

Series SNF/SNG Circuits Summary

SERIES SNF/SNG TTL INTEGRATED CIRCUITS

SERIES SNG GATES*

FUNCTIONS	OPERATING TEMPERATURE RANGE -55°C to 125°C		OPERATING TEMPERATURE RANGE 0°C to 75°C		PACKAGES‡		
		FAN-OUT		FAN-OUT	Dual-In-Line		Flat
Dual 4-Input NAND Gates	SNG40	15	SNG42	12	J	N	U
	SNG41	7	SNG43	6			
Expandable 2-2-2-3-Input AND-OR-INVERT Gates	SNG50	15	SNG52	12	J	N	U
	SNG51	7	SNG53	6			
8-Input NAND Gates	SNG60	15	SNG62	12	J	N	U
	SNG61	7	SNG63	6			
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gates	SNG70	15	SNG72	12	J	N	U
	SNG71	7	SNG73	6			
Dual Pulse Shaper/Delay AND Gates	SNG80	15	SNG82	12	J	N	U
	SNG81	7	SNG83	6			
2-Wide 3-Input AND-OR-INVERT Gates with 2-Input Gated Complement	SNG90	15	SNG92	12	J	N	U
	SNG91	7	SNG93	6			
Expandable 3-Wide 3-Input AND-OR-INVERT Gates	SNG100	15	SNG102	12	J	N	U
	SNG101	7	SNG103	6			
Expandable 2-Wide 4-Input AND-OR-INVERT Gates	SNG110	15	SNG112	12	J	N	U
	SNG111	7	SNG113	6			
Expandable 8-Input NAND Gates	SNG120	15	SNG122	12	J	N	U
	SNG121	7	SNG123	6			
Dual 4-Input Line Drivers	SNG130	30	SNG132	24	J	N	U
	SNG131	15	SNG133	12			
Quadruple 2-Input NAND Gates	SNG140	15	SNG142	12	J	N	U
	SNG141	7	SNG143	6			
3-2-2-3-Input Expanders for AND-OR-INVERT Gates	SNG150		SNG152		J	N	U
	SNG151		SNG153				
Triple 2-Input NAND Drivers	SNG160	15	SNG162	12	J	N	U
	SNG161	7	SNG163	6			
Dual 4-Input Expanders for AND-OR-INVERT Gates	SNG170		SNG172		J	N	U
	SNG171		SNG173				
Dual 4-Input Expanders for NAND Gates	SNG180		SNG182		J	N	U
	SNG181		SNG183				
Triple 3-Input NAND Gates	SNG190	15	SNG192	12	J	N	U
	SNG191	7	SNG193	6			
Expandable 8-Input NAND Gates	SNG200	11	SNG202	9	J	N	U
	SNG201	6	SNG203	5			
Expandable 2-Wide 4-Input AND-OR-INVERT Gates	SNG210	11	SNG212	9	J	N	U
	SNG211	6	SNG213	5			
Quadruple 2-Input NAND Gates	SNG220	11	SNG222	9	J	N	U
	SNG221	6	SNG223	5			
3-2-2-3-Input Expanders for AND-OR-INVERT Gates	SNG230		SNG232		J	N	U
	SNG231		SNG233				
Dual 4-Input NAND Gates	SNG240	11	SNG242	9	J	N	U
	SNG241	6	SNG243	5			
Expandable 2-2-2-3-Input AND-OR-INVERT Gates	SNG250	11	SNG252	9	J	N	U
	SNG251	6	SNG253	5			
8-Input NAND Gates	SNG260	11	SNG262	9	J	N	U
	SNG261	6	SNG263	5			
Dual 4-Input Expanders for AND-OR-INVERT Gates	SNG270		SNG272		J	N	U
	SNG271		SNG273				
OR-Expandable Dual 4-Input AND Gates	SNG280	15	SNG282	12	J	N	U
	SNG281	7	SNG283	6			
Dual 2-3-Input Expanders for OR Expandable AND Gates	SNG290		SNG292		J	N	U
	SNG291		SNG293				
Expandable 3-Wide 3-Input AND-OR-INVERT Gates	SNG300	11	SNG302	9	J	N	U
	SNG301	6	SNG303	5			
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gates	SNG310	11	SNG312	9	J	N	U
	SNG311	6	SNG313	5			
Triple 3-Input NAND Gates	SNG320	11	SNG322	9	J	N	U
	SNG321	6	SNG323	5			
Quadruple 2-Input NAND Lamp/Line Drivers	SNG351	30	SNG353	24	J	N	U

*Interchangeable with SUHL 1† and SUHL 2† TTL circuits

†Trademark of Sylvania Electric Products, Inc.

