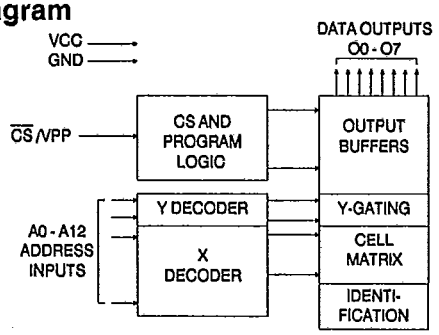
AT27HC641/2

T-46-13-29

Features

- Bipolar Speed
  - Read Access Time - 35ns
- Low Power CMOS Operation
  - 35 mA max. Standby
  - 75 mA Active at 10 MHz
- Direct Bipolar PROM Replacement
- High Output Drive Capability
- Reprogrammable - 4ms/byte (typical)
  - Tested 100% for Programmability
- JEDEC Approved Byte-Wide Pinout
  - 300 mil, 600 mil, DIP, or LCC packages
- CMOS and TTL Compatible Inputs and Outputs
- High Reliability Latch-Up Resistant CMOS Technology
- Integrated Product Identification Code
- Full Military, Commercial and Industrial Temperature Ranges

Block Diagram



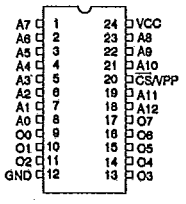
Description

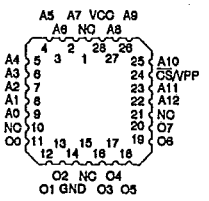
The AT27HC641/642 chip family is a high-speed, low-power 65,536 bit Ultraviolet Erasable and Electrically Programmable Read Only Memory (EPROM) organized 8K x 8. All require only one 5V power supply in normal read mode operation. All bytes on the 641 and 642 parts can be accessed in less than 35ns, making these parts compatible with high performance systems, without penalizing bit density or power consumption.

The 640 series chips come in a choice of JEDEC-approved 24-pin DIPs or 28-pad LCC packages, providing a direct power saving CMOS upgrade for systems originally using Bipolar PROMs. The AT27HC641 is available in standard 600 mil cerdip or plastic (OTP) and LCC packages, while the AT27HC642 provides a space-saving 300 mil cerdip or plastic (OTP) package.

Pin Configurations

Pin Name	Function
A0-A12	Addresses
$\overline{CS}$/V_{PP}	Chip Select/V_{PP}
O0-O7	Outputs





64K (8K x 8)
UV
Erasable
CMOS
PROM

5

Description (Continued)

Atmel's 1.5 micron, high speed CMOS technology provides optimum speed, low-power and high noise immunity. Power consumption on the AT27HC641 and AT27HC642 is typically only 50 mA in Active Mode and less than 20mA in Standby. The high speed CMOS process is an extension of Atmel's high quality and highly manufacturable floating poly EPROM technology. EPROM reprogrammability, which is fully tested before shipment, provides inherently better programmability and reliability than one-time fusable PROMs.

With a storage capacity of 8K bytes, Atmel's 640 series parts allow firmware to be stored reliably and to be accessed at bipolar PROM speeds. All the 640 series parts have exceptional output drive capability - source 4 mA and sink 16 mA per output.

Atmel's 640 series chips also have additional features to ensure high quality and efficient production use. The fast programming algorithm reduces the time required to program the chip and guarantees reliable programming. The Integrated Product Identification Code electronically identifies the device and manufacturing origin. This feature is used by industry standard programming equipment to select the proper programming algorithms and voltages.

Erasure Characteristics

The entire memory array of an Atmel 640 series chip is erased (all outputs read as V_{OH}) after exposure to ultraviolet light at a wavelength of 2537Å. Complete erasure is assured after a minimum of 20 minutes exposure using 12,000 $\mu W/cm^2$ intensity lamps spaced one inch away from the chip. Minimum erase time for lamps at other intensity ratings can be calculated from the minimum integrated erasure dose of $15 W \cdot sec/cm^2$. To prevent unintentional erasure, an opaque label is recommended to cover the clear window on any UV erasable EPROM which will be subjected to continuous fluorescent indoor lighting or sunlight.

