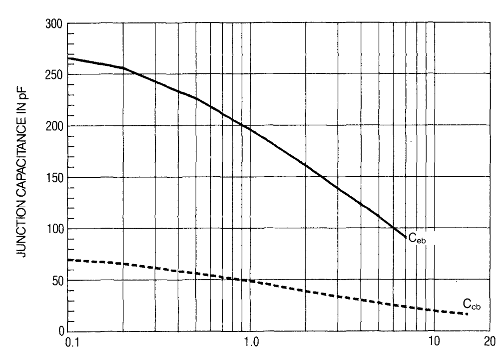
Dwg. No. A-13, 698

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 697

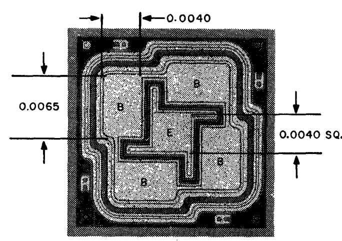
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 694

Process BAA
NPN Small-Signal Transistor

This double-diffused, silicon epitaxial planar device is designed for general-purpose use. Selected versions of the Process BAA NPN transistor find broad application in AM radio equipment, IF stages, and converters, and as audio drivers, video amplifiers, and operational amplifier output stages.



BAA 0.023″ × 0.023″

ALTERNATE PROCESS: FEE

ABSOLUTE MAXIMUM RATINGS

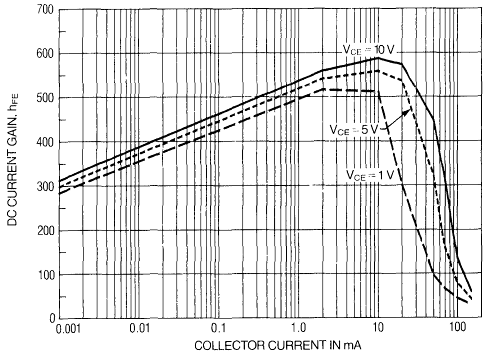
Collector Current, I_C . . . . 200 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	80	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.5	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	100	180	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 40\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	400	—	—
		$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	50	500	800	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	20	550	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.08	0.2	V
		$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.17	0.3	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.9	1.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5\,V$, $I_C = 1.0\,mA$	100	200	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	3.4	5.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	5.8	8.0	pF

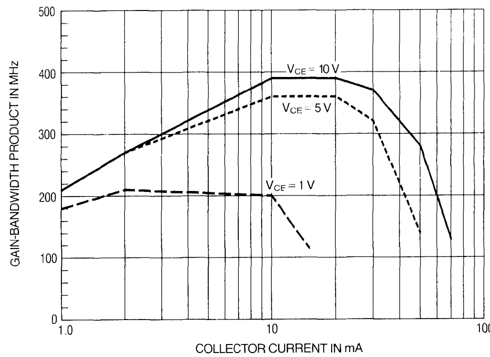
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



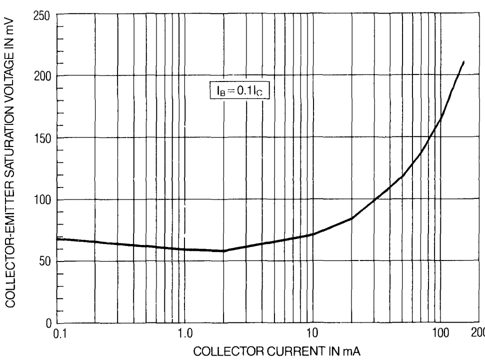
Dwg. No. A-13, 699

f_T AS A FUNCTION OF COLLECTOR CURRENT



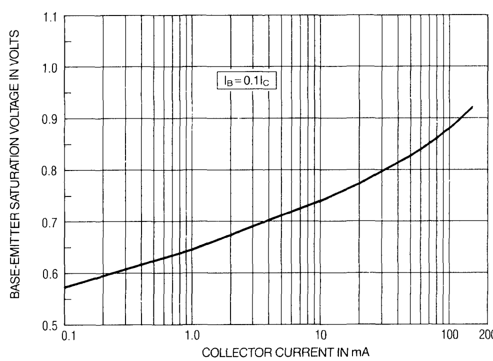
Dwg. No. A-13700

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



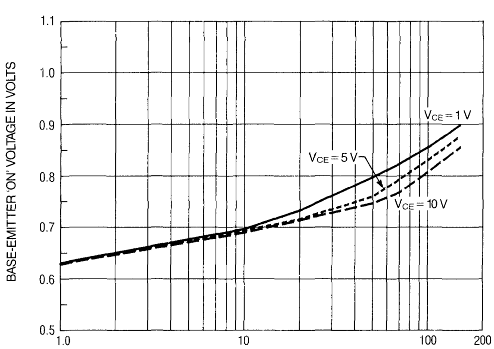
Dwg. No. A-13, 701

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



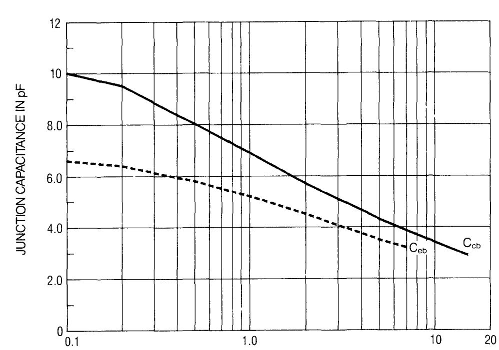
Dwg. No. A-13, 703

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. NO. A-13, 704

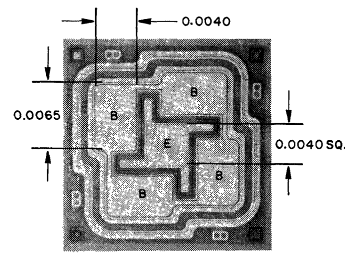
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No A-13, 702

Process BBC
NPN Small-Signal Transistor

The electrical characteristics of selected versions of Process BBC, the NPN counterpart of Sprague Electric's planar PNP Process BDA transistor, match those of many popular device types. These double-diffused silicon epitaxial chips are used as general-purpose amplifiers and medium-power switching transistors in a wide variety of small-signal, low-noise applications.



BBC 0.023″ × 0.023″

ALTERNATE PROCESSES: DCA, JGA, TNL

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

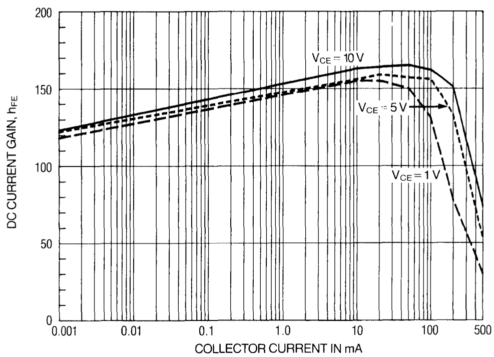
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	25	55	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.4	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	140	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	140	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	50	150	800	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	—	150	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.04	0.07	V
		$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.11	0.25	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.83	1.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 50\,mA$	200	340	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	4.3	4.5	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	18.5	20	pF
Delay Time*	t_d	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	9.0	10	ns
Rise Time*	t_r	$I_B = 15\,mA$	—	16	25	ns
Storage Time*	t_s	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	300	400	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 15\,mA$	—	50	80	ns

*Switching speeds measured at 2N2222A test conditions.

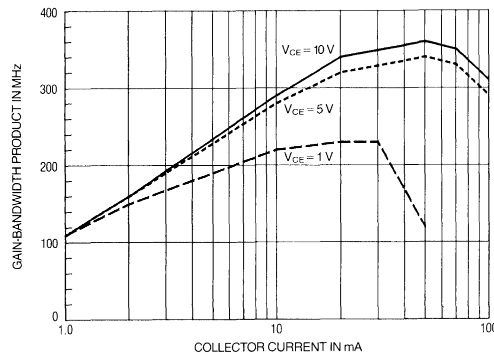
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



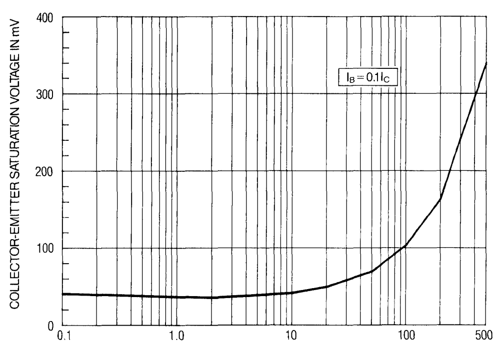
Dwg. No. A-13,705

f_T AS A FUNCTION OF COLLECTOR CURRENT



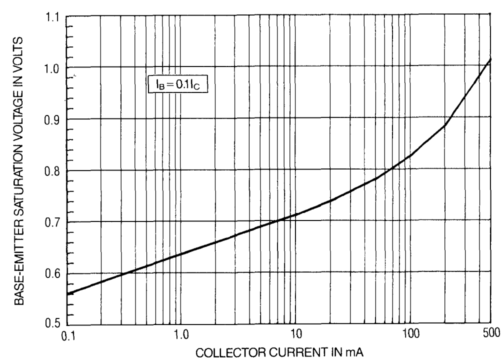
Dwg. No. A-13,709

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



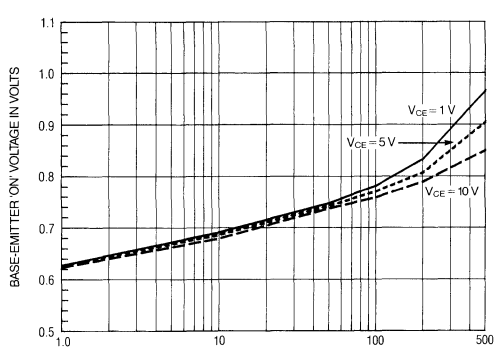
Dwg. NO. A-13,706

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



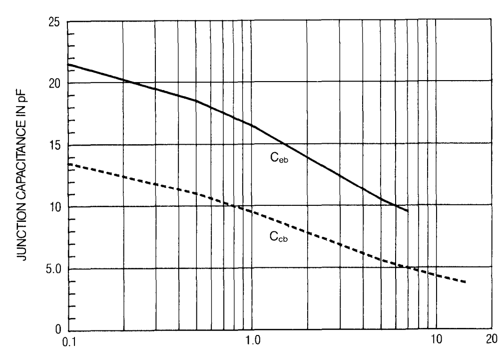
Dwg. No. A-13,707

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,708

JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



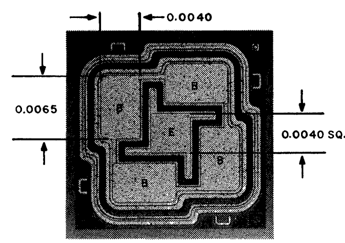
Dwg No. A-13,710

Process BCA
PNP Small-Signal Transistor

Process BCA is a PNP silicon epitaxial planar transistor. It is designed for use in low-noise amplifier circuits. It is the complement to the NPN Process VXA transistor.

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C . . . . 150 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C



BCA 0.023″ × 0.023″

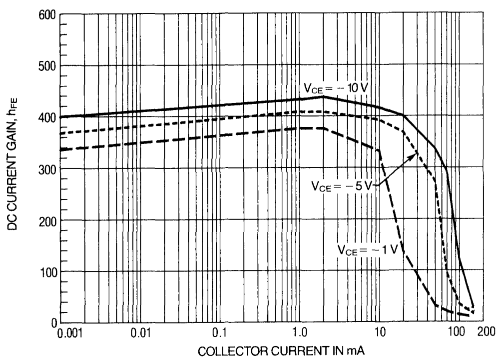
ALTERNATE PROCESS: VHB

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits			Units
			Min.	Typ.	Max.	
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	170	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	175	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	400	—	—
		$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	300	400	900	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	390	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 1.0\,mA$, $I_B = 0.1\,mA$	—	0.06	0.25	V
		$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.08	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.74	1.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 1.0\,mA$	100	130	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	4.0	6.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	13	20	pF

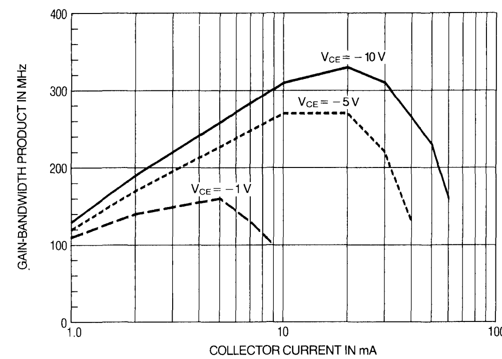
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



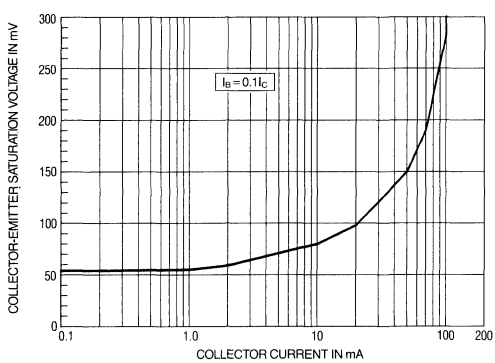
Dwg. No. A-13,716

f_T AS A FUNCTION OF COLLECTOR CURRENT



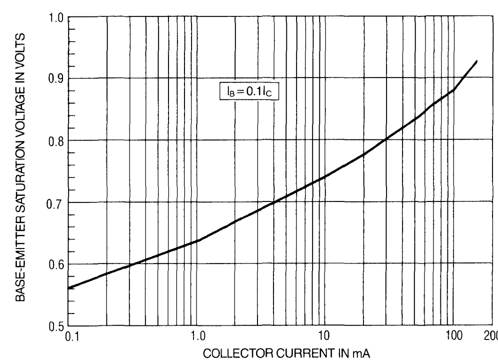
Dwg. No A-13,712

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



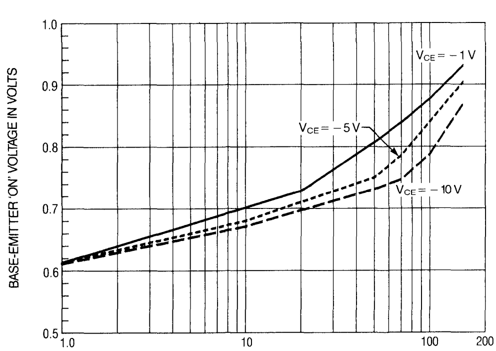
Dwg No. A-13,713

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



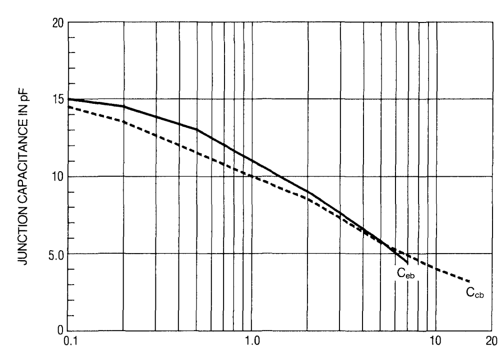
Dwg No. A-13,714

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,715

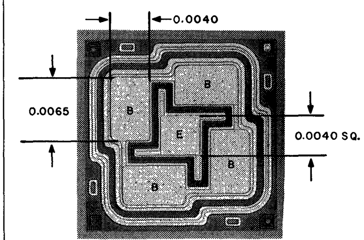
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,711

Process BDA
PNP Small-Signal Transistor

A general-purpose PNP transistor, Process BDA is used as a low-noise, high-gain amplifier and as a medium-power switcher at frequencies from dc to UHF. Selected Process BDA chips conform to the electrical characteristics of a broad variety of popular transistor types. The double-diffused, silicon epitaxial planar device is the complement to Sprague Electric's NPN Process BBC transistor.



BDA 0.023″ × 0.023″

ALTERNATE PROCESSES: DDA, JFA, TQL

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

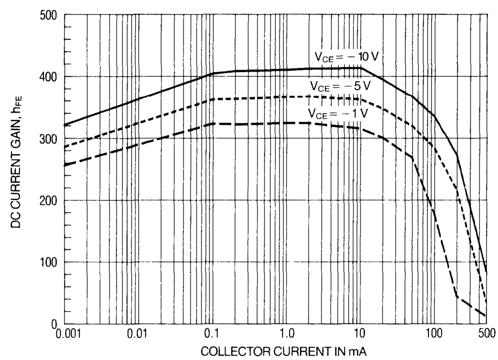
ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	65	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.2	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	40	90	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 40\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	360	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	50	360	600	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	20	280	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.19	0.4	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.83	1.6	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.86	1.3	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 50\,mA$	100	280	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	5.7	8.0	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	19	30	pF
Noise Figure	NF	$I_C = 200\,mA$, $V_{CE} = 5.0\,V$, $R_S = 2\,k\Omega$, $f = 1.0\,kHz$	—	6.0	15	$\frac{nV}{\sqrt{Hz}}$
Delay Time*	t_d	$V_{CC} = 6.0\,V$, $I_C = 150\,mA$,	—	5.0	10	ns
Rise Time*	t_r	$I_B = 15\,mA$	—	14	20	ns
Storage Time*	t_s	$V_{CC} = 6.0\,V$, $I_C = 150\,mA$,	—	70	100	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 15\,mA$	—	50	80	ns

*Switching speeds measured at 2N2907 test conditions.

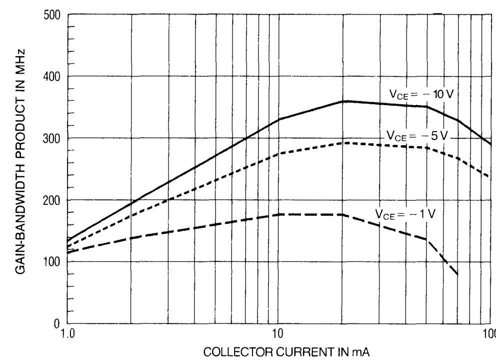
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



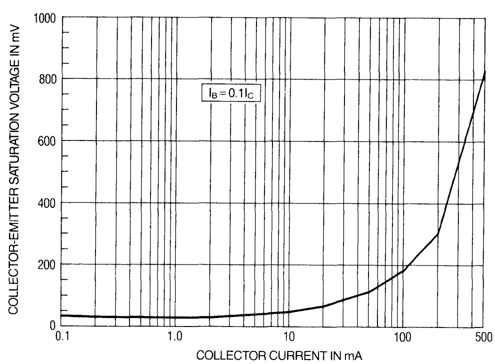
Dwg. No. A-14,091

f_T AS A FUNCTION OF COLLECTOR CURRENT



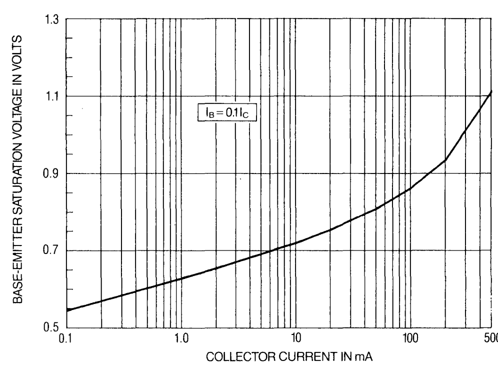
Dwg. No. A-14,093

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



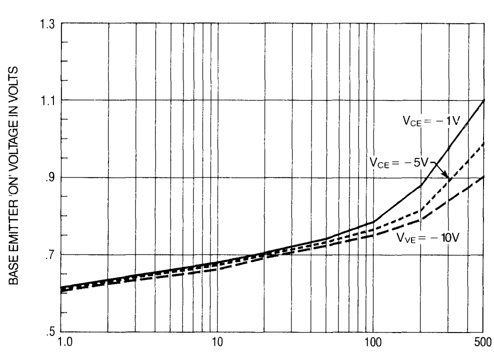
Dwg. No. A-14,094

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



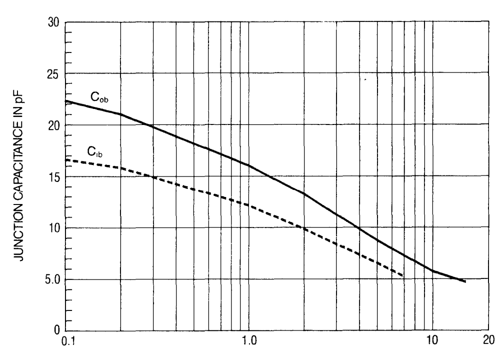
Dwg. No. A-14,090

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg No. A-14,095

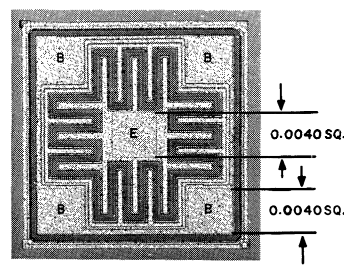
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg No. A-14,092

Process BFA
PNP Small-Signal Transistor

Exhibiting excellent current-gain linearity and very low collector-emitter saturation voltage, Process BFA finds broad application as a medium-power amplifier and switching transistor. This PNP, double-diffused, silicon epitaxial device is the complement to Sprague Electric's NPN Process DAC transistor.



BFA 0.024″ × 0.024″

ALTERNATE PROCESSES: DFC, JMA

ABSOLUTE MAXIMUM RATINGS

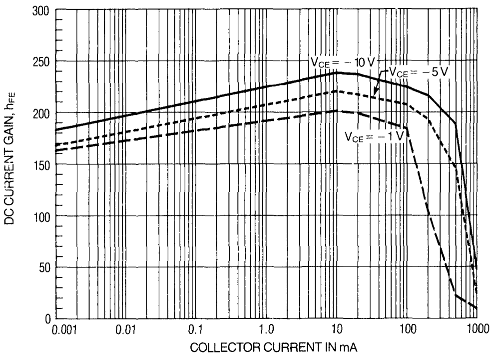
Collector Current, I_C .... 800 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	100	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	50	140	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 50\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	220	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	50	210	500	—
		$V_{CE} = 5.0\,V$, $I_C = 500\,mA$	—	150	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.12	0.15	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.38	0.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.95	1.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 100\,mA$	100	330	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	7.0	15	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	43	70	pF

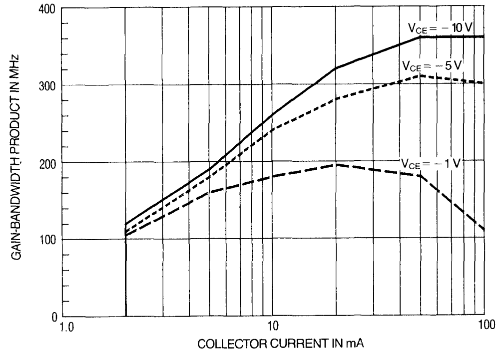
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



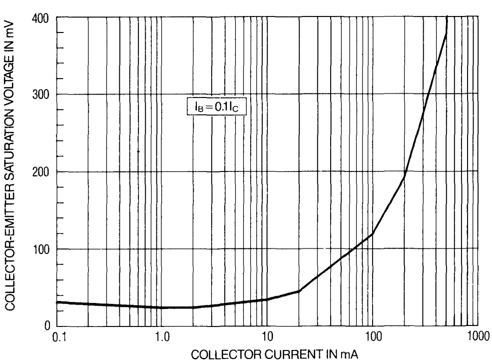
Dwg. No. A-13,717

f_T AS A FUNCTION OF COLLECTOR CURRENT



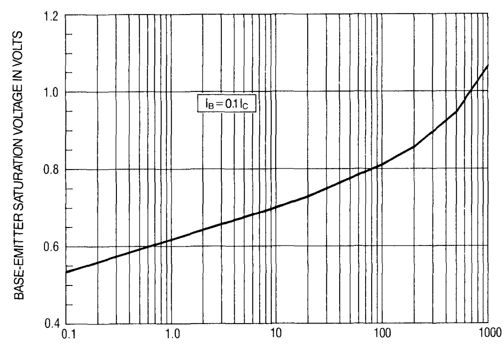
Dwg. No. A-13,719

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



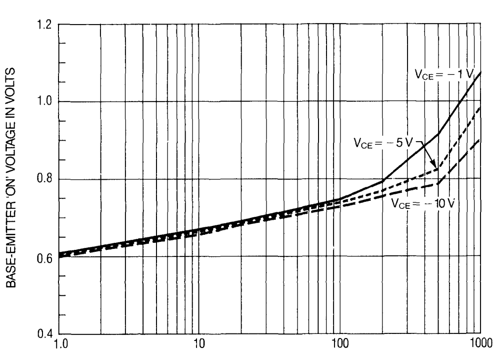
Dwg. No. A-13,720

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



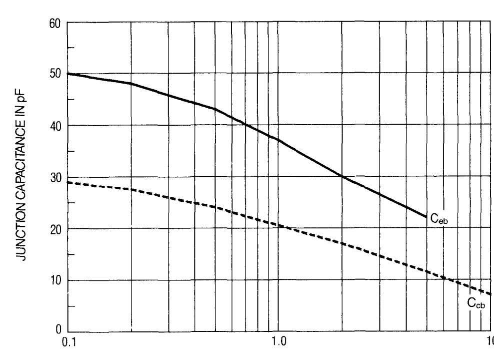
Dwg. No. A-13,721

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,722

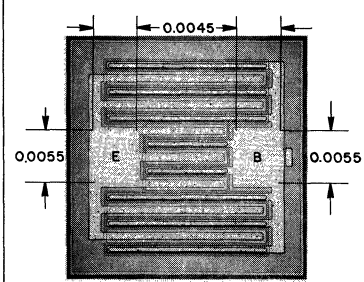
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,718

Process BHB
NPN High-Speed Switching Transistor

Process BHB is a double-diffused epitaxial planar NPN silicon device designed to be used in high-speed, high-current switching applications.



BHB 0.027″ × 0.027″

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 1000 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

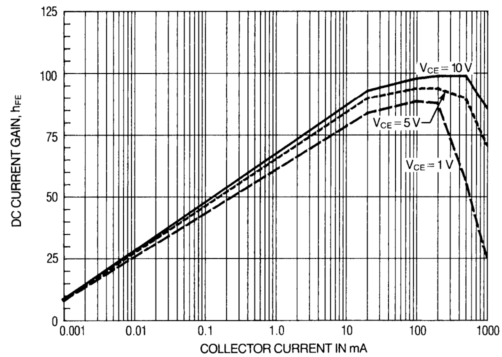
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	50	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	5.0	7.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	70	110	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 2.0\,V$	—	—	200	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0\,V$, $I_C = 10\,mA$	—	80	—	—
		$V_{CE} = 1.0\,V$, $I_C = 100\,mA$	60	90	150	—
		$V_{CE} = 1.0\,V$, $I_C = 500\,mA$	35	55	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.15	0.26	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.28	0.52	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.95	1.1	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 50\,mA$	300	370	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	7.0	12	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	55	55	pF
Delay Time*	t_d	$V_{CC} = 30\,V$, $I_C = 500\,mA$,	—	10	10	ns
Rise Time*	t_r	$I_B = 50\,mA$	—	10	30	ns
Storage Time*	t_s	$V_{CC} = 30\,V$, $I_C = 500\,mA$,	—	30	50	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 50\,mA$	—	10	25	ns

*Switching speeds measured at 2N3725 test conditions.

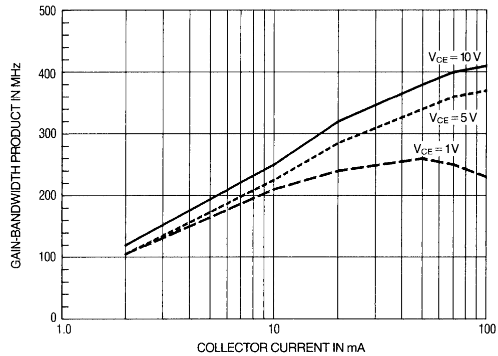
Typical Characteristics at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



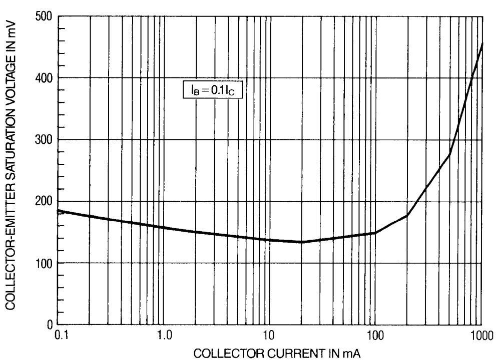
Dwg. No. A-13,723

f_T AS A FUNCTION OF COLLECTOR CURRENT



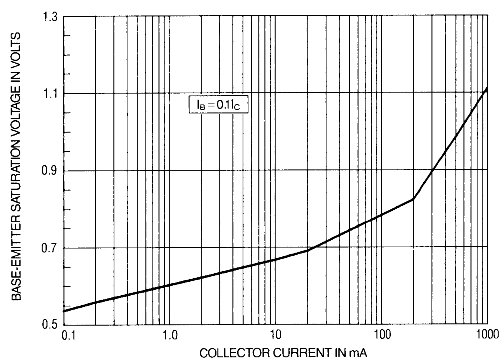
Dwg. No. A-13,725

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



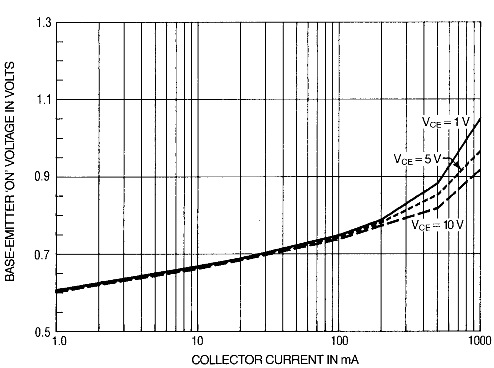
Dwg. No. A-13,726

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



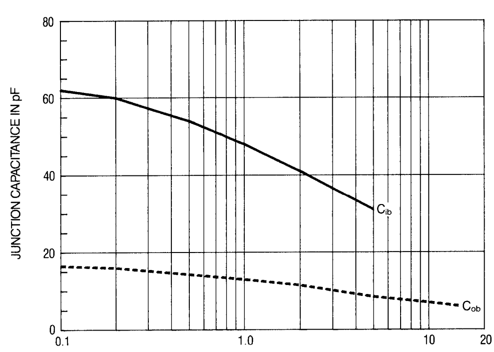
Dwg. No. A-13,727

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,728

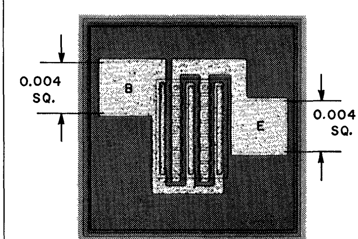
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,724

Process BJB
NPN High-Speed Switching Transistor

Process BJB is a double-diffused epitaxial planar NPN silicon device. It is designed to be used in high-speed, medium-current switching applications.



BJB 0.020″ × 0.020″

ABSOLUTE MAXIMUM RATINGS

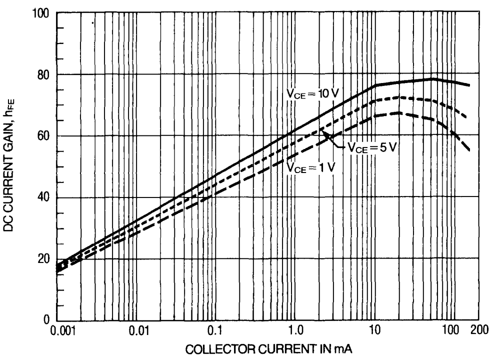
Collector Current, I_C .... 300 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

			Limits			
Characteristic	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	10	20	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	5.0	6.8	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	30	55	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 30\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	50	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	70	—	—
		$V_{CE} = 5.0\,V$, $I_C = 50\,mA$	—	70	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.13	0.3	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.16	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.83	1.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	440	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	3.0	5.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	7.0	15	pF

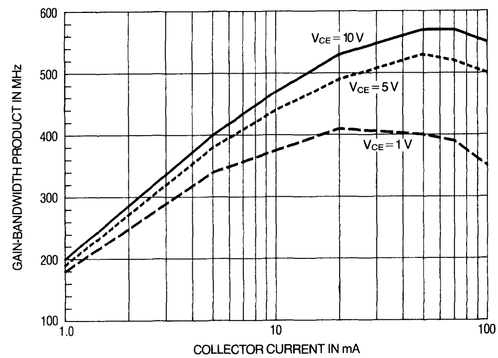
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



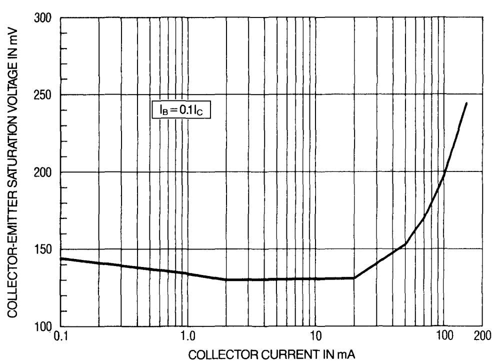
Dwg. No. A-13,729

f_T AS A FUNCTION OF COLLECTOR CURRENT



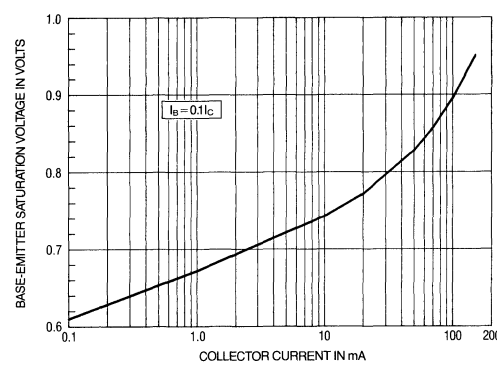
Dwg. No. A-13,731

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



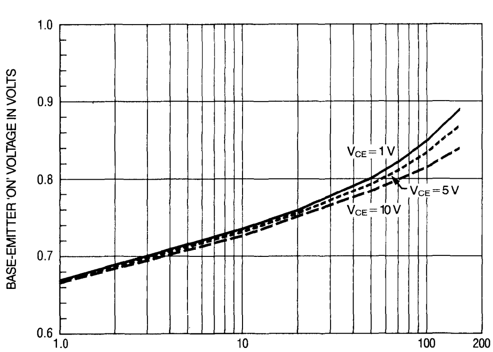
Dwg. No. A-13,733

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



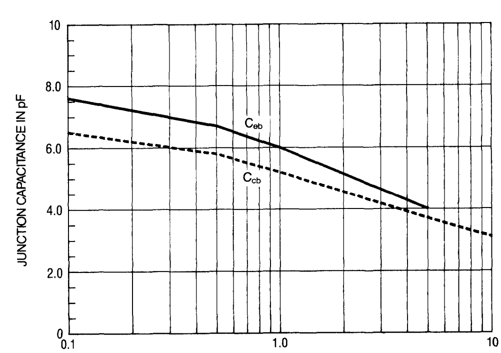
Dwg No. A-13,732

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,734

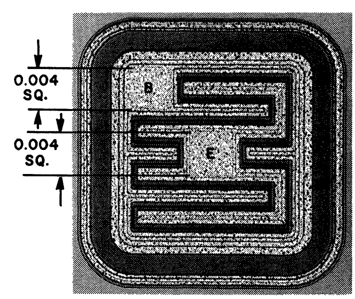
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,730

Process BLA
NPN High-Voltage Transistor

The NPN process BLA transistor is a double-diffused silicon epitaxial planar device used primarily in video circuits and similar high-voltage, low-current applications. Its PNP complement is the Sprague Electric Process BMA transistor.



BLA 0.028″ × 0.028″

ALTERNATE PROCESS: DVA

ABSOLUTE MAXIMUM RATINGS

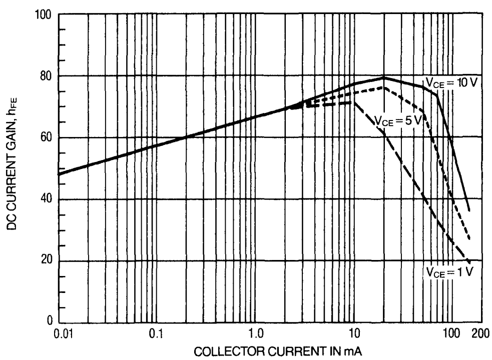
Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1.0$ mA	200	320	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\ \mu$A	6.0	9.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\ \mu$A	250	390	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 200$ V	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0$ V	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 10$ V, $I_C = 1.0$ mA	—	65	—	—
		$V_{CE} = 10$ V, $I_C = 10$ mA	25	75	300	—
		$V_{CE} = 10$ V, $I_C = 50$ mA	20	75	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10$ mA, $I_B = 1.0$ mA	—	0.07	0.12	V
		$I_C = 50$ mA, $I_B = 5.0$ mA	—	0.09	0.16	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 10$ mA, $I_B = 1.0$ mA	—	0.71	1.00	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10$ V, $I_C = 10$ mA	40	65	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10$ V, f = 1.0 MHz	—	3.3	6.0	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5$ V, f = 1.0 MHz	—	50	60	pF

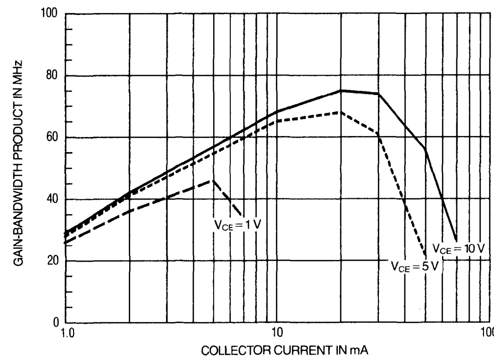
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



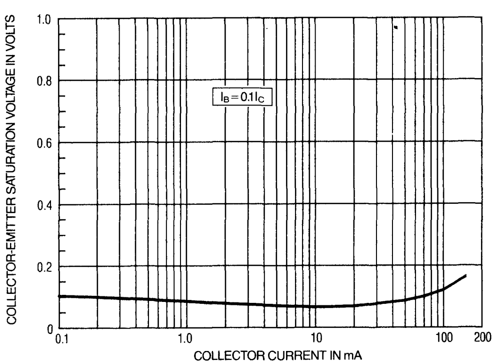
Dwg. No. A-13,736

f_T AS A FUNCTION OF COLLECTOR CURRENT



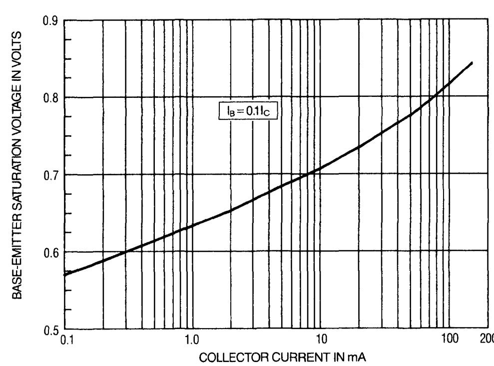
Dwg. No. A-13,738

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



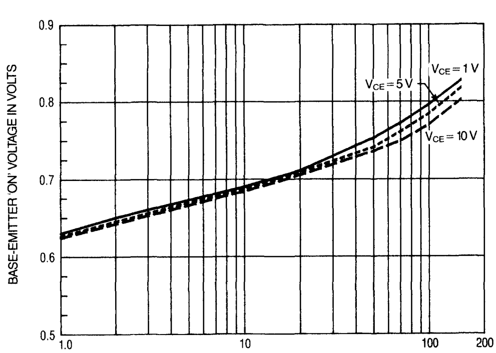
Dwg. No. A-13,740

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



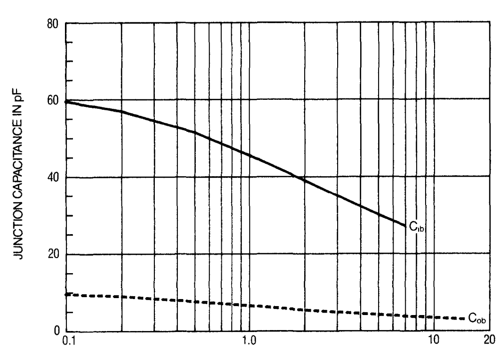
Dwg. No. A-13,735

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,737

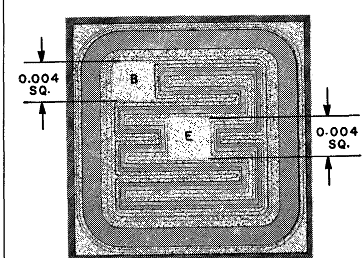
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,739

Process BMA
PNP High-Voltage Transistor

The PNP process BMA transistor is a double-diffused silicon epitaxial planar device used primarily in video circuits and similar high-voltage, low-current applications. Its NPN complement is the Sprague Electric Process BLA transistor.



BMA 0.028″ × 0.028″

ABSOLUTE MAXIMUM RATINGS

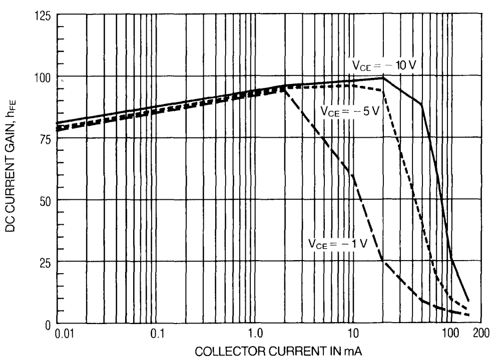
Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

			Limits			
Characteristic	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1.0\,mA$	300	400	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	300	400	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 200\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 10\,V$, $I_C = 1.0\,mA$	—	95	—	—
		$V_{CE} = 10\,V$, $I_C = 10\,mA$	25	100	300	—
		$V_{CE} = 10\,V$, $I_C = 50\,mA$	20	90	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.16	0.25	V
		$I_C = 20\,mA$, $I_B = 2.0\,mA$	—	0.23	0.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.72	0.9	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 10\,mA$	40	80	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	5.3	8.0	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	50	100	pF

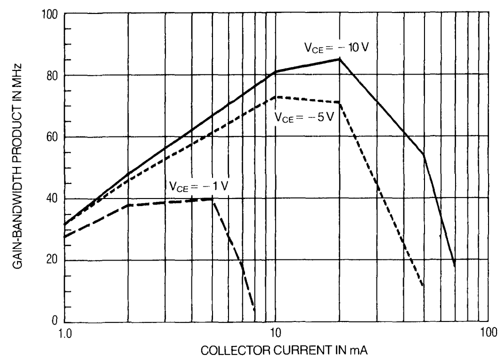
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



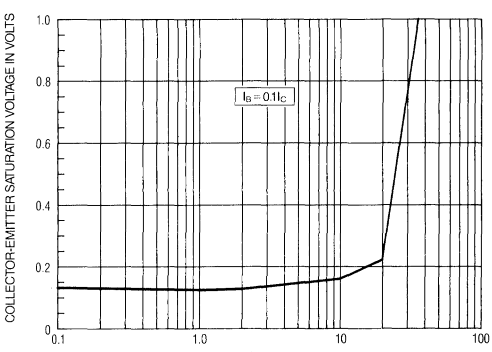
Dwg. No. A-13,743

f_T AS A FUNCTION OF COLLECTOR CURRENT



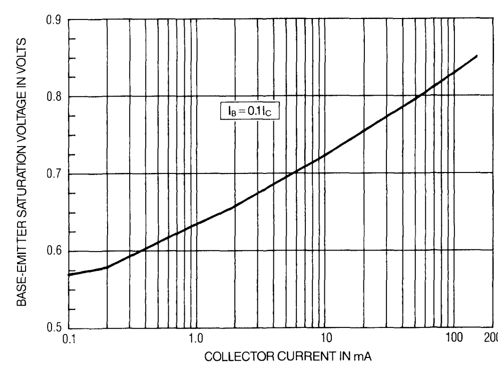
Dwg. No. A-13,745

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



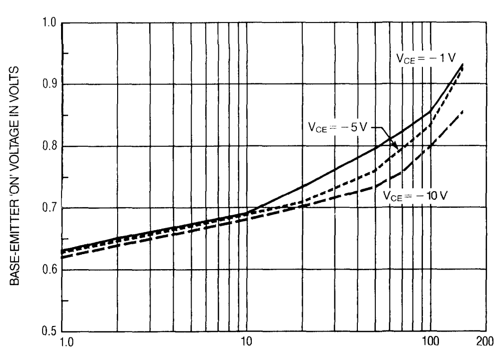
Dwg. No. A-13,741

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



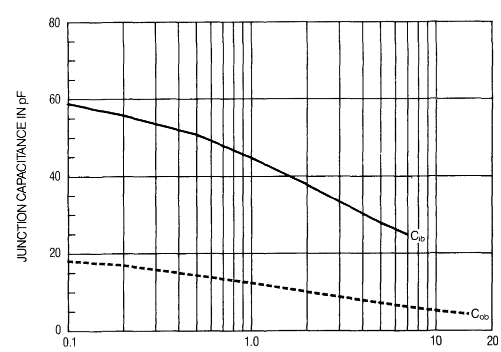
Dwg. No. A-13,742

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,746

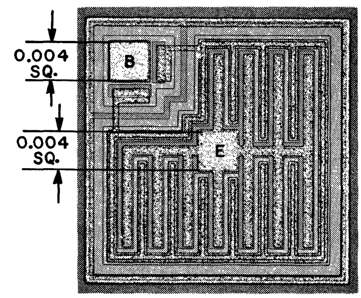
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,744

Process BNB
NPN Darlington Transistor

Process BNB is a double-diffused epitaxial planar NPN silicon Darlington pair. It is designed for use in high-gain, high-current amplifier circuits. Its complement is the PNP Process BOB Darlington transistor.



BNB 0.031″ × 0.031″

ABSOLUTE MAXIMUM RATINGS

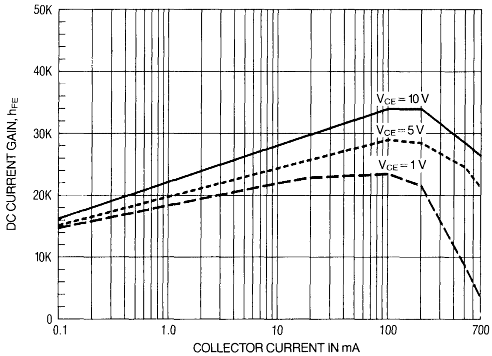
Collector Current, I_C .... 1000 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	40	80	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	10	14	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	100	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 40\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 10\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	22k	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	—	30k	—	—
		$V_{CE} = 5.0\,V$, $I_C = 200\,mA$	—	28k	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 0.01\,mA$	—	0.71	1.0	V
		$I_C = 200\,mA$, $I_B = 0.2\,mA$	—	0.8	1.2	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 200\,mA$, $I_B = 0.2\,mA$	—	1.5	2.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	100	190	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	1.4	6.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 1.0\,V$, $f = 1.0\,MHz$	—	5.0	10	pF

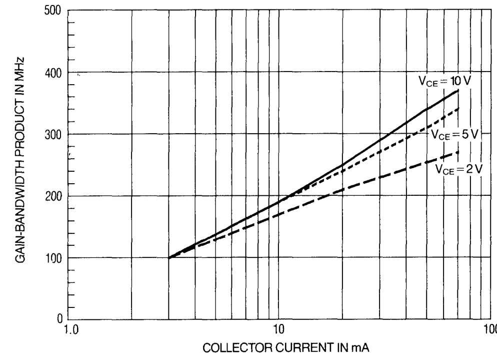
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



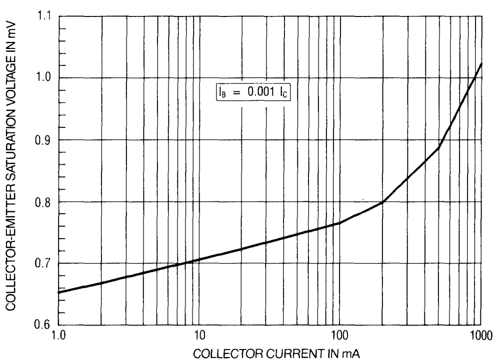
Dwg No. A-13,747

f_T AS A FUNCTION OF COLLECTOR CURRENT



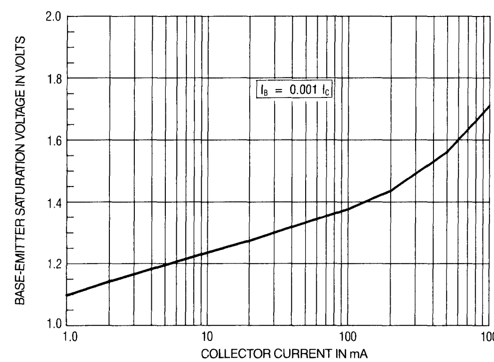
Dwg. No. A-13,749

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



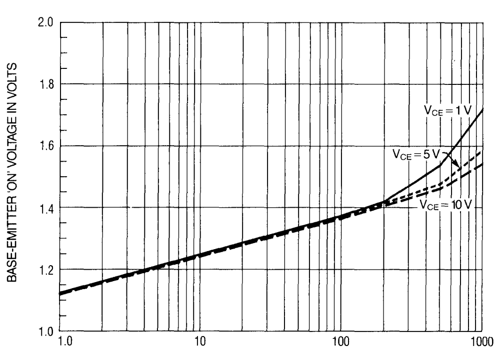
Dwg. No. A-13,750

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



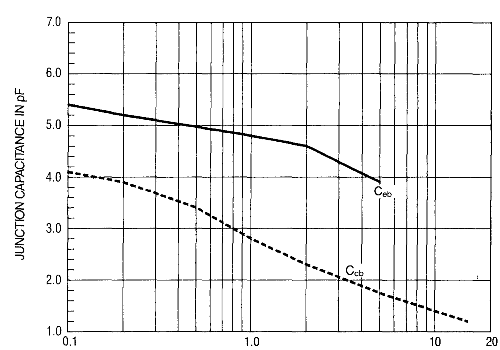
Dwg. No. A-13,751

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,752

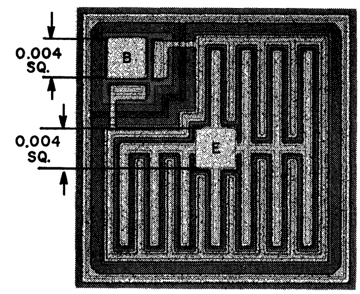
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,748

Process BOB
PNP Darlington Transistor

Process BOB is a PNP silicon epitaxial planar Darlington pair. It is designed for use in high-current, high-gain amplifier applications. Its NPN complement is the Process BNB Darlington transistor.



BOB 0.031″ × 0.031″

ABSOLUTE MAXIMUM RATINGS

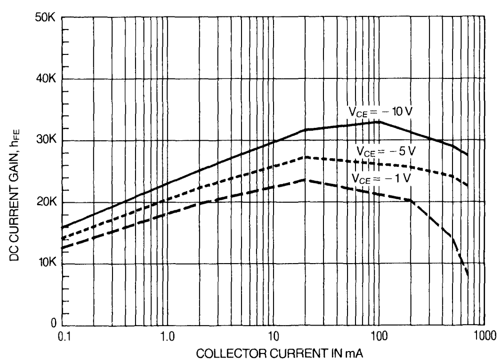
Collector Current, I_C .... 1000 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits			Units
			Min.	Typ.	Max.	
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	85	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	30	60	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	12	16	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 50\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 10\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	20k	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	3k	25k	60k	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	3k	25k	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 0.01\,mA$	—	0.70	1.0	V
		$I_C = 100\,mA$, $I_B = 0.1\,mA$	—	0.76	1.2	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 0.1\,mA$	—	1.4	1.6	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 20\,mA$	100	200	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	2.3	8.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 1.0\,V$, $f = 1.0\,MHz$	—	3.7	10	pF

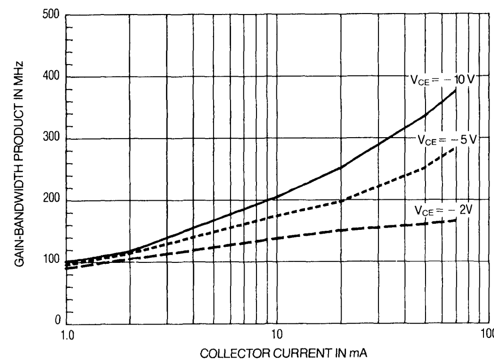
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



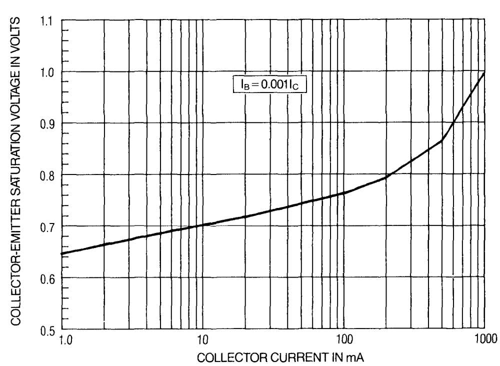
Dwg. No. A-13,758

f_T AS A FUNCTION OF COLLECTOR CURRENT



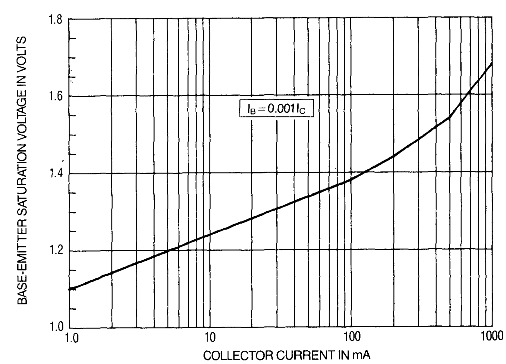
Dwg. No. A-13,754

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



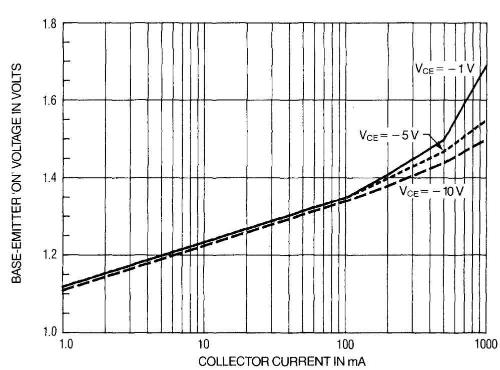
Dwg. No. A-13,756

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



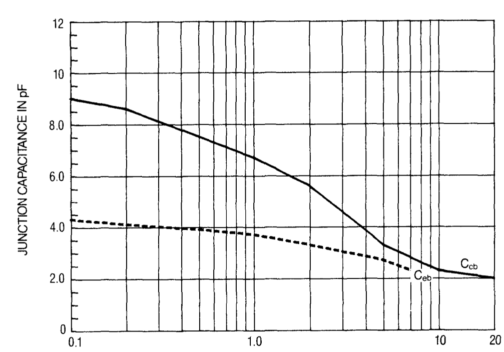
Dwg. No. A-13,755

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



DWg. No. A-13,757

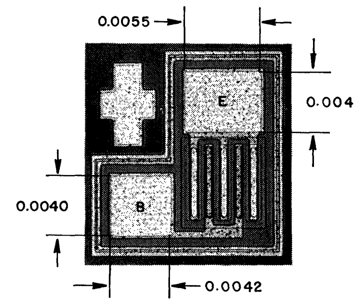
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,753

Process BTB
PNP Switching Transistor

The Process BTB transistor is a double-diffused epitaxial planar device with a gold diffusion. It is primarily used in general-purpose switching and amplifier circuits. Its NPN complement is the Process FFB transistor.



BTB 0.016″ × 0.017″

ALTERNATE PROCESS: SMN

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C . . . . 200 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

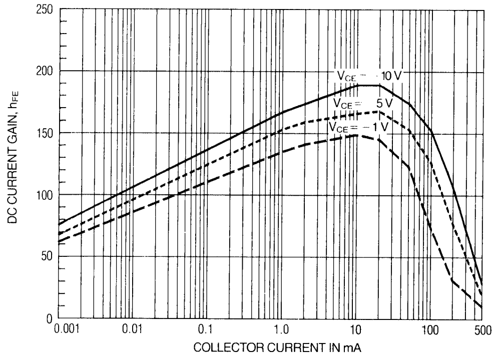
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	60	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.2	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	40	75	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 40\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0\,V$, $I_C = 1.0\,mA$	—	135	—	—
		$V_{CE} = 1.0\,V$, $I_C = 10\,mA$	50	170	500	—
		$V_{CE} = 1.0\,V$, $I_C = 50\,mA$	20	130	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.06	0.25	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.11	0.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.85	0.95	V
Gain-Bandwidth Product	f_T	$V_{CE} = 20\,V$, $I_C = 10\,mA$	250	650	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	2.1	4.5	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	6.5	10	pF
Noise Figure	NF	$V_{CE} = 5.0\,V$, $I_C = 100\,\mu A$, $R_S = 1\,k\Omega$, BW = 10 Hz-15.7 kHz	—	1.0	5.0	dB
Delay Time*	t_d	$V_{CC} = 3.0\,V$, $I_C = 10\,mA$,	—	18	35	ns
Rise Time*	t_r	$I_B = 1.0\,mA$	—	14	35	ns
Storage Time*	t_s	$V_{CC} = 3.0\,V$, $I_C = 10\,mA$,	—	150	225	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 1.0\,mA$	—	22	75	ns

*Switching speeds measured at 2N3906 test conditions.

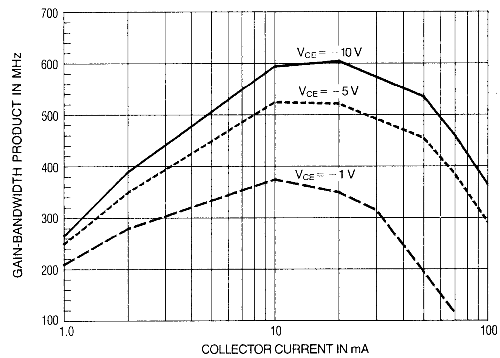
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



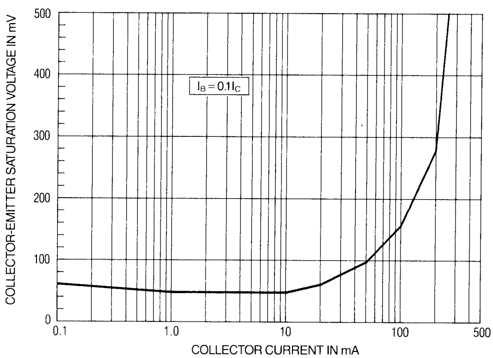
Dwg. No. A-14, 113

f_T AS A FUNCTION OF COLLECTOR CURRENT



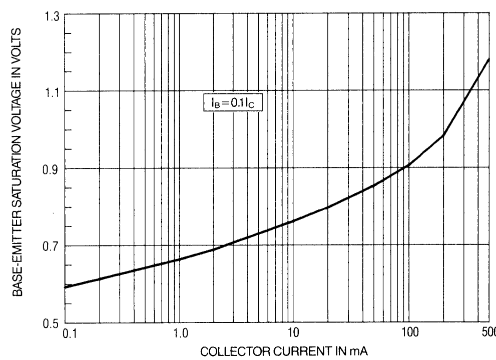
Dwg. No. A-14, 112

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



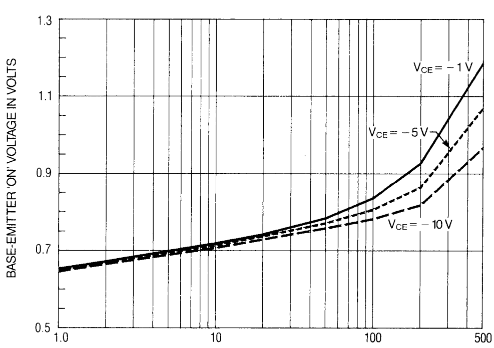
Dwg. NO. A-14, 116

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



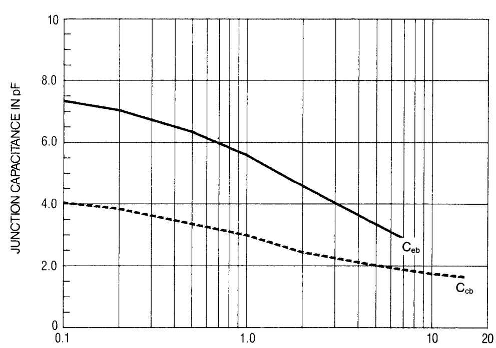
Dwg. No. A-14, 114

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-14, 115

JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



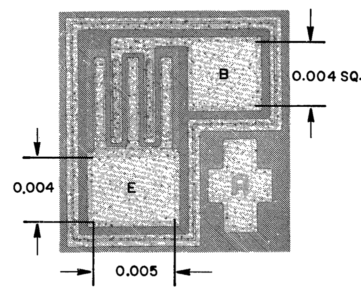
Dwg. No. A-14, 111

Process BXE
PNP Small-Signal Transistor

Process BXE is a double-diffused PNP epitaxial planar silicon transistor designed for use in general-purpose amplifier and switching applications. Its NPN complement is Process FEE.

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 200 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C



BXE 0.016″ × 0.017″

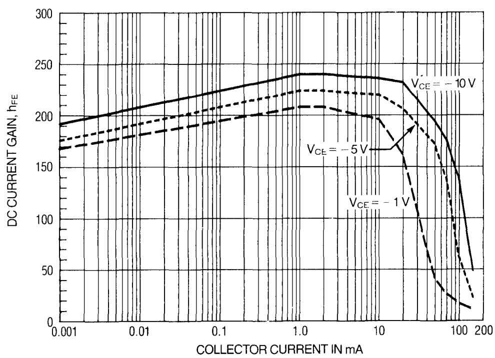
ALTERNATE PROCESS: SLL

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	100	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	115	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	220	—	—
		$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	220	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	220	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.07	0.3	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.14	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.9	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	100	200	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	1.8	4.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	7.2	16	pF
Noise Figure	NF	$V_{CE} = 5.0\,V$, $I_C = 10\,\mu A$, $R_S = 10\,k\Omega$, BW = 10 Hz–15.7 kHz	—	0.5	3.0	dB

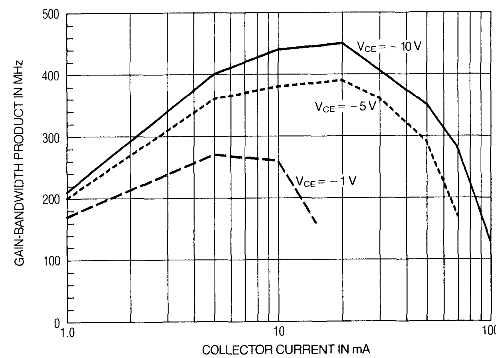
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



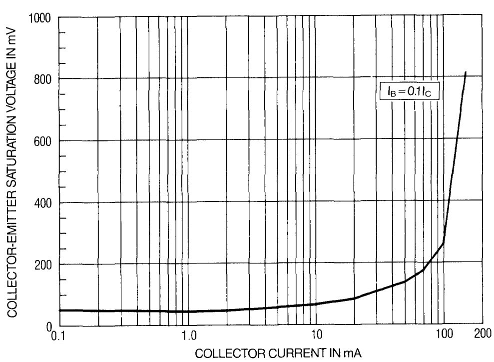
Dwg. No. A-13,759

f_T AS A FUNCTION OF COLLECTOR CURRENT



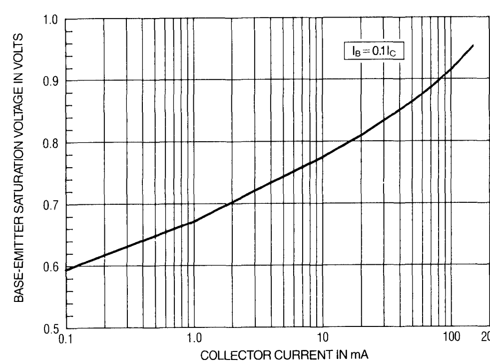
Dwg. NO. A-13,761

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



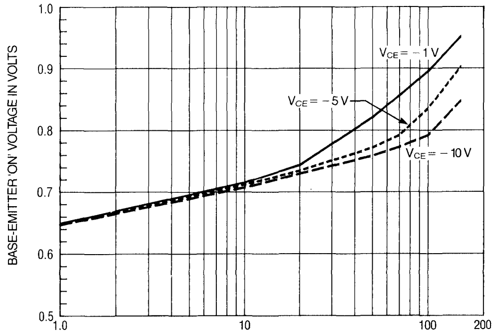
Dwg No. A-13,762

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



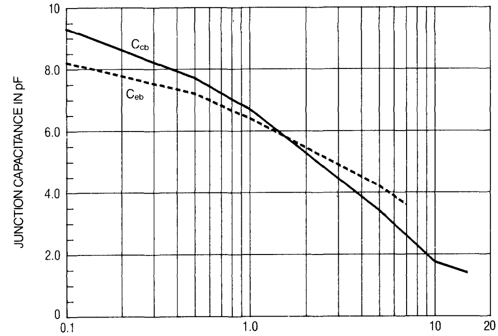
Dwg. No. A-13,763

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,764

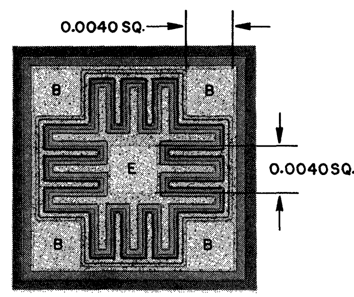
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg No. A-13,760

Process DAC
NPN Small-Signal Transistor

Process DAC is a double-diffused NPN silicon epitaxial planar device. It is designed for use in high-current switching and general-purpose amplifier applications.



DAC 0.024″ × 0.024″

ALTERNATE PROCESS: JLA

ABSOLUTE MAXIMUM RATINGS

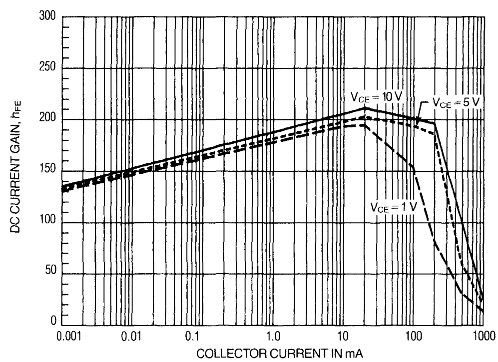
Collector Current, I_C . . . . 800 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	100	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.3	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	120	200	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 100V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0V,\ I_C = 1.0\,mA$	—	180	—	—
		$V_{CE} = 5.0V,\ I_C = 100\,mA$	80	190	500	—
		$V_{CE} = 5.0V,\ I_C = 500\,mA$	20	60	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA,\ I_B = 10\,mA$	—	0.07	0.25	V
		$I_C = 500\,mA,\ I_B = 50\,mA$	—	0.23	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA,\ I_B = 50\,mA$	—	0.95	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0V,\ I_C = 50\,mA$	150	300	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10V,\ f = 1.0\,MHz$	—	6.0	20	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5V,\ f = 1.0\,MHz$	—	50	80	pF

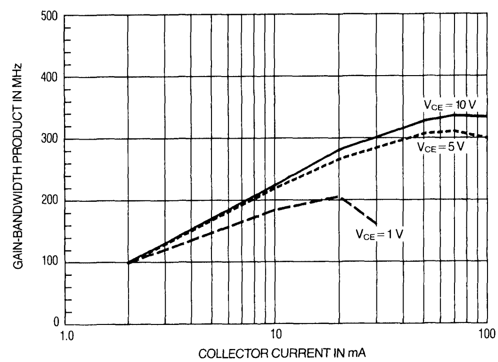
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



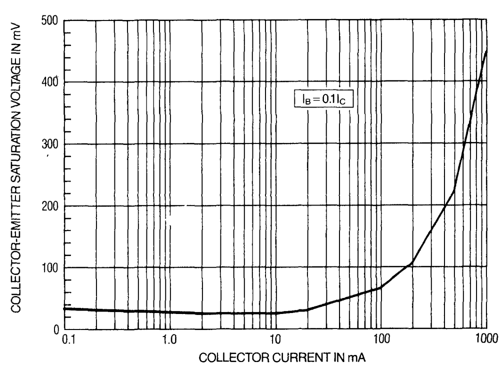
Dwg. No. A-13,769

f_T AS A FUNCTION OF COLLECTOR CURRENT



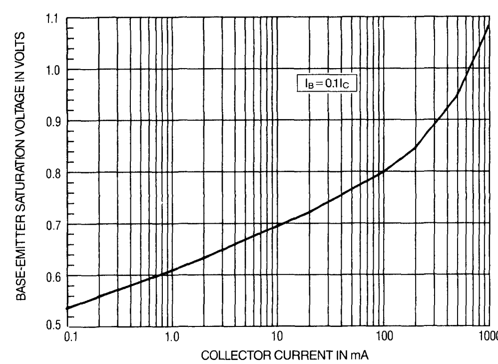
Dwg. No. A-13,766

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



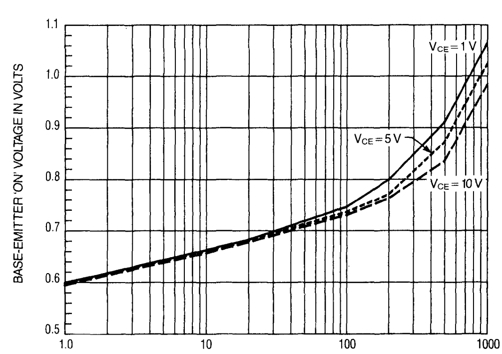
Dwg No. A-13,767

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



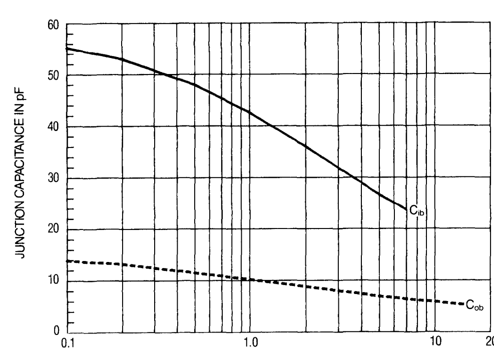
Dwg. No. A-13,768

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,770

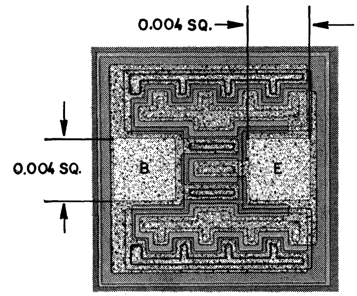
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,765

Process DCA
NPN Small-Signal Transistor

Process DCA is a double-diffused NPN silicon epitaxial device. It is primarily used in general-purpose amplifier and medium-power switching applications. Its complement is the PNP Process DDA transistor.



DCA 0.019″ × 0.019″

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C . . . . 500 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

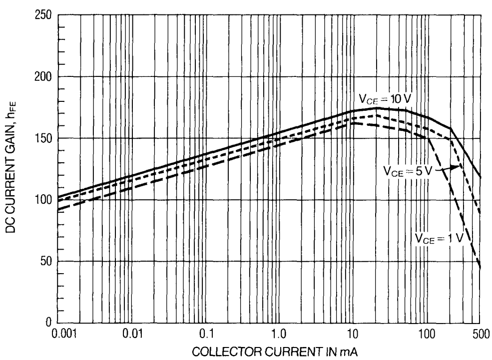
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	20	55	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.1	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	70	110	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0\,V$, $I_C = 0.1\,mA$	—	150	—	—
		$V_{CE} = 1.0\,V$, $I_C = 10\,mA$	50	160	600	—
		$V_{CE} = 1.0\,V$, $I_C = 100\,mA$	30	150	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.1	0.3	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.3	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	1.0	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 20\,mA$	250	300	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	4.0	8.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	24	30	pF
Delay Time*	t_d	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	10	10	ns
Rise Time*	t_r	$I_B = 15\,mA$	—	13	25	ns
Storage Time*	t_s	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	200	225	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 15\,mA$	—	24	60	ns

*Switching speeds measured at 2N2222A test conditions.

