Features

- Fast Read Access Time 45 ns
- Low-Power CMOS Operation
 - 100 µA max. Standby
 - 20 mA max. Active at 5 MHz
- JEDEC Standard Packages
 - 28-Lead 600-mil PDIP
 - 32-Lead PLCC
 - 28-Lead TSOP and SOIC
- 5V ± 10% Supply
- . 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
- Integrated Product Identification Code
- Commercial, Industrial and Automotive Temperature Ranges

Description

The AT27C256R is a low-power, high-performance 262,144-bit one-time programmable read only memory (OTP EPROM) organized 32K by 8 bits. It requires only one 5V power supply in normal read mode operation. Any byte can be accessed in less than 45 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 only 8 mA in Active Mode and less than 10 μ A in Standby.

(continued)

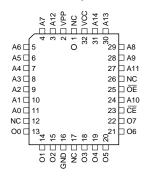
Pin Configurations

Pin Name	Function			
A0 - A14	Addresses			
O0 - O7	Outputs			
CE	Chip Enable			
ŌĒ	Output Enable			
NC	No Connect			

PDIP, SOIC Top View

		,	l
VPP □	1	28	□ vcc
A12 □	2	27	□ A14
A7 □	3	26	□ A13
A6 □	4	25	□ A8
A5 □	5	24	□ A9
A4 □	6	23	□ A11
A3 □	7	22	□ Œ
A2 □	8	21	□ A10
A1 □	9	20	□ CE
A0 □	10	19	07
O0 [11	18	□ 06
01 🗆	12	17	□ 05
02 □	13	16	□ 04
GND □	14	15	□ 03

PLCC Top View

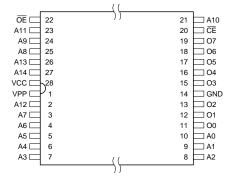


Note:

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

TSOP Top View







256K (32K x 8) OTP EPROM

AT27C256R

Rev. 0014H-07/98





The AT27C256R is available in a choice of industry standard JEDEC-approved one time programmable (OTP) plastic DIP, PLCC, SOIC, and TSOP packages. All devices feature two-line control (\overline{CE} , \overline{OE}) to give designers the flexibility to prevent bus contention.

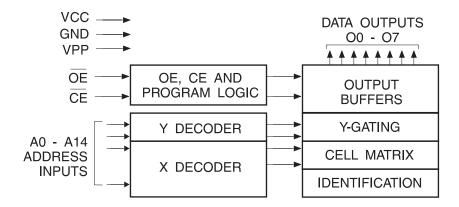
With 32K byte storage capability, the AT27C256R allows firmware to be stored reliably and to be accessed by the system without the delays of mass storage media.

Atmel's 27C256R 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.

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 Bias55°C to +125°C
Storage Temperature65°C to +150°C
Voltage on Any Pin with Respect to Ground2.0V to +7.0V ⁽¹⁾
Voltage on A9 with Respect to Ground2.0V to +14.0V ⁽¹⁾
V _{PP} Supply Voltage with Respect to Ground2.0V 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:

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 +7.0 volts for pulses of less than 20 ns.

Operating Modes

Mode\Pin	CE	ŌĒ	Ai	V_{PP}	Outputs
Read	V _{IL}	V _{IL}	Ai	V _{CC}	D _{OUT}
Output Disable	V _{IL}	V _{IH}	X ⁽¹⁾	V_{CC}	High Z
Standby	V _{IH}	X ⁽¹⁾	X ⁽¹⁾	V_{CC}	High Z
Rapid Program ⁽²⁾	V _{IL}	V _{IH}	Ai	V_{PP}	D _{IN}
PGM Verify ⁽²⁾	X ⁽¹⁾	V _{IL}	Ai	V_{PP}	D _{OUT}
Optional PGM Verify ⁽²⁾	V _{IL}	V _{IL}	Ai	V_{CC}	D _{OUT}
PGM Inhibit ⁽²⁾	V _{IH}	V _{IH}	X ⁽¹⁾	V_{PP}	High Z
Product Identification ⁽⁴⁾	V _{IL}	V _{IL}	$A9 = V_{H}^{(3)}$ $A0 = V_{IH} \text{ or } V_{IL}$ $A1 - A14 = V_{IL}$	V _{cc}	Identification Code

