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Features

- Fast Read Access Time - 90 ns
- Low Power CMOS Operation
  - 100 µA max. Standby
  - 40 mA max. Active at 5 MHz
- JEDEC Standard Packages
  - 32 Lead PLCC
  - 32-Lead 600-mil PDIP and Cerdip
  - 32-Lead 450-mil SOIC (SOP)
  - 32-Lead TSOP
- 5V ± 10% Supply
- High-Reliability CMOS Technology
  - 2,000V ESD Protection
  - 200 mA Latchup Immunity
- Rapid™ Programming Algorithm - 50 µs/byte (typical)
- CMOS and TTL Compatible Inputs and Outputs
- Integrated Product Identification Code
- Industrial and Commercial Temperature Ranges

8-Megabit (1M x 8) UV Erasable CMOS EPROM

AT27C080

Description

The AT27C080 chip is a low-power, high-performance 8,388,608-bit ultraviolet erasable programmable read only memory (EPROM) organized as 1M by 8 bits. The AT27C080 requires only one 5V power supply in normal read mode operation. Any byte can be accessed in less than 90 ns, eliminating the need for speed reducing WAIT states on high-performance microprocessor systems.

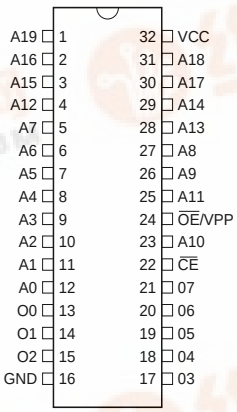
Atmel's scaled CMOS technology provides low active power consumption and fast programming. Power consumption is typically 10 mA in active mode and less than 10 µA in standby mode.

(continued)

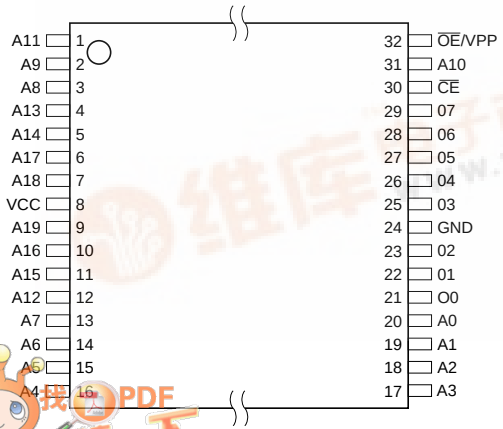
Pin Configurations

Pin Name	Function
A0 - A19	Addresses
O0 - O7	Outputs
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable

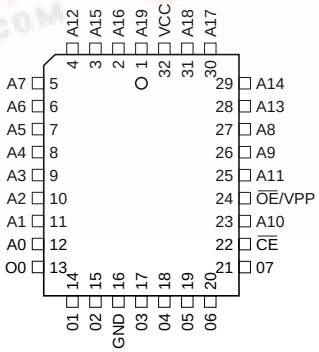
CDIP, PDIP, SOIC Top View



TSOP Top View
Type 1



PLCC Top View



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The AT27C080 is available in a choice of packages, including; one-time programmable (OTP) plastic PLCC, PDIP, SOIC (SOP), and TSOP, as well as windowed ceramic Cerdip. All devices feature two-line control ($\overline{CE}$, $\overline{OE}$) to give designers the flexibility to prevent bus contention.

With high density 1M byte storage capability, the AT27C080 allows firmware to be stored reliably and to be accessed by the system without the delays of mass storage media.

Atmel's 27C080 has additional features to ensure high quality and efficient production use. The Rapid™ Programming Algorithm reduces the time required to program the part and guarantees reliable programming. Programming time is typically only 50 µs/byte. The Integrated Product Identification Code electronically identifies the device and manufacturer. This feature is used by industry standard programming equipment to select the proper programming algorithms and voltages.