‡For outline drawings of all packages, see Section 1.

SERIES SNF/SNG TTL INTEGRATED CIRCUITS

GATES

Pin 4 is V_{CC}, pin 10 is GND

<p>SNG40, 41, 42, 43 SNG240, 241, 242, 243</p> <p>Dual 4-Input NAND Gates</p>	<p>SNG50, 51, 52, 53 SNG250, 251, 252, 253</p> <p>Expandable 2-2-2-3-Input AND-OR-INVERT Gates</p>	<p>SNG70, 71, 72, 73 SNG310, 311, 312, 313</p> <p>Expandable 2-Wide 2-Input AND-OR-INVERT Gates</p>	
<p>SNG60, 61, 62, 63 SNG260, 261, 262, 263</p> <p>8-Input NAND Gates</p>	<p>SNG90, 91, 92, 93</p> <p>2-Wide 3-Input AND-OR-INVERT Gates with 2-Input Gated Complement</p>	<p>SNG100, 101, 102, 103 SNG300, 301, 301, 303</p> <p>Expandable 3-Wide 3-Input AND-OR-INVERT Gates</p>	
<p>SNG110, 111, 112, 113 SNG210, 211, 212, 213</p> <p>Expandable 2-Wide 4-Input AND-OR-INVERT Gates</p>	<p>SNG120, 121, 122, 123 SNG200, 201, 202, 203</p> <p>Expandable 8-Input NAND Gates</p>	<p>SNG140, 141, 142, 143 SNG220, 221, 222, 223</p> <p>Quadruple 2-Input NAND Gates</p>	<p>SNG190, 191, 192, 193 SNG320, 321, 322, 323</p> <p>Triple 3-Input NAND Gates</p>

SERIES SNF/SNG TTL INTEGRATED CIRCUITS

GATES (continued)		EXPANDERS		Pin 4 is V _{CC} , pin 10 is GND	
<p>SNG80, 81, 82, 83</p> <p>Dual Pulse Shaper/Delay AND Gates</p>		<p>SNG150, 151, 152, 153 SNG230, 231, 232, 233</p> <p>3-2-2-3 Input Expanders for A-O-I Gates</p>		<p>SNG170, 171, 172, 173 SNG270, 271, 272, 273</p> <p>Dual 4-Input Expanders for A-O-I Gates</p>	
<p>SNG280, 281, 282, 283</p> <p>OR-Expandable Dual 4-Input AND Gates</p>		<p>SNG180, 181, 182, 183</p> <p>Dual 4-Input Expanders for NAND Gates</p>		<p>SNG290, 291, 292, 293</p> <p>Dual 2-3 Input Expanders for OR-Expandable AND Gates</p>	
DRIVERS					
<p>SNG130, 131, 132, 133, 134</p> <p>Dual 4-Input Line Drivers</p>		<p>SNG160, 161, 162, 163</p> <p>Triple 2-Input NAND Drivers</p>		<p>SNG351, 353</p> <p>Quadruple 2-Input NAND Lamp/Line Drivers</p>	

12

SERIES SNF/SNG TTL INTEGRATED CIRCUITS

SERIES SNG GATES

electrical characteristics (unless otherwise noted, VCC = 5 V)

PARAMETER	CONDITIONS	SNG40, 41		SNG200, 201		SNG130, 131		SNG180, 181		SNG230, 231		SNG270, 271		SNG290, 291		SNG351		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
I _L	V _I = 0 V	-1.33	-2	-1.33	-2	-2	-2	-1.33	-1	-2	-2	-2	-2	-1.33	-1	-2(6)		mA
I _H	V _I = 4.5 V	100	100	100	100	200	200	100	100	100	100	100	100	100	100	100(6)		mA
I _H	V _I = 5.5 V	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1(6)		mA
V _{IH} min	-55°C	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2(7)		V
	25°C	1.7	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	2(7)		V
	125°C	1.4	1.6	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	2(7)		V	
	ALL	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.6(7)		V
V _{IL} max	-55°C	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5(7)		V
	25°C	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.5(7)		V
	125°C	2.7	2.5	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.5(7)		V
	ALL	-1.5	-2.2	-1.5	-3	-1.5	-3	0	0	0	0	0	0	0	0	0.6(7)		V
I _{OH}	V _O = 5.5 V	260	250	260	250	280	280	260	250	260	250	260	250	250	250	250(6)		mA
I _{OS}	V _O = 0 V	-10	-45	-25	-100	-50	-150	-0.8	-1.33	-0.8	-1.33	-0.8	-1.33	-0.8	-1.33	250(6)		mA
V _{OL}	-55°C	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		mA
	25°C	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		mA
	125°C	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45		mA
	ALL	2.8	2.7	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8		mA
V _{BE} or V _{BC}	-55°C	3.2	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2		V
	25°C	3.35	3.15	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35		V
	125°C	3.35	3.15	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35		V
	ALL	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33		V
V _{CE}	I _B = 1.33 mA, V _{CE} = 1.5 V	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		V
I _{FE}	I _B = 1.33 mA, V _{CE} = 1.5 V	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		mA
V _{OL}	SNG130: I _{OL} = 100 mA																	V
	SNG131: I _{OL} = 60 mA																	V
I _{OH}	V _{OH} = 7 V																	mA