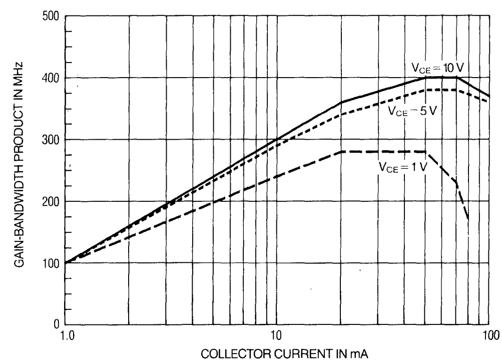
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



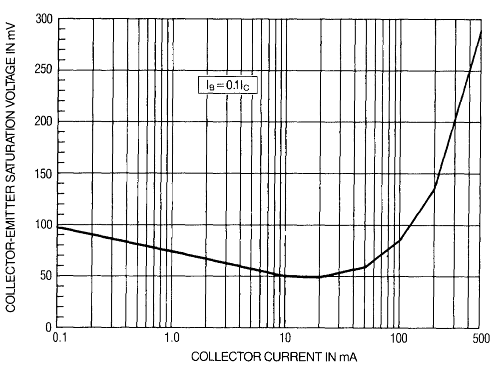
Dwg. No. A-13,771

f_T AS A FUNCTION OF COLLECTOR CURRENT



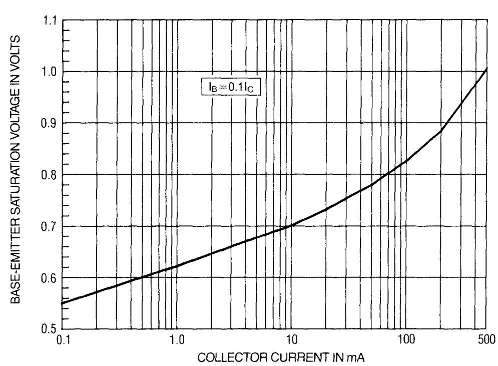
Dwg. No. A-13,773

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



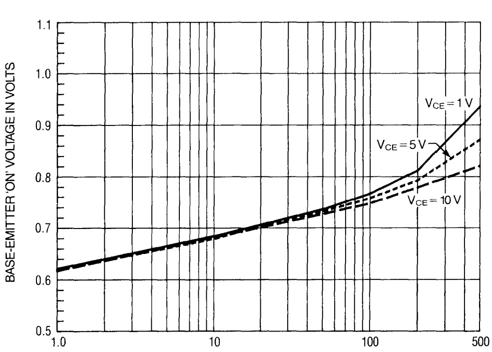
Dwg. No. A-13,774

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



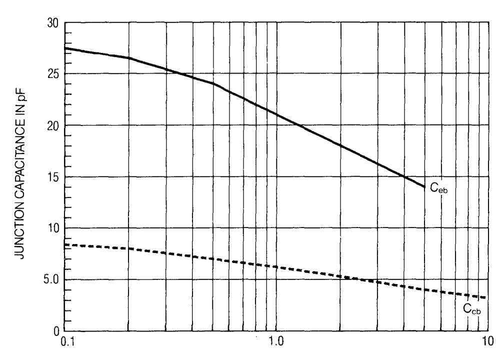
Dwg. No. A-13,775

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,776

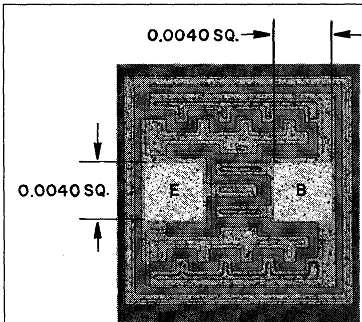
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,772

Process DDA
PNP Small-Signal Transistor

Process DDA is a double-diffused epitaxial planar silicon PNP transistor. It is designed for use as a low-noise, high-gain amplifier or as a medium-power switch. Its complement is the NPN Process DCA.



DDA 0.019″ × 0.019″

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C . . . . 500 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

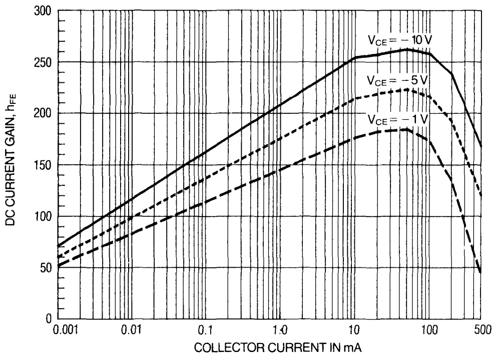
ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	50	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	30	60	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 30\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	140	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	30	210	660	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	30	210	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.1	0.4	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.35	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	1.1	1.3	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 20\,mA$	150	370	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	5.0	8	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	20	30	pF
Delay Time*	t_d	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	5.0	15	ns
Rise Time*	t_r	$I_B = 15\,mA$	—	13	20	ns
Storage Time*	t_s	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	150	225	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 15\,mA$	—	25	30	ns

*Switching speeds measured at 2N4403 test conditions.

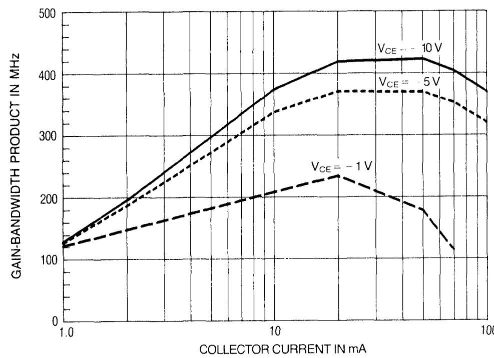
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT

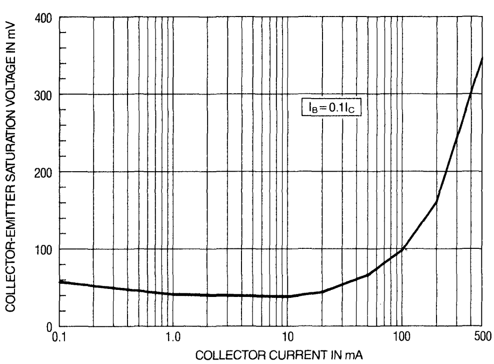


Dwg. No. A-13,780

f_T AS A FUNCTION OF COLLECTOR CURRENT

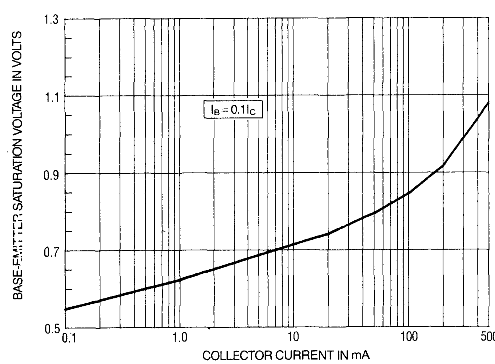


$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



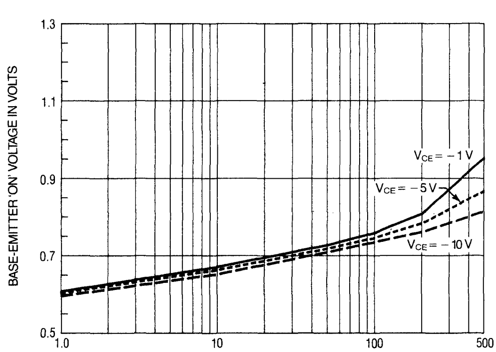
Dwg. No. A-13,781

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



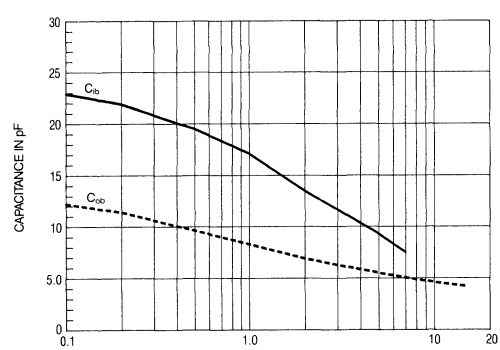
Dwg. No. A-13,782

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,778

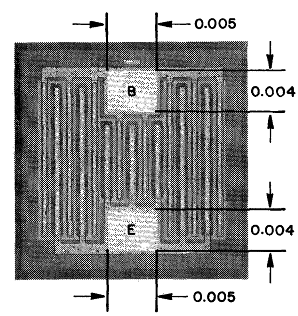
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,777

Process DFC
PNP Small-Signal Transistor

Process DFC is a PNP silicon double-diffused epitaxial planar device designed primarily to be used in medium-power amplifier and switching circuits.



DFC 0.027″ × 0.027″

ALTERNATE PROCESSES: BFA, JMA

ABSOLUTE MAXIMUM RATINGS

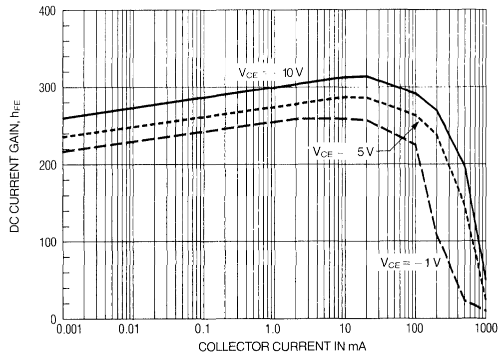
Collector Current, I_C . . . . 800 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	50	90	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.2	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	110	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 70\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0\,V$, $I_C = 1.0\,mA$	—	250	—	—
		$V_{CE} = 1.0\,V$, $I_C = 10\,mA$	—	260	—	—
		$V_{CE} = 1.0\,V$, $I_C = 100\,mA$	—	220	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.09	0.30	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.29	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$; $I_B = 50\,mA$	—	1.0	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	150	250	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	7.3	15	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	42	55	pF

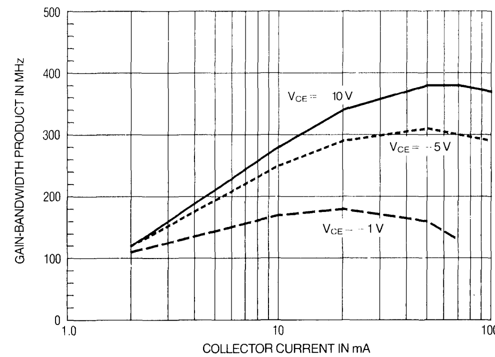
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



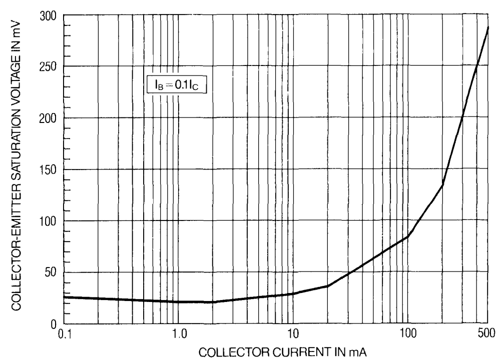
Dwg. No. A-13,783

f_T AS A FUNCTION OF COLLECTOR CURRENT



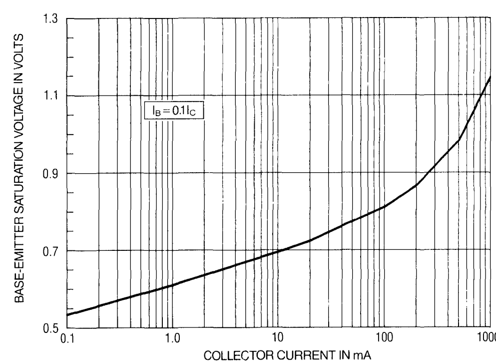
Dwg. No. A-13,785

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



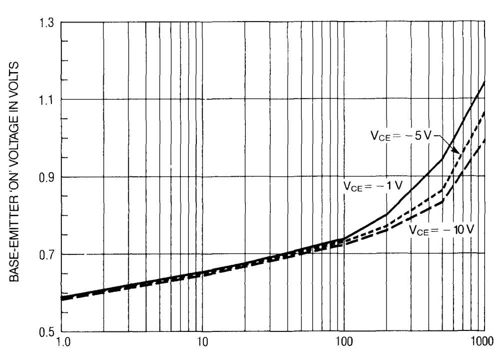
Dwg. No. A-13,786

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



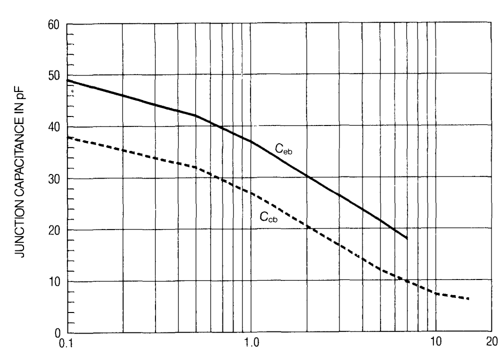
Dwg. No. A-13,787

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,788

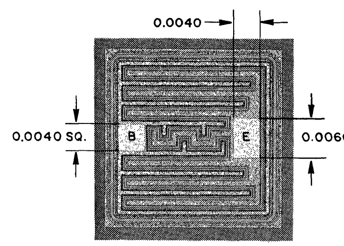
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,784

Process DID
NPN Small-Signal Transistor

Designed for general-purpose switch and amplifier applications, the Process DID NPN transistor operates at collector currents of up to 1 A. This double-diffused silicon epitaxial planar device is half of an NPN/PNP pair complemented by the Sprague Electric Process DJC transistor.



DID 0.030″ × 0.030″

ALTERNATE PROCESS: YCA

ABSOLUTE MAXIMUM RATINGS

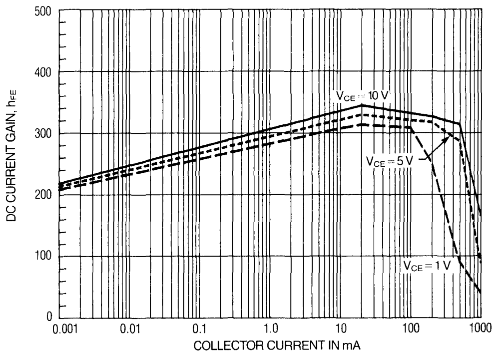
Collector Current, I_C . . . . 1000 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	70	95	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.1	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	90	150	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	300	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	50	310	400	—
		$V_{CE} = 5.0\,V$, $I_C = 500\,mA$	—	280	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.05	0.2	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.15	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.76	0.8	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	150	280	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	8.0	30	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	100	150	pF

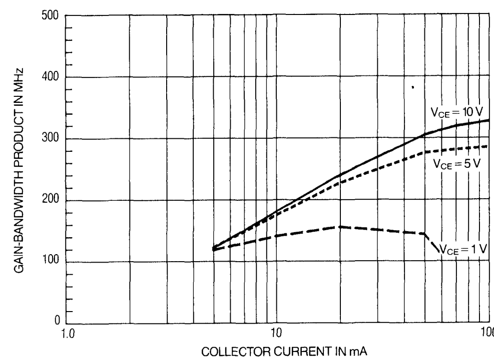
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



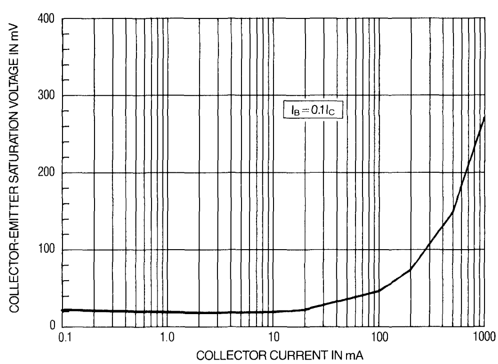
Dwg. No. A-13,794

f_T AS A FUNCTION OF COLLECTOR CURRENT



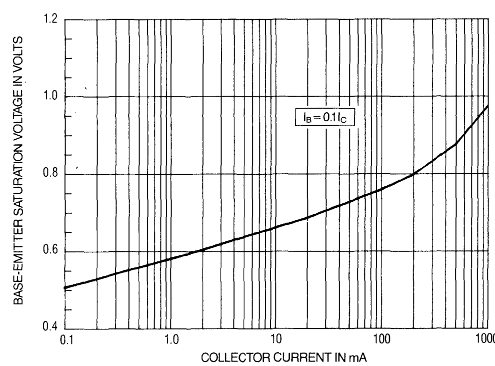
Dwg. No. A-13,789

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



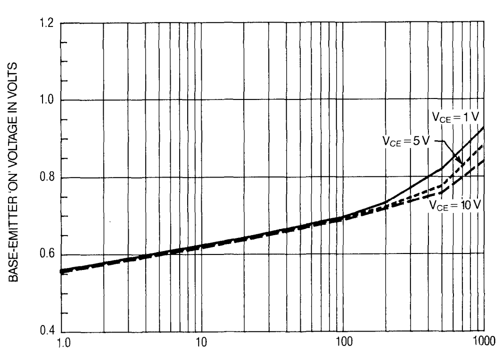
Dwg. No. A-13,792

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



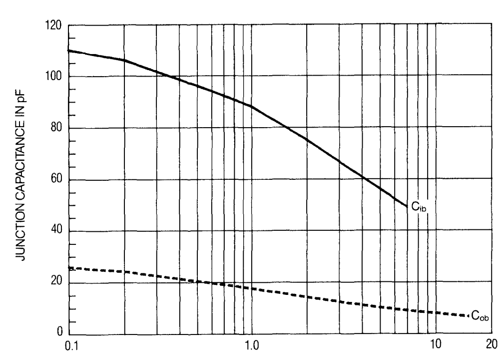
Dwg No. A-13,791

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,793

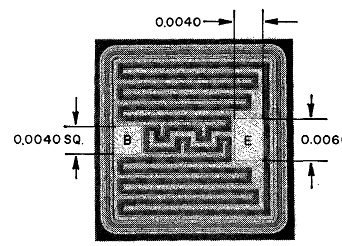
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,790

Process DJC
PNP Small-Signal Transistor

Designed for general-purpose switch and amplifier applications, the Process DJC PNP transistor operates at collector currents of up to 1A. This double-diffused silicon epitaxial planar device is half of an NPN/PNP pair complemented by the Sprague Electric Process DID transistor.



DJC 0.030″ × 0.030″

ALTERNATE PROCESS: YDA

ABSOLUTE MAXIMUM RATINGS

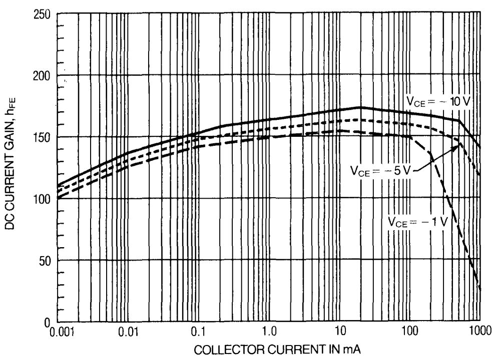
Collector Current, I_C .... 1000 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	105	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.3	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	100	140	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 100\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	150	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	50	160	500	—
		$V_{CE} = 5.0\,V$, $I_C = 500\,mA$	25	145	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.075	0.2	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.23	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.9	1.1	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 50\,mA$	100	220	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	13	30	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	100	110	pF

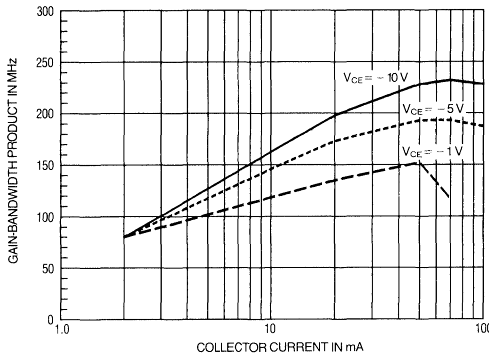
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



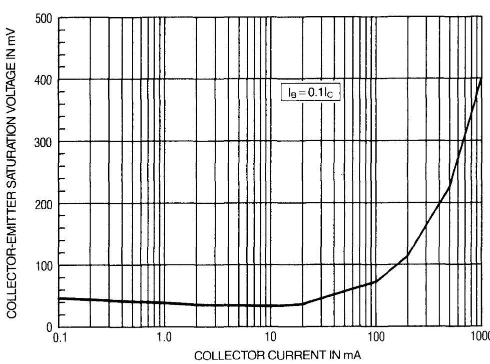
Dwg. No. A-13,797

f_T AS A FUNCTION OF COLLECTOR CURRENT



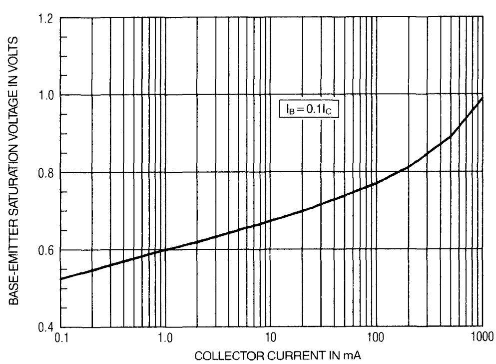
Dwg. No. A-13,798

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



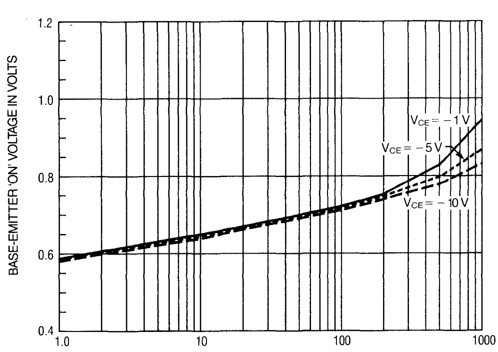
Dwg. No. A-13,795

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



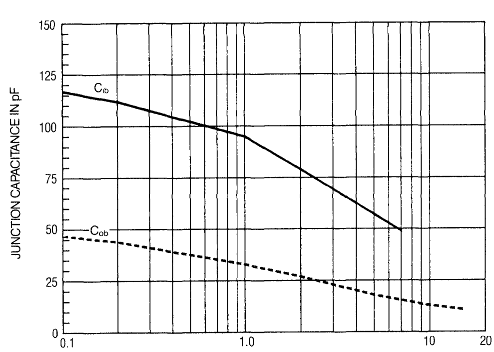
Dwg. No. A-13,796

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,800

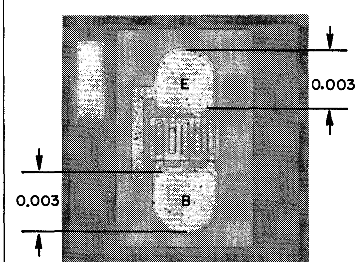
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,799

Process DLA
NPN Small-Signal Transistor

Process DLA is a double-diffused NPN silicon epitaxial planar device designed for use in UHF amplifiers, mixers and oscillators.



DLA 0.015″ × 0.015″

ABSOLUTE MAXIMUM RATINGS

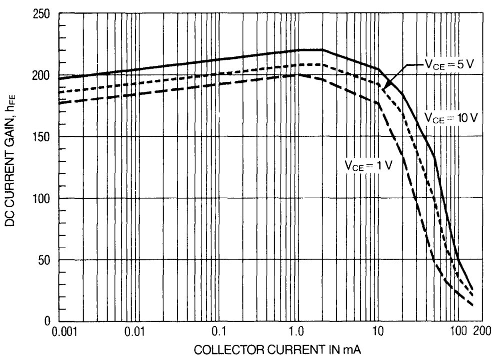
Collector Current, I_C .... 50 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	15	28	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	5.0	5.7	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	30	45	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 30\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 4.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0\,V$, $I_C = 0.1\,mA$	—	200	—	—
		$V_{CE} = 1.0\,V$, $I_C = 10\,mA$	—	180	—	—
		$V_{CE} = 1.0\,V$, $I_C = 50\,mA$	—	50	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.09	0.4	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.27	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.94	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 10\,mA$	600	1000	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	0.65	1.7	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	0.8	2.0	pF

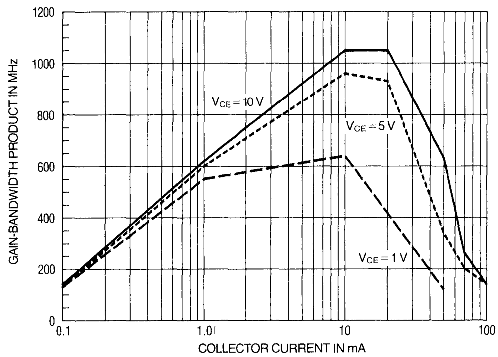
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



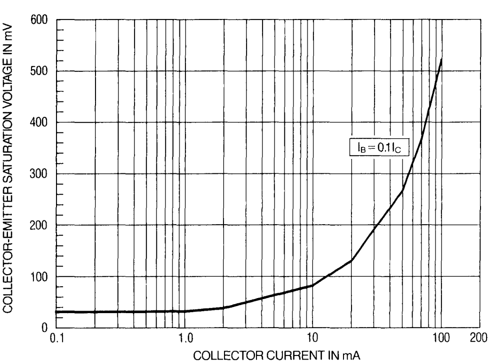
Dwg. No. A-13, 801

f_T AS A FUNCTION OF COLLECTOR CURRENT



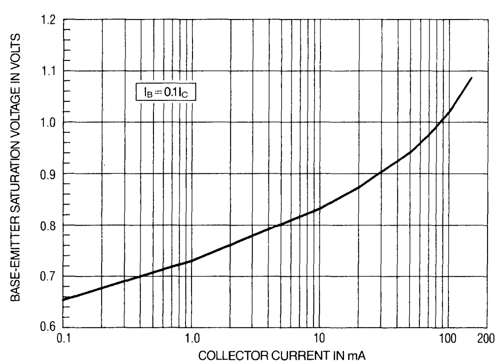
Dwg. No. A-13, 806

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



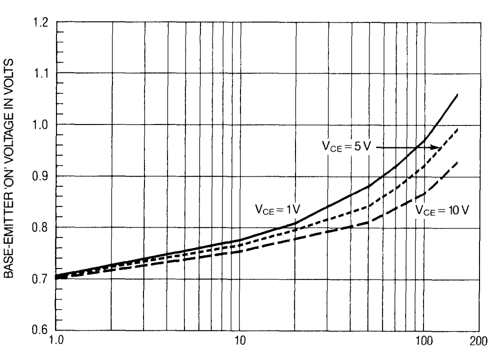
Dwg. No. A-13, 804

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



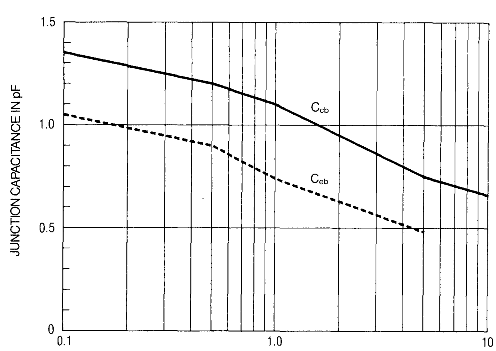
Dwg. No. A-13, 803

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg No. A-13, 802

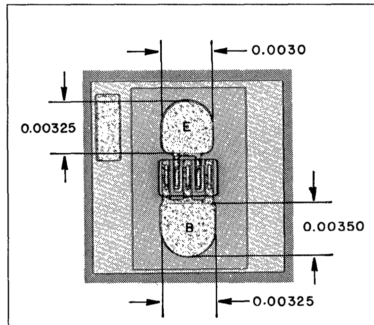
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg No A-13, 805

Process DMA
NPN Small-Signal Transistor

Process DMA is a double-diffused NPN silicon epitaxial planar device designed for use in VHF and UHF amplifiers, mixers, and oscillators.



ABSOLUTE MAXIMUM RATINGS

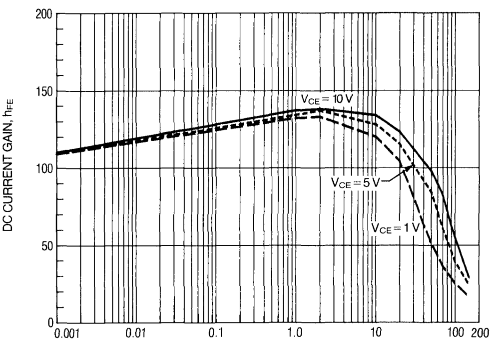
Collector Current, I_C . . . . 50 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10$ mA	15	27	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\ \mu A$	5.0	5.7	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\ \mu A$	30	45	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 30$ V	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 4.0$ V	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0$ V, $I_C = 0.1$ mA	—	120	—	—
		$V_{CE} = 1.0$ V, $I_C = 10$ mA	30	120	300	—
		$V_{CE} = 1.0$ V, $I_C = 50$ mA	20	50	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10$ mA, $I_B = 1.0$ mA	—	0.09	0.4	V
		$I_C = 50$ mA, $I_B = 5.0$ mA	—	0.28	1.0	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 10$ mA, $I_B = 1.0$ mA	—	0.85	1.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10$ V, $I_C = 10$ mA	600	900	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10$ V, f = 1.0 MHz	—	0.7	1.7	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5$ V, f = 1.0 MHz	—	0.9	2.0	pF

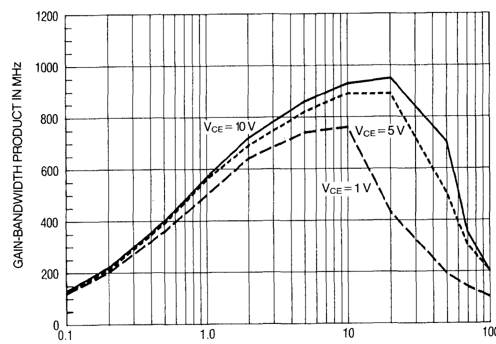
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



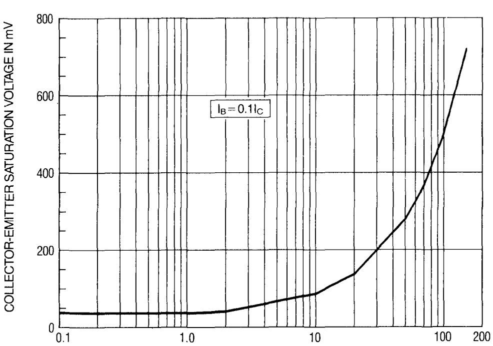
Dwg. No. A-13, 811

f_T AS A FUNCTION OF COLLECTOR CURRENT



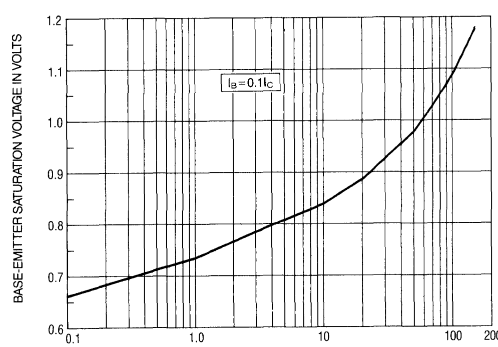
Dwg. No. A-13, 808

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



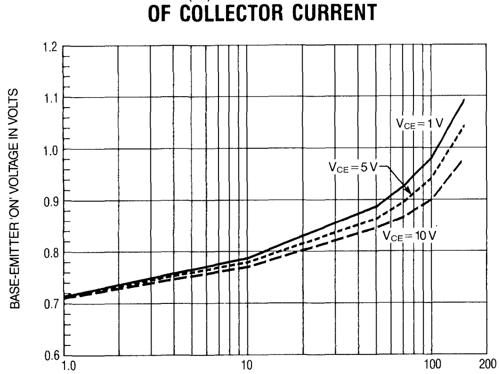
Dwg. No. A-13, 809

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



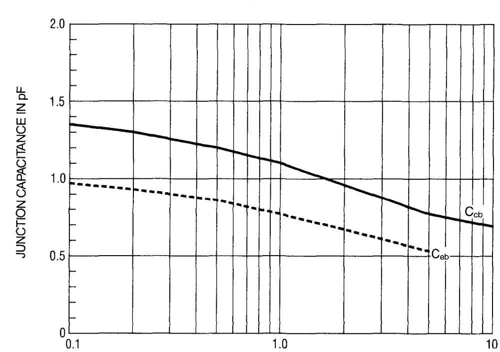
Dwg. No. A-13, 810

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 812

JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



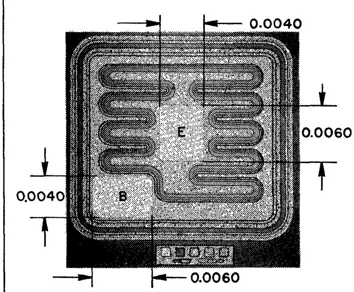
Dwg. No. A-13, 807

Process DSA
NPN Small-Signal Transistor

Process DSA is an NPN silicon double-diffused epitaxial planar device designed for use in high-current, high-frequency applications.

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C . . . . 1000 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C



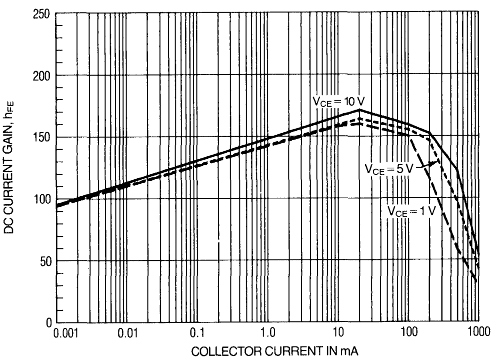
DSA 0.024″ × 0.026″

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	40	90	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	9.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	140	220	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 140V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0V$, $I_C = 1.0\,mA$	—	140	—	—
		$V_{CE} = 5.0V$, $I_C = 100\,mA$	80	150	—	—
		$V_{CE} = 5.0V$, $I_C = 500\,mA$	20	100	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.07	0.25	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.21	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.97	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0V$, $I_C = 50\,mA$	100	130	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10V$, $f = 1.0\,MHz$	—	5.0	20	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5V$, $f = 1.0\,MHz$	—	50	80	pF

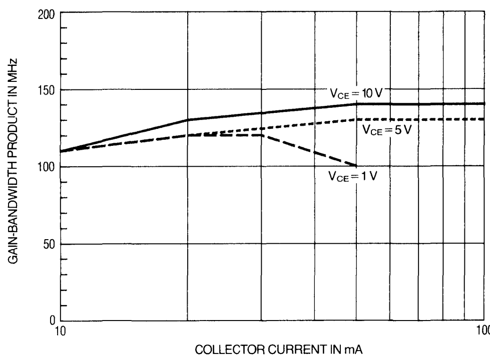
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



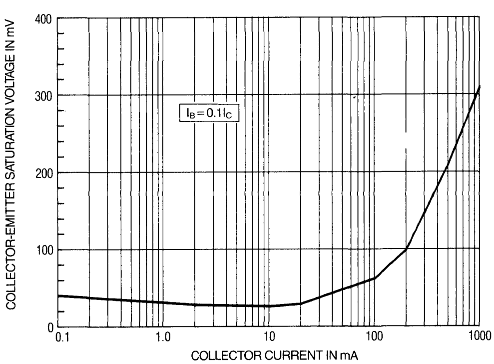
Dwg. No. A-13, 818

f_T AS A FUNCTION OF COLLECTOR CURRENT



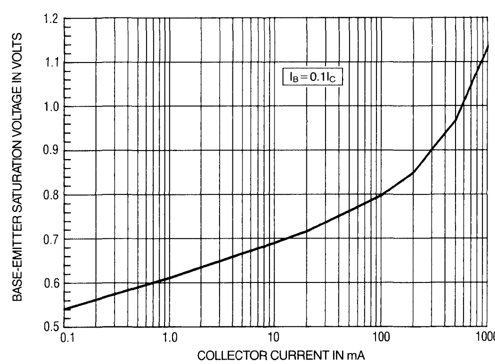
Dwg. No. A-13, 814

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



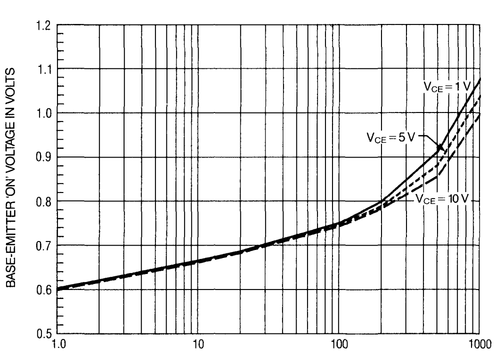
Dwg. No. A-13, 815

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



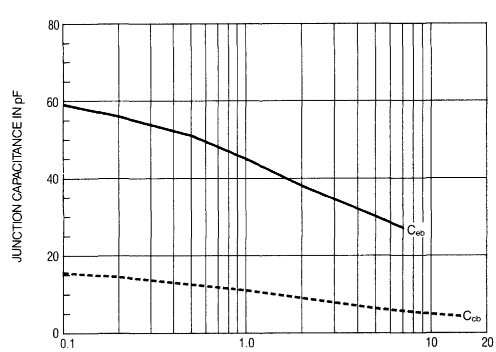
Dwg. No. A-13, 816

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 817

JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



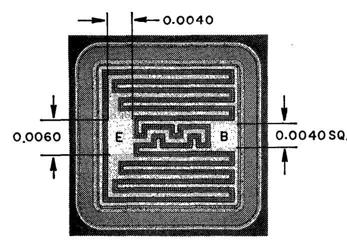
Dwg. No. A-13, 813

Process DVA
NPN High-Voltage Transistor

Process DVA is a double-diffused epitaxial planar NPN silicon device designed primarily for use in video circuits and other high-voltage, low-circuit applications.

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C . . . . 500 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C



DVA 0.034″×0.034″

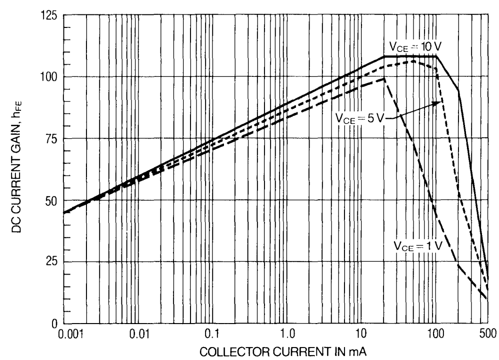
ALTERNATE PROCESS: BLA

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	200	300	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	9.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	220	360	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 200\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 10\,V$, $I_C = 1.0\,mA$	—	80	—	—
		$V_{CE} = 10\,V$, $I_C = 10\,mA$	25	95	—	—
		$V_{CE} = 10\,V$, $I_C = 50\,mA$	20	100	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.06	0.12	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.07	0.16	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.75	1.00	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 10\,mA$	40	80	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	5.6	20	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	100	150	pF

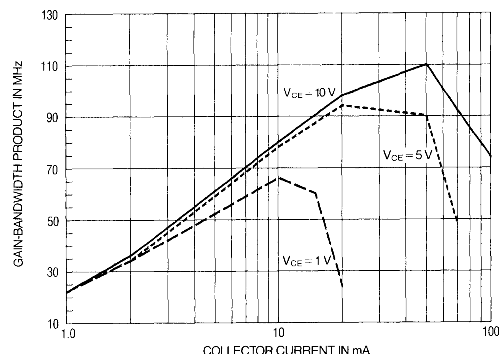
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



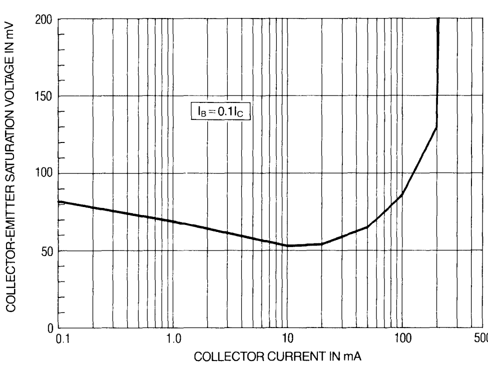
Dwg. NO. A-14,070

f_T AS A FUNCTION OF COLLECTOR CURRENT



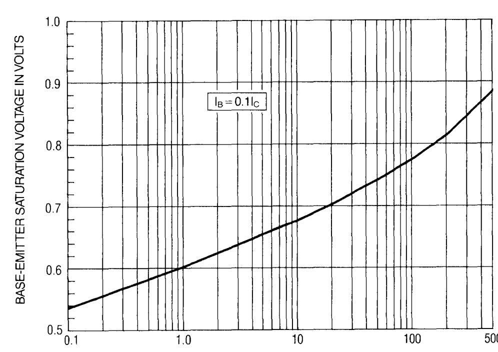
Dwg. No. A-14,066

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



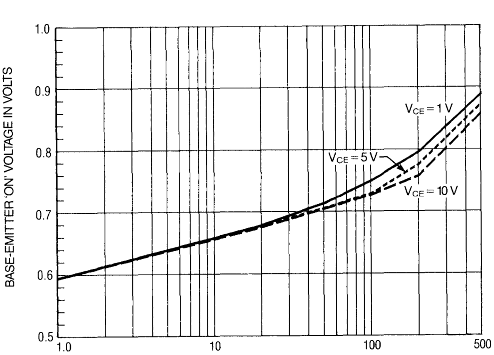
Dwg. No. A-14,067

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



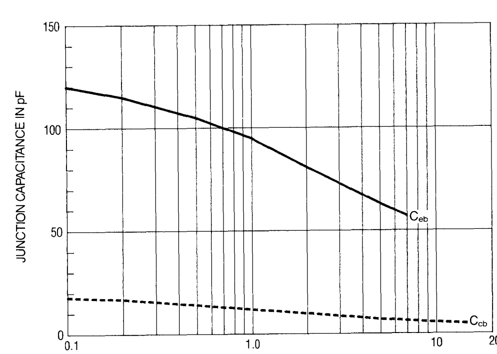
Dwg. NO. A-14,068

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-14,069

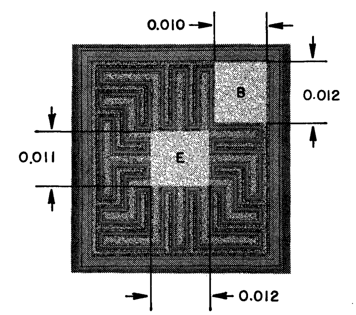
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,065

Process FAA
PNP High-Power Transistor

Process FAA is a double-diffused epitaxial planar PNP silicon device designed as a high-speed, high-current switch and for use in other high-power applications.



FAA 0.045″ × 0.049″

ABSOLUTE MAXIMUM RATINGS

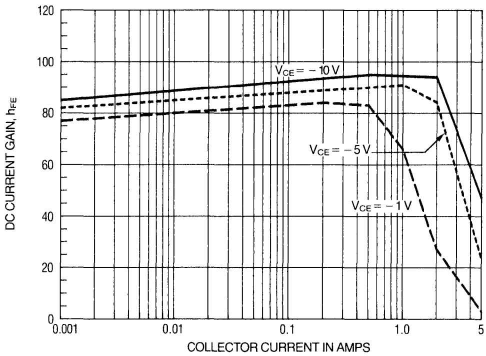
Collector Current, I_C .... 3.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	100	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.6	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	110	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80\,V$	—	—	1000	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	1000	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	—	85	—	—
		$V_{CE} = 5.0\,V$, $I_C = 1.0\,A$	—	90	—	—
		$V_{CE} = 5.0\,V$, $I_C = 2.0\,A$	—	80	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.13	0.5	V
		$I_C = 1.0\,A$, $I_B = 100\,mA$	—	0.23	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 1.0\,A$, $I_B = 100\,mA$	—	0.97	1.5	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	60	130	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	40	120	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	300	1000	pF

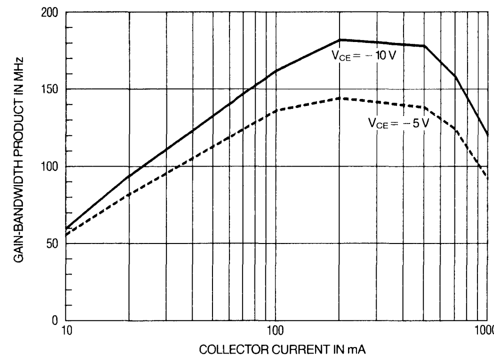
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



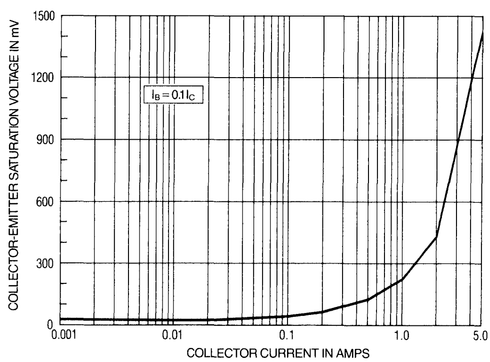
Dwg. No. A-13, 819

f_T AS A FUNCTION OF COLLECTOR CURRENT



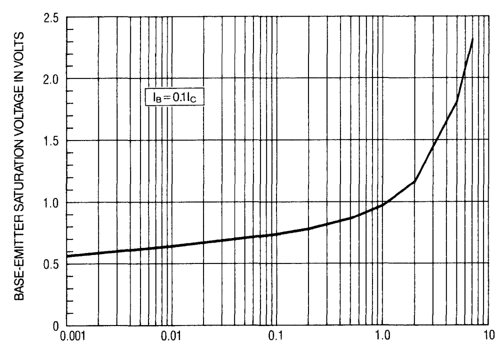
Dwg. No. A-13, 822

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



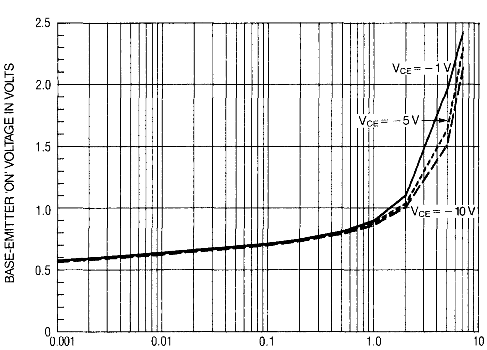
Dwg No. A-13, 823

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



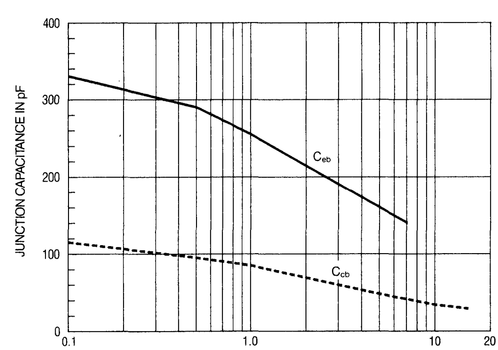
Dwg. No. A-13, 824

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 820

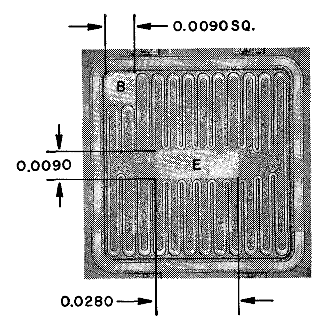
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 821

Process FBB
NPN High-Power Transistor

Process FBB is a double-diffused epitaxial planar NPN silicon device. It is designed for use in power amplifier and switching circuits.



FBB 0.076″ × 0.076″

ABSOLUTE MAXIMUM RATINGS

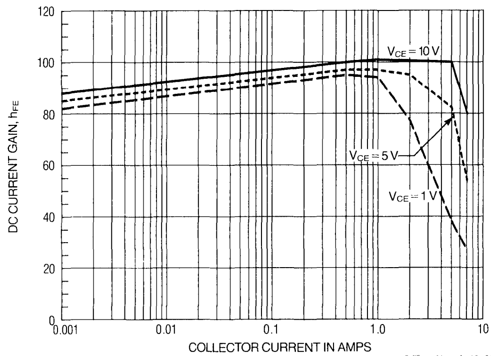
Collector Current, I_C 5.0A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	100	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	5.0	7.5	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	150	220	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 150V$	—	—	1000	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0V$	—	—	1000	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0V, I_C = 100\,mA$	—	95	—	—
		$V_{CE} = 5.0V, I_C = 1.0A$	—	95	—	—
		$V_{CE} = 5.0V, I_C = 2.0A$	—	95	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 500\,mA, I_B = 50\,mA$	—	0.08	0.5	V
		$I_C = 1.0A, I_B = 100\,mA$	—	0.14	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 1.0A, I_B = 100\,mA$	—	0.86	1.2	V
Output Capacitance	C_{cb}	$V_{CB} = 10V, f = 1.0\,MHz$	—	60	300	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5V, f = 1.0\,MHz$	—	960	1000	pF

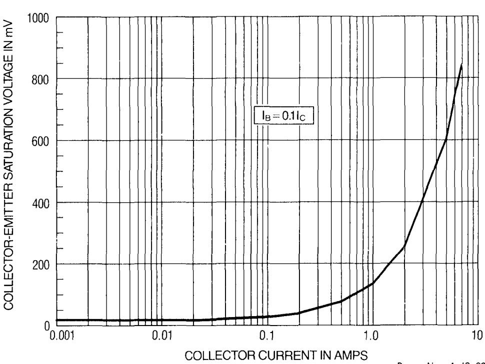
Typical Characteristics at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



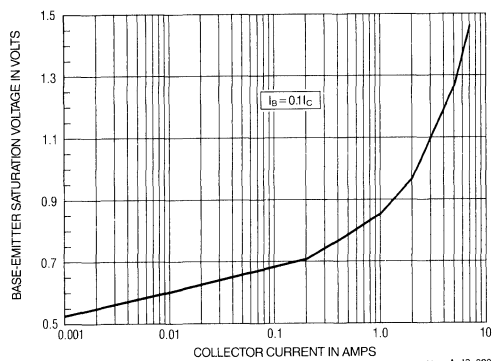
Dwg. No. A-13, 825

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



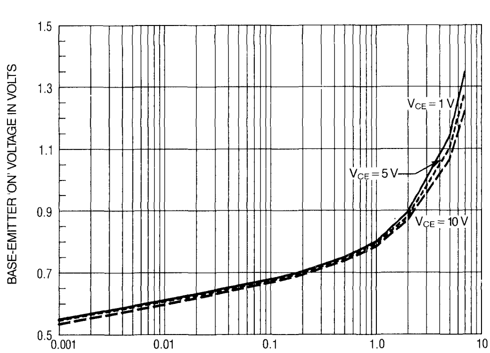
Dwg. No. A-13, 827

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



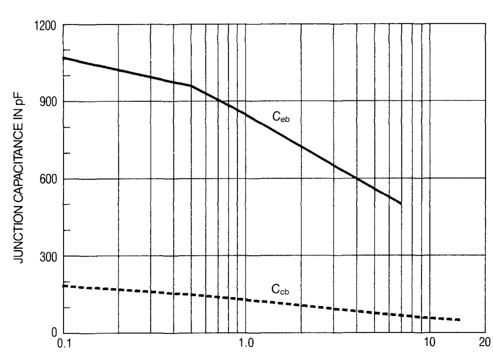
Dwg. No. A-13, 828

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 829

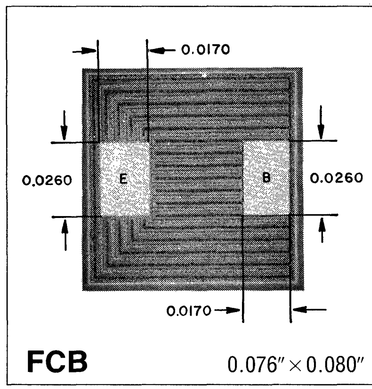
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No A-13, 826

Process FCB
NPN High-Power Transistor

Process FCB is a epitaxial planar NPN silicon transistor. It is designed for use in high-power amplifier and switching circuits. Its complement is the PNP Process FDB transistor.



ABSOLUTE MAXIMUM RATINGS

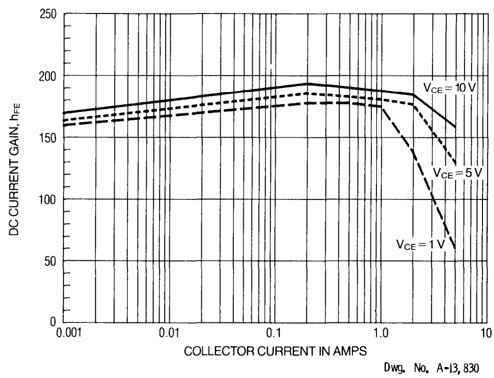
Collector Current, I_C 5.0A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

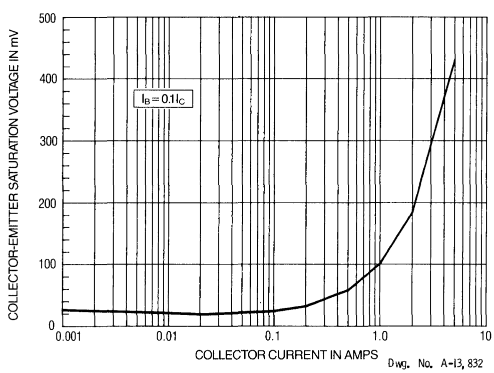
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10mA$	50	90	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu A$	5.0	7.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\mu A$	120	190	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 100V$	—	—	1000	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 4.0V$	—	—	1000	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0V$, $I_C = 100mA$	—	180	—	—
		$V_{CE} = 5.0V$, $I_C = 1.0A$	—	180	—	—
		$V_{CE} = 5.0V$, $I_C = 2.0A$	—	170	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 500mA$, $I_B = 50mA$	—	0.06	—	V
		$I_C = 1.0A$, $I_B = 100mA$	—	0.1	—	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 1.0A$, $I_B = 100mA$	—	0.84	—	V
Output Capacitance	C_{cb}	$V_{CB} = 10V$, $f = 1.0MHz$	—	60	—	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5V$, $f = 1.0MHz$	—	1000	—	pF

Typical Characteristics
at T_A = +25°C

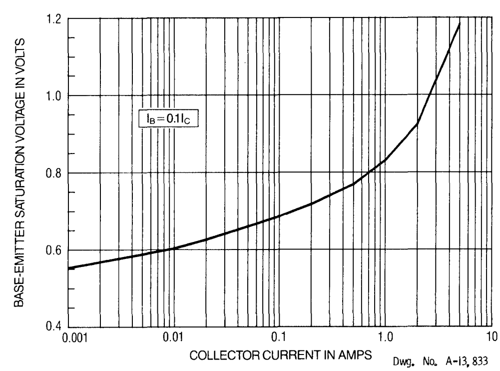
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



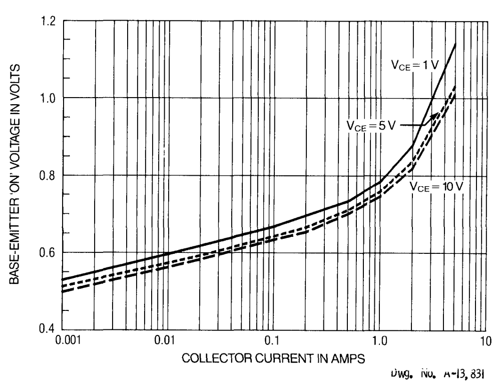
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



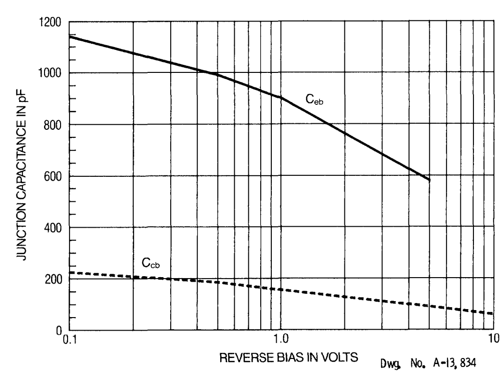
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

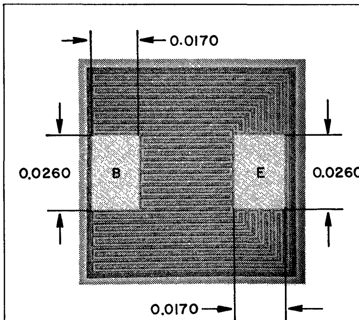


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process FDB
PNP High-Power Transistor

Process FDB is a PNP silicon double-diffused epitaxial planar device designed for use in high-power amplifier and switching circuits. Its NPN complement is the Process FCB transistor.



FDB 0.078″ × 0.080″

ABSOLUTE MAXIMUM RATINGS

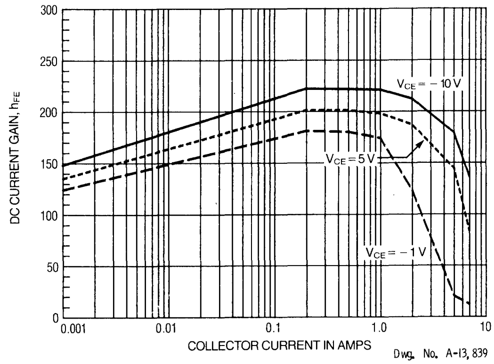
Collector Current, I_C 5.0A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

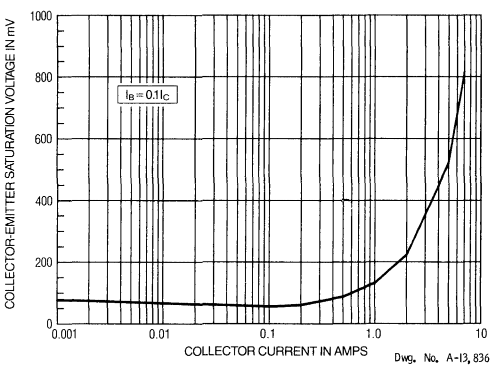
Characteristic	Symbol	Test Conditions	Limits			Units
			Min.	Typ.	Max.	
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10mA$	60	100	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu A$	6.0	7.9	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\mu A$	80	140	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80V$	—	—	1000	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0V$	—	—	1000	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0V$, $I_C = 100mA$	—	190	—	—
		$V_{CE} = 5.0V$, $I_C = 1.0A$	—	200	—	—
		$V_{CE} = 5.0V$, $I_C = 2.0A$	—	185	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 500mA$, $I_B = 50mA$	—	0.09	—	V
		$I_C = 1.0A$, $I_B = 100mA$	—	0.14	—	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 1.0A$, $I_B = 100mA$	—	0.85	—	V
Output Capacitance	C_{cb}	$V_{CB} = 10V$, $f = 1.0MHz$	—	100	300	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5V$, $f = 1.0MHz$	—	900	1000	pF

Typical Characteristics
at T_A = +25°C

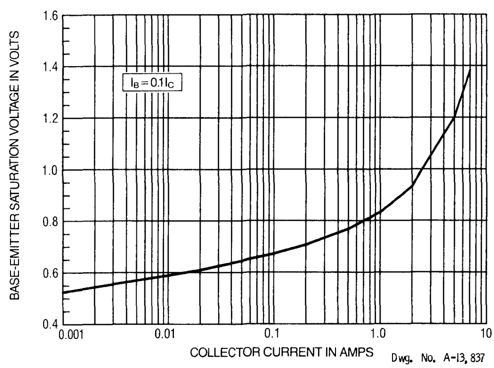
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



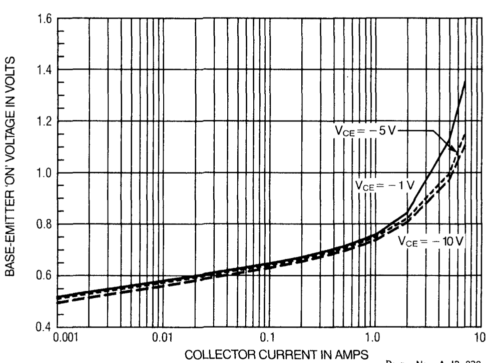
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



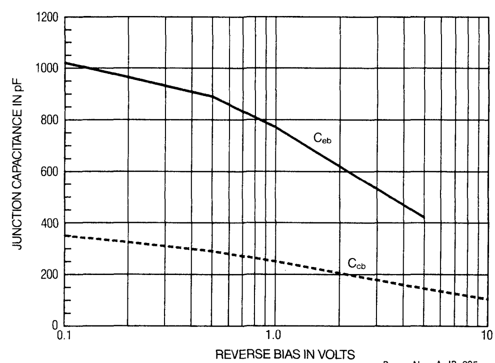
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

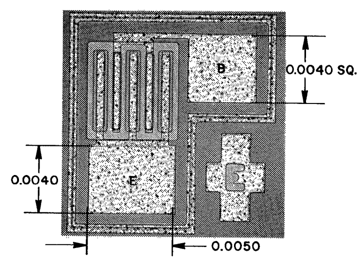


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process FEE
NPN Small-Signal Transistor

The FEE Process results in double-diffused silicon epitaxial planar transistors intended for use in AM radio, IF, and converter applications. It also finds wide use as an audio driver, high-level video amplifier, and in operational amplifier output stages.



ALTERNATE PROCESS: BAA

ABSOLUTE MAXIMUM RATINGS

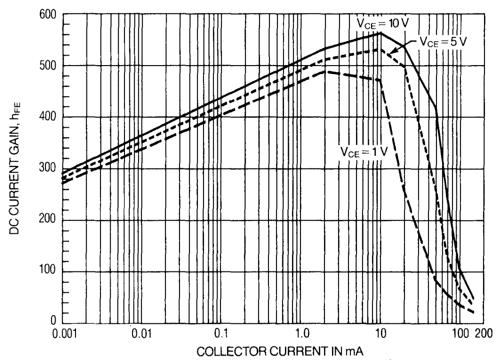
Collector Current, I_C .... 200 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	85	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	120	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V,\ I_C = 0.1\,mA$	—	410	—	—
		$V_{CE} = 5.0\,V,\ I_C = 1.0\,mA$	50	490	800	—
		$V_{CE} = 5.0\,V,\ I_C = 10\,mA$	80	530	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA,\ I_B = 1.0\,mA$	—	0.04	0.2	V
		$I_C = 50\,mA,\ I_B = 5.0\,mA$	—	0.09	0.3	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 10\,mA,\ I_B = 1.0\,mA$	—	0.77	0.9	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V,\ I_C = 1.0\,mA$	100	240	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V,\ f = 1.0\,MHz$	—	1.8	4.0	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5\,V,\ f = 1.0\,MHz$	—	5.5	8.0	pF

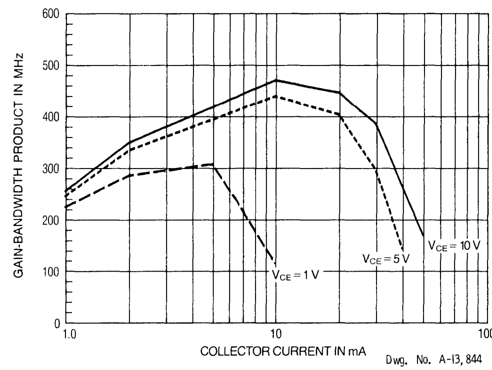
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



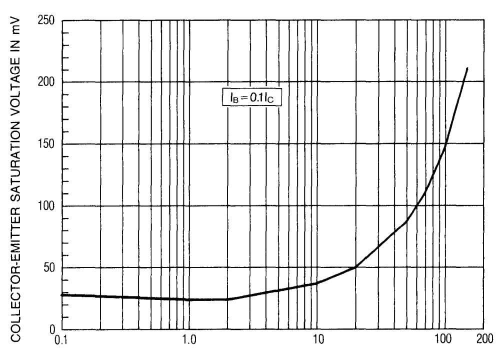
Dwg. No. A-13, 842

f_T AS A FUNCTION OF COLLECTOR CURRENT



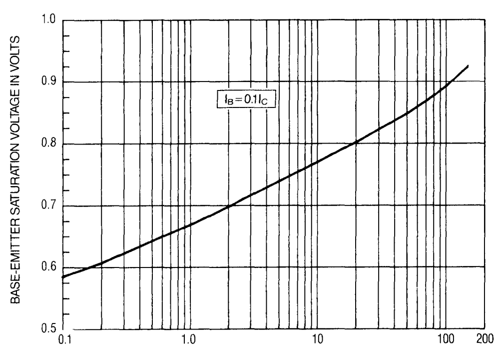
Dwg. No. A-13, 844

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



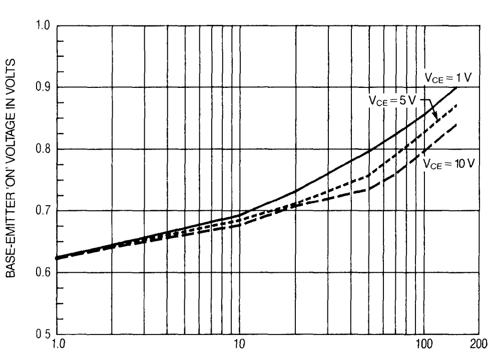
Dwg. No. A-13, 841

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



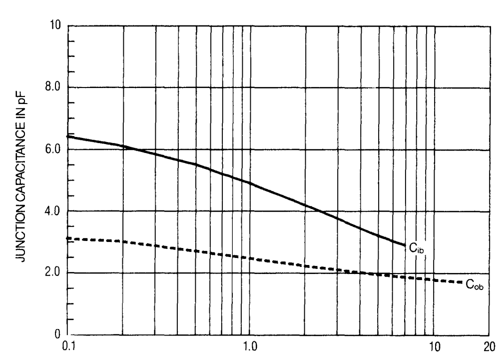
Dwg. No. A-13, 840

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg No. A-13, 845

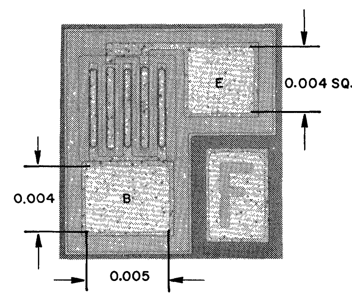
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg No. A-13, 843

Process FFB
NPN Switching Transistor

Process FFB is a double-diffused epitaxial planar device with gold diffusion and is primarily used in general-purpose switching and amplifier circuits. Process FFB is the complement to the PNP Process BTB transistor.



FFB 0.017″ × 0.017″

ALTERNATE PROCESS: TVO

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C . . . . 200 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

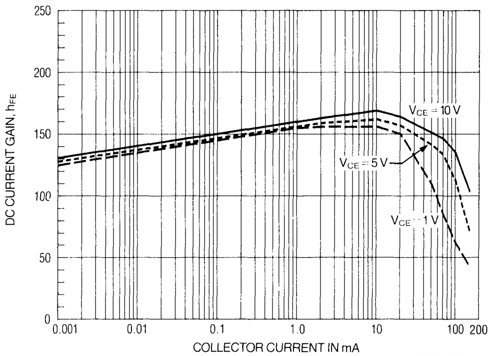
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	50	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.5	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	100	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0\,V$, $I_C = 1.0\,mA$	—	150	—	—
		$V_{CE} = 1.0\,V$, $I_C = 10\,mA$	50	155	800	—
		$V_{CE} = 1.0\,V$, $I_C = 50\,mA$	20	110	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.06	0.2	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.095	0.3	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.85	0.95	V
Gain-Bandwidth Product	f_T	$V_{CE} = 20\,V$, $I_C = 10\,mA$	250	470	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 5.0\,V$, $f = 1.0\,MHz$	—	2.0	4.0	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	5.0	8.0	pF
Noise Figure	NF	$V_{CE} = 5.0\,V$, $I_C = 100\,\mu A$, $R_S = 1\,k\Omega$, BW = 10 Hz – 15.7 kHz	—	1.0	5.0	dB
Delay Time*	t_d	$V_{CC} = 3.0\,V$, $I_C = 10\,mA$,	—	15	35	ns
Rise Time*	t_r	$I_B = 1.0\,mA$	—	12	35	ns
Storage Time*	t_s	$V_{CC} = 3.0\,V$, $I_C = 10\,mA$,	—	170	200	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 1.0\,mA$	—	19	50	ns

*Switching speeds measured at 2N3904 test conditions.

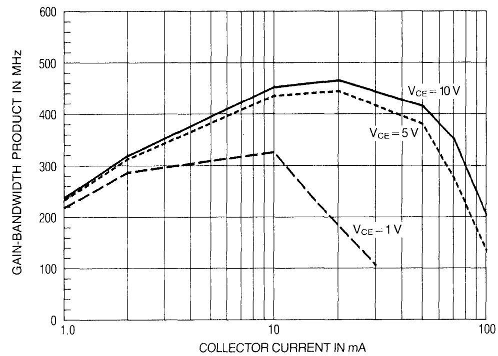
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



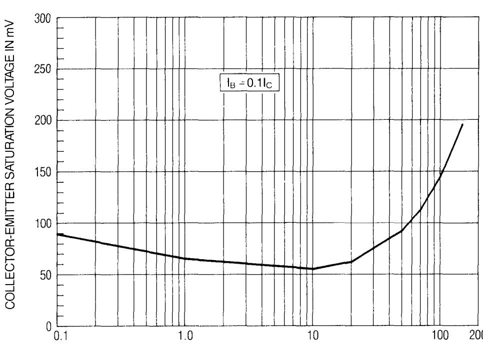
Dwg. No. A-14, 122

f_T AS A FUNCTION OF COLLECTOR CURRENT



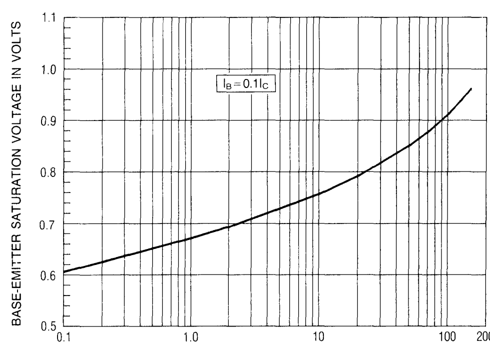
Dwg. No. A-14, 118

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



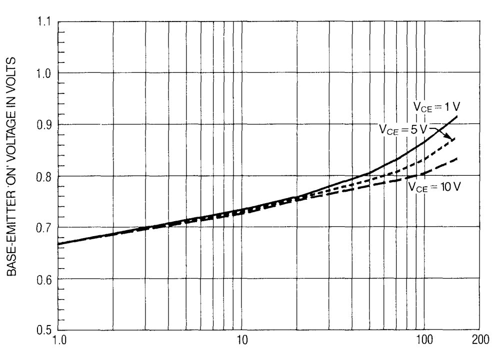
Dwg. No. A-14, 121

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



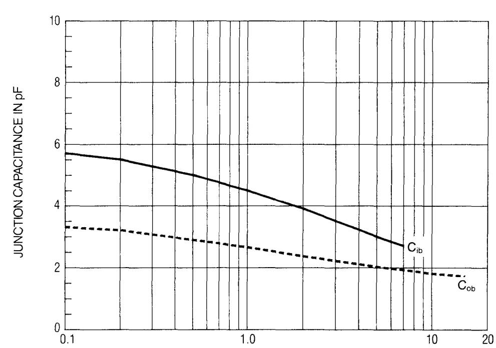
Dwg. No. A-14, 120

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-14, 117

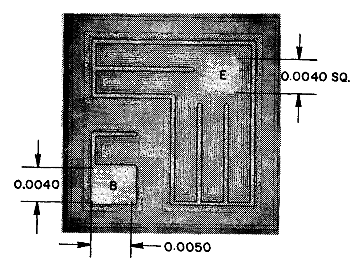
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14, 119

Process JEA
NPN High-Voltage Darlington Transistor

Process JEA is a double-diffused epitaxial planar silicon Darlington pair. It is designed for use in high-voltage, high-gain amplifier circuits.



JEA 0.018″ × 0.018″

ABSOLUTE MAXIMUM RATINGS

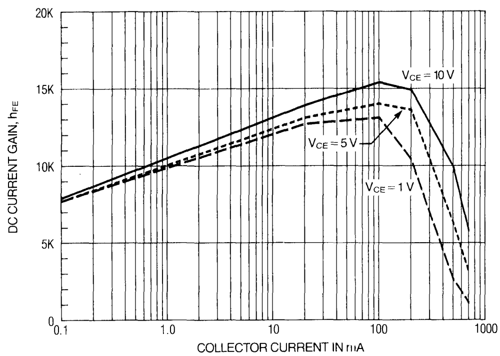
Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1.0\,mA$	60	110	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	10	16.5	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	185	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 10\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	10k	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	5k	12k	50k	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	5k	14k	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 0.01\,mA$	—	0.76	1.0	V
		$I_C = 100\,mA$, $I_B = 0.1\,mA$	—	0.83	1.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 0.1\,mA$	—	1.5	2.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 20\,mA$	100	330	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	3.0	8.0	pF
Input Capacitance	C_{ib}	$V_{EB} = 1.0\,V$, $f = 1.0\,MHz$	—	5.0	20	pF

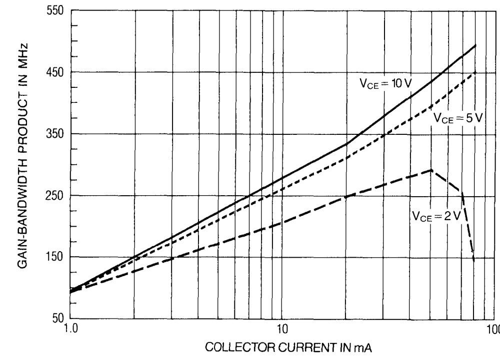
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



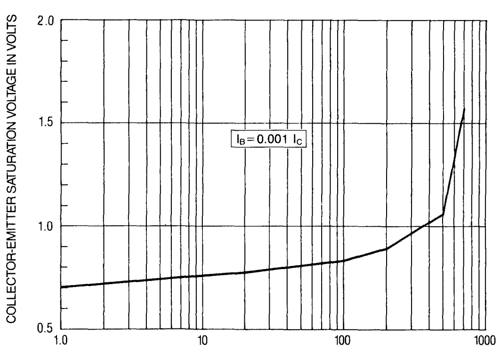
Dwg No. A-14, 059

f_T AS A FUNCTION OF COLLECTOR CURRENT



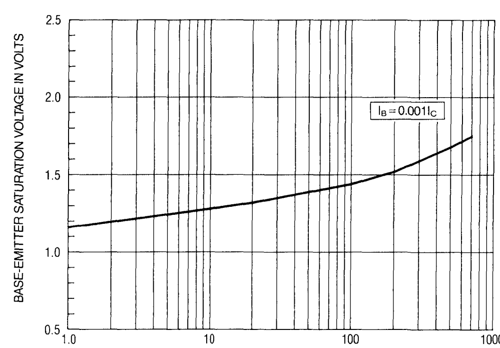
Dwg. No. A-14, 062

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



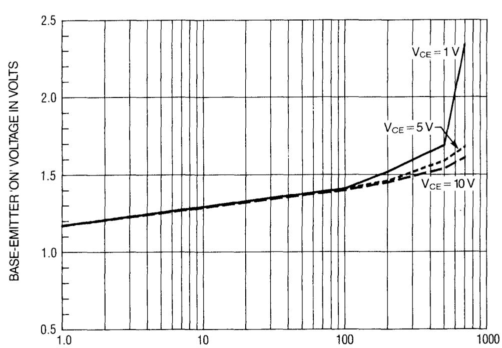
Dwg. No. A-14, 058

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



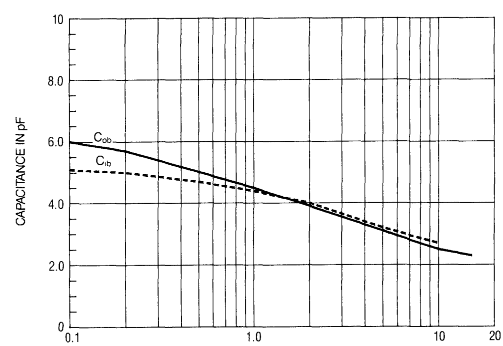
Dwg No. A-14, 063

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-14, 064

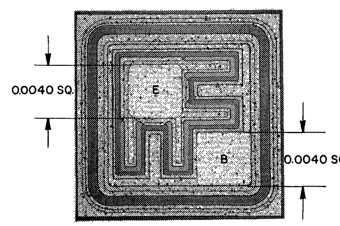
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg NO. A-14, 060

Process JFA
PNP Small-Signal Transistor

Process JFA is a double-diffused PNP silicon epitaxial planar device for low-noise, high-gain amplifiers, medium-power switching, and general-purpose use from dc to UHF. Process JFA is the complement to the NPN Process JGA.



