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## Features

- Single 2.7V to 3.6V Supply
- Hardware and Software Data Protection
- Low Power Dissipation
  - 15 mA Active Current
  - 20  $\mu$ A CMOS Standby Current
- Fast Read Access Time – 200 ns
- Automatic Page Write Operation
  - Internal Address and Data Latches for 64 Bytes
  - Internal Control Timer
- Fast Write Cycle Times
  - Page Write Cycle Time: 10 ms Maximum
  - 1 to 64 Byte Page Write Operation
- $\overline{\text{DATA}}$  Polling for End of Write Detection
- High-reliability CMOS Technology
  - Endurance: 100,000 Cycles
  - Data Retention: 10 Years
- JEDEC Approved Byte-wide Pinout
- Industrial Temperature Ranges
- Green (Pb/Halide-free) Packaging Option

## 1. Description

The AT28BV64B is a high-performance electrically erasable programmable read only-memory (EEPROM). Its 64K of memory is organized as 8,192 words by 8 bits. Manufactured with Atmel's advanced nonvolatile CMOS technology, the device offers access times to 200 ns with power dissipation of just 54 mW. When the device is deselected, the CMOS standby current is less than 20  $\mu$ A.

The AT28BV64B 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 AT28BV64B has additional features to ensure high quality and manufacturability. A software data protection mechanism guards against inadvertent writes. The device also includes an extra 64 bytes of EEPROM for device identification or tracking.



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**64K (8K x 8)  
Battery-Voltage  
Parallel  
EEPROM  
with Page Write  
and Software  
Data Protection**

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**AT28BV64B**



## 5. DC and AC Operating Range

AT28BV64B-20	
Operating Temperature (Case)	-40° C - 85° C
V <sub>CC</sub> Power Supply	2.7V to 3.6V

## 6. Operating Modes

Mode	$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	I/O
Read	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	D <sub>OUT</sub>
Write <sup>(2)</sup>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	D <sub>IN</sub>
Standby/Write Inhibit	V <sub>IH</sub>	X <sup>(1)</sup>	X	High Z
Write Inhibit	X	X	V <sub>IH</sub>	
Write Inhibit	X	V <sub>IL</sub>	X	
Output Disable	X	V <sub>IH</sub>	X	High Z
Chip Erase	V <sub>IL</sub>	V <sub>H</sub> <sup>(3)</sup>	V <sub>IL</sub>	High Z

- Notes:
1. X can be V<sub>IL</sub> or V<sub>IH</sub>.
  2. Refer to AC Programming Waveforms.
  3. V<sub>H</sub> = 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 <sub>CC</sub> + 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

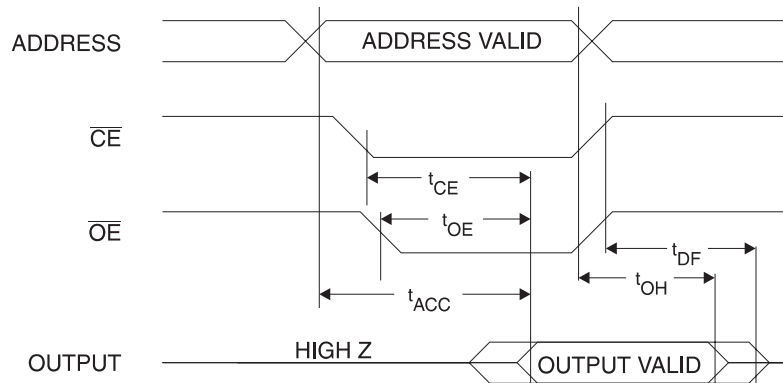
## 8. DC Characteristics

Symbol	Parameter	Condition	Min	Max	Units
I <sub>LI</sub>	Input Load Current	V <sub>IN</sub> = 0V to V <sub>CC</sub> + 1V		10	μA
I <sub>LO</sub>	Output Leakage Current	V <sub>I/O</sub> = 0V to V <sub>CC</sub>		10	μA
I <sub>SB</sub>	V <sub>CC</sub> Standby Current CMOS	$\overline{CE} = V_{CC} - 0.3V$ to V <sub>CC</sub> + 1V		50	μA
I <sub>CC</sub>	V <sub>CC</sub> Active Current	f = 5 MHz; I <sub>OUT</sub> = 0 mA		15	mA
V <sub>IL</sub>	Input Low Voltage			0.6	V
V <sub>IH</sub>	Input High Voltage		2.0		V
V <sub>OL</sub>	Output Low Voltage	I <sub>OL</sub> = 1.6 mA		0.45	V
V <sub>OH</sub>	Output High Voltage	I <sub>OH</sub> = -100 μA	2.0		V

