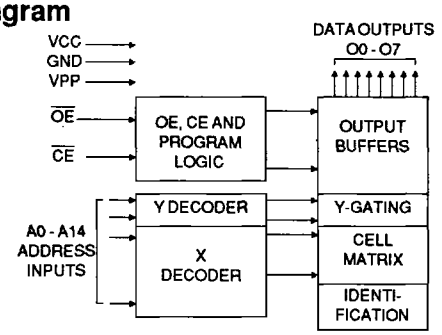
256K (32K x 8) UV Erasable CMOS EPROM

Features

- Low Power CMOS Operation
  - 100 µA max. Standby
  - 20 mA max. Active at 5 MHz
- Fast Read Access Time - 90ns
- Wide Selection of JEDEC Standard Packages Including OTP
  - 28-Lead 600 mil Cerdip and OTP Plastic DIP or SOIC
  - 32-Pad LCC
  - 32-Lead JLCC and OTP PLCC
- 5V±10% Supply
- High Reliability CMOS Technology
  - 2000V ESD Protection
  - 200mA Latchup Immunity
- Rapid Programming - 100µs/byte (typical)
- Two-line Control
- CMOS and TTL Compatible Inputs and Outputs
- Integrated Product Identification Code
- Military, Commercial and Industrial Temperature Ranges
- Fully Compatible with AT27C256

Block Diagram



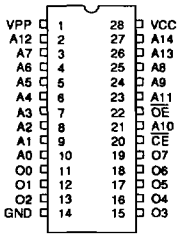
Description

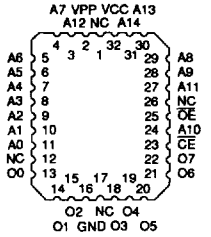
The AT27C256R chip is a low-power, high performance 262,144 bit Ultraviolet Erasable and Electrically Programmable Read Only Memory (EPROM) organized 32K x 8. It requires only one 5V power supply in normal read mode operation. Any byte can be accessed in less than 90ns, eliminating the need for speed reducing WAIT states on high performance microprocessor systems.

The AT27C256R meets or exceeds all specifications for the AT27C256. Atmel's 1.2 micron scaled CMOS technology additionally provides lower active power consumption, and significantly faster programming. Power consumption is typically only 8mA in Active Mode and less than 10µA in Standby.

Pin Configurations

Pin Name	Function
A0-A14	Addresses
O0-O7	Outputs
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
NC	No Connect





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

Description (Continued)

The AT27C256R comes in a choice of industry standard JEDEC-approved packages including; 28-pin DIP ceramic or one time programmable (OTP) plastic, 28-pin OTP plastic small outline (SOIC), 32-pad ceramic leadless chip carrier (LCC), and 32 lead ceramic (JLCC),or OTP plastic J-leaded chip carrier (PLCC). All devices feature two line control ($\overline{CE}$, $\overline{OE}$) to give designers the flexibility to prevent bus contention.

With high density 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 100µs/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 AT27C256R 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 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 15W-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)
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.

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	$\overline{CE}$	$\overline{OE}$	Ai	V_{PP}	V_{CC}	Outputs
Read	V_{IL}	V_{IL}	Ai	V_{CC}	V_{CC}	D_{OUT}
Output Disable	V_{IL}	V_{IH}	X(1)	V_{CC}	V_{CC}	High Z
Standby	V_{IH}	X	X	V_{CC}	V_{CC}	High Z
Rapid Program(2)	V_{IL}	V_{IH}	Ai	V_{PP}	V_{CC}	D_{IN}
PGM Verify(2)	X	V_{IL}	Ai	V_{PP}	V_{CC}	D_{OUT}
Optional PGM Verify(2)	V_{IL}	V_{IL}	Ai	V_{CC}	V_{CC}	D_{OUT}
PGM Inhibit(2)	V_{IH}	V_{IH}	X	V_{PP}	V_{CC}	High Z
Product Identification(4)	V_{IL}	V_{IL}	A9=V_H (3) A0=V_{IH} or V_{IL} A1-A14=V_{IL}	V_{CC}	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

