Features

- **Fast Read Access Time - 70 ns**
- **Dual Voltage Range Operation**
  - **Low Voltage Power Supply Range, 3.0V to 3.6V or Standard 5V ± 10% Supply Range**
- **Compatible with JEDEC Standard AT27C512R**
- **Low Power CMOS Operation**
  - **20 µA max. (less than 1 µA typical) Standby for V_{CC} = 3.6V**
  - **29 mW max. Active at 5 MHz for V_{CC} = 3.6V**
- **JEDEC Standard Packages**
  - **32-Lead PLCC**
  - **28-Lead 330-mil SOIC**
  - **28-Lead TSOP**
- **High Reliability CMOS Technology**
  - **2,000V ESD Protection**
  - **200 mA Latchup Immunity**
- **Rapid™ Programming Algorithm - 100 µs/byte (typical)**
- **CMOS and TTL Compatible Inputs and Outputs**
  - **JEDEC Standard for LVTTL**
- **Integrated Product Identification Code**
- **Commercial and Industrial Temperature Ranges**

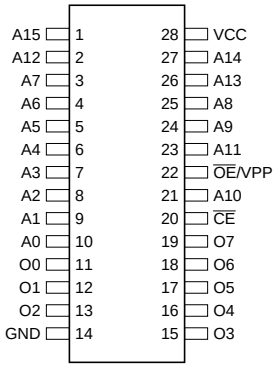
Description

The AT27LV512A is a high performance, low power, low voltage 524,288-bit one-time programmable read only memory (OTP EPROM) organized as 64K by 8 bits. It requires only one supply in the range of 3.0V to 3.6V in normal read mode operation, making it ideal for fast, portable systems using battery power. *(continued)*

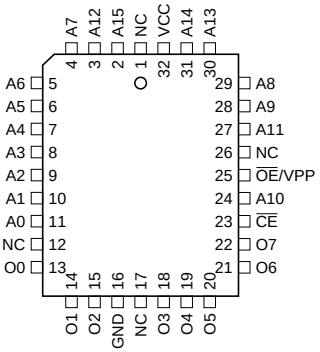
Pin Configurations

Pin Name	Function
A0 - A15	Addresses
O0 - O7	Outputs
$\overline{CE}$	Chip Enable
$\overline{OE}$/VPP	Output Enable/ Program Supply
NC	No Connect

SOIC Top View



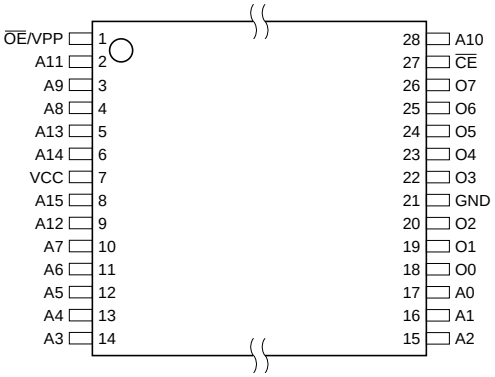
PLCC Top View



Note: PLCC Package Pins 1 and 17 are DON'T CONNECT.

TSOP Top View

Type 1



512K (64K x 8) Low Voltage OTP EPROM

AT27LV512A

Rev. 0607B–10/98

Atmel's innovative design techniques provide fast speeds that rival 5V parts while keeping the low power consumption of a 3.3V supply. At V_{CC} = 3.0V, any byte can be accessed in less than 70 ns. With a typical power dissipation of only 18 mW at 5 MHz and V_{CC} = 3.3V, the AT27LV512A consumes less than one fifth the power of a standard 5V EPROM.

Standby mode supply current is typically less than 1 µA at 3.3V.

The AT27LV512A is available in industry standard JEDEC-approved one-time programmable (OTP) plastic PLCC, SOIC, and TSOP packages. All devices feature two-line control ($\overline{CE}$, $\overline{OE}$) to give designers the flexibility to prevent bus contention.