JFA 0.018″ × 0.018″

ALTERNATE PROCESSES: BDA, DDA, TQL

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

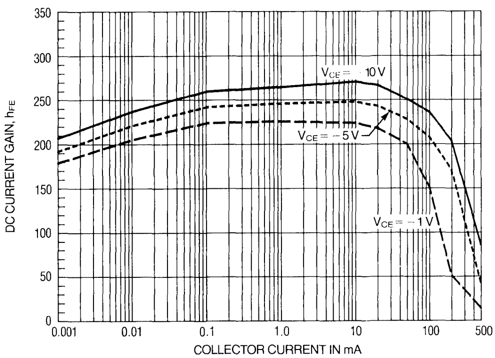
ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	75	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	40	110	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 30\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	240	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	250	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	—	200	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.2	0.35	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.64	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	1.1	1.3	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 20\,mA$	200	400	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	4.1	8.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	16	30	pF
Delay Time*	t_d	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	5.0	10	ns
Rise Time*	t_r	$I_B = 15\,mA$	—	12	20	ns
Storage Time*	t_s	$V_{CC} = 6.0\,V$, $I_C = 150\,mA$,	—	76	100	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 15\,mA$	—	30	45	ns

*Switching speeds measured at 2N2907 test conditions.

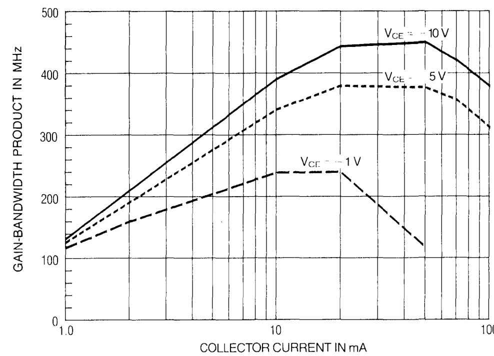
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



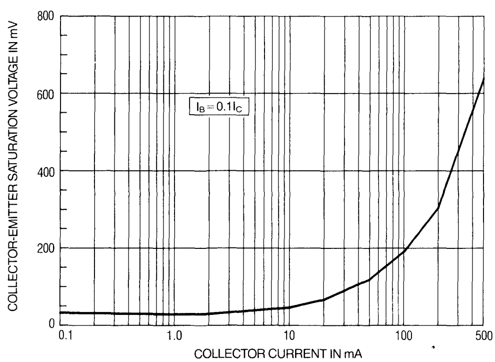
Dwg. No. A-13, 848

f_T AS A FUNCTION OF COLLECTOR CURRENT



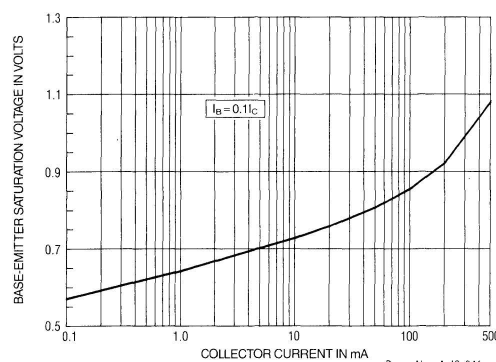
Dwg. No. A-13, 849

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



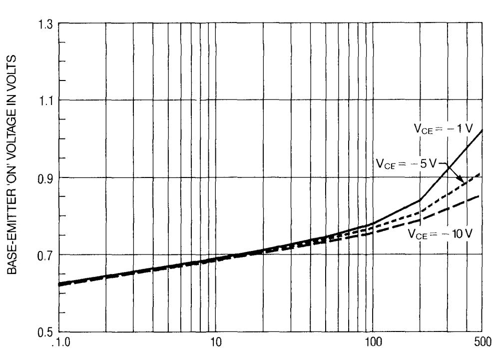
Dwg. No. A-13, 847

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



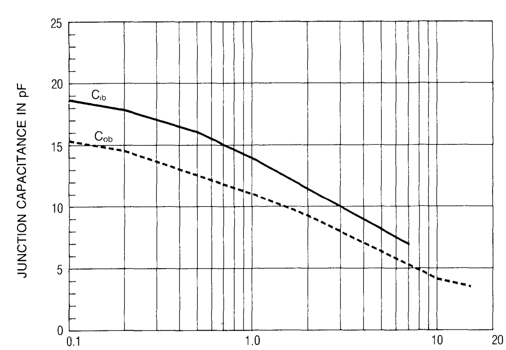
Dwg. No. A-13, 846

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 850

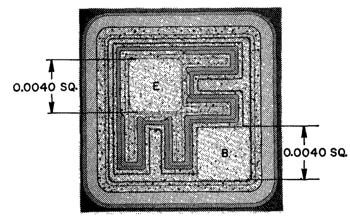
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 851

Process JGA
NPN Small-Signal Transistor

Process JGA is a double-diffused NPN silicon epitaxial planar device intended for use in general-purpose amplifiers and medium power switching applications. Process JGA is the complement to the PNP Process JFA.



JGA 0.018″ × 0.018″

ALTERNATE PROCESSES: BBC, DCA, TNL

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 500 mA
Base Current, I_B .... 250 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

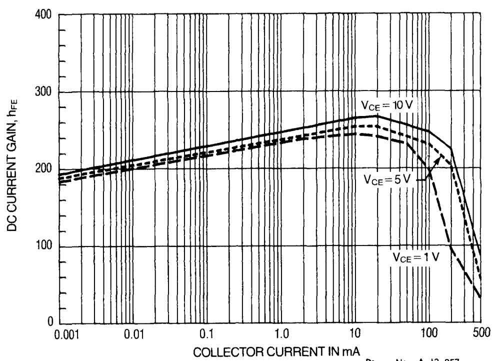
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	50	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.2	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	130	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	225	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	50	250	800	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	—	230	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.03	0.2	V
		$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.1	0.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.85	1.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 50\,mA$	100	420	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	3.4	10	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	17	30	pF
Delay Time*	t_d	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	8.0	10	ns
Rise Time*	t_r	$I_B = 15\,mA$	—	12	25	ns
Storage Time*	t_s	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	300	350	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 15\,mA$	—	45	60	ns

*Switching speeds measured at 2N2222A test conditions.

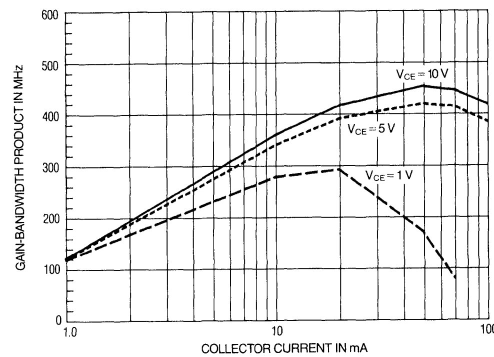
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



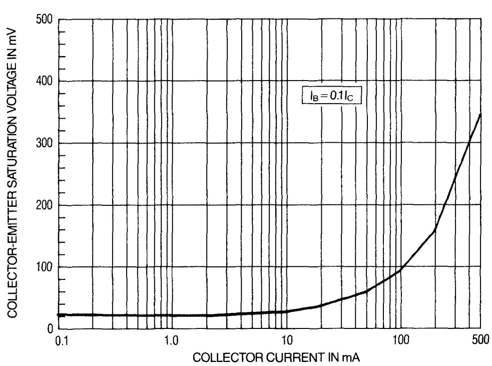
Dwg. No. A-13, 857

f_T AS A FUNCTION OF COLLECTOR CURRENT



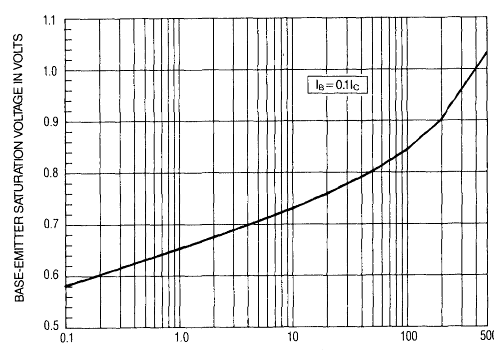
Dwg No. A-13, 853

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



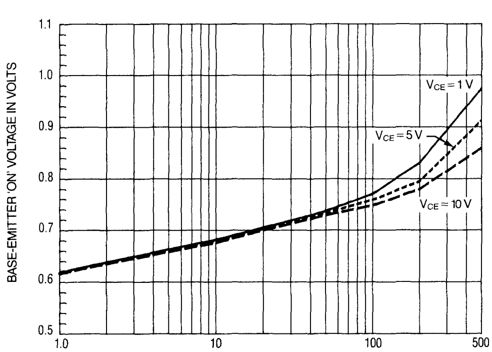
Dwg No. A-13, 854

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



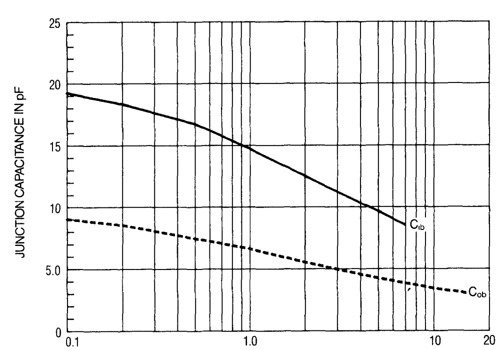
Dwg No. A-13, 855

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg No. A-13, 856

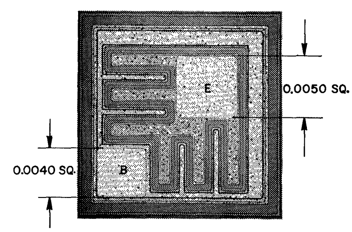
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 852

Process JLA
NPN Small-Signal Transistor

Process JLA is a double-diffused epitaxial planar NPN silicon device. It is designed for use in general-purpose amplifier and high-current switching circuits.



JLA 0.020″ × 0.020″

ALTERNATE PROCESS: DAC

ABSOLUTE MAXIMUM RATINGS

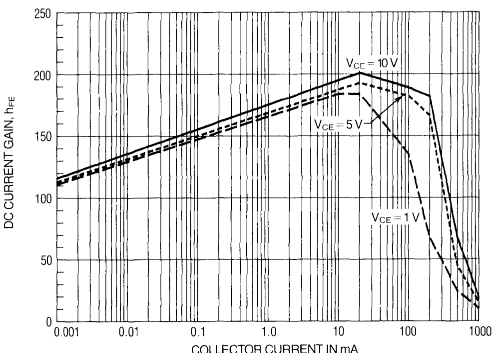
Collector Current, I_C .... 800 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	95	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	140	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	170	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	80	180	500	—
		$V_{CE} = 5.0\,V$, $I_C = 500\,mA$	20	45	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.09	0.25	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.3	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.96	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 50\,mA$	150	350	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	4.0	20	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	40	80	pF

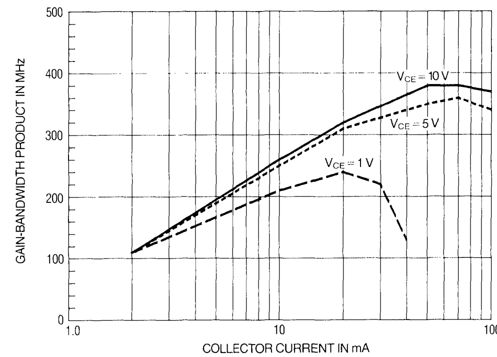
Typical Characteristics
at $T_A = +25°C$

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



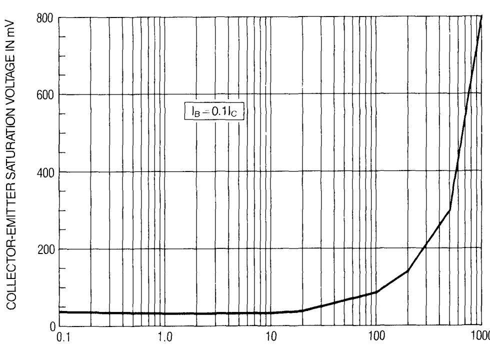
Dwg. No. A-13, 863

f_T AS A FUNCTION OF COLLECTOR CURRENT



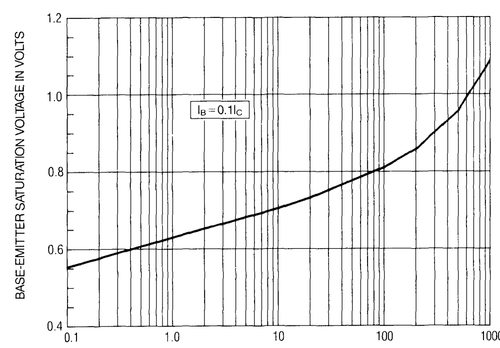
Dwg. No. A-13, 858

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



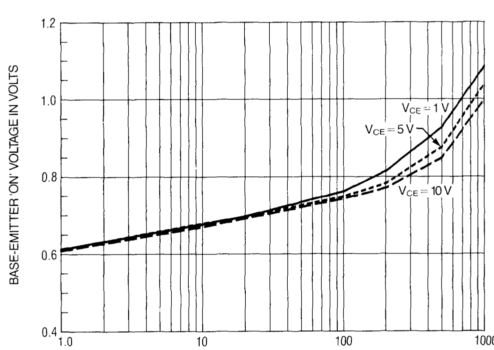
Dwg No. A-13, 860

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



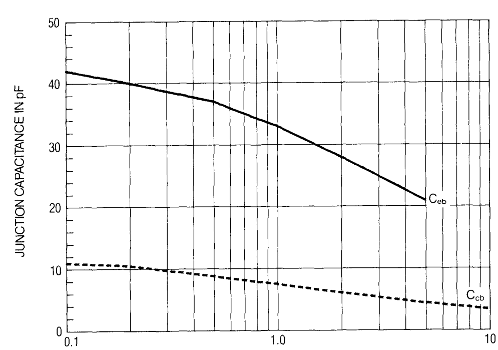
Dwg No. A-13, 861

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 862

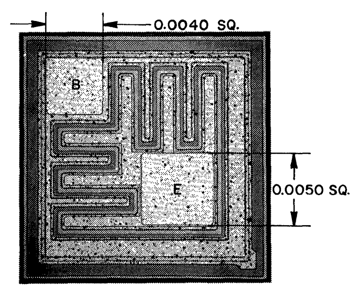
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 859

Process JMA
PNP Small-Signal Transistor

Process JMA is a PNP double-diffused silicon epitaxial planar transistor. Process JMA finds broad application as a medium-power amplifier and switching transistor. The NPN complement to this device is the Process JLA transistor.



JMA 0.020″ × 0.020″

ALTERNATE PROCESSES: BFA, DFC

ABSOLUTE MAXIMUM RATINGS

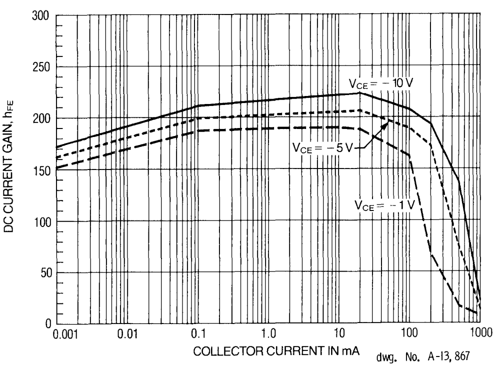
Collector Current, I_C . . . . 800 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	50	100	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.1	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	125	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0\,V$, $I_C = 1.0\,mA$	—	190	—	—
		$V_{CE} = 1.0\,V$, $I_C = 10\,mA$	60	190	500	—
		$V_{CE} = 1.0\,V$, $I_C = 100\,mA$	20	160	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.1	0.30	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.36	0.75	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.98	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	150	250	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	6.0	15	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	35	55	pF

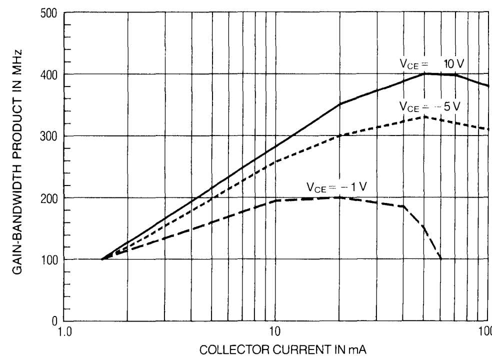
Typical Characteristics at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



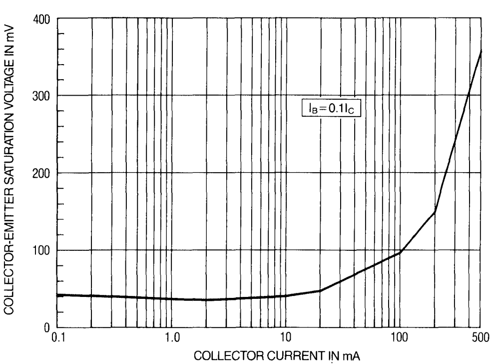
dwg. No. A-13, 867

f_T AS A FUNCTION OF COLLECTOR CURRENT



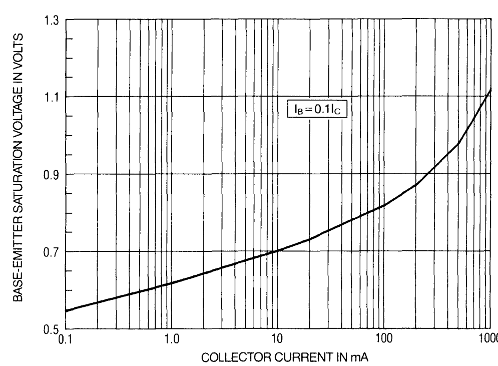
Dwg. No. A-13, 866

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



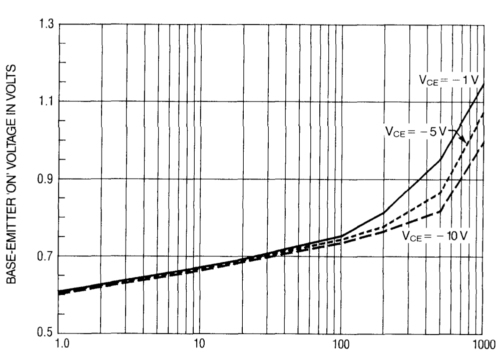
Dwg. No. A-13, 864

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



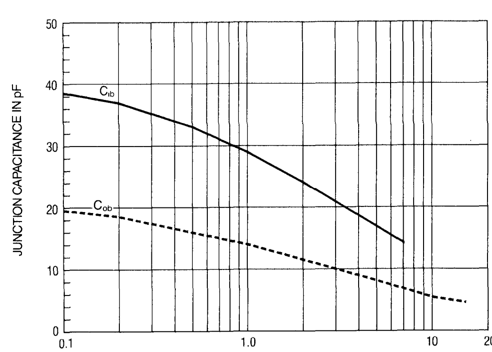
Dwg. No. A-13, 865

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. NO. A-13, 868

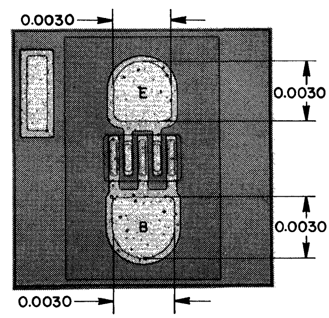
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 869

Process JYA
PNP RF Amplifier

Process JYA is a PNP silicon epitaxial planar transistor designed for use in low-power, high-frequency amplifier applications.



JYA 0.015″ × 0.015″

ABSOLUTE MAXIMUM RATINGS

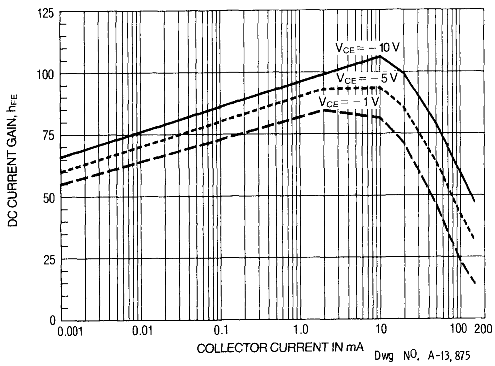
Collector Current, I_C . . . . 50 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

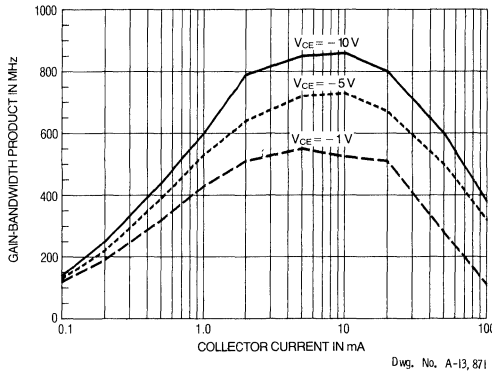
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1.0\,mA$	20	27	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	5.0	7.6	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	20	40	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 20\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 4.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 10\,V$, $I_C = 0.1\,mA$	—	90	—	—
		$V_{CE} = 10\,V$, $I_C = 10\,mA$	—	100	—	—
		$V_{CE} = 10\,V$, $I_C = 50\,mA$	—	80	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.09	0.2	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.23	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.97	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 5.0\,mA$	600	850	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	0.62	0.85	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	1.2	4.0	pF

Typical Characteristics
at $T_A = +25°C$

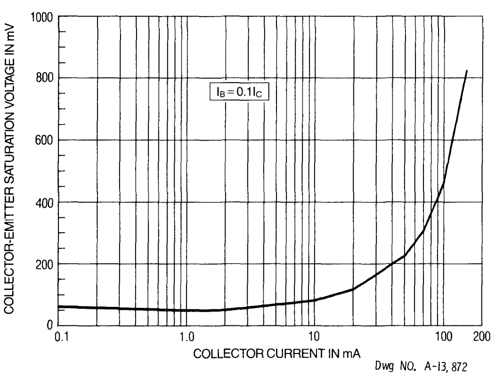
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



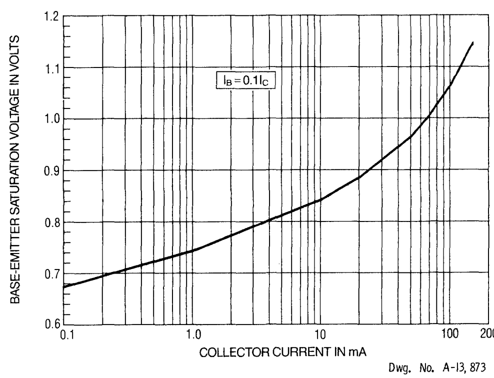
f_T AS A FUNCTION OF COLLECTOR CURRENT



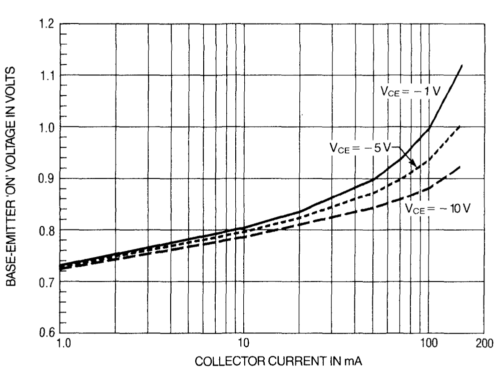
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



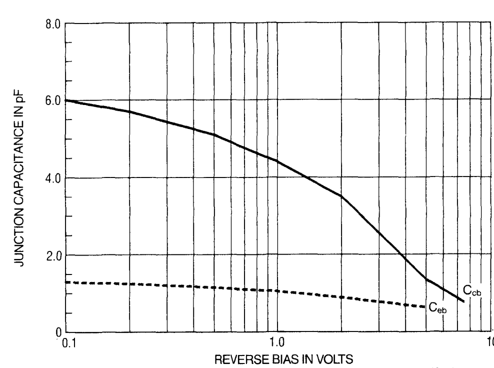
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

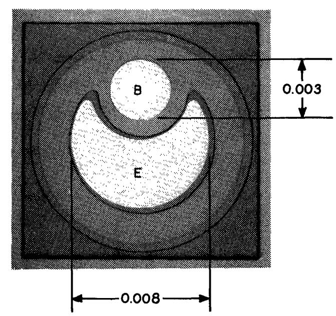


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process SHF
PNP Chopper

Process SHF is a PNP silicon double-diffused planar epitaxial device. It is designed for low-level, pulse-width modulation.



SHF 0.020″ × 0.020″

ABSOLUTE MAXIMUM RATINGS

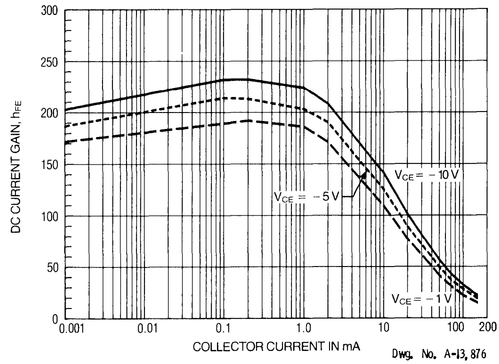
Collector Current, I_C .... 50 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

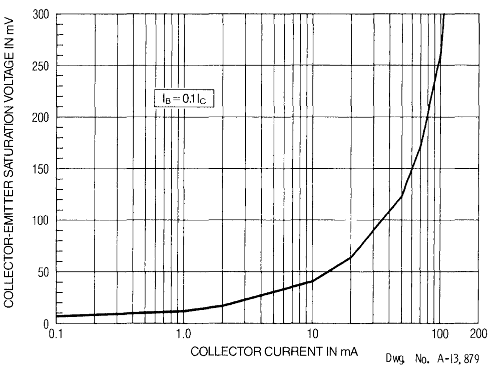
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	95	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	30	45	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	150	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 30\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	210	—	—
		$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	200	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	120	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.04	0.2	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.13	0.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.9	1.2	V
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	3.1	14	pF
Input Capacitance	C_{eb}	$V_{EB} = 5.0\,V$, $f = 1.0\,MHz$	—	2.4	8.0	pF

Typical Characteristics
at $T_A = +25°C$

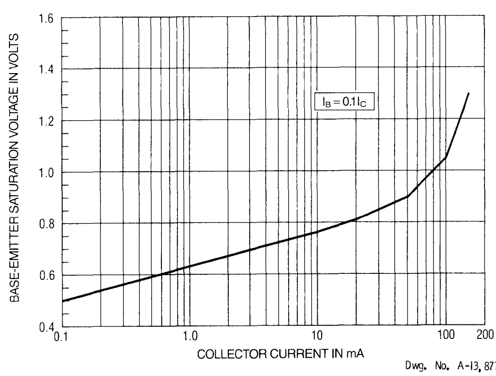
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



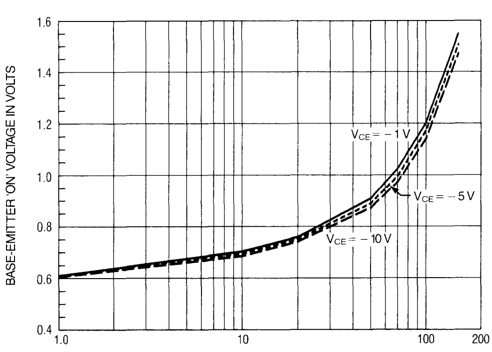
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



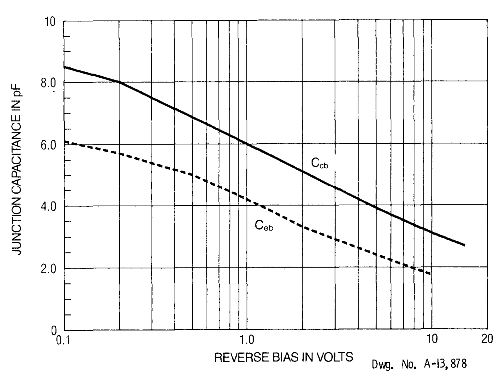
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

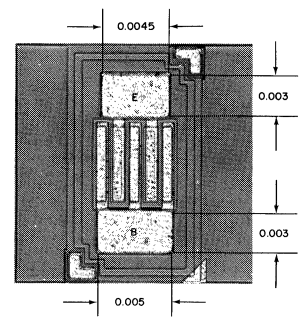


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process SKL
NPN Small-Signal Transistor

The SKL Process produces double-diffused, NPN silicon epitaxial planar transistors intended for use in general-purpose amplifier or switching applications and for complementary symmetry circuits when paired with PNP Process SLL devices



SKL 0.019″ × 0.019″

ABSOLUTE MAXIMUM RATINGS

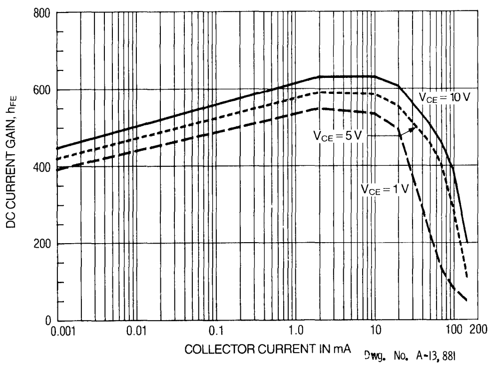
Collector Current, I_C . . . . 200 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

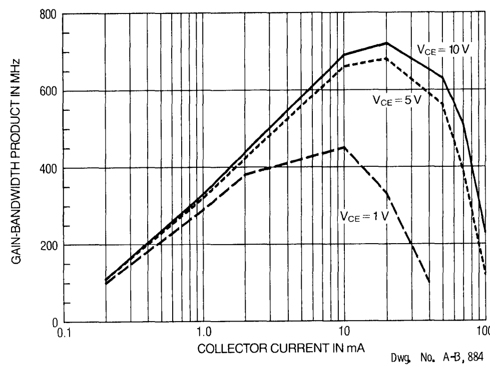
Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	45	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.3	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	90	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 50\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V,\ I_C = 0.1\,mA$	—	530	—	—
		$V_{CE} = 5.0\,V,\ I_C = 10\,mA$	—	580	—	—
		$V_{CE} = 5.0\,V,\ I_C = 100\,mA$	—	290	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA,\ I_B = 1.0\,mA$	—	0.04	0.2	V
		$I_C = 100\,mA,\ I_B = 10\,mA$	—	0.14	0.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA,\ I_B = 10\,mA$	—	0.9	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V,\ I_C = 10\,mA$	200	660	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V,\ f = 1.0\,MHz$	—	1.5	—	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V,\ f = 1.0\,MHz$	—	4.5	—	pF

Typical Characteristics
at T_A = +25°C

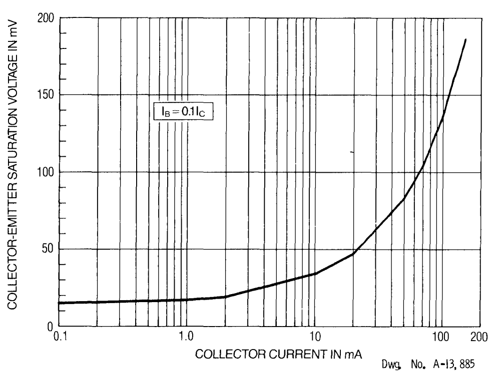
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



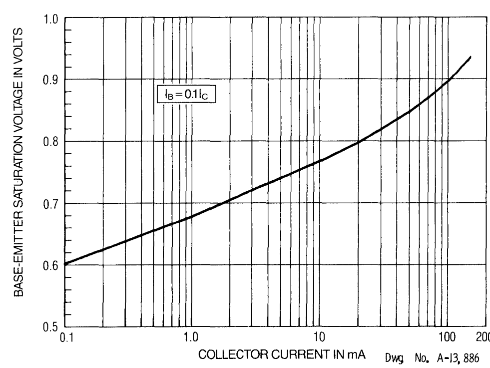
f_T AS A FUNCTION OF COLLECTOR CURRENT



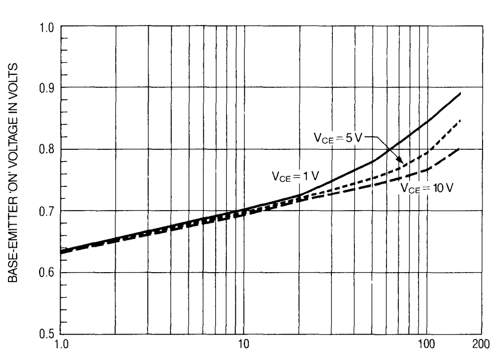
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



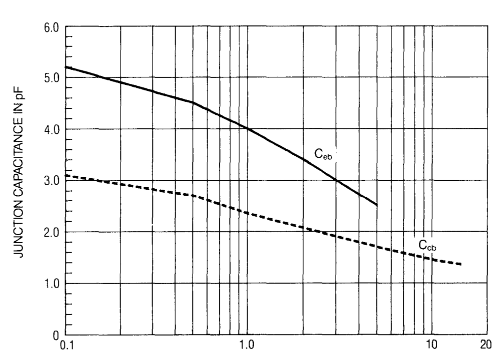
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

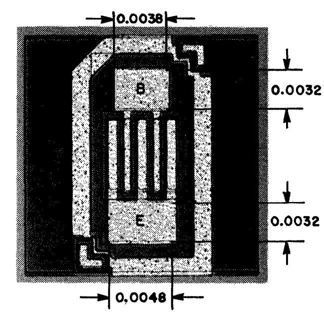


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process SLL
PNP Small-Signal Transistor

Process SLL is a double-diffused epitaxial planar PNP silicon device. It is designed for use in general-purpose amplifier and switching applications. Its PNP complement is the Sprague Process SKL transistor.



SLL 0.019″ × 0.019″

ALTERNATE PROCESS: BXE

ABSOLUTE MAXIMUM RATINGS

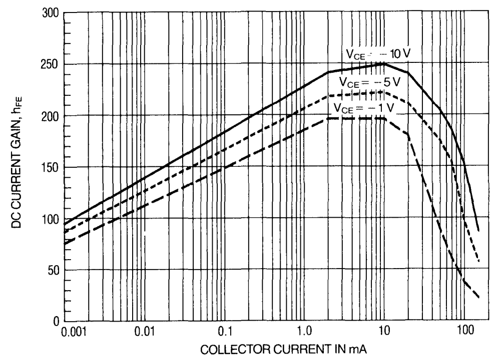
Collector Current, I_C .... 200 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C = 10 mA	40	70	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E = 10 μA	6.0	8.2	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 100 μA	50	80	—	V
Collector Cutoff Current	I_{CBO}	V_{CB} = 40 V	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB} = 6.0 V	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	V_{CE} = 5.0 V, I_C = 0.1 mA	—	170	—	—
		V_{CE} = 5.0 V, I_C = 1.0 mA	—	210	—	—
		V_{CE} = 5.0 V, I_C = 10 mA	—	220	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 10 mA, I_B = 1.0 mA	—	0.05	—	V
		I_C = 50 mA, I_B = 5.0 mA	—	0.1	—	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C = 50 mA, I_B = 5.0 mA	—	0.86	—	V
Gain-Bandwidth Product	f_T	V_{CE} = 5.0 V, I_C = 1.0 mA	100	220	—	MHz
Output Capacitance	C_{cb}	V_{CB} = 10 V, f = 1.0 MHz	—	1.5	4.0	pF
Input Capacitance	C_{eb}	V_{EB} = 0.5 V, f = 1.0 MHz	—	6.4	16	pF

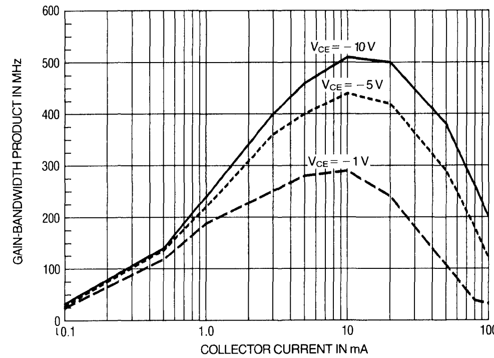
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



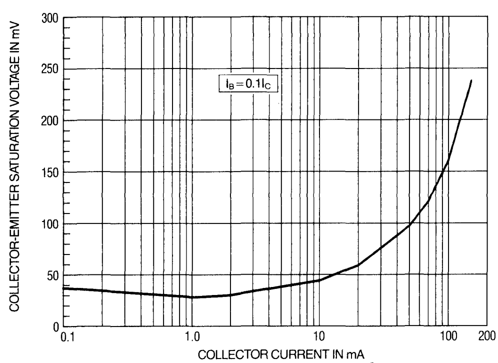
Dwg. No. A-13, 892

f_T AS A FUNCTION OF COLLECTOR CURRENT



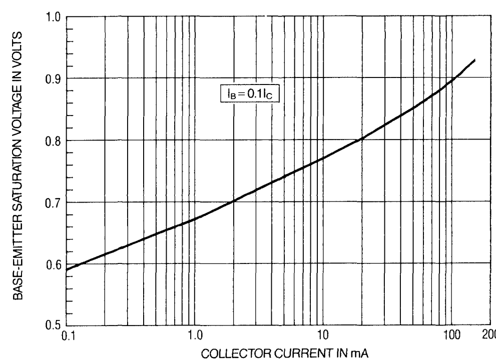
Dwg. No. A-13, 888

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



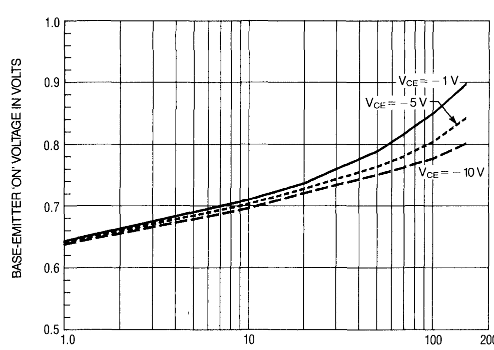
Dwg. No. A-13, 889

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



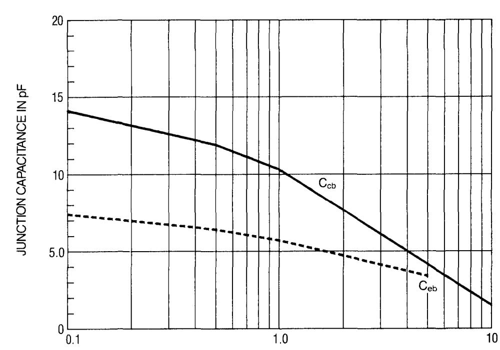
Dwg. No. A-13, 890

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 891

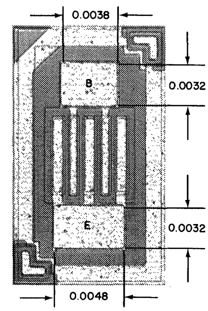
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 887

Process SMN
PNP High-Speed Switching Transistor

Process SMN is a PNP double-diffused silicon epitaxial planar transistor with gold diffusion. It is primarily used in amplifier and general-purpose switching circuits. Its complement is the NPN process TVO (FFB).



SMN 0.012″ × 0.019″

ALTERNATE PROCESS: BTB

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 200 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S...... −55°C to +150°C

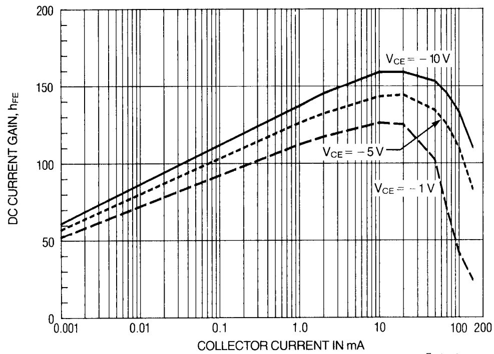
ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	65	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.1	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	40	85	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 40\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0\,V$, $I_C = 1.0\,mA$	—	110	—	—
		$V_{CE} = 1.0\,V$, $I_C = 10\,mA$	50	125	500	—
		$V_{CE} = 1.0\,V$, $I_C = 50\,mA$	20	100	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.06	0.25	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.12	0.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.86	0.95	V
Gain-Bandwidth Product	f_T	$V_{CE} = 20\,V$, $I_C = 10\,mA$	250	600	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	1.5	4.5	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	6.6	10	pF
Noise Figure	NF	$V_{CE} = 5.0\,V$, $I_C = 100\,\mu A$, $R_S = 1.0\,k\Omega$, BW = 10 Hz–15.7 kHz	—	1.0	5.0	dB
Delay Time*	t_d	$V_{CC} = 3.0\,V$, $I_C = 10\,mA$,	—	18	35	ns
Rise Time*	t_r	$I_B = 1.0\,mA$	—	14	35	ns
Storage Time*	t_s	$V_{CC} = 3.0\,V$, $I_C = 10\,mA$,	—	140	225	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 1.0\,mA$	—	22	75	ns

*Switching speeds measured at 2N3906 test conditions.

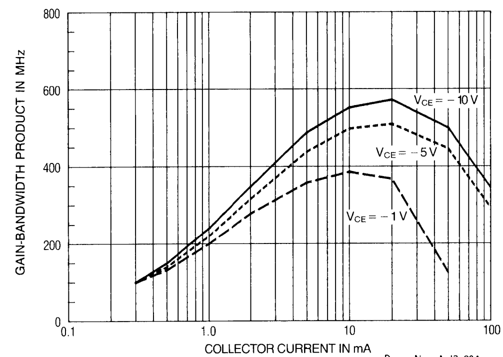
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



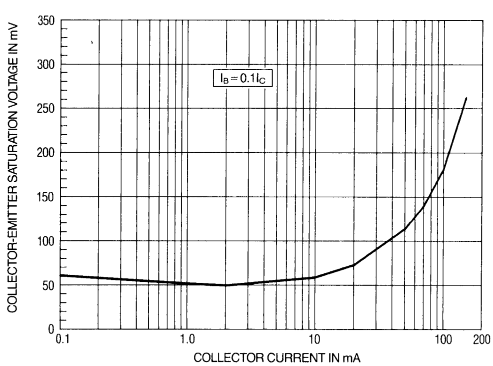
Dwg. No A-13, 895

f_T AS A FUNCTION OF COLLECTOR CURRENT



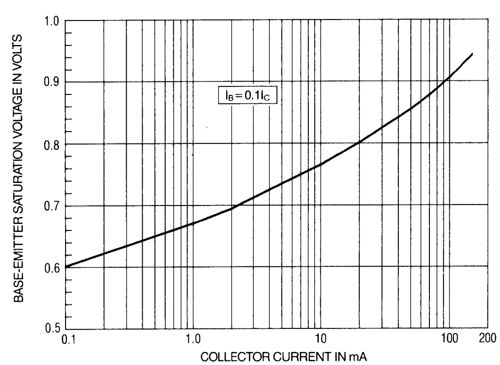
Dwg. No. A-13, 894

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



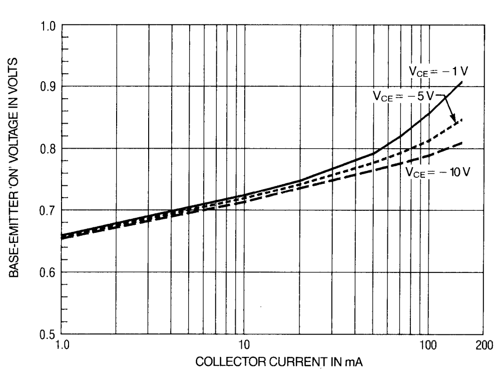
Dwg. No. A-13, 897

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



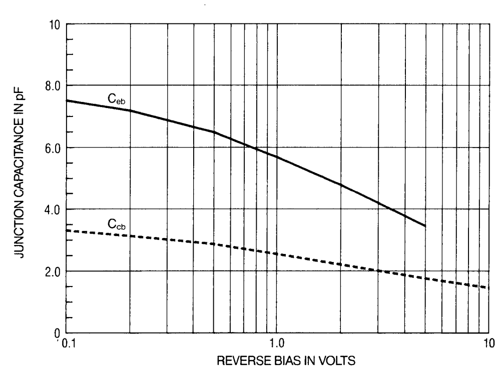
Dwg. No. A-13, 896

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 893

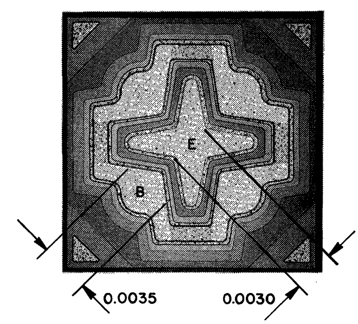
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg No. A-13, 898

Process SPL
NPN Small-Signal Transistor

Process SPL is a double-diffused NPN silicon epitaxial transistor. It is designed to be used in general-purpose amplifier and medium-power switching applications.



SPL 0.022″×0.022″

ALTERNATE PROCESS: DCA

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

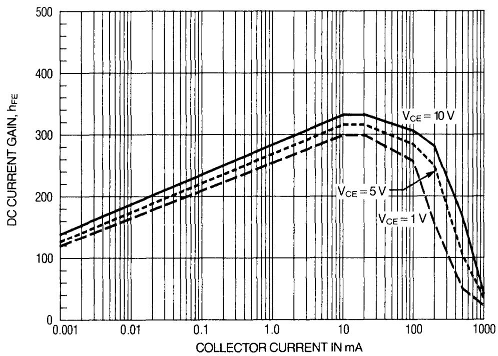
ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	50	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.5	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	110	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 50\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 10\,V$, $I_C = 0.1\,mA$	—	260	—	—
		$V_{CE} = 10\,V$, $I_C = 10\,mA$	75	330	—	—
		$V_{CE} = 10\,V$, $I_C = 100\,mA$	100	300	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.1	0.25	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.3	1.0	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	1.1	2.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 20\,mA$	250	400	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	4.0	8.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	17	25	pF
Delay Time*	t_d	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	8.0	10	ns
Rise Time*	t_r	$I_B = 15\,mA$	—	15	25	ns
Storage Time*	t_s	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	160	225	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 15\,mA$	—	40	60	ns

*Switching speeds measured at 2N2222A test conditions.

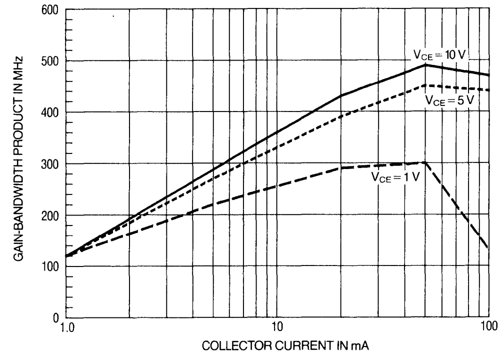
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



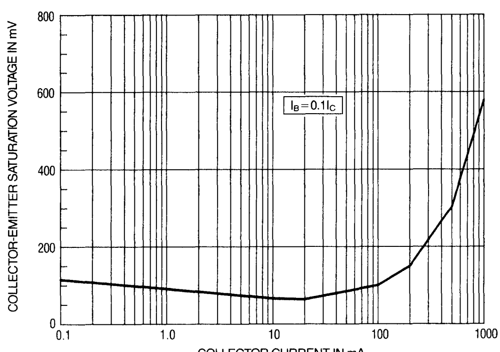
Dwg. No. A-13, 902

f_T AS A FUNCTION OF COLLECTOR CURRENT



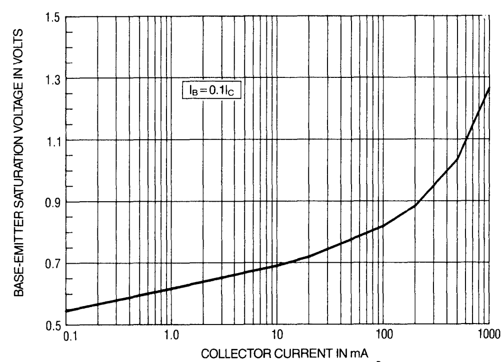
Dwg. No. A-13, 901

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



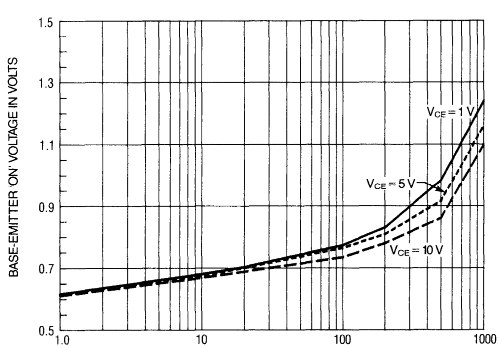
Dwg. No. A-13, 904

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



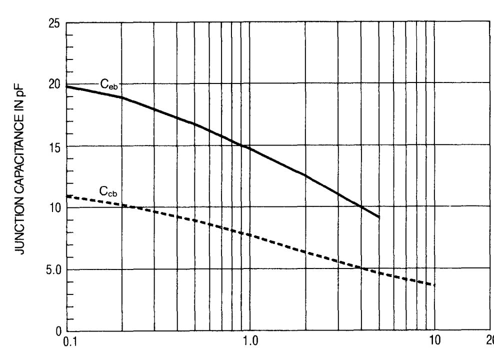
Dwg. No. A-13, 903

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 899

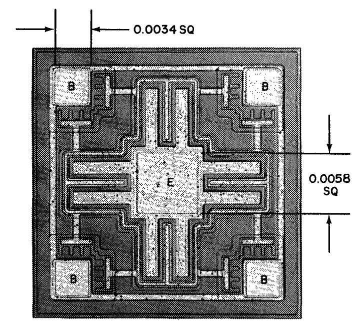
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 900

Process SQL
NPN Darlington Transistor

Process SQL is a double-diffused silicon epitaxial NPN Darlington pair. This device is designed for use as a high-gain amplifier in audio and control circuits and as a driver with up to 1 A collector current. Process SQL devices complement the PNP Darlington, Process SRB.



SQL 0.028″ × 0.028″

ALTERNATE PROCESS: TPM

ABSOLUTE MAXIMUM RATINGS

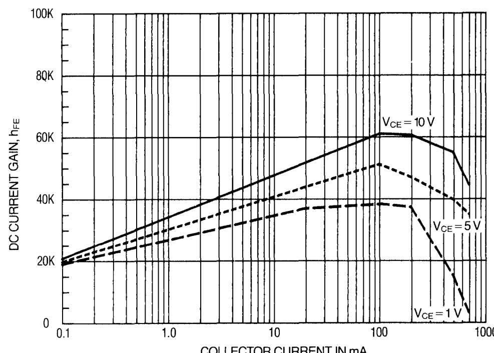
Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	25	45	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	12	14.2	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	65	95	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 10\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	28k	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	7k	36k	100k	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	20k	50k	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 0.01\,mA$	—	0.7	1.2	V
		$I_C = 200\,mA$, $I_B = 0.2\,mA$	—	0.81	1.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 200\,mA$, $I_B = 0.2\,mA$	—	1.45	1.6	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	150	230	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	5.2	10	pF
Input Capacitance	C_{eb}	$V_{EB} = 1.0\,V$, $f = 1.0\,MHz$	—	11.3	25	pF

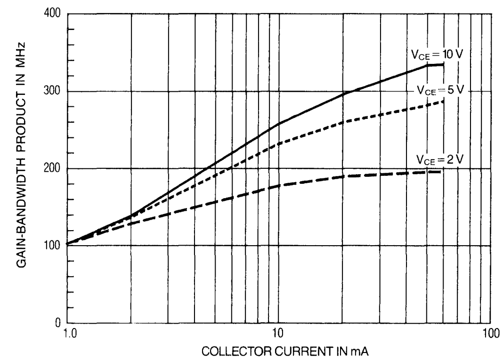
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



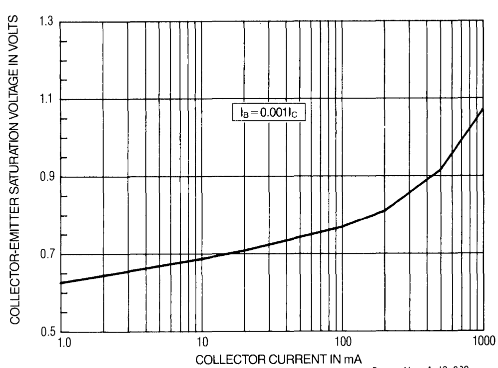
Dwg. no. A-13,905

f_T AS A FUNCTION OF COLLECTOR CURRENT



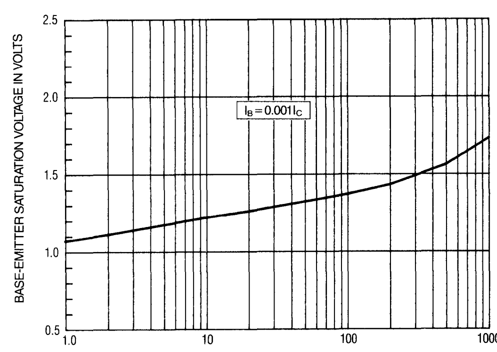
Dwg. No. A-13,907

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



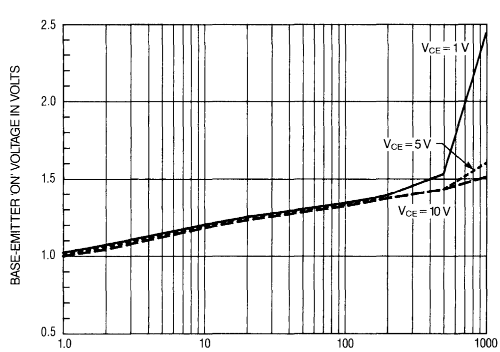
Dwg. No. A-13,909

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



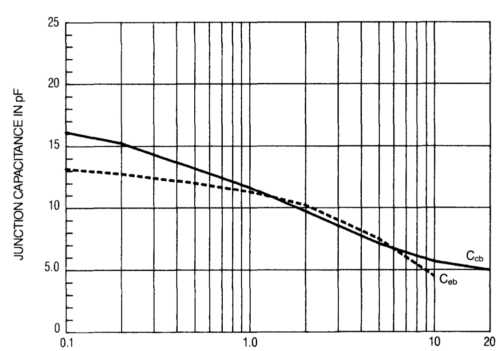
Dwg. No. A-13,910

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,908

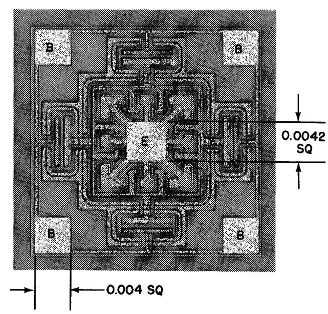
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,906

Process SRB
PNP Darlington Transistor

Process SRB is a double-diffused silicon epitaxial PNP Darlington pair. This device is designed for use as a high-gain amplifier in audio and control circuits and as a driver with up to 1A collector current. Process SRB devices complement the NPN Darlington, Process SQL.



SRB 0.029″ × 0.029″

ABSOLUTE MAXIMUM RATINGS

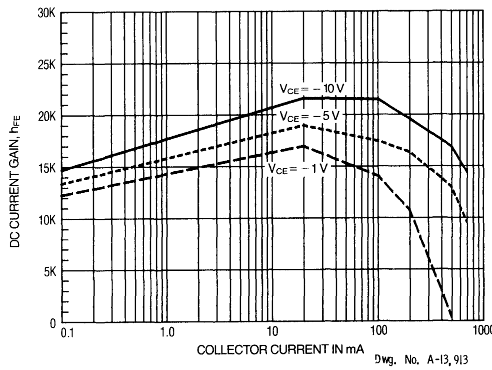
Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

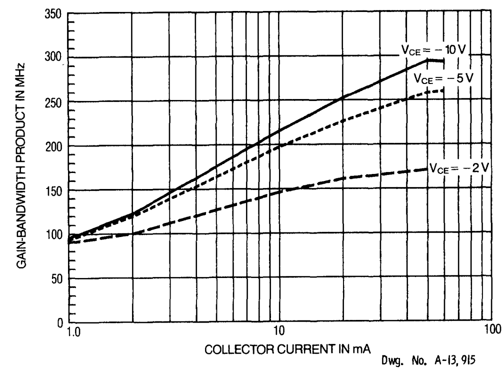
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	50	75	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	12	16.7	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	85	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 10\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	16k	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	3k	18k	80k	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	3k	17k	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 0.01\,mA$	—	0.75	1.2	V
		$I_C = 200\,mA$, $I_B = 0.2\,mA$	—	0.88	1.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 200\,mA$, $I_B = 0.2\,mA$	—	1.47	2.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	100	200	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	6.4	10	pF
Input Capacitance	C_{ib}	$V_{EB} = 1.0\,V$, $f = 1.0\,MHz$	—	9.4	20	pF

Typical Characteristics
at T_A = +25°C

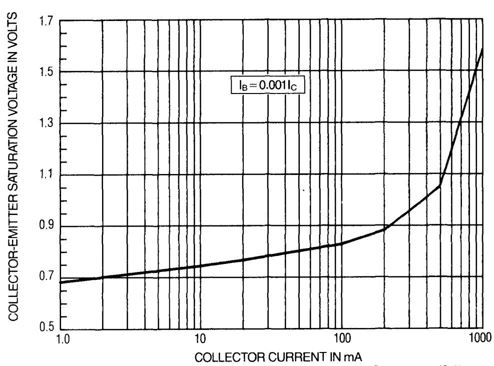
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



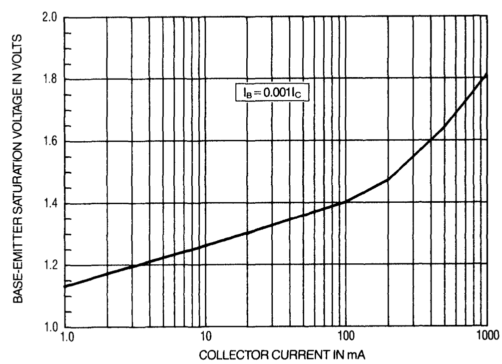
f_T AS A FUNCTION OF COLLECTOR CURRENT



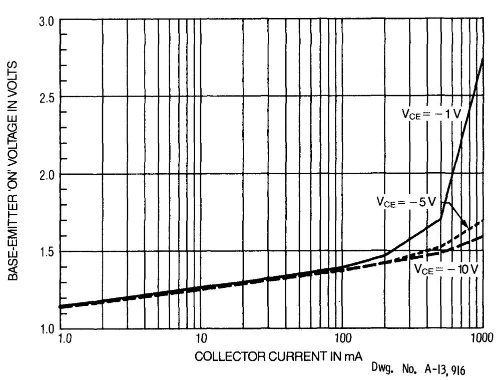
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



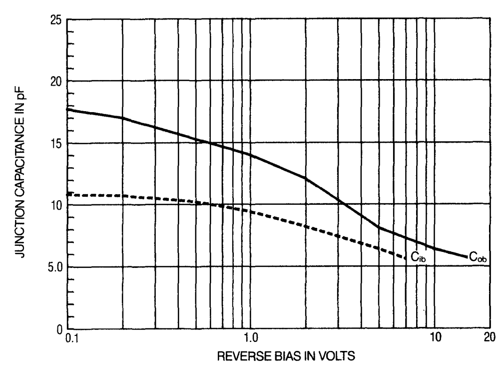
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

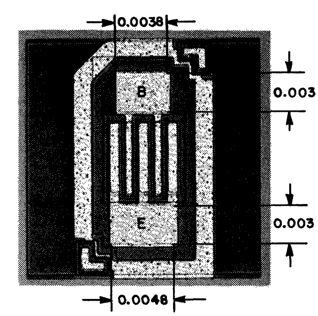


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process STL
PNP Small-Signal Transistor

Process STL is a double-diffused epitaxial planar PNP silicon device. It is designed for use in general-purpose amplifier and switching applications.



STL 0.019″ × 0.019″

ABSOLUTE MAXIMUM RATINGS

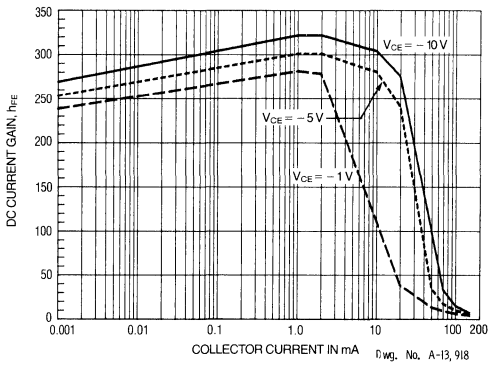
Collector Current, I_C . . . . 100 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

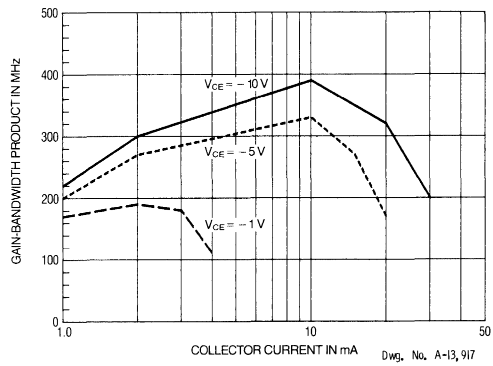
Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	95	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.2	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	95	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	300	—	—
		$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	300	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	280	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.1	0.3	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.38	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.9	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	100	200	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	1.6	4.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	6.4	16	pF

Typical Characteristics
at $T_A = +25°C$

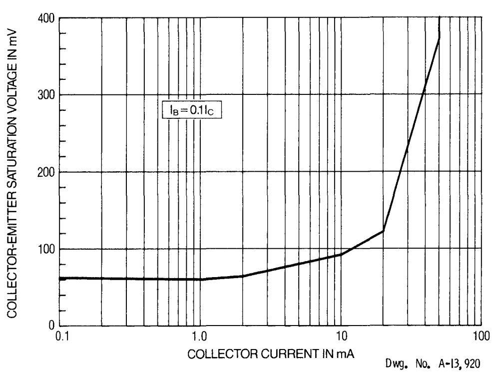
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



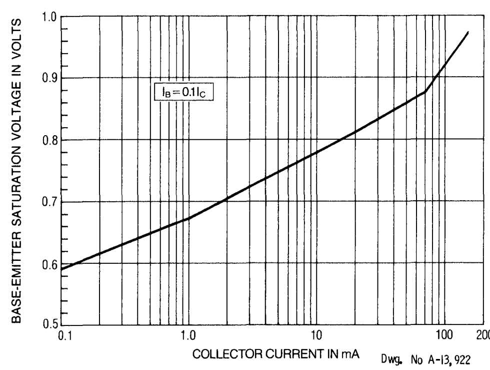
f_T AS A FUNCTION OF COLLECTOR CURRENT



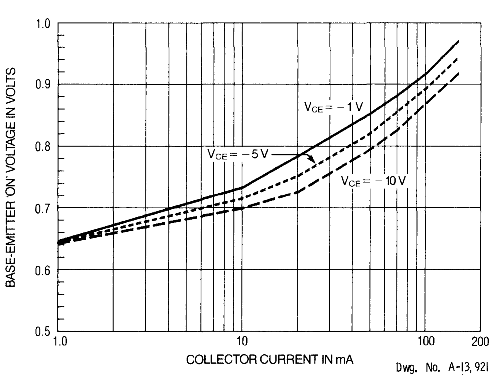
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



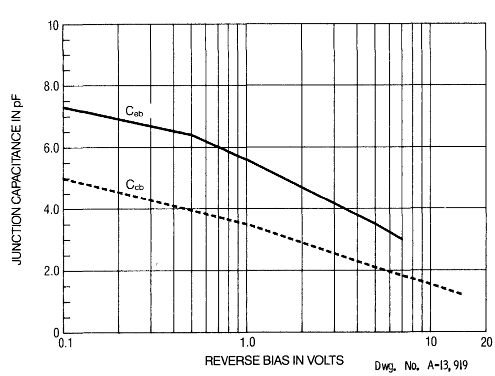
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

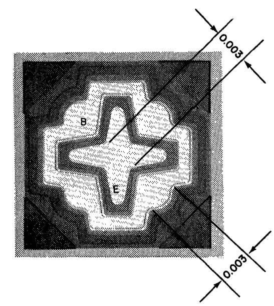


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process TNL
NPN Small-Signal Transistor

Process TNL transistors and chips are double-diffused NPN silicon epitaxial planar devices intended for use in general-purpose amplifiers and medium-power switching applications. Selected chips and finished devices, such as the 2N5376 and 2N5377, are ideally suited for industrial small-signal, low-noise applications. Process TNL is the complement to the PNP Process TQL.



TNL 0.022″ × 0.022″

ALTERNATE PROCESSES: BBC, DCA, JGA

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

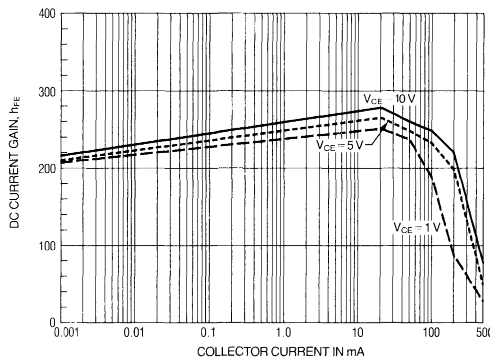
ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	55	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	5.0	7.6	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	95	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 50\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	240	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	260	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	—	230	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.04	—	V
		$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.1	—	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.9	—	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 50\,mA$	—	400	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	3.5	—	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	18	—	pF
Delay Time*	t_d	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	8.0	10	ns
Rise Time*	t_r	$I_B = 15\,mA$	—	17	25	ns
Storage Time*	t_s	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	330	400	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 15\,mA$	—	50	70	ns

*Switching speeds measured at 2N2222A test conditions.

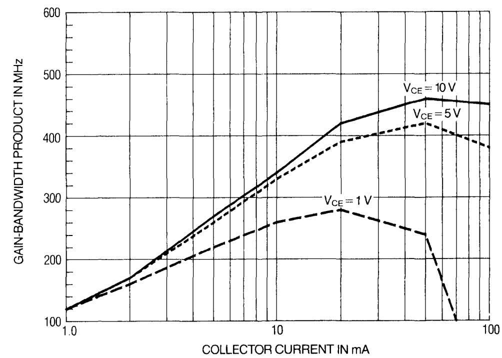
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



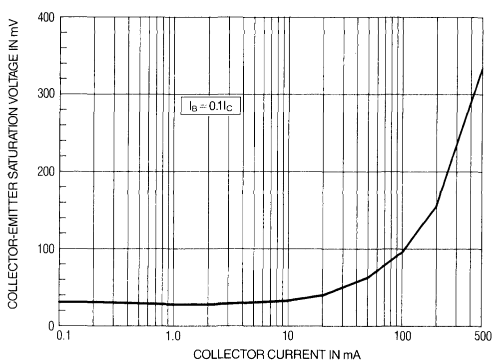
Dwg. No. A-13, 923

f_T AS A FUNCTION OF COLLECTOR CURRENT



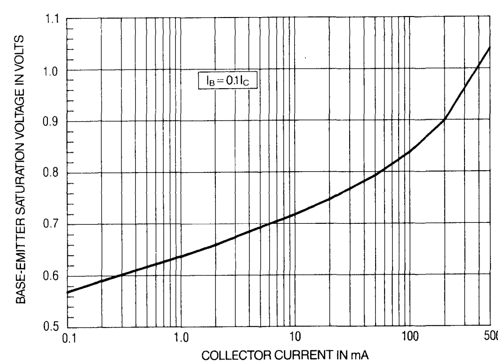
Dwg. No A-13, 925

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



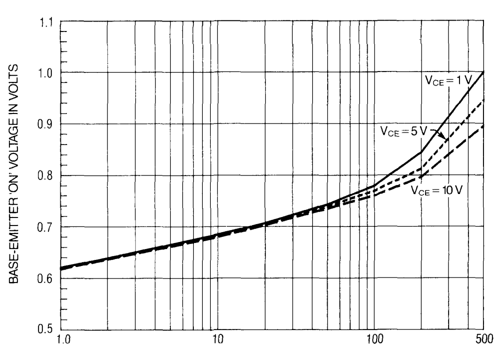
Dwg No. A-13, 926

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



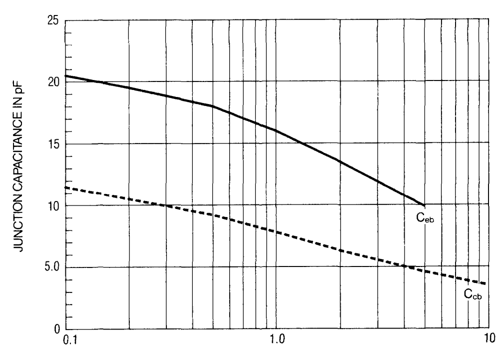
Dwg. No. A-13, 927

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 928

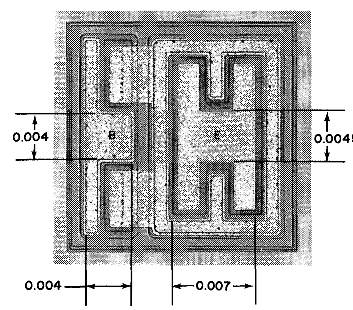
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 924

Process TPM
NPN Darlington Transistor

Process TPM is a double-diffused silicon epitaxial planar NPN Darlington pair.



TPM 0.024″ × 0.024″

ABSOLUTE MAXIMUM RATINGS

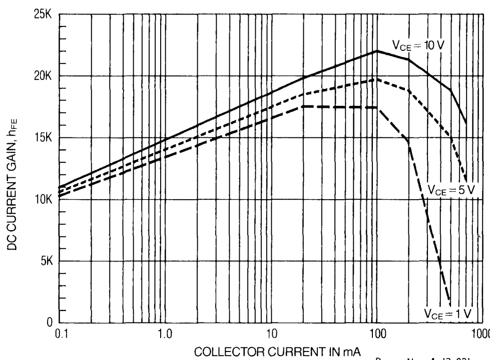
Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	55	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	12	14.2	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	100	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 10\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 2.0\,mA$	—	15k	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	6k	17k	100k	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	10k	20k	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 0.01\,mA$	—	0.72	1.0	V
		$I_C = 200\,mA$, $I_B = 0.2\,mA$	—	0.9	1.4	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 200\,mA$, $I_B = 0.2\,mA$	—	1.5	1.6	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 2.0\,mA$	100	135	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	4.0	10	pF
Input Capacitance	C_{eb}	$V_{EB} = 1.0\,V$, $f = 1.0\,MHz$	—	10	15	pF

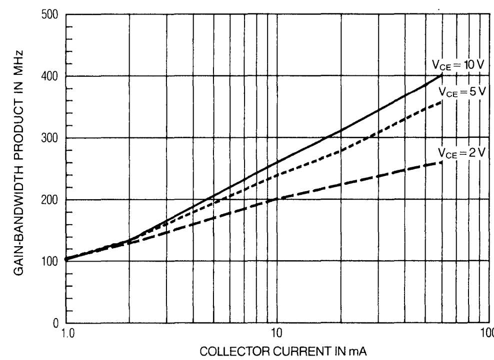
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



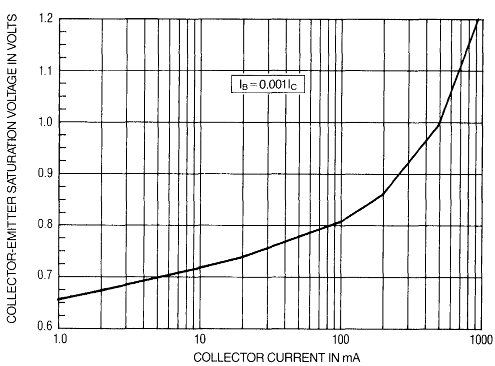
Dwg. No. A-13,931

f_T AS A FUNCTION OF COLLECTOR CURRENT



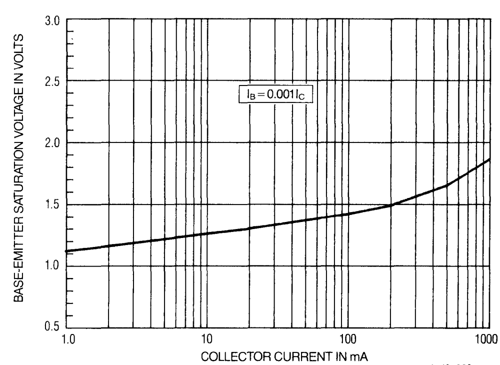
Dwg. No. A-13933

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



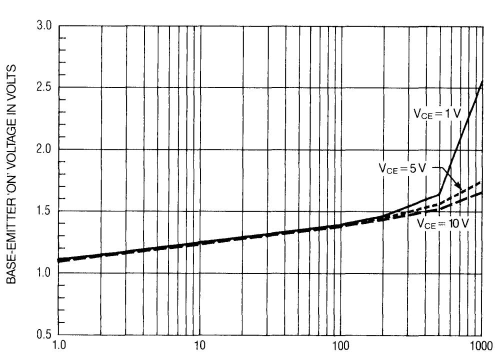
Dwg. No. A-13,929

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



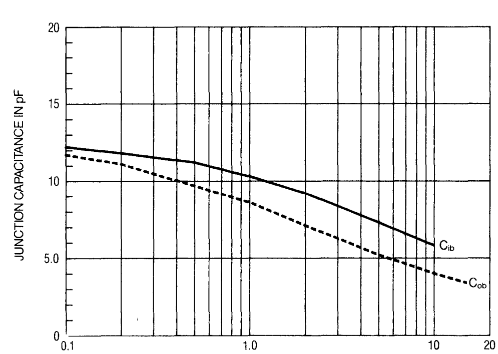
Dwg. No. A-13,930

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,934

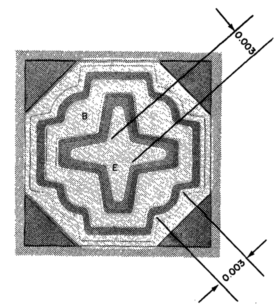
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,932

Process TQL
PNP Small-Signal Transistor

Process TQL is a double-diffused PNP silicon epitaxial planar device for low-noise, high-gain amplification, medium-power switching, and general-purpose use from dc to UHF. Process TQL is the complement to the NPN Process TNL.