		AT27C256R				
		-90	-12	-15	-20	-25
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	-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 ± 10%	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} (2)	V_{PP} (1) Read/Standby Current	V_{PP}=3.8 to V_{CC}+0.3V			10	µA
I_{SB}	V_{CC} (1) Standby Current	I_{SB1} (CMOS) $\overline{CE}$=V_{CC}-0.3 to V_{CC}+1.0V	Com.		100	µA
			Ind.,Mil.		200	µA
		I_{SB2} (TTL) $\overline{CE}$=2.0 to V_{CC}+1.0V	Com.		2	mA
			Ind.,Mil.		3	mA
I_{CC}	V_{CC} Active Current	f=5MHz,I_{OUT}=0mA, $\overline{CE}$=V_{IL}	Com.		20	mA
			Ind.,Mil.		25	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}=2.1mA			.45	V
V_{OH}	Output High Voltage	I_{OH}=-100µA		V_{CC}-0.3		V
		I_{OH}=-2.5mA		3.5		V
		I_{OH}=-400µA		2.4		V
V_{PP}	V_{PP} Read Voltage	V_{CC}=5±0.25V		3.8	V_{CC}+.3	V

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

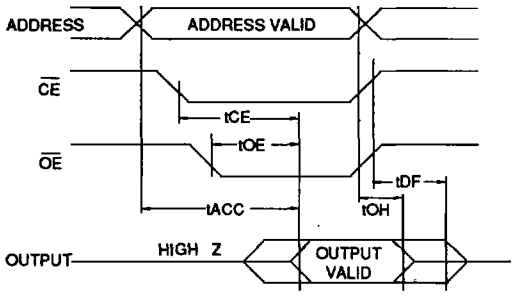
2. V_{PP} may be connected directly to V_{CC}, except during programming. The supply current would then be the sum of I_{CC} and I_{PP}.

A.C. Characteristics for Read Operation

				AT27C256R										
				-90		-12		-15		-20		-25		
Symbol	Parameter	Condition		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Units
t_{ACC} (4)	Address to Output Delay	$\overline{CE}$=$\overline{OE}$ =V_{IL}	Com.		90		120		150		200		250	ns
			Ind.,Mil.		90		120		150		200		250	ns
t_{CE} (3)	$\overline{CE}$ to Output Delay	$\overline{OE}$=V_{IL}			90		120		150		200		250	ns
t_{OE} (3,4)	$\overline{OE}$ to Output Delay	$\overline{CE}$=V_{IL}			40		50		60		75		100	ns
t_{DF} (2,5)	$\overline{OE}$ or $\overline{CE}$ High to Output Float	$\overline{CE}$=V_{IL}			30		30		45		55		60	ns
t_{OH}	Output Hold from Address, $\overline{CE}$ or $\overline{OE}$, whichever occurred first	$\overline{CE}$=$\overline{OE}$ =V_{IL}			0		0		0		0		0	ns

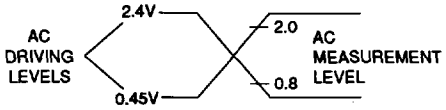
Notes: 2, 3, 4, 5. - see AC Waveforms for Read Operation.

A.C. Waveforms for Read Operation [1]



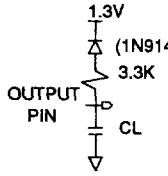
Notes:
1. Timing measurement references are 0.8V and 2.0V. Input AC driving levels are 0.45V and 2.4V, unless otherwise specified.
2. t_{DF} is specified from $\overline{OE}$ or $\overline{CE}$, whichever occurs first. Output float is defined as the point when data is no longer driven.
3. $\overline{OE}$ may be delayed up to t_{CE}-t_{OE} after the falling edge of $\overline{CE}$ without impact on t_{CE}.
4. $\overline{OE}$ 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 Waveforms and Measurement Levels



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

Output Test Load



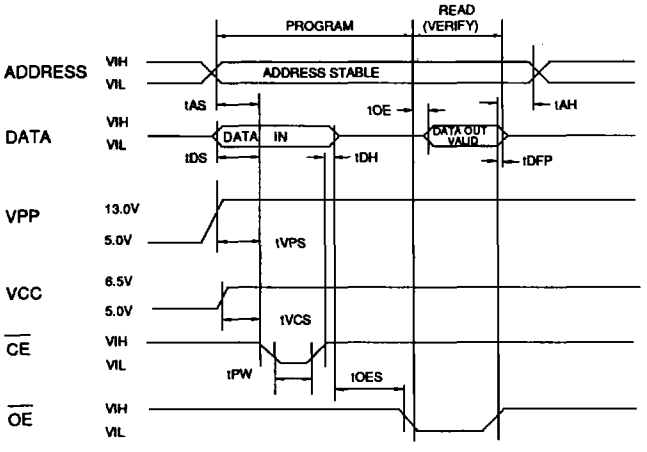
Note: C_L=100pF including jig capacitance.

