

### Features

- Fast Read Access Time - 150 ns
- Fast Byte Write - 1 ms
- Self-Timed Byte Write Cycle
  - Internal Address and Data Latches
  - Internal Control Timer
  - Automatic Clear Before Write
- Direct Microprocessor Control
  - DATA POLLING
  - READY/BUSY Open Drain Output
- Low Power
  - 30 mA Active Current
  - 100 µA CMOS Standby Current
- High Reliability
  - Endurance: 10<sup>4</sup> or 10<sup>5</sup> Cycles
  - Data Retention: 10 Years
- 5V ± 10% Supply
- CMOS & TTL Compatible Inputs and Outputs
- JEDEC Approved Byte Wide Pinout
- Commercial and Industrial Temperature Ranges
- Full Military, Commercial and Industrial Temperature Ranges Including High Rel

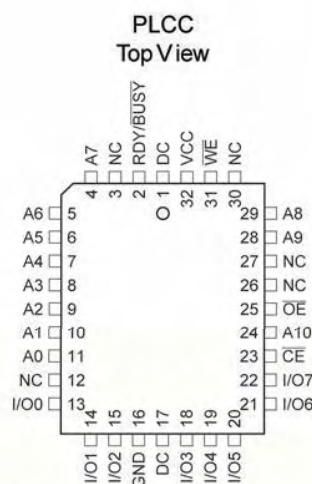
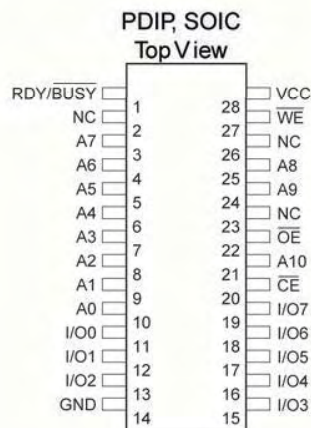
### Description

The FT28C17 is a low-power, high-performance Electrically Erasable and Programmable Read Only Memory with easy to use features. The FT28C17 is a 16K memory organised as 2,048 words by 8 bits. The device is manufactured with Force's reliable nonvolatile CMOS technology.

(continued)

### Pin Configurations

Pin Name	Function
A0 - A10	Addresses
$\overline{\text{CE}}$	Chip Enable
$\overline{\text{OE}}$	Output Enable
$\overline{\text{WE}}$	Write Enable
I/O0 - I/O7	Data Inputs/Outputs
RDY/BUSY	Ready/Busy Output
NC	No Connect
DC	Don't Connect



Note: PLCC package pins 1 and 17 are DON'T CONNECT.



### Device Operation

#### READ:

5 9 .9 59 \$ &  
%  
! \$ \$!  
% \$ \$ % \$ \$  
% !  
% \$ \$ 59 B C # 9  
% \$ \$ 59 B 9 CF  
% \$ \$ ! 0 & ' #  
% ! % % & #  
\$ \$ %  
! 5 & ' % \$ #

#### READY/BUSY: -

"()\*+, ( #  
%  
! \$  
!

#### DATA POLLING:

"()\*+, ( .# \$ ' ' !  
! " \$ -//012  
\$ ! " \$  
& % \$  
0). B  
C! 5 &  
!

#### WRITE PROTECTION: 0

\$ = B C A  
G A % 8! A B C  
% F B % C A A  
8! A ' 3 B C  
% \$ % F B C % G \$  
.9 & 9 \$ 59 \$ % %  
!

#### CHIP CLEAR:

% \$ % E0- /9  
! \* \$ 9 .9 ' & #  
4 59

#### DEVICE IDENTIFICATION:

99- . ' % ' # 8 %  
! \* \$ D ± 4!3A \$  
94E E % %  
\$

### DC and AC Operating Range

		FT28C17
Operating Temperature (Case)	Com.	0°C - 70°C
	Ind.	-40°C - 85°C
	Mil	-55°C - 125°C
V <sub>CC</sub> Power Supply		5V ± 10%

### 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
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
Chip Erase	V <sub>IL</sub>	V <sub>H</sub> <sup>(3)</sup>	V <sub>IL</sub> Hi	gh 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.