Absolute Maximum Ratings*

Temperature Under Bias	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Voltage on Any Pin with Respect to Ground	-2.0V to +7.0V(1)
Voltage on A9 with Respect to Ground	-2.0V to +14.0V(1)
$\overline{CS}/V_{PP}$ Supply Voltage with Respect to Ground	-2.0V to +14.0V(1)
Integrated UV Erase Dose	7258 $W \cdot sec/cm^2$

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Notes:
1. Minimum voltage is -0.6V dc which may undershoot to -2.0V for pulses of less than 20ns. Maximum output pin voltage is V_{CC}+0.75V dc which may overshoot to +7.0V for pulses of less than 20ns.

Operating Modes

MODE \ PIN	$\overline{CS}/V_{PP}$	AI	V_{CC}	Outputs
Read	V_{IL}	AI	V_{CC}	D_{OUT}
Standby	V_{IH}	X(1)	V_{CC}	High Z
Fast Program(2)	V_{PP}	AI	V_{CC}	D_{IN}
PGM Verify	V_{IL}	AI	V_{CC}	D_{OUT}
Product Identification(4)	V_{IL}	A9 = V_H (3) A0 = V_{IH} or V_{IL} A1-A12 = V_{IL}	V_{CC}	Identification Code

Notes: 1. X can be V_{IL} or V_{IH}.
2. Refer to Programming characteristics.
3. V_H = 12.0 ± 0.5V.
4. Two identifier bytes may be selected. All AI inputs are held low (V_{IL}), except A9 which is set to V_H and A0 which is toggled low (V_{IL}) to select the Manufacturer's Identification byte and high (V_{IH}) to select the Device Code byte.

D.C. and A.C. Operating Conditions for Read Operation

		AT27HC641 / AT27HC642				
		-35	-45	-55	-70	-90
Operating Temperature (Case)	Com.	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C
	Ind.		-40°C - 85°C	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C
	Mil.		-55°C - 125°C	-55°C - 125°C	-55°C - 125°C	-55°C - 125°C
V_{CC} Power Supply		5V ± 5%	5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%

D.C. and Operating Characteristics for Read Operation

Symbol	Parameter	Condition		Min	Max	Units
I_{LI}	Input Load Current	V_{IN} = -0.1V to V_{CC} + 1V			10	µA
I_{LO}	Output Leakage Current	V_{OUT} = -0.1V to V_{CC} + 0.1V			10	µA
I_{PP1}	$\overline{CS}/V_{PP}$ (1) Read/Standby Current	$\overline{CS}/V_{PP}$ = -0.1V to V_{CC} + 1V			10	µA
I_{SB}	V_{CC} (1) Standby Current	I_{SB1} (CMOS) $\overline{CS}/V_{PP}$ = V_{CC}-0.3 to V_{CC} + 1.0V	Com.		35	mA
			Ind.,Mil.		40	mA
		I_{SB2} (TTL) $\overline{CS}/V_{PP}$ = 2.0 to V_{CC} + 1.0V	Com.		35	mA
			Ind.,Mil.		40	mA
I_{CC}	V_{CC} Active Current	f = 10MHz, I_{OUT} = 0mA, $\overline{CS}/V_{PP}$ = V_{IL}	Com.		75	mA
			Ind.,Mil.		90	mA
I_{OS} (2)	Output Short Circuit Current	V_{OUT} = 0V			-100	mA
V_{IL}	Input Low Voltage			-0.6	0.8	V
V_{IH}	Input High Voltage			2.0	V_{CC} + 1	V
V_{OL}	Output Low Voltage	I_{OL} = 16mA			.4	V
V_{OH}	Output High Voltage	I_{OH} = -100µA		V_{CC}-0.3		V
		I_{OH} = -4.0mA		2.4		V

Notes: 1. V_{CC} must be applied simultaneously or before $\overline{CS}/V_{PP}$, and removed simultaneously or after $\overline{CS}/V_{PP}$.

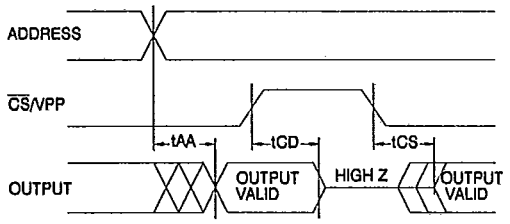
2. Not more than one output at a time should be shorted. Duration of short circuit test should not exceed 30 sec. This parameter is only sampled and is not 100% tested. See Absolute Maximum Ratings.