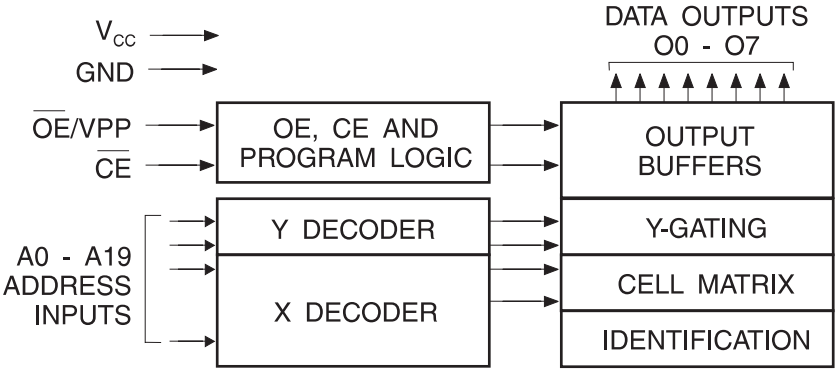
Erasure Characteristics

The entire memory array of the AT27C080 is erased (all outputs read as V_{OH}) after exposure to ultraviolet light at a wavelength of 2,537Å. Complete erasure is assured after a minimum of 20 minutes of exposure using 12,000 µW/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**.**sec/cm^2. To prevent unintentional erasure, an opaque label is recommended to cover the clear window on any UV erasable EPROM that will be subjected to continuous flourescent indoor lighting or sunlight.

System Considerations

Switching between active and standby conditions via the Chip Enable pin may produce transient voltage excursions. Unless accommodated by the system design, these transients may exceed data sheet limits, resulting in device non-conformance. At a minimum, a 0.1 µF high frequency, low inherent inductance, ceramic capacitor should be utilized for each device. This capacitor should be connected between the V_{CC} and Ground terminals of the device, as close to the device as possible. Additionally, to stabilize the supply voltage level on printed circuit boards with large EPROM arrays, a 4.7 µF bulk electrolytic capacitor should be utilized, again connected between the V_{CC} and Ground terminals. This capacitor should be positioned as close as possible to the point where the power supply is connected to the array.

Block Diagram



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)
V_{PP} Supply Voltage with Respect to Ground	-2.0V to +14.0V(1)
Integrated UV Erase Dose	7258 W•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.

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

Operating Modes

Mode/Pin	$\overline{CE}$	$\overline{OE}/V_{PP}$	Ai	Outputs
Read	V_{IL}	V_{IL}	Ai	D_{OUT}
Output Disable	X	V_{IH}	X(1)	High Z
Standby	V_{IH}	X	X	High Z
Rapid Program(2)	V_{IL}	V_{PP}	Ai	D_{IN}
PGM Verify	V_{IL}	V_{IL}	Ai	D_{OUT}
PGM Inhibit	V_{IH}	V_{PP}	X	High Z
Product Identification(4)	V_{IL}	V_{IL}	A9 = V_H(3) A0 = V_{IH} or V_{IL} A1 - A19 = V_{IL}	Identification Code

Notes: 1. X can be V_{IL} or V_{IH}.
2. Refer to Programming Characteristics.
3. $V_H = 12.0 \pm 0.5$V.
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.

DC and AC Operating Conditions for Read Operation

		AT27C080			
		-90	-10	-12	-15
Operating Temperature (Case)	Com.	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
V_{CC} Power Supply		5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%

DC and Operating Characteristics for Read Operation

Symbol	Parameter	Condition	Min	Max	Units
I_{LI}	Input Load Current	V_{IN} = 0V to V_{CC} (Com., Ind.)		±1.0	µA
I_{LO}	Output Leakage Current	V_{OUT} = 0V to V_{CC} (Com., Ind.)		±5.0	µA
I_{SB}	V_{CC}[1] Standby Current	I_{SB1} (CMOS), $\overline{CE}$ = V_{CC} ± 0.3V		100	µA
		I_{SB2} (TTL), $\overline{CE}$ = 2.0 to V_{CC} + 0.5V		1.0	mA
I_{CC}	V_{CC} Active Current	f = 5 MHz, I_{OUT} = 0 mA, $\overline{CE}$ = V_{IL}		40	mA
V_{IL}	Input Low Voltage		-0.6	0.8	V
V_{IH}	Input High Voltage		2.0	V_{CC} + 0.5	V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA		0.4	V
V_{OH}	Output High Voltage	I_{OH} = -400 µA	2.4		V

