Features

- **Fast Read Access Time – 150 ns**
- **Automatic Page Write Operation**
  - **Internal Address and Data Latches for 64 Bytes**
  - **Internal Control Timer**
- **Fast Write Cycle Times**
  - **Page Write Cycle Time: 3 ms or 10 ms Maximum**
  - **1 to 64-byte Page Write Operation**
- **Low Power Dissipation**
  - **50 mA Active Current**
  - **200 µA CMOS Standby Current**
- **Hardware and Software Data Protection**
- **$\overline{\text{DATA}}$ Polling for End of Write Detection**
- **High Reliability CMOS Technology**
  - **Endurance: 10^4 or 10^5 Cycles**
  - **Data Retention: 10 Years**
- **Single 5V $\pm$10% Supply**
- **CMOS and TTL Compatible Inputs and Outputs**
- **JEDEC Approved Byte-wide Pinout**
- **Full Military and Industrial Temperature Ranges**
- **Green (Pb/Halide-free) Packaging Option**

256K (32K x 8) Paged Parallel EEPROM

AT28C256

1. Description

The AT28C256 is a high-performance electrically erasable and programmable read-only memory. Its 256K of memory is organized as 32,768 words by 8 bits. Manufactured with Atmel's advanced nonvolatile CMOS technology, the device offers access times to 150 ns with power dissipation of just 440 mW. When the device is deselected, the CMOS standby current is less than 200 µA.

The AT28C256 is accessed like a Static RAM for the read or write cycle without the need for external components. The device contains a 64-byte page register to allow writing of up to 64 bytes simultaneously. During a write cycle, the addresses and 1 to 64 bytes of data are internally latched, freeing the address and data bus for other operations. Following the initiation of a write cycle, the device will automatically write the latched data using an internal control timer. The end of a write cycle can be detected by $\overline{\text{DATA}}$ Polling of I/O7. Once the end of a write cycle has been detected a new access for a read or write can begin.

Atmel's AT28C256 has additional features to ensure high quality and manufacturability. The device utilizes internal error correction for extended endurance and improved data retention characteristics. An optional software data protection mechanism is available to guard against inadvertent writes. The device also includes an extra 64 bytes of EEPROM for device identification or tracking.

5. DC and AC Operating Range

		AT28C256-15	AT28C256-20	AT28C256-25	AT28C256-35
Operating Temperature (Case)	Ind.	-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%

6. Operating Modes

Mode	$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	I/O
Read	V_{IL}	V_{IL}	V_{IH}	D_{OUT}
Write[2]	V_{IL}	V_{IH}	V_{IL}	D_{IN}
Standby/Write Inhibit	V_{IH}	X[1]	X	High Z
Write Inhibit	X	X	V_{IH}	
Write Inhibit	X	V_{IL}	X	
Output Disable	X	V_{IH}	X	High Z
Chip Erase	V_{IL}	V_H[3]	V_{IL}	High Z

Notes: 1. X can be V_{IL} or V_{IH}.

2. Refer to AC programming waveforms.

3. V_H = 12.0V ± 0.5V.

7. Absolute Maximum Ratings*

Temperature under Bias .... -55°C to +125°C

Storage Temperature .... -65°C to +150°C

All Input Voltages
(including NC Pins)
with Respect to Ground .... -0.6V to +6.25V