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

		AT27C256R							
		-45	-55	-70	-90	-12	-15		
	Com.	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C		
Operating Temp. (Case)	Ind.	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C		
iomp. (Gado)	Auto.			-40°C - 125°C	-40°C - 125°C	-40°C - 125°C	-40°C - 125°C		
V _{CC} Supply		5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%		

DC and Operating Characteristics for Read Operation

Symbol	Parameter	Condition		Min	Max	Units
	leavet lead Commant	V 0V/45 V	Com., Ind.		±1	μA
ILI	Input Load Current	$V_{IN} = 0V \text{ to } V_{CC}$	Auto.		±5	μA
	Outrot Lealing Comment)/ 0\/ t= \/	Com., Ind.		±5	μΑ
I _{LO}	Output Leakage Current	$V_{OUT} = 0V \text{ to } V_{CC}$	Auto.		±10	μA
I _{PP1} ⁽²⁾	V _{PP} ⁽¹⁾ Read/Standby Current	$V_{PP} = V_{CC}$			10	μA
	V (1) O(= = - O = = = 1	I_{SB1} (CMOS), $\overline{CE} = V_{CC} \pm \overline{CE}$	0.3V		100	μA
I _{SB}	V _{CC} ⁽¹⁾ Standby Current	I_{SB2} (TTL), $\overline{CE} = 2.0$ to V_0	_{CC} + 0.5V		1	mA
I _{CC}	V _{CC} Active Current	$f = 5 \text{ MHz}, I_{OUT} = 0 \text{ mA}, \overline{E}$	= 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	٧
V _{OL}	Output Low Voltage	I _{OL} = 2.1 mA			0.4	٧
V _{OH}	Output High Voltage	I _{OH} = -400 μA		2.4		V

Notes: 1. V_{CC} must be applied simultaneously with or before V_{PP} and removed simultaneously with or after V_{PP} .

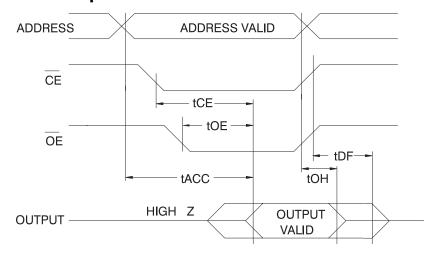
2. V_{PP} may be connected directly to V_{CC} , except during programming. The supply current would then be the sum of I_{CC} and I_{PP}

AC Characteristics for Read Operation

								AT270	C256R						
			-	45		55	-	70	-	90	-	12	-	15	
Symbol	Parameter	Condition	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Units
t _{ACC} ⁽³⁾	Address to Output Delay	$\overline{CE} = \overline{OE} = V_{IL}$		45		55		70		90		120		150	ns
t _{CE} ⁽²⁾	CE to Output Delay	OE = V _{IL}		45		55		70		90		120		150	ns
t _{OE} ⁽²⁾⁽³⁾	OE to Output Delay	CE = V _{IL}		20		25		30		30		35		40	ns
t _{DF} ⁽⁴⁾⁽⁵⁾	OE or CE High to Output Float, whichever occurred to	irst		20		20		25		25		30		35	ns
t _{OH}	Output Hold from Address, whichever occurred first	CE or OE,	7		7		7		0		0		0		ns