TQL 0.022″ × 0.022″

ALTERNATE PROCESSES: BDA, DDA, JFA

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 500 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

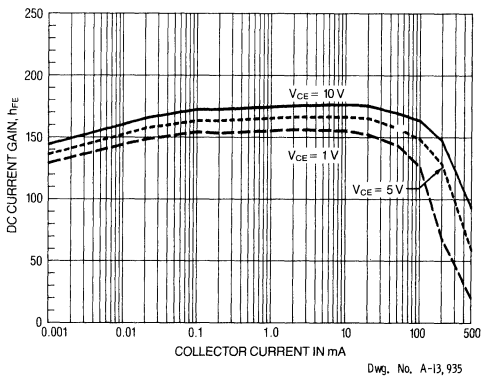
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	40	76	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.4	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	100	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 0.1\,mA$	—	160	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	165	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	—	150	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.05	0.4	V
		$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.12	—	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.86	0.95	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	100	310	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	6.0	10	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	16	30	pF
Delay Time*	t_d	$V_{CC} = 30\,V$, $I_C = 150\,mA$,	—	5.0	10	ns
Rise Time*	t_r	$I_B = 15\,mA$	—	14	20	ns
Storage Time*	t_s	$V_{CC} = 6.0\,V$, $I_C = 150\,mA$,	—	60	80	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 15\,mA$	—	44	60	ns

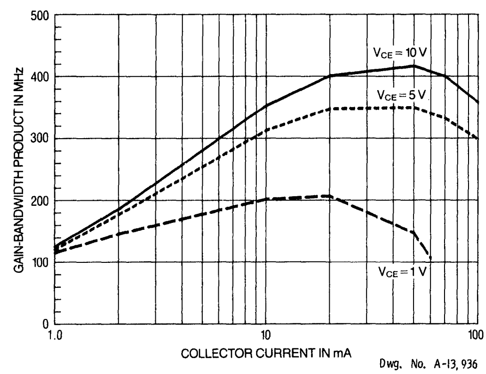
*Switching speeds measured at 2N2907 test conditions.

Typical Characteristics
at T_A = +25°C

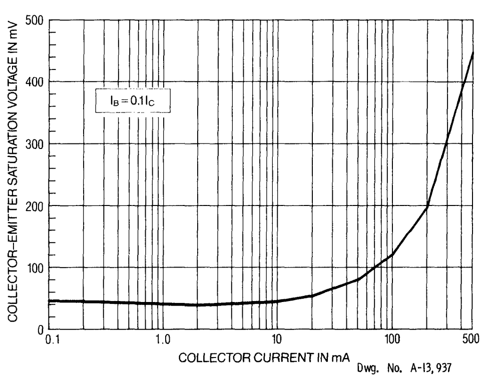
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



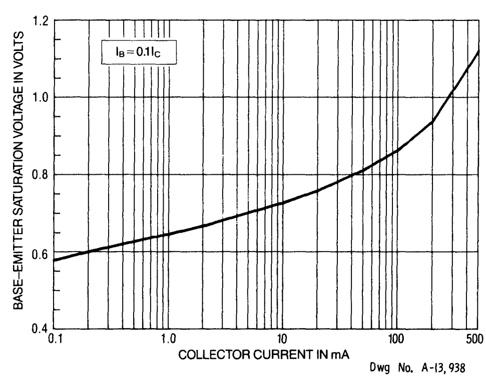
f_T AS A FUNCTION OF COLLECTOR CURRENT



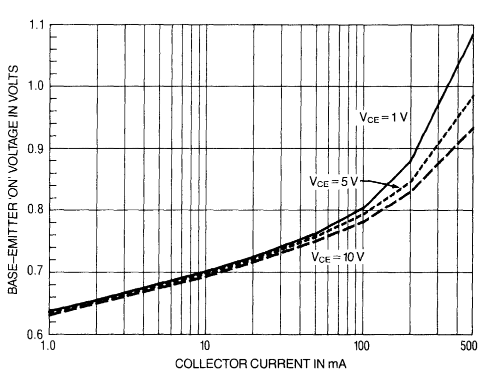
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



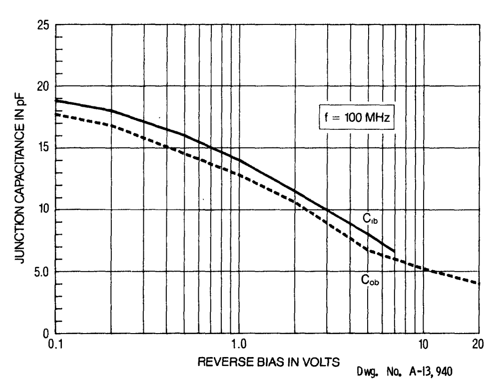
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

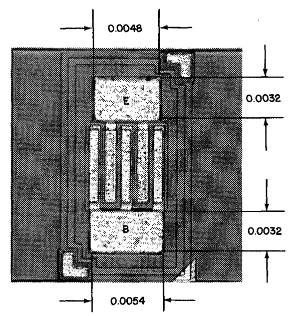


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process TVO
NPN High-Speed Switching Transistor

Process TVO is an NPN double-diffused silicon epitaxial planar device with gold diffusion. It is used as a general-purpose switch and amplifier. The PNP complement to this device is Process BTB.



TVO 0.019″ × 0.019″

ALTERNATE PROCESS: FFB

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 200 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

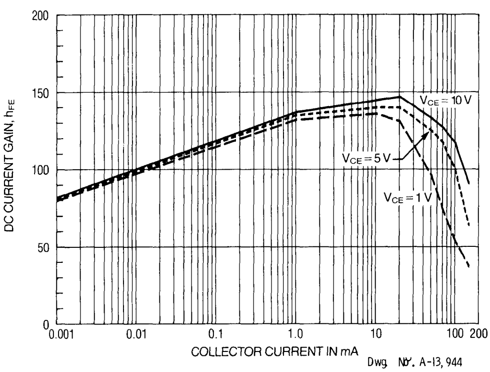
ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	50	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.1	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	70	110	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 70\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 1.0\,V$, $I_C = 1.0\,mA$	—	130	—	—
		$V_{CE} = 1.0\,V$, $I_C = 10\,mA$	—	135	—	—
		$V_{CE} = 1.0\,V$, $I_C = 50\,mA$	—	95	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.07	0.2	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.11	0.3	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.85	0.95	V
Gain-Bandwidth Product	f_T	$V_{CE} = 20\,V$, $I_C = 10\,mA$	250	460	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 5.0\,V$, $f = 1.0\,MHz$	—	1.6	4.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	5.0	8.0	pF
Noise Figure	NF	$V_{CE} = 5.0\,V$, $I_C = 100\,\mu A$, $R_S = 1.0\,k\Omega$, BW = 10 Hz – 15.7 kHz	—	1.0	5.0	dB
Delay Time*	t_d	$V_{CC} = 3.0\,V$, $I_C = 10\,mA$,	—	15	35	ns
Rise Time*	t_r	$I_B = 1.0\,mA$	—	12	35	ns
Storage Time*	t_s	$V_{CC} = 30\,V$, $I_C = 10\,mA$,	—	190	225	ns
Fall Time*	t_f	$I_{B1} = I_{B2} = 1.0\,mA$	—	20	50	ns

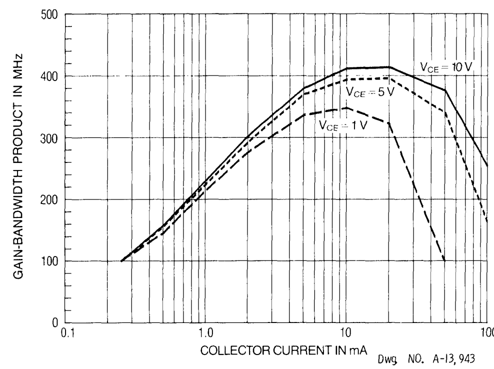
*Switching speeds measured at 2N3904 test conditions.

Typical Characteristics
at T_A = +25°C

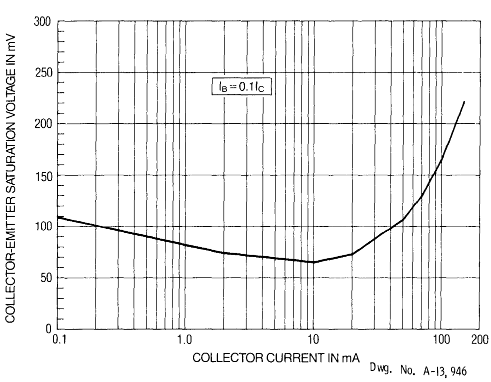
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



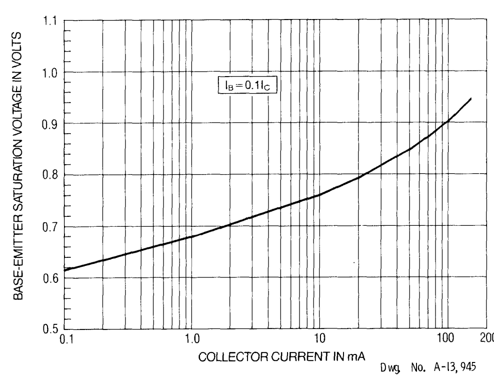
f_T AS A FUNCTION OF COLLECTOR CURRENT



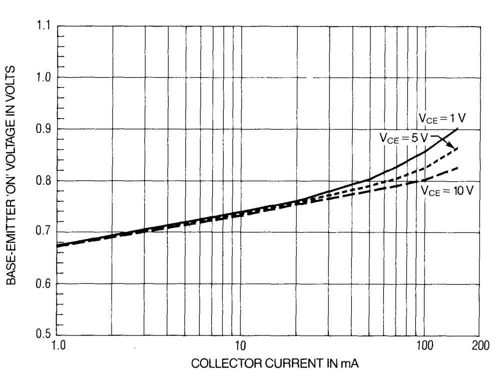
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



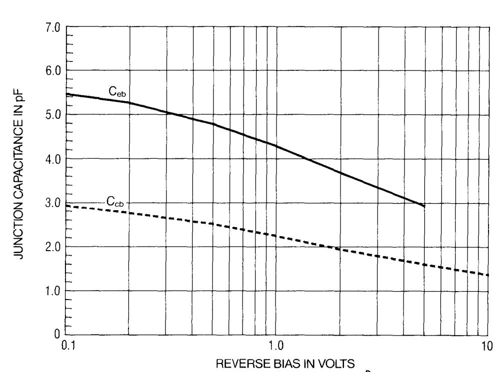
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

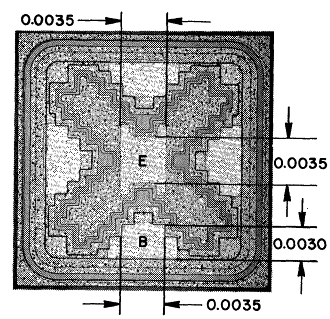


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process VAB
NPN High-Voltage Transistor

Process VAB is an NPN double-diffused silicon epitaxial planar device designed for use in general-purpose, high-voltage amplifier circuits. Process VAB is the complement to PNP Process VHB.



VAB 0.024″ × 0.024″

ALTERNATE PROCESS: VXA

ABSOLUTE MAXIMUM RATINGS

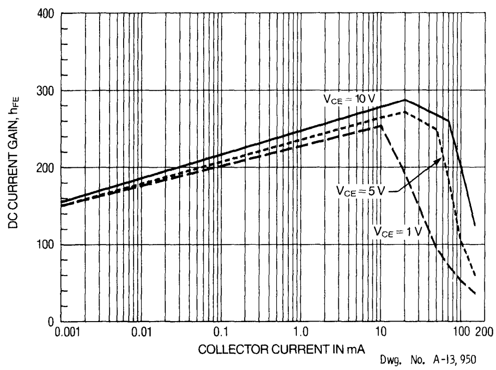
Collector Current, I_C .... 300 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

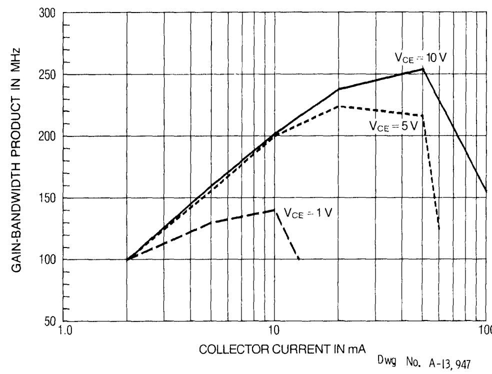
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1.0\,mA$	90	180	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.5	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	200	310	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 200\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	240	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	70	260	500	—
		$V_{CE} = 5.0\,V$, $I_C = 50\,mA$	50	250	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.05	0.2	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.08	0.25	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.8	1.00	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 10\,mA$	100	200	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	3.0	6.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	33	50	pF

Typical Characteristics
at $T_A = +25°C$

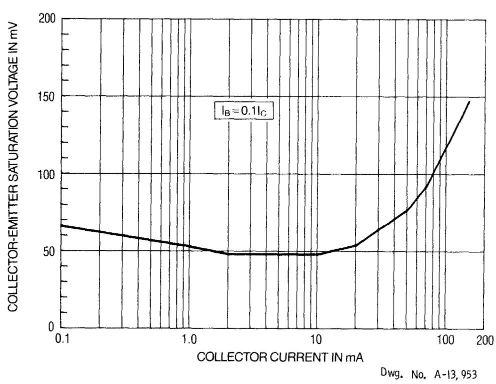
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



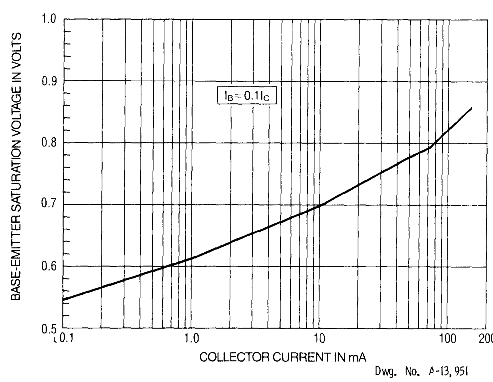
f_T AS A FUNCTION OF COLLECTOR CURRENT



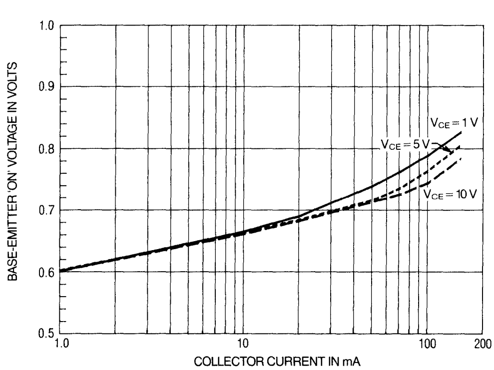
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



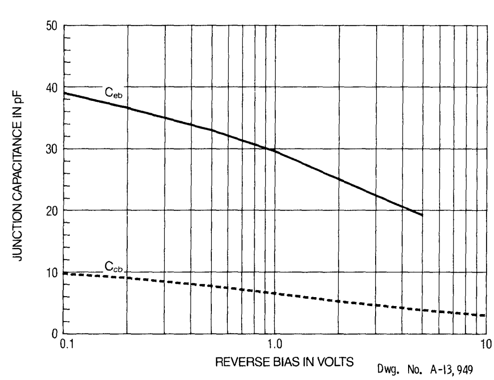
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

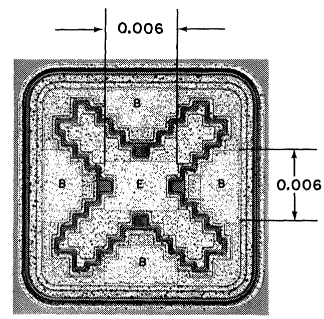


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process VHB
PNP High-Voltage Transistor

Process VHB is a PNP double-diffused silicon epitaxial planar device. It is designed for use in high-voltage amplifier circuits. It is the complement to NPN Process VAB.



VHB 0.024″ × 0.024″

ALTERNATE PROCESS: BCA

ABSOLUTE MAXIMUM RATINGS

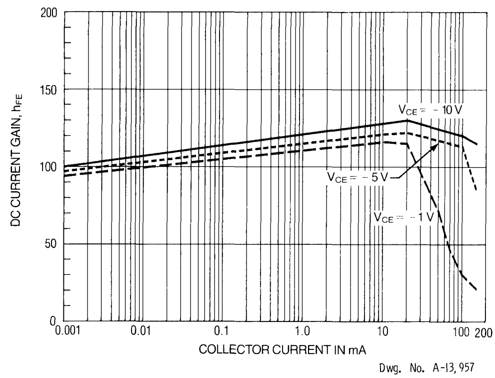
Collector Current, I_C . . . . 300 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

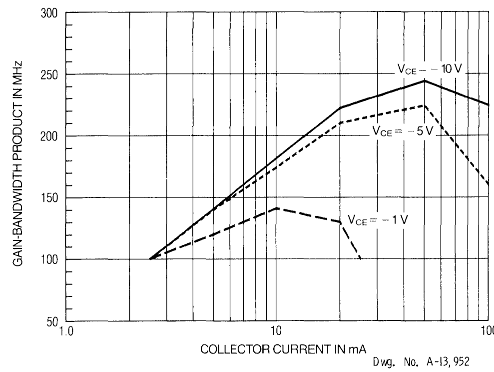
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1.0\,mA$	120	210	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.4	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	160	240	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 160\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	120	—	—
		$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	120	—	—
		$V_{CE} = 5.0\,V$, $I_C = 50\,mA$	—	115	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.075	0.2	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.12	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.8	1.0	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 10\,mA$	100	180	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	5.1	6.0	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	44	55	pF
Noise Figure	NF	$V_{CE} = 5.0\,V$, $I_C = 250\,\mu A$, $R_S = 1\,k\Omega$, BW = 10 Hz–15.7 kHz	—	1.0	8.0	dB

Typical Characteristics
at T_A = +25°C

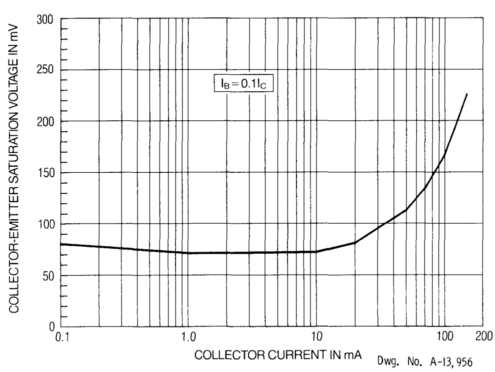
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



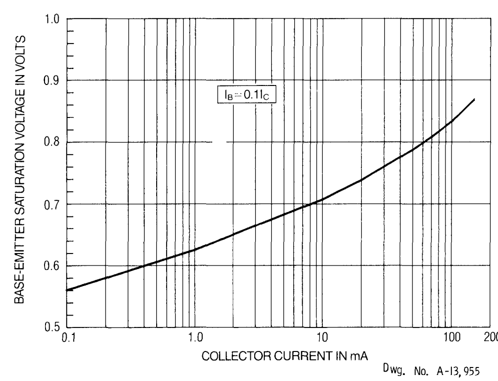
f_T AS A FUNCTION OF COLLECTOR CURRENT



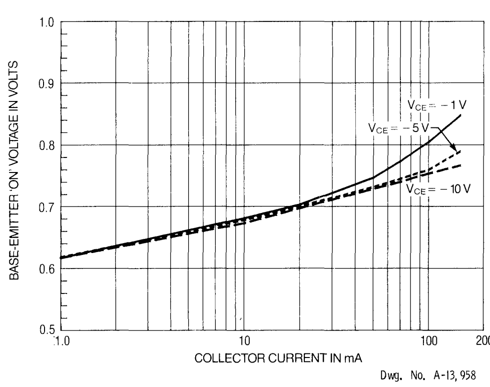
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



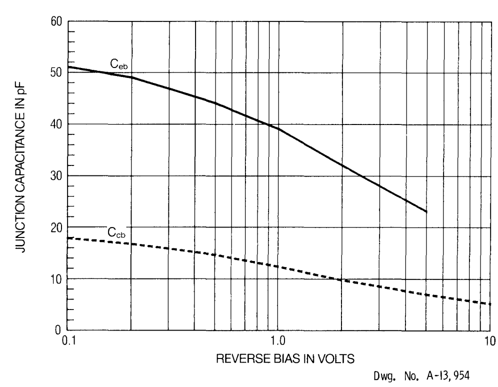
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

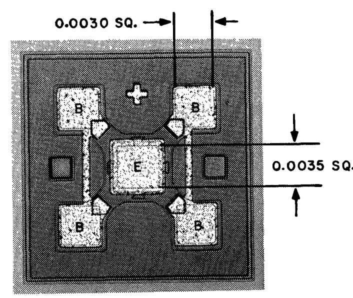


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process VRB
NPN Small-Signal Transistor

Process VRB is an NPN double-diffused silicon epitaxial planar transistor designed for general-purpose amplifier and switching circuits.



VRB 0.019″ × 0.019″

ABSOLUTE MAXIMUM RATINGS

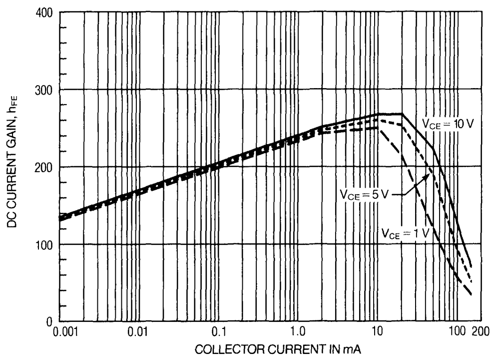
Collector Current, I_C .... 200 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	30	50	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.5	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	70	115	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 70\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 10\,V$, $I_C = 0.1\,mA$	—	200	—	—
		$V_{CE} = 10\,V$, $I_C = 10\,mA$	50	265	600	—
		$V_{CE} = 10\,V$, $I_C = 100\,mA$	20	130	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.05	0.25	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.12	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.93	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 5.0\,mA$	120	380	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	1.9	4.0	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	5.2	15	pF

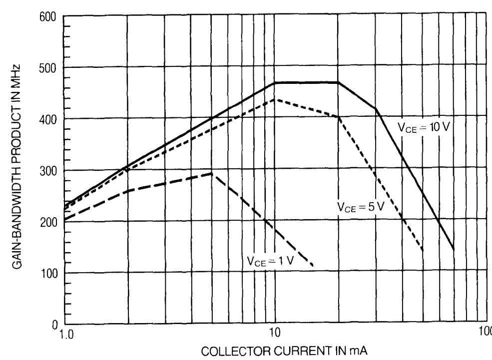
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



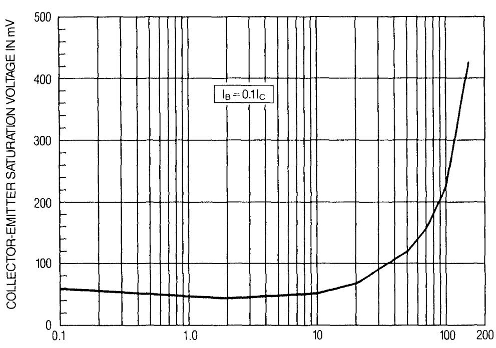
Dwg. No. A-14, 086

f_T AS A FUNCTION OF COLLECTOR CURRENT



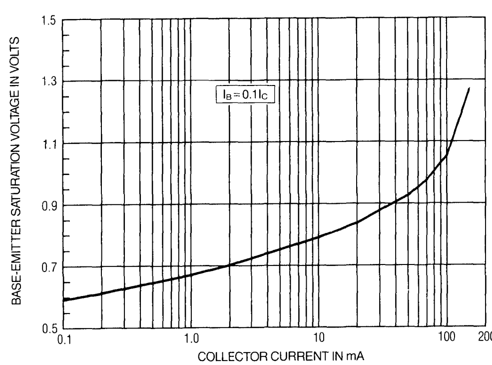
Dwg. NO. A-14, 087

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



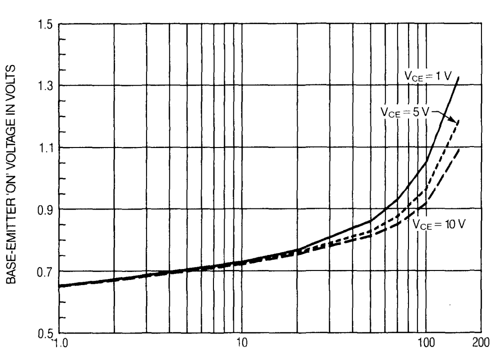
Dwg. No. A-14, 084

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



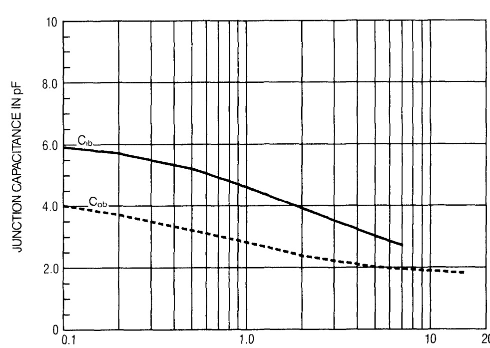
Dwg. No. A-14, 085

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-14, 088

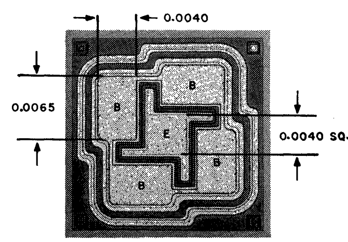
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14, 089

Process VXA
NPN Small-Signal Transistor

Process VXA is a double-diffused NPN silicon epitaxial planar device. It is designed for use in general-purpose high-voltage amplifiers. It is the complement to the PNP Process BCA.



VXA 0.023″ × 0.023″

ABSOLUTE MAXIMUM RATINGS

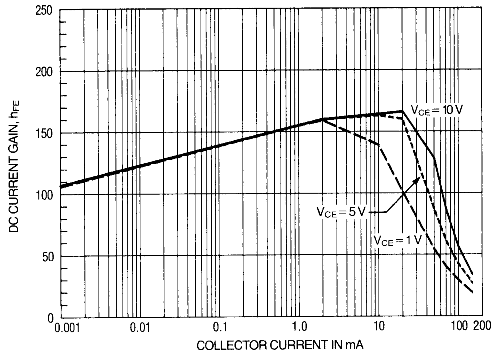
Collector Current, I_C .... 150 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	100	185	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.4	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	180	280	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 180V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0V$, $I_C = 1.0\,mA$	—	150	—	—
		$V_{CE} = 5.0V$, $I_C = 10\,mA$	80	160	500	—
		$V_{CE} = 5.0V$, $I_C = 50\,mA$	30	90	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\,mA$, $I_B = 1.0\,mA$	—	0.07	0.15	V
		$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.11	0.25	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 50\,mA$, $I_B = 5.0\,mA$	—	0.8	1.2	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10V$, $I_C = 10\,mA$	100	210	—	MHz
Output Capacitance	C_{ob}	$V_{CB} = 10V$, $f = 1.0MHz$	—	2.4	6.0	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5V$, $f = 1.0MHz$	—	17	30	pF
Noise Figure	NF	$V_{CE} = 5.0V$, $I_C = 250\,\mu A$, $R_S = 1\,k\Omega$, BW = 10 Hz – 15.7 kHz	—	1.0	8.0	dB

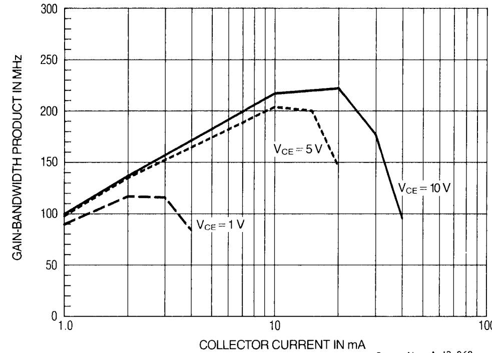
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



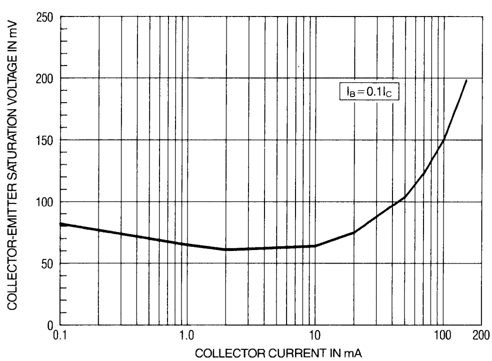
Dwg. No. A-13, 959

f_T AS A FUNCTION OF COLLECTOR CURRENT



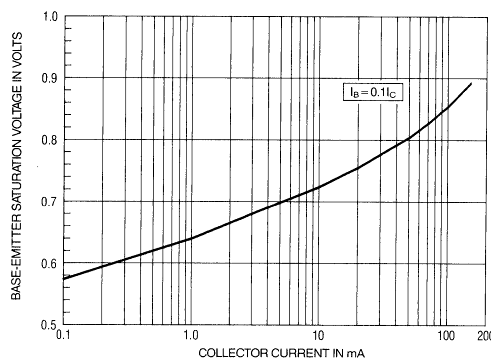
Dwg. No. A-13, 960

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



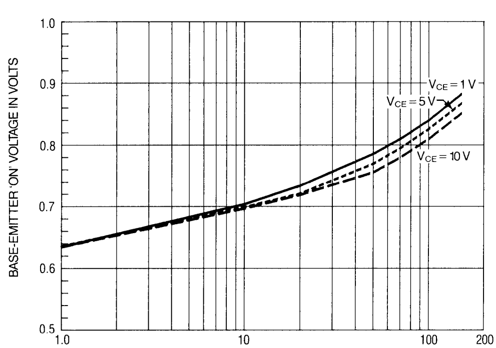
Dwg. No. A-13, 963

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



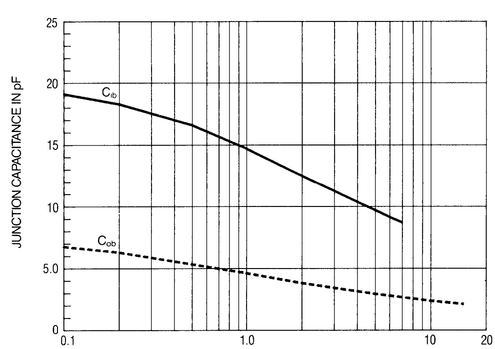
Dwg. No. A-13,962

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13, 964

JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



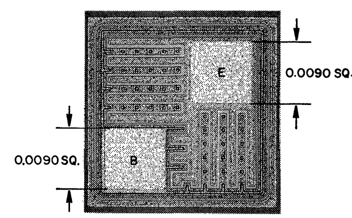
Dwg. No. A-13, 961

Process YCA
NPN Small-Signal Transistor

Process YCA is a double-diffused epitaxial planar NPN silicon transistor designed for use in general-purpose switching and amplifier circuits. It can operate at collector currents of up to 1 A. It is the complement to the PNP Process YDA.

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C . . . . 1000 mA
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C



YCA 0.031″ × 0.031″

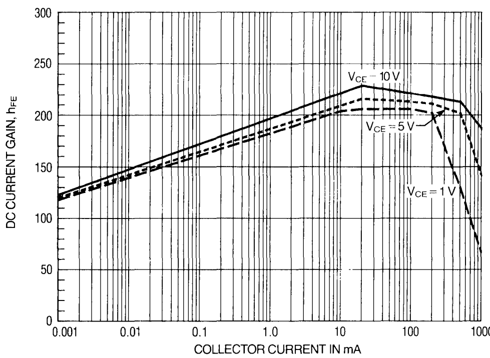
ALTERNATE PROCESS: DID

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	50	80	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	8.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	120	180	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 100\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 10\,mA$	—	200	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	50	210	—	—
		$V_{CE} = 5.0\,V$, $I_C = 500\,mA$	—	200	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.05	0.2	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.16	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.77	0.8	V
Gain-Bandwidth Product	f_T	$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	150	230	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	9.0	30	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	120	150	pF

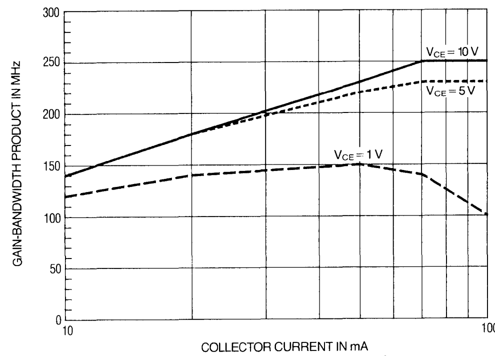
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



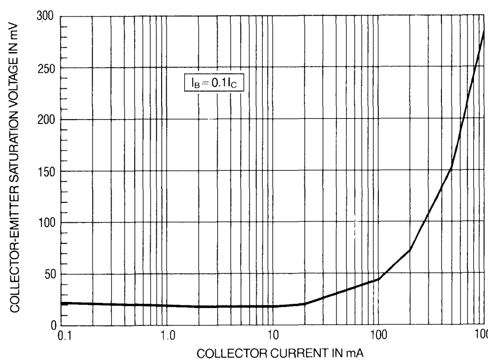
Dwg. No. A-13, 970

f_T AS A FUNCTION OF COLLECTOR CURRENT



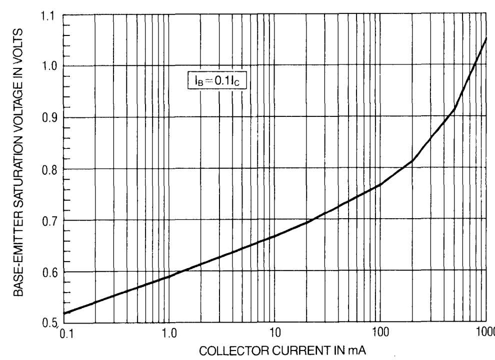
Dwg. No. A-13, 967

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



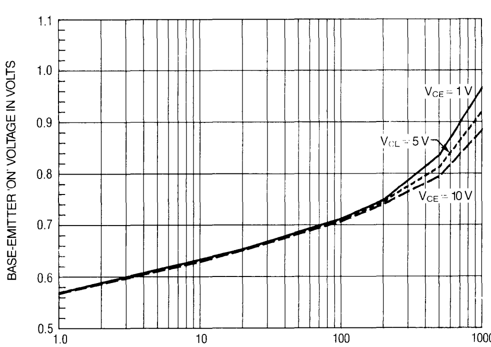
Dwg. No. A-13, 966

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



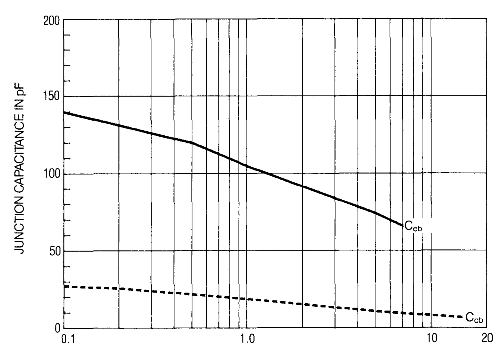
Dwg. No. A-13, 968

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg No A-13, 969

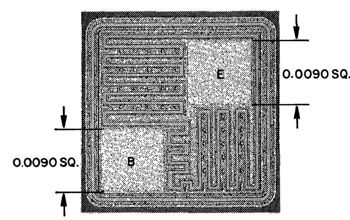
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13, 965

Process YDA
PNP Small-Signal Transistor

Process YDA is a PNP silicon double-diffused epitaxial planar device designed for use in general-purpose amplifier and switching circuits. It can operate with a collector current of up to 1A. It is the complement to the NPN Process YCA.



YDA 0.031″ × 0.031″

ALTERNATE PROCESS: DJC

ABSOLUTE MAXIMUM RATINGS

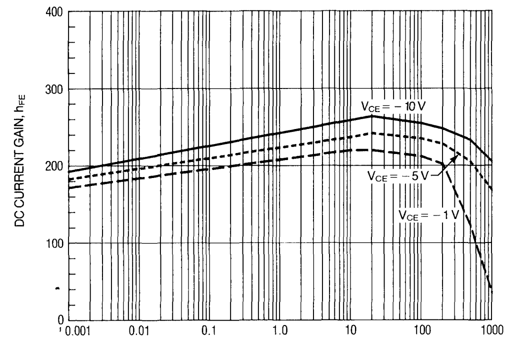
Collector Current, I_C .... 1000 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	50	90	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	6.0	7.5	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	80	135	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80\,V$	—	—	100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 5.0\,V$	—	—	100	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 1.0\,mA$	—	230	—	—
		$V_{CE} = 5.0\,V$, $I_C = 100\,mA$	50	230	500	—
		$V_{CE} = 5.0\,V$, $I_C = 500\,mA$	25	200	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 100\,mA$, $I_B = 10\,mA$	—	0.06	0.2	V
		$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.18	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 500\,mA$, $I_B = 50\,mA$	—	0.92	1.1	V
Gain-Bandwidth Product	f_T	$V_{CE} = 10\,V$, $I_C = 50\,mA$	100	240	—	MHz
Output Capacitance	C_{cb}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	15	30	pF
Input Capacitance	C_{eb}	$V_{EB} = 0.5\,V$, $f = 1.0\,MHz$	—	125	150	pF

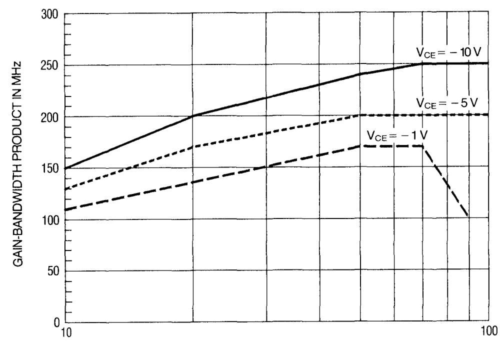
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



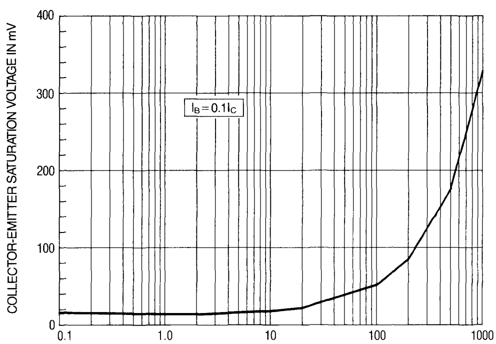
Dwg No. A-13,972

f_T AS A FUNCTION OF COLLECTOR CURRENT



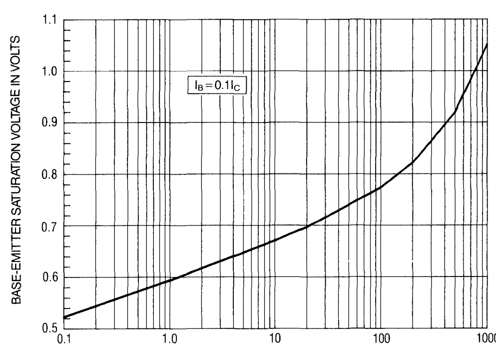
Dwg. No. A-13,973

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



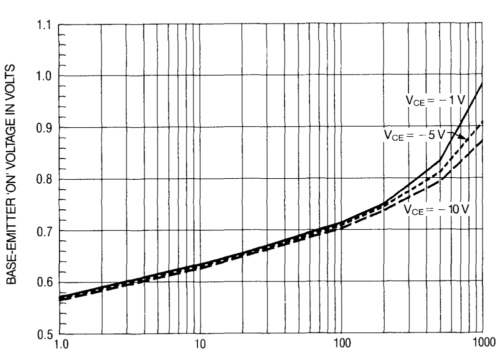
Dwg. No. A-13,974

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



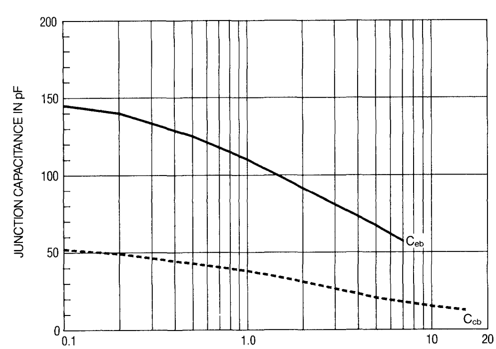
Dwg. No. A-13,975

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,976

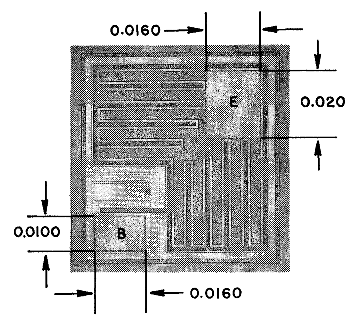
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,971

Process YFA
NPN Power Darlington Transistor

Process YFA is a double-diffused epitaxial planar NPN silicon Darlington pair. It is designed for use in high-gain, high-power amplifiers. Its complement is the PNP Process YJA.



YFA 0.063″ × 0.067″

ABSOLUTE MAXIMUM RATINGS

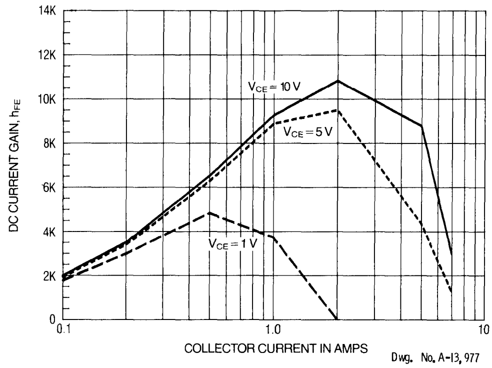
Collector Current, I_C 7.0A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10mA$	60	100	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu A$	6.0	8.6	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\mu A$	80	120	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 80V$	—	—	1000	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 6.0V$	—	—	1000	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0V$, $I_C = 500mA$	—	6.3k	—	—
		$V_{CE} = 5.0V$, $I_C = 1.0A$	—	8.8k	—	—
		$V_{CE} = 5.0V$, $I_C = 5.0A$	—	4.3k	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 500mA$, $I_B = 1.0mA$	—	0.86	—	V
		$I_C = 1.0A$, $I_B = 2.0mA$	—	0.92	—	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 1.0A$, $I_B = 2.0mA$	—	1.6	—	V
Output Capacitance	C_{ob}	$V_{CB} = 10V$, $f = 1.0MHz$	—	10	—	pF
Input Capacitance	C_{ib}	$V_{EB} = 0.5V$, $f = 1.0MHz$	—	14	—	pF

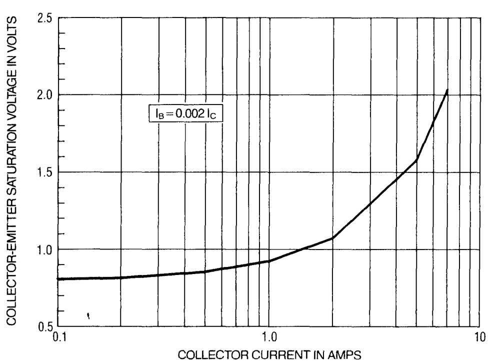
Typical Characteristics
at T_A = +25°C

h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



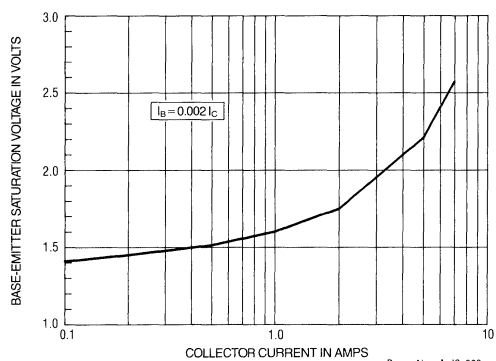
Dwg. No. A-13,977

$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



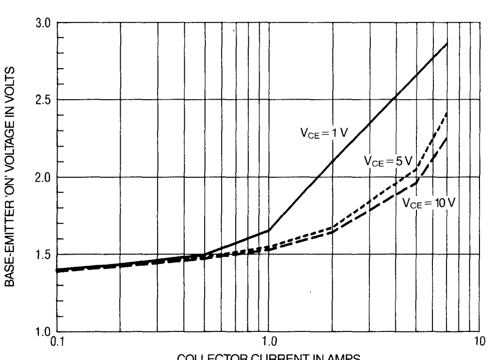
Dwg. No. A-13,979

$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



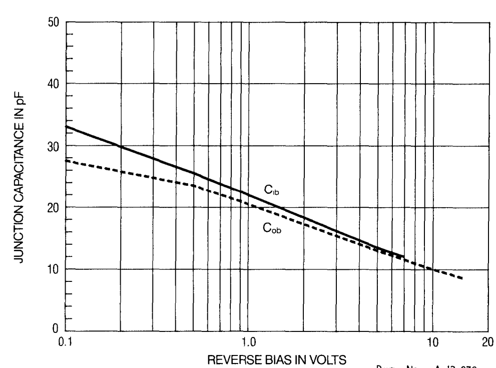
Dwg. No. A-13,980

$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-13,981

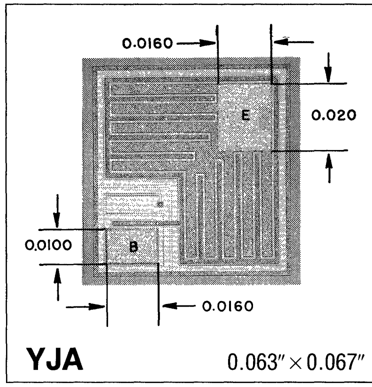
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-13,978

Process YJA
PNP Power Darlington Transistor

Process YJA is an epitaxial planar PNP silicon Darlington transistor. It is designed for use in high-gain, high-power applications. It is the PNP complement to Process YFA.



ABSOLUTE MAXIMUM RATINGS

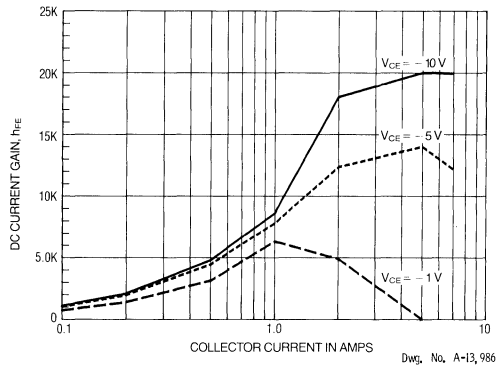
Collector Current, I_C .... 7.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

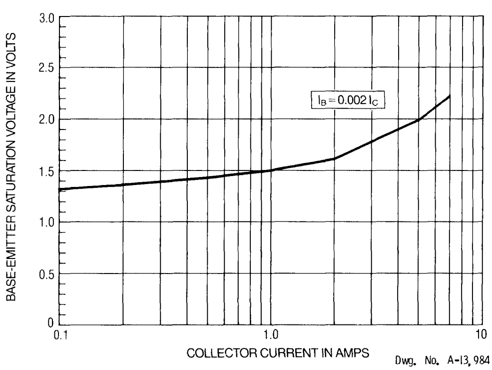
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\,mA$	60	100	—	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\,\mu A$	4.0	6.0	—	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 100\,\mu A$	60	100	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\,V$	—	—	1000	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 4.0\,V$	—	—	1000	nA
Static Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 5.0\,V$, $I_C = 500\,mA$	—	4.4k	—	—
		$V_{CE} = 5.0\,V$, $I_C = 1.0\,A$	—	7.8k	—	—
		$V_{CE} = 5.0\,V$, $I_C = 5.0\,A$	—	16k	—	—
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 500\,mA$, $I_B = 1.0\,mA$	—	0.77	—	V
		$I_C = 1.0\,A$, $I_B = 2.0\,mA$	—	0.82	—	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 1.0\,A$, $I_B = 2.0\,mA$	—	1.5	—	V
Output Capacitance	C_{ob}	$V_{CB} = 10\,V$, $f = 1.0\,MHz$	—	21	—	pF
Input Capacitance	C_{ib}	$V_{EB} = 5.0\,V$, $f = 1.0\,MHz$	—	40	—	pF

Typical Characteristics
at $T_A = +25°C$

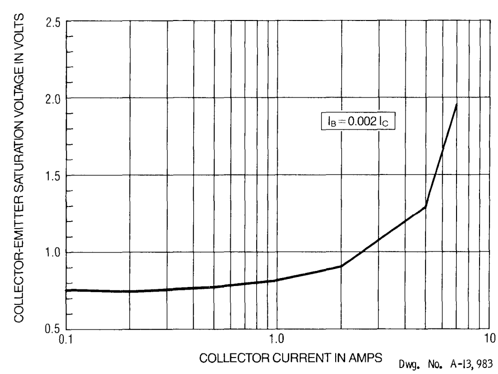
h_{FE} AS A FUNCTION OF COLLECTOR CURRENT



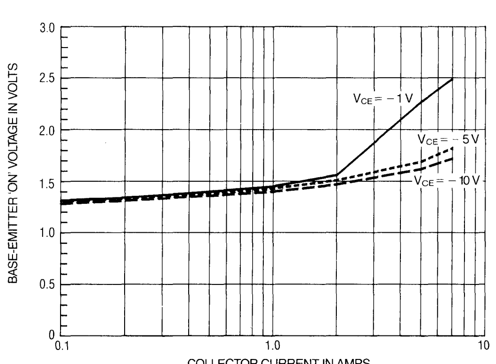
$V_{CE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



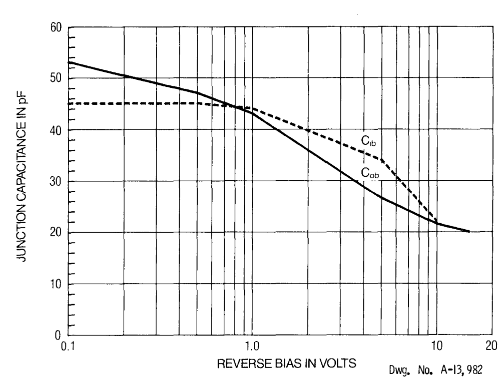
$V_{BE(sat)}$ AS A FUNCTION OF COLLECTOR CURRENT



$V_{BE(ON)}$ AS A FUNCTION OF COLLECTOR CURRENT

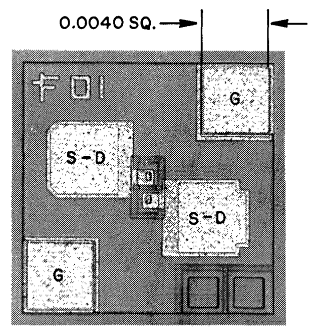


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process NJ01
N-Channel Junction Field-Effect Transistor

Process NJ01 is an N-channel junction field-effect transistor designed for low-current and audio applications. This device exhibits very low gate leakage current and high input impedance.



NJ01 0.016″ × 0.016″

ABSOLUTE MAXIMUM RATINGS

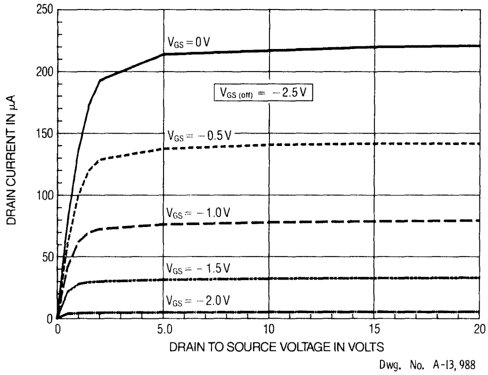
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

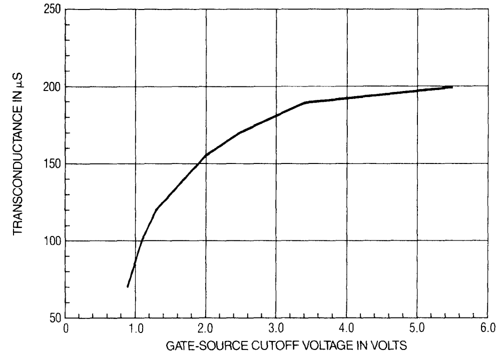
Characteristic	Symbol	Test Conditions	Limits			Units
			Min.	Typ.	Max.	
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\,\mu A$, $V_{DS} = 0V$	40	50	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 20V$, $V_{DS} = 0V$	—	1.0	10	pA
Drain Saturation Current	I_{DSS}	$V_{DS} = 10V$, $V_{GS} = 0V$	0.03	—	0.6	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 10V$, $I_D = 1.0\,nA$	1.0	—	5.5	V
Forward Transconductance	g_{fs}	$V_{DS} = 10V$, $V_{GS} = 0V$, $f = 1\,kHz$	—	175	—	μS
Input Capacitance	C_{ISS}	$V_{DS} = 10V$, $V_{GS} = 0V$, $f = 1\,MHz$	—	2.0	3.0	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 10V$, $V_{GS} = 0V$, $f = 1\,MHz$	—	0.9	1.5	pF

Typical Characteristics
at T_A = +25°C

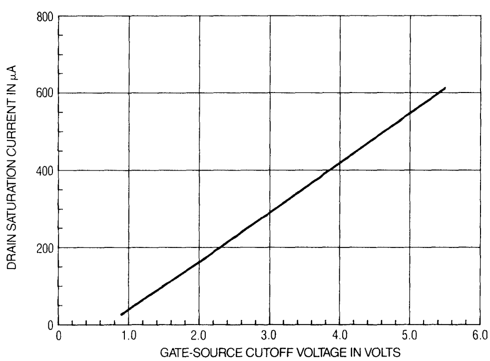
DRAIN CURRENT AS A FUNCTION OF V_{DS}



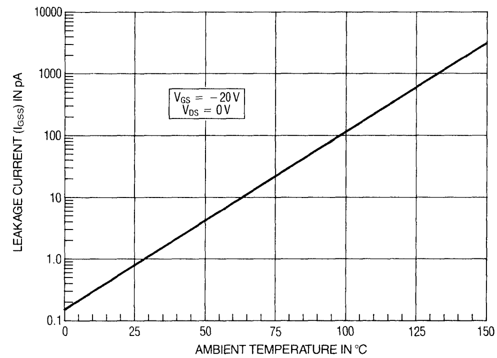
g_{fs} AS A FUNCTION OF $V_{GS(off)}$



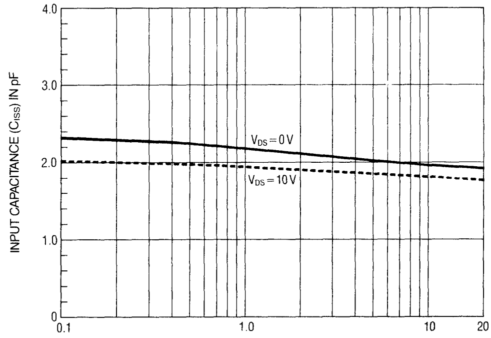
DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



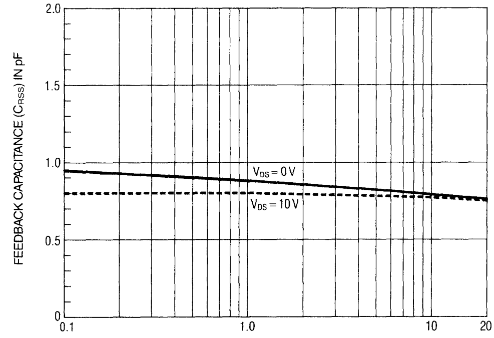
LEAKAGE CURRENT AS A FUNCTION OF TEMPERATURE



INPUT CAPACITANCE AS A FUNCTION OF V_{GS}

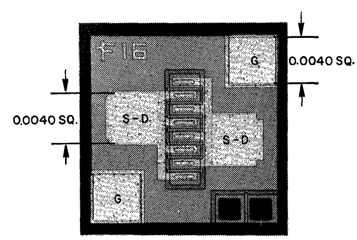


FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Process NJ16
N-Channel Junction Field-Effect Transistor

Process NJ16 is an N-channel junction field-effect transistor designed for low-current, general-purpose applications. This process is particularly useful in applications that require high breakdown voltages and low noise.



NJ16 0.017″ × 0.017″

ABSOLUTE MAXIMUM RATINGS

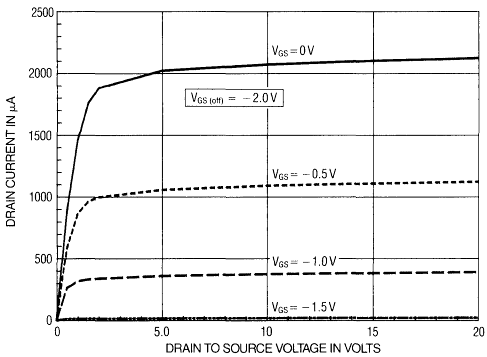
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\mu A$, $V_{DS} = 0V$	50	60	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 30V$, $V_{DS} = 0V$	—	10	100	pA
Drain Saturation Current	I_{DSS}	$V_{DS} = 15V$, $V_{GS} = 0V$	0.2	—	9.0	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 15V$, $I_D = 1.0nA$	0.8	—	5.5	V
Forward Transconductance	g_{fs}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1kHz$	—	2.2	—	mS
Input Capacitance	C_{ISS}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1MHz$	—	3.0	7.0	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1MHz$	—	1.0	3.0	pF
Noise Voltage	e_N	$V_{DS} = 10V$, $V_{GS} = 0V$, $f = 10Hz$	—	6.0	30	$\frac{nV}{\sqrt{Hz}}$

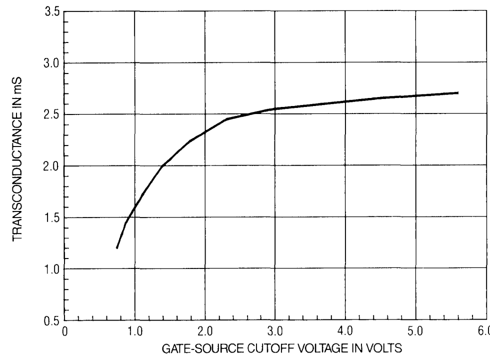
Typical Characteristics
at $T_A = +25°C$

DRAIN CURRENT AS A FUNCTION OF V_{DS}



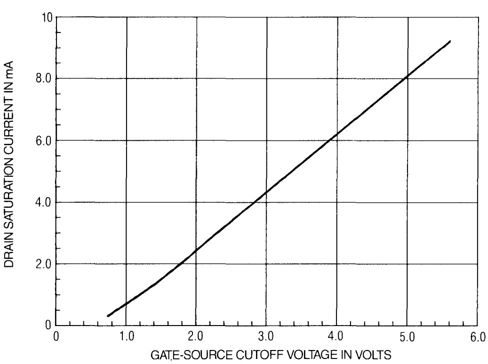
Dwg NO A-13, 995

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



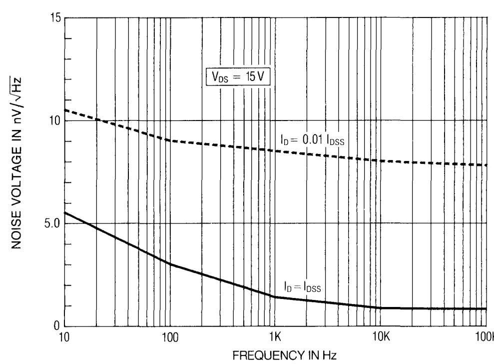
Dwg. No. A-13, 997

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



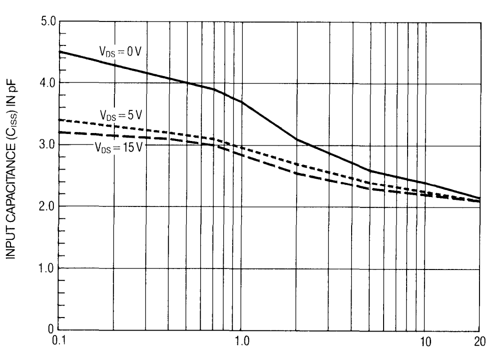
Dg. No. A-13, 996

NOISE AS A FUNCTION OF FREQUENCY



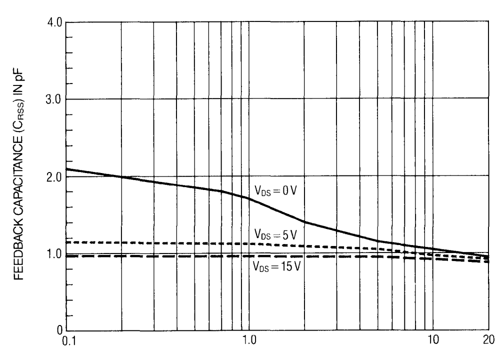
Dwg. No. A-13, 994

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. NO. A-13, 998

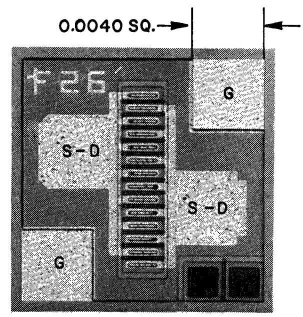
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-13, 993

Process NJ26
N-Channel Junction Field-Effect Transistor

Process NJ26 is an N-channel junction field-effect transistor designed for general-purpose amplifier applications at frequencies of up to 450MHz.



NJ26 0.016″ × 0.016″

ABSOLUTE MAXIMUM RATINGS

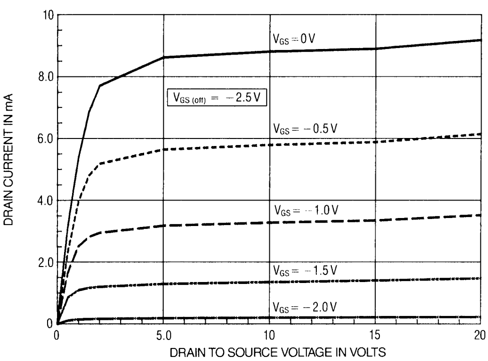
Gate Current, I_G 10mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\mu A$, $V_{DS} = 0V$	30	40	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 20V$, $V_{DS} = 0V$	—	10	100	pA
Drain Saturation Current	I_{DSS}	$V_{DS} = 15V$, $V_{GS} = 0V$	2.0	—	22	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 15V$, $I_D = 1.0nA$	1.0	—	5.0	V
Forward Transconductance	g_{fs}	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1kHz	—	6.0	—	mS
Input Capacitance	C_{ISS}	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1MHz	—	4.3	5.0	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1MHz	—	1.0	1.5	pF
Noise Figure	NF	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1kHz, $R_G = 1M\Omega$	—	—	2.5	dB

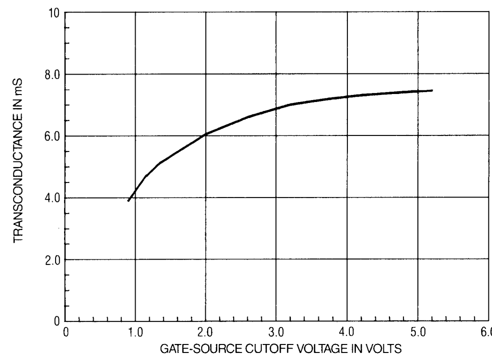
Typical Characteristics
at $T_A = +25°C$

DRAIN CURRENT AS A FUNCTION OF V_{DS}



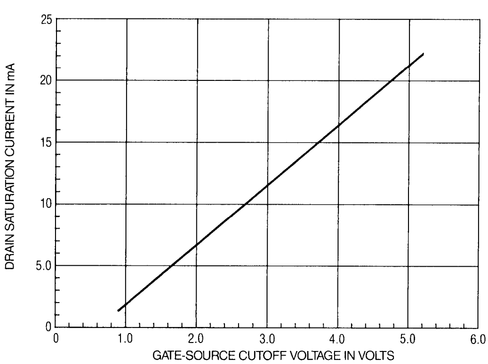
Dwg. No. A-14,000

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



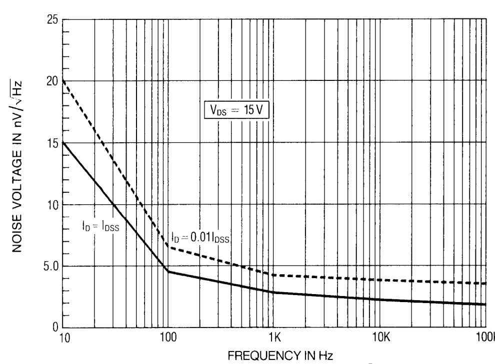
Dwg. No. A-13,403

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



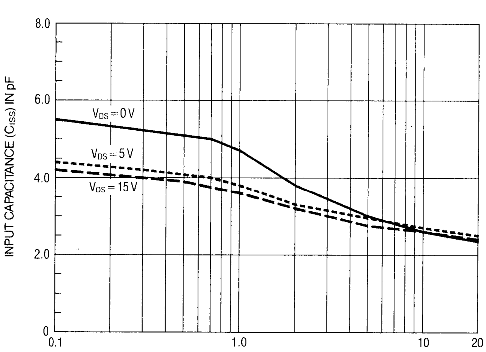
Dwg No. A-14,404

NOISE AS A FUNCTION OF FREQUENCY



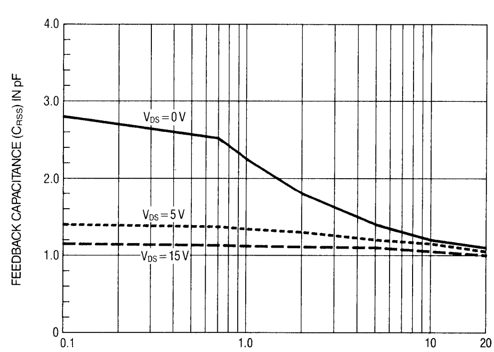
Dwg No. A-13,999

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14,002

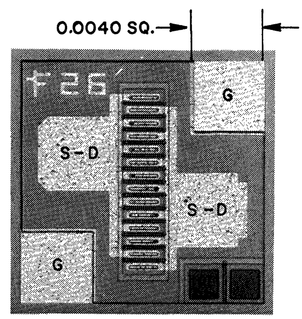
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14,001

Process NJ26L
N-Channel Junction Field-Effect Transistor

Process NJ26L is an N-channel junction field-effect transistor designed for general-purpose, low-noise, high-gain applications not requiring high breakdown voltages.



NJ26L 0.016″ × 0.016″

ABSOLUTE MAXIMUM RATINGS

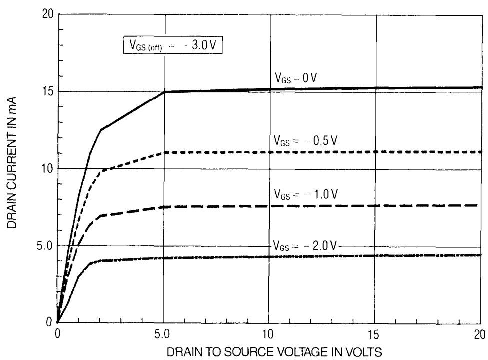
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\,\mu A$, $V_{DS} = 0V$	25	30	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 15V$, $V_{DS} = 0V$	—	10	100	pA
Drain Saturation Current	I_{DSS}	$V_{DS} = 15V$, $V_{GS} = 0V$	2.0	—	40	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 15V$, $I_D = 1.0nA$	1.5	—	6.0	V
Forward Transconductance	g_{fs}	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1 kHz	—	9.0	—	mS
Input Capacitance	C_{ISS}	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1 MHz	—	5.0	—	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1 MHz	—	1.5	—	pF
Noise Voltage	e_N	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1 kHz	—	1.0	—	$\frac{nV}{\sqrt{Hz}}$

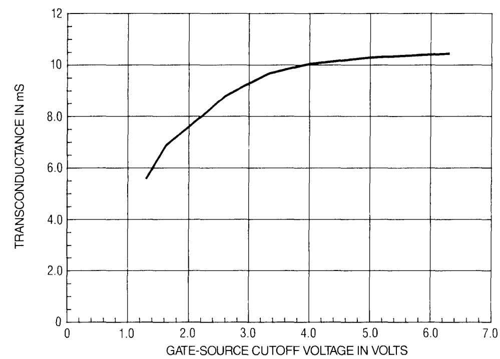
Typical Characteristics
at $T_A = +25°C$

DRAIN CURRENT AS A FUNCTION OF V_{DS}



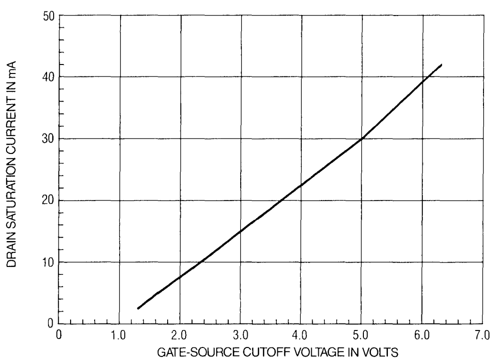
Dwg. No. A-14,005

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



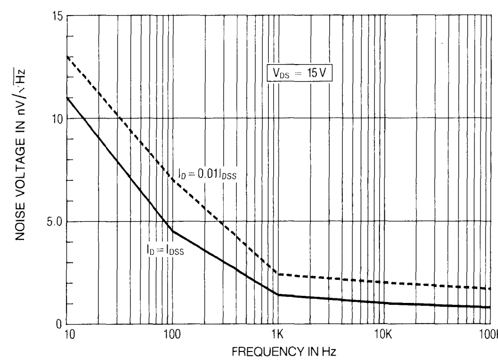
Dwg. No. A-14,009

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



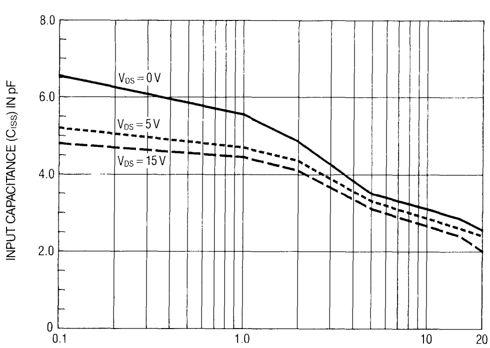
Dwg. No. A-14,010

NOISE AS A FUNCTION OF FREQUENCY



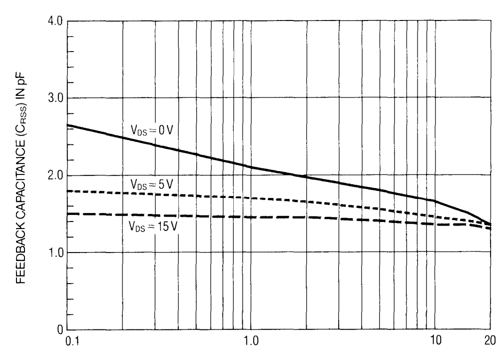
Dwg. No. A-14,006

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14,008

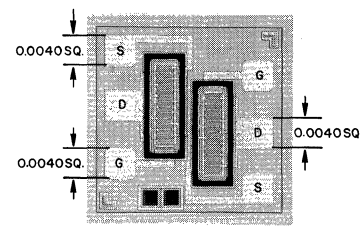
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg No. A-14,007

Process NJ28D
Dual N-Channel Junction Field-Effect Transistor

Process NJ28D is a monolithic dual N-channel junction field-effect transistor. It is similar to Process NJ35D, but has a wider range of operating current and higher gain.