All Output Voltages
with Respect to Ground .... -0.6V to V_{CC} + 0.6V

Voltage on $\overline{OE}$ and A9
with Respect to Ground .... -0.6V to +13.5V

*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

8. DC Characteristics

Symbol	Parameter	Condition		Min	Max	Units
I_{LI}	Input Load Current	V_{IN} = 0V to V_{CC} + 1V			10	µA
I_{LO}	Output Leakage Current	$V_{I/O}$ = 0V to V_{CC}			10	µA
I_{SB1}	V_{CC} Standby Current CMOS	$\overline{CE}$ = V_{CC} - 0.3V to V_{CC} + 1V	Ind.		200	µA
			Mil.		300	µA
I_{SB2}	V_{CC} Standby Current TTL	$\overline{CE}$ = 2.0V to V_{CC} + 1V			3	mA
I_{CC}	V_{CC} Active Current	f = 5 MHz; I_{OUT} = 0 mA			50	mA
V_{IL}	Input Low Voltage				0.8	V
V_{IH}	Input High Voltage			2.0		V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA			0.45	V
V_{OH}	Output High Voltage	I_{OH} = -400 µA		2.4		V

9. AC Read Characteristics

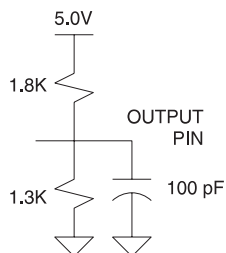| Symbol	Parameter	AT28C256-15 Min	AT28C256-15 Max	AT28C256-20 Min	AT28C256-20 Max	AT28C256-25 Min	AT28C256-25 Max	AT28C256-35 Min	AT28C256-35 Max	Units
t_{ACC}	Address to Output Delay		150		200		250		350	ns
t_{CE}[1]	$\overline{CE}$ to Output Delay		150		200		250		350	ns
t_{OE}[2]	$\overline{OE}$ to Output Delay	0	70	0	80	0	100	0	100	ns
t_{DF}[3][4]	$\overline{CE}$ or $\overline{OE}$ to Output Float	0	50	0	55	0	60	0	70	ns
t_{OH}	Output Hold from $\overline{OE}$, $\overline{CE}$ or Address, whichever occurred first	0		0		0		0		ns

10. AC Read Waveforms[1][2][3][4]
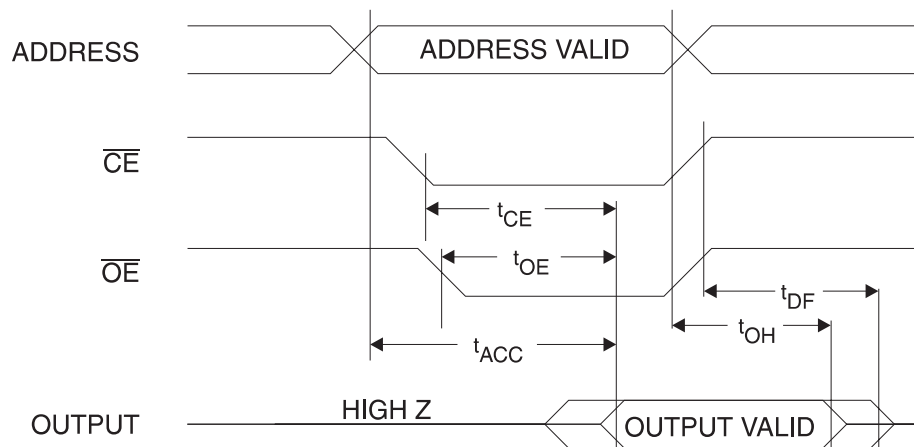
Notes: 1. $\overline{CE}$ may be delayed up to t_{ACC} - t_{CE} after the address transition without impact on t_{ACC}.

2. $\overline{OE}$ may be delayed up to t_{CE} - t_{OE} after the falling edge of $\overline{CE}$ without impact on t_{CE} or by t_{ACC} - t_{OE} after an address change without impact on t_{ACC}.

3. t_{DF} is specified from $\overline{OE}$ or $\overline{CE}$ whichever occurs first (C_L = 5 pF).