A.C. Characteristics for Read Operation

			AT27HC641 / AT27HC642										
			-35		-45		-55		-70		-90		
Symbol	Parameter		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Units
t_{AA} (4)	Address to Output Delay	Com.		35		45		55		70		90	ns
		Ind.,Mil				45		55		70		90	ns
t_{CS} (2,4)	$\overline{CS}/V_{PP}$ to Output Delay			25		30		35		45		55	ns
t_{CD} (3,4,5)	$\overline{CS}/V_{PP}$ to Output Float		0	25	0	30	0	35	0	40	0	45	ns

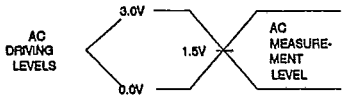
Notes: 2, 3, 4, 5. - see AC Waveforms for Read Operation.

A.C. Waveforms for Read Operation (1)



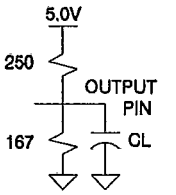
Notes:
1. Timing measurement reference is 1.5V. Input AC driving levels are 0.0V and 3.0V, unless otherwise specified.
2. Asserting $\overline{CS}/V_{PP}$ may be delayed up to $t_{AA} - t_{CS}$ after the address transition without impact on access time.
3. This parameter is only sampled and is not 100% tested.
4. C_L = 30pF, add 10ns for C_L = 100pF.
5. Output float is defined as the point when data is no longer driven.

Input Test Waveforms and Measurement Levels



t_R, t_F < 5ns (10% to 90%)

Output Test Load



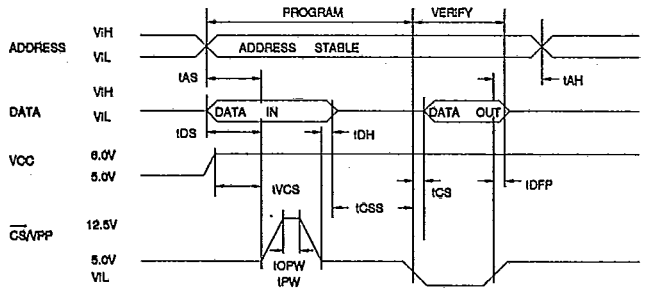
Note: C_L=30pF including jig capacitance.

Pin Capacitance (f = 1MHz T = 25°C) (1)

	Typ	Max	Units	Conditions
C_{IN}	4	6	pF	V_{IN} = 0V
C_{OUT}	8	12	pF	V_{OUT} = 0V

Notes: 1. Typical values for nominal supply voltage. This parameter is only sampled and is not 100% tested.

Programming Waveforms (1)



Notes:
1. The Input Timing References are 0.0V for V_{IL} and 3.0V for V_{IH}.
2. t_{CS} and t_{DFP} are characteristics of the device but must be accommodated by the programmer.

D.C. Programming Characteristics

T_A=25±5°C, V_{CC}=6.0±0.25V, $\overline{CS}/V_{PP}$=12.5±0.5V

Symbol	Parameter	Test Conditions	Limits Min	Max	Units
I_{LI}	Input Load Current	$V_{IN}=V_{IL},V_{IH}$		10	µA
V_{IL}	Input Low Level	(All Inputs)	-0.6	0.8	V
V_{IH}	Input High Level		2.0	V_{CC}+1	V
V_{OL}	Output Low Volt.	I_{OL}=16mA		.4	V
V_{OH}	Output High Volt.	I_{OH}=-4.0mA	2.4		V
I_{CC2}	V_{CC} Supply Current (Program and Verify)			80	mA
I_{PP2}	$\overline{CS}/V_{PP}$ Supply Current	$\overline{CS}/V_{PP}=V_{PP}$		30	mA
V_{ID}	A9 Product Identification Voltage		11.5	12.5	V