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

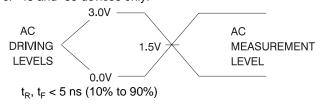
AC Waveforms for Read Operation⁽¹⁾



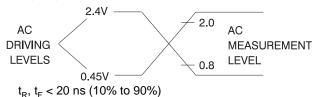
- Notes: 1. Timing measurement reference level is 1.5V for -45 and -55 devices. Input AC drive levels are $V_{IL} = 0.0V$ and $V_{IH} = 3.0V$. Timing measurement reference levels for all other speed grades are $V_{OL} = 0.8V$ and $V_{OH} = 2.0V$. Input AC drive levels are $V_{IL} = 0.45V$ and $V_{IH} = 2.4V$.
 - 2. $\overline{\text{OE}}$ may be delayed up to t_{CE} t_{OE} after the falling edge of $\overline{\text{CE}}$ without impact on t_{CE} .
 - 3. $\overline{\text{OE}}$ 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

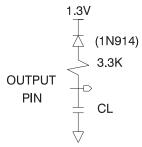
For -45 and -55 devices only:



For -70, -90, -12, and -15 devices:



Output Test Load



Note: $C_L = 100 \text{ pF}$ including jig capacitance, except for the -45 and -55 devices, where $C_L = 30 \text{ pF}$.

Pin Capacitance

 $f = 1 \text{ MHz}, T = 25^{\circ}C^{(1)}$

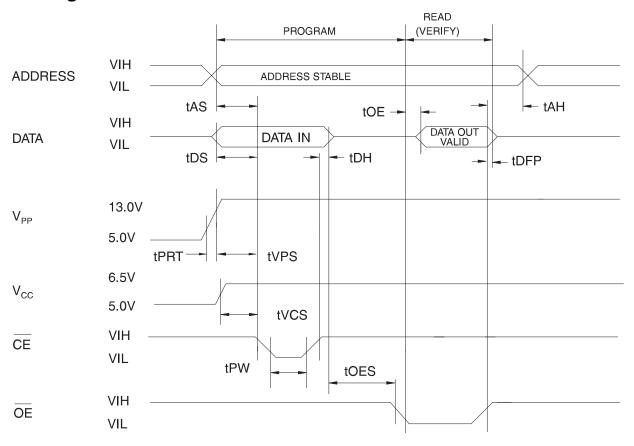
Symbol	Тур	Max	Units	Conditions
C _{IN}	4	6	pF	$V_{IN} = 0V$
C _{OUT}	8	12	pF	V _{OUT} = 0V

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





Programming Waveforms⁽¹⁾



Notes: 1.

- 1. The Input Timing Reference is 0.8V for $V_{\rm IL}$ and 2.0V for $V_{\rm IH}$.
- 2. t_{OE} and t_{DFP} are characteristics of the device but must be accommodated by the programmer.
- When programming the AT27C256R a 0.1 μF capacitor is required across V_{PP} and ground to suppress spurious voltage transients.

DC Programming Characteristics

 $T_A = 25 \pm 5^{\circ}C, \ V_{CC} = 6.5 \pm 0.25 V, \ V_{PP} = 13.0 \pm 0.25 V$

			Lin	nits	
Symbol	Parameter	Test Conditions	Min	Max	Units
ILI	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	V
V _{OL}	Output Low Volt	I _{OL} = 2.1 mA		0.4	V
V _{OH}	Output High Volt	I _{OH} = -400 μA	2.4		V
I _{CC2}	V _{CC} Supply Current (Program and Verify)			25	mA
I _{PP2}	V _{PP} Current	CE = V _{IL}		25	mA
V _{ID}	A9 Product Identification Voltage		11.5	12.5	V