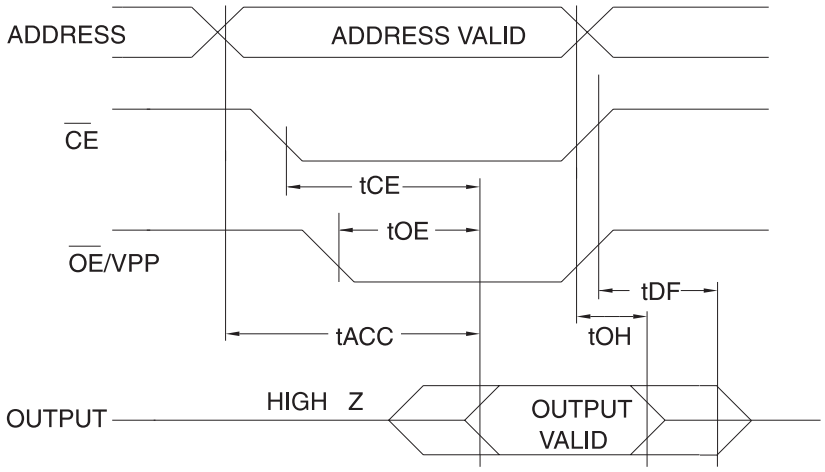
Note: 1. V_{CC} must be applied simultaneously or before $\overline{OE}$/ V_{PP}, and removed simultaneously or after $\overline{OE}$/V_{PP}.

AC Characteristics for Read Operation

			AT27C080								
			-90		-10		-12		-15		
Symbol	Parameter	Condition	Min	Max	Min	Max	Min	Max	Min	Max	Units
t_{ACC}[4]	Address to Output Delay	$\overline{CE}$ = $\overline{OE}$/V_{PP} = V_{IL}		90		100		120		150	ns
t_{CE}[3]	$\overline{CE}$ to Output Delay	$\overline{OE}$ = V_{IL}		90		100		120		150	ns
t_{OE}[3][4]	$\overline{OE}$ to Output Delay	$\overline{CE}$ = V_{IL}		20		20		30		35	ns
t_{DF}[2][5]	$\overline{OE}$ or $\overline{CE}$ High to Output Float, whichever occurred first			30		30		35		40	ns
t_{OH}	Output Hold from Address, $\overline{CE}$ or $\overline{OE}$/V_{PP} whichever occurred first		0		0		0		0		ns

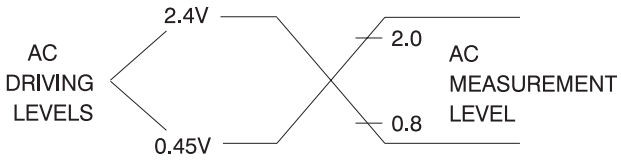
Note: 2, 3, 4, 5. See AC Waveforms for Read Operation.

AC Waveforms for Read Operation(1)



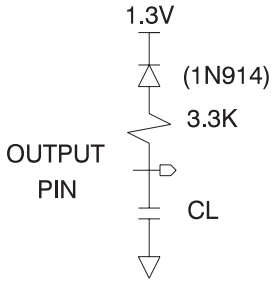
Notes:
1. Timing measurement references are 0.8V and 2.0V. Input AC drive levels are 0.45V and 2.4V, unless otherwise specified.
2. t_{DF} is specified form OE/VPP or CE, whichever occurs first. Output float is defined as the point when data is no longer driven.
3. $\overline{OE}/V_{PP}$ may be delayed up to t_{CE} - t_{OE} after the falling edge of $\overline{CE}$ without impact on $t_{CE.}$
4. $\overline{OE}/V_{PP}$ may be delayed up to t_{ACC}- t_{OE} after the address is valid without impact on t_{ACC}.
5. This parameter is only sampled and is not 100% tested.

Input Test Waveform and Measurement Levels



t_R, t_F < 20 ns (10% to 90%)

Output Test Load



Note: 1. CL = 100 pF including jig capacitance.