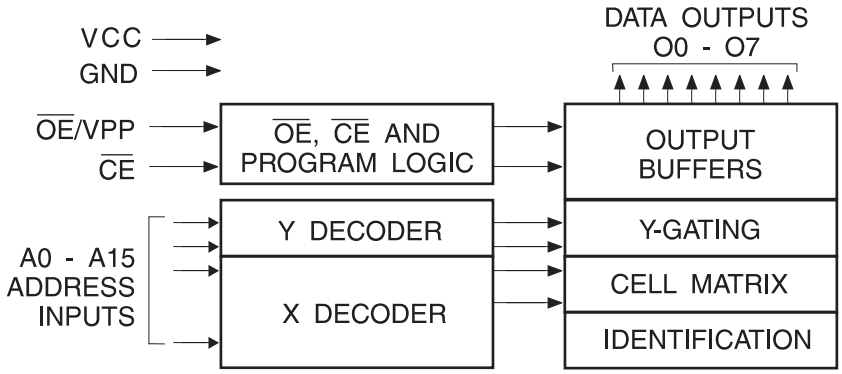
The AT27LV512A operating with V_{CC} at 3.0V produces TTL level outputs that are compatible with standard TTL logic devices operating at V_{CC} = 5.0V. The device is also capable of standard 5-volt operation making it ideally suited for dual supply range systems or card products that are pluggable in both 3-volt and 5-volt hosts.

Atmel's AT27LV512A 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 100 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. The AT27LV512A programs exactly the same way as a standard 5V AT27C512R and uses the same programming equipment.

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	-40°C to +85°C
Storage Temperature	-65°C to +125°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)

*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 be exceeded if certain precautions are observed (consult application notes) and which may overshoot to +7.0 volts for pulses of less than 20 ns.

Operating Modes

Mode \ Pin	$\overline{CE}$	$\overline{OE}/V_{PP}$	Ai	V_{CC}	Outputs
Read(2)	V_{IL}	V_{IL}	Ai	V_{CC}(2)	D_{OUT}
Output Disable(2)	V_{IL}	V_{IH}	X(1)	V_{CC}(2)	High Z
Standby(2)	V_{IH}	X	X	V_{CC}(2)	High Z
Rapid Program(3)	V_{IL}	V_{PP}	Ai	V_{CC}(3)	D_{IN}
PGM Inhibit(3)	V_{IH}	V_{PP}	X	V_{CC}(3)	High Z
Product Identification(3)(5)	V_{IL}	V_{IL}	A9 = V_H(4) A0 = V_{IH} or V_{IL} A1 - A15 = V_{IL}	V_{CC}(3)	Identification Code

Notes:
1. X can be V_{IL} or V_{IH}.
2. Read, output disable, and standby modes require, $3.0V \le V_{CC} \le 3.6V$, or $4.5V \le V_{CC} \le 5.5V$.
3. Refer to Programming Characteristics. Programming modes require V_{CC} = 6.5V.
4. $V_H = 12.0 \pm 0.5V$.
5. 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

		AT27LV512A			
		-70	-90	-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		3.0V to 3.6V	3.0V to 3.6V	3.0V to 3.6V	3.0V to 3.6V
		5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%

DC and Operating Characteristics for Read Operation

Symbol	Parameter	Condition	Min	Max	Units
V_{CC} = 3.0V to 3.6V					
I_{LI}	Input Load Current	V_{IN} = 0V to V_{CC}		±1	µA
I_{LO}	Output Leakage Current	V_{OUT} = 0V to V_{CC}		±5	µA
I_{PP1}[2]	V_{PP}[1] Read/Standby Current	V_{PP} = V_{CC}		10	µA
I_{SB}	V_{CC}[1] Standby Current	I_{SB1} (CMOS), $\overline{CE}$ = V_{CC} ± 0.3V		20	µA
		I_{SB2} (TTL), $\overline{CE}$ = 2.0 to V_{CC} + 0.5V		100	µA
I_{CC}	V_{CC} Active Current	f = 5 MHz, I_{OUT} = 0 mA, $\overline{CE}$ = V_{IL}		8	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} = 2.0 mA		0.4	V
V_{OH}	Output High Voltage	I_{OH} = -2.0 mA	2.4		V
V_{CC} = 4.5V to 5.5V					
I_{LI}	Input Load Current	V_{IN} = 0V to V_{CC}		±1	µA
I_{LO}	Output Leakage Current	V_{OUT} = 0V to V_{CC}		±5	µA
I_{PP1}[2]	V_{PP}[1] Read/Standby Current	V_{PP} = V_{CC}		10	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	mA
I_{CC}	V_{CC} Active Current	f = 5 MHz, I_{OUT} = 0 mA, $\overline{CE}$ = V_{IL}		20	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