NJ28D 0.026″ × 0.026″

ABSOLUTE MAXIMUM RATINGS

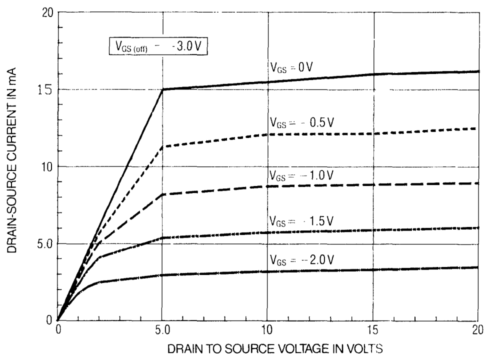
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

			Limits			
Characteristic	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\mu A$, $V_{DS} = 0V$	25	35	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 15V$, $V_{DS} = 0V$	—	50	100	pA
Drain Saturation Current	I_{DSS}	$V_{DS} = 15V$, $V_{GS} = 0V$	5.0	—	40	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 15V$, $I_D = 1.0nA$	1.0	—	8.0	V
Forward Transconductance	g_{fs}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1kHz$	—	7.5	—	mS
Input Capacitance	C_{ISS}	$V_{DS} = 0V$, $V_{GS} = 10V$, $f = 1MHz$	—	4.5	—	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 0V$, $V_{GS} = 10V$, $f = 1MHz$	—	1.7	—	pF
Noise Voltage	e_N	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1kHz$	—	7.0	—	$\frac{nV}{\sqrt{Hz}}$
Differential Gate-Source Voltage	V_{GS1}-V_{GS2}	$V_{DG} = 10V$, $I_D = 5.0mA$	—	15	50	mV

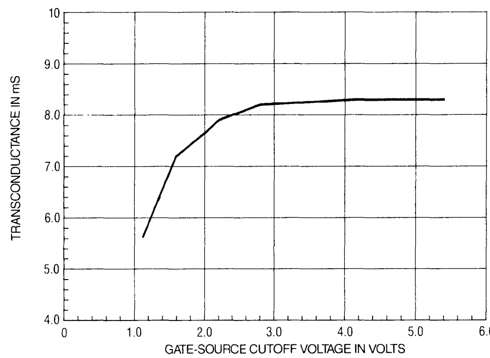
Typical Characteristics
at $T_A = +25°C$

DRAIN CURRENT AS A FUNCTION OF V_{DS}



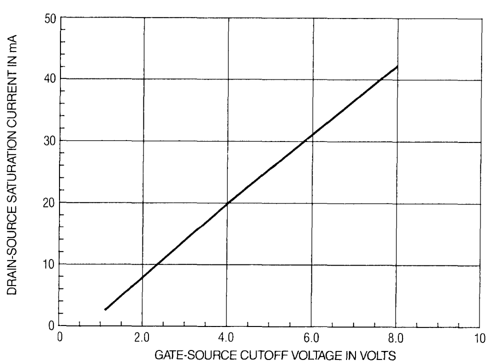
Dwg. No. A-14, 011

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



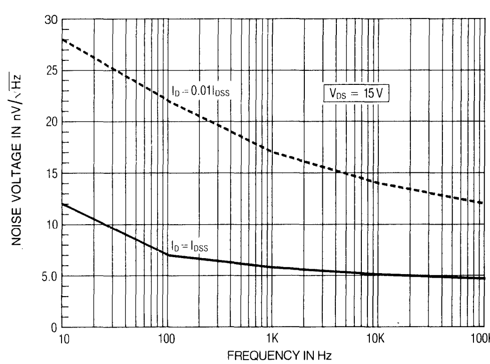
Dwg. No. A-14, 015

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



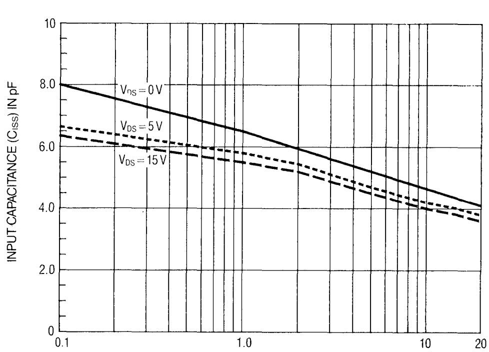
Dwg. No. A-14, 016

NOISE AS A FUNCTION OF FREQUENCY



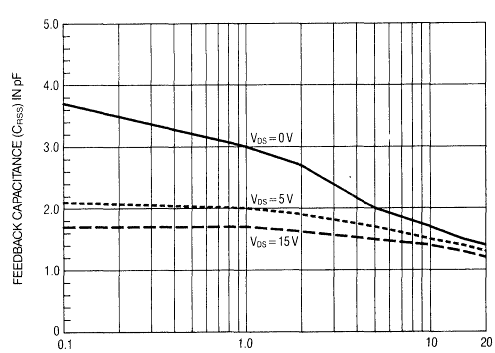
Dwg. No. A-14, 012

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 014

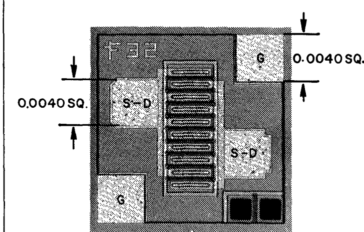
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 013

Process NJ32
N-Channel Junction Field-Effect Transistor

Process NJ32 is an N-channel junction field-effect transistor designed for use as a general-purpose audio amplifier. It is similar to Process NJ16 in basic design, but has higher gain and lower ON resistance.



NJ32 0.018″ × 0.018″

ABSOLUTE MAXIMUM RATINGS

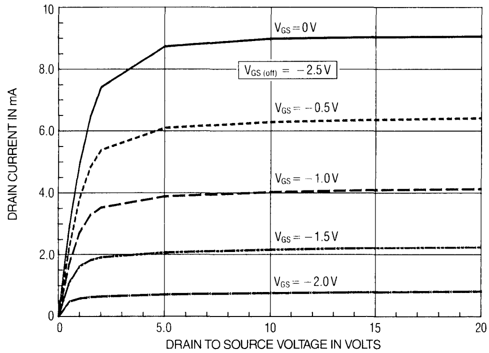
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\,\mu A$, $V_{DS} = 0V$	25	50	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 15V$, $V_{DS} = 0V$	—	10	100	pA
Drain Saturation Current	I_{DSS}	$V_{DS} = 15V$, $V_{GS} = 0V$	1.0	—	22	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 15V$, $I_D = 1.0\,nA$	1.0	—	6.0	V
Forward Transconductance	g_{fs}	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1 kHz	—	5.0	—	mS
Input Capacitance	C_{ISS}	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1 MHz	—	6.0	7.0	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1 MHz	—	1.3	3.0	pF
Noise Figure	NF	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1 kHz, $R_G = 1\,M\Omega$	—	1.0	2.5	dB

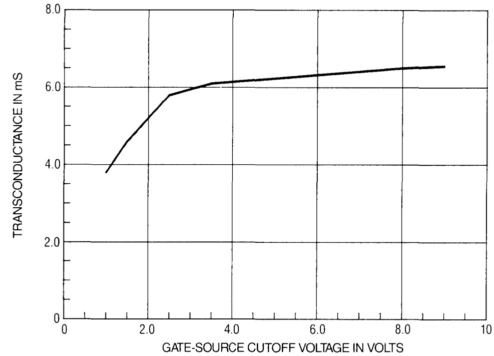
Typical Characteristics at $T_A = +25°C$

DRAIN CURRENT AS A FUNCTION OF V_{DS}



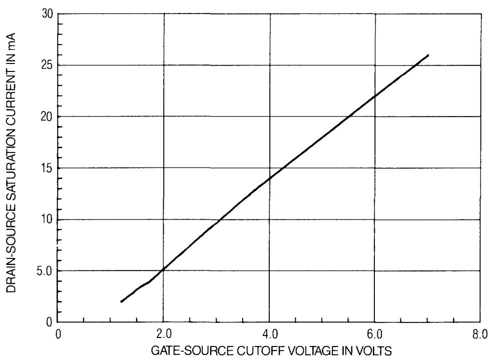
Dwg. No. A-14,017

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



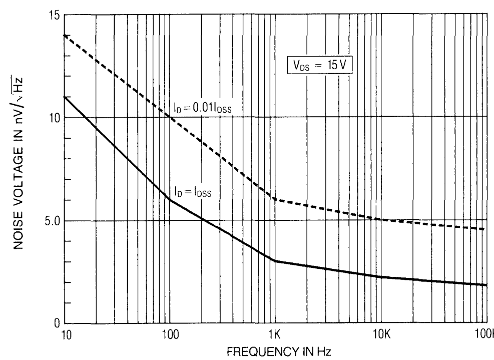
Dwg. No. A-14,021

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



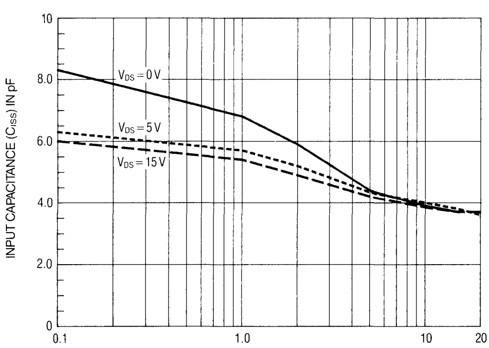
Dwg. No. A-14,022

NOISE AS A FUNCTION OF FREQUENCY



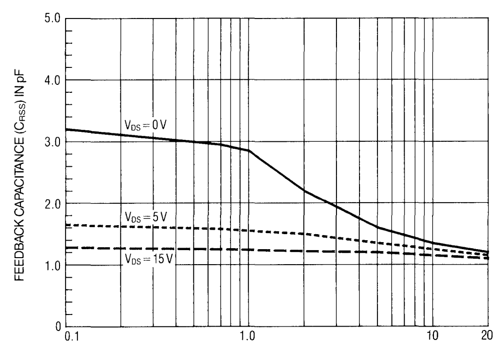
Dwg. No. A-14,018

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14,02J

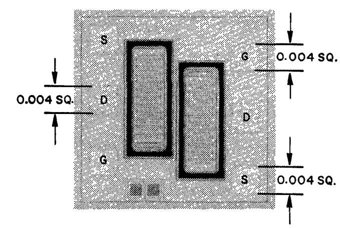
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14,019

Process NJ35D
Dual N-Channel Junction Field-Effect Transistor

Process NJ35D is a monolithic dual N-channel junction field-effect transistor designed for use as a differential amplifier. The matching characteristics are virtually independent of operating current and voltage.



NJ35D 0.028″ × 0.028″

ABSOLUTE MAXIMUM RATINGS

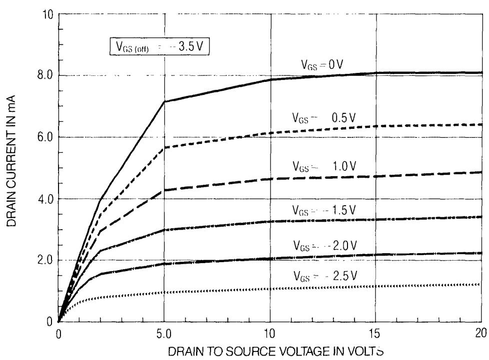
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\,\mu A$, $V_{DS} = 0V$	50	60	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 30V$, $V_{DS} = 0V$	—	50	100	pA
Drain Saturation Current	I_{DSS}	$V_{DS} = 15V$, $V_{GS} = 0V$	1.0	—	15	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 15V$, $I_D = 1.0\,nA$	1.0	—	7.0	V
Forward Transconductance	g_{fs}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1\,kHz$	—	3.5	—	mS
Input Capacitance	C_{ISS}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1\,MHz$	—	6.5	—	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1\,MHz$	—	2.0	—	pF
Noise Voltage	e_N	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1\,kHz$	—	7.0	—	$\frac{nV}{\sqrt{Hz}}$
Differential Gate-Source Voltage	V_{GS1}-V_{GS2}	$V_{DG} = 20V$, $I_D = 0.2\,mA$	—	15	50	mV

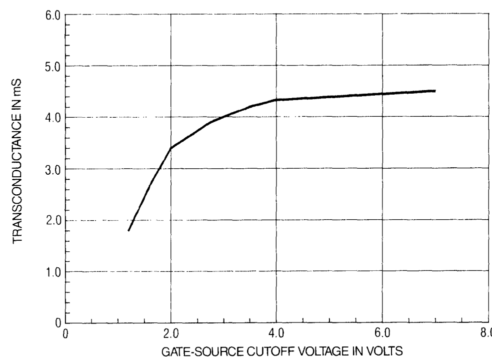
Typical Characteristics
at T_A = +25°C

DRAIN CURRENT AS A FUNCTION OF V_{DS}



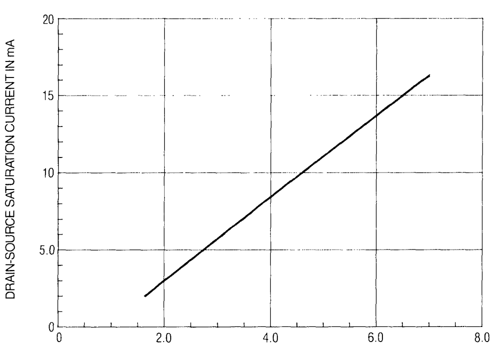
Dwg. No. A-14, 023

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



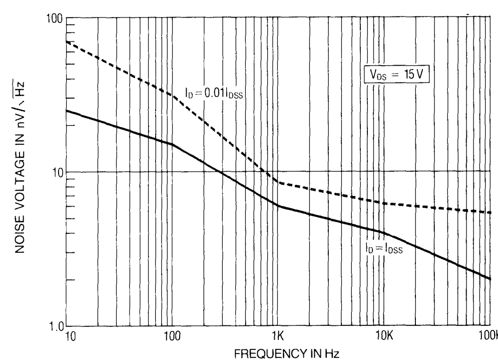
Dwg No. A-14, 027

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



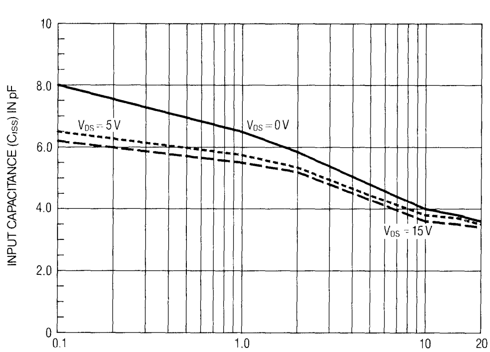
Dwg. No. A-14, 028

NOISE AS A FUNCTION OF FREQUENCY



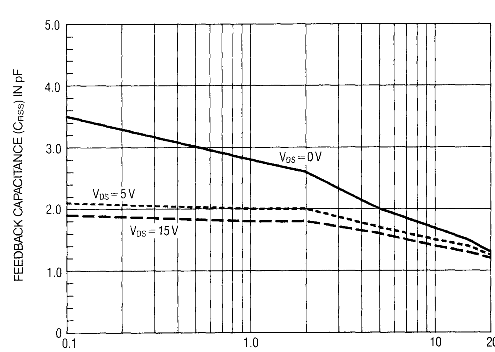
Dwg No. A-14, 024

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg No. A-14, 026

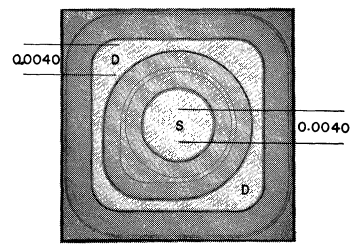
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg No. A-14, 025

Process NJ42
N-Channel Junction Field-Effect Transistor

Process NJ42 is an N-channel junction field-effect transistor designed for use as a high-voltage, general-purpose amplifier in applications requiring the high input impeadance of a JFET.



NJ42 0.032″ × 0.032″

ABSOLUTE MAXIMUM RATINGS

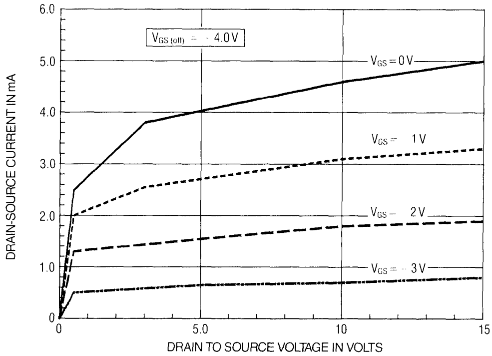
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\mu A$, $V_{DS} = 0V$	300	400	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 150V$, $V_{DS} = 0V$	—	1.0	10	nA
Drain Saturation Current	I_{DSS}	$V_{DS} = 30V$, $V_{GS} = 0V$	2.0	—	8.0	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 30V$, $I_D = 4.0nA$	4.0	—	12	V
Forward Transconductance	g_{fs}	$V_{DS} = 30V$, $V_{GS} = 0V$, f = 1 kHz	—	800	—	µS
Input Capacitance	C_{ISS}	$V_{DS} = 30V$, $V_{GS} = 0V$, f = 1 MHz	—	7.5	10	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 30V$, $V_{GS} = 0V$, f = 1 MHz	—	2.0	5.0	pF
Noise Voltage	e_N	$V_{DS} = 15V$, $V_{GS} = 0V$, f = 1 kHz	—	10	—	$\frac{nV}{\sqrt{Hz}}$

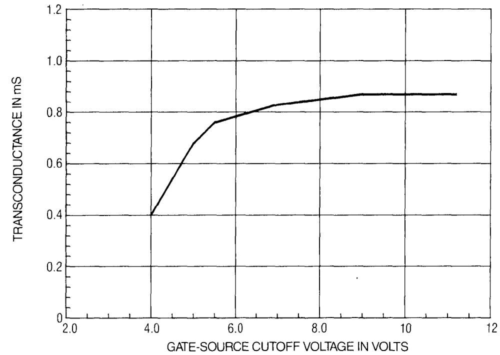
Typical Characteristics
at T_A = +25°C

DRAIN CURRENT AS A FUNCTION OF V_{DS}



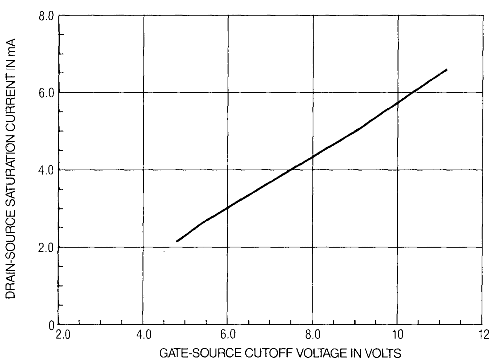
Dwg. No. A-14, 029

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



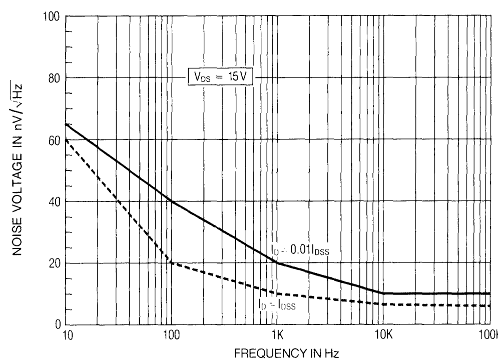
Dwg. No. A-14, 033

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



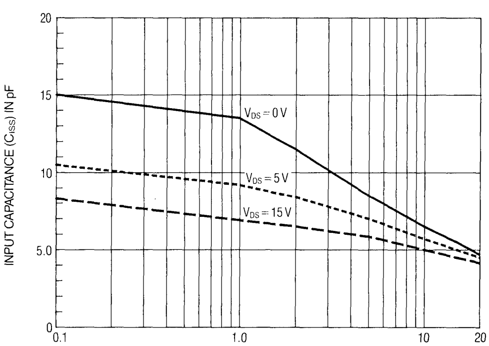
Dwg No. A-14, 034

NOISE AS A FUNCTION OF FREQUENCY



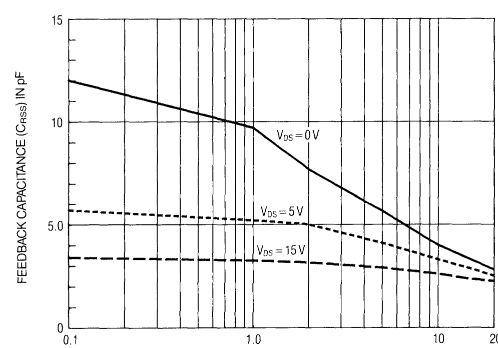
Dwg. No. A-14, 030

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 031

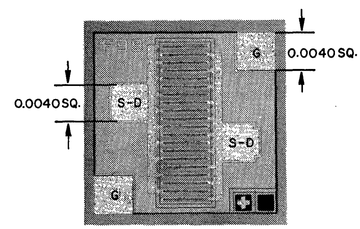
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 032

Process NJ99
N-Channel Junction Field-Effect Transistor

Process NJ99 is an N-channel junction field-effect transistor designed for use as either a general-purpose, high-gain amplifier or as a switch. Selected devices can be matched to a 75Ω input.



NJ99 0.021″ × 0.021″

ABSOLUTE MAXIMUM RATINGS

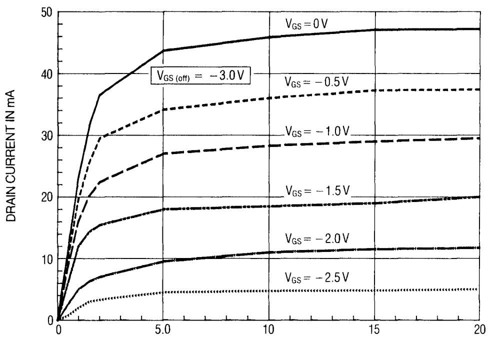
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\mu A$, $V_{DS} = 0V$	25	40	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 15V$, $V_{DS} = 0V$	—	10	100	pA
Drain Saturation Current	I_{DSS}	$V_{DS} = 15V$, $V_{GS} = 0V$	5.0	—	90	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 15V$, $I_D = 1.0nA$	1.0	—	5.5	V
Forward Transconductance	g_{fs}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1kHz$	—	22	—	mS
Drain-Source 'ON' Resistance	r_{DS}	$I_D = 1.0mA$, $V_{GS} = 0V$	—	40	—	Ω
Input Capacitance	C_{ISS}	$V_{DS} = 0V$, $V_{GS} = 10V$, $f = 1MHz$	—	6.5	—	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 0V$, $V_{GS} = 10V$, $f = 1MHz$	—	2.5	—	pF

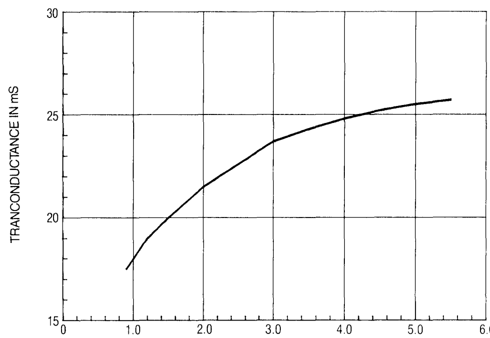
Typical Characteristics
at T_A = +25°C

DRAIN CURRENT AS A FUNCTION OF V_{DS}



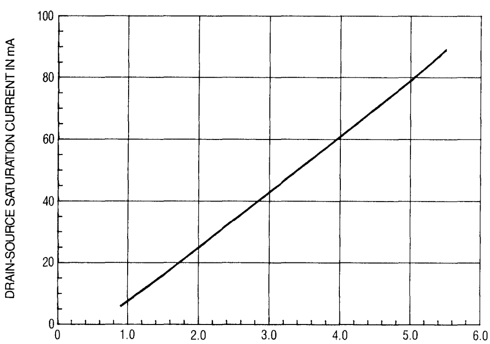
Dwg. No. A-14, 035

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



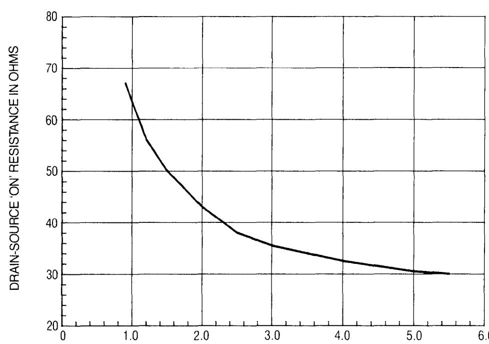
Dwg. No. A-14, 038

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



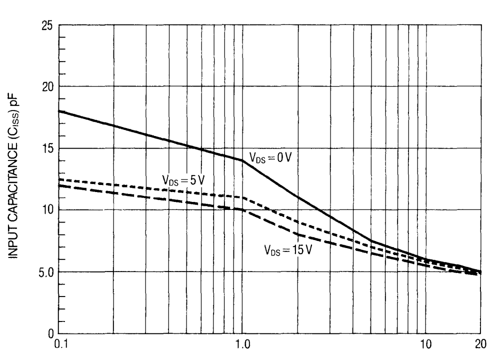
Dwg. No. A-14, 039

r_{DS} AS A FUNCTION OF $V_{GS(off)}$



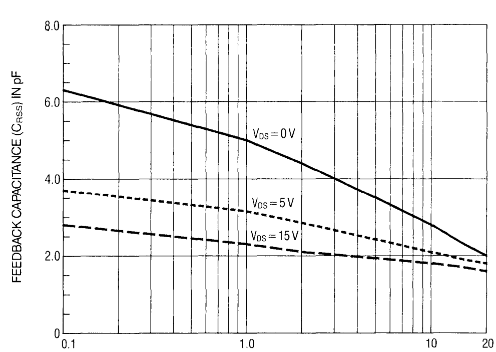
Dwg. No. A-14, 037

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg No. A-14, 036

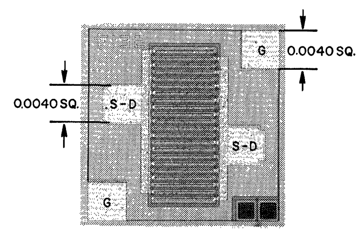
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 040

Process NJ132
N-Channel Junction Field-Effect Transistor

Process NJ132 is an N-channel junction field-effect transistor designed primarily for high-speed switching applications, such as low ON resistance analog switching.



NJ132 0.022″ × 0.022″

ABSOLUTE MAXIMUM RATINGS

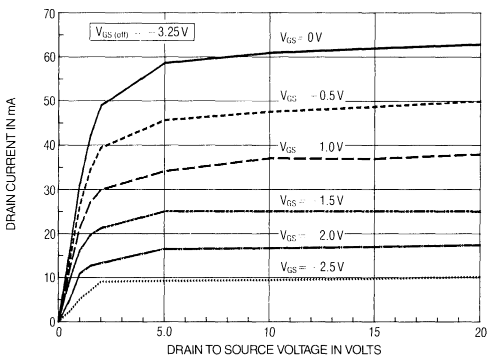
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\,\mu A$, $V_{DS} = 0V$	30	45	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 20V$, $V_{DS} = 0V$	—	10	100	pA
Drain Saturation Current	I_{DSS}	$V_{DS} = 20V$, $V_{GS} = 0V$	10	—	150	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 20V$, $I_D = 1.0nA$	0.5	—	7.0	V
Drain-Source 'ON' Resistance	r_{DS}	$I_D = 1.0mA$, $V_{GS} = 0V$	—	25	—	Ω
Input Capacitance	C_{ISS}	$V_{DS} = 20V$, $V_{GS} = 0V$, $f = 1MHz$	—	12	—	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 0V$, $V_{GS} = 10V$, $f = 1MHz$	—	2.5	—	pF
On Time	t_{ON}	$V_{DD} = 10V$, $I_D = 6.0mA$	—	10	20	ns
Off Time	t_{OFF}	$V_{DD} = 10V$, $I_D = 6.0mA$	—	45	55	ns

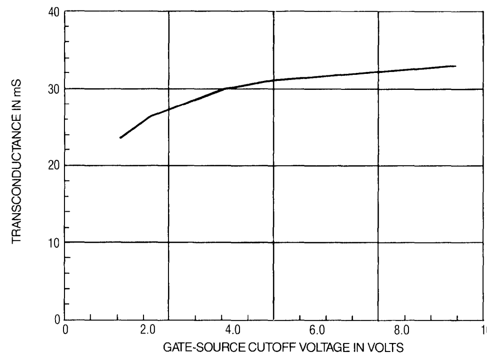
Typical Characteristics
at $T_A = +25°C$

DRAIN CURRENT AS A FUNCTION OF V_{DS}



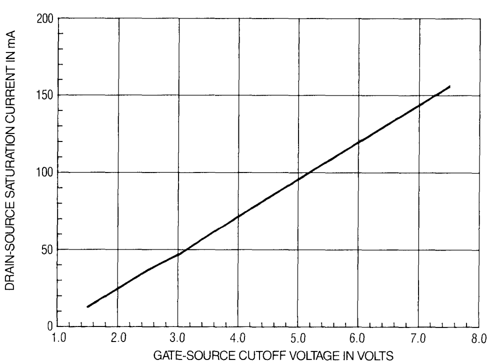
Dwg. No. A-14, 071

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



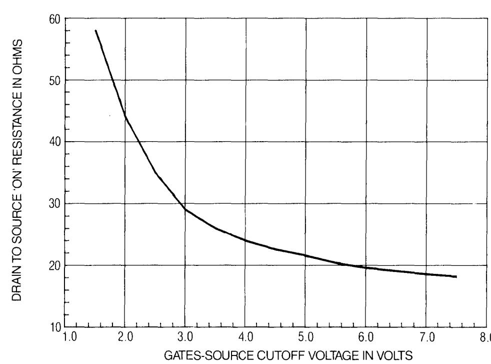
Dwg. No. A-14, 073

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



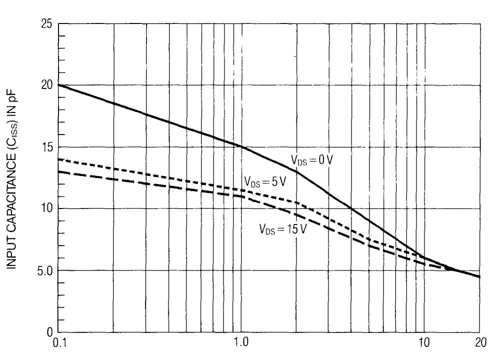
Dwg. No. A-14, 072

r_{DS} AS A FUNCTION OF $V_{GS(off)}$



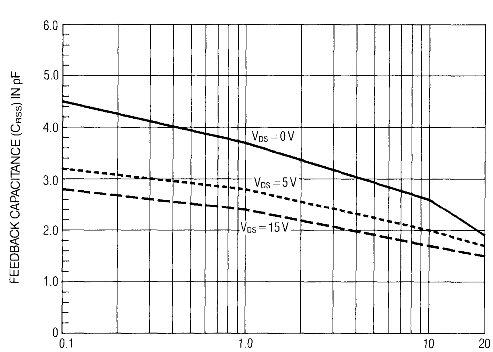
Dwg No. A-14, 076

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 074

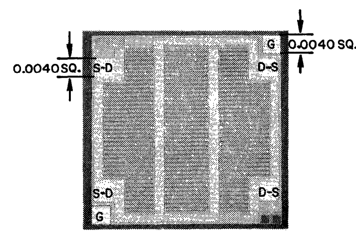
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 075

Process NJ903
N-Channel Junction Field-Effect Transistor

Process NJ903 is an N-channel junction field-effect transistor designed for very low ON resistance analog or digital switching applications.



NJ903 0.040″ × 0.040″

ABSOLUTE MAXIMUM RATINGS

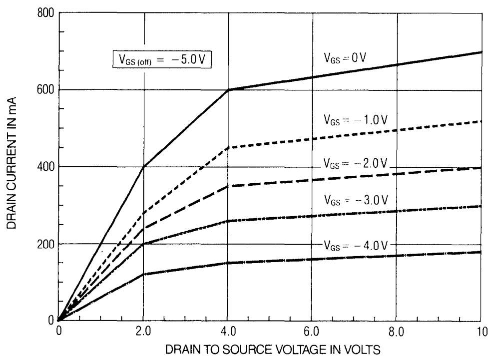
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\mu A$, $V_{DS} = 0V$	25	50	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 15V$, $V_{DS} = 0V$	—	0.5	3.0	nA
Drain Saturation Current	I_{DSS}	$V_{DS} = 10V$, $V_{GS} = 0V$	100	—	900	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 10V$, $I_D = 1.0nA$	2.0	—	7.0	V
Drain-Source 'ON' Resistance	r_{DS}	$I_D = 1.0mA$, $V_{GS} = 0V$	—	3.5	—	Ω
Input Capacitance	C_{ISS}	$V_{DS} = 0V$, $V_{GS} = 10V$, $f = 1MHz$	—	45	—	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 0V$, $V_{GS} = 10V$, $f = 1MHz$	—	22	—	pF

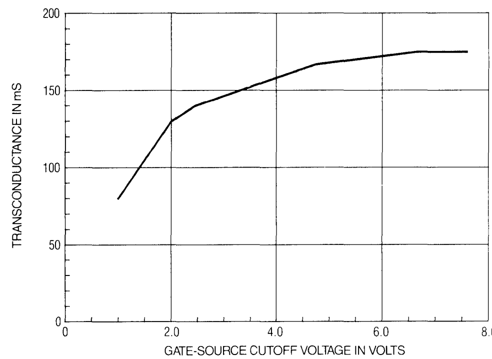
Typical Characteristics
at T_A = +25°C

DRAIN CURRENT AS A FUNCTION OF V_{DS}



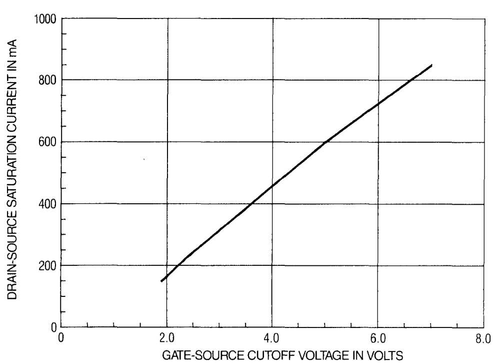
Dwg NO. A-14, 077

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



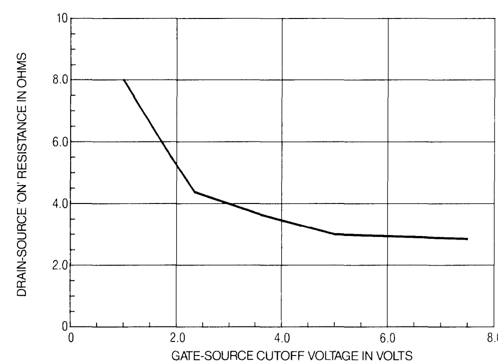
Dwg. No. A-14, 082

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



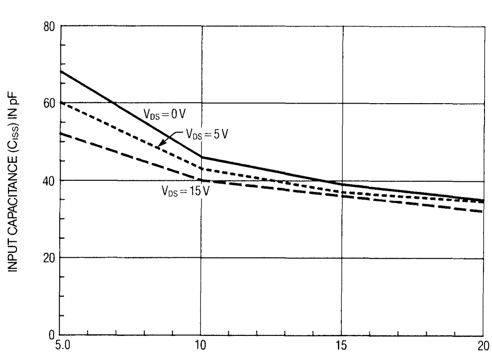
Dwg. No. A-14, 079

r_{DS} AS A FUNCTION OF $V_{GS(off)}$



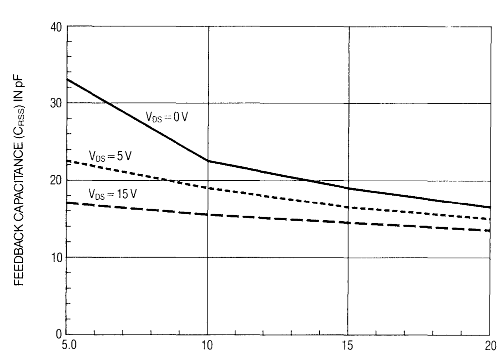
Dwg. NO. A-14, 083

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 080

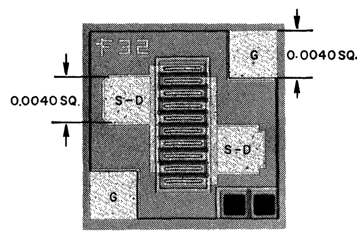
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 081

Process PJ32
P-Channel Junction Field-Effect Transistor

Process PJ32 is a P-channel junction field-effect transistor designed as a complement to Process NJ32 and for use as a general-purpose amplifier.



PJ32 0.018″ × 0.018″

ABSOLUTE MAXIMUM RATINGS

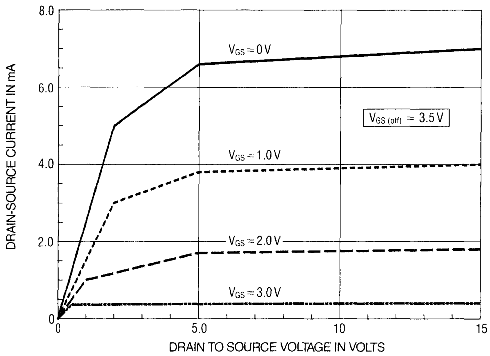
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0\,\mu A$, $V_{DS} = 0\,V$	30	50	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 15\,V$, $V_{DS} = 0\,V$	—	1.0	2.0	nA
Drain Saturation Current	I_{DSS}	$V_{DS} = 15\,V$, $V_{GS} = 0\,V$	1.0	—	15	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 15\,V$, $I_D = 1.0\,nA$	2.0	—	7.0	V
Forward Transconductance	g_{fs}	$V_{DS} = 15\,V$, $V_{GS} = 0\,V$, $f = 1\,kHz$	—	3.5	—	mS
Input Capacitance	C_{ISS}	$V_{DS} = 0\,V$, $V_{GS} = 10\,V$, $f = 1\,MHz$	—	3.5	—	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 0\,V$, $V_{GS} = 10\,V$, $f = 1\,MHz$	—	1.7	—	pF
Noise Voltage	e_N	$V_{DS} = 15\,V$, $V_{GS} = 0\,V$, $f = 100\,Hz$	—	60	—	$\frac{nV}{\sqrt{Hz}}$

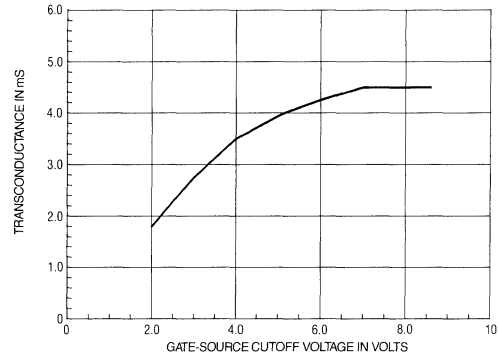
Typical Characteristics
at T_A = +25°C

DRAIN CURRENT AS A FUNCTION OF V_{DS}



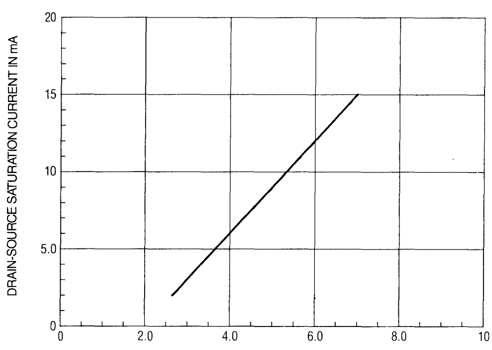
Dwg. No. A-14, 041

g_{fs} AS A FUNCTION OF $V_{GS(off)}$



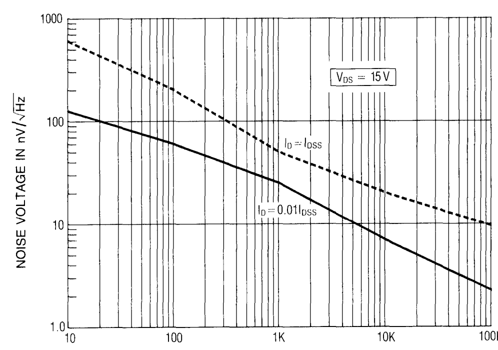
Dwg. No. A-14, 046

DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



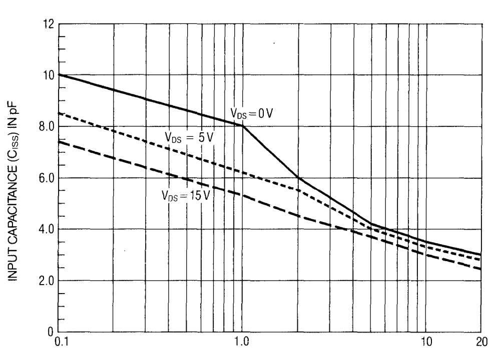
Dwg. No. A-14, 045

NOISE AS A FUNCTION OF FREQUENCY



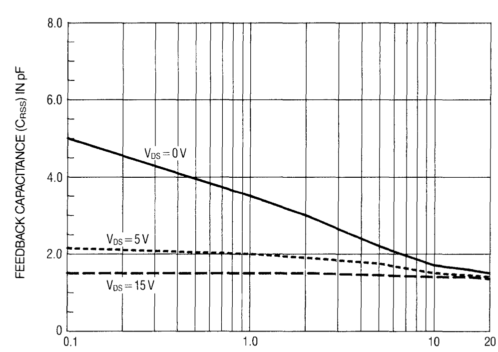
Dwg. No. A-14, 043

INPUT CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg. No. A-14, 042

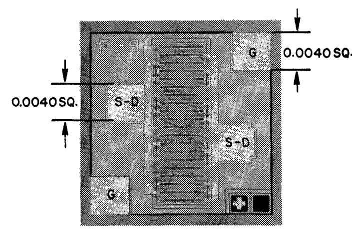
FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Dwg No. A-14, 044

Process PJ99
P-Channel Junction Field-Effect Transistor

Process PJ99 is a P-channel junction field-effect transistor designed as a complement to the NJ99 process and for use as either a switch or as a general-purpose amplifier. Devices from this process can be matched to a 75Ω input.



PJ99 0.021″ × 0.021″

ABSOLUTE MAXIMUM RATINGS

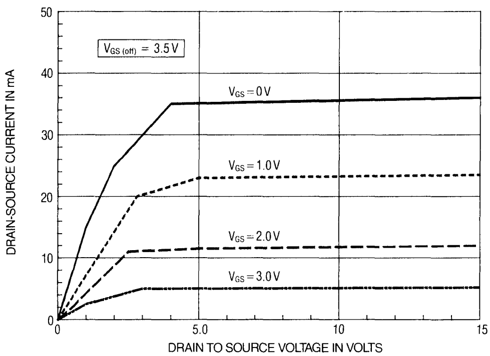
Gate Current, I_G .... 10 mA
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −65°C to +175°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

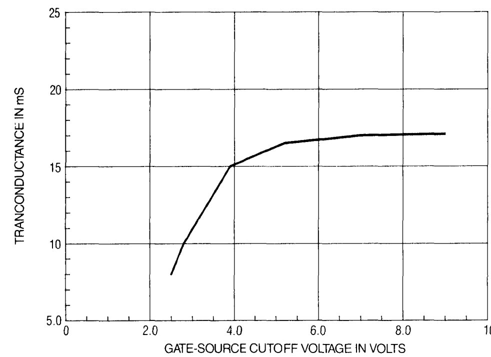
Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = 1.0 \mu A$, $V_{DS} = 0V$	30	40	—	V
Reverse-Gate Leakage Current	I_{GSS}	$V_{GS} = 20V$, $V_{DS} = 0V$	—	0.5	1.0	nA
Drain Saturation Current	I_{DSS}	$V_{DS} = 15V$, $V_{GS} = 0V$	5.0	—	60	mA
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 15V$, $I_D = 1.0 nA$	2.0	—	8.0	V
Forward Transconductance	g_{fs}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1 MHz$	—	15	—	mS
Drain-Source 'ON' Resistance	r_{DS}	$I_D = 1.0 mA$, $V_{GS} = 0V$	—	75	—	Ω
Input Capacitance	C_{ISS}	$V_{DS} = 15V$, $V_{GS} = 0V$, $f = 1 MHz$	—	18	—	pF
Feedback Capacitance	C_{RSS}	$V_{DS} = 0V$, $V_{GS} = 10V$, $f = 1 MHz$	—	4.5	—	pF
Noise Voltage	e_N	$V_{DS} = 10V$, $V_{GS} = 0V$, $f = 1 kHz$	—	8.0	—	$\frac{nV}{\sqrt{Hz}}$

Typical Characteristics
at T_A = +25°C

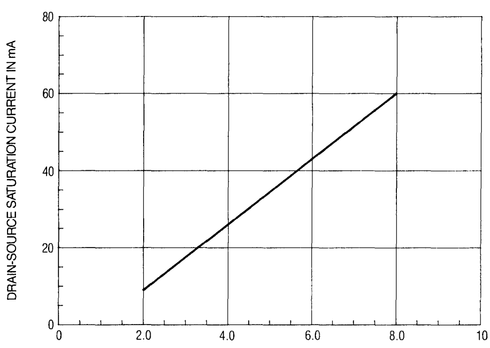
DRAIN CURRENT AS A FUNCTION OF V_{DS}



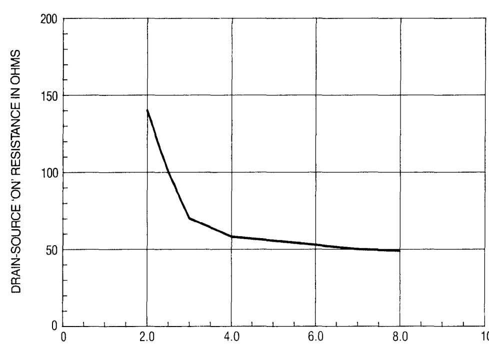
g_{fs} AS A FUNCTION OF $V_{GS(off)}$



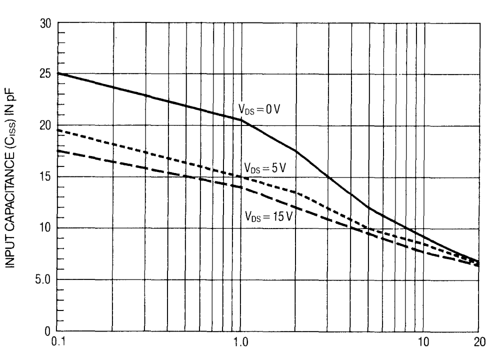
DRAIN SATURATION CURRENT AS A FUNCTION OF $V_{GS(off)}$



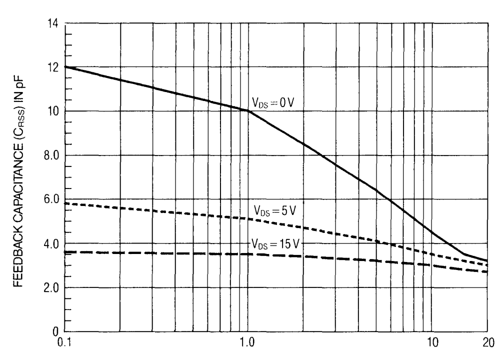
r_{DS} AS A FUNCTION OF $V_{GS(off)}$



INPUT CAPACITANCE AS A FUNCTION OF V_{GS}

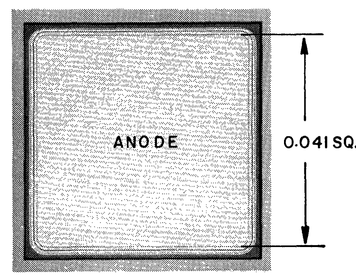


FEEDBACK CAPACITANCE AS A FUNCTION OF V_{GS}



Process BGA
Power Schottky Diode

Process BGA is a silicon Schottky-barrier diode designed for high-power applications. It can operate with forward currents of up to 3A and has a typical breakdown-voltage rating of 60V.



BGA 0.050″ × 0.050″

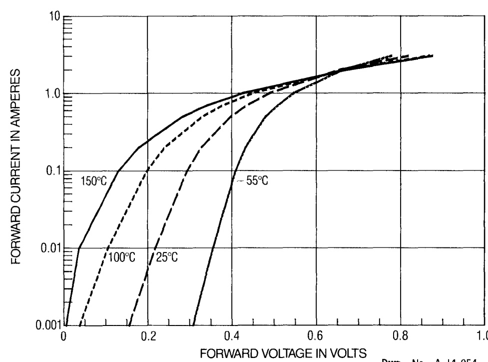
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1s) 3.0A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

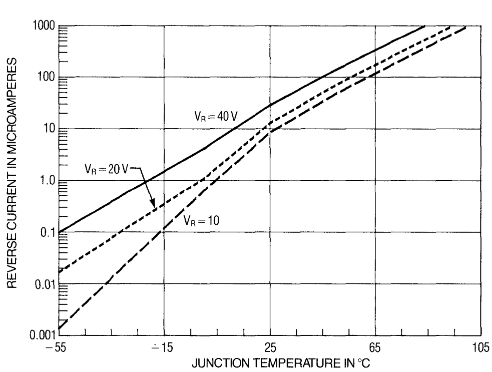
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
V_{BR}	I_R = 1.0mA	50	60	—	V
I_R	V_R = 40V	—	30	200	μA
V_F	I_F = 1.0A	—	490	—	mV
C_J	V_R = 0V, f = 1MHz	—	330	—	pF

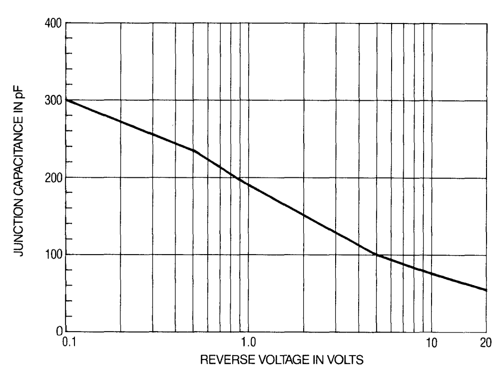
FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE

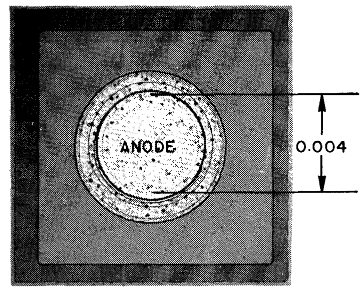


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process BKA
Schottky Diode

Process BKA is a silicon high-speed Schottky-barrier junction diode. It has a typical breakdown-voltage rating of 60 V and can operate with a forward current of up to 200 mA.



BKA 0.015″ × 0.015″

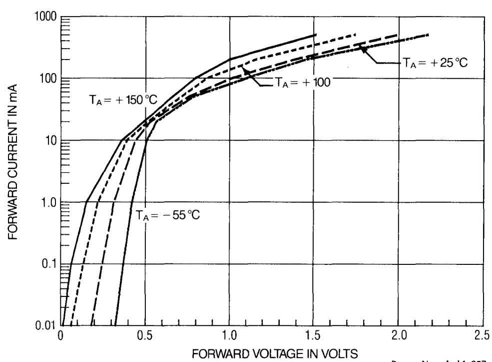
ABSOLUTE MAXIMUM RATINGS

Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

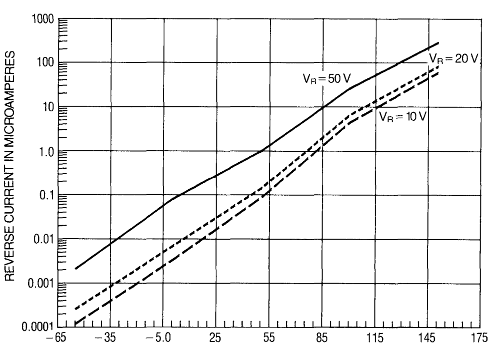
Characteristic	Test Conditions	Limits Min.	Typ.	Max.	Units
V_{BR}	$I_R = 10\,\mu A$	40	60	—	V
I_R	$V_R = 20\,V$	—	60	200	nA
V_F	$I_F = 10\,mA$	—	440	500	mV
C_J	$V_R = 0\,V$, f = 1 MHz	—	4.3	5.0	pF

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



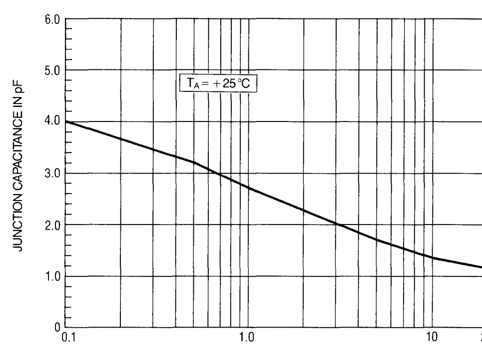
Dwg. No. A-14,057

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14,058

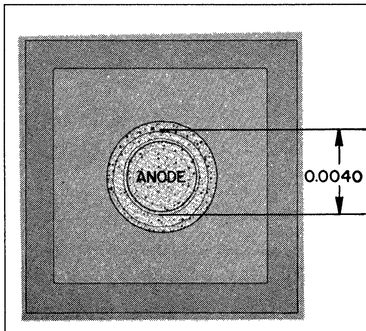
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,056

Process BKD
Schottky Diode

Process BKD is a silicon, high-speed Schottky-barrier junction diode with a typical breakdown-voltage rating of 80 V. It can sustain forward currents of up to 200 mA.



BKD 0.015″ × 0.015″

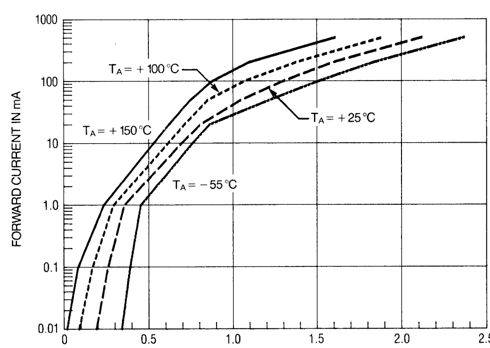
ABSOLUTE MAXIMUM RATINGS

Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

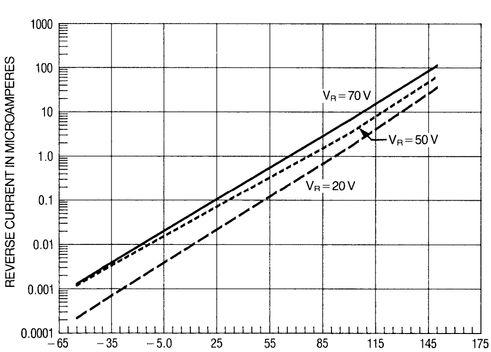
Characteristic	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
V_{BR}	$I_R = 10\,\mu A$	70	80	—	V
I_R	$V_R = 50\,V$	—	50	200	nA
V_F	$I_F = 1.0\,mA$	—	350	410	mV
C_J	$V_R = 0\,V$, f = 1 MHz	—	1.6	1.8	pF

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



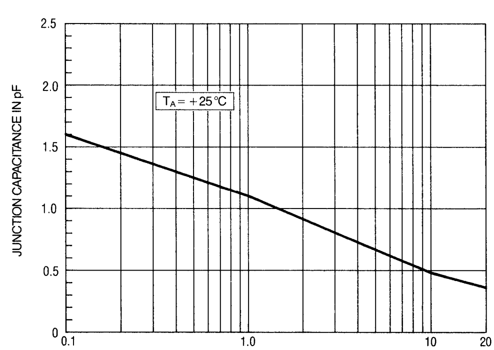
Dwg. No. A-14,060

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg No. A-14,061

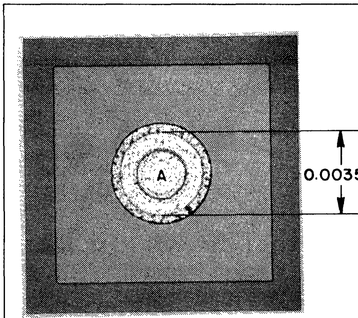
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,059

Process BKF
Schottky Diode

Process BKF is a high-speed silicon Schottky-barrier diode. It has a typical breakdown-voltage rating of 70V and can operate with up to 200mA of forward current.



BKF 0.015″ × 0.015″

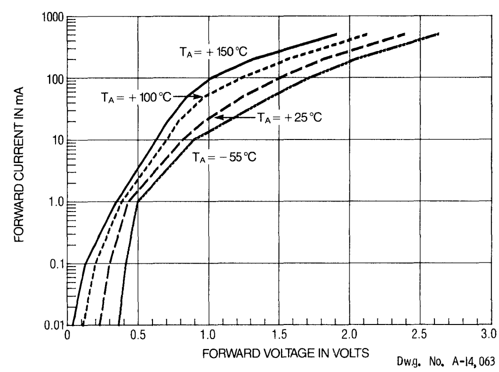
ABSOLUTE MAXIMUM RATINGS

Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

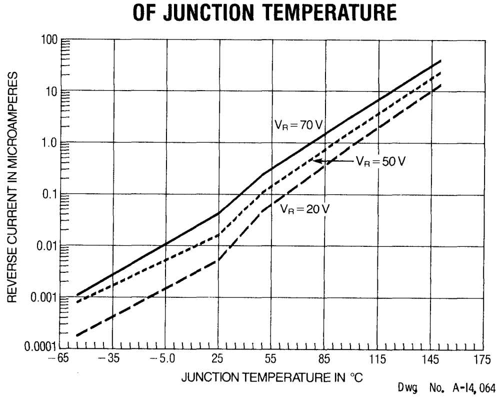
ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

		Limits			
Characteristic	Test Conditions	Min.	Typ.	Max.	Units
V_{BR}	$I_R = 10\mu A$	50	70	—	V
I_R	$V_R = 20V$	—	5.0	200	nA
V_F	$I_F = 1.0mA$	—	400	450	mV
C_J	$V_R = 0V$, f = 1 MHz	—	1.0	1.2	pF

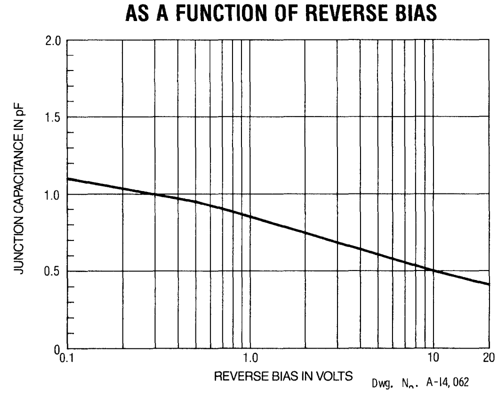
FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE

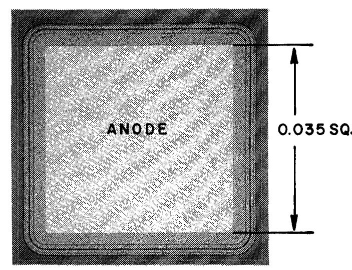


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process BQB Power Schottky Diode

Process BQB is a silicon Schottky-barrier diode with a typical breakdown-voltage rating of 45 V. Designed for high-power applications, it can sustain a forward current of up to 1 A.



BQB 0.040″ × 0.040″

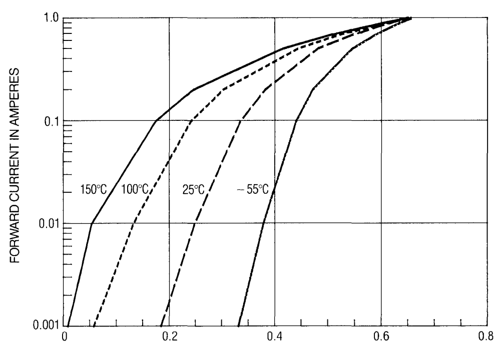
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) . . . . 1.0 A
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

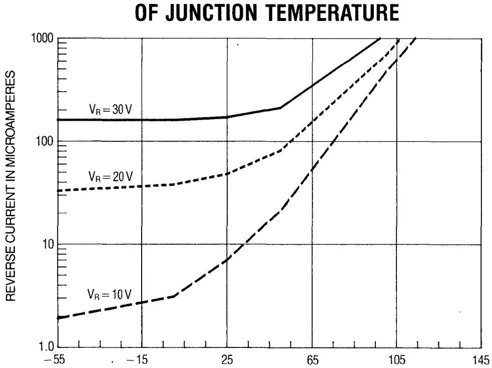
		Limits			
Characteristic	Test Conditions	Min.	Typ.	Max.	Units
V_{BR}	$I_R = 1.0$ mA	40	45	—	V
I_R	$V_R = 20$ V	—	50	200	μA
V_F	$I_F = 1.0$ mA	—	650	—	mV
C_J	$V_R = 0$ V, f = 1 MHz	—	210	—	pF

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



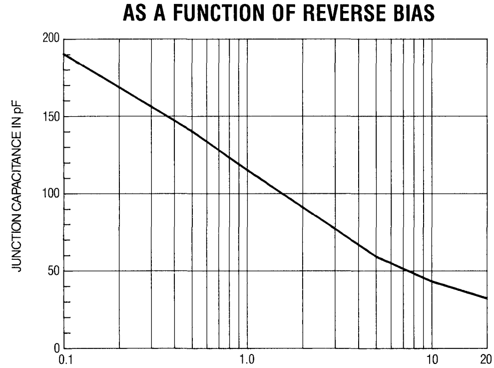
Dwg. No. A-14, 067

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14, 066

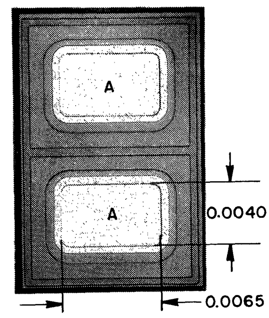
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14, 065

Process DBA
Dual Diode with Common Cathode

Process DBA is an epitaxial silicon dual diode with a common cathode terminal. It has a typical breakdown rating of 85 V and will operate with forward currents of up to 2 A.



DBA 0.022″ × 0.022″

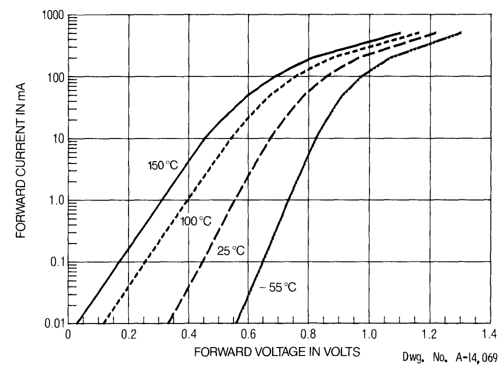
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) .... 500 mA
(Pulse Width = 1 μs) .... 2.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

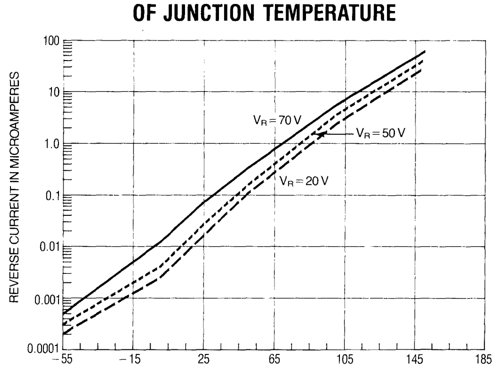
Characteristic	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
V_{BR}	I_R = 10 μA	70	85	—	V
I_R	V_R = 50 V	—	30	80	nA
V_F	I_F = 100 mA	—	860	1000	mV
C_J	V_R = 0 V, f = 1 MHz	—	1.5	2.0	pF
t_{rr}	I_F = I_R = 10 mA	—	3.2	6.0	ns

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



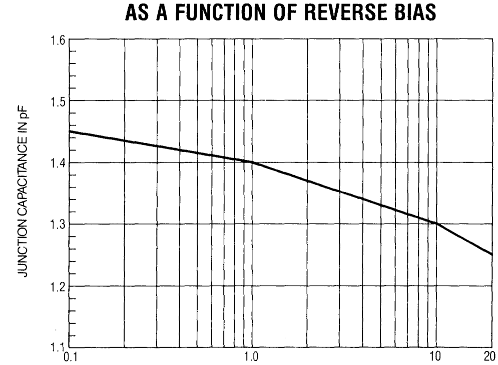
Dwg. No. A-14,069

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14,068

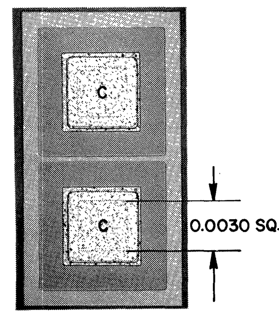
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,070

Process DOB
Dual Diode with Common Anode

Process DOB is a gold-doped silicon epitaxial N on P dual diode with a common anode terminal. It has a typical breakdown rating of 90 V and will operate with forwara current of up to 2 A.



DOB 0.015″ × 0.021″

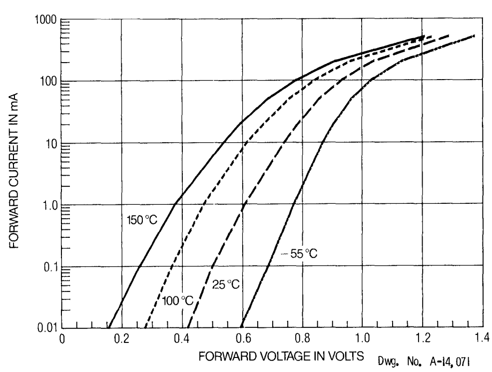
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) .... 500 mA
(Pulse Width = 1 μs) .... 2.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

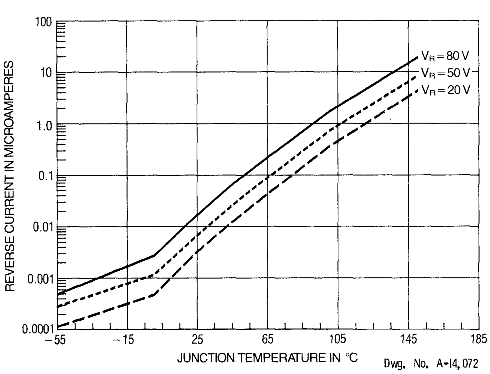
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Test Conditions	Limits			Units
		Min.	Typ.	Max.	
V_{BR}	I_R = 10 μA	70	90	—	V
I_R	V_R = 50 V	—	7.0	75	nA
V_F	I_F = 100 mA	—	860	1000	mV
C_J	V_R = 0 V, f = 1 MHz	—	2.1	4.0	pF
t_{rr}	I_F = I_R = 10 mA	—	6.0	8.0	ns

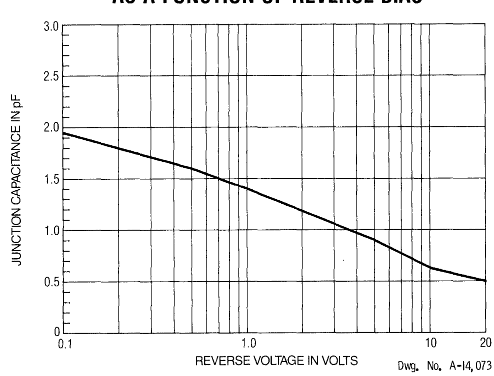
FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE

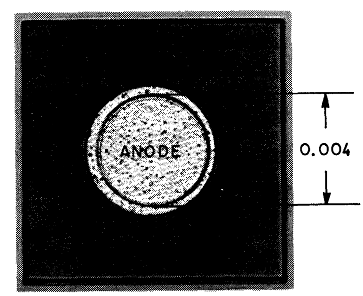


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process TRB
Medium-Speed Switching Diode

Process TRB produces a non-gold-doped silicon epitaxial diode designed as a low-leakage, medium-speed switching device. It has a typical breakdown rating of 80 V.



TRB 0.015" × 0.015"

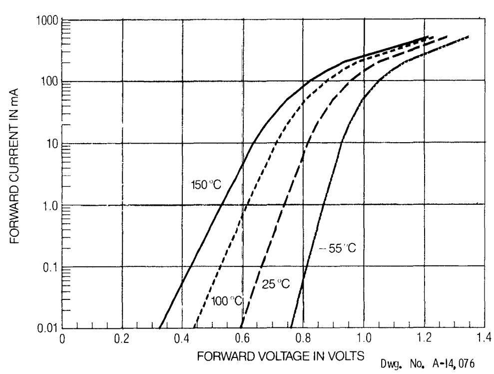
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) . . . . 500 mA
(Pulse Width = 1 μs) . . . . 2.0 A
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

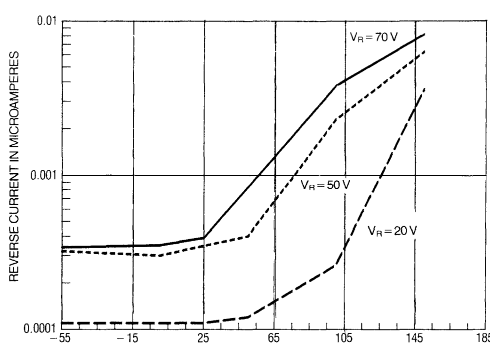
ELECTRICAL CHARACTERISTICS at T_A = +25°C

		Limits			
Characteristic	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
V_{BR}	I_R = 10 μA	50	80	—	V
I_R	V_R = 50 V	—	0.5	10	nA
V_F	I_F = 10 mA	—	820	1000	mV
C_J	V_R = 0 V, f = 1 MHz	—	3.0	5.0	pF
t_{rr}	$I_F = I_R$ = 10 mA	—	40	100	ns

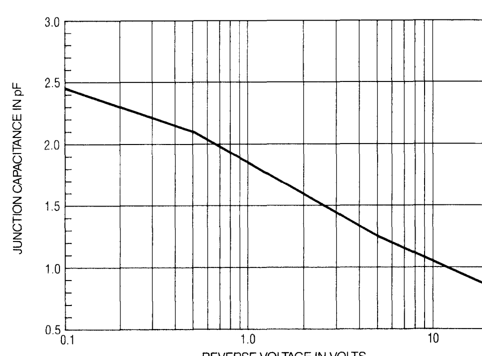
FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE

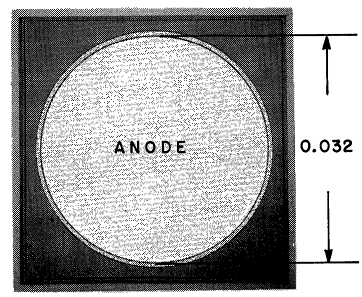


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process TRJ
Silicon Rectifier Diode

This silicon epitaxial diode is a 200 V, 1.0 A rectifier designed to meet 1N4001, 1N4002, and 1N4003 specifications.



TRJ 0.040″ × 0.040″

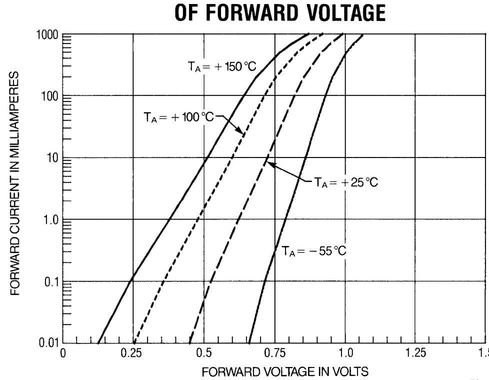
ABSOLUTE MAXIMUM RATINGS

Peak Repetitive Voltage, V_{RRM} . . . . 200 V
Peak Reverse Working Voltage, V_{RWM} . . . . 200 V
DC Blocking Voltage, V_R . . . . 200 V
Non Repetitive Peak Reverse Voltage, V_{RM}
(Half-Wave 60 Hz Peak) . . . . 200 V
Input Voltage (rms) . . . . 140 V
Average Rectified Forward Current, I_O . . . . 1.0 A
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

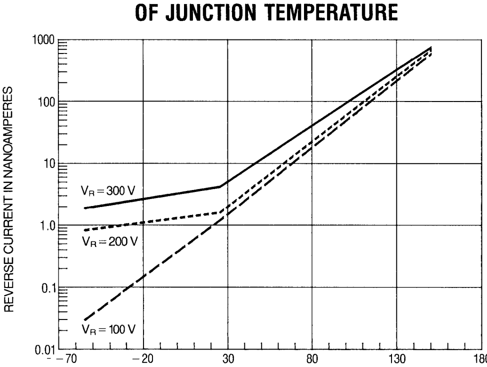
		Limits			
Characteristic	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
V_{BR}	$I_R = 10\,\mu A$	200	350	—	V
I_R	$V_R = 300\,V$	—	5.0	100	nA
V_F	$I_F = 1000\,mA$	—	990	1100	mV
C_J	$V_R = 10\,V$, f = 1 MHz	—	6.0	8.0	pF

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



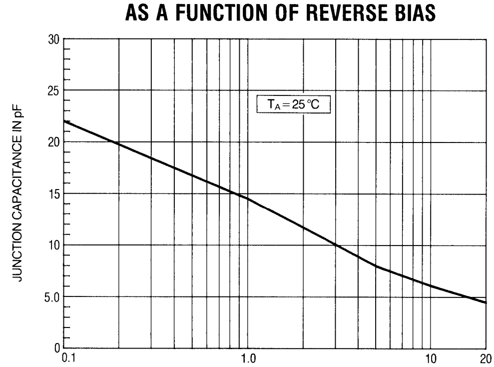
Dwg. No. A-14,079

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14,077

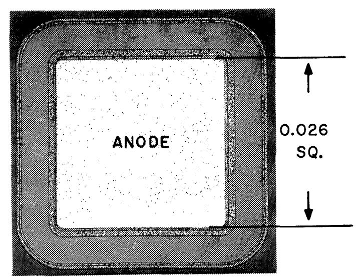
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,078

Process TRL
Silicon Rectifier Diode

The TRL process yields a 400 V, 1.0 A rectifier with a relatively large anode bonding pad on a 43-mil chip. The silicon epitaxial diode meets 1N4004 specifications and is designed for general-purpose, low-power applications.