A.C. Programming Characteristics

T_A=25±5°C, V_{CC}=6.0±0.25V, $\overline{CS}/V_{PP}$=12.5±0.5V

Symbol	Parameter	Test Conditions* (see Note 1)	Limits Min	Max	Units
t_{AS}	Address Setup Time		2		µs
t_{CSS}	$\overline{CS}/V_{PP}$ Setup Time		2		µs
t_{DS}	Data Setup Time		2		µs
t_{AH}	Address Hold Time		0		µs
t_{DH}	Data Hold Time		2		µs
t_{DFP}	$\overline{CS}/V_{PP}$ High to Output Float Delay	(Note 2)	0	130	ns
t_{VCS}	V_{CC} Setup Time		2		µs
t_{PW}	$\overline{CS}/V_{PP}$ Initial Program Pulse Width	(Note 3)	0.95	1.05	ms
t_{OPW}	$\overline{CS}/V_{PP}$ Overprogram Pulse Width	(Note 4)	2.85	78.75	ms
t_{CS}	Data Valid from $\overline{CS}/V_{PP}$			70	ns

*A.C. Conditions of Test:

Input Rise and Fall Times (10% to 90%) 5ns
Input Pulse Levels ..... 0.0V to 3.0V
Input Timing Reference Level 1.5V
Output Timing Reference Level 1.5V

Notes:

1. V_{CC} must be applied simultaneously or before $\overline{CS}/V_{PP}$ and removed simultaneously or after $\overline{CS}/V_{PP}$.
2. This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven — see timing diagram.
3. Initial Program Pulse width tolerance is 1msec±5%.
4. The length of the overprogram pulse may vary from 2.85 msec to 78.75 msec as a function of the iteration counter value X.

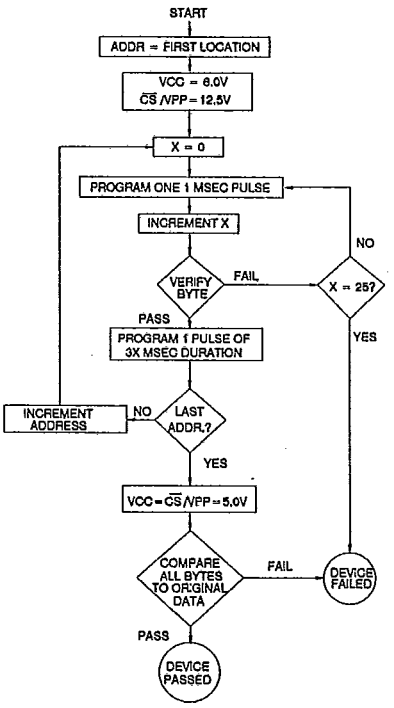
Atmel's 27HC641/2 Integrated Product Identification Code:

Codes	Pins A0	O7	O6	O5	O4	O3	O2	O1	O0	Hex Data
Manufacturer	0	0	0	0	1	1	1	1	1	1F
Device Type	1	0	0	0	1	0	0	0	0	10

Fast Programming Algorithm

Two 12.5V $\overline{CS}/V_{PP}$ pulse widths are used to program; initial and overprogram. Ai are set to address the desired byte. V_{CC} is raised to 6.0V. The first $\overline{CS}/V_{PP}$ pulse is 1ms. The programmed byte is then verified. If the byte programmed successfully, then an overprogram $\overline{CS}/V_{PP}$ pulse is applied for 3ms. If the byte fails to program after the first 1ms pulse, then up to 25 successive 1ms pulses are applied with a verification after each pulse. When the byte passes verification, the overprogram pulse width is 3X (times) the number of 1ms pulses required earlier (75ms max).

If the part fails to verify after 25 1ms pulses have been applied, it is considered as failed. After the first byte is programmed, the Ai are set to the next address repeating the algorithm until all required addresses are programmed. Then V_{CC} is lowered to 5.0V. All bytes subsequently are read to compare with the original data to determine if the device passes or fails.