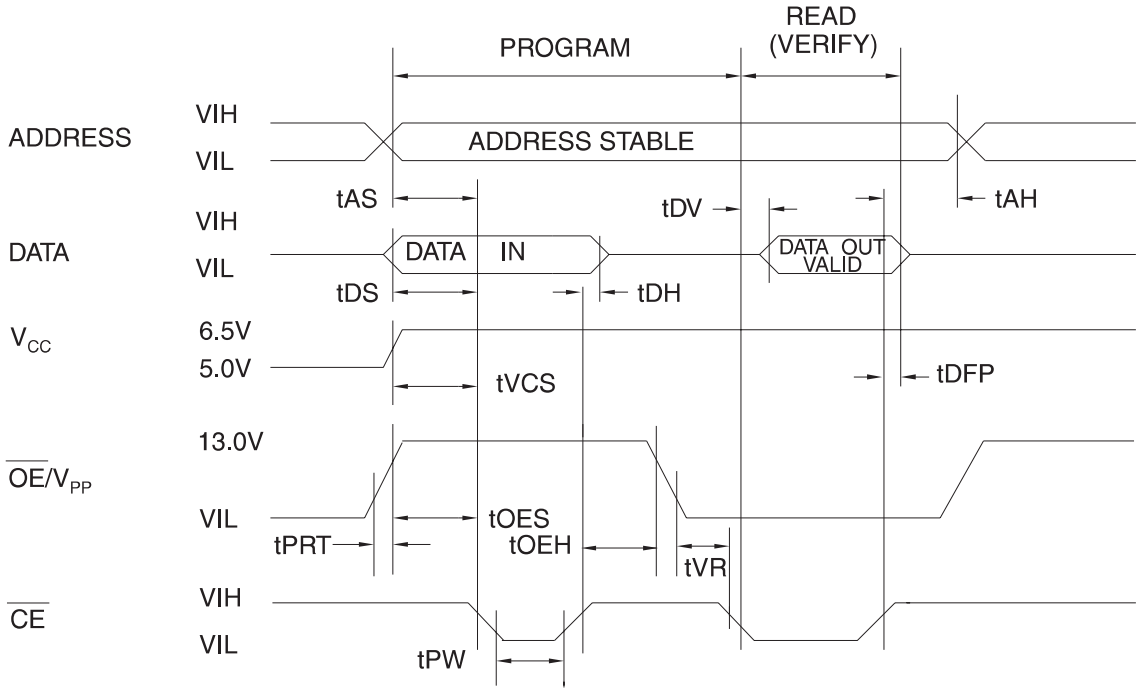
Pin Capacitance

f = 1 MHz, T = 25°C(1)

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

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

Programming Waveforms



Notes: 1. The Input Timing reference is 0.8V for V_{IL} and 2.0V for V_{IH}.

2. t_{OE} and t_{DFP} are characteristics of the device but must be accommodated by the programmer.

DC Programming Characteristics

T_A = 25 ± 5°C, V_{CC} = 6.5 ± 0.25V, $\overline{OE}/V_{PP}$ = 13.0 ± 0.25V

Symbol	Parameter	Test Conditions	Limits		Units
			Min	Max	
I_{LI}	Input Load Current	$V_{IN} = V_{IL}, V_{IH}$		±10	µA
V_{IL}	Input Low Level		-0.6	0.8	V
V_{IH}	Input High Level		2.0	V_{CC} + 1.0	V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA		0.4	V
V_{OH}	Output High Voltage	I_{OH} = -400 µA	2.4		V
I_{CC2}	V_{CC} Supply Current (Program and Verify)			40	mA
I_{PP2}	$\overline{OE}/V_{PP}$ Supply Current	$\overline{CE} = V_{IL}$		25	mA
V_{ID}	A9 Product Identification Voltage		11.5	12.5	V