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

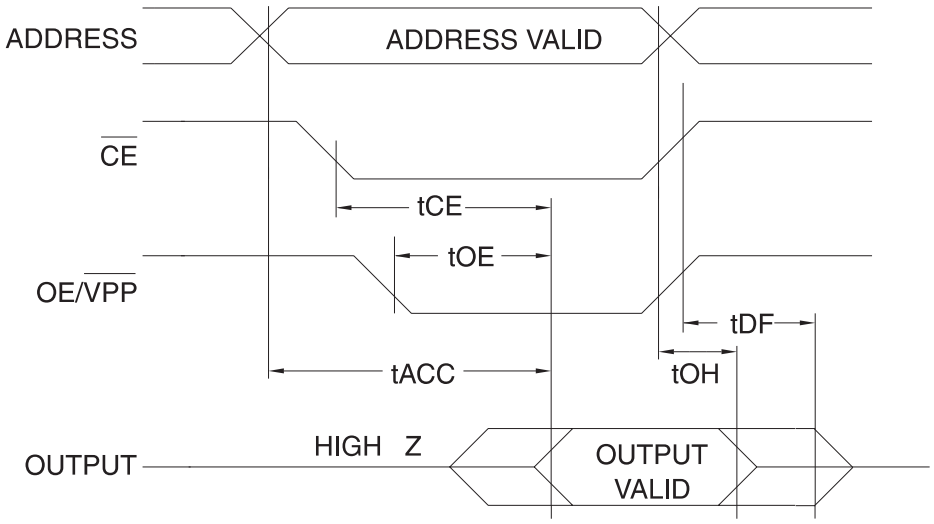
2. $\overline{OE}/V_{PP}$ may be connected directly to V_{CC}, except during programming. The supply current would then be the sum of I_{CC} and I_{PP}

AC Characteristics for Read Operation

V_{CC} = 3.0V to 3.6V and 4.5V to 5.5V

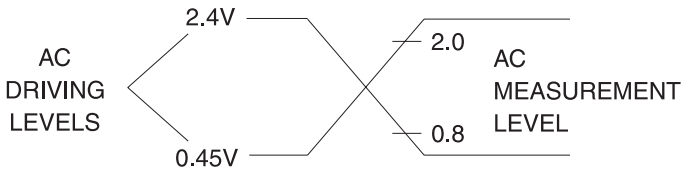
Symbol	Parameter	Condition	AT27LV512A								Units
			-70		-90		-12		-15		
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{ACC}[3]	Address to Output Delay	$\overline{CE}$ = $\overline{OE}/V_{PP}$ = V_{IL}		70		90		120		150	ns
t_{CE}[2]	$\overline{CE}$ to Output Delay	$\overline{OE}/V_{PP}$ = V_{IL}		70		90		120		150	ns
t_{OE}[2][3]	$\overline{OE}/V_{PP}$ to Output Delay	$\overline{CE}$ = V_{IL}		40		50		50		60	ns
t_{DF}[4][5]	$\overline{OE}/V_{PP}$ or $\overline{CE}$ High to Output Float, whichever occurred first			35		40		40		50	ns
t_{OH}	Output Hold from Address, $\overline{CE}$ or $\overline{OE}/V_{PP}$, whichever occurred first		0		0		0		0		ns

AC Waveforms for Read Operation[1]



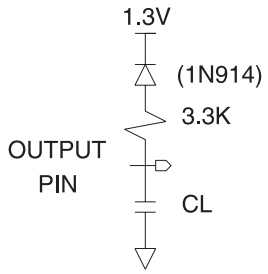
Notes:
1. Timing measurement references are 0.8V and 2.0V. Input AC drive levels are 0.45V and 2.4V, unless otherwise specified.
2. $\overline{OE}/V_{PP}$ may be delayed up to t_{CE} - t_{OE} after the falling edge of $\overline{CE}$ without impact on t_{CE}.
3. $\overline{OE}/V_{PP}$ may be delayed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

Input Test Waveforms and Measurement Levels



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

Output Test Load



Note: CL = 100 pF including jig capacitance.