TRL 0.043″ × 0.043″

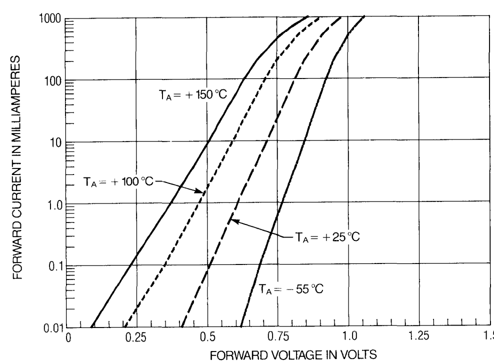
ABSOLUTE MAXIMUM RATINGS

Peak Repetitive Voltage, V_{RRM} .... 400 V
Peak Reverse Working Voltage, V_{RWM} .... 400 V
DC Blocking Voltage, V_R .... 400 V
Non Repetitive Peak Reverse Voltage, V_{RM}
(Half-Wave 60 Hz Peak) .... 400 V
Input Voltage (rms) .... 280 V
Average Rectified Forward Current, I_O .... 1.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

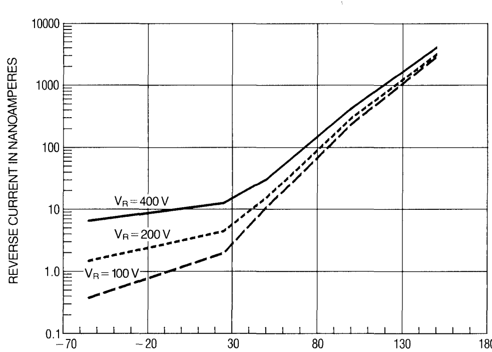
Characteristic	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
V_{BR}	$I_R = 10\,\mu A$	400	480	—	V
I_R	$V_R = 400 V$	—	0.02	10	μA
V_F	$I_F = 1000 mA$	—	980	1100	mV
C_J	$V_R = 10 V$, f = 1 MHz	—	6.2	9.0	pF

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



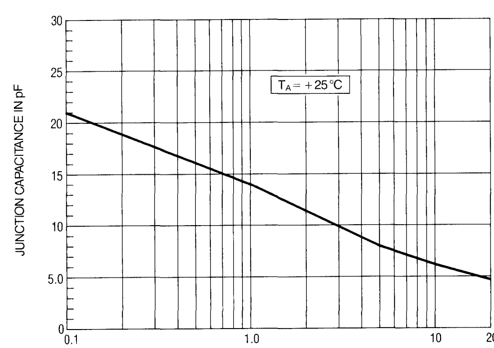
Dwg No A-14, 080

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14, 082

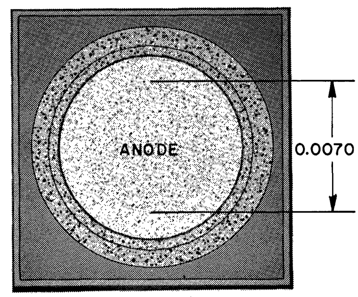
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14, 081

Process TRO
Medium-Speed Switching Diode

Process TRO produces a non-gold-doped silicon epitaxial diode used primarily as a medium-speed switching device. Designed to 1N485 specifications, the diode has a breakdown-voltage rating of 200 V, and a typical t_{rr} rating of 100 ns.



TRO 0.019″ × 0.019″

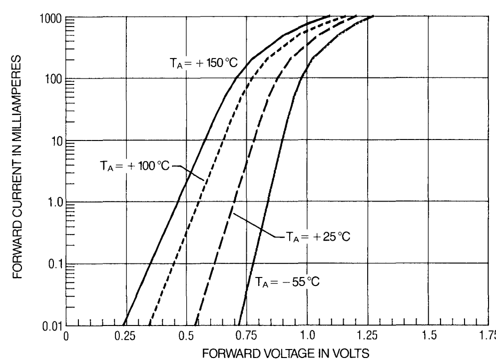
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) .... 1000 mA
(Pulse Width = 1 μs) .... 4.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

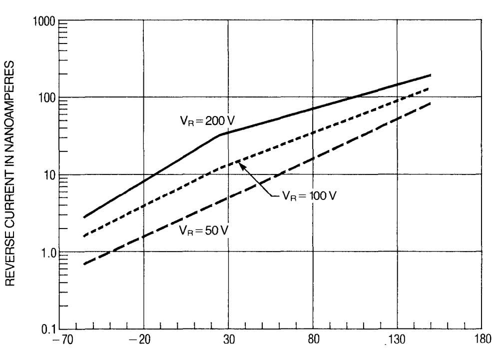
Characteristic	Test Conditions	Limits Min.	Typ.	Max.	Units
V_{BR}	I_R = 10 μA	200	210	—	V
I_R	V_R = 100 V	—	0.2	10	nA
V_F	I_F = 100 mA	—	880	1000	mV
C_J	V_R = 0 V, f = 1 MHz	—	6.0	10	pF
t_{rr}	I_F = I_R = 10 mA	—	0.1	3.0	μs

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



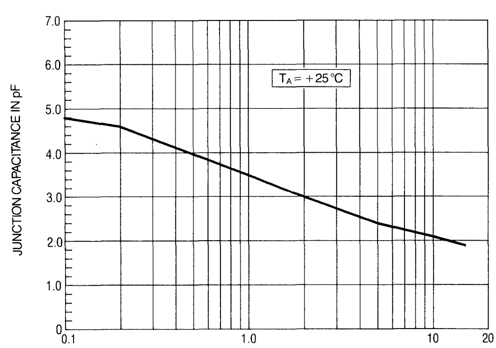
Dwg. No. A-14,085

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg No A-14,084

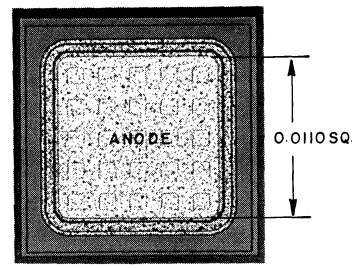
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No A-14,083

Process TRR
Medium-Speed Switching Diode

Process TRR is a non-gold-doped silicon epitaxial diode designed to 1N3595 specifications and used in medium-speed switching applications.



TRR 0.017″ × 0.017″

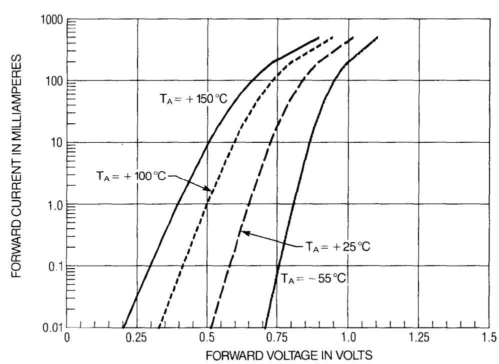
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) . . . . 500 mA
(Pulse Width = 1 μs) . . . . 2.0 A
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

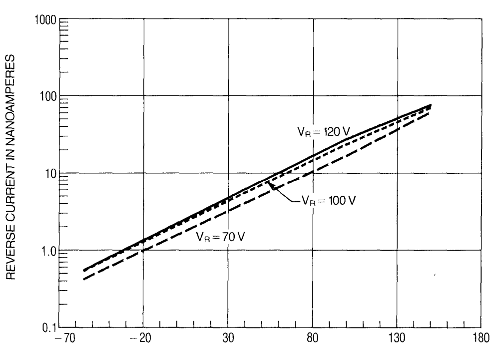
Characteristic	Test Conditions	Limits Min.	Typ.	Max.	Units
V_{BR}	I_R = 10 μA	150	170	—	V
I_R	V_R = 125 V	—	5.0	10	nA
V_F	I_F = 100 mA	—	840	1000	mV
C_J	V_R = 0 V, f = 1 MHz	—	6.6	8.0	pF
t_{rr}	$I_F = I_R$ = 10 mA	—	0.04	3.0	μs

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



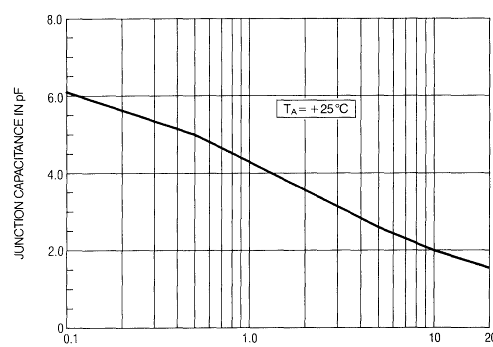
Dwg. No. A-14,088

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14,087

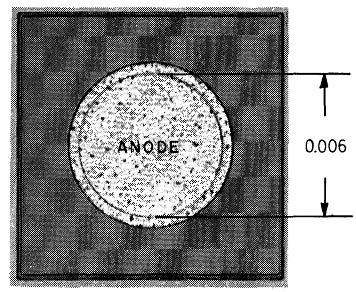
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,086

Process TRS
Medium-Speed Switching Diode

Designed for switching applications requiring low leakage-current characteristics, this non-gold-doped silicon epitaxial diode has a typical reverse recovery time of 70 ns and a typical I_R of less than 1.0 nA.



TRS 0.015″ × 0.015″

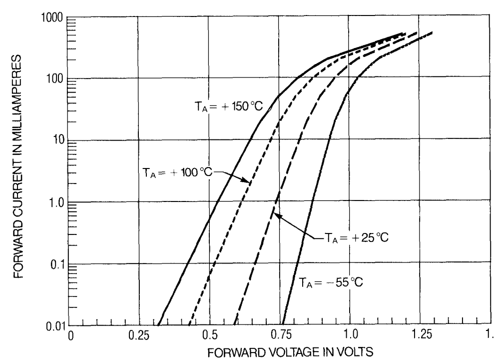
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) . . . . 1000 mA
(Pulse Width = 1 μs) . . . . 4.0 A
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

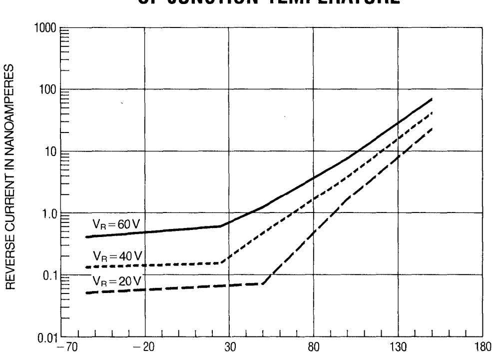
		Limits			
Characteristic	Test Conditions	Min.	Typ.	Max.	Units
V_{BR}	I_R = 10 μA	50	75	—	V
I_R	V_R = 40 V	—	0.2	10	nA
V_F	I_F = 10 mA	—	830	1000	mV
C_J	V_R = 0 V, f = 1 MHz	—	5.0	7.0	pF
t_{rr}	I_F = I_R = 10 mA	—	70	100	ns

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



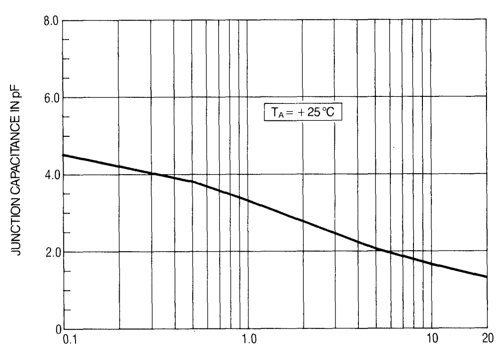
Dwg. No. A-14,091

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg No. A-14,090

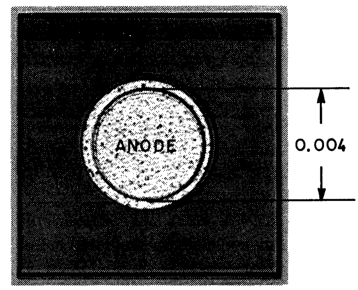
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,089

Process TSB
High-Speed Switching Diode

This gold-doped silicon epitaxial diode, designed to meet 1N914 specifications, has a typical reverse recovery time of 3.2 ns and a typical junction capacitance of 0.5 pF.



TSB 0.015″ × 0.015″

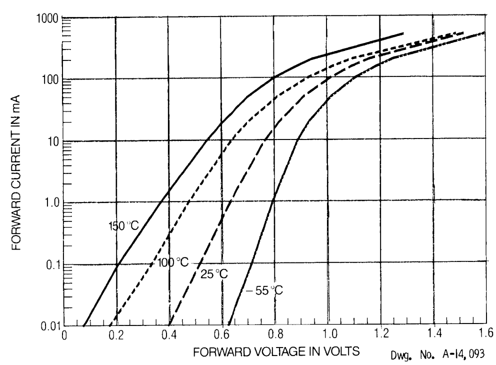
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) .... 500 mA
(Pulse Width = 1 μs) .... 2.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

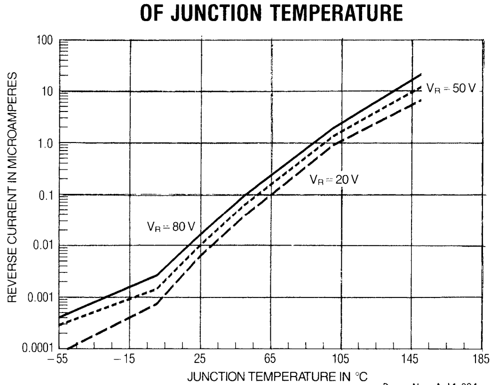
		Limits			
Characteristic	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
V_{BR}	I_R = 10 μA	100	130	—	V
I_R	V_R = 20 V	—	7.0	25	nA
V_F	I_F = 10 mA	—	780	1000	mV
C_J	V_R = 0 V, f = 1 MHz	—	0.5	4.0	pF
t_{rr}	I_F = I_R = 10 mA	—	3.2	8.0	ns

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



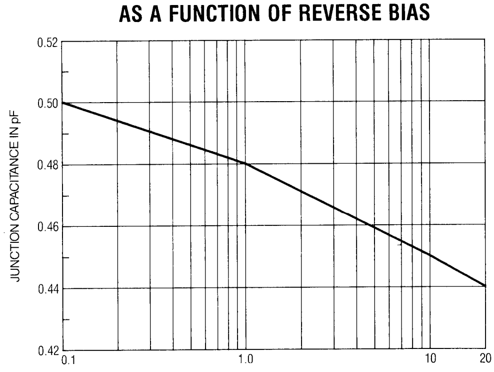
Dwg. No. A-14,093

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14,094

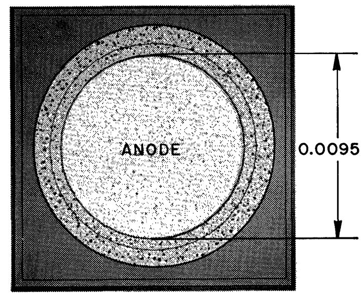
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,092

Process TSO
High-Speed Switching Diode

Process TSO produces a gold-doped silicon epitaxial diode with 1N3070 high-speed switching characteristics. It has a typical breakdown-voltage rating of 250 V and a typical junction capacitance of 2.2 pF.



TSO 0.019″ × 0.019″

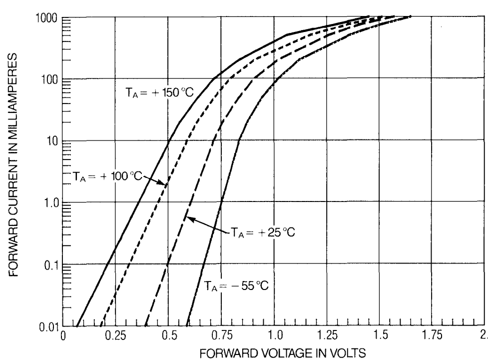
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) . . . . 1000 mA
(Pulse Width = 1 μs) . . . . 4.0 A
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

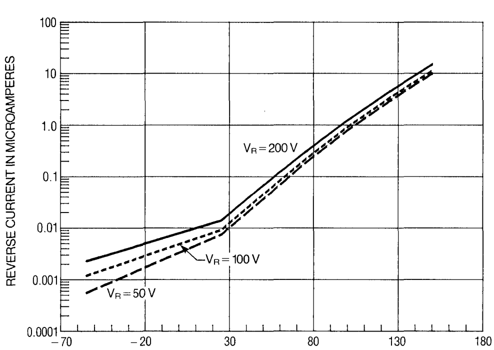
		Limits			
Characteristic	Test Conditions	Min.	Typ.	Max.	Units
V_{BR}	I_R = 10 μA	200	250	—	V
I_R	V_R = 150 V	—	15	100	nA
V_F	I_F = 100 mA	—	910	1000	mV
C_J	V_R = 0 V, f = 1 MHz	—	2.2	5.0	pF
t_{rr}	$I_F = I_R$ = 10 mA	—	25	50	ns

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



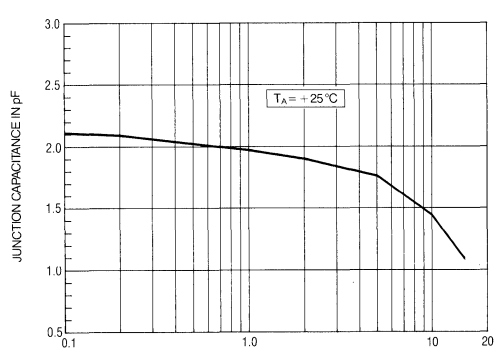
Dwg. No. A-14,097

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14,096

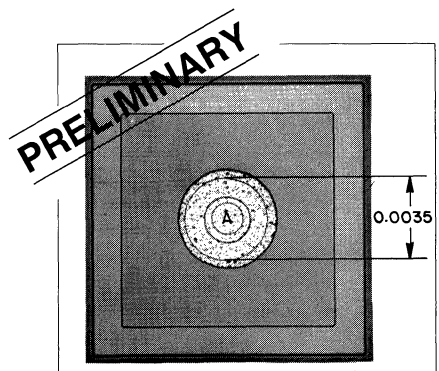
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,095

Process TSP
Ultra-High-Speed Switching Diode

Process TSP is a gold-doped silicon epitaxial diode designed as an ultra-fast switch. It meets the specifications of the 1N4376 and FD700.



TSP 0.015″ × 0.015″

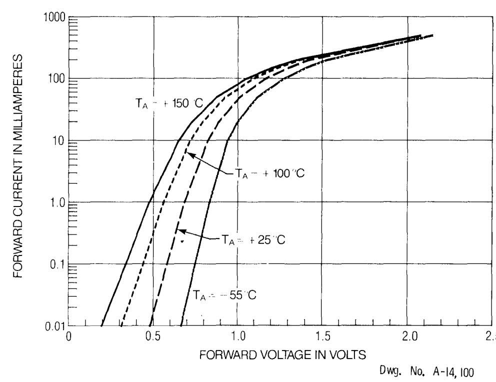
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) .... 500 mA
(Pulse Width = 1 μs) .... 2.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

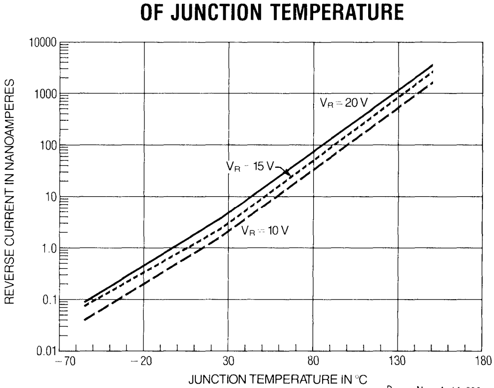
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
V_{BR}	I_R = 10 μA	30	40	—	V
I_R	V_R = 20 V	—	3.0	50	nA
V_F	I_F = 10 mA	—	830	880	mV
C_J	V_R = 0 V, f = 1 MHz	—	0.7	1.0	pF
t_{rr}	I_F = I_R = 10 mA	—	0.75	1.0	ns

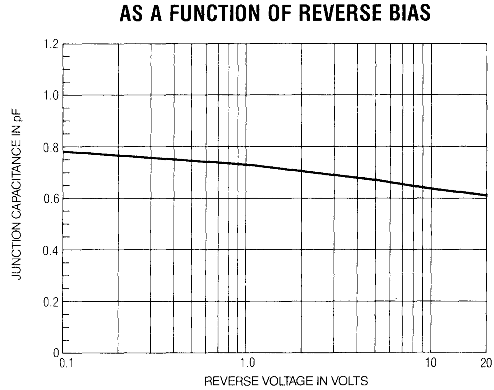
FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE

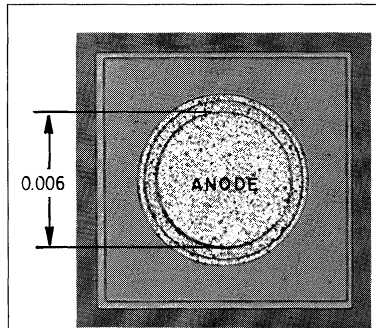


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process TSS
High-Speed Switching Diode

Designed to meet the high-speed switching specifications of 1N3600, Process TSS is a gold-doped silicon epitaxial diode.



TSS 0.015″ × 0.015″

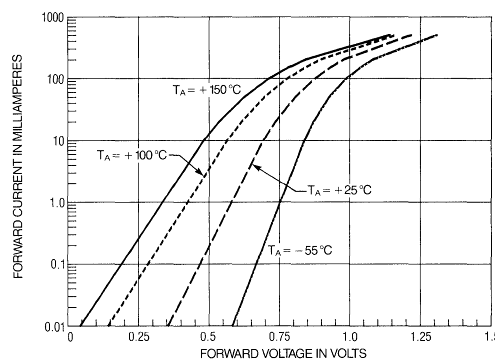
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) .... 1000 mA
(Pulse Width = 1 μs) .... 4.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

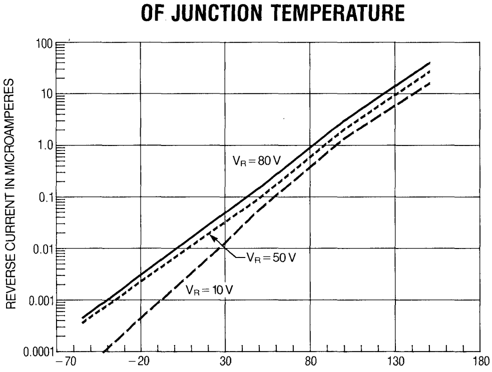
Characteristic	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
V_{BR}	$I_R = 10\ \mu A$	75	110	—	V
I_R	$V_R = 50\ V$	—	20	100	nA
V_F	$I_F = 10\ mA$	—	690	740	mV
C_J	$V_R = 0\ V$, f = 1 MHz	—	1.2	2.5	pF
t_{rr}	$I_F = I_R = 10\ mA$	—	3.4	4.0	ns

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



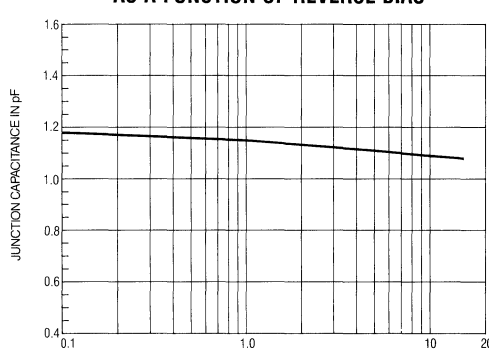
Dwg. No. A-14,103

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14,102

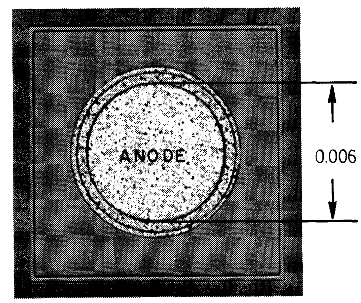
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14,101

Process TSU
High-Speed Switching Diode

Process TSU produces a gold-doped silicon epitaxial diode that meets or exceeds high-speed switching characteristics of 1N4610. It has a typical reverse recovery time of 4.0ns and a typical junction capacitance of 1.0pF.



TSU 0.015″ × 0.015″

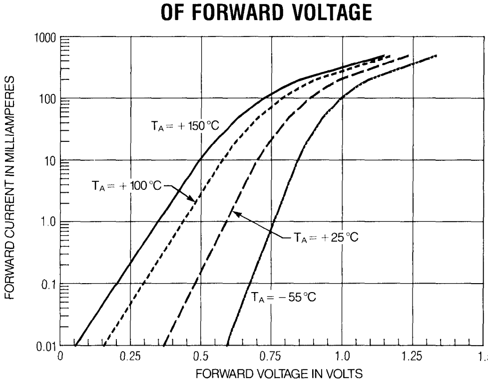
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) .... 1000 mA
(Pulse Width = 1 μs) .... 4.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

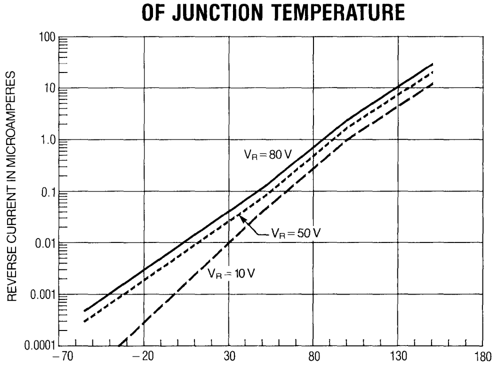
Characteristic	Test Conditions	Limits Min.	Typ.	Max.	Units
V_{BR}	$I_R = 10\,\mu A$	75	110	—	V
I_R	$V_R = 50\,V$	—	12	100	nA
V_F	$I_F = 10\,mA$	—	700	750	mV
C_J	$V_R = 0\,V$, f = 1 MHz	—	1.0	2.5	pF
t_{rr}	$I_F = I_R = 10\,mA$	—	4.0	10	ns

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



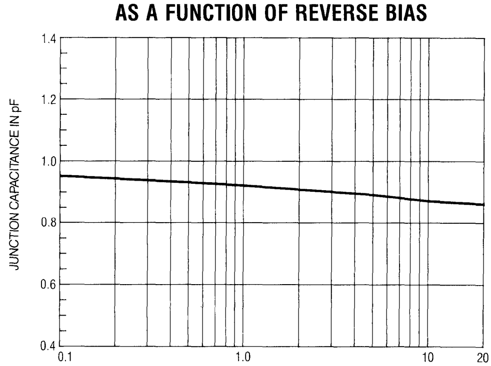
Dwg. No. A-14,106

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14,105

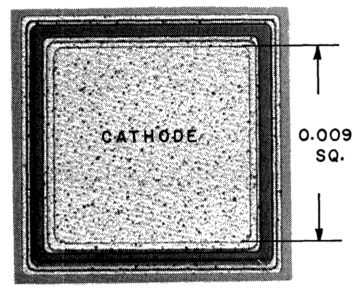
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14, 104

Process TTU
High-Speed Switching Diode

A gold-doped silicon epitaxial diode used primarily in high-speed switching applications, Process TTU, with its P-type substrate, is the NP counterpart of PN Type 1N914 and Process TSB diodes.



TTU 0.015″ × 0.015″

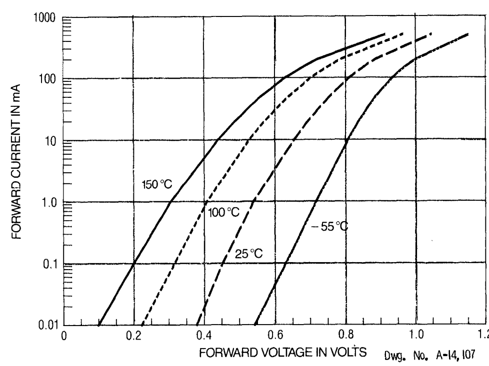
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) .... 500 mA
(Pulse Width = 1 μs) .... 2.0 A
Operating Junction Temperature, T_J .... +150°C
Storage Temperature Range, T_S ..... −55°C to +150°C

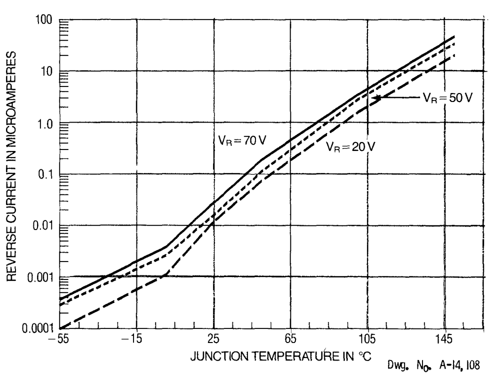
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Test Conditions	Limits Min.	Typ.	Max.	Units
V_{BR}	I_R = 10 μA	75	110	—	V
I_R	V_R = 20 V	—	12	50	nA
V_F	I_F = 10 mA	—	650	900	mV
C_J	V_R = 0 V f = 1 MHz	—	9.0	10	pF
t_{rr}	$I_F = I_R$ = 10 mA	—	3.5	8.0	ns

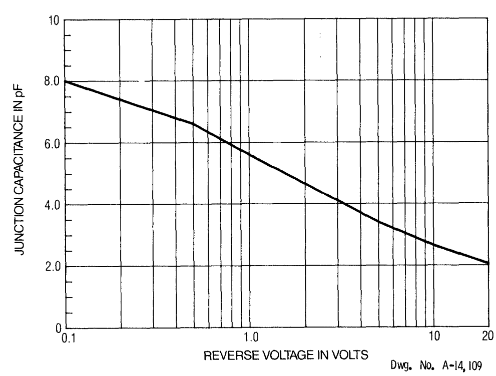
FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE

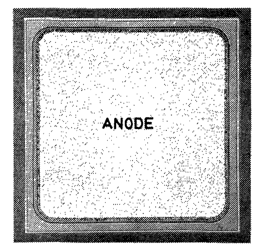


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process YAA Power Diode

Process YAA is a silicon epitaxial P on N diode designed for high-power applications. It can operate with a forward current of up to 3A.



YAA 0.047″ × 0.047″

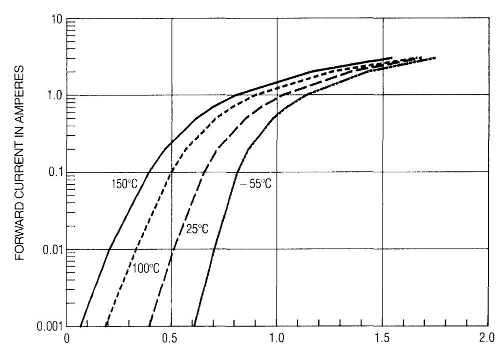
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1s) 3.0A
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

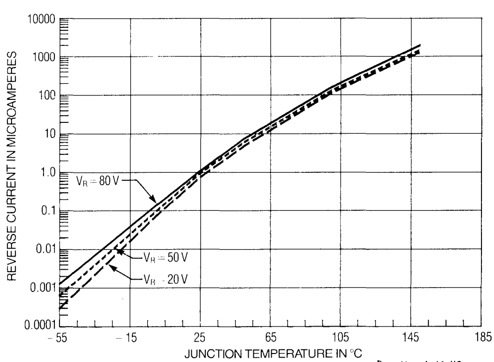
Characteristic	Test Conditions	Limits Min.	Typ.	Max.	Units
V_{BR}	I_R = 1.0mA	120	140	—	V
I_R	V_R = 80V	—	1.2	5.0	μA
V_F	I_F = 1.0A	—	1.0	—	V
C_J	V_R = 0V, f = 1MHz	—	24	—	pF

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



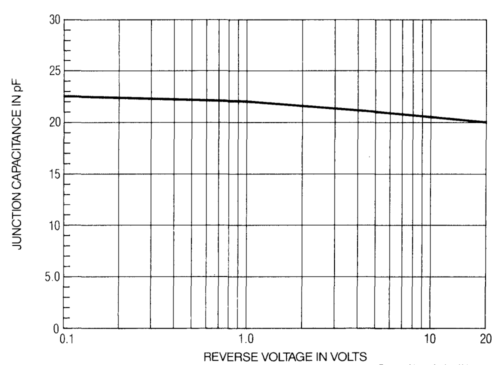
Dwg. No. A-14, 111

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg No. A-14, 112

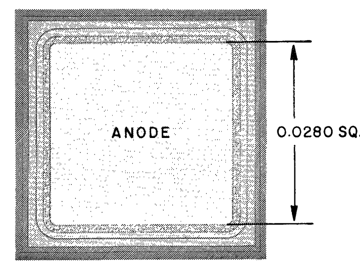
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14, 110

Process YBA
Power Diode

Process YBA is a silicon epitaxial P on N diode designed for high-power applications. It can sustain a forward current of up to 5A.



YBA 0.040″ × 0.040″

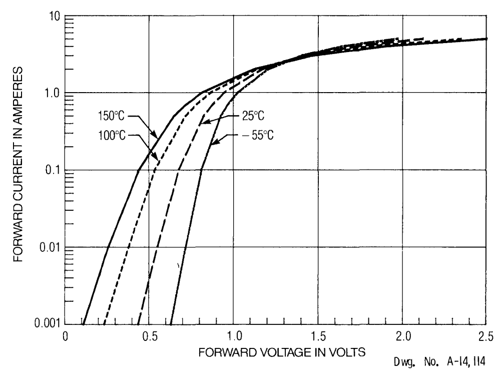
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1 s) . . . . 5.0 A
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

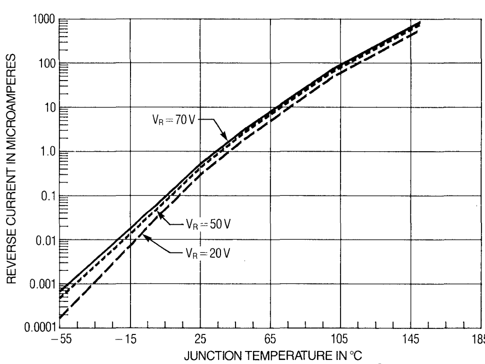
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Test Conditions	Limits Min.	Typ.	Max.	Units
V_{BR}	I_R = 1.0 mA	100	140	—	V
I_R	V_R = 70 V	—	0.6	1.0	μA
V_F	I_F = 3.0 A	—	1.4	—	V
C_J	V_R = 0 V, f = 1 MHz	—	15	—	pF

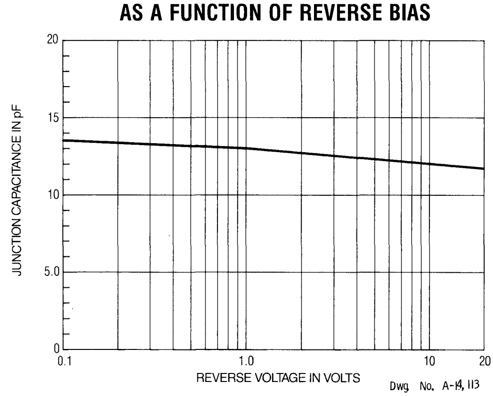
FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE

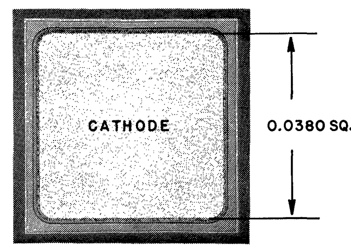


JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Process YIA
Power Diode

Process YIA is a silicon epitaxial N on P diode designed for high-power applications. It can operate with a forward current of up to 5A.



YIA 0.047″ × 0.047″

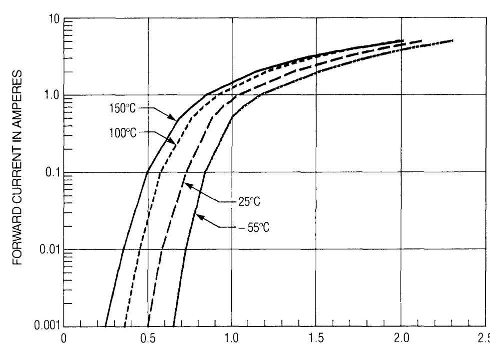
ABSOLUTE MAXIMUM RATINGS

Peak I_F Surge (Pulse Width = 1s) 5.0A
Operating Junction Temperature, T_J . . . . +150°C
Storage Temperature Range, T_S . . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at T_A = +25°C

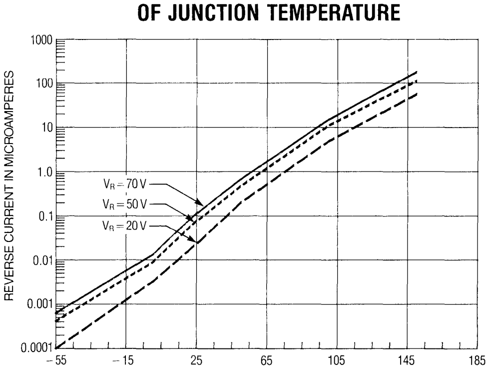
Characteristic	Test Conditions	Limits Min.	Typ.	Max.	Units
V_{BR}	I_R = 1.0mA	100	110	—	V
I_R	V_R = 70V	—	0.2	1.0	µA
V_F	I_F = 3.0A	—	1.4	—	V
C_J	V_R = 0V, f = 1MHz	—	130	—	pF

FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE



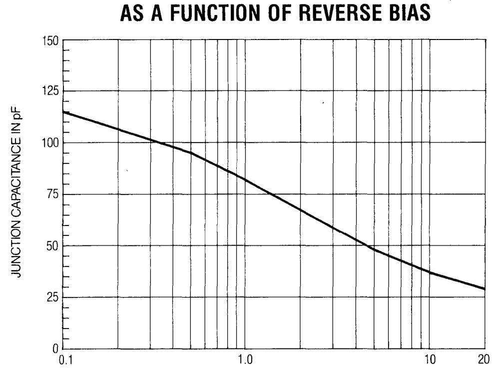
Dwg No. A-14, 116

REVERSE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE



Dwg. No. A-14, 117

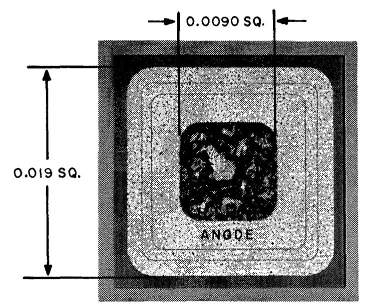
JUNCTION CAPACITANCE AS A FUNCTION OF REVERSE BIAS



Dwg. No. A-14, 118

Process ZAA and ZAB
Zener Diodes

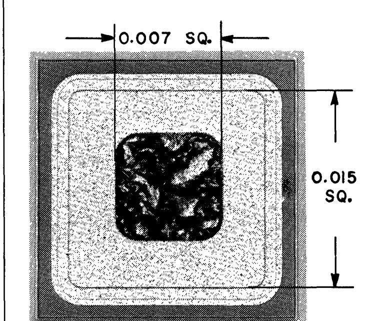
- Alloy Junction
- Buried Zener Junction for High Reliability
- Silicon Epitaxial Layer Construction for Low Series Resistance
- Silicon Nitride Passivation



ZAA 0.025″ × 0.025″

Process ZAA

Zener Voltage
2.7 V—5.1 V



ZAB 0.020″ × 0.020″

Process ZAB

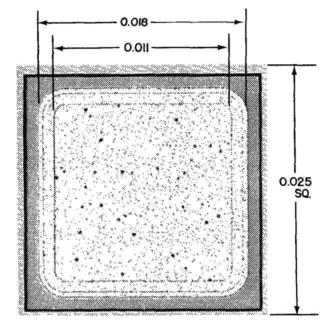
Zener Voltage
3.9 V—5.1 V

NOTE: Sprague Electric recommends against wire-bonding in the coarse (center) region of the alloy junction.

Process ZC, ZE and ZK Zener Diodes

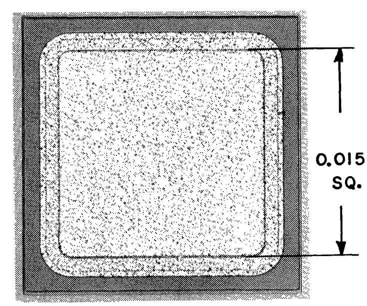
- Silicon Epitaxial Layer Construction for Low Series Resistance
- Buried Zener Junction for High Reliability
- Silicon Nitride Passivation

Process	Zener Voltage
ZCA	5.6V–12V
ZKA	12V–25V
ZEA	>25V



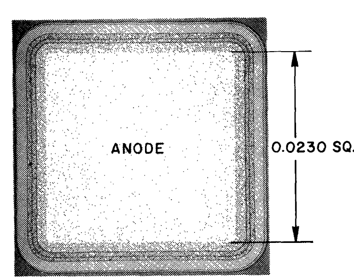
ZCA, ZEA, ZKA 0.025″ × 0.025″

Process	Zener Voltage
ZCB	5.6V–12V
ZKB	12V–25V
ZEB	>25V



ZCB, ZEB, ZKB 0.020″ × 0.020″

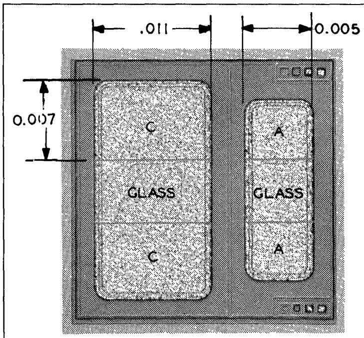
Process	Zener Voltage
ZCD	5.6V–12V
ZKD	12V–25V
ZED	>25V



ZCD, ZED, ZKD 0.035″ × 0.035″

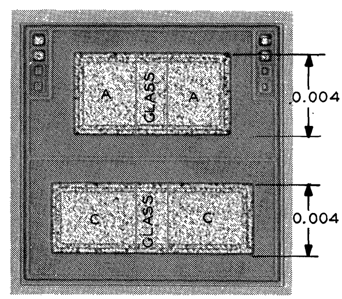
Process ZHO, ZHP, ZHQ, ZHR Temperature-Compensated Zener Reference Diodes

- Anode and Cathode on Top
- Silicon Epitaxial Layer Construction for Low Series Resistance
- Buried Zener Junction for High Reliability
- Silicon Nitride Passivation



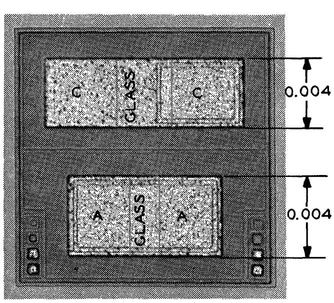
ZHO 0.028″ × 0.028″

$V_Z = 6.2$ V at $I_Z = 7.5$ mA



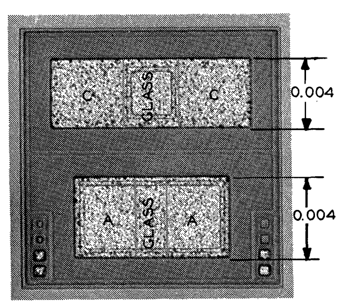
ZHP 0.022″ × 0.022″

$V_Z = 6.4$ V at $I_Z = 2.0$ mA



ZHQ 0.022″ × 0.022″

$V_Z = 6.4$ V at $I_Z = 1.0$ mA



ZHR 0.022″ × 0.022″

$V_Z = 6.4$ V at $I_Z = 0.5$ mA

NOTES

SECTION 5—TRANSISTOR AND DIODE ARRAYS

Additional information on transistor arrays
ULN-2031A through ULN-2086A, ULS-2045H
and ULS-2083H, is available from:

Sprague Electric Company
Integrated Circuits Division
115 Northeast Cutoff
Worcester, Massachusetts 01606
(617) 853-5000

CHIPS-IN-DIPs

SPRAGUE ELECTRIC'S CUSTOM-ARRAY PROGRAM

The Chips-In-Dips program uses discrete semiconductor chips from Sprague Electric Company's comprehensive line of standard devices to create transistor, diode, and Darlington arrays assembled to users' specifications at our Concord, N.H., manufacturing facility.

The program gives Sprague extensive special-design capabilities for applications with design restrictions such as short lead time, small quantities, and unique circuit requirements. Chips-In-Dips is an attractive alternative to development of monolithic integrated circuits and commitment to high-volume purchases.

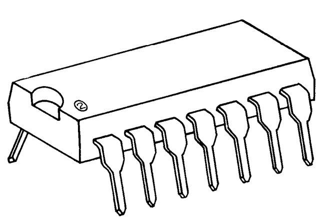
Assembly of discrete devices in dual in-line packages allows relatively higher power dissipation while reducing handling and boosting component density. The standard molded Dip, the package most commonly used for automated circuit assembly, offers superior mechanical protection of components during automatic insertion into printed wiring boards.

Series TPQ transistor arrays, Series TND diode arrays, and Series TPP Darlington arrays are among standard products offered by Sprague's Chips-In-Dips program. Semiconductor chips available for custom-array products include those described in the most recent issue of Sprague catalog CN-164.

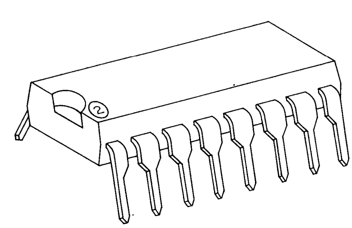
MAXIMUM RATINGS

Package Power Dissipation, P_D .... 2 W*
Operating Temperature Range, T_A .... −55°C to +150°C
Storage Temeprature Range, T_S .... −65°C to +150°C

*Derate at the rate of 16 mW/°C above T_A = +25°C



Dwg. No. A-11,562A

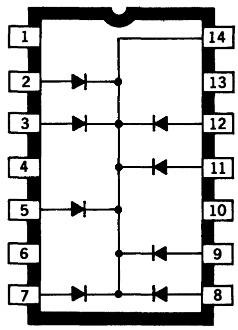


Dwg. No. A-11,420A

SERIES TND DIODE ARRAYS

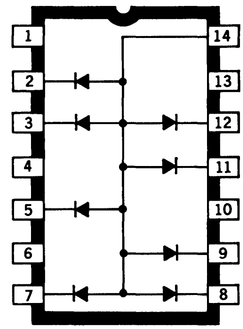
The TND series consists of diode arrays packaged in 14-pin and 16-pin dual in-line plastic packages for easy automatic insertion and better printed circuit board density.

In addition to the diode characteristics for standard products shown here, arrays consisting of diodes with 1N3070, 1N3595, 1N3600, 1N4153, or 1N4447 characteristics can be furnished on request. Other package configurations are available on special order.



Dwg. No. A-13,359

TND933
TND940



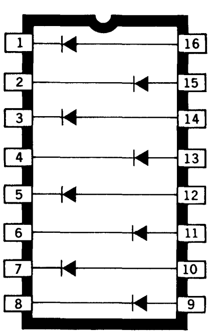
Dwg. No. A-13,360

TND938
TND939

ELECTRICAL CHARACTERISTICS at T_A = +25°C

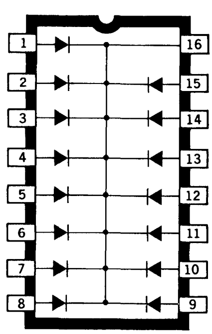
Device Type	V_{BR} Min. (V)	V_F Max. (V)	V_F @ I_F (mA)	I_R Max. (nA)	I_R @ V_R (V)	Device Type	V_{BR} Min. (V)	V_F Max. (V)	V_F @ I_F (mA)	I_R Max. (nA)	I_R @ V_R (V)
TND903	75	1.0	100	—	—	TND933	60	1.0	100	100	40
TND905	100	1.0	10	—	—	TND938	60	1.0	100	100	40
TND907	120	1.0	100	10	50	TND939	40	1.0	100	100	25
TND908	100	1.0	10	—	—	TND940	40	1.0	100	100	25
TND918	75	1.0	50	—	—	TND942	75	1.0	10	100	25
TND921	75	1.0*	10	—	—						

*All diodes match to with ±15 mV at I_F = 10 mA.



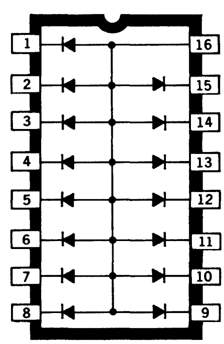
Dwg. No. A-10,903

TND903
TND907
TND908
TND918
TND921



Dwg. No. A-10,901

TND905



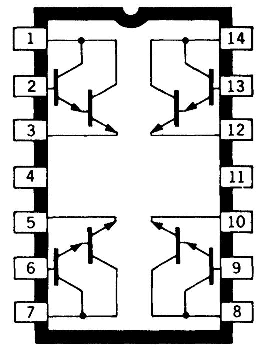
Dwg. No. A-13,361

TND942

TPP4000
MEDIUM-POWER DARLINGTON ARRAY

This Sprague medium-power array consists of four Darlington pairs in a single 14-pin dual in-line plastic package. Features include a collector-current rating of 4 A, a minimum h_{FE} of 2,000, and a package power dissipation rating of 2 W.

The standard molded dual in-line package is identical to the type used for many integrated circuits. It offers superior mechanical protection for circuit elements during automatic insertion into printed wiring boards.



Dwg. No. A-10,782A

ABSOLUTE MAXIMUM RATINGS

Collector Current, I_C .... 4.0 A
Power Dissipation, P_D (total package) .... 2 W*
Operating Temperature Range, T_A .... $-55°C$ to $+150°C$
Storage Temperature Range, T_S .... $-65°C$ to $+150°C$

*Derate at the rate of 16 mW/°C above $T_A = +25°C$

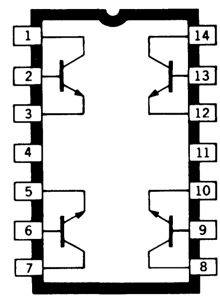
ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	BV_{CES}	$I_C = 100\ \mu A$	40	50	—	V
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 100\ \mu A$	50	60	—	V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 100\ \mu A$	12	14	—	V
Collector-Cutoff Current	I_{CBO}	$V_{CB} = 30$ V	—	10	100	nA
Emitter-Cutoff Current	I_{EBO}	$V_{EB} = 10$ V	—	10	100	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_B = 1.0$ mA, $I_C = 1.0$ A	—	1.0	1.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_B = 1.0$ mA, $I_C = 1.0$ A	—	1.6	2.0	V
Static Forward Current-Transfer Ratio	h_{FE}	$V_{CE} = 5.0$ V, $I_C = 500$ mA	2000	—	—	—
		$V_{CE} = 5.0$ V, $I_C = 1.0$ A	2000	—	—	—
		$V_{CE} = 5.0$ V, $I_C = 2.0$ A	2000	—	—	—

SERIES TPQ
QUAD TRANSISTOR ARRAYS

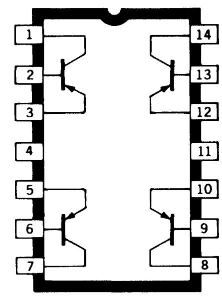
SPRAGUE SERIES TPQ quad transistor arrays are general-purpose silicon transistor arrays consisting of four independent devices. Shown are 20 NPN types, 15 PNP types, and 12 NPN/PNP complementary pairs.

All of these devices are furnished in a 14-pin dual in-line plastic package. The molded package is identical to that used with most consumer integrated circuits and offers superior mechanical protection during insertion into printed wiring boards.



Dwg. No. A-10-050A

TPQ2221	TPQ4002A
TPQ2221A	TPQ5550
TPQ2222	TPQ5551
TPQ2222A	TPQ6426
TPQ2483	TPQ6427
TPQ2484	TPQ7041
TPQ3724	TPQ7042
TPQ3725	TPQ7043
TPQ3904	TPQA05
TPQ4001A	TPQA06



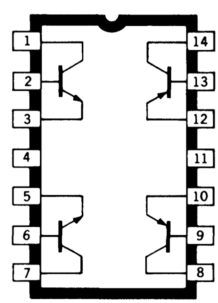
Dwg. No. A-10,051A

TPQ2906	TPQ4354
TPQ2906A	TPQ5400
TPQ2907	TPQ5401
TPQ2907A	TPQ7091
TPQ3798	TPQ7092
TPQ3799	TPQ7093
TPQ3906	TPQA55
	TPQA56

ABSOLUTE MAXIUMUM RATINGS

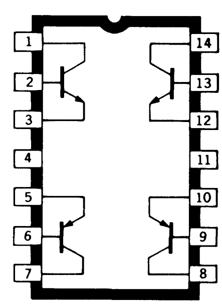
Power Dissipation, P_D (Each Transistor) . . . . 500 mW
(Total Package) . . . . 2.0 W*
Operating Temperature Range, T_A . . . . −55°C to +150°C
Storage Temperature Range, T_S . . . . −65°C to +150°C

*Derate at the rate of 16 mW/°C above T_A = +25°C



Dwg. No. A-10,052A

TPQ6001
TPQ6002
TPQ6100
TPQ6100A
TPQ6501
TPQ6502



Dwg. No. A-10,053A

TPQ6600
TPQ6600A
TPQ6700
TPQ7051
TPQ7052
TPQ7053

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

				I_{CBO}		DC Current Gain	Conditions		Saturation Voltage			f_T			
Part Number	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	Max. (nA)	@ V_{CB} (V)	h_{FE} Min.	I_C (mA)	V_{CE} (V)	V_{CE} Max. (V)	V_{BE} Max. (V)	@ I_C (mA)	Min. (MHz)	@ I_C (mA)	C_{ob} Max. (pF)	Similar Discrete Devices
Four NPN Devices															
TPQ2221	60	40	5.0	50	50	35 40 20	10 150 300	10 10 10	0.40 1.60	1.30 2.60	150 300	200	20	8.0	2N2221
TPQ2221A	75	40	6.0	50	50	35 40 20	10 150 300	10 10 10	0.40 1.60	1.30 2.60	150 300	200	20	8.0	2N2221A
TPQ2222	60	40	5.0	50	50	75 100 30	10 150 300	10 10 10	0.40 1.60	1.30 2.60	150 300	200	20	8.0	2N2222
TPQ2222A	75	40	6.0	50	50	75 100 30	10 150 300	10 10 10	0.40 1.60	1.30 2.60	150 300	200	20	8.0	2N2222A
TPQ2483	60	40	6.0	20	45	100 150 150	0.1 1.0 10	5.0 5.0 5.0	0.35 0.50 (See Note 1)	0.70 0.80	1.0 10	50	0.5	6.0	2N2483
TPQ2484	60	40	6.0	20	45	200 300 300	0.1 1.0 10	5.0 5.0 5.0	0.35 0.50 (See Note 1)	0.70 0.80	1.0 10	50	0.5	6.0	2N2484
TPQ3724	60 (Note 2)	30	5.0	500	40	35 25	100 500	1.0 2.0	0.45	1.00	500	250	50	10	2N3724
TPQ3725	60 (Note 2)	40	5.0	500	40	35 25	100 500	1.0 2.0	0.45	1.00	500	250	50	10	2N3725
TPQ3904	60	40	6.0	50	40	30 50 75	0.1 1.0 10	1.0 1.0 1.0	0.20	0.85	10	250	10	4.0	2N3904
TPQ4001A	60	40	6.0	500	30	50 30 20	100 500 1000	1.0 1.0 5.0	0.26 0.52 0.95	0.86 1.1 1.7	100 500 1000	200	50	10	—
TPQ4002A	70	45	6.0	500	30	50 30 20	100 500 1000	1.0 1.0 5.0	0.26 0.52 0.95	0.86 1.1 1.7	100 500 1000	200	50	10	—
TPQ5550	160	140	6.0	100	100	60 60 20	1.0 10 50	5.0 5.0 5.0	0.15 0.25	1.00 1.20	10 50	100	10	6.0	2N5550
TPQ5551	180	160	6.0	50	120	80 80 30	1.0 10 50	5.0 5.0 5.0	0.15 0.25	1.00 1.20	10 50	100	10	6.0	2N5551
TPQ6426	40	30	12	100	30	5k 10k	10 100	5.0 5.0	1.5	2.0	100	125	10	8.0	2N6426
TPQ6427	50	40	12	100	30	5k 10k	10 100	5.0 5.0	1.5	2.0	100	125	10	8.0	2N6427

NOTES:
1. Base-emitter voltage shown is $V_{BE(ON)}$ at indicated I_C, $V_{CE} = 5.0$ V.
2. BV_{CES}

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Part Number	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	Conditions I_C (mA)	Conditions V_{CE} (V)	Saturation Voltage V_{CE} Max. (V)	Saturation Voltage V_{BE} Max. (V)	@ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob} Max. (pF)	Similar Discrete Devices
Four NPN Devices (Continued)															
TPQ7041	150	150	5.0	100	120	25	1.0	10	0.5	0.9	20	50	10	5.0	—
						40	10	10							
						40	30	10							
TPQ7042	200	200	5.0	100	150	25	1.0	10	0.5	0.9	20	50	10	5.0	—
						40	10	10							
						40	30	10							
TPQ7043	250	250	5.0	100	180	25	1.0	10	0.5	0.9	20	50	10	5.0	—
						40	10	10							
						40	30	10							
TPQA05	60	60	4.0	100	(Note 1)	50	10	1.0	0.25	—	100	—	—	10	MPSA05
						50	100	2.0							
TPQA06	80	80	4.0	100	(Note 2)	50	10	1.0	0.25	—	100	—	—	10	MPSA06
						50	100	2.0							
Four PNP Devices															
TPQ2906	−60	−40	−5.0	50	−30	35	10	−10	−0.40	−1.30	150	200	50	8.0	2N2906
						40	150	−10	−1.60	−2.60	300				
						30	300	−10							
TPQ2906A	−60	−40	−5.0	50	−30	35	10	−10	−0.40	−1.30	150	200	50	8.0	2N2906A
						40	150	−10	−1.60	−2.60	300				
						30	300	−10							
TPQ2907	−60	−40	−5.0	50	−30	75	10	−10	−0.40	−1.30	150	200	50	8.0	2N2907
						100	150	−10	−1.60	−2.60	300				
						50	300	−10							
TPQ2907A	−60	−60	−5.0	50	−30	75	10	−10	−0.40	−1.30	150	200	50	8.0	2N2907A
						100	150	−10	−1.60	−2.60	300				
						50	300	−10							
TPQ3798	−60	−40	−5.0	10	−50	100	0.01	−5.0	−0.20	−0.70	0.1	60	1.0	4.0	2N3798
						150	0.1	−5.0	−0.25	−0.80	1.0				
						150	0.5	−5.0							
						125	10	−5.0							
TPQ3799	−60	−60	−5.0	10	−50	225	0.01	−5.0	−0.20	−0.70	0.1	60	1.0	4.0	2N3799
						300	0.1	−5.0	−0.25	−0.80	1.0				
						300	0.5	−5.0							
						250	10	−5.0							
TPQ3906	−40	−40	−5.0	50	−30	40	0.1	−1.0	−0.25	−0.85	10	200	10	4.5	2N3906
						60	1.0	−1.0							
						75	10	−1.0							

NOTES:
1. I_{CES} at $V_{CE} = 50$ V, $V_{BE} = 0$.
2. I_{CES} at $V_{CE} = 60$ V, $V_{BE} = 0$.

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Part Number	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain Conditions I_C (mA)	DC Current Gain Conditions V_{CE} (V)	Saturation Voltage V_{CE} Max. (V)	Saturation Voltage V_{BE} Max. (V)	Saturation Voltage @ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob} Max. (pF)	Similar Discrete Devices
Four PNP Devices (Continued)															
TPQ4354	−60	−60	−5.0	50	−50	25 40 50 40	0.1 1.0 10 100	−10 −10 −10 −10	−0.15	−0.90	150	100	50	30 (Note 1)	2N4354
TPQ5400	−130	−120	−5.0	100	(Note 2)	30 40 40	1.0 10 50	−5.0 −5.0 −5.0	−0.20 −0.50	−1.00 −1.00	10 50	100	10	6.0	2N5400
TPQ5401	−160	−150	−5.0	100	(Note 3)	50 60 50	1.0 10 50	−5.0 −5.0 −5.0	−0.20 −0.50	1.00 1.00	10 50	100	10	6.0	2N5401
TPQ7091	150	150	5.0	250	120	25 35 25	1.0 10 30	10 10 10	0.5	0.9	20	50	10	5.0	—
TPQ7092	200	200	5.0	250	160	25 35 25	1.0 10 30	10 10 10	0.5	0.9	20	50	10	5.0	—
TPQ7093	250	250	5.0	250	180	25 35 25	1.0 10 30	10 10 10	0.5	0.9	20	50	10	5.0	—
TPQA55	−60	−60	−4.0	100	(Note 4)	50 50	10 100	−1.0 −2.0	−0.25	—	100	—	—	15	MPSA55
TPQA56	−80	−80	−4.0	100	(Note 5)	50 50	10 100	−1.0 −2.0	−0.25	—	100	—	—	15	MPSA56
Two NPN/Two PNP Devices															
TPQ6001 (Note 6)	60	30	5.0	30	50	25 35 40 20	1.0 10 150 300	10 10 10 10	0.40 1.40	1.30 2.00	150 300	200	50	8.0	2N2221 and 2N2906
TPQ6002 (Note 6)	60	30	5.0	30	50	50 75 100 30	1.0 10 150 300	10 10 10 10	0.40 1.40	1.30 2.00	150 300	200	50	8.0	2N2222 and 2N2907
TPQ6100 (Note 6)	60	40	5.0	10	50	50 75 75 60	0.1 0.5 1.0 10	5.0 5.0 5.0 5.0	0.25	0.80	1.0	100	0.5	4.0	2N2483 and 2N3798
TPQ6100A (Note 6)	60	45	5.0	10	50	100 150 150 125	0.1 0.5 1.0 10	5.0 5.0 5.0 5.0	0.25	0.80	1.0	100	0.5	4.0	2N2484 and 2N3799

NOTES:
1. C_{cb}
2. I_{CES} at $V_{CE} = 100$ V, $V_{BE} = 0$.
3. I_{CES} at $V_{CE} = 120$ V, $V_{BE} = 0$.
4. I_{CES} at $V_{CE} = 50$ V, $V_{BE} = 0$.
5. I_{CES} at $V_{CE} = 60$ V, $V_{BE} = 0$.
6. NPN/PNP complementary pairs. Polarity shown is for NPN devices.

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Part Number (See Note)	$V_{(BR)CBO}$ (V)	$V_{(BR)CEO}$ (V)	$V_{(BR)EBO}$ (V)	I_{CBO} Max. (nA)	I_{CBO} @ V_{CB} (V)	DC Current Gain h_{FE} Min.	DC Current Gain Conditions I_C (mA)	DC Current Gain Conditions V_{CE} (V)	Saturation Voltage V_{CE} Max. (V)	Saturation Voltage V_{BE} Max. (V)	Saturation Voltage @ I_C (mA)	f_T Min. (MHz)	f_T @ I_C (mA)	C_{ob} Max. (pF)	Similar Discrete Devices
Two NPN/Two PNP Devices (Continued)															
TPQ6501	60	30	5.0	30	50	25 35 40 20	1.0 10 150 300	10 10 10 10	0.40 1.40	1.30 2.00	150 300	200	50	8.0	2N2221 and 2N2906
TPQ6502	60	30	5.0	30	50	50 75 100 30	1.0 10 150 300	10 10 10 10	0.40 1.40	1.30 2.00	150 300	200	50	8.0	2N2222 and 2N2907
TPQ6600	60	40	5.0	10	50	50 75 75 60	0.1 0.5 1.0 10	5.0 5.0 5.0 5.0	0.25	0.80	1.0	100	0.5	4.0	2N2483 and 2N3798
TPQ6600A	60	45	5.0	10	50	100 150 150 60	0.1 0.5 1.0 10	5.0 5.0 5.0 5.0	0.25	0.80	1.0	100	0.5	4.0	2N2484 and 2N3799
TPQ6700	40	40	5.0	50	30	30 50 70	0.1 1.0 10	1.0 1.0 1.0	0.25	0.90	10	200	10	4.5	2N3904 and 2N3906
TPQ7051	150	150	5.0	250	120	25 35 25	1.0 10 30	10 10 10	0.7	0.9	20	50	10	6.0	—
TPQ7052	200	200	5.0	250	150	25 35 25	1.0 10 30	10 10 10	0.7	0.9	20	50	10	6.0	—
TPQ7053	250	200	5.0	250	180	25 35 25	1.0 10 30	10 10 10	0.7	0.9	20	50	10	6.0	—

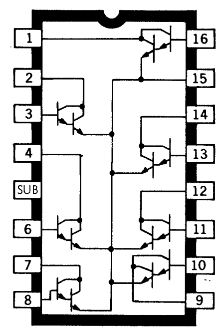
NOTE:
NPN/PNP complementary pairs. Polarity shown is for NPN devices.

ULN-2031A, ULN-2032A, AND ULN-2033A HIGH-CURRENT DARLINGTON TRANSISTOR ARRAYS

SPRAGUE TYPE ULN-2031A, ULN-2032A, and ULN-2033A High-Current Darlington Transistor Arrays are comprised of seven silicon Darlington pairs on a common monolithic substrate. The Type ULN-2031A consists of 14 NPN transistors connected to form seven Darlington pairs with NPN action. The Type ULN-2032A (h_{FE} = 500 min.) and the Type ULN-2033A (h_{FE} = 50 min.) consist of seven NPN and seven PNP transistors connected to form seven Darlington pairs with PNP action. All devices feature a common emitter configuration.

These devices are especially suited for interfacing between MOS, TTL, or DTL outputs and 7-segment LED or tungsten filament indicators. Peak inrush currents to 100 mA are allowable. They are also ideal for a variety of other driver applications such as relay control and thyristor firing.

The ULN-2031A, ULN-2032A, and ULN-2033A transistor arrays are housed in 16-lead DIP plastic packages which include a separate substrate connection for maximum circuit design flexibility.



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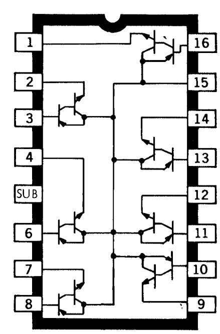
ULN-2031A



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ULN-2032A
ULN-2033A

Additional information on transistor arrays ULN-2031A through ULN-2086A, ULS-2045H and ULS-2083H, is available from:

Sprague Electric Company
Integrated Circuits Division
115 Northeast Cutoff
Worcester, Massachusetts 01606
(617) 853-5000

ABSOLUTE MAXIMUM RATINGS
at +25°C Free-Air Temperature (unless otherwise noted)

Power Dissipation (any one Darlington pair) . . . 500 mW
(total package) . . . 750 mW
Derating Factor Above +25°C . . . 6.67 mW/°C
Ambient Temperature Range (operating), T_A . . . −20°C to +85°C
Storage Temperature Range, T_S . . . −55°C to +125°C
Individual Darlington Pair Ratings:
Collector-to-Emitter Voltage, V_{CEO} . . . 16 V
Collector-to-Base Voltage, V_{CBO} . . . 40 V
Collector-to-Substrate Voltage, V_{CIO} . . . 40 V
Emitter-to-Base Voltage, V_{EBO}
Type ULN-2031A . . . 5 V
Type ULN-2032A and ULN-2033A . . . 40 V
Continuous Collector Current, I_C . . . 80 mA
Continuous Base Current, I_B . . . 5 mA

NOTE:
The substrate must be connected to a voltage which is more negative than any collector or base voltage so as to maintain isolation between transistors, and to provide normal transistor action.

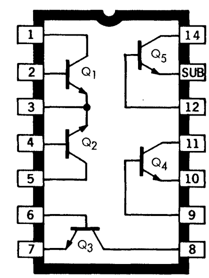
ELECTRICAL CHARACTERISTICS at T_A = +25°C

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 500 μA	40	—	—	V
Collector-Substrate Breakdown Voltage	BV_{CIO}	I_C = 500 μA	40	—	—	V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 1 mA	16	—	—	V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 500 μA				
Type ULN-2031A			5	—	—	V
Type ULN-2032A and ULN-2033A			40	—	—	V
D-C Forward Current Transfer Ratio	h_{FE}	V_{CE} = 2 V, I_C = 20 mA				
Type ULN-2031A and ULN-2032A			500	—		—
Type ULN-2033A			50	—	500	—
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	I_C = 20 mA, I_B = 500 μA				
Type ULN-2031A			—	—	2	V
Type ULN-2032A and ULN-2033A			—	—	1	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$					
Type ULN-2031A and ULN-2032A		I_C = 20 mA, I_B = 40 μA	—	—	1.2	V
		I_C = 80 mA, I_B = 1 mA	—	—	1.5	V
Type ULN-2033A		I_C = 20 mA, I_B = 400 μA	—	—	1.2	V
		I_C = 80 mA, I_B = 2 mA	—	—	1.5	V
Collector Cutoff Current	I_{CEO}	V_{CE} = 8 V	—	—	100	μA
	I_{CBO}	V_{CB} = 10 V	—	—	10	μA

ULS-2045H AND ULN-2046A TRANSISTOR ARRAYS
(Three Isolated Transistors and One Differential Amplifier

THE ULS-2045H and ULN-2046A are general-purpose transistor arrays each consisting of five silicon N-P-N transistors on a single monolithic chip. Two transistors are internally connected to form a differential pair. Integrated circuit construction provides close electrical and thermal matching between each transistor.

These arrays are well-suited for a wide range of applications such as: DC to VHF signal processing systems; temperature-compensated amplifiers; custom designed differential amplifiers and discrete transistors in conventional circuits.



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Two package configurations are available. Type ULS-2045H is supplied in a hermetic 14-lead dual in-line ceramic package and is rated for operation over the military temperature temperature of −55°C to +125°C. Type ULN-2046A is electrically identical to the ULS-2045H but is supplied in a dual in-line plastic package rated for −20°C to +85°C ambients.

ABSOLUTE MAXIMUM RATINGS at +25°C Free-Air Temperature (unless otherwise noted)

	ULS-2045H		ULN-2046A		
	EACH TRANSISTOR	TOTAL PACKAGE	EACH TRANSISTOR	TOTAL PACKAGE	UNITS
Power Dissipation:					
T_A to +55°C	—	—	300	750	mW
T_A to +75°C	300	750	—	—	mW
Derating Factor:					
T_A > +55°C	—	—	—	6.67	mW/°C
T_A > +75°C	—	8	—	—	mW/°C

Collector-Base Voltage, V_{CBO} . . . 30 V
Collector-Emitter Voltage, V_{CEO} . . . 20 V
Collector-Substrate Voltage, V_{CIO} (See note 2) . . . 20 V
Emitter-Base Voltage, V_{EBO} . . . 6 V
Collector Current, I_C . . . 50 mA
Operating Temperature Range, T_A:
Type ULS-2045H . . . −55°C to +125°C
Type ULN-2046A . . . −20°C to +85°C
Storage Temperature Range, T_S . . . −65°C to +150°C

Notes:
1. The maximum ratings are limiting absolute values above which the serviceability may be impaired from the viewpoint of life or satisfactory performance. The breakdown voltages may be far above the maximum voltage ratings. To avoid permanent damage to the transistor, do not attempt to measure these characteristics above the maximum ratings.
2. Pin 13 is conencted to the substrate. This terminal must be tied to the most negative point in the external circuit to maintain isolation between transistors and to provide for normal transistor action.