AC Programming Characteristics

T_A = 25 ± 5°C, V_{CC} = 6.5 ± 0.25V, $\overline{OE}/V_{PP}$ = 13.0 ± 0.25V

Symbol	Parameter	Test Conditions[1]	Limits		Units
			Min	Max	
t_{AS}	Address Setup Time	Input Rise and Fall Times: (10% to 90%) 20 ns. Input Pulse Levels: 0.45V to 2.4V Input Timing Reference Level: 0.8V to 2.0V Output Timing Reference Level: 0.8V to 2.0V	2.0		µs
t_{OES}	$\overline{OE}/V_{PP}$ Setup Time		2.0		µs
t_{OEH}	$\overline{OE}/V_{PP}$ Hold Time		2.0		µs
t_{DS}	Data SetupTime		2.0		µs
t_{AH}	Address Hold Time		0.0		µs
t_{DH}	Data Hold Time		2.0		µs
t_{DFP}	$\overline{CE}$ High to Output Float Delay[2]		0.0	130	ns
t_{VCS}	V_{CC} Setup Time		2.0		µs
t_{PW}	$\overline{CE}$ Program Pulse Width[3]		47.5	52.5	µs
t_{DV}	Data Valid from $\overline{CE}$			1.0	µs
t_{VR}	$\overline{OE}/V_{PP}$ Recovery Time		2.0		ns
t_{PRT}	$\overline{OE}/V_{PP}$ Pulse Rise Time During Programming		50		ns

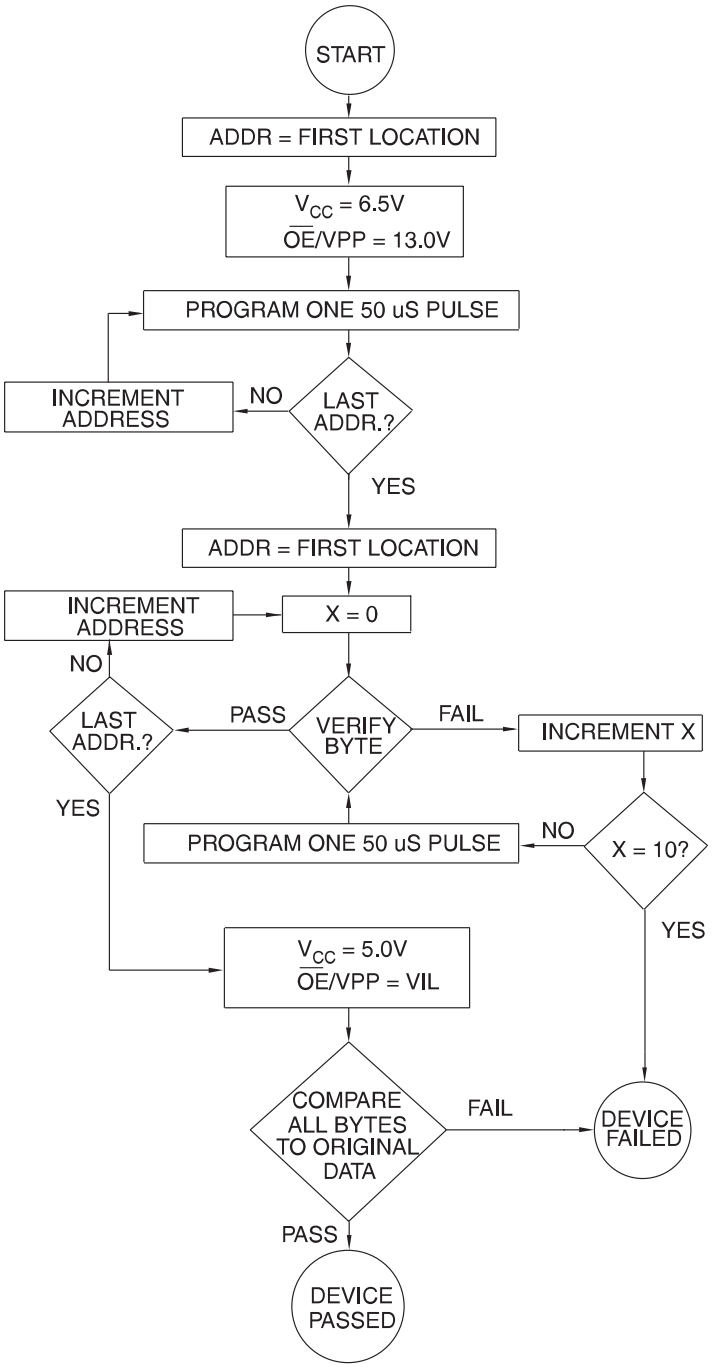
Notes:
1. V_{CC} must be applied simultaneously or before $\overline{OE}/V_{PP}$ and removed simultaneously or after $\overline{OE}/V_{PP}$.
2. This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven—see timing diagram.
3. Program Pulse width tolerance is 50 µs ± 5%.