## 9. AC Read Characteristics

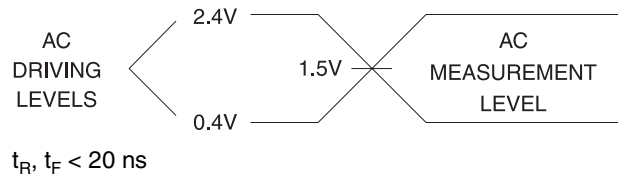
Symbol	Parameter	AT28BV64B-20		Units
		Min	Max	
$t_{ACC}$	Address to Output Delay		200	ns
$t_{CE}^{(1)}$	$\overline{CE}$ to Output Delay		200	ns
$t_{OE}^{(2)}$	$\overline{OE}$ to Output Delay	0	80	ns
$t_{DF}^{(3)(4)}$	$\overline{CE}$ or $\overline{OE}$ to Output Float	0	55	ns
$t_{OH}$	Output Hold from $\overline{OE}$ , $\overline{CE}$ or Address, Whichever Occurred First	0		ns

## 10. AC Read Waveforms<sup>(1)(2)(3)(4)</sup>

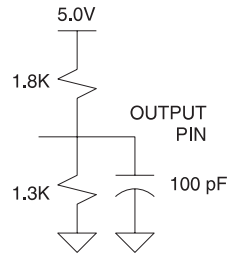


- Notes:
- $\overline{CE}$  may be delayed up to  $t_{ACC} - t_{CE}$  after the address transition without impact on  $t_{ACC}$ .
  - $\overline{OE}$  may be delayed up to  $t_{CE} - t_{OE}$  after the falling edge of  $\overline{CE}$  without impact on  $t_{CE}$  or by  $t_{ACC} - t_{OE}$  after an address change without impact on  $t_{ACC}$ .
  - $t_{DF}$  is specified from  $\overline{OE}$  or  $\overline{CE}$  whichever occurs first ( $C_L = 5$  pF).
  - This parameter is characterized and is not 100% tested.

### 11. Input Test Waveforms and Measurement Level



### 12. Output Test Load



### 13. Pin Capacitance

f = 1 MHz, T = 25°C<sup>(1)</sup>

Symbol	Typ	Max	Units	Conditions
C <sub>IN</sub>	4	6	pF	V <sub>IN</sub> = 0V
C <sub>OUT</sub>	8	12	pF	V <sub>OUT</sub> = 0V

Note: 1. This parameter is characterized and is not 100% tested.