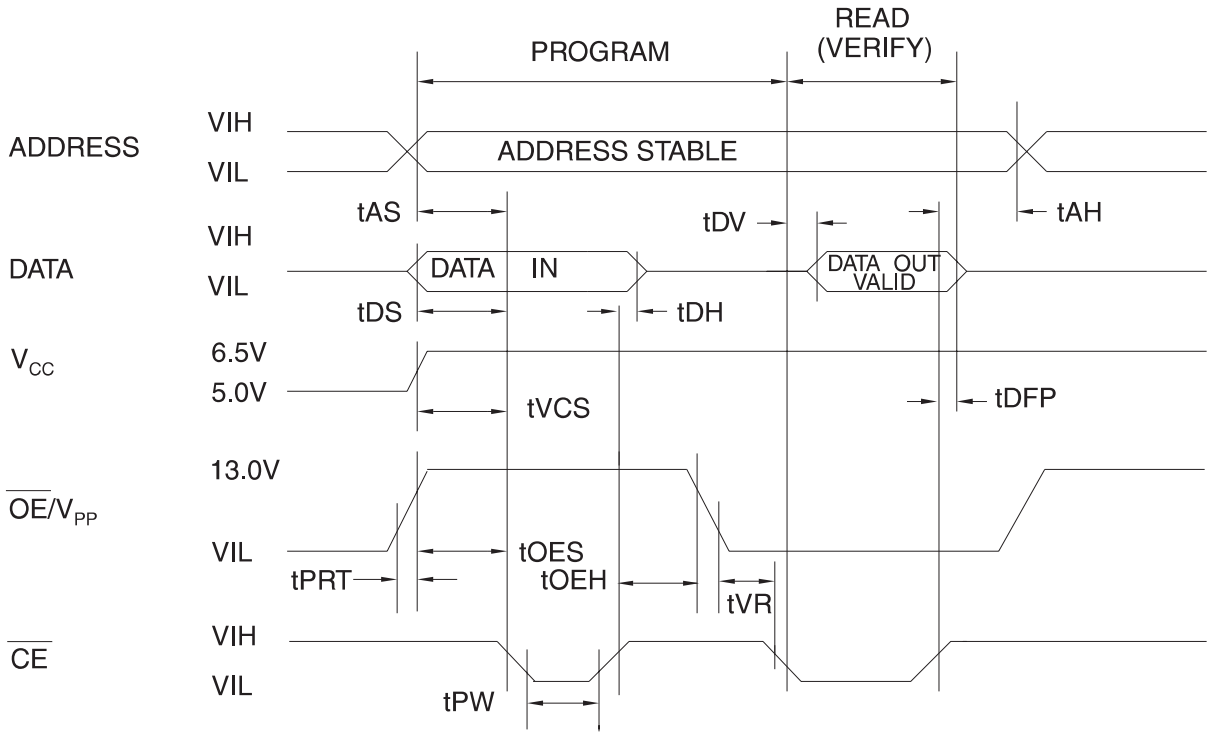
Pin Capacitance

f = 1 MHz, T = 25°C[1]

Symbol	Typ	Max	Units	Conditions
C_{IN}	4	6	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[1]



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

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

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} + 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
I_{CC2}	V_{CC} Supply Current (Program and Verify)			25	mA
I_{PP2}	$\overline{OE}/V_{PP}$ Current	$\overline{CE} = V_{IL}$		25	mA
V_{ID}	A9 Product Identification Voltage		11.5	12.5	V

AC Programming Characteristics

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

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		µs
t_{OES}	$\overline{OE}/V_{PP}$ Setup Time		2		µs
t_{OEH}	$\overline{OE}/V_{PP}$ Hold 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}	$\overline{CE}$ High to Output Float Delay[2]		0	130	ns
t_{VCS}	V_{CC} Setup Time		2		µs
t_{PW}	$\overline{CE}$ Program Pulse Width[3]		95	105	µs
t_{DV}	Data Valid from $\overline{CE}$[2]			1	µs
t_{VR}	$\overline{OE}/V_{PP}$ Recovery Time		2		µs
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 100 µsec ± 5%.