STATIC ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10\ \mu A, I_E = 0$	20	60		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = 1\ mA, I_B = 0$	15	24		V
Collector-Substrate Breakdown Voltage	BV_{CIO}	$I_C = 10\ \mu A, I_{CI} = 0$	20	60		V
Emitter-Base Breakdown Voltage	BV_{BO}	$I_E = 10\ \mu A, I_C = 0$	5	7		V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 10\ V, I_E = 0$			40	nA
	I_{CEO}	$V_{CE} = 10\ V, I_B = 0$			0.5	μA
Static Forward Current Transfer Ratio	h_{FE}	$I_C = 10\ \mu A, V_{CE} = 3\ V$		54		—
		$I_C = 1\ mA, V_{CE} = 3\ V$	40	100		—
		$I_C = 10\ mA, V_{CE} = 3\ V$		100		—
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C = 10\ mA, I_B = 1\ mA$		0.23		V
Base-Emitter Voltage	V_{BE}	$I_E = 1\ mA, V_{CE} = 3\ V$		0.715		V
		$I_E = 10\ mA, V_{CE} = 3\ V$		0.800		V
Input Offset Current for Matched Pair Q_1 and Q_2	I_{101}-I_{102}	$I_C = 1\ mA, V_{CE} = 3\ V$		0.3	2	μA
Magnitude of Input Offset Voltage for Differential Pair	V_{BE1}-V_{BE2}	$I_C = 1\ mA, V_{CE} = 3\ V$		0.45	5	mV
Magnitude of Input Offset Voltage for Isolated Transistors	V_{BE3}-V_{BE4}	$I_C = 1\ mA, V_{CE} = 3\ V$		0.45	5	mV
	V_{BE4}-V_{BE5}	$I_C = 1\ mA, V_{CE} = 3\ V$		0.45	5	mV
	V_{BE5}-V_{BE3}	$I_C = 1\ mA, V_{CE} = 3\ V$		0.45	5	mV
Temperature Coefficient of Base-Emitter Voltage	$\frac{\Delta V_{BE}}{\Delta T}$	$I_C = 1\ mA, V_{CE} = 3\ V$		−1.9		mV/°C
Temperature Coefficient Magnitude of Input-Offset Voltage	$\frac{\Delta V_{10}}{\Delta T}$	$I_C = 1\ mA, V_{CE} = 3\ V$		1.1		μV/°C

DYNAMIC ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

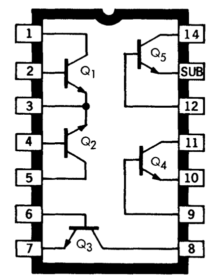
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Small-Signal Common-Emitter Forward Current Transfer Ratio	h_{fe}	$I_C = 1\ mA, V_{CE} = 3\ V, f = 1\ kHz$		110		—
Small-Signal Common-Emitter Short-Circuit Input Impedance	h_{ie}	$I_C = 1\ mA, V_{CE} = 3\ V, f = 1\ kHz$		3.5		kΩ
Small-Signal Common-Emitter Open-Circuit Output Impedance	h_{oe}	$I_C = 1\ mA, V_{CE} = 3\ V, f = 1\ kHz$		15.6		μmho
Small-Signal Common-Emitter Open-Circuit Reverse Voltage-Transfer Ratio	h_{re}	$I_C = 1\ mA, V_{CE} = 3\ V, f = 1\ kHz$		1.8×10^{-4}		—
Gain-Bandwidth Product	f_T	$I_C = 3\ mA, V_{CE} = 3\ V$	300	550		MHz
Emitter-to-Base Capacitance	C_{EB}	$V_{EB} = 3\ V, I_E = 0, f = 1\ MHz$		0.6		pF
Collector-to-Base Capacitance	C_{CB}	$V_{CB} = 3\ V, I_C = 0, f = 1\ MHz$		0.6		pF
Collector-to-Substrate Capacitance	C_{CI}	$V_{CS} = 3\ V, I_C = 0, f = 1\ MHz$		2.8		pF
Noise Figure	N.F.	$I_C = 100\ \mu A, V_{CE} = 3\ V, R_g = 1\ k\Omega$, $f = 1\ kHz, BW = 15.7\ kHz$		3.25		dB

NOTE: Characteristics apply for each transistor unless otherwise specified.

ULN-2046A-1
TRANSISTOR ARRAY

TYPE ULN-2046A-1 general-purpose transistor array consists of five silicon NPN transistors, two of which are connected as a differential amplifier. The monolithic construction provides close electrical and thermal matching between all transistors.

Except as shown in the following electrical characteristics, Type ULN-2046A-1 transistor array is identical to Type ULN-2046A.



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ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10\ \mu A, I_E = 0$	40	60	—	V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = 1$ mA, $I_B = 0$	30	—	—	V
Collector-Substrate Breakdown Voltage	VB_{CIO}	$I_C = 10\ \mu A, I_{CI} = 0$	40	60	—	V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 10$ V, $I_E = 0$	—	—	100	nA
	I_{CEO}	$V_{CE} = 10$ V, $I_B = 0$	—	—	5.0	μA
Static Forward Current Transfer Ratio	h_{FE}	$I_C = 1$ mA, $V_{CE} = 3$ V	30	100	—	

NOTE:
Pin 13 is connected to the substrate. This terminal must be tied to the most negative point in the external circuit to maintain isolation between transistors and to provide for normal transistor action.

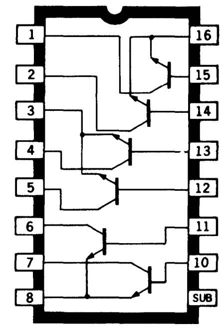
Additional information on transistor arrays ULN-2031A through ULN-2086A, ULS-2045H and ULS-2083H, is available from:

Sprague Electric Company
Integrated Circuits Division
115 Northeast Cutoff
Worcester, Massachusetts 01606
(617) 853-5000

ULN-2047A TRANSISTOR ARRAY
(Three Differential Amplifiers)

TYPE ULN-2047A is a silicon NPN multiple transistor array comprising three independent differential amplifiers. It is specifically intended for use in switching applications such as electronic organ keyboards. All base leads are brought out on one side of the 16-lead plastic dual in-line package to simplify printed wiring board layout. A separate substrate connection permits maximum circuit design flexibility.

Type ULN-2047A is supplied in a 16-pin dual in-line plastic package.



Dwg. No. A-10,231

ABSOLUTE MAXIMUM RATINGS at +25°C Free-Air Temperature

Power Dissipation, P_D (any one transistor) . . . . 300 mW
(total package) . . . . 750 mW*
Operating Temperature Range, T_A . . . . −20°C to +85°C
Storage Temperature Range, T_S . . . . −55°C to +150°C

ELECTRICAL CHARACTERISTICS at 25°C Free-Air Temperature

Collector-Emitter Breakdown Voltage, BV_{CEO} (note 1)
at I_C = 5 mA . . . . 30 V Min.
Emitter Cutoff Current, I_{EBO} (note 2)
at V_{EB} = 5 V . . . . 100 nA Max.
Collector Cutoff Current, I_{CES} (note 1)
at V_{CE} = 25 V . . . . 100 nA Max.
D-C Forward Current Transfer Ratio, h_{FE} (note 1)
at V_{CE} = 2 V, I_C = 0.1 mA . . . . 30 Min.
at V_{CE} = 2 V, I_C = 10 mA . . . . 75 Min.
Differential Input Offset Voltage, V_{IO} (note 1)
at V_{CE} = 2 V, I_{C1} = I_{C2} = 1 mA . . . . 5 mV Max.

NOTES:
1. All other pins common to emitter of transistor under test.
2. Base and collector of associated transistor connected to emitter, all other pins common to base of transistor under test.

Additional information on transistor arrays ULN-2031A through ULN-2086A, ULS-2045H and ULS-2083H, is available from:

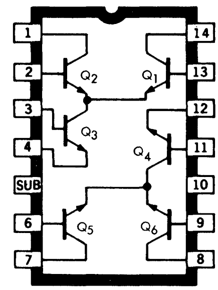
Sprague Electric Company
Integrated Circuits Division
115 Northeast Cutoff
Worcester, Massachusetts 01606
(617) 853-5000

ULN-2054A TRANSISTOR ARRAY
(Dual Independent Differential Amplifiers)

THE ULN-2054A is a transistor array consisting of six silicon NPN transistors on a single monolithic chip. The transistors are internally interconnected to form two independent differential amplifiers.

The ULN-2054A is intended for a wide range of applications requiring extremely close electrical and thermal matching characteristics. Some applications are: cascade limiter circuits; balanced mixer circuits; balanced quadrature/synchronous detector circuits; balanced (push-pull) cascade/sense/IF amplifier circuits; or in almost any multifunction system requiring RF/Mixer/Oscillator, converter/IF functions.

Available in a 14-lead dual in-line plastic package the ULN-2054A is rated for operation over a −20°C to +85°C ambient temperature range.



Dwg. No. A-8035A

Other features are:
- Input Offset Voltage—5 mV max.
- Input Offset Current—2 μA max.
- Voltage gain (single-stage double-ended output) —32 dB typ.
- Common-Mode Rejection Ratio (each amplifier) —100 dB typ.

ABSOLUTE MAXIMUM RATINGS
at +25°C Free-Air Temperature
(unless otherwise noted)

Power Dissipation T_A to +55°C:	
Each Transistor	300 mW
Total Package	750 mW
Derating Factor, Total Package, $T_A \geq 55°C$	6.67 mW/°C
Collector-Base Voltage, $V_{(BR)CBO}$	20 V
Collector-Substrate Voltage, $V_{(BR)CIO}$ (See note 2)	20 V
Collector-Emitter Voltage, $V_{(BR)CEO}$	15 V
Emitter-Base Voltage, $V_{(BR)EBO}$	5 V
Collector Current, I_C	50 mA
Base Current I_B	5 mA
Operating Temperature Range, T_A	−20°C to +85°C
Storage Temperature Range, T_S	−65°C to +150°C

Notes:
1. The maximum ratings are limiting absolute values above which the serviceability may be impaired from the viewpoint of life or satisfactory performance. The breakdown voltages may be far above the maximum voltage ratings. To avoid permanent damage to the transistor, do not attempt to measure these characteristics above the maximum ratings.
2. Pin 5 is connected to the substrate. This terminal must be tied to the most negative point in the external circuit to maintain isolation between transistors and to provide for normal transistor action.

STATIC ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

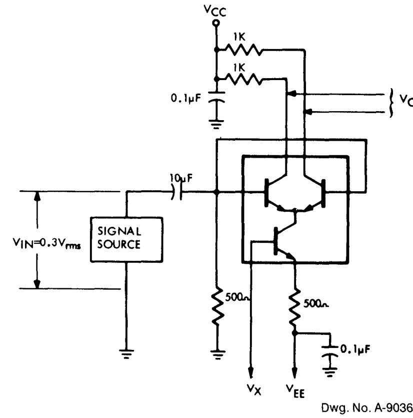
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\ \mu A, I_E = 0$	20	60		V
Collector-Substrate Breakdown Voltage	$V_{(BR)CIO}$	$I_C = 10\ \mu A, I_{C1} = 0$	20	60		V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1$ mA, $I_B = 0$	15	24		V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\ \mu A, I_C = 0$	5	7		V
Collector Cutoff Current	I_{CBO}	$V_{CB} = 10$ V, $I_E = 0$			100	nA
Base-Emitter Voltage	V_{BE}	$I_C = 50\ \mu A, V_{CB} = 3$ V		0.630	0.700	V
		$I_C = 1$ mA, $V_{CB} = 3$ V		0.715	0.800	V
		$I_C = 3$ mA, $V_{CB} = 3$ V		0.750	0.850	V
		$I_C = 10$ mA, $V_{CB} = 3$ V		0.800	0.900	V
Temperature Coefficient of Base-Emitter Voltage	$\frac{\Delta V_{BE}}{\Delta T}$	$I_C = 1$ mA, $V_{CB} = 3$ V		−1.9		mV/°C
Input Offset Voltage	V_{10}	$I_{E(Q3)} = I_{E(Q4)} = 2$ mA, $V_{CB} = 3$ V		0.45	5	mV
Input Offset Current	0_{10}	$I_{E(Q3)} = I_{E(Q4)} = 2$ mA, $V_{CB} = 3$ V		0.3	2	μA
Input Bias Current	I_1	$I_{E(Q3)} = I_{E(Q4)} = 2$ mA, $V_{CB} = 3$ V		10	24	μA
Quiescent Operating Current Ratio	$\frac{I_{C(Q1)}}{I_{C(Q2)}}$	$I_{E(Q3)} = 2$ mA, $V_{CB} = 3$ V		0.98-1.02		—
	$\frac{I_{C(Q5)}}{I_{C(Q6)}}$	$I_{E(Q4)} = 2$ mA, $V_{CB} = 3$ V		0.98-1.02		—
Temperature Coefficient Magnitude of Input-Offset Voltage	$\frac{\Delta V_{10}}{\Delta T}$	$I_{E(Q3)} = I_{E(Q4)} = 2$ mA, $V_{CB} = 3$ V		1.1		μV/°C

DYNAMIC ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

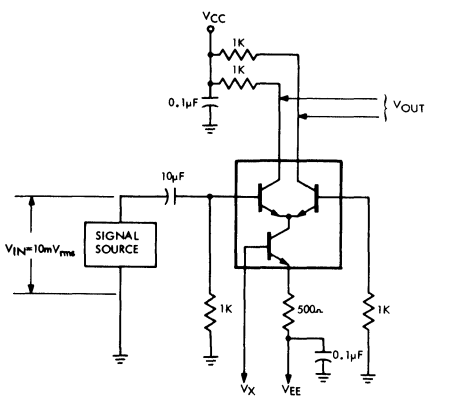
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
Common-Mode Rejection Ratio For Each Amplifier	CMR	$V_{CC} = 12$ V, $V_{EE} = -6$ V, $V_X = 3.3$ V, f = 1 kHz (See figure 1)		100		dB
AGC Range, One Stage	AGC	$V_{CC} = 12$ V, $V_{EE} = -6$ V, $V_X = 3.3$ V, f = 1 kHz (See figure 2)		75		dB
Voltage Gain, Single Stage Double Ended Output	A_v	$V_{CC} = 12$ V, $V_{EE} = -6$ V, $V_X = 3.3$ V, f = 1 kHz (See figure 2)		32		dB
AGC Range, Two Stage	AGC	$V_{CC} = 12$ V, $V_{EE} = -6$ V, $V_X = 3.3$ V, f = 1 kHz (See figure 3)		105		dB
Voltage Gain, Two Stage Double-Ended Output	A_v	$V_{CC} = 12$ V, $V_{EE} = -6$ V, $V_X = 3.3$ V, f = 1 kHz (See figure 3)		60		dB
Small-Signal Common-Emitter Forward Current Transfer Ratio	h_{fe}	$I_C = 1$ mA, $V_{CE} = 3$ V, f = 1 kHz		110		—
Small-Signal Common-Emitter Short-Circuit Input Impedance	h_{ie}	$I_C = 1$ mA, $V_{CE} = 3$ V, f = 1 kHz		3.5		IΩ
Small-Signal Common-Emitter Open-Circuit Output Impedance	h_{oe}	$I_C = 1$ mA, $V_{CE} = 3$ V, f = 1 kHz		15.6		μmho
Small-Signal Common-Emitter Open-Circuit Reverse Voltage-Transfer Ratio	h_{re}	$I_C = 1$ mA, $V_{CE} = 3$ V, f = 1 kHz		1.8×10^{-4}		—
Gain-Bandwidth Product (for Single Transistor)	f_T	$I_C = 3$ mA, $V_{CE} = 3$ V		550		MHz
Noise Figure (for Single Transistor)	N.F.	$V_{CE} = 3$ V, f = 1 kHz, $I_C = 100\ \mu A$, $R_g = 1$ kΩ, BW = 15.7 kHz		3.25		dB
Noise Figure (for each Amplifier)	N.F.	f = 100 MHz		8		dB

NOTE: Characteristics apply for each transistor unless otherwise specified.

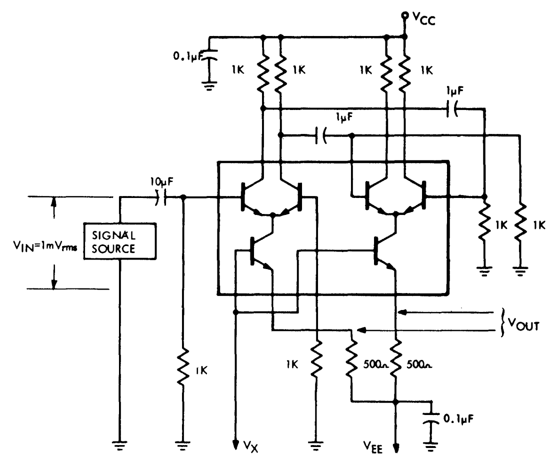
AMPLIFIER TEST CIRCUITS



COMMON MODE REJECTION RATIO
Figure 1



SINGLE-STAGE VOLTAGE GAIN
Figure 2



TWO-STAGE VOLTAGE GAIN
Figure 3

Additional information on transistor arrays
ULN-2031A through ULN-2086A, ULS-2045H
and ULS-2083H, is available from:

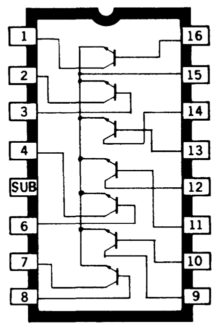
Sprague Electric Company
Integrated Circuits Division
115 Northeast Cutoff
Worcester, Massachusetts 01606
(617) 853-5000

ULN-2081A AND ULN-2082A GENERAL-PURPOSE HIGH-CURRENT TRANSISTOR ARRAYS

SPRAGUE TYPE ULN-2081A and ULN-2082A Transistor Arrays are comprised of seven high-current silicon NPN transistors on a common monolithic substrate. The Type ULN-2081A is connected in a common-emitter configuration and the Type ULN-2082A is connected in a common-collector configuration.

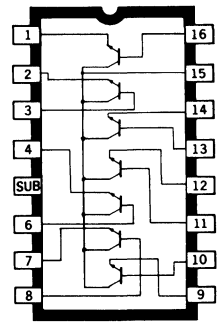
Both arrays are capable of directly driving seven segment displays and LED displays. They are ideal for a variety of other driver applications such as relay control and thyristor firing.

Type ULN-2081A and ULN-2082A are housed in 16-lead Dip plastic packages which include a separate substrate connection for maximum circuit design flexibility.



Dwg. No. A-9042B

ULN-2081A



Dwg. No. A-9043B

ULN-2082A

ABSOLUTE MAXIMUM RATINGS

Power Dissipation (any one transistor) .... 500 mW
(total package) .... 750 mW
Ambient Temperature Range (operating) .... −20°C to +85°C
Individual Transistor Ratings:
Collector-to-Emitter Voltage, V_{CEO} .... 16 V
Collector-to-Base Voltage, V_{CBO} .... 20 V
Collector-to-Substrate Voltage, V_{CIO} .... 20 V
Emitter-to-Base Voltage, V_{EBO} .... 5 V
Collector Current, I_C .... 200 mA
Base Current, I_B .... 20 mA

NOTE:
The collector of each transistor in the Type ULN-2081A and ULN-2082A is isolated from the substrate by an integral diode. The substrate must be connected to a voltage which is more negative than any collector voltage so as to maintain isolation between transistors, and to provide normal transistor action. Undesired coupling between transistors is avoided by maintaining the substrate terminal (5) at either d-c or signal (a-c) ground. An appropriate bypass capacitor can be used to establish a signal ground.

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

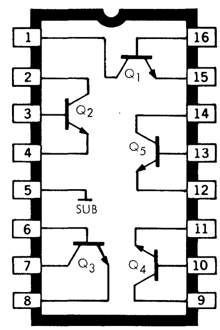
Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Emitter Breakdown Voltage	BV_{CES}	$I_C = 500\ \mu A$	20	80		V
Collector-Substrate Breakdown Voltage	BV_{CIE}	$I_{CI} = 500\ \mu A$	20	80		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = 1$ mA	16	40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 500\ \mu A$	5	7		V
Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 0.5$ V, $I_C = 30$ mA	30	80		
		$V_{CE} = 0.8$ V, $I_C = 50$ mA	40			
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	$I_C = 30$ mA		0.75	1	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C = 30$ mA		0.13	0.5	V
		$I_C = 50$ mA		0.2	0.7	V
Collector Cutoff Current	I_{CEO}	$V_{CE} = 10$ V			10	μA
	I_{CBO}	$V_{CB} = 10$ V			1	μA

ULN-2083A AND ULS-2083H TRANSISTOR ARRAYS
(Five Independent NPN Transistors)

DESIGNED for use in general purpose, medium current (to 100 mA) switching and differential amplifier applications, the ULN-2083A and ULS-2083H transistor arrays each consist of five NPN transistors on a single monolithic chip. Two transistors are matched at low currents (1 mA) making them ideal for use in balanced mixer circuits, push-pull amplifiers, and other circuit functions requiring close thermal and offset matching.

A separate substrate connection permits maximum circuit design flexibility. In order to maintain isolation between transistors and provide normal transistor action, the substrate must be connected to a voltage which is more negative than any collector voltage. The substrate terminal (pin 5) should therefore be maintained at either d-c ground or suitably bypassed to a-c ground to avoid undesired coupling between transistors.

Two package configurations are available. The Type ULN-2083A is supplied in a 16-lead dual in-line plastic package for operation over the temperature range of −20°C to +85°C. This package is similar to JEDEC style MO-001AC. The Type ULS-2083H is electrically identical to the ULN-2083A but is supplied in a hermetic dual in-line package for operation over the temperature range of −55°C to +125°C. This package conforms to the dimensional requirements of Military Specification MIL-M-38510 and can meet all of the applicable environmental requirements of Military Standard MIL-STD-883.



Dwg. No. A-10,232

ABSOLUTE MAXIMUM RATINGS
at +25°C Free-Air Temperature

Power Dissipation, P_D (any one transistor) . . . . 500 mW
(total package) . . . . 750 mW*
Operating Temperature Range, T_A (ULN-2083A) . . . . −20°C to +85°C
(ULS-2083H) . . . . −55°C to +125°C
Storage Temperature Range, T_S . . . . −55°C to +150°C

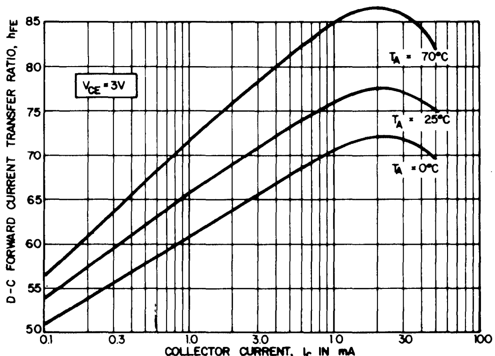
*Derate at the rate of 6.67 mW/°C above 25°C.

ELECTRICAL CHARACTERISTICS at T_A = +25°C Free-Air Temperature

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 100 µA	20	60	—	V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 1 mA	15	24	—	V
Collector-Substrate Breakdown Voltage	BV_{CIO}	I_C = 100 µA	20	60	—	V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 500 µA	5.0	6.9	—	V
Collector Cutoff Current	I_{CEO}	V_{CE} = 10 V	—	—	10	µA
	I_{CBO}	V_{CB} = 10 V	—	—	1.0	µA
Base Emitter Voltage	V_{BE}	V_{CE} = 3 V, I_C = 10 mA	650	740	850	mV
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	I_C = 50 mA, I_B = 5 mA	—	400	700	mV
D-C Forward Current Transfer Ratio	h_{FE}	V_{CE} = 3 V, I_C = 10 mA	40	76	—	
		V_{CE} = 3 V, I_C = 50 mA	40	75	—	
Differential Input Offset Voltage*	V_{IO}	V_{CE} = 3 V, I_C = 1 mA	—	1.2	5.0	mV
Differential Input Offset Current	I_{IO}	V_{CE} = 3 V, I_C = 1 mA	—	0.7	2.5	µA

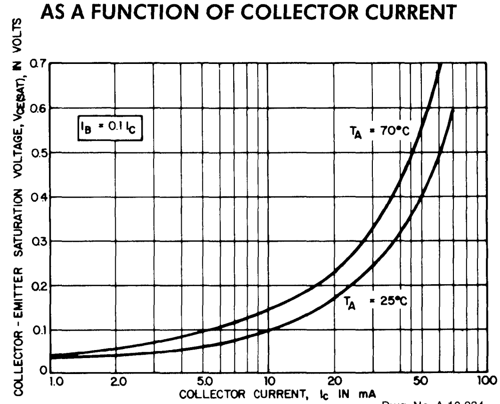
*Applies only to transistors Q_1 and Q_2 when connected as a differential pair.

D-C FORWARD CURRENT TRANSFER RATIO AS A FUNCTION OF COLLECTOR CURRENT



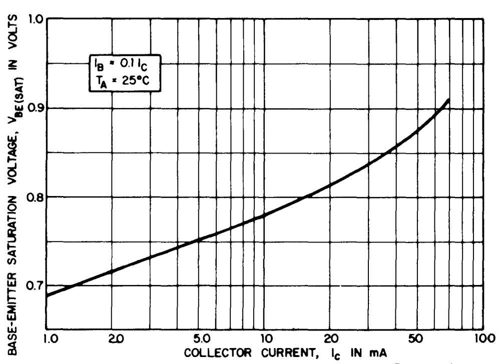
Dwg. No. A-10,236

COLLECTOR-EMITTER SATURATION VOLTAGE AS A FUNCTION OF COLLECTOR CURRENT



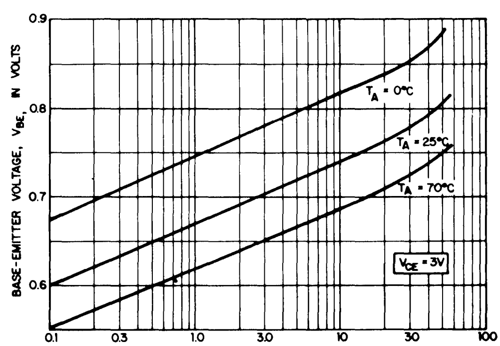
Dwg. No. A-10,234

BASE-EMITTER SATURATION VOLTAGE AS A FUNCTION OF COLLECTOR CURRENT



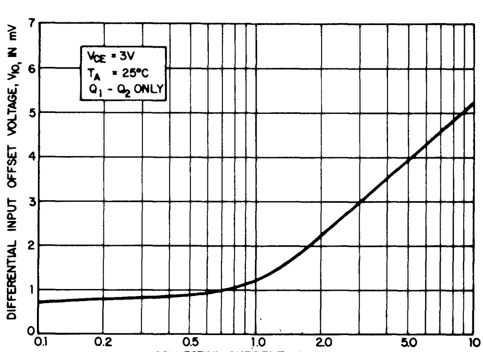
Dwg. No. A-10,237

BASE-EMITTER VOLTAGE AS A FUNCTION OF COLLECTOR CURRENT



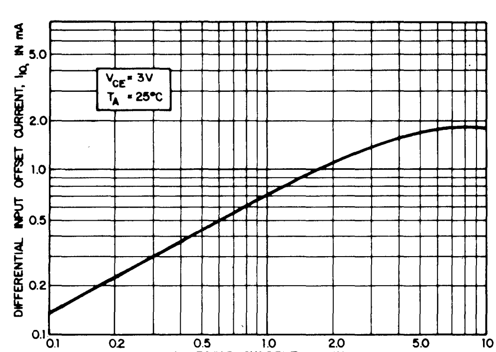
Dwg. No. A-10,234

DIFFERENTIAL INPUT OFFSET VOLTAGE AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-10,238

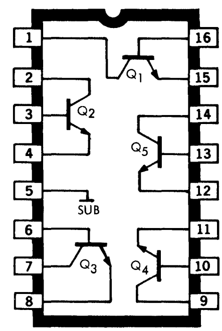
DIFFERENTIAL INPUT OFFSET CURRENT AS A FUNCTION OF COLLECTOR CURRENT



Dwg. No. A-10,240

ULN-2083A-1 TRANSISTOR ARRAY

This device is a general-purpose transistor array for use in medium-current switching and differential amplifier applications. With the exception of the increased breakdown voltages shown below, Type ULN-2083A-1 is identical to Type ULN-2083A transistor array.



Dwg. No. A-10,232

ELECTRICAL CHARACTERISTICS at T_A = +25°C Free-Air Temperature

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 100 μA	40	60	—	V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 1 mA	30	—	—	V

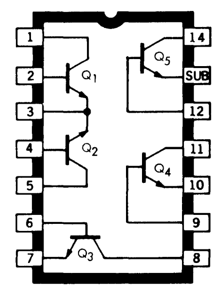
Additional information on transistor arrays ULN-2031A through ULN-2086A, ULS-2045H and ULS-2083H, is available from:

Sprague Electric Company
Integrated Circuits Division
115 Northeast Cutoff
Worcester, Massachusetts 01606
(617) 853-5000

ULN-2086A TRANSISTOR ARRAY

Type ULN-2086A general-purpose transistor array consists of five silicon NPN transistors, two of which are connected as a differential amplifier. The monolithic construction provides close electrical and thermal matching between all transistors.

With the exception of the collector cutoff current specifications listed below and the omission of guaranteed limits on input offset voltage and input offset current, Type ULN-2086A is identical to Type ULN-2046A transistor array.



Dwg. No. A-9834

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$

Characteristic	Symbol	Test Conditions	Limits			Units
			Min.	Typ.	Max.	
Collector Cutoff Current	I_{CBO}	$V_{CB} = 10\ V, I_E = 0$	—	—	100	nA
	I_{CEO}	$V_{CE} = 10\ V, I_B = 0$	—	—	5.0	μA

NOTE: The substrate terminal must be tied to the most negative point in the external circuit to maintain isolation between transistors and to provide for normal transistor action.

Additional information on transistor arrays ULN-2031A through ULN-2086A, ULS-2045H and ULS-2083H, is available from:

Sprague Electric Company
Integrated Circuits Division
115 Northeast Cutoff
Worcester, Massachusetts 01606
(617) 853-5000

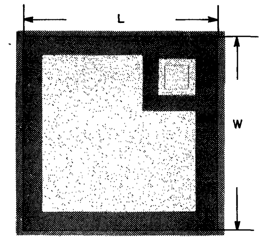
SECTION 6—MOS CAPACITORS

TYPE 15K PART NUMBERING SYSTEM

15K 2020 H 0R5 D 100 B A

- **A** — **CHIP CODE.** SEE NOTES BELOW TABLES.
- **B** — **BACKSIDE METALIZATION.** B = GOLD.
- **100** — **D-C VOLTAGE RATING IN VOLTS.**
- **D** — **CAPACITANCE TOLERANCE.**
  - D = ±0.5 pF.
  - J = ±5%
  - K = ±10%
  - M = ±20%
- **0R5** — **CAPACITANCE IN pF.** FIRST TWO CHARACTERS ARE SIGNIFICANT DIGITS. THE THIRD IS THE NUMBER OF ZEROS THAT FOLLOW. FOR RATINGS BELOW 10 pF, THE LETTER 'R' APPEARS AS A DECIMAL POINT.
- **H** — **TEMPERATURE COEFFICIENT OF CAPACITANCE.** H = ±35 ppm/°C. (±15 ppm/°C).
- **2020** — **CHIP SIZE** IN THOUSANDTHS OF AN INCH.
- **15K** — **SPRAGUE DEVICE TYPE.**

TYPE 15K
SINGLE-SECTION MOS CAPACITORS

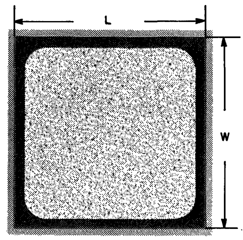


'A'

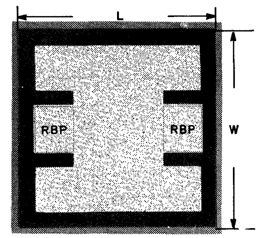
Capacitance (pF)	Chip Size (mils)	Chip Size (mm)	WVDC (V)	Part Number	Chip Code*
0.5	20 × 20	0.51 × 0.51	100	15K2020H0R5D100BA	A
1.0	20 × 20	0.51 × 0.51	100	15K2020H1R0D100BA	A
1.2	20 × 20	0.51 × 0.51	100	15K2020H1R2D100BA	A
1.5	20 × 20	0.51 × 0.51	100	15K2020H1R5D100BA	A
1.8	20 × 20	0.51 × 0.51	100	15K2020H1R8D100BA	A
2.2	20 × 20	0.51 × 0.51	100	15K2020H2R2D100BA	A
2.7	20 × 20	0.51 × 0.51	100	15K2020H2R7D100BA	A
3.3	20 × 20	0.51 × 0.51	100	15K2020H3R3D100BA	A
3.9	20 × 20	0.51 × 0.51	100	15K2020H3R9D100BA	A
4.7	20 × 20	0.51 × 0.51	100	15K2020H4R7D100BA	A
5.6	20 × 20	0.51 × 0.51	100	15K2020H5R6D100BA	A
6.8	20 × 20	0.51 × 0.51	100	15K2020H6R8D100BA	A
6.8	30 × 30	0.76 × 0.76	100	15K3030H6R8D100BA	A
8.2	20 × 20	0.51 × 0.51	100	15K2020H8R2D100BA	A
10	20 × 20	0.51 × 0.51	75	15K2020H100K075BA	A
10	30 × 30	0.76 × 0.76	100	15K3030H100K100BA	A
12	30 × 30	0.76 × 0.76	100	15K3030H120K100BA	A
15	30 × 30	0.76 × 0.76	100	15K3030H150K100BA	A
18	30 × 30	0.76 × 0.76	100	15K3030H180K100BA	A
22	30 × 30	0.76 × 0.76	100	15K3030H220K100BA	A
22	40 × 40	1.02 × 1.02	100	15K4040H220K100BA	A
27	30 × 30	0.76 × 0.76	100	15K3030H270K100BA	A
33	30 × 30	0.76 × 0.76	75	15K3030H330K075BA	A
33	40 × 40	1.02 × 1.02	100	15K4040H330K100BA	A
39	30 × 30	0.76 × 0.76	65	15K3030H390K065BA	A
39	40 × 40	1.02 × 1.02	100	15K4040H390K100BA	A
47	40 × 40	1.02 × 1.02	100	15K4040H470K100BA	A
47	40 × 40	1.27 × 1.27	100	15K5050H470K100BA	A
56	40 × 40	1.02 × 1.02	100	15K5050H560K100BA	A
56	50 × 50	1.27 × 1.27	100	15K5050H560K100BA	A
68	40 × 40	1.02 × 1.02	75	15K4040H680K075BA	A
68	50 × 50	1.27 × 1.27	100	15K5050H680K100BA	A
68	60 × 60	1.52 × 1.52	100	15K6060H680K100BA	A
82	40 × 40	1.02 × 1.02	65	15K4040H820K065BA	A
82	50 × 50	1.27 × 1.27	100	15K5050H820K100BA	A
82	60 × 60	1.52 × 1.52	100	15K6060H820K100BA	A
100	50 × 50	1.27 × 1.27	75	15K5050H101K075BA	A
100	60 × 60	1.52 × 1.52	100	15K6060H101K100BA	A
120	50 × 50	1.27 × 1.27	65	15K5050H121K065BA	A
120	60 × 60	1.52 × 1.52	100	15K6060H121K100BA	A
130	60 × 60	1.52 × 1.52	100	15K6060H131J100BA	A
150	60 × 60	1.52 × 1.52	100	15K6060H151K100BA	A
180	60 × 60	1.52 × 1.52	100	15K6060H181K100BA	A
200	60 × 60	1.52 × 1.52	85	15K6060H201K085BA	A
270	60 × 60	1.52 × 1.52	75	15K6060H221K075BA	A
270	60 × 60	1.52 × 1.52	65	15K6060H271K065BA	A

*Back connection is made directly to the silicon substrate or to an ohmic contact on the front.

TYPE 15K SINGLE-SECTION MOS CAPACITORS



'B'



'C'

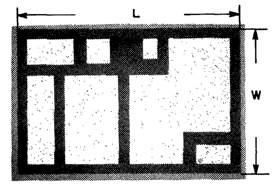
Capacitance (pF)	Chip Size (mils)	Chip Size (mm)	WVDC (V)	Part Number	Chip Code*
5.0	20 × 20	0.51 × 0.51	100	15K2020H5R0D100BB	B
8.2	20 × 20	0.51 × 0.51	100	15K2020H8R2M100BB	B
10	20 × 20	0.51 × 0.51	100	15K2020H100K100BB	B
12	20 × 20	0.51 × 0.51	100	15K2020H120K100BB	B
15	20 × 20	0.51 × 0.51	100	15K2020H150K100BB	B
18	20 × 20	0.51 × 0.51	80	15K2020H180K080BB	B
22	20 × 20	0.51 × 0.51	65	15K2020H220K065BB	B
27	25 × 25	0.64 × 0.64	90	15K2525H270K090BB	B
33	25 × 25	0.64 × 0.64	75	15K2525H330K075BB	B
39	25 × 25	0.64 × 0.64	60	15K2525H390K060BB	B
47	45 × 45	1.14 × 1.14	100	15K4545H470K100BB	B
56	45 × 45	1.14 × 1.14	100	15K4545H560K100BB	B
68	45 × 45	1.14 × 1.14	100	15K4545H680K100BB	B
82	45 × 45	1.14 × 1.14	100	15K4545H820K100BB	B
100	45 × 45	1.14 × 1.14	100	15K4545H101M100BB	B
120	45 × 45	1.14 × 1.14	80	15K4545H121K080BB	B
150	45 × 45	1.14 × 1.14	60	15K4545H151K060BB	B

*No ohmic connection to backside is provided on the front surface.

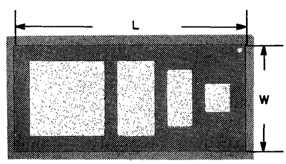
Capacitance (pF)	Chip Size (mils)	Chip Size (mm)	WVDC (V)	Part Number	Chip Code*
47	30 × 30	0.76 × 0.76	50	15K3030H470K050BC	C
56	30 × 30	0.76 × 0.76	40	15K3030H560K040BC	C
68	30 × 30	0.76 × 0.76	35	15K3030H680K035BC	C
82	30 × 30	0.76 × 0.76	30	15K3030H820K030BC	C
100	45 × 45	1.14 × 1.14	80	15K4545H101K080BC	C
120	45 × 45	1.14 × 1.14	65	15K4545H121K065BC	C
150	45 × 45	1.14 × 1.14	50	15K4545H151K050BC	C
180	45 × 45	1.14 × 1.14	40	15K4545H181K040BC	C
200	45 × 45	1.14 × 1.14	40	15K4545H201M040BC	C
220	45 × 45	1.14 × 1.14	35	15K4545H221K035BC	C
270	45 × 45	1.14 × 1.14	30	15K4545H271K030BC	C

* Has remote bonding pads. Bonding area has extra protection with thicker dielectric under the pad. Active capacitor area is passivated with silicon nitride. No ohmic connection to backside is provided on the front surface.

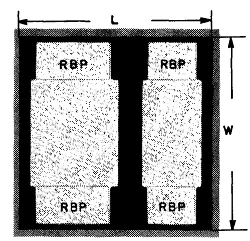
TYPE 16K
MULTI-SECTION MOS CAPACITORS



'A'



'B'



'C'

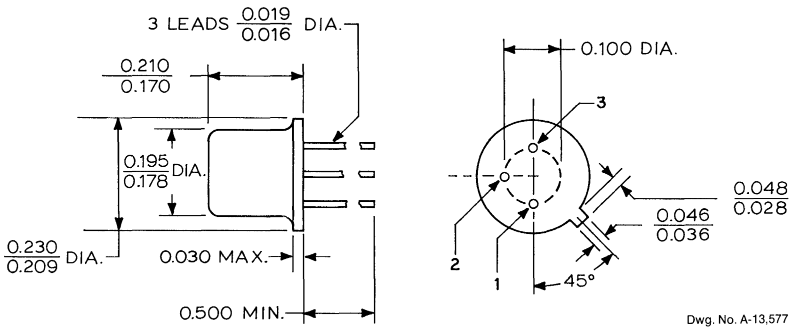
Capacitance (pF)	Chip Size (mils)	Chip Size (mm)	WVDC (V)	Part Number[1]	Chip Code
0.5/1.0/2.0/4.0/8.0/16	52 × 36	1.32 × 0.91	140	16K1001	A
1.0/2.0/4.0/8.0/16/32	52 × 36	1.32 × 0.91	70	16K1002	A
2.0/4.0/8.0/16/32/64	52 × 36	1.32 × 0.91	30	16K1003	A
10/15	20 × 20	0.51 × 0.51	28	16K1004	C
20/33	30 × 30	0.76 × 0.76	45	16K1005	C
1.0/2.0/4.0/8.0	40 × 20	1.02 × 0.51	100	16K1006	B
3.0/4.5	20 × 20	0.51 × 0.51	90	16K1007	C
7.0/10.5	20 × 20	0.51 × 0.51	40	16K1008	C
0.25/0.5/1.0/2.0	30 × 20	0.76 × 0.51	150	16K1009[2]	B
1.0/2.0/4.0/8.0	30 × 20	0.76 × 0.51	40	16K1010	B

NOTES:
1. Type 16K part numbers are sequentially assigned to 10 designs. Capacitance tolerance must be specified by adding the appropriate letter from the Type 15K Part Numbering System.
2. Not available with ± 5% tolerance.

SECTION 7—PACKAGE INFORMATION

TO-18

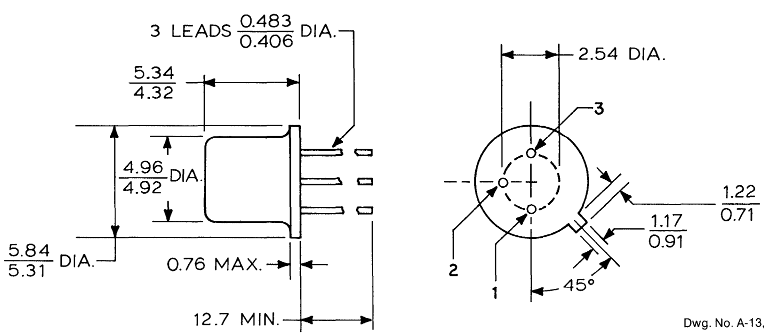
DIMENSIONS IN INCHES



Dwg. No. A-13,577

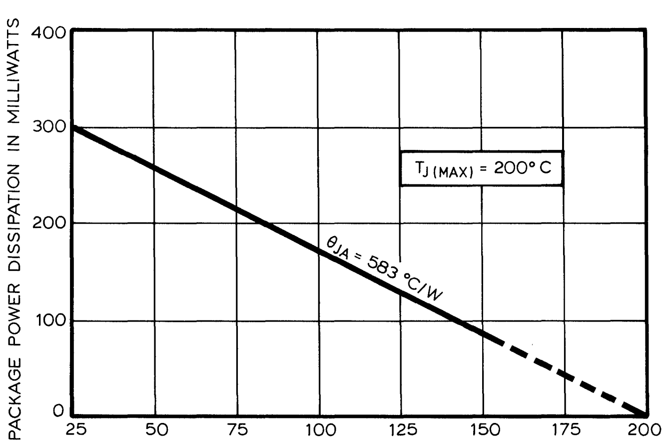
DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm



Dwg. No. A-13,578

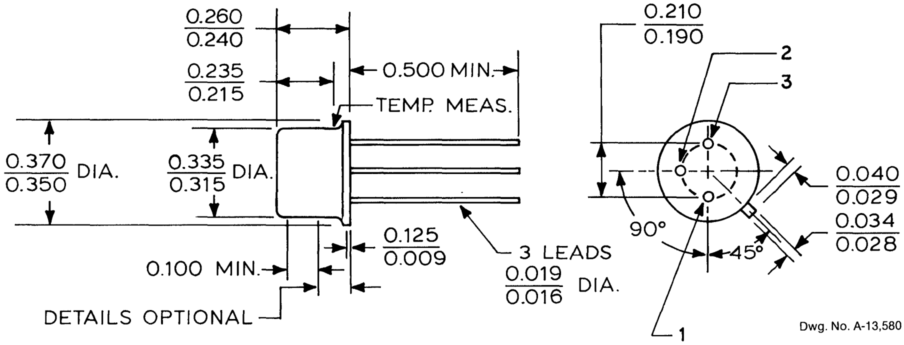
MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,579

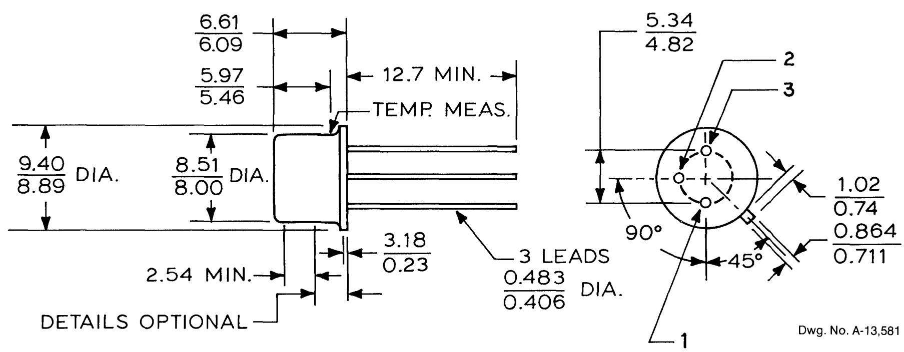
TO-39

DIMENSIONS IN INCHES

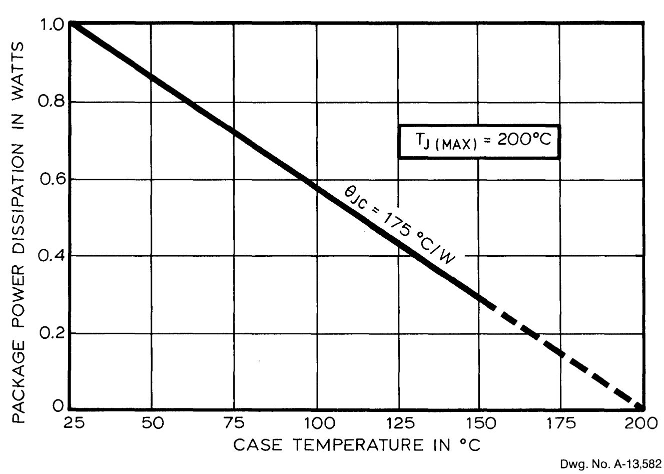


DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm

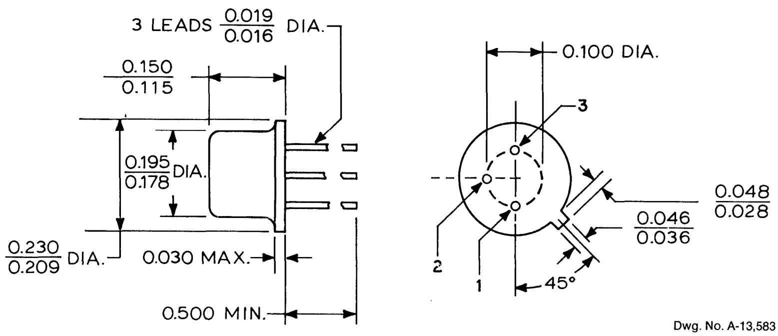


MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF CASE TEMPERATURE



TO-52

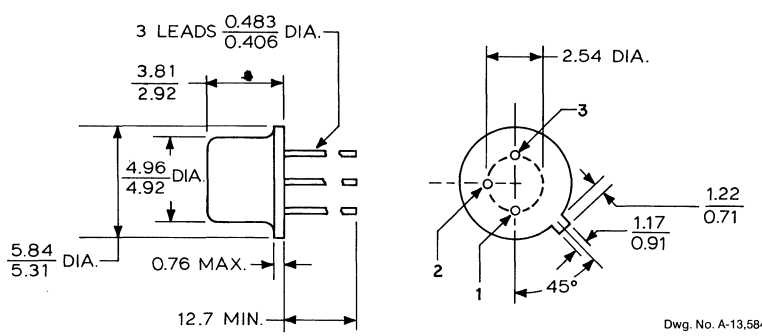
DIMENSIONS IN INCHES



Dwg. No. A-13,583

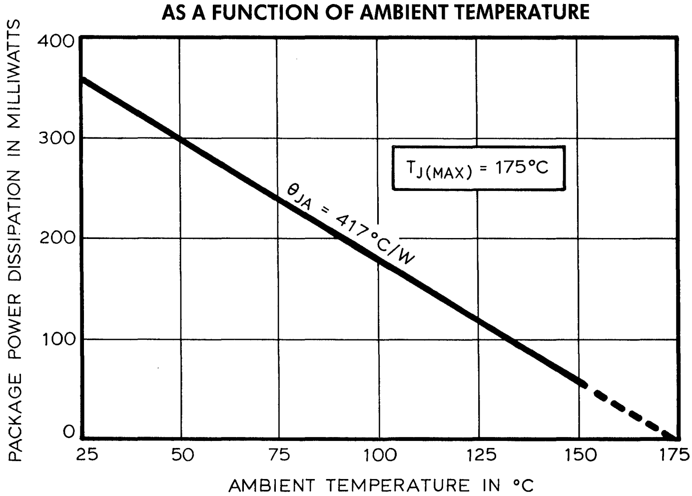
DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm



Dwg. No. A-13,584

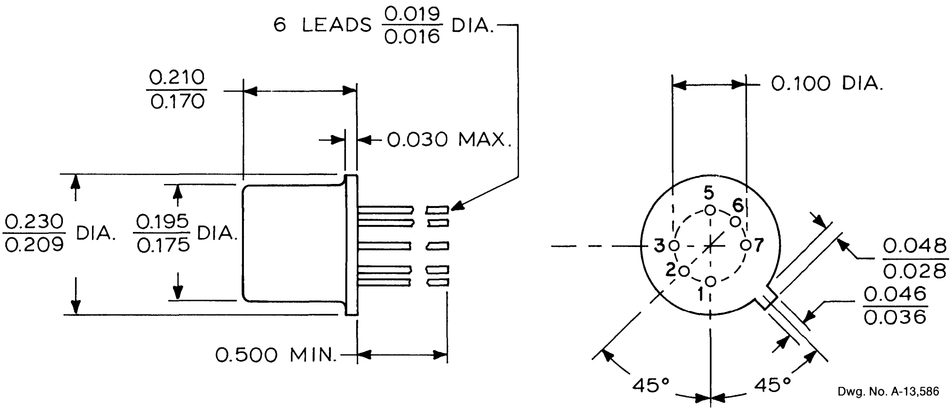
MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,585

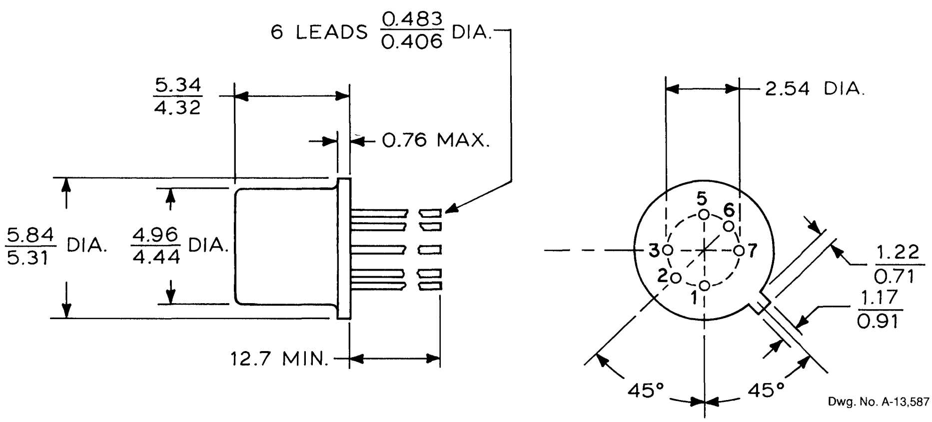
TO-71

DIMENSIONS IN INCHES

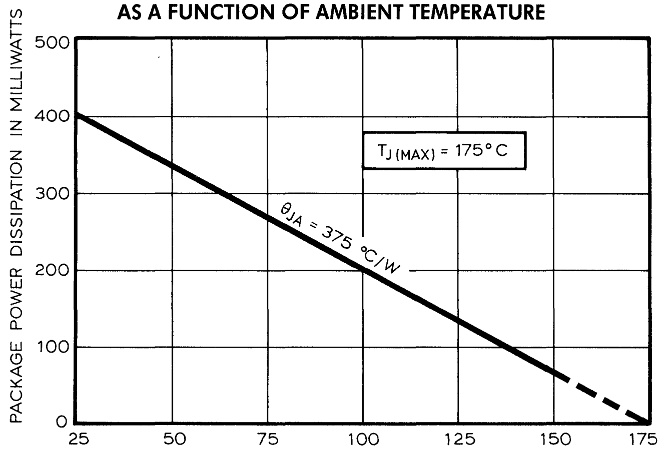


DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm



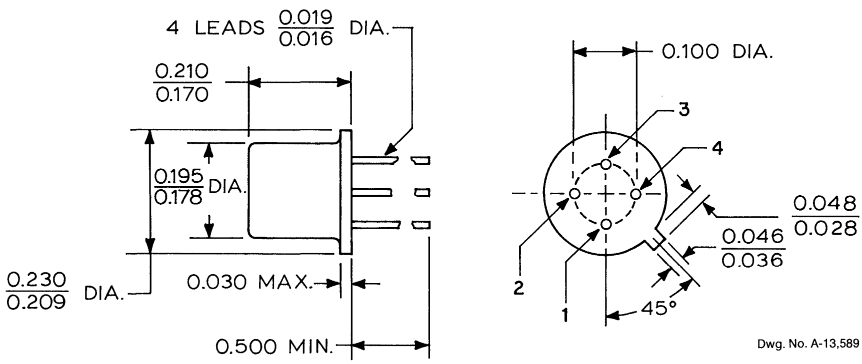
MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,588

TO-72

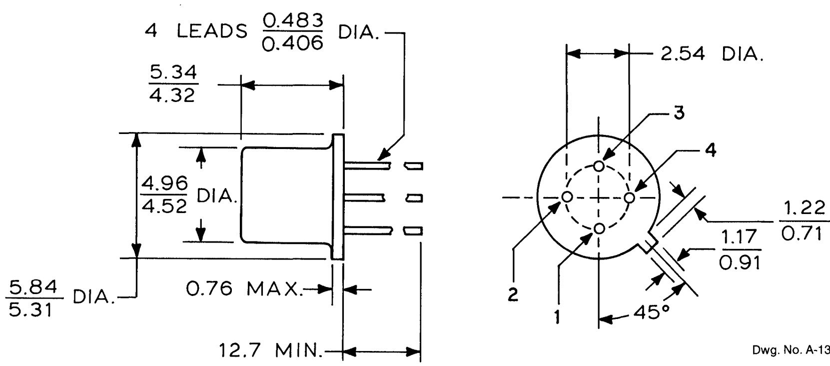
DIMENSIONS IN INCHES



Dwg. No. A-13,589

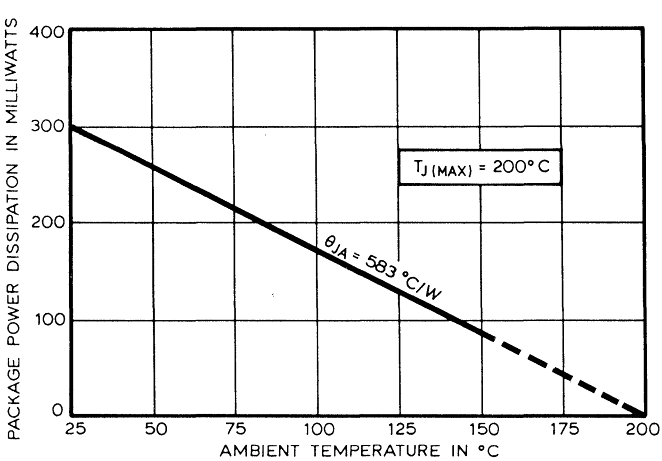
DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm



Dwg. No. A-13,590

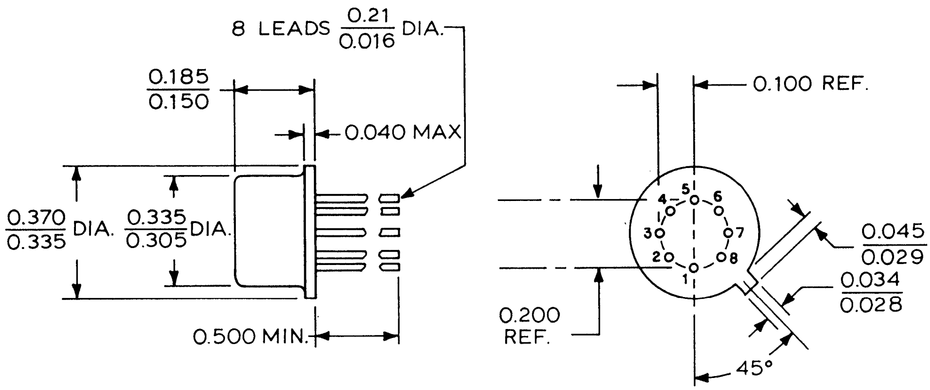
MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,579

TO-78

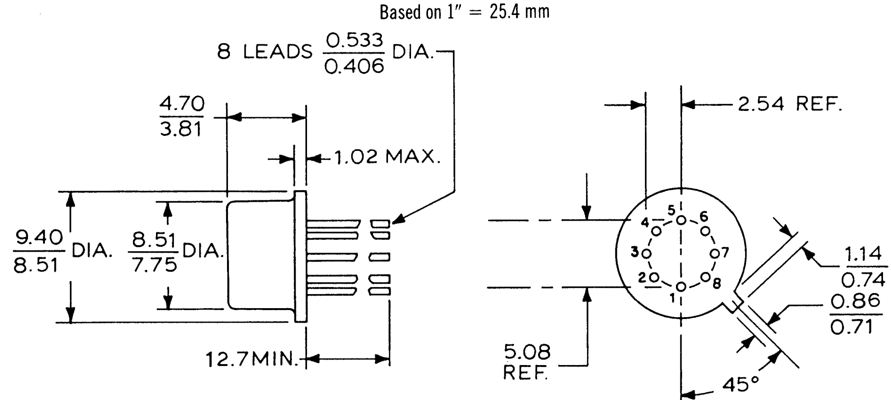
DIMENSIONS IN INCHES



Dwg. No. A-13,592

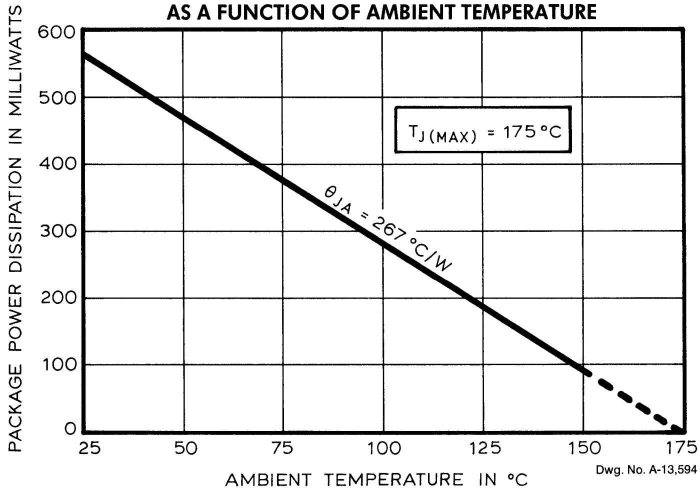
DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm



Dwg. No. A-13,593

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



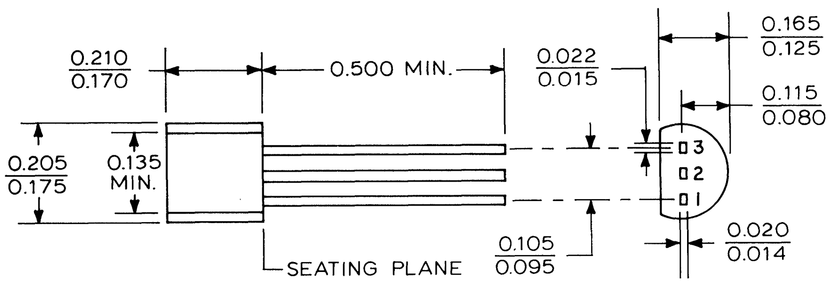
Dwg. No. A-13,594

PINOUT

Pin	Terminal
1	S1
2	D1
3	G1
4	Case
5	S2
6	D2
7	G2
8	Open

TO-226AA/STYLE CT

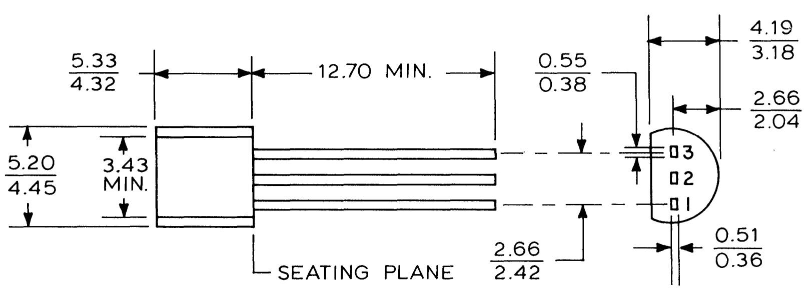
DIMENSIONS IN INCHES



Dwg. No. A-13,610

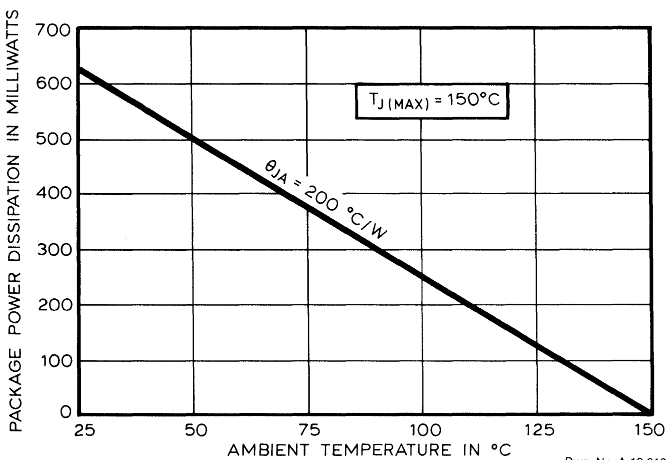
DIMENSIONS IN MILLIMETERS

Based on 1" = 25.4 mm

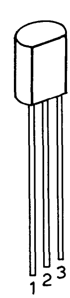


Dwg. No. A-13,611

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,612

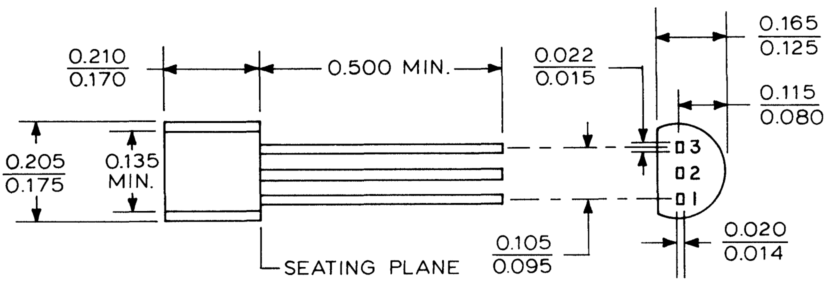


CT PINOUT

Pin	Terminal
1	Emitter
2	Base
3	Collector

TO-226AA/STYLE CZ

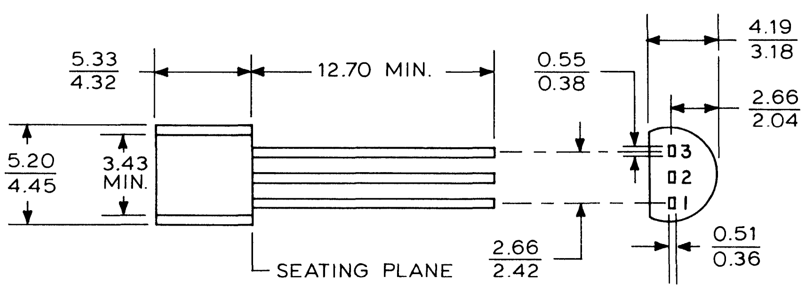
DIMENSIONS IN INCHES



Dwg. No. A-13,610

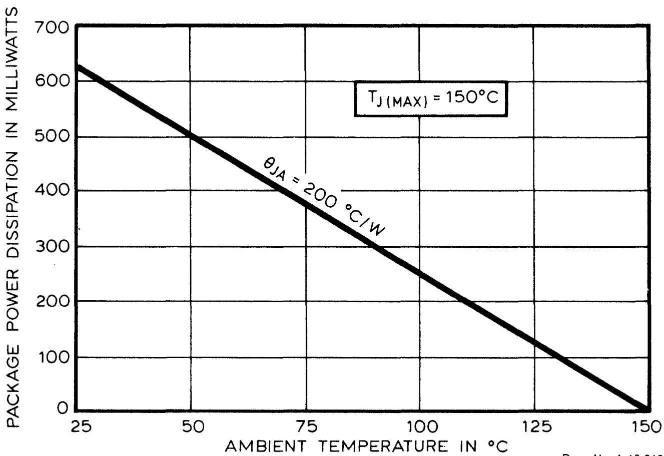
DIMENSIONS IN MILLIMETERS

Based on 1" = 25.4 mm

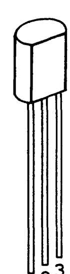


Dwg. No. A-13,611

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,612

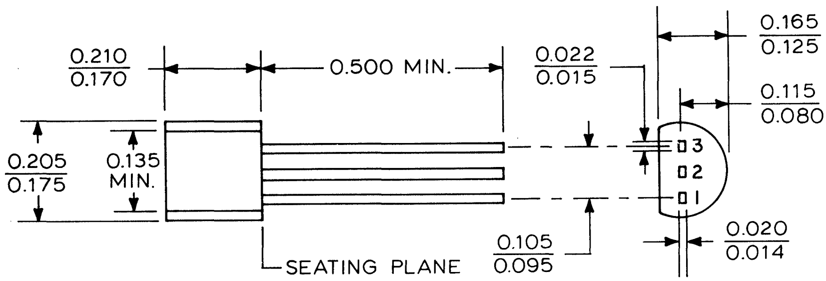


CZ PINOUT

Pin	Terminal
1	Emitter
2	Collector
3	Base

TO-226AA/STYLE CP

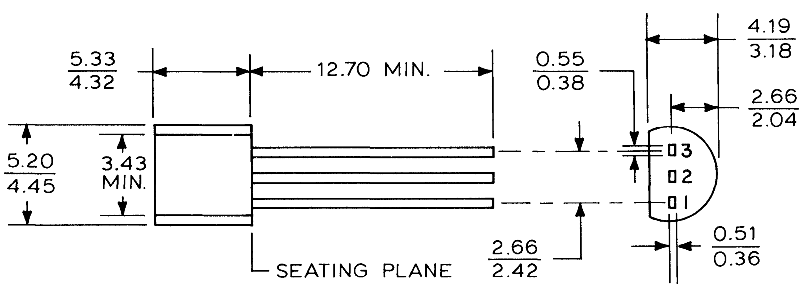
DIMENSIONS IN INCHES



Dwg. No. A-13,610

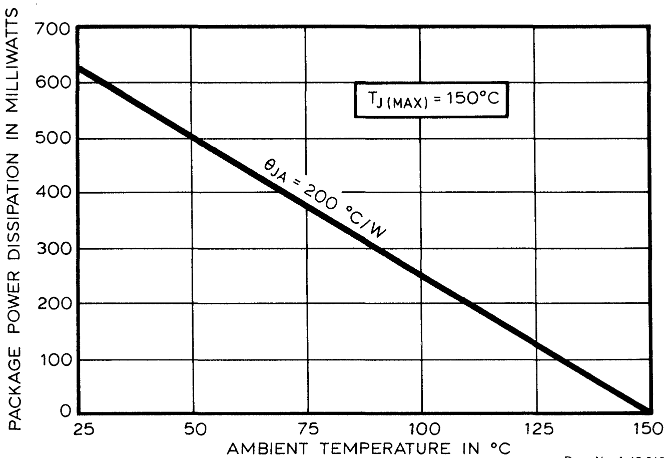
DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm

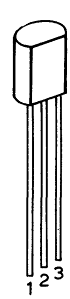


Dwg. No. A-13,611

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,612

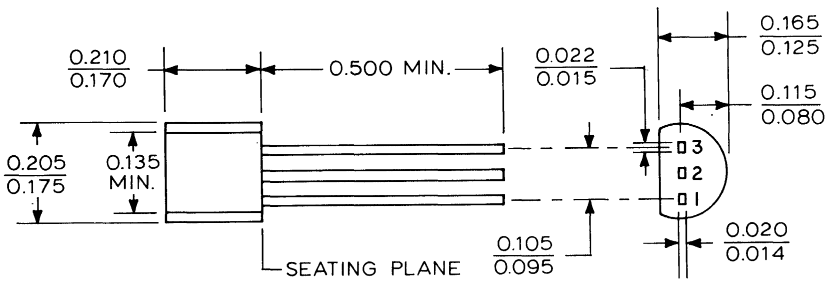


CP PINOUT

Pin	Terminal
1	Base
2	Emitter
3	Collector

TO-226AA/STYLES CG AND CO

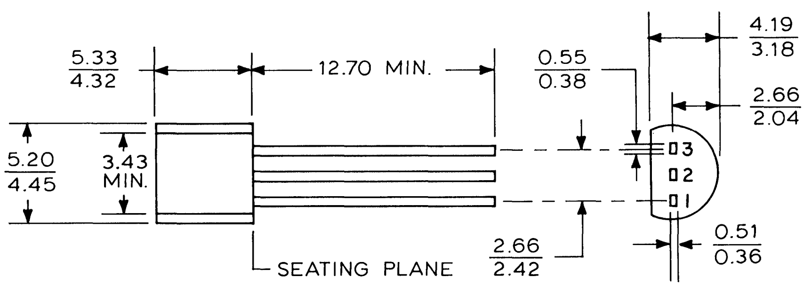
DIMENSIONS IN INCHES



Dwg. No. A-13,610

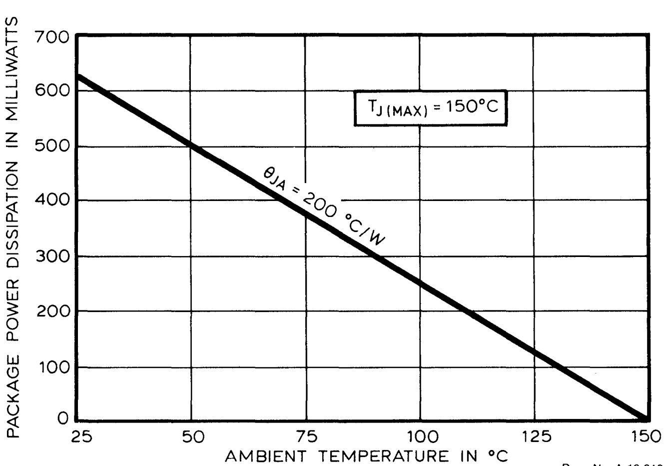
DIMENSIONS IN MILLIMETERS

Based on 1" = 25.4 mm

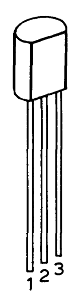


Dwg. No. A-13,611

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,612



CG PINOUT

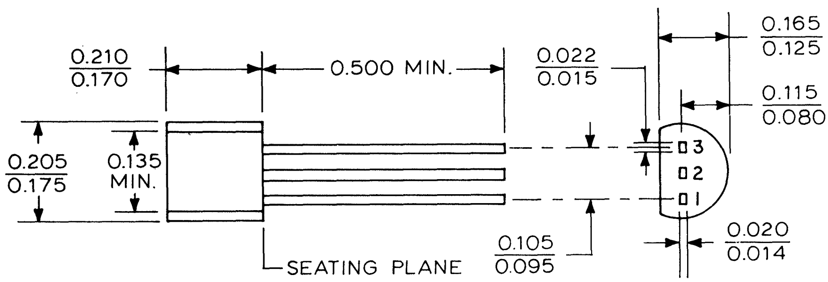
Pin	Terminal
1	Drain
2	Source
3	Gate

CO PINOUT

Pin	Terminal
1	Source
2	Drain
3	Gate

TO-226AA/STYLES CI AND CN

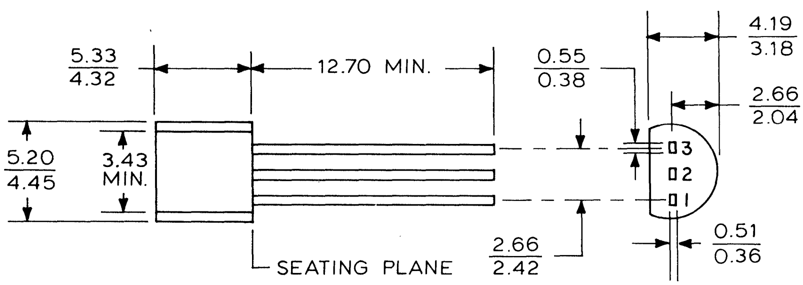
DIMENSIONS IN INCHES



Dwg. No. A-13,610

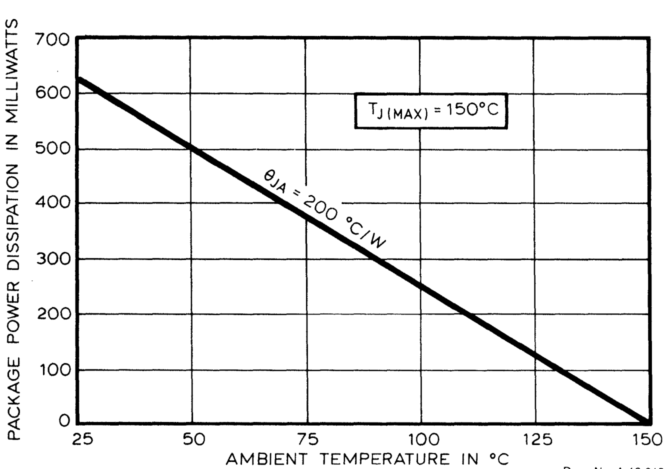
DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm

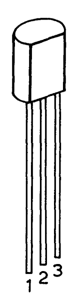


Dwg. No. A-13,611

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,612



CI PINOUT

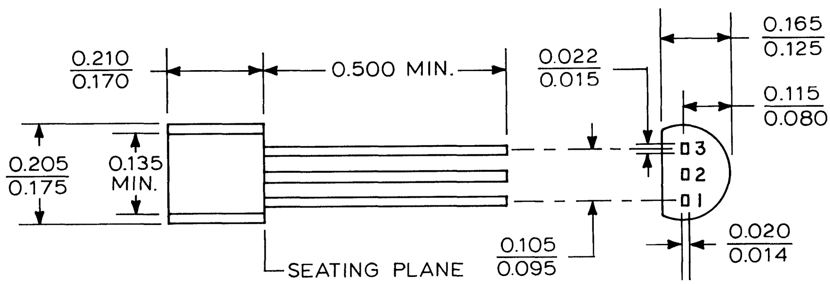
Pin	Terminal
1	Drain
2	Gate
3	Source

CN PINOUT

Pin	Terminal
1	Source
2	Gate
3	Drain

TO-226AA/STYLES CJ AND CY

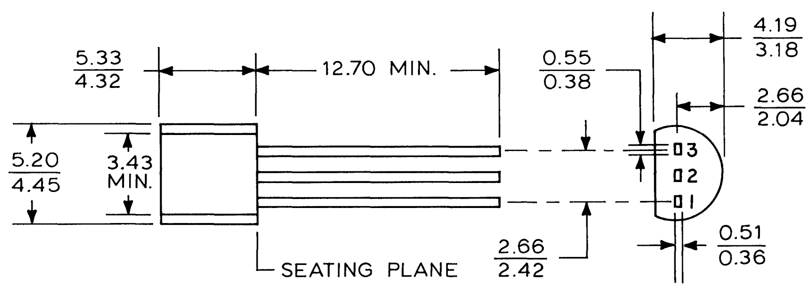
DIMENSIONS IN INCHES



Dwg. No. A-13,610

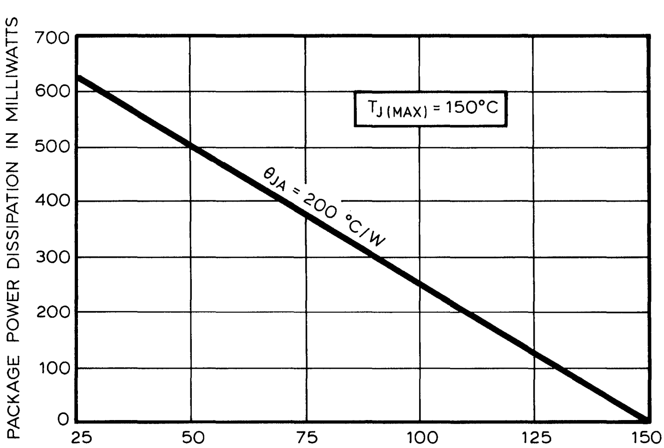
DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm

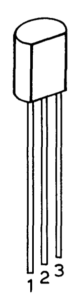


Dwg. No. A-13,611

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,612



CJ PINOUT

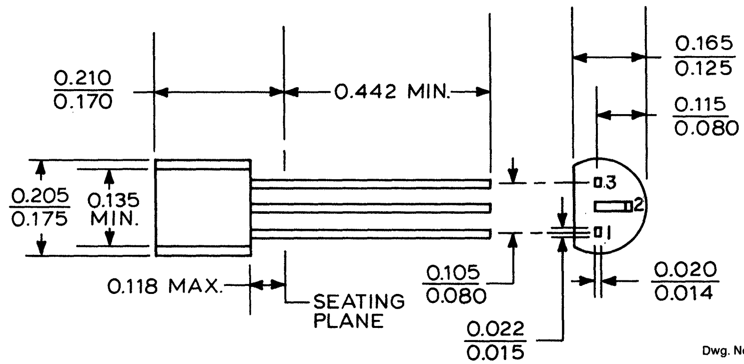
Pin	Terminal
1	Gate
2	Source
3	Drain

CY PINOUT

Pin	Terminal
1	Gate
2	Drain
3	Source

TO-226AB

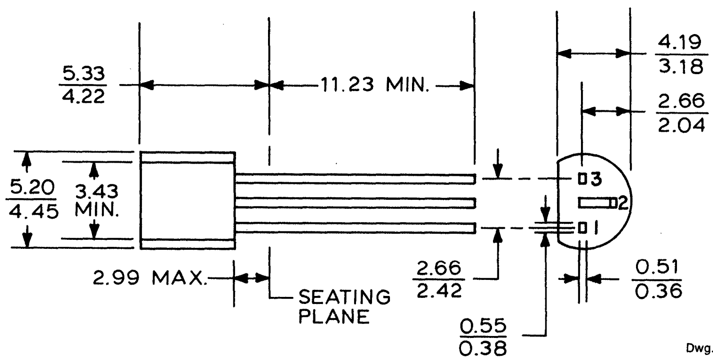
DIMENSIONS IN INCHES



Dwg. No. A-13,613

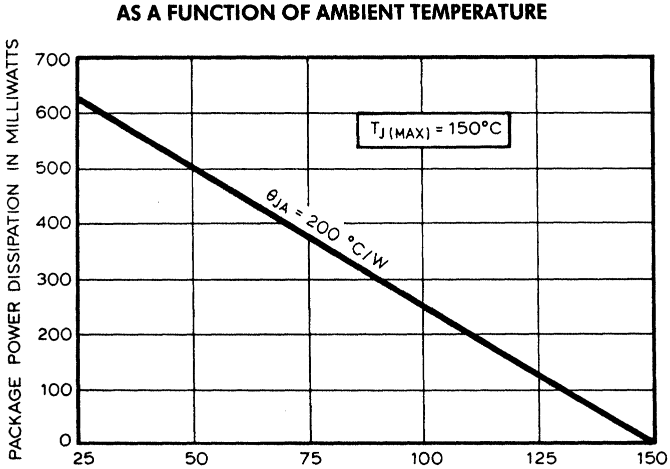
DIMENSIONS IN MILLIMETERS

Based on 1" = 25.4 mm



Dwg. No. A-13,614

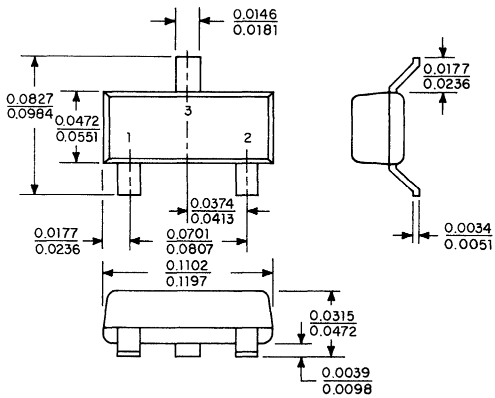
MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,612

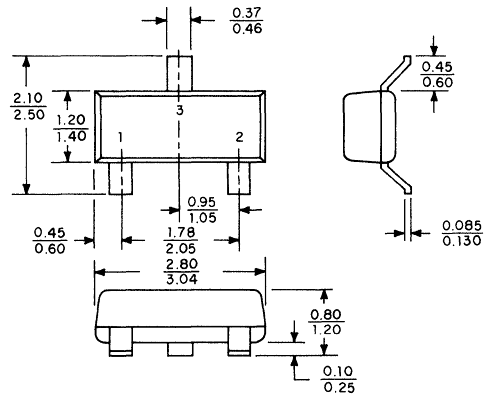
TO-236AA

DIMENSIONS IN INCHES
Based on 25.4 mm = 1″



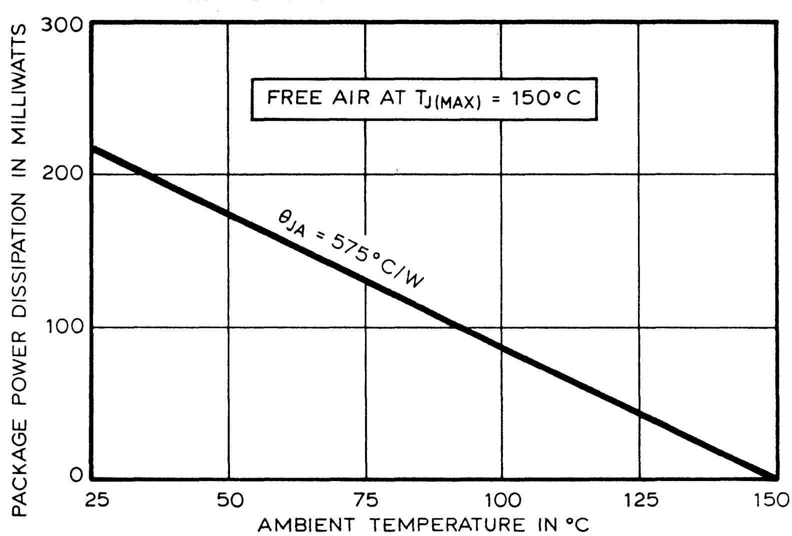
Dwg. No. A-11,506C MM

DIMENSIONS IN MILLIMETERS



Dwg. No. A-11,506C IN

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



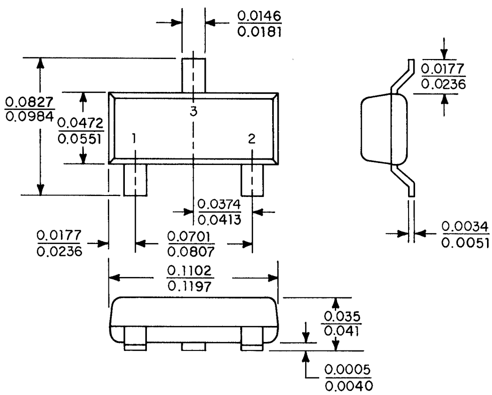
Dwg. No. A-13,616

Die size = 0.635 mm by 0.635 mm (0.025″ by 0.025″). Other factors that determine allowable package power dissipation in application include circuit board material, pad size, and proximity of other heat producing circuit elements.