4. This parameter is characterized and is not 100% tested.

11. Input Test Waveforms and Measurement Level

AC DRIVING LEVELS

3.0V

0.0V

1.5V

AC MEASUREMENT LEVEL

t_R, t_F < 5 ns

12. Output Test Load

5.0V

1.8K

1.3K

OUTPUT PIN

100 pF
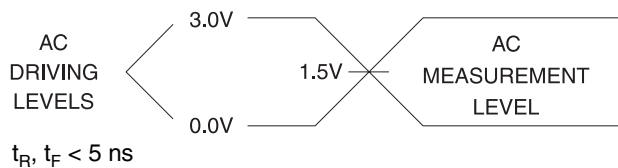
13. Pin Capacitance

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.   This parameter is characterized and is not 100% tested.

14. AC Write Characteristics

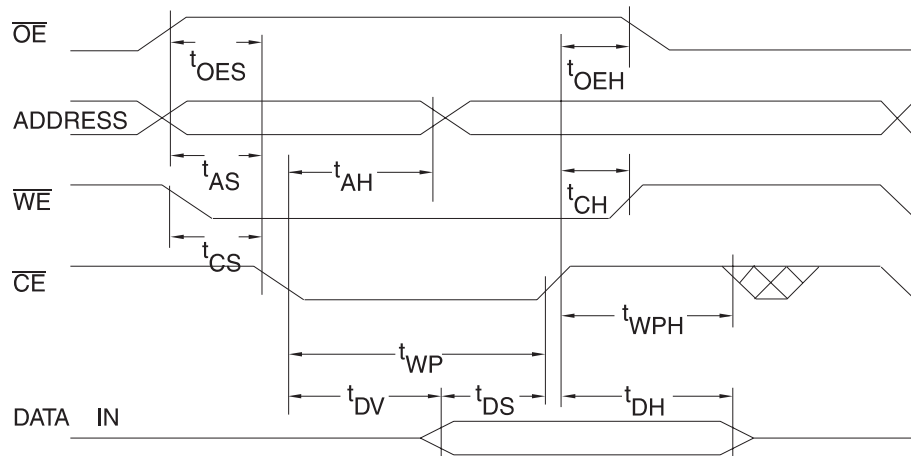| Symbol	Parameter	Min	Max	Units
t_{AS}, t_{OES}	Address, $\overline{OE}$ Setup Time	0		ns
t_{AH}	Address Hold Time	50		ns
t_{CS}	Chip Select Setup Time	0		ns
t_{CH}	Chip Select Hold Time	0		ns
t_{WP}	Write Pulse Width ($\overline{WE}$ or $\overline{CE}$)	100		ns
t_{DS}	Data Setup Time	50		ns
t_{DH}, t_{OEH}	Data, $\overline{OE}$ Hold Time	0		ns
t_{DV}	Time to Data Valid	NR[1]		

Note: 1. NR = No Restriction

# 15. AC Write Waveforms

15.1 $\overline{WE}$ Controlled
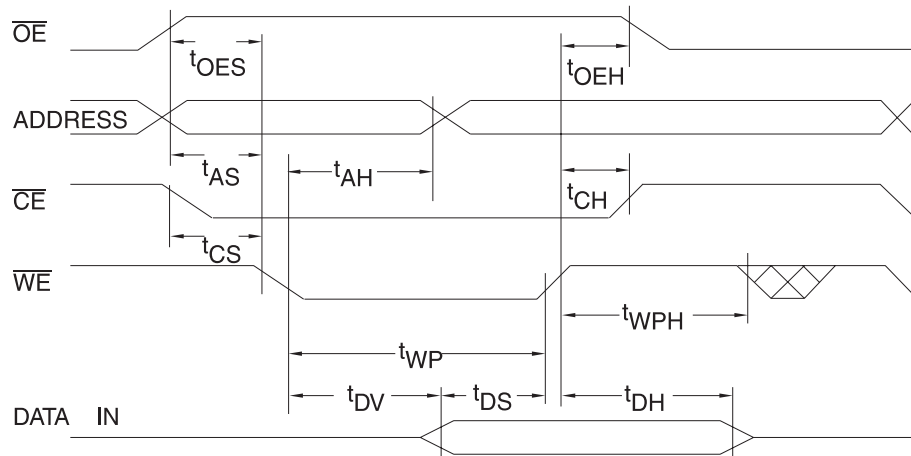
## 15.2 $\overline{CE}$ Controlled