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 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.
3. When programming the AT27C256R a 0.1µF capacitor is required across V_{PP} and ground to suppress spurious voltage transients.

D.C. Programming Characteristics

T_A=25±5°C, V_{CC}=6.5±0.25V, V_{PP}=13.0±0.25V

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}=2.1mA		.45	V
V_{OH}	Output High Volt.	I_{OH}=-400µA	2.4		V
I_{CC2}	V_{CC} Supply Current (Program and Verify)			25	mA
I_{PP2}	V_{PP} Current	$\overline{CE}=V_{IL}$		25	mA
V_{ID}	A9 Product Identification Voltage		11.5	12.5	V

A.C. Programming Characteristics

T_A=25±5°C, V_{CC}=6.5±0.25V, V_{PP}=13.0±0.25V

Symbol	Parameter	Test Conditions* (see Note 1)	Limits Min	Max	Units
t_{AS}	Address Setup Time		2		µs
t_{OES}	$\overline{OE}$ 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}	$\overline{OE}$ High to Output Float Delay	(Note 2)	0	130	ns
t_{VPS}	V_{PP} Setup Time		2		µs
t_{VCS}	V_{CC} Setup Time		2		µs
t_{PW}	$\overline{CE}$ Program Pulse Width	(Note 3)	95	105	µs
t_{OE}	Data Valid from $\overline{OE}$	(Note 2)		150	ns

*A.C. Conditions of Test:

Input Rise and Fall Times (10% to 90%) 20ns
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

Notes:

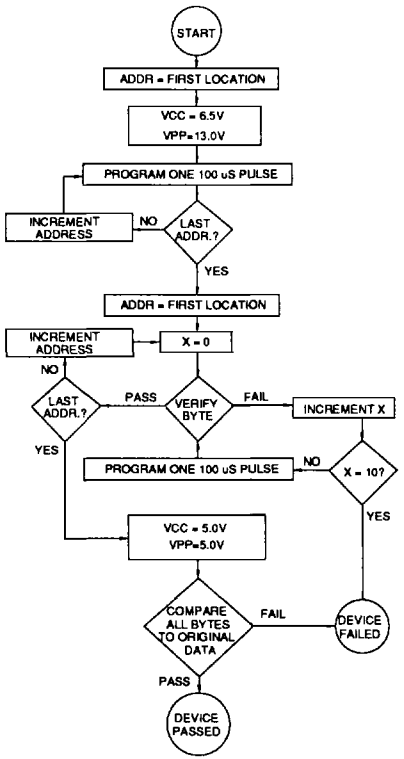
1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}.
2. This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven — see timing diagram.
3. Program Pulse width tolerance is 100µsec±5%.

Atmel's 27C256R 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	0	1E
Device Type	1	1	0	0	0	1	1	0	0	8C

Rapid Programming Algorithm

A 100µs $\overline{CE}$ 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 100µs $\overline{CE}$ 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 100µs 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} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
90	20	0.1	AT27C256R-90DC AT27C256R-90JC AT27C256R-90KC AT27C256R-90LC AT27C256R-90PC AT27C256R-90RC	28DW6 32J 32KW 32LW 28P6 28R	Commercial (0°C to 70°C)
90	25	0.2	AT27C256R-90DI AT27C256R-90JI AT27C256R-90KI AT27C256R-90LI AT27C256R-90PI AT27C256R-90RI	28DW6 32J 32KW 32LW 28P6 28R	Industrial (-40°C to 85°C)
120	20	0.1	AT27C256R-12DC AT27C256R-12JC AT27C256R-12KC AT27C256R-12LC AT27C256R-12PC AT27C256R-12RC	28DW6 32J 32KW 32LW 28P6 28R	Commercial (0°C to 70°C)
120	25	0.2	AT27C256R-12DI AT27C256R-12JI AT27C256R-12KI AT27C256R-12LI AT27C256R-12PI AT27C256R-12RI	28DW6 32J 32KW 32LW 28P6 28R	Industrial (-40°C to 85°C)
			AT27C256R-12DM AT27C256R-12KM AT27C256R-12LM	28DW6 32KW 32LW	Military (-55°C to 125°C)
			AT27C256R-12DM/883 AT27C256R-12KM/883 AT27C256R-12LM/883	28DW6 32KW 32LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
150	20	0.1	AT27C256R-15DC AT27C256R-15JC AT27C256R-15KC AT27C256R-15LC AT27C256R-15PC AT27C256R-15RC	28DW6 32J 32KW 32LW 28P6 28R	Commercial (0°C to 70°C)
150	25	0.2	AT27C256R-15DI AT27C256R-15JI AT27C256R-15KI AT27C256R-15LI AT27C256R-15PI AT27C256R-15RI	28DW6 32J 32KW 32LW 28P6 28R	Industrial (-40°C to 85°C)
			AT27C256R-15DM AT27C256R-15KM AT27C256R-15LM	28DW6 32KW 32LW	Military (-55°C to 125°C)
			AT27C256R-15DM/883 AT27C256R-15KM/883 AT27C256R-15LM/883	28DW6 32KW 32LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)