[†] Specifications guaranteed at "ALL" temperatures are verified by measurements at T_A = -55°C, T_A = 25°C, and T_A = 125°C.

- (1) V_{OH} = 6.5 V
- (2) R_{collector} = 800 Ω
- (3) V_E = 1 V at -55°C, 0.85 V at 25°C, and 0.65 V at 125°C
- (4) V_E = 0.9 V at -55°C, 0.75 V at 25°C, and 0.55 V at 125°C
- (5) R_L = 750 Ω
- (6) V_{CC} = 5.5 V
- (7) V_{CC} = 4.5 V
- (8) V_O = 8 V
- (9) V_{OL} for these expanders is measured between collector and emitter.

SERIES SNF/SNG TTL INTEGRATED CIRCUITS

SERIES SNG GATES (Continued)

electrical characteristics (unless otherwise noted, $V_{CC} = 5\text{ V}$)

PARAMETER	CONDITIONS	T _A [†]	SNG42, 43		SNG202, 203		SNG132, 133		SNG152, 153 SNG172, 173		SNG232, 233		SNG272, 273		SNG292, 293		SNG363		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
I _{IL}	V _I = 0 V	ALL	-1.66	1	-2.5	1	-2.5	2	-1.66	1	-2.5	1	-2.5	1	-1.6	1	-2.5(6)	1(6)	mA
I _{IH}	V _I = 4.5 V	ALL	100	1	100	1	200	2	100	1	100	1	100	1	100	100(6)	1(6)	μA	
I _{IH}	V _I = 5.5 V	ALL	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8	2(7)	V	
V _{IH} min	V _I (applied)	0°C	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.6	2(7)	V	
		25°C	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	2(7)	V	
		75°C	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	2(7)	V	
V _{IH} max	V _I (applied)	0°C	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.8	2(7)	V	
		25°C	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	0.8(7)	V	
		75°C	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.8(7)	V	
V _{IL} max	V _I (applied)	0°C	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5.5(7)	V	
		25°C	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	5.5(7)	V	
		75°C	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5.5(7)	V	
I _{OH}	SNGXX2: I _{OH} (forced)	ALL	-1.2	-1.8	-2.4	-2.4	-2.4	-2.4	0	0	0	0	0	0	0	0	1(7)	mA	
I _{OS}	SNGXX3: I _{OH} (forced)	ALL	-0.6	-1	-1.2	-1.2	-1.2	-1.2	0	0	0	0	0	0	0	0	1(7)	mA	
I _{OH}	V _{OH} = 5.5 V	ALL	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250(8)	μA	
I _{OH}	V _{OH} = 5 V	ALL	-10	-45	-25	-100	-50	-150	-0.75	-1.55	-0.75	-1.55	-0.75	-1.55	-0.75	-1.55	1(5)	μA	
V _{OL}	V _{IH} = 3 V	0°C	0.4	0.4	0.4	0.4	0.4	0.4	0.65(2.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.6(9)	V	
		25°C	0.4	0.4	0.4	0.4	0.4	0.4	0.65(2.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.6(9)	V	
		75°C	0.45	0.45	0.45	0.45	0.45	0.45	0.65(2.4)	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.6(9)	V	
V _{OH}	V _I = 0.45 V	0°C	3	2.9	3	3	3	3	4.8(2.4)	3	3	3	3	3	3	3	4.8(5)	V	
		25°C	3.1	3	3.1	3.1	3.1	3.1	4.8(2.4)	3.1	3.1	3.1	3.1	3.1	3.1	3.1	4.8(5)	V	
		75°C	3.15	3	3.15	3.15	3.15	3.15	4.8(2.4)	3.15	3.15	3.15	3.15	3.15	3.15	3.15	4.8(5)	V	
V _{BE} or V _{BC}	I _B = 1.66 mA for V _{BE}	0°C																V	
	I _B = 1.66 mA for V _{BC}	25°C																V	
V _{CE}	I _B = 1.66 mA	ALL																V	
I _{FEE}	I _B = 1.66 mA, V _{CE} = 1.5 V	ALL																V	
V _{OL}	SNG132: I _{OL} = 100 mA	25°C						0.8										V	
	SNG133: I _{OL} = 60 mA	25°C						0.6										V	
I _{OH}	V _{OH} = 7 V	25°C						1(1)										mA	