16. Page Mode Characteristics

Symbol	Parameter		Min	Max	Units
t_{WC}	Write Cycle Time (option available)	AT28C256		10	ms
		AT28C256F		3	ms
t_{AS}	Address Setup Time		0		ns
t_{AH}	Address Hold Time		50		ns
t_{DS}	Data Setup Time		50		ns
t_{DH}	Data Hold Time		0		ns
t_{WP}	Write Pulse Width		100		ns
t_{BLC}	Byte Load Cycle Time			150	µs
t_{WPH}	Write Pulse Width High		50		ns

17. Page Mode Write Waveforms[1][2]
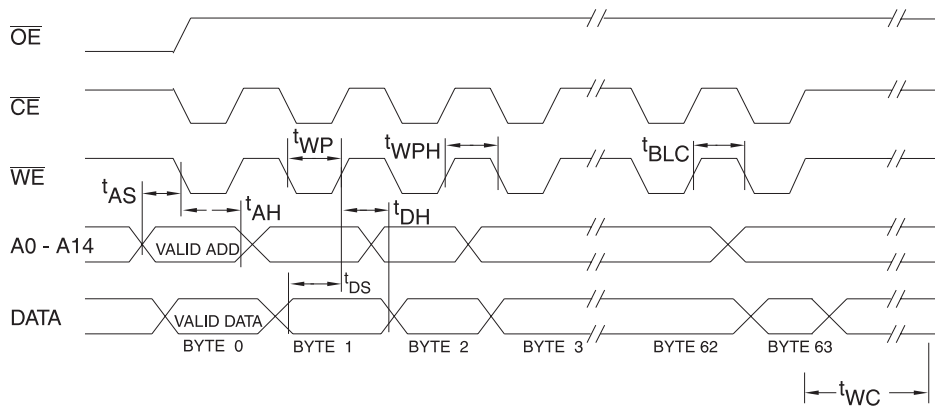
Notes: 1.   A6 through A14 must specify the same page address during each high to low transition of $\overline{WE}$ (or $\overline{CE}$).

2. $\overline{OE}$ must be high only when $\overline{WE}$ and $\overline{CE}$ are both low.

18. Chip Erase Waveforms
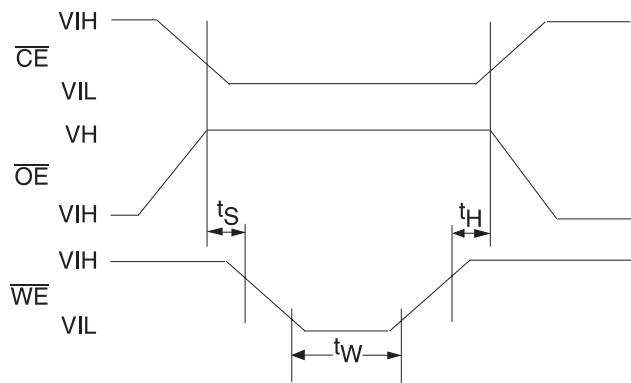
$t_S = t_H = 5$ µsec (min.)
$t_W = 10$ msec (min.)
$V_H = 12.0V \pm 0.5V$