TO-236AB/STYLES CE AND CW

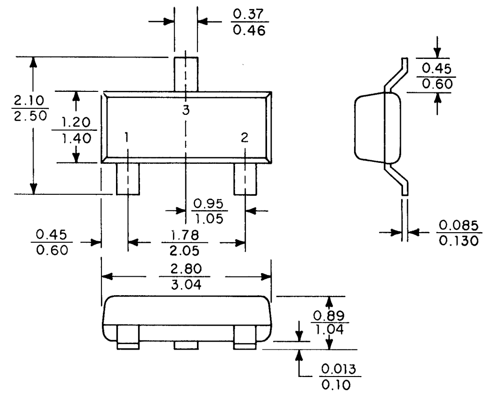
DIMENSIONS IN INCHES

Based on 25.4 mm = 1″



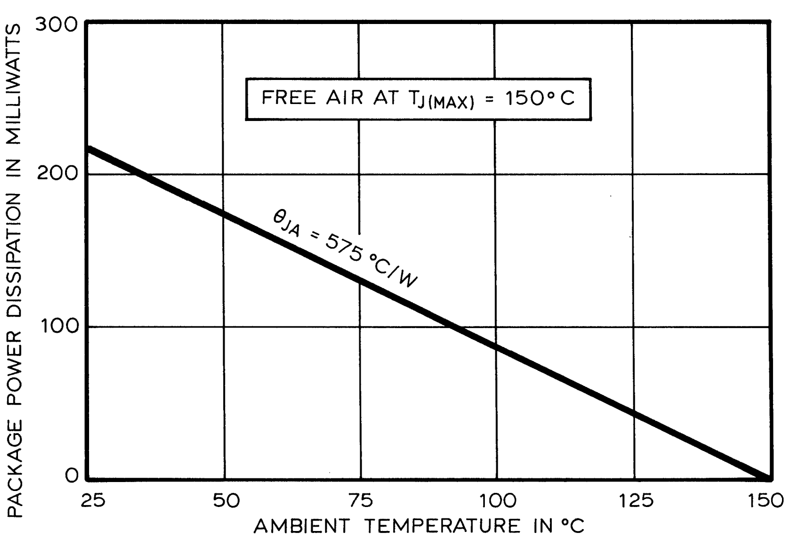
Dwg. No. A-12,328B IN

DIMENSIONS IN MILLIMETERS



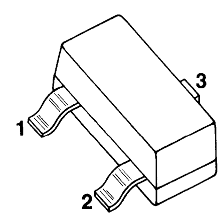
Dwg. No. A-12,328B MM

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,616

Die size = 0.635 mm by 0.635 mm (0.025″ by 0.025″). Other factors that determine allowable package power dissipation in application include circuit board material, pad size, and proximity of other heat producing circuit elements.



CE PINOUT

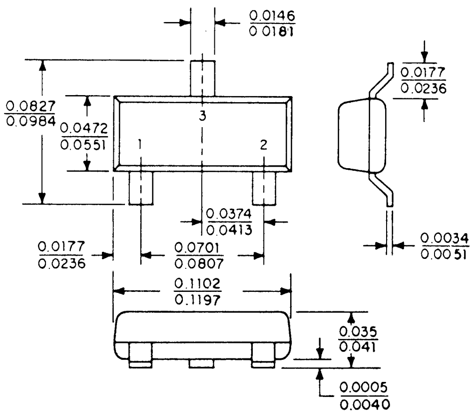
Pin	Terminal
1	Base
2	Emitter
3	Collector

CW PINOUT

Pin	Terminal
1	Emitter
2	Base
3	Collector

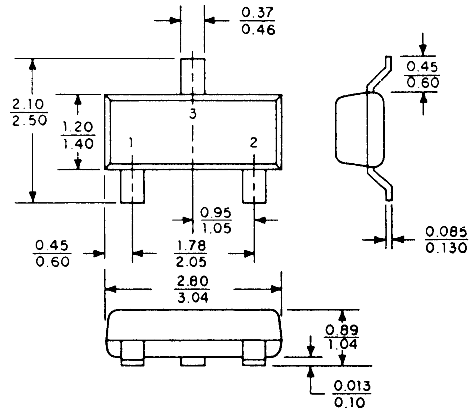
TO-236AB/STYLE CK

DIMENSIONS IN INCHES
Based on 25.4 mm = 1″



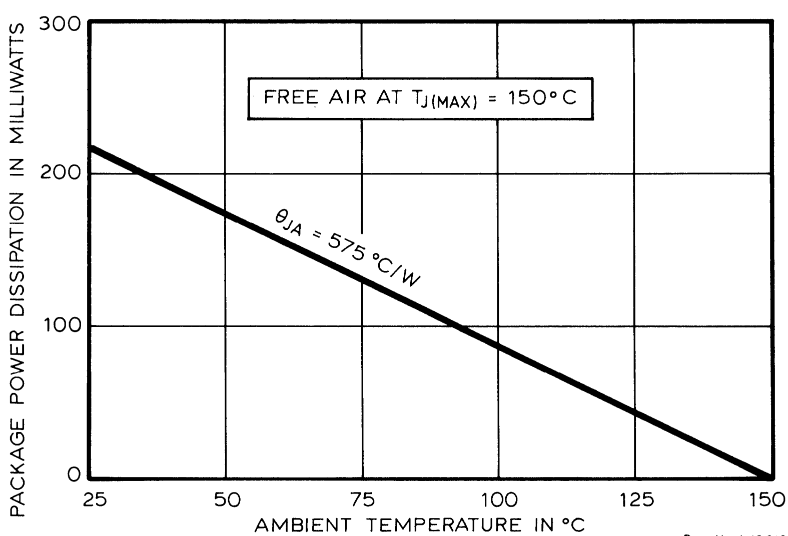
Dwg. No. A-12,238B IN

DIMENSIONS IN MILLIMETERS

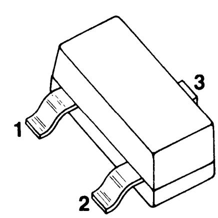


Dwg. No. A-12,238B MM

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg No. A-13.616

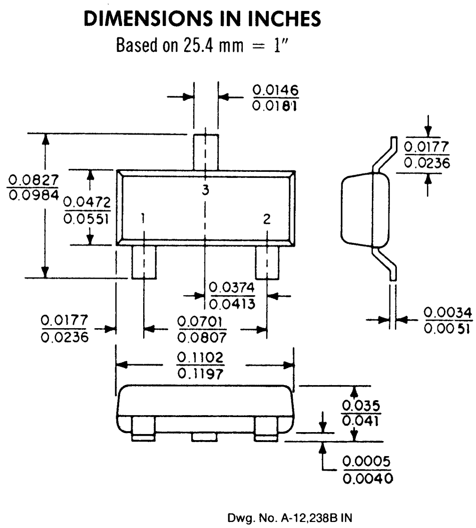


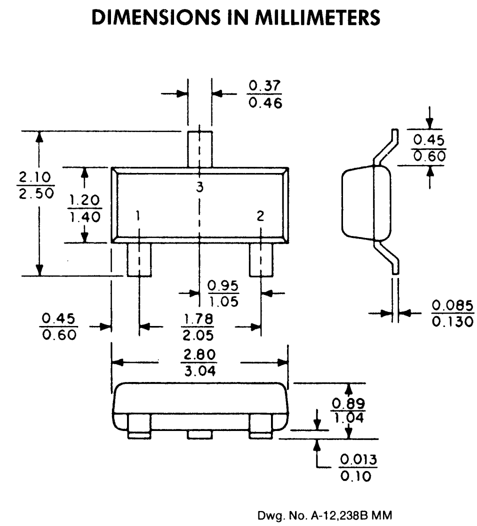
CK PINOUT

Pin	Terminal
1	Drain
2	Source
3	Gate

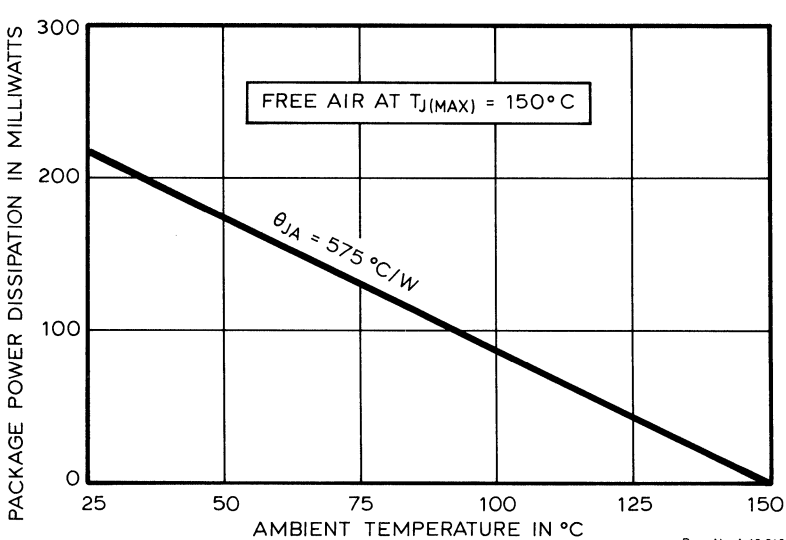
Die size = 0.635 mm by 0.635 mm (0.025″ by 0.025″). Other factors that determine allowable package power dissipation in application include circuit board material, pad size, and proximity of other heat producing circuit elements.

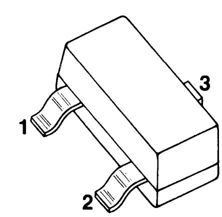
TO-236AB/STYLE CL





MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE





CL PINOUT

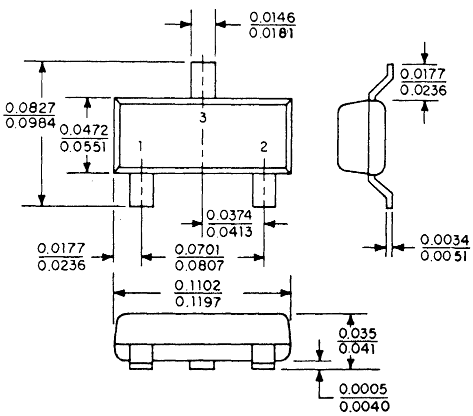
Pin	Terminal
1	Anode
2	No Connection
3	Cathode

Die size = 0.635 mm by 0.635 mm (0.025″ by 0.025″). Other factors that determine allowable package power dissipation in application include circuit board material, pad size, and proximity of other heat producing circuit elements.

TO-236AB/STYLE CA

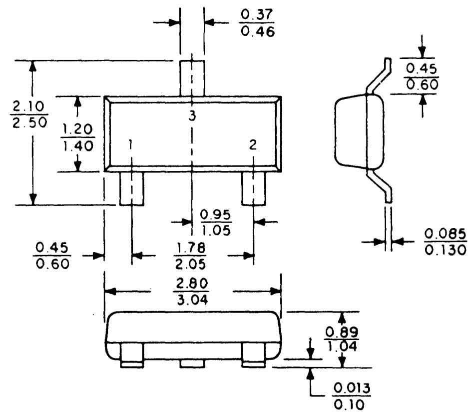
DIMENSIONS IN INCHES

Based on 25.4 mm = 1″



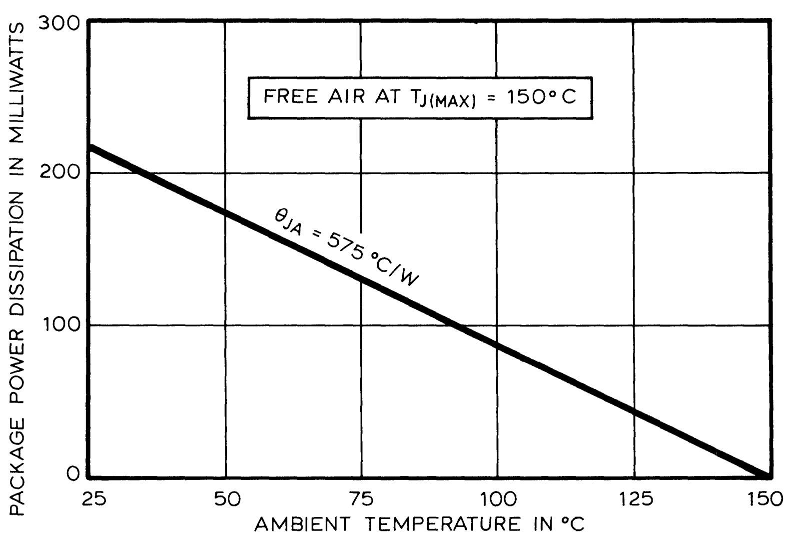
Dwg. No. A-12,238B IN

DIMENSIONS IN MILLIMETERS

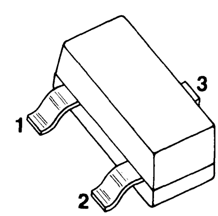


Dwg. No. A-12,238B MM

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg No. A-13,616



CA PINOUT

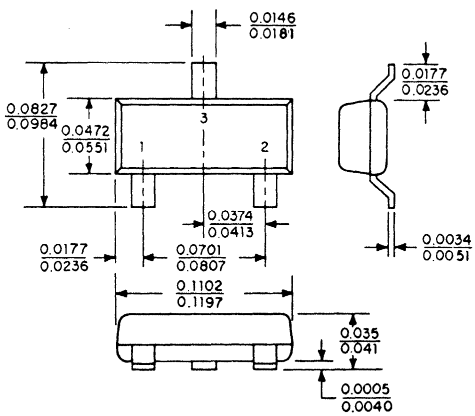
Pin	Terminal
1	Anode
2	Anode
3	Cathode

Die size = 0.635 mm by 0.635 mm (0.025″ by 0.025″). Other factors that determine allowable package power dissipation in application include circuit board material, pad size, and proximity of other heat producing circuit elements.

TO-236AB/STYLE CB

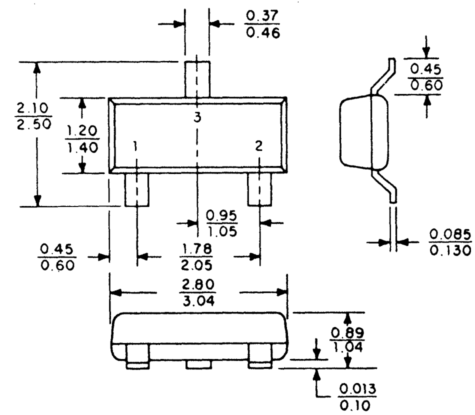
DIMENSIONS IN INCHES

Based on 25.4 mm = 1″



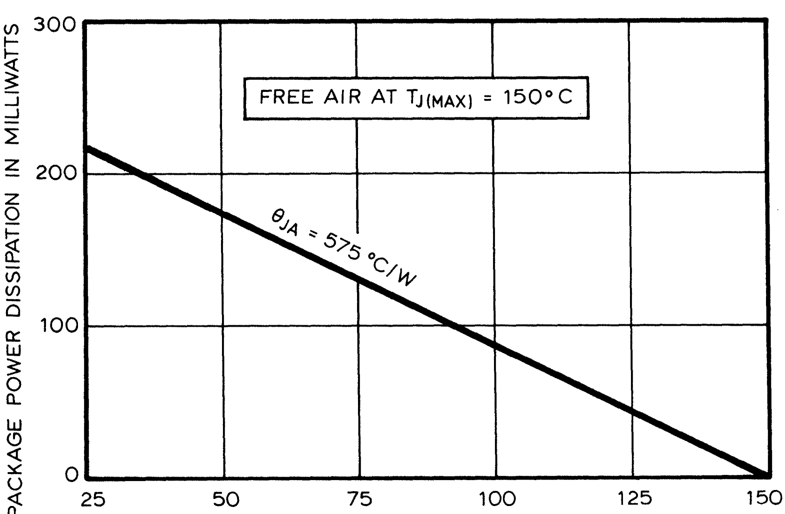
Dwg. No. A-12,238B IN

DIMENSIONS IN MILLIMETERS

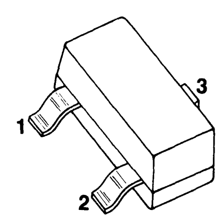


Dwg. No. A-12,238B MM

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,616



CB PINOUT

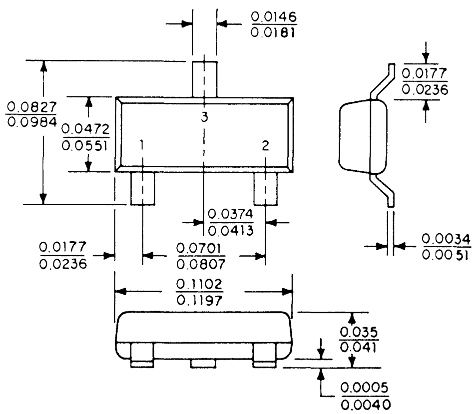
Pin	Terminal
1	Anode
2	Cathode
3	Anode and Cathode

Die size = 0.635 mm by 0.635 mm (0.025″ by 0.025″). Other factors that determine allowable package power dissipation in application include circuit board material, pad size, and proximity of other heat producing circuit elements.

TO-236AB/STYLE CC

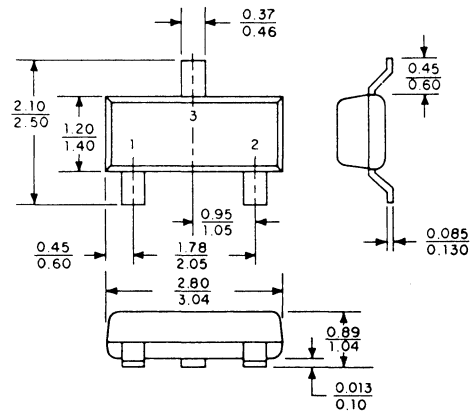
DIMENSIONS IN INCHES

Based on 25.4 mm = 1″



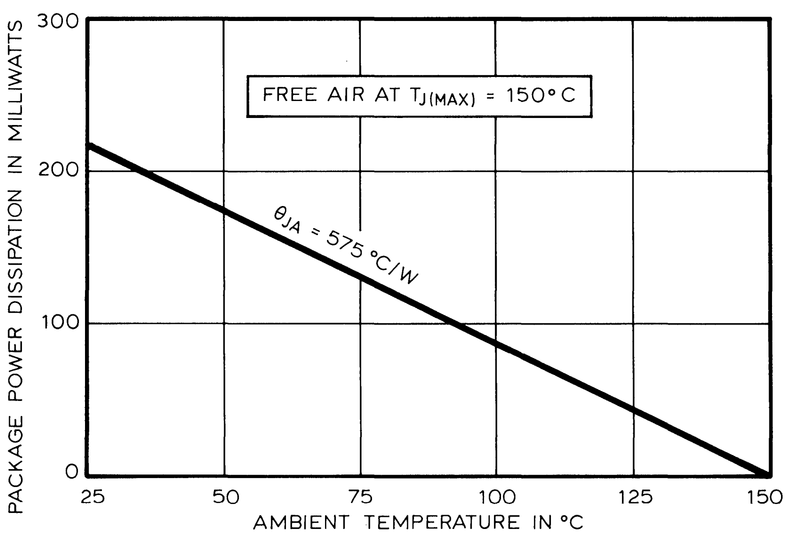
Dwg. No. A-12,238B IN

DIMENSIONS IN MILLIMETERS

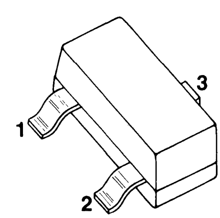


Dwg. No. A-12,238B MM

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,616



Die size = 0.635 mm by 0.635 mm (0.025″ by 0.025″). Other factors that determine allowable package power dissipation in application include circuit board material, pad size, and proximity of other heat producing circuit elements.

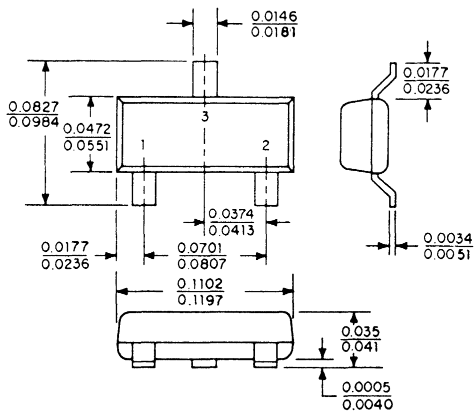
CC PINOUT

Pin	Terminal
1	Cathode
2	Cathode
3	Anode

TO-236AB/STYLE CU

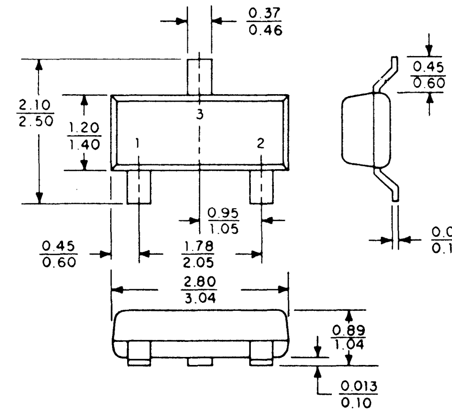
DIMENSIONS IN INCHES

Based on 25.4 mm = 1″



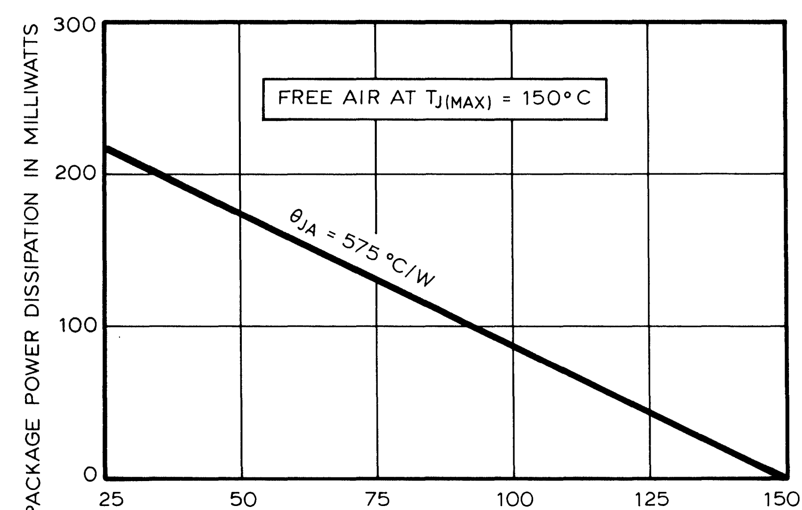
Dwg. No. A-12,238B IN

DIMENSIONS IN MILLIMETERS

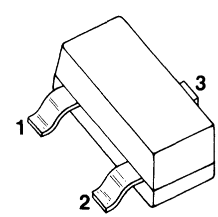


Dwg. No. A-12,238B MM

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,616



CU PINOUT

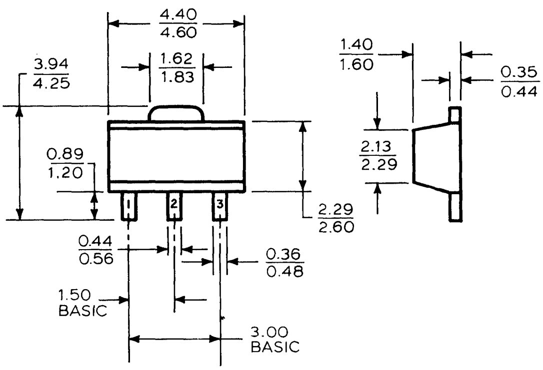
Pin	Terminal
1	Anode
2	Cathode
3	No Connection

Die size = 0.635 mm by 0.635 mm (0.025″ by 0.025″). Other factors that determine allowable package power dissipation in application include circuit board material, pad size, and proximity of other heat producing circuit elements.

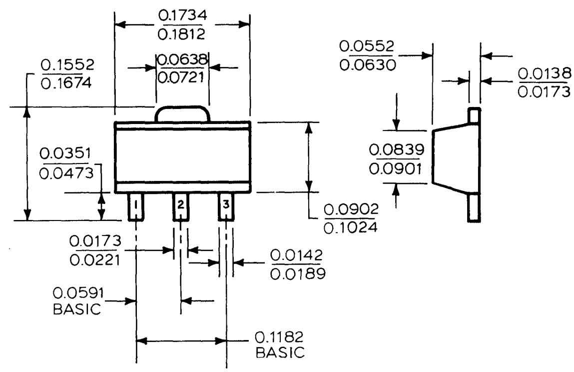
TO-243AA

DIMENSIONS IN INCHES
Based on 25.4 mm = 1″

DIMENSIONS IN MILLIMETERS

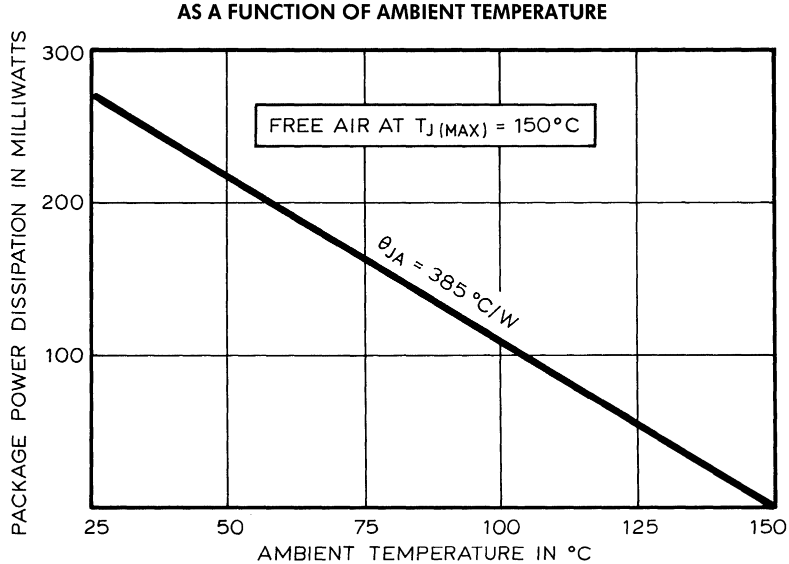


Dwg. No. A-12,608 MM



Dwg. No. A-12,608 IN

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE

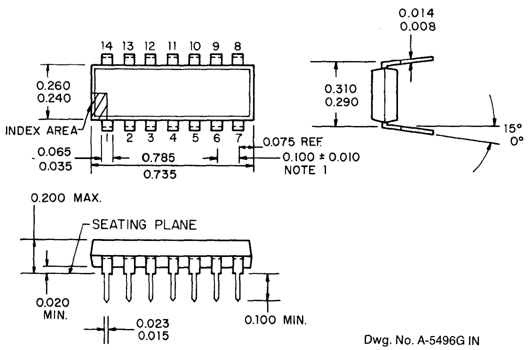


Dwg. No. A-13,622

Die size = 0.635 mm by 0.635 mm (0.025″ by 0.025″). Other factors that determine allowable package power dissipation in application include circuit board material, pad size, and proximity of other heat producing circuit elements.

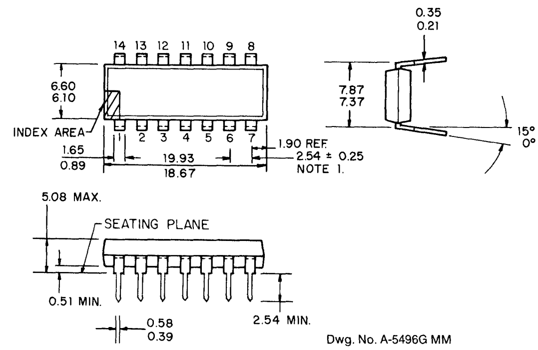
14-PIN DUAL IN-LINE PLASTIC

DIMENSIONS IN INCHES



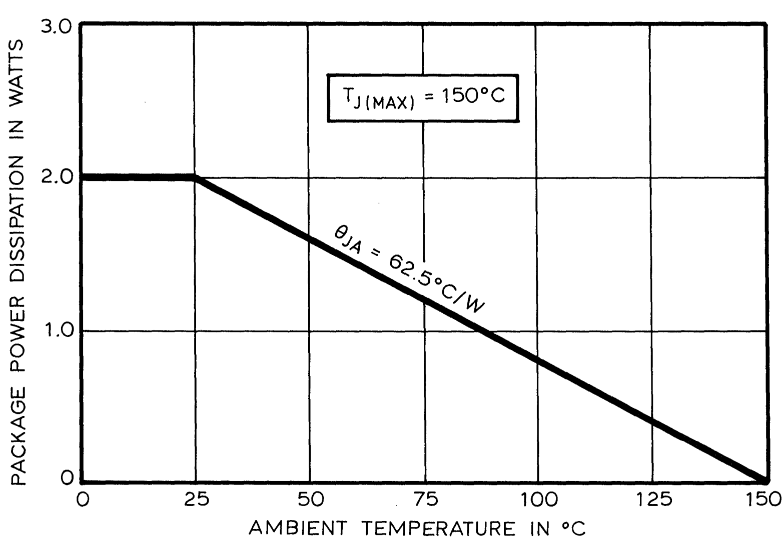
DIMENSIONS IN MILLIMETERS

Based on 1″ = 25.4 mm



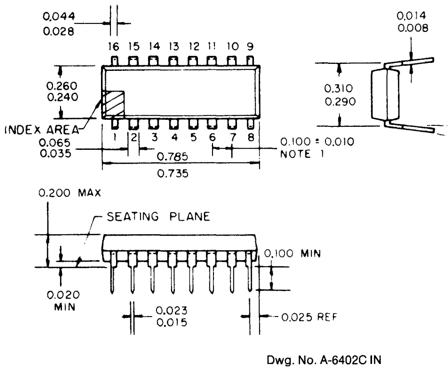
NOTES:
1. Lead spacing tolerances is non-cumulative.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Lead gauge plane is 0.030″ (0.76 mm) max. below seating plane.

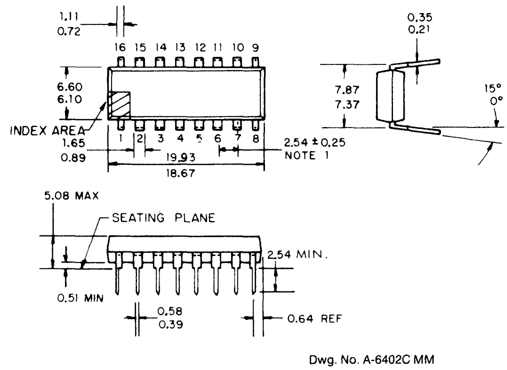
MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



Dwg. No. A-13,623

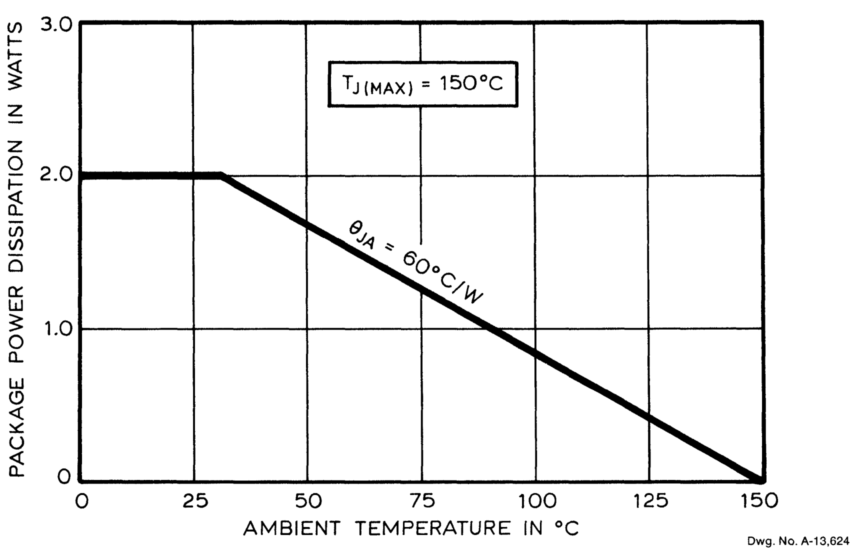
16-PIN DUAL IN-LINE PLASTIC





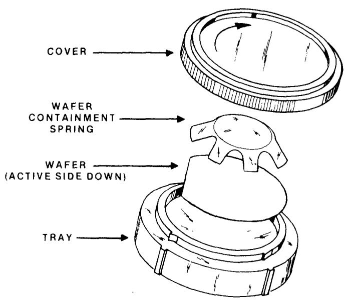
NOTES:
1. Lead spacing tolerances is non-cumulative.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Lead gauge plane is 0.030" (0.76 mm) max. below seating plane.

MAXIMUM ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



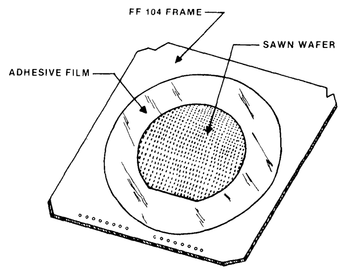
SEMICONDUCTOR CHIP PACKAGING

UNSCRIBED WAFER IN NATURAL POLYPROPYLENE TRAY



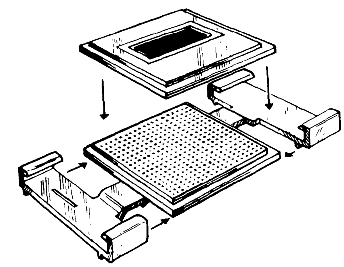
Dwg. No. A-11,626

SAWN WAFER ON STRETCHED MEMBRANE



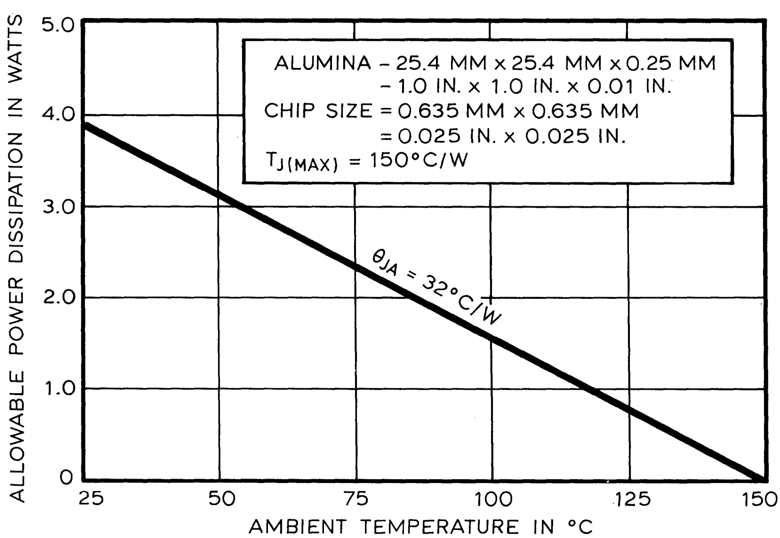
Dwg. No. A-11,621

INDIVIDUAL COMPARTMENTS IN SEE-THROUGH PLASTIC BOX



Dwg. No. A-11,547

MAXIMUM ALLOWABLE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



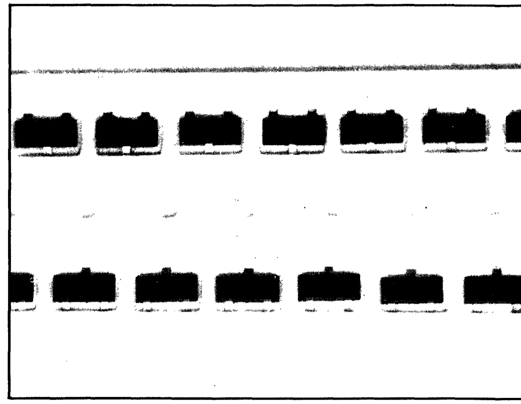
Dwg. No. A-13,625

TO-236AA/AB

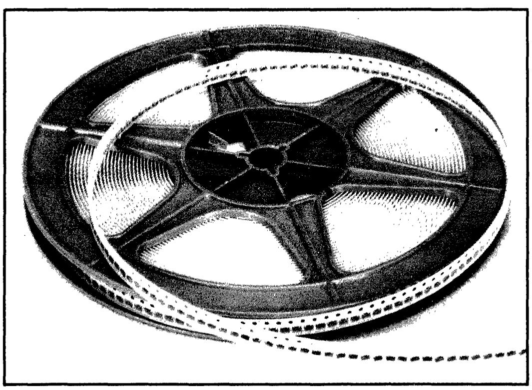
SHIPPING

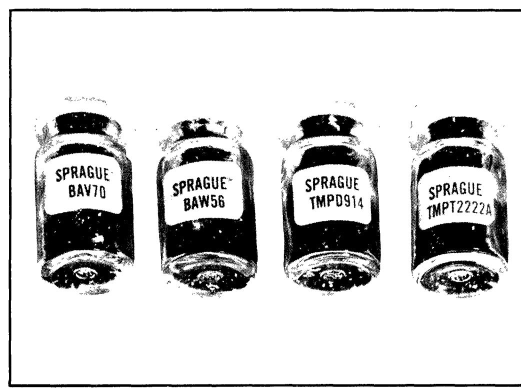
Shipping options for Sprague small-outline transistors and diodes include vial pack and 8 mm tape and reel for use with automated insertion equipment.

The 8 mm tape pack puts 3000 devices on a 7-inch (178 mm) reel. Components can be placed in the tape cavity with the single lead toward the sprocket hole or with the double leads toward the sprocket hole. Tape and reel dimensions conform to EIA Standard 481 Rev. A.



Tape and Reel Options

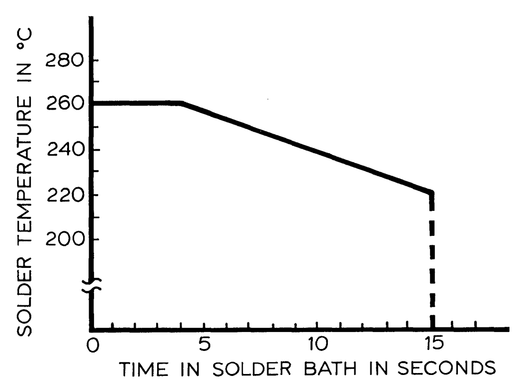




MOUNTING . . .

Sprague surface-mount semiconductors can be attached to substrates by conventional techniques such as vapor-phase or wave soldering and hot-plate methods.

Recommended maximum time/temperature soldering conditions are shown in the graph. In general, attachment with a soldering iron is not recommended due to the difficulty of consistently controlling temperature and time temperature.



AND CLEANING

Sprague small-outline semiconductors are compatible with most commonly used defluxing solvents. Freon-based alcohol compounds such as Du Pont TMS or TES (or equivalents) are recommended. Solutions containing methylene chloride or other known epoxy solvents should not be used.

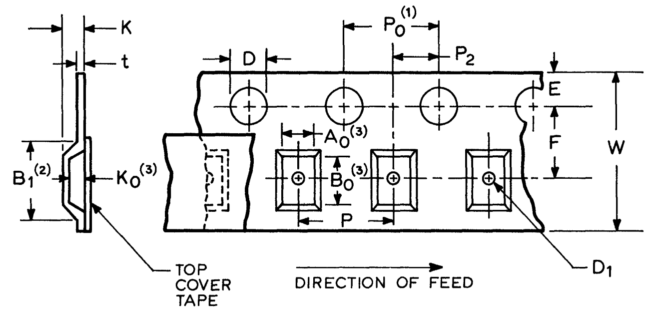
TAPE DIMENSIONS FOR TO-236AA/AB

Dimension	Millimeters	Inches
B_1 Max.[2]	4.2	0.165
D	1.5 (+0.10, −0.0)	0.059 (+0.004, −0.0)
D_1 Min.	1.0	0.039
E	1.75 (±0.10)	0.069 (±0.004)
F	3.5 (±0.05)	0.138 (±0.002)
K Max.	2.4	0.094
P	4.0 (±0.10)	0.157 (±0.004)
P_0[1]	4.0 (±0.10)	0.157 (±0.004)
P_2	2.0 (±0.05)	0.079 (±0.002)
R Min.	25	0.984
t Max.	0.400	0.016
t_1 Max.	0.10	0.004
W	8.0 (±0.30)	0.315 (±0.012)

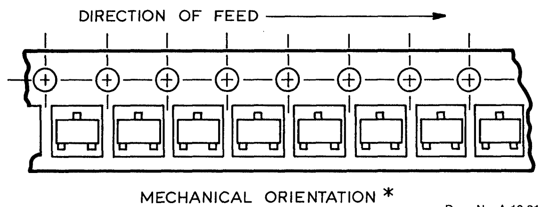
[1]Cumulative tolerance over 10 pitches = ±0.2 mm (±0.08 in.).

[2]For machine reference only, including draft and radii concentric around B_0.

[3]A_0, B_0, and K_0 are determined by component size. Clearance between the component and the cavity must be within 0.05 mm (0.002 in.), minimum, 0.50 mm (0.020 in.), maximum, for 8 mm tape; it must be within 0.05 (0.002 in.), minimum 0.65 mm (0.026 in.), maximum, for 12 mm tape.

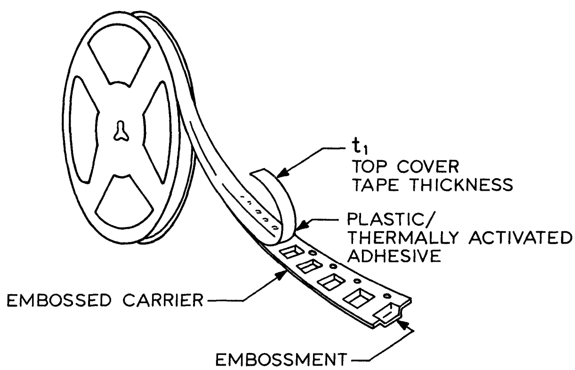


Dwg. No. A-13,310

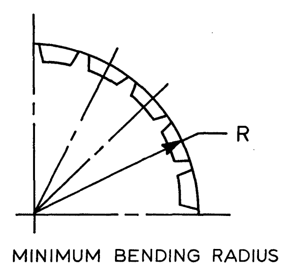


Dwg. No. A-13,313

*Available on request with double leads toward sprocket holes.

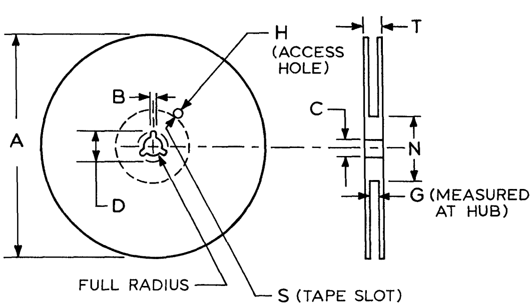


Dwg. No. A-13,312



Dwg. No. A-13,311

REEL DIMENSIONS FOR TO-236AA/AB



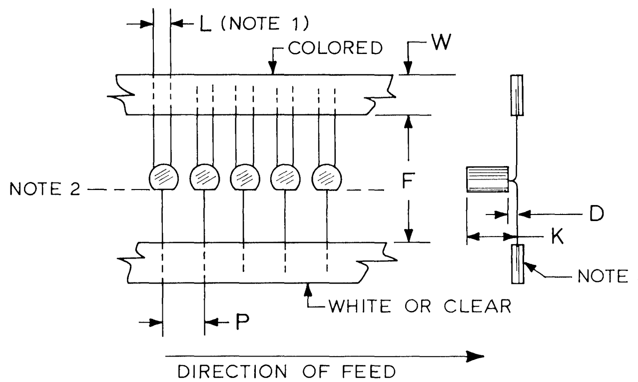
Dimension	Millimeters	Inches
A Max.	330	12.992
B Min.	1.5	0.059
C	13.0 (±0.20)	0.512 (±0.008)
D Min.	20.2	0.795
G	8.4 (+1.5, −0.0)	0.331 (+0.059, −0.0)
H Min.	40	1.575
N Min.	50	1.973
S Min.	2.5 Wide 10 Deep	0.098 Wide 0.394 Deep
T Max.	14.4	0.567

Dwg. No. A-13,314

AXIAL-TAPED TO-226AA TAPE DIMENSIONS

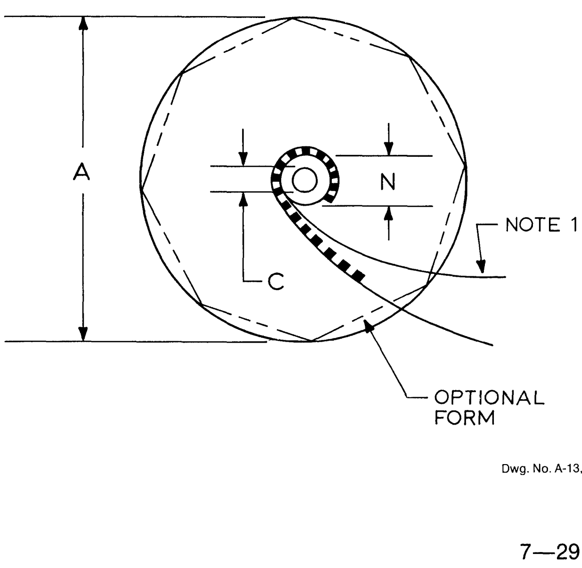
Dimension	Millimeters	Inches
D Min.	0.38	0.015
D Max.	1.78	0.070
F Typ.	6.35	0.250
K Max.	6.73	0.265
L	2.54 ± 0.38	0.100 ± 0.015
P	6.35 ± 0.38	0.250 ± 0.015
W Min.	20.63	0.812
W Max.	22.15	0.872

NOTES:
1. Leads straight within 0.38 mm (0.015 in.) between body and tape.
2. Component bodies in line within 0.38 mm (0.015 in.).
3. Lead length in contact with tape, each side, 1.78 mm (0.070 in.), minimum.



Dwg. No. A-13,626

REEL DIMENSIONS

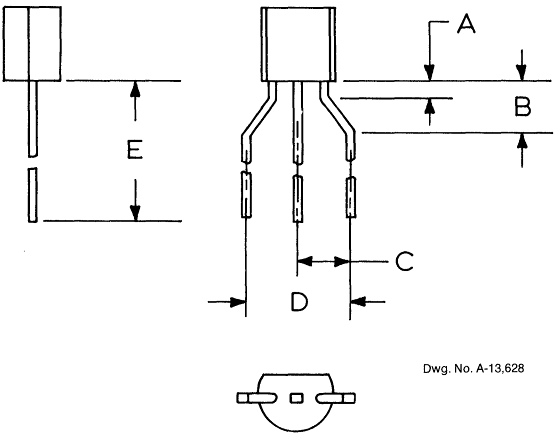


Dimension	Millimeters	Inches
A Max.	355.6	14
C	14.29	0.563
N Min.	76.20	3.0

NOTES:
1. Kraft paper, minimum 0.13 mm (0.005 in.) thick, as interliner.

Dwg. No. A-13,627

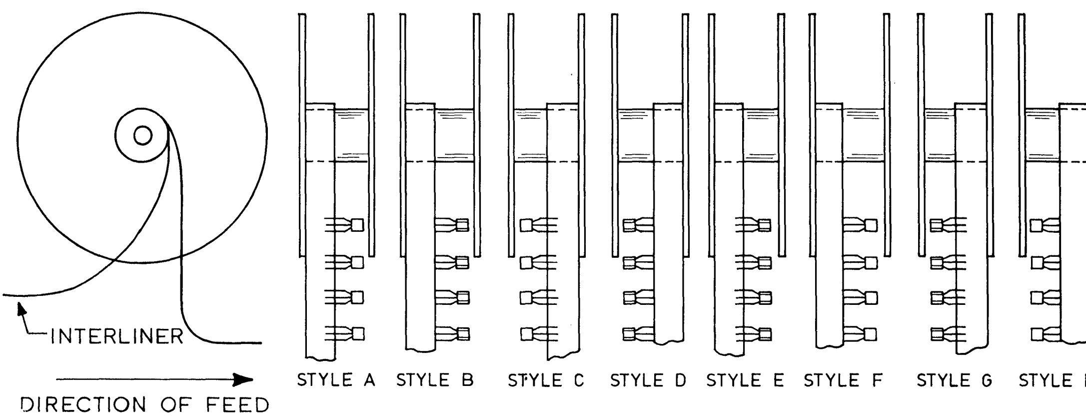
RADIAL-TAPED TO-226AA LEAD DIMENSIONS



Dimension	Millimeters	Inches
A	1.52 ± 0.38	0.060 ± 0.015
B	3.18 ± 0.38	0.125 ± 0.015
C	2.54 ± 0.30	0.100 ± 0.012
D	5.08 + 0.76, − 0.20	0.200 + 0.030, − 0.008
E Min.	12.70	0.500
E Max.	15.70	0.620

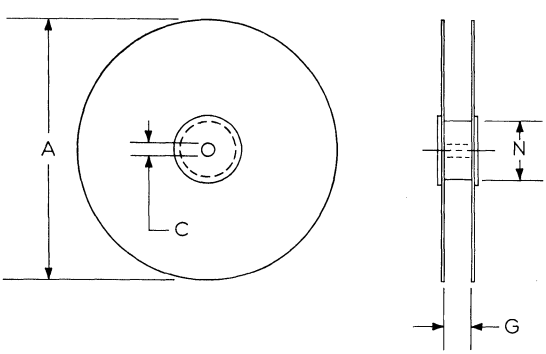
Styles A and F—Flat side down, carrier tape to left.
Styles B and E—Flat side up, carrier tape to left.
Styles C and H—Flat side down, carrier tape to right.
Styles D and G—Flat side up, carrier tape to right.

Dwg. No. A-13,628



Dwg. No. A-13,629

REEL DIMENSIONS



Dimension	Millimeters	Inches
A	355.6 ± 6.35	14 ± 0.250
C	21.59 ± 6.35	0.850 ± 0.250
G	45.72 ± 7.62	1.800 ± 0.300
N Min.	76.20 ± 6.35	3.0 ± 0.250

Dwg. No. A-13,630

SECTION 8 — HOW TO ORDER

SPRAGUE FACILITIES

Sprague Electric Company manufactures active and passive components at 15 North American locations and in five countries in Europe and the Far East. It has been a high-volume producer of semiconductors for more than 30 years.

Headquarters of the Semiconductor Division is in Concord, New Hampshire. Wafer fabrication for discrete semiconductors is done at Worcester, Massachusetts, and Garland, Texas. Assembly operations are located at the Concord and Garland plants and in Manila, the Philippines.

HOW TO ORDER

To place an order, obtain price and delivery information, or request technical literature, contact your local Sprague sales office or sales representative. (See the following lists of sales locations.) For additional help:

From U.S. and Canada

Sprague Electric Co.
92 Hayden Avenue
Lexington, MA 02173
(617) 862-5500
Telex: 710-321-0021

From Asia

Sprague Asia Ltd.
G.P.O. Box 4289
Hong Kong
0-283188
Telex: 43395

From Europe and Mideast

Sprague World Trade Corp.
18 Avenue Louis Casai
1209-Geneva
Switzerland
98-4021
Telex: 845-23469

Requests for technical information and applications assistance can be sent to the appropriate manufacturing facility.

For discrete semiconductor chips, discrete semiconductors in plastic packages, MOS capacitors:

Sprague Electric Company
70 Pembroke Road
Concord, NH 03301
(603) 224-1961
Telex: 710-361-1495

For junction field-effect transistors in metal cases:

Sprague InterFET
322 Gold Street
Garland, TX 75042
(214) 487-1287

For monolithic transistor arrays:

Sprague Electric Company
115 Northeast Cutoff
Worcester, MA 01606
(617) 853-5000
Telex: 710-340-6304

Sprague Electric Company
World Headquarters
92 Hayden Avenue
Lexington, MA 02173
(617) 862-5500

SALES OFFICES
U.S. and Canada

UNITED STATES

ALABAMA
EPI Inc.
Suite 13 — 9694 Hwy. 20 W
Madison 35758
Tel. 205/461-7000

Electramark Inc.
Suite 21
3322 South Memorial Parkway
Huntsville 35801
Tel. 205/883-9948

ARIZONA
Sprague Electric Company
Suite 209 — 1819 S. Dobson Rd.
Mesa 85202 — 5690
Tel. 602/244-0154
Tel. 602/831-6762

Sprague Electric Company
Suite 601
1150 E. Pennsylvania Street
Tucson 85714 — 1640
Tel. 602/746-0955

CALIFORNIA (Metro. L.A.)
Sprague Electric Company
Suite 150 — 3100 S. Harbor Blvd.
Santa Ana 92704
Tel. 714/549-9913

Sprague Electric Company
Suite 459
15350 Sherman Way
Van Nuys 91406
Tel. 818/994-6500

(Northern)
William J. Purdy Company
770 Airport Blvd.
Burlingame 94010 — 1927
Tel. 415/347-7701

(San Diego)
Miner Associates, Inc.
Suite 117 — 10721 Treena Street
San Diego 92131 — 1009
Tel. 619/566-9891

COLORADO
William J. Purdy Company
5570 E. Yale Ave.
Denver 80222 — 6907
Tel. 303/753-6800

Todd & Fry Associates
P.O. Box 1689
Longmont 80502 — 1689
Tel. 303/776-7331

CONNECTICUT
Sprague Electric Company
88 Main Street South
Southbury 06488
Tel. 203/264-9595

Sprague Electric Company
120 Hartford Turnpike South
P.O. Box 578
Wallingford 06492 — 0578
Tel. 203/284-8300

CONNECTICUT (continued)
Data Mark Inc.
Unit 7C-2514 Boston Post Road
Guilford 06437
Tel. 203/453-0575

DIST. OF COLUMBIA
Sprague Electric Company
Suite 311
14333 Laurel-Bowie Road
Laurel, MD 20708 — 1130
Tel. 301/953-1717

Trinkle Sales Inc.
P.O. Box 5320
Cherry Hill, NJ 08034 — 0460
Tel. 609/795-4200

FLORIDA
Sprague Electric Company
P.O. Box 1410
Altamonte Springs 32715 — 1410
Tel. 305/831-3636

Sprague Electric Company
Suite 419 — 1500 N.W. 62nd Street
Ft. Lauderdale 33309 — 1802
Tel. 305/491-7411

Sprague Electric Company
Suite T, Building 501
8001 North Dale Mabry
Tampa 33614 — 3265
Tel. 813/935-8203

GEORGIA
Electramark Inc.
6030 — I Unity Drive
Norcross 30071 — 3583
Tel. 404/446-7915

Electronic Marketing Associates
Suite 101
6695 Peachtree Industrial Blvd.
Atlanta 30360 — 2116
Tel. 404/448-1215

ILLINOIS (Northern)
D. Dolin Sales
609 Academy Drive
Northbrook 60062
Tel. 312/498-6770

(Southern)
EPI Inc.
Suite 201 — 103 W. Lockwood
St. Louis, MO 63119 — 2915
Tel. 314/962-1411

INDIANA
Sprague Electric Company
Suite 290 — 8200 Haverstick Road
Indianapolis 46240
Tel. 317/253-4247

IOWA
J. R. Sales Engineering, Inc.
1930 St. Andrews, N. E.
Cedar Rapids 52402
Tel. 319/393-2232

KANSAS
EPI Inc.
9016 West 83rd Street
Overland Park 66204
Tel. 913/341-2024

KENTUCKY
Sprague Electric Company
821 Corporate Drive
Unit #16, Suite 200
Lexington 40503
Tel. 606/224-4230

MARYLAND
Sprague Electric Company
Suite 311
14333 Laurel-Bowie Road
Laurel 20708 — 1130
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Trinkle Sales Inc.
P.O. Box 5320
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MASSACHUSETTS
New England Technical Sales Corp.
101 Cambridge Street
Burlington 01803
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MICHIGAN
Sprague Electric Company
Suite 301 — 2155 Jackson Road
Ann Arbor 48103 — 3917
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MINNESOTA
HMR, Inc.
9065 Lyndale Ave. South
Minneapolis 55420 — 3520
Tel. 612/888-2122

MISSISSIPPI
EPI Inc.
Suite 13 — 9694 Hwy. 20 W
Madison, AL 35758
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MISSOURI
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Suite 201 — 103 W. Lockwood
St. Louis 63119 — 2915
Tel. 314/962-1411

NEBRASKA
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1930 St. Andrews, N. E.
Cedar Rapids, Iowa 52402
Tel. 319/393-2232

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Albuquerque 87108 — 1613
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NEW YORK (Downstate)
Sprague Electric Company
2001 Palmer Ave.
Larchmont 10538 — 2420
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Sprague Electric Company
P.O. Box 541
Central Islip 11722 — 0541
Tel. 516/234-8700

(Upstate)
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2002 Teall Ave.
Syracuse 13206 — 1542
Tel. 315/437-7311

Paston-Hunter Co., Inc.
2002 Teall Ave.
Syracuse 13206 — 1596
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Sprague Electric Company
9741-M Southern Pine Blvd.
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Tel. 614/761-1881

OREGON
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Suite H
16111 S.E. McGillivray Boulevard
Vancouver, WA 98664 — 9025
Tel. 503/225-0493
Tel. 206/892-0361

William J. Purdy Company
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PENNSYLVANIA
Trinkle Sales Inc.
P.O. Box 5320
Cherry Hill, NJ 08034 — 0460
Tel. Phila. 215/922-2080

SOUTH CAROLINA
Electronic Marketing Associates
210 W. Stone Ave.
Greenville 29609 — 5499
Tel. 803/233-4637

TENNESSEE (Eastern)
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9225 Honeycutt Creek Road
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Sprague Electric Company
Suite 220
9319 LBJ Freeway
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TEXAS (continued)
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Suite 350W — 1106 Clayton Lane
Austin 78723 — 1033
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Laurel, MD 20708 — 1130
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3826 Woodland Park, North
Seattle 98103 — 7996
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16111 S.E. McGillivray Blvd.
Vancouver 98664
Tel. 206/892-0361
Tel. 503/225-0493

William J. Purdy Company
4082-148th Ave. N.E.
Redmond 98052 — 5165
Tel. 206/882-3144

WISCONSIN
D. Dolin Sales
131 West Layton Ave.
Milwaukee 53207 — 5991
Tel. 414/482-1111

CANADA

Sprague Electric of Canada, Ltd
Suite 220
2375 Steeles Avenue, W.
Downsview, Ontario M3J 3A8
Tel. 416/665-6066

Sprague Electric of canada, Ltd.
Suite 1610 — 85 Albert St.
Ottawa, Ont. K1P 6A4
Tel. 613/238-2542

Bird Marketing, Inc.
Unit 1
111 Esna Park Drive
Markham, Ont. L3R1H2
Tel. 416/477-7722

Sprague World Trade Corporation
18 Avenue Louis Casai
1209 Geneva, Switzerland
22-98 40 21

SALES OFFICES
Europe and the Mideast

Austria	Sprague Elektronik GmbH, Wasserburger Landstr. 268, D-8 München, Tel. 089-4301077 Distributor: Elbatex GmbH, Eitnerg. 6, A-1232 Wien, Tel. 0222/86-32-11-0
Benelux	Sprague Benelux, Excelsiorlaan 21, Bus 3, B-1930 Zaventem, Tel. Belgium 02-721 48 60
Finland	Field Oy, Veneentekijäntie 18, SF-00210 Helsinki, Tel. 80-69 22 577
France	Sprague France S.A.R.L., 3 rue Camille Desmoulins, F-94230 Cachan, Tel. 1-547 66 00 Sprague France S.A.R.L., BP 2174, rue Pierre et Marie Curie, F-37021 Tours Cédex, Tel. 47-54 05 75 Sprague France S.A.R.L., 129 rue Servient, F-69003 Lyon, Tel. 7-863 61 20 Sprague France S.A.R.L., 20 chemin de la Cépière, F-31081 Toulouse Cédex, Tel. 61-41 06 92 Sprague France S.A.R.L., 10 avenue de Crimée, F-35000 Rennes, Tel. 99-53 36 37
West Germany	Sprague Elektronik GmbH, Hainer Weg 48, D-6000 Frankfurt 70, Tel. 69-609005-0
East Germany	Dipl. Gerhard Stoits, Nordbahnstrasse 44, A-1020 Wien, Tel. 43-222 24 71 37
Greece	Emitron Electronic Corp., Dimaraki St. 22, GR-Athens 301, Tel. 021-346 97 97
Hungary	Apical S.A., Bahnstr. 25, CH-8603 Schwerzenbach, Tel. 01-825 25 26
Israel	Racom Electronics Co. Ltd., 7 Kehilat Saloniki St., P.O. Box 21120, IL-Tel Aviv 61210, Tel. 03-49 19 22
Italy	Sprague Italiana S.p.A., Via G. de Castro 4, I-20144 Milano, Tel. 02-498 78 91
Norway	Hefro Teknisk A/S, Postboks 6596, Rodelökka, N-Oslo 5, Tel. 02-38 02 86
Portugal	Sprague World Trade Corp., Tour Balexert, 18 avenue Louis Casaï, CH-1209 Geneva, Tel. 22-98 40 21 Distributor: Niposom, Rua Casimiro Freire 9A, P-1900 Lisboa, Tel. 351-189 66 10
South Africa	Allied Electric (Pty) Ltd., P.O. Box 6387, ZA-Dunswart 1508, Tel. 892.1001
Spain	Saenger S.A., c/Barri Vermell, E-s/n Barcelona 30, Tel. 3-313 73 00 Saenger S.A., c/Hilarion Eslava 47, E-28015 Madrid, Tel. 91-244 58 07
Sweden	Sprague Scandinavia AB, Sollentunavaegen 141, Box 802, 191 28 Sollentuna, Tel. 011-46-8-920595
Switzerland	Sprague World Trade Corp., Tour Balexert, 18 avenue Louis Casaï, CH-1209 Geneva, Tel. 22-98 40 21 Distributor: Telion AG, Albisriederstr, 232, CH-8047 Zürich, Tel. 01-493 15 15
Turkey	Kapman Komandit, Plastic Han No. 1, Yanikkapi sokak, P.O. Box 158, Beyoglu, TR-Istanbul, Tel. 45 76 25
U.K.	Sprague Electric LTD, Module D, Airtech 2, Fleming Way, Crawley, West Sussex, RH10 2YQ, Great Britain, Tel. 0293 517878, Tlx: 877813, Fax: 0293 551363
Yugoslavia	Belram S.A., 83 avenue des Mimosas, B-Brussels 15, Tel. 02-734 33 32
Other Eastern Countries	Sprague World Trade Corp., Tour Balexert, 18 avenue Louis Casaï, CH-1209 Geneva, Tel. 22-98 40 21 Otece, Avenue des Camélias 50, B-1150 Bruxelles, Tel. 02-770 38 19

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0-283188

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Japan	Sprague Japan K.K. Shinjuku KB Building 11-3, Nishi-Shinjuku 6-Chome Shinjuku-Ku, Tokyo 160 Japan Tel. (03) 348-5221
Korea	Technomil Ltd. Sprague Korea Branch 4th Fl., Daiyoung Building 44-1, Yoido-Dong Young Dung Po-Ku, Seoul, Korea Tel. (2) 783-9784
Singapore	Sprague Electric Private Ltd. Singapore Office 11th Floor, 450/452 Inchcape House Alexandra Road Singapore 0511 Tel. 475-1826
Taiwan	Sprague Taiwan Branch Technomil Ltd. 8/F, 142 Sec. 4 Chung Hsiao East Road Taipei, Taiwan, R.O.C. Tel. 771-9582

In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

The information included herein is believed to be accurate and reliable. However, the Sprague Electric Company assumes no responsibility for its use; nor for any infringements of patents or other rights of third parties which may result from its use.

SPRAGUE
THE MARK OF RELIABILITY

Litho in U.S. Amer.