[†] Specifications guaranteed at "ALL" temperatures are verified by measurements at T_A = 0°C, T_A = 25°C, and T_A = 75°C.

- (1) V_{OH} = 6.5 V
- (2) R_{collector} = 800 Ω
- (3) V_E = 0.9 V at 0°C, 0.85 V at 25°C, and 0.75 V at 75°C
- (4) V_E = 0.8 V at 0°C, 0.75 V at 25°C, and 0.65 V at 75°C
- (5) R_L = 750 Ω
- (6) V_{CC} = 5.25 V
- (7) V_{CC} = 4.75 V
- (8) V_{CC} = 8 V
- (9) V_{CC} = 4.75 V, V_I = 2.2 V
- (10) V_{OL} for these expanders is measured between collector and emitter.

**SERIES SNF/SNG
TTL INTEGRATED CIRCUITS**

**SERIES SNG GATES (Continued)
Dual Pulse Shaper/Delay 3-Input AND Gates**

electrical characteristics, VCC = 5 V

PARAMETER	CONDITIONS	TA (1)		SNG280, 281		SNG282, 283		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
IIL	VIL = 0 V	ALL	ALL	-1.33	ALL	-1.66	mA	
IiH	VIH = 4.5 V	ALL	ALL	100	ALL	100	μA	
IiH	VIH = 5.5 V	ALL	ALL	1	ALL	1	mA	
VOH	VI (applied)	-55°C	0°C	1.9	1.8	1.8	V	
		25°C	25°C	1.6	1.7	1.7	V	
		125°C	75°C	1.3	1.6	1.6	V	
VOH min	VOH (measured)	-55°C	0°C	2.5	2.5	2.5	V	
		25°C	25°C	2.4	2.6	2.6	V	
		125°C	75°C	2.7	2.7	2.7	V	
VOH	SNG280, 282: IOH (forced) SNG281, 283: IOH (forced)	ALL	ALL	-1.5	-1.2	-1.2	mA	
		ALL	ALL	-0.7	-0.6	-0.6	mA	
		-55°C	0°C	1.3	1.2	1.2	V	
VOH max	VI (applied)	25°C	25°C	1.2	1.2	1.2	V	
		125°C	75°C	0.85	1	1	V	
		ALL	ALL	0.45	0.45	0.45	V	
VOL	SNG280, 282: IOL (forced) SNG281, 283: IOL (forced)	ALL	ALL	20	20	20	mA	
		ALL	ALL	10	10	10	mA	
		VOH = 5.5 V	ALL	ALL	250	250	250	μA
VOL	VO = 0 V	ALL	ALL	-15	-60	-15	mA	
		-55°C	0°C	0.4	0.4	0.4	mA	
		25°C	25°C	0.4	0.4	0.4	mA	
VOL	IOL = forced as above	125°C	75°C	0.45	0.45	0.45	mA	
		-55°C	0°C	2.8	3.1(3)	3.1(3)	V	
		25°C	25°C	3.1	3.1(3)	3.1(3)	V	
VOH	IOH = forced as above	125°C	75°C	3.3	3.3	3.3	V	