AC Programming Characteristics

 $T_A = 25 \pm 5^{\circ}C, \ V_{CC} = 6.5 \pm 0.25V, \ V_{PP} = 13.0 \pm 0.25V$

			Lin	nits	
Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Max	Units
t _{AS}	Address Setup Time		2		μs
t _{OES}	OE Setup Time		2		μs
t _{DS}	Data Setup Time	Input Rise and Fall Times	2		μs
t _{AH}	Address Hold Time	(10% to 90%) 20ns	0		μs
t _{DH}	Data Hold Time	Input Pulse Levels	2		μs
t _{DFP}	OE High to Output Float Delay ⁽²⁾	0.45V to 2.4V	0	130	ns
t _{VPS}	V _{PP} Setup Time	Input Timing Reference Level	2		μs
t _{VCS}	V _{CC} Setup Time	0.8V to 2.0V	2		μs
t _{PW}	CE Program Pulse Width ⁽³⁾	Output Timing Reference Level	95	105	μs
t _{OE}	Data Valid from $\overline{OE}^{(2)}$	0.8V to 2.0V		150	ns
t _{PRT}	V _{PP} Pulse Rise Time During Programming		50		ns

Notes: 1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP} .

3. Program Pulse width tolerance is 100 μ sec \pm 5%.

Atmel's 27C256R Integrated Product Identification Code

					Pins					Hex
Codes	A0	07	O6	O5	04	О3	02	01	00	Data
Manufacturer	0	0	0	0	1	1	1	1	0	1E
Device Type	1	1	0	0	0	1	1	0	0	8C



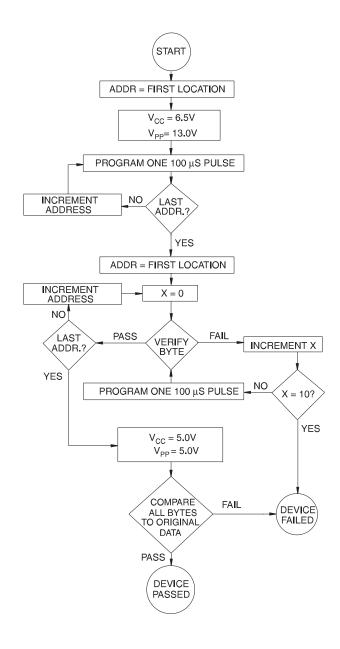
^{2.} This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven—see timing diagram.



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 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. V_{PP} is then lowered to 5.0V 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}	I _{cc}	(mA)			
(ns)	Active	Standby	Ordering Code	Package	Operation Range
45	20	0.1	AT27C256R-45JC	32J	Commercial
			AT27C256R-45PC	28P6	(0°C to 70°C)
			AT27C256R-45RC	28R	
			AT27C256R-45TC	28T	
	20	0.1	AT27C256R-45JI	32J	Industrial
			AT27C256R-45PI	28P6	(-40°C to 85°C)
			AT27C256R-45RI	28R	
			AT27C256R-45TI	28T	
55	20	0.1	AT27C256R-55JC	32J	Commercial
			AT27C256R-55PC	28P6	(0°C to 70°C)
			AT27C256R-55RC	28R	
			AT27C256R-55TC	28T	
	20	0.1	AT27C256R-55JI	32J	Industrial
			AT27C256R-55PI	28P6	(-40°C to 85°C)
			AT27C256R-55RI	28R	
			AT27C256R-55TI	28T	
70	20	0.1	AT27C256R-70JC	32J	Commercial
			AT27C256R-70PC	28P6	(0°C to 70°C)
			AT27C256R-70RC	28R	
			AT27C256R-70TC	28T	
	20	0.1	AT27C256R-70JI	32J	Industrial
			AT27C256R-70PI	28P6	(-40°C to 85°C)
			AT27C256R-70RI	28R	
			AT27C256R-70TI	28T	
	20	0.1	AT27C256R-70JA	32J	Automotive
			AT27C256R-70PA	28P6	(-40°C to 125°C)
			AT27C256R-70RA	28R	

(continued)

Package Type				
32J	32-Lead, Plastic J-Leaded Chip Carrier (PLCC)			
28P6	28-Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)			
28R	28-Lead, 0.330" Wide, Plastic Gull Wing Small Outline (SOIC)			
28T	28-Lead, Thin Small Outline Package (TSOP)			