Atmel's 27C080 Integrated Product Identification Code

	Pins									
Codes	A0	O7	O6	O5	O4	O3	O2	O1	O0	**Hex Data**
Manufacturer	0	0	0	0	1	1	1	1	0	1E
Device Type	1	1	0	0	0	1	0	1	0	8A

Rapid Programming Algorithm

A 50 µs $\overline{CE}$ pulse width is used to program. The address is set to the first location. V_{CC} is raised to 6.5V and $\overline{OE}/V_{PP}$ is raised to 13.0V. Each address is first programmed with one 50 µs $\overline{CE}$ pulse without verification. Then a verification reprogramming loop is executed for each address. In the event a byte fails to pass verification, up to 10 successive 50 µs pulses are applied with a verification after each pulse. If the byte fails to verify after 10 pulses have been applied, the part is considered failed. After the byte verifies properly, the next address is selected until all have been checked. $\overline{OE}/V_{PP}$ is then lowered to V_{IL} and V_{CC} to 5.0V. All bytes are read again and compared with the original data to determine if the device passes or fails.



Ordering Information

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
90	40	0.1	AT27C080-90DC AT27C080-90JC AT27C080-90PC AT27C080-90RC AT27C080-90TC	32DW6 32J 32P6 32R 32T	Commercial (0°C to 70°C)
	40	0.1	AT27C080-90DI AT27C080-90JI AT27C080-90PI AT27C080-90RI AT27C080-90TI	32DW6 32J 32P6 32R 32T	Industrial (-40°C to 85°C)
100	40	0.1	AT27C080-10DC AT27C080-10JC AT27C080-10PC AT27C080-10RC AT27C080-10TC	32DW6 32J 32P6 32R 32T	Commercial (0°C to 70°C)
	40	0.1	AT27C080-10DI AT27C080-10JI AT27C080-10PI AT27C080-10RI AT27C080-10TI	32DW6 32J 32P6 32R 32T	Industrial (-40°C to 85°C)

(continued)

Package Type	
32DW6	32-Lead, 0.600" Windowed, Ceramic Dual Inline Package (Cerdip)
32J	32-Lead,Plastic J-Leaded Chip Carrier (PLCC)
32P6	32-Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)
32R	32-Lead, 0.450" Wide, Plastic Gull Wing Small Outline (SOIC)
32T	32-Lead, Plastic Thin Small Outline Package (TSOP)

Ordering Information (Continued)

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
120	40	0.1	AT27C080-12DC AT27C080-12JC AT27C080-12PC AT27C080-12RC AT27C080-12TC	32DW6 32J 32P6 32R 32T	Commercial (0°C to 70°C)
	40	0.1	AT27C080-12DI AT27C080-12JI AT27C080-12PI AT27C080-12RI AT27C080-12TI	32DW6 32J 32P6 32R 32T	Industrial (-40°C to 85°C)
150	40	0.1	AT27C080-15DC AT27C080-15JC AT27C080-15PC AT27C080-15RC AT27C080-15TC	32DW6 32J 32P6 32R 32T	Commercial (0°C to 70°C)
	40	0.1	AT27C080-15DI AT27C080-15JI AT27C080-15PI AT27C080-15RI AT27C080-15TI	32DW6 32J 32P6 32R 32T	Industrial (-40°C to 85°C)

Package Type	
32DW6	32-Lead, 0.600" Windowed, Ceramic Dual Inline Package (Cerdip)
32J	32-Lead,Plastic J-Leaded Chip Carrier (PLCC)
32P6	32-Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)
32R	32-Lead, 0.450" Wide, Plastic Gull Wing Small Outline (SOIC)
32T	32-Lead, Plastic Thin Small Outline Package (TSOP)