electrical characteristics, VCC = 5 V

PARAMETER	CONDITIONS	TA (1)		SNG80, 81		SNG82, 83		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
IIL	VIL = 0 V	ALL	ALL	-1.33	ALL	-1.66	mA	
IiH	VIH = 4.5 V	ALL	ALL	100	ALL	100	μA	
IiH	VIH = 5.5 V	ALL	ALL	1	ALL	1	mA	
VOH	VI (applied)	-55°C	0°C	1.88†	1.75†	1.75†	V	
		25°C	25°C	1.55†	1.51†	1.51†	V	
		125°C	75°C	1.28†	1.40†	1.40†	V	
VOH	VOH (measured)	ALL	ALL	3.2	3.2	3.2	V	
		ALL	ALL	-3	-3	-3	mA	
		ALL	ALL	-1.5	-1.5	-1.5	mA	
VOH	SNG80, 82: IOH SNG81, 83: IOH	-55°C	0°C	1.21	1.21	1.21	V	
		25°C	25°C	1.11	1.11	1.11	V	
		125°C	75°C	0.91	1.02†	1.02†	V	
VOL	VI (applied)	ALL	ALL	3.2	3.2	3.2	V	
		ALL	ALL	-3	-3	-3	mA	
		ALL	ALL	-1.5	-1.5	-1.5	mA	
VOL	SNG80, 82: IOL SNG81, 83: IOL	-55°C	0°C	1.4†	1.32†	1.32†	V	
		25°C	25°C	1.22†	1.22†	1.22†	V	
		125°C	75°C	0.95†	1.07†	1.07†	V	
VOL	VO = 0 V	ALL	ALL	0.4	0.4	0.4	mA	
		ALL	ALL	22	22	22	μA	
		ALL	ALL	12	12	12	μA	
VOL	IOL = forced as above	-55°C	0°C	0.77†	0.75†	0.75†	V	
		25°C	25°C	0.81†	0.81†	0.81†	V	
		125°C	75°C	0.57†	0.71	0.71	V	
VOL	VOH = 5.5 V	ALL	ALL	0.4	0.4	0.4	mA	
		ALL	ALL	22	22	22	μA	
		ALL	ALL	12	12	12	μA	
VOH	IOH = forced as above	ALL	ALL	250	250	250	μA	
IOS	VO = 0 V	ALL	ALL	-25	-100	-25	mA	

† This symbol designates a voltage which rises from 0 V to the specified level.

‡ This symbol designates a voltage which falls from 4 V to the specified level.

(1) Specifications guaranteed at "ALL" temperatures in this column are verified by measurements at TA = -55°C, TA = 25°C, and TA = 125°C.

(2) Specifications guaranteed at "ALL" temperatures in this column are verified by measurements at TA = 0°C, TA = 25°C, and TA = 75°C.

(3) VIH = 3 V.

**SERIES SNF/SNG
TTL INTEGRATED CIRCUITS**

SERIES SNG GATES (Continued)

maximum supply current in mA at specified free-air temperature

TYPE	ICCH V _{CC} = 8 V 25°C	ICCL V _{CC} = 5 V -55°C to 125°C	ICCH V _{CC} = 5 V -55°C to 125°C	ICCH V _{CC} = 7 V 25°C	ICCL V _{CC} = 5 V 0°C to 75°C	ICCH V _{CC} = 5 V 0°C to 75°C
SNG40, 41	10	12	6	10	15	6
SNG50, 51	12	9	7.5	12	11	7.5
SNG60, 61	5	6	3	5	7.5	3
SNG70, 71	10	14	7	10	18	8
SNG80, 81	50 ⁽³⁾	35	11	50	35	11
SNG90, 91	34	10 ⁽⁴⁾	7	24	12 ⁽⁴⁾	7
SNG100, 101	10	8	6	10	10	6
SNG110, 111	10	7	4	10	9	4
SNG120, 121	5	6	3	5	7.5	3
SNG130, 131	15	28	9	15	34	11
SNG140, 141	20	24	12	20	30	12
SNG150, 151	20	5 ⁽¹⁾ (2)	6 ⁽¹⁾	20	6 ⁽¹⁾ (2)	7 ⁽¹⁾
SNG160, 161	15	27	9	15	28.5	9
SNG170, 171	10	2.5 ⁽²⁾	3	10	3 ⁽²⁾	3.5
SNG180, 181	NA	NA	NA	NA	NA	NA
SNG190, 191	15	18	9	15	22.5	9
SNG200, 201	6.5	7.5	3.5	6.75	10	5
SNG210, 211	10	9	6	11	12	7.5
SNG220, 221	26	30	14	27	40	20
SNG230, 231	14	6	8.5	15	7.2	10.5
SNG240, 241	13	15	7.5	13.5	20	10
SNG250, 251	17	12	10	18	16	13
SNG260, 261	6.5	7.5	3.5	6.75	10	5
SNG270, 271	7	3 ⁽²⁾	4.25	7.5	3.6 ⁽²⁾	5.25
SNG280, 281	32	22	20	34	27	24
SNG290, 291	20	5	6	20	6	7
SNG300, 301	13.5	10.5	7.8	15	14	10
SNG310, 311	20	18	12	22	24	15
SNG320, 321	19.5	22.5	10.5	20.25	30	15
SNG351	28 ⁽³⁾	48	10	35	55	12

(1) Output emitters tied together, output collectors tied together.