Ordering Information

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
170	20	0.1	AT27C256R-17DC AT27C256R-17JC AT27C256R-17KC AT27C256R-17LC AT27C256R-17PC AT27C256R-17RC	28DW6 32J 32KW 32LW 28P6 28R	Commercial (0°C to 70°C)
170	25	0.2	AT27C256R-17DI AT27C256R-17JI AT27C256R-17KI AT27C256R-17LI AT27C256R-17PI AT27C256R-17RI	28DW6 32J 32KW 32LW 28P6 28R	Industrial (-40°C to 85°C)
			AT27C256R-17DM AT27C256R-17KM AT27C256R-17LM	28DW6 32KW 32LW	Military (-55°C to 125°C)
			AT27C256R-17DM/883 AT27C256R-17KM/883 AT27C256R-17LM/883	28DW6 32KW 32LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
200	20	0.1	AT27C256R-20DC AT27C256R-20JC AT27C256R-20KC AT27C256R-20LC AT27C256R-20PC AT27C256R-20RC	28DW6 32J 32KW 32LW 28P6 28R	Commercial (0°C to 70°C)
200	25	0.2	AT27C256R-20DI AT27C256R-20JI AT27C256R-20KI AT27C256R-20LI AT27C256R-20PI AT27C256R-20RI	28DW6 32J 32KW 32LW 28P6 28R	Industrial (-40°C to 85°C)
			AT27C256R-20DM AT27C256R-20KM AT27C256R-20LM	28DW6 32KW 32LW	Military (-55°C to 125°C)
			AT27C256R-20DM/883 AT27C256R-20KM/883 AT27C256R-20LM/883	28DW6 32KW 32LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
250	20	0.1	AT27C256R-25DC AT27C256R-25JC AT27C256R-25KC AT27C256R-25LC AT27C256R-25PC AT27C256R-25RC	28DW6 32J 32KW 32LW 28P6 28R	Commercial (0°C to 70°C)
250	25	0.2	AT27C256R-25DI AT27C256R-25JI AT27C256R-25KI AT27C256R-25LI AT27C256R-25PI AT27C256R-25RI	28DW6 32J 32KW 32LW 28P6 28R	Industrial (-40°C to 85°C)

Ordering Information

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
250	25	0.2	AT27C256R-25DM AT27C256R-25KM AT27C256R-25LM	28DW6 32KW 32LW	Military (-55°C to 125°C)
			AT27C256R-25DM/883 AT27C256R-25KM/883 AT27C256R-25LM/883	28DW6 32KW 32LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
150	25	0.2	5962-86063 05 XX 5962-86063 05 YX 5962-86063 05 ZX	28DW6 32LW 32KW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
170	25	0.2	5962-86063 04 XX 5962-86063 04 YX 5962-86063 04 ZX	28DW6 32LW 32KW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
200	25	0.2	5962-86063 01 XX 5962-86063 01 YX 5962-86063 01 ZX	28DW6 32LW 32KW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
250	25	0.2	5962-86063 02 XX 5962-86063 02 YX 5962-86063 02 ZX	28DW6 32LW 32KW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
300	25	0.2	5962-86063 03 XX 5962-86063 03 YX 5962-86063 03 ZX	28DW6 32LW 32KW	Military/883C Class B, Fully Compliant (-55°C to 125°C)

Package Type	
28DW6	28 Lead, 0.600" Wide, Windowed, Ceramic Dual Inline Package (Cerdip)
32J	32 Lead, Plastic J-Leaded Chip Carrier OTP (PLCC)
32KW	32 Lead, Windowed, Ceramic J-Leaded Chip Carrier (JLCC)
32LW	32 Pad, Windowed, Ceramic Leadless Chip Carrier (LCC)
28P6	28 Lead, 0.600" Wide, Plastic Dual Inline Package OTP (PDIP)
28R	28 Lead, 0.330" Wide, Plastic Gull Wing Small Outline OTP (SOIC)