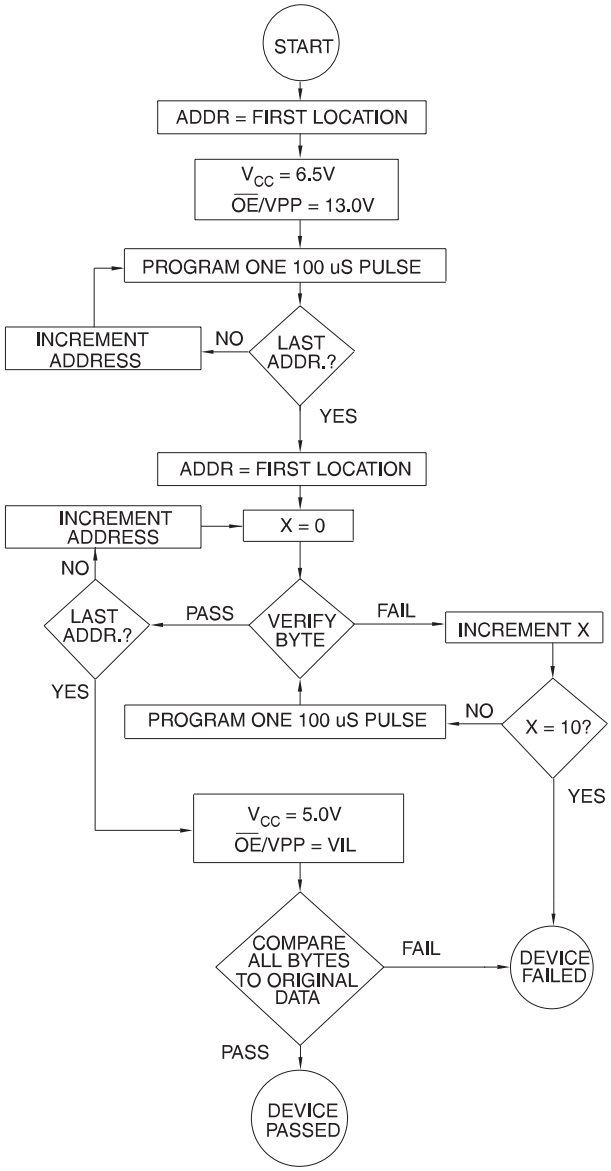
Atmel's 27LV512A Integrated Product Identification Code[1]

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

Note: 1. The AT27LV512A has the same Product Identification Code as the AT27C512R. Both are programming compatible.

Rapid Programming Algorithm

A 100 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 100 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 100 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.