(2) V_{emitter} = 0.8 V

(3) V_{CC} = 7 V

(4) ICCL is tested with gate 1 "on" and gate 11 "off", then vice-versa.

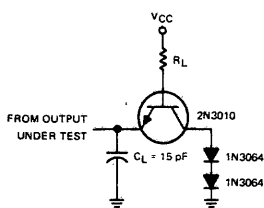
SERIES SNF/SNG TTL INTEGRATED CIRCUITS

SERIES SNG GATES (Continued)

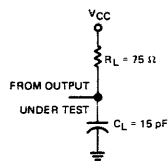
maximum switching times in ns at 25°C free-air temperature

TYPE	t _{PHL}	t _{PLH}	t _{THL}	t _{TLH}	LOAD CIRCUIT	R _L (Ω)				
						SNGXX0	SNGXX1	SNGXX2	SNGXX3	
SNG40, 41, 42, 43	20	20	5	8	1	260	570	330	600	
SNG50, 51, 52, 53	23	23	6	8	1	260	570	330	600	
SNG60, 61, 62, 63	24	20	5	8	1	260	570	330	600	
SNG70, 71, 72, 73	22	22	6	8	1	260	570	330	600	
SNG80, 81, 82, 83	20	20	4	4	1	← 2500 →				
SNG90, 91, 92, 93	Gate 1	22	22	6	8	1	260	570	330	600
	Gate 2	20	20	5	5					
SNG100, 101, 102, 103	22	22	6	8	1	260	570	330	600	
SNG110, 111, 112, 113	22	22	6	8	1	260	570	330	600	
SNG120, 121, 122, 123	28	20	5	8	1	260	570	330	600	
SNG130, 131, 132, 133	C _L = 150 pF	25	25	12	15	4	260	570	330	600
	C _L = 1000 pF	50	40	30	30					
SNG140, 141, 142, 143	20	20	5	8	1	260	570	330	600	
SNG150, 151, 152, 153	Δ4	Δ4								
SNG160, 161, 162, 163	20	30	5		3	← 350 →				
	20	70			3	← 5000 →				
SNG170, 171, 172, 173	Δ1	Δ1								
SNG180, 181, 182, 183	Δ3	Δ3								
SNG190, 191, 192, 193	20	20	5	8	1	260	570	330	600	
SNG200, 201, 202, 203	15	10	3	4.5	1	← 2500 →				
SNG210, 211, 212, 213	11	11	3	4.5	1	← 2500 →				
SNG220, 221, 222, 223	10	10	2.5	4	1	← 2500 →				
SNG230, 231, 232, 233	Δ2	Δ2								
SNG240, 241, 242, 243	10	10	2.5	4	1	← 2500 →				
SNG250, 251, 252, 253	12	12	3	4.5	1	← 2500 →				
SNG260, 261, 262, 263	12	10	3	4	1	← 2500 →				
SNG270, 271, 272, 273	Δ1	Δ1								
SNG280, 281, 282, 283	15	15	5	8	1	← 4000 →				
SNG290, 291, 292, 293	15	15	5	8	1	← 4000 →				
SNG300, 301, 302, 303	12	12	3	4.5	1	← 2500 →				
SNG310, 311, 312, 313	11	11	3	4.5	1	← 2500 →				
SNG320, 321, 322, 323	10	10	2.5	4	1	← 2500 →				
SNG351, 353	25	10	10	10	2	← 75 →				

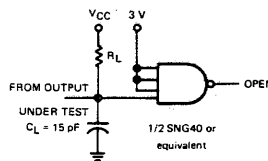
Δ—typical average delay added through expanded gate.



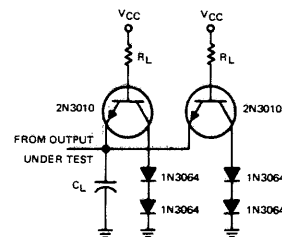
LOAD CIRCUIT 1



LOAD CIRCUIT 2



LOAD CIRCUIT 3



LOAD CIRCUIT 4

C_L includes probe and jig capacitance.