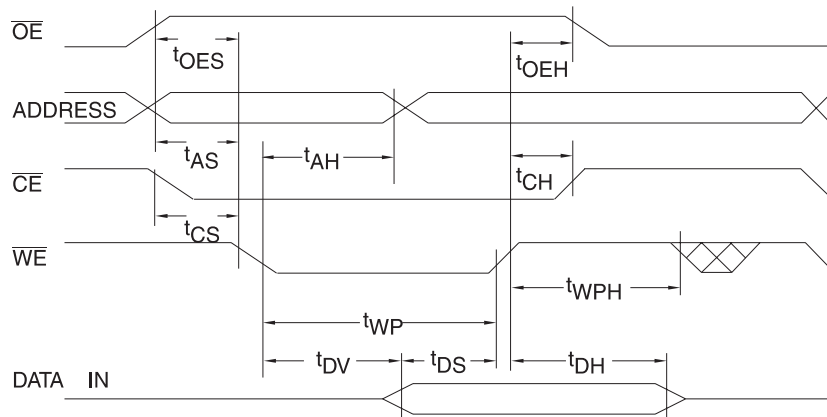
## 14. AC Write Characteristics

Symbol	Parameter	Min	Max	Units
$t_{AS}, t_{OES}$	Address, $\overline{OE}$ Set-up Time	0		ns
$t_{AH}$	Address Hold Time	100		ns
$t_{CS}$	Chip Select Set-up Time	0		ns
$t_{CH}$	Chip Select Hold Time	0		ns
$t_{WP}$	Write Pulse Width ( $\overline{WE}$ or $\overline{CE}$ )	200		ns
$t_{DS}$	Data Set-up Time	100		ns
$t_{DH}, t_{OEH}$	Data, $\overline{OE}$ Hold Time	0		ns
$t_{DV}$	Time to Data Valid	NR <sup>(1)</sup>		
$t_{WPH}$	Write Pulse Width High	100		ns

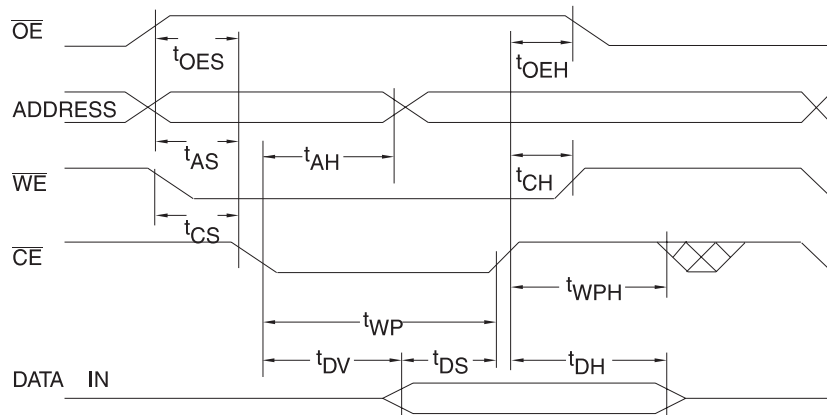
- Notes: 1. NR = No Restriction  
 2. All byte write operations must be preceded by the SDP command sequence.

## 15. AC Write Waveforms

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



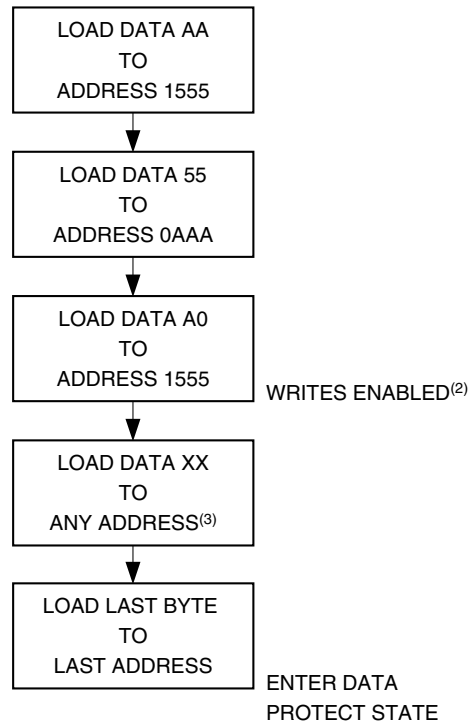
### 15.2 $\overline{CE}$ Controlled



### 16. Page Mode Characteristics

Symbol	Parameter	Min	Max	Units
t <sub>WC</sub>	Write Cycle Time		10	ms
t <sub>AS</sub>	Address Set-up Time	0		ns
t <sub>AH</sub>	Address Hold Time	100		ns
t <sub>DS</sub>	Data Set-up Time	100		ns
t <sub>DH</sub>	Data Hold Time	0		ns
t <sub>WP</sub>	Write Pulse Width	200		ns
t <sub>BLC</sub>	Byte Load Cycle Time		100	μs
t <sub>WPH</sub>	Write Pulse Width High	100		ns

### 17. Write Algorithm<sup>(1)</sup>



- Notes:
1. Data Format: I/O7 - I/O0 (Hex); Address Format: A12 - A0 (Hex).
  2. Data protect state will be re-activated at the end of the write cycle.
  3. 1 to 64 bytes of data are loaded.