5

Ordering Information

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
35	75	35	AT27HC641-35DC AT27HC642-35DC AT27HC641-35LC	24DW6 24DW3 28LW	Commercial (0°C to 70°C)
45	75	35	AT27HC641-45DC AT27HC642-45DC AT27HC641-45LC	24DW6 24DW3 28LW	Commercial (0°C to 70°C)
45	90	40	AT27HC641-45DI AT27HC642-45DI AT27HC641-45LI	24DW6 24DW3 28LW	Industrial (-40°C to 85°C)
			AT27HC641-45DM AT27HC642-45DM AT27HC641-45LM	24DW6 24DW3 28LW	Military (-55°C to 125°C)
			AT27HC641-45DM/883 AT27HC642-45DM/883 AT27HC641-45LM/883	24DW6 24DW3 28LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
55	75	35	AT27HC641-55DC AT27HC642-55DC AT27HC641-55LC AT27HC641-55PC AT27HC642-55PC	24DW6 24DW3 28LW 24P6 24P3	Commercial (0°C to 70°C)
55	90	40	AT27HC641-55DI AT27HC642-55DI AT27HC641-55LI AT27HC641-55PI AT27HC642-55PI	24DW6 24DW3 28LW 24P6 24P3	Industrial (-40°C to 85°C)
			AT27HC641-55DM AT27HC642-55DM AT27HC641-55LM	24DW6 24DW3 28LW	Military (-55°C to 125°C)
			AT27HC641-55DM/883 AT27HC642-55DM/883 AT27HC641-55LM/883	24DW6 24DW3 28LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
70	75	35	AT27HC641-70DC AT27HC642-70DC AT27HC641-70LC AT27HC641-70PC AT27HC642-70PC	24DW6 24DW3 28LW 24P6 24P3	Commercial (0°C to 70°C)
70	90	40	AT27HC641-70DI AT27HC642-70DI AT27HC641-70LI AT27HC641-70PI AT27HC642-70PI	24DW6 24DW3 28LW 24P6 24P3	Industrial (-40°C to 85°C)
			AT27HC641-70DM AT27HC642-70DM AT27HC641-70LM	24DW6 24DW3 28LW	Military (-55°C to 125°C)

Ordering Information

t_{ACC} (ns)	I_{CC} (mA) Active	I_{CC} (mA) Standby	Ordering Code	Package	Operation Range
70	90	40	AT27HC641-70DM/883 AT27HC642-70DM/883 AT27HC641-70LM/883	24DW6 24DW3 28LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
90	75	35	AT27HC641-90DC AT27HC642-90DC AT27HC641-90LC AT27HC641-90PC AT27HC642-90PC	24DW6 24DW3 28LW 24P6 24P3	Commercial (0°C to 70°C)
90	90	40	AT27HC641-90DI AT27HC642-90DI AT27HC641-90LI AT27HC641-90PI AT27HC642-90PI	24DW6 24DW3 28LW 24P6 24P3	Industrial (-40°C to 85°C)
			AT27HC641-90DM AT27HC642-90DM AT27HC641-90LM	24DW6 24DW3 28LW	Military (-55°C to 125°C)
			AT27HC641-90DM/883 AT27HC642-90DM/883 AT27HC641-90LM/883	24DW6 24DW3 28LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
45	90	40	5962-87515 01 JX 5962-87515 01 KX 5962-87515 01 LX 5962-87515 01 3X	24DW6 24FW 24DW3 28LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
55	90	40	5962-87515 02 JX 5962-87515 02 KX 5962-87515 02 LX 5962-87515 02 3X	24DW6 24FW 24DW3 24LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
70	90	40	5962-87515 03 JX 5962-87515 03 KX 5962-87515 03 LX 5962-87515 03 3X	24DW6 24FW 24DW3 28LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
90	90	40	5962-87515 04 JX 5962-87515 04 KX 5962-87515 04 LX 5962-87515 04 3X	24DW6 24FW 24DW3 28LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)

Package Type	
24DW3	24 Lead, 0.300" Wide, Windowed, Ceramic Dual Inline Package (Cerdip)
24DW6	24 Lead, 0.600" Wide, Windowed, Ceramic Dual Inline Package (Cerdip)
24FW	24 Lead, Windowed, Ceramic Bottom-Brazed Flat Package (Flatpack)
28LW	28 Pad, Windowed, Ceramic Leadless Chip Carrier (LCC)
24P3	24 Lead, 0.300" Wide, Plastic Dual Inline Package OTP (PDIP)
24P6	24 Lead, 0.600" Wide, Plastic Dual Inline Package OTP (PDIP)