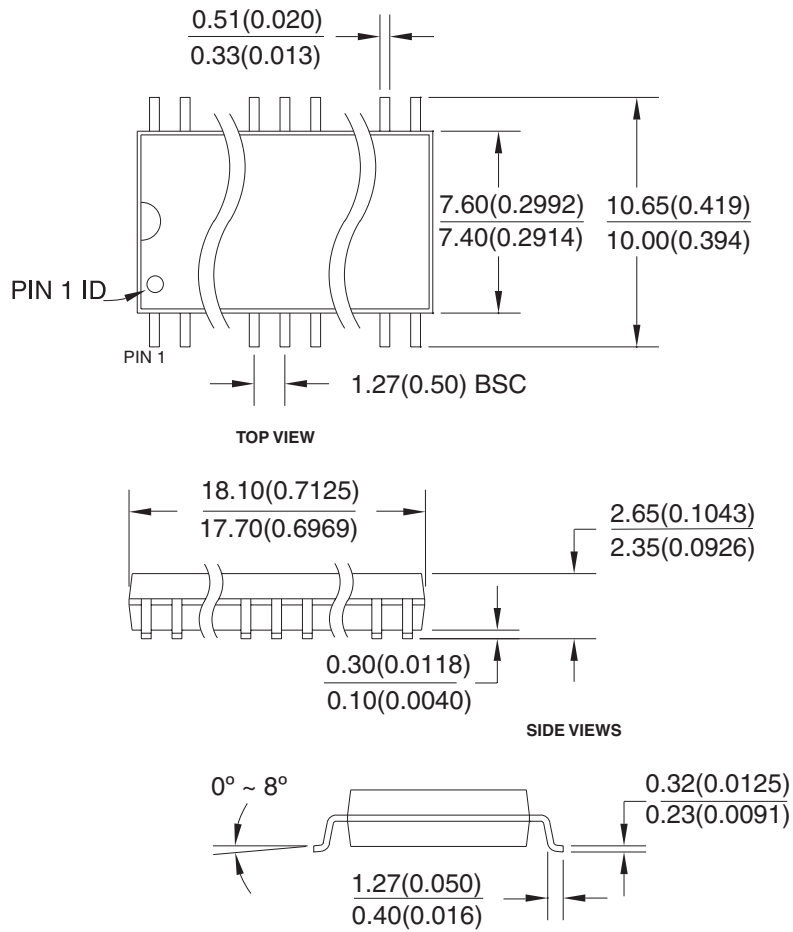## 27.2 Green Package Option (Pb/Halide-free)

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
150	50	0.2	AT28C256(E, F)-15JU	32J	Industrial
			AT28C256(E, F)-15PU	28P6	(-40° C to 85° C)
			AT28C256(E, F)-15SU	28S	
			AT28C256(E, F)-15TU	28T	

Package Type	
32J	32-lead, Plastic J-leaded Chip Carrier (PLCC)
28P6	28-lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)
28S	28-lead, 0.300" Wide, Plastic Gull Wing Small Outline (SOIC)
28T	28-lead, Plastic Thin Small Outline Package (TSOP)
Options	
Blank	Standard Device: Endurance = 10K Write Cycles; Write Time = 10 ms
F	Fast Write Option: Write Time = 3 ms

29.6   28S – SOIC

Dimensions in Millimeters and (Inches).
Controlling dimension: Millimeters.

$$\frac{0.51(0.020)}{0.33(0.013)}$$

PIN 1 ID

PIN 1

$$\frac{7.60(0.2992)}{7.40(0.2914)}$$ $$\frac{10.65(0.419)}{10.00(0.394)}$$

1.27(0.50) BSC

TOP VIEW

$$\frac{18.10(0.7125)}{17.70(0.6969)}$$

$$\frac{2.65(0.1043)}{2.35(0.0926)}$$

$$\frac{0.30(0.0118)}{0.10(0.0040)}$$

SIDE VIEWS

0° ~ 8°

$$\frac{0.32(0.0125)}{0.23(0.0091)}$$

$$\frac{1.27(0.050)}{0.40(0.016)}$$

	TITLE	DRAWING NO.	REV.
ATMEL 2325 Orchard Parkway San Jose, CA 95131	**28S**, 28-lead, 0.300" Body, Plastic Gull Wing Small Outline (SOIC) JEDEC Standard MS-013	28S	B