12

SERIES SNF/SNG TTL INTEGRATED CIRCUITS

SERIES SNF FLIP-FLOPS*

FUNCTION	OPERATING TEMPERATURE RANGE -55°C to 125°C	FAN-OUT	OPERATING TEMPERATURE RANGE 0°C to 75°C	FAN-OUT	PACKAGES†	
					Dual-in-Line	Flat
S-R Flip-Flops	SNF10	15	SNF12	12	J	U
	SNF11	7	SNF13	6	N	U
S-R Clocked Flip-Flops	SNF20	15	SNF22	12	J	U
	SNF21	7	SNF23	6	N	U
Capacitively-Coupled S-R Flip-Flops	SNF30	15	SNF32	12	J	U
	SNF31	7	SNF33	6	N	U
AND-Input J-K Flip-Flops	SNF50	15	SNF52	12	J	U
	SNF51	7	SNF53	6	N	U
AND-OR-Input J-K Flip-Flops	SNF60	15	SNF62	12	J	U
	SNF61	7	SNF63	6	N	U
Dual J-K Flip-Flops (Separate Clocks)	SNF100	11	SNF102	9	J	U
	SNF101	6	SNF103	5	N	U
Dual J-K Flip-Flops (Common Clock and Clear)	SNF110	11	SNF112	9	J	U
	SNF111	6	SNF113	5	N	U
Dual J-K Flip-Flops (Separate Clocks)	SNF120	11	SNF122	9	J	U
	SNF121	6	SNF123	5	N	U
Dual J-K Flip-Flops (Common Clock and Clear)	SNF130	11	SNF132	9	J	U
	SNF131	6	SNF133	5	N	U
AND-Input J-K Flip-Flops	SNF200	11	SNF202	9	J	U
	SNF201	6	SNF203	5	N	U
AND-OR-Input J-K Flip-Flops	SNF210	11	SNF212	9	J	U
	SNF211	6	SNF213	5	N	U
AND-Input J-K Flip-Flops	SNF250	11	SNF252	9	J	U
	SNF251	6	SNF253	5	N	U
AND-OR-Input J-K Flip-Flops	SNF260	11	SNF262	9	J	U
	SNF261	6	SNF263	5	N	U

‡ For outline drawings of all packages, see section 1.

12

* Interchangeable with SUHL 11 and SUHL 21 TTL circuits.
† Trademark of Sylvania Electric Products, Inc.

SERIES SNF/SNG TTL INTEGRATED CIRCUITS

SERIES SNF FLIP-FLOPS (Continued)

Pin 4 is V_{CC}, pin 10 is GND

line summary

GATED FLIP-FLOPS

SNF10, 11, 12, 13

INPUTS AT t_n		OUTPUTS AT t_{n+1}	
S	R	Q	\bar{Q}
H	H	Q_n	\bar{Q}_n
H	L	L	H
L	H	H	L
L	L	Indeterminate	

$\bar{S} = \bar{S}_1 + \bar{S}_2 + \bar{S}_3$
 $\bar{R} = \bar{R}_1 + \bar{R}_2 + \bar{R}_3$

S-R FLIP-FLOPS

SNF20, 21, 22, 23

INPUTS AT t_n		OUTPUTS AT t_{n+1}	
S	R	Q	\bar{Q}
L	L	Q_n	\bar{Q}_n
L	H	L	H
H	L	H	L
H	H	Indeterminate	

S = S1 · S2 · S3
R = R1 · R2 · R3
Low input to preset sets Q high
Low input to clear resets Q low
Preset and clear are operable when clock is low.

S-R CLOCKED FLIP-FLOPS

SNF30, 31, 32, 33

INPUTS AT t_n		OUTPUTS AT t_{n+1}	
S	R	Q	\bar{Q}
H	H	Q_n	\bar{Q}_n
H	L	L	H
L	H	H	L
L	L	Indeterminate	

An active-low condition at S requires a low at S_C and a high-to-low transition at C_S.
An active-low condition at R requires a low at R_C and a high-to-low transition at C_R.

SNF50, 51, 52, 53
SNF200, 201, 202, 203
SNF250, 251, 252, 253

INPUTS AT t_n		OUTPUTS AT t_{n+1}	
J	K	Q	\bar{Q}
L	L	Q_n	\bar{Q}_n
L	H	L	H
H	L	H	L
H	H	\bar{Q}_n	Q_n

J = J1 · J2 · J3
K = K1 · K2 · K3

AND-INPUT J-K FLIP-FLOPS

SNF60, 61, 62, 63
SNF210, 211, 212, 213
SNF260, 261, 262, 263

INPUTS AT t_n		OUTPUTS AT t_{n+1}	
J	K	Q	\bar{Q}
L	L	Q_n	\bar{Q}_n
L	H	L	H
H	L	H	L
H	H	\bar{Q}_n	Q_n

J = J1A · J1B + J2A · J2B
K = K1A · K1B + K2A · K2B

DUAL FLIP-FLOPS

SNF100, 101, 102, 103
SNF120, 121, 122, 123

INPUTS AT t_n		OUTPUTS AT t_{n+1}	
J	K	Q	\bar{Q}
L	L	Q_n	\bar{Q}_n
L	H	L	H
H	L	H	L
H	H	\bar{Q}_n	Q_n