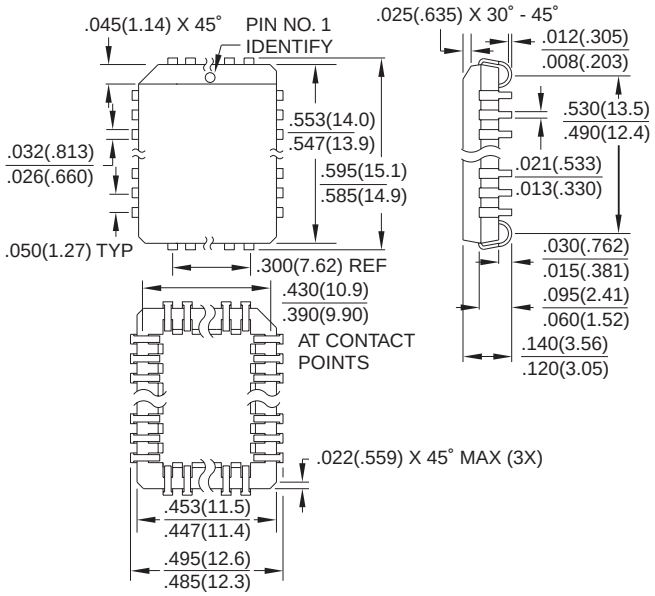
Ordering Information

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
70	8	0.02	AT27LV512A-70JC AT27LV512A-70RC AT27LV512A-70TC	32J 28R 28T	Commercial (0°C to 70°C)
	8	0.02	AT27LV512A-70JI AT27LV512A-70RI AT27LV512A-70TI	32J 28R 28T	Industrial (-40°C to 85°C)
90	8	0.02	AT27LV512A-90JC AT27LV512A-90RC AT27LV512A-90TC	32J 28R 28T	Commercial (0°C to 70°C)
	8	0.02	AT27LV512A-90JI AT27LV512A-90RI AT27LV512A-90TI	32J 28R 28T	Industrial (-40°C to 85°C)
120	8	0.02	AT27LV512A-12JC AT27LV512A-12RC AT27LV512A-12TC	32J 28R 28T	Commercial (0°C to 70°C)
	8	0.02	AT27LV512A-12JI AT27LV512A-12RI AT27LV512A-12TI	32J 28R 28T	Industrial (-40°C to 85°C)
150	8	0.02	AT27LV512A-15JC AT27LV512A-15RC AT27LV512A-15TC	32J 28R 28T	Commercial (0°C to 70°C)
	8	0.02	AT27LV512A-15JI AT27LV512A-15RI AT27LV512A-15TI	32J 28R 28T	Industrial (-40°C to 85°C)

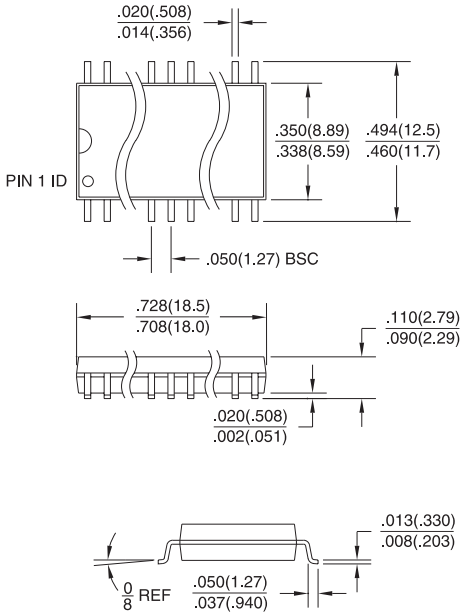
Package Type	
32J	32-Lead, Plastic J-Leaded Chip Carrier (PLCC)
28R	28-Lead, 0.330" Wide, Plastic Gull Wing Small Outline (SOIC)
28T	28-Lead, Thin Small Outline Package (TSOP)

Packaging Information

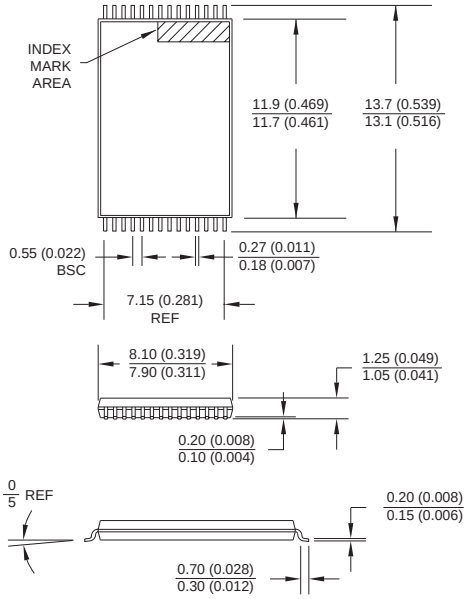
32J, 32-Lead, Plastic J-Leaded Chip Carrier (PLCC)
Dimensions in Inches and (Millimeters)
JEDEC STANDARD MS-016 AE



28R, 28-Lead, 0.330" Wide, Plastic Gull Wing Small Outline (SOIC)
Dimensions in Inches and (Millimeters)



28T, 28-Lead, Plastic Thin Small Outline Package (TSOP)
Dimensions in Millimeters and (Inches)*



*Controlling dimension: millimeters

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