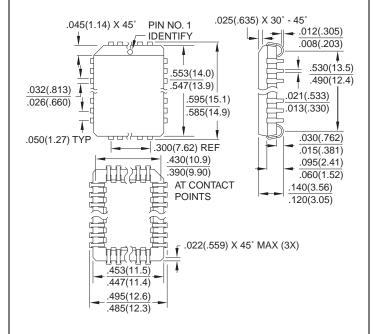
Ordering Information (Continued)

t _{ACC}	I _{CC} (mA)				
(ns)	Active	Standby	Ordering Code	Package	Operation Range
90	20	0.1	AT27C256R-90JC	32J	Commercial
			AT27C256R-90PC	28P6	(0°C to 70°C)
			AT27C256R-90RC	28R	
			AT27C256R-90TC	28T	
	20	0.1	AT27C256R-90JI	32J	Industrial
			AT27C256R-90PI	28P6	(-40°C to 85°C)
			AT27C256R-90RI	28R	
			AT27C256R-90TI	28T	
	20	0.1	AT27C256R-90JA	32J	Automotive
			AT27C256R-90PA	28P6	(-40°C to 125°C)
			AT27C256R-90RA	28R	
120	20	0.1	AT27C256R-12JC	32J	Commercial
			AT27C256R-12PC	28P6	(0°C to 70°C)
			AT27C256R-12RC	28R	
			AT27C256R-12TC	28T	
	20	0.1	AT27C256R-12JI	32J	Industrial
			AT27C256R-12PI	28P6	(-40°C to 85°C)
			AT27C256R-12RI	28R	
			AT27C256R-12TI	28T	
	20	0.1	AT27C256R-12JA	32J	Automotive
			AT27C256R-12PA	28P6	(-40°C to 125°C)
			AT27C256R-12RA	28R	
150	20	0.1	AT27C256R-15JC	32J	Commercial
			AT27C256R-15PC	28P6	(0°C to 70°C)
			AT27C256R-15RC	28R	
			AT27C256R-15TC	28T	
	20	0.1	AT27C256R-15JI	32J	Industrial
			AT27C256R-15PI	28P6	(-40°C to 85°C)
			AT27C256R-15RI	28R	
			AT27C256R-15TI	28T	
	20	0.1	AT27C256R-15JA	32J	Automotive
			AT27C256R-15PA	28P6	(-40°C to 125°C)
			AT27C256R-15RA	28R	

Package Type				
32J	32-Lead, Plastic J-Leaded Chip Carrier (PLCC)			
28P6	28-Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)			
28R	28-Lead, 0.330" Wide, Plastic Gull Wing Small Outline (SOIC)			
28T	28-Lead, Thin Small Outline Package (TSOP)			

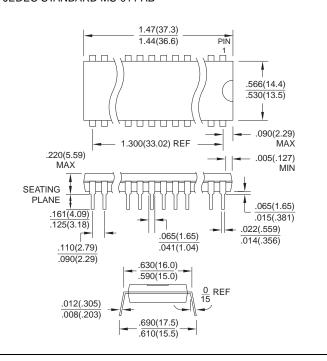
Packaging Information

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



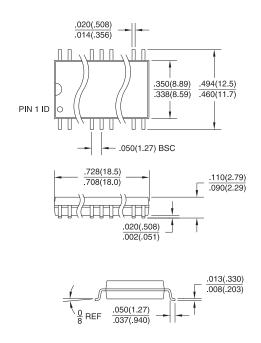
28P6, 28-Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)

Dimensions in Inches and (Millimeters) JEDEC STANDARD MS-011 AB



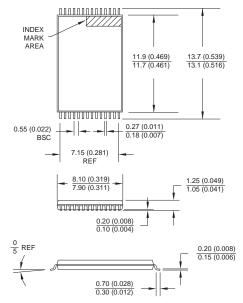
28R, 28-Lead, 0.330" Wide, Plastic Gull Wing Small Outline (SOIC)

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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