DUAL J-K FLIP-FLOPS (SEPARATE CLOCKS)

SNF110, 111, 112, 113
SNF130, 131, 132, 133

INPUTS AT t_n		OUTPUTS AT t_{n+1}	
J	K	Q	\bar{Q}
L	L	Q_n	\bar{Q}_n
L	H	L	H
H	L	H	L
H	H	\bar{Q}_n	Q_n

DUAL J-K FLIP-FLOPS (COMMON CLOCK AND CLEAR)

H = high level
L = low level
 t_n = bit time before clock pulse
 t_{n+1} = bit time after clock impulse
 Q_n = level of output Q at t_n
 \bar{Q}_n = complement of Q_n or level of output \bar{Q} at t_n

SERIES SNF/SNG TTL INTEGRATED CIRCUITS

SERIES SNF FLIP-FLOPS (Continued)

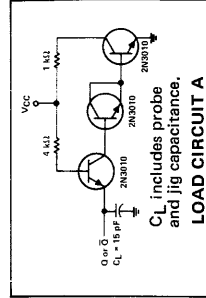
electrical characteristics (unless otherwise noted, VCC = 5 V)

PARAMETER	CONDITIONS	SNF10, 11		SNF20, 21		SNF30, 31		SNF40, 41		SNF50, 51		SNF60, 61		SNF70, 71		SNF80, 81		SNF90, 91		SNF100, 101		SNF110, 111		SNF120, 121		SNF130, 131		SNF200, 201		SNF210, 211		SNF260, 261		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
I _L	R, S, J, or K INPUTS CLOCK INPUT PRESET INPUT CLEAR INPUT C _B or C _S INPUT	-1.33		-2.66		-1.33		-1.33		-1.33		-1.33		-1.33		-1.33		-1.33		-1.33		-1.33		-1.33		-1.33		-1.33		-1.33		-1.33		mA
I _H	R, S, J, or K INPUTS CLOCK INPUT PRESET INPUT CLEAR INPUT	100		100		150		100		100		100		100		100		100		100		100		100		100		100		100		100		μA
I _{PH}	R, S, J, or K INPUTS CLOCK INPUT PRESET INPUT CLEAR INPUT	1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		mA
V _{IH} min	V _I (applied)	2		2		2		2		2		2		2		2		2		2		2		2		2		2		2		2		V
V _{IH} max	V _O (measured)	1.7		1.7		1.7		1.7		1.7		1.7		1.7		1.7		1.7		1.7		1.7		1.7		1.7		1.7		1.7		1.7		V
V _{IL} max	V _O (measured)	1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		V
V _{OH}	V _{IH} = 2.8 V, V _{IL} = 0.45 V, I _{OH} = forced (as above)	2.8		2.8		2.8		2.8		2.8		2.8		2.8		2.8		2.8		2.8		2.8		2.8		2.8		2.8		2.8		2.8		V
V _{OL}	V _{IH} = 2.8 V, V _{IL} = 0.45 V, I _{OL} = forced (as above)	0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		0.4		V
I _{CC}	LOAD CIRCUIT A	30		30		30		30		30		30		30		30		30		30		30		30		30		30		30		30		mA
I _{PH}	LOAD CIRCUIT A	5		5		5		5		5		5		5		5		5		5		5		5		5		5		5		5		mA
I _{PLH}	LOAD CIRCUIT A	20		20		20		20		20		20		20		20		20		20		20		20		20		20		20		20		ns
I _{PLH}	LOAD CIRCUIT A	8		8		8		8		8		8		8		8		8		8		8		8		8		8		8		8		ns

† Specifications guaranteed at "ALL" temperatures are verified by measurements at T_A = -55°C, T_A = 25°C, and T_A = 125°C.

recommended operating conditions at T_A = 25°C

Parameter	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910	920	930	940	950	960	970	980	990	1000
Clock frequency	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910	920	930	940	950	960	970	980	990	1000
Width of clock pulse	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910	920	930	940	950	960	970	980	990	1000
Width of preset pulse	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910	920	930	940	950	960	970	980	990	1000
Width of clear pulse	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910	920	930	940	950	960	970	980	990	1000



- (1) T_A = 25°C only.
- (2) V_I = 0.2 V.
- (3) Outputs and preset are open, all other inputs are grounded.
When Q is grounded and all other inputs are open, I_{IH} = 4 mA maximum.
- (4) V_{IH} = 3 V.

12