## 23. Ordering Information<sup>(1)</sup>

### 23.1 Standard Package

t <sub>ACC</sub> (ns)	I <sub>CC</sub> (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
200	15	0.05	AT28BV64B-20JI AT28BV64B-20PI AT28BV64B-20SI AT28BV64B-20TI	32J 28P6 28S 28T	Industrial (-40° C to 85° C)

Note: 1. See "Valid Part Numbers" below.

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

t <sub>ACC</sub> (ns)	I <sub>CC</sub> (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
200	15	0.05	AT28BV64B-20JU AT28BV64B-20TU AT28BV64B-20SU	32J 28T 28S	Industrial (-40° C to 85° C)

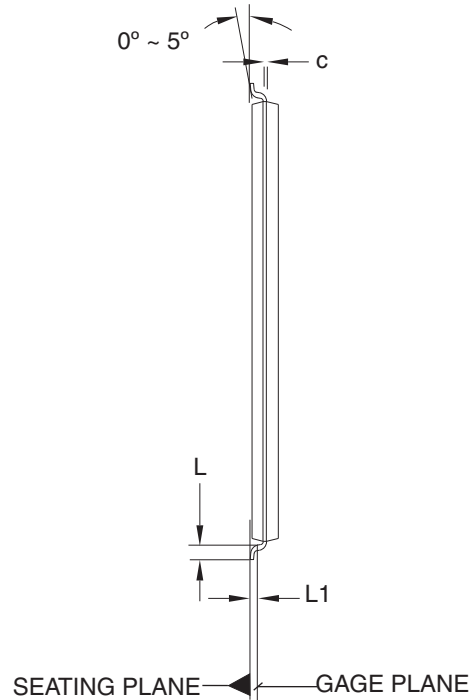
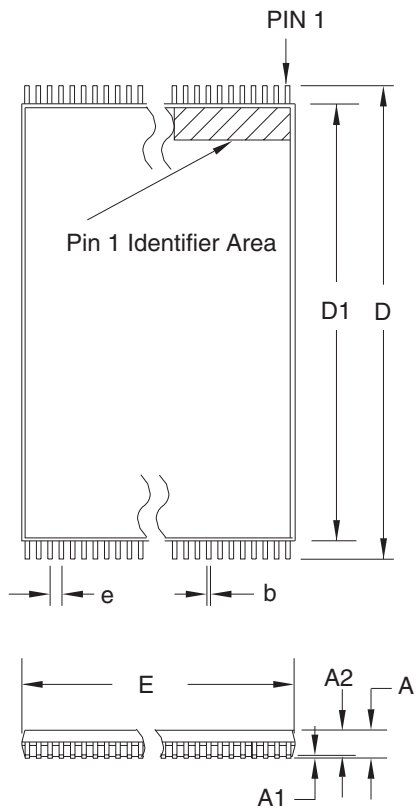
Package Type	
<b>32J</b>	32-lead, Plastic J-leaded Chip Carrier (PLCC)
<b>28P6</b>	28-lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)
<b>28S</b>	28-lead, 0.300" Wide, Plastic Gull Wing Small Outline (SOIC)
<b>28T</b>	28-lead, Plastic Thin Small Outline Package (TSOP)

## 24. Valid Part Numbers

The following table lists standard Atmel products that can be ordered.

Device Numbers	Speed	Package and Temperature Combinations
AT28BV64B	20	JI, JU, PI, SI, SU, TI, TU

## 25.4 28T – TSOP



**COMMON DIMENSIONS**  
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	1.20	
A1	0.05	–	0.15	
A2	0.90	1.00	1.05	
D	13.20	13.40	13.60	
D1	11.70	11.80	11.90	Note 2
E	7.90	8.00	8.10	Note 2
L	0.50	0.60	0.70	
L1	0.25 BASIC			
b	0.17	0.22	0.27	
c	0.10	–	0.21	
e	0.55 BASIC			

- Notes:
1. This package conforms to JEDEC reference MO-183.
  2. Dimensions D1 and E do not include mold protrusion. Allowable protrusion on E is 0.15 mm per side and on D1 is 0.25 mm per side.
  3. Lead coplanarity is 0.10 mm maximum.



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**TITLE**

**28T**, 28-lead (8 x 13.4 mm) Plastic Thin Small Outline Package, Type I (TSOP)

**DRAWING NO.**

28T

**REV.**

C