### DC Characteristics

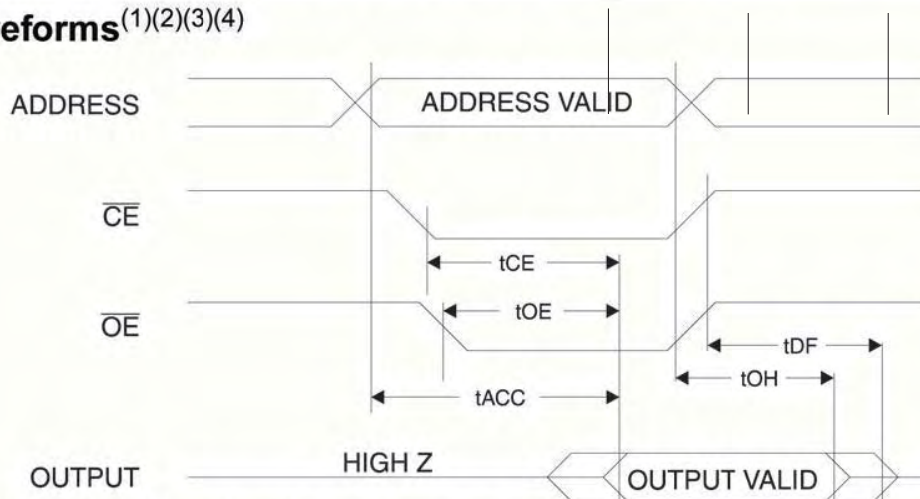
Symbol	Parameter	Condition	Min	Max	Units
I <sub>LI</sub>	Input Load Current	V <sub>IN</sub> = 0V to V <sub>CC</sub> + 1V		10	μA
I <sub>LO</sub>	Output Leakage Current	V <sub>I/O</sub> = 0V to V <sub>CC</sub>		10	μA
I <sub>SB1</sub>	V <sub>CC</sub> Standby Current CMOS	$\overline{CE} = V_{CC} - 0.3V$ to V <sub>CC</sub> + 1.0V		100	μA
I <sub>SB2</sub>	V <sub>CC</sub> Standby Current TTL	$\overline{CE} = 2.0V$ to V <sub>CC</sub> + 1.0V	Com.	2	mA
			Ind.	3	mA
I <sub>CC</sub>	V <sub>CC</sub> Active Current AC	f = 5 MHz; I <sub>OUT</sub> = 0 mA $\overline{CE} = V_{IL}$	Com.	30	mA
			Ind.	45	mA
V <sub>IL</sub>	Input Low Voltage			0.8	V
V <sub>IH</sub>	Input High Voltage		2.0		V
V <sub>OL</sub>	Output Low Voltage	I <sub>OL</sub> = 2.1 mA = 4.0 for RDY/BUSY		.4	V
V <sub>OH</sub>	Output High Voltage	I <sub>OH</sub> = -400 μA	2.4		V



### AC Read Characteristics

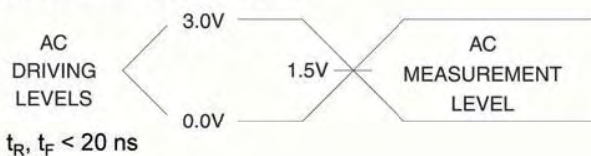
Symbol	Parameter	Typical		Units
		Min	Max	
$t_{ACC}$	Address to Output Delay		150	ns
$t_{CE}^{(1)}$	$\overline{CE}$ to Output Delay		150	ns
$t_{OE}^{(2)}$	$\overline{OE}$ to Output Delay	10	70	ns
$t_{DF}^{(3)(4)}$	$\overline{CE}$ or $\overline{OE}$ High to Output Float	0	50	ns
$t_{OH}$	Output Hold from $\overline{OE}$ , $\overline{CE}$ or Address, whichever occurred first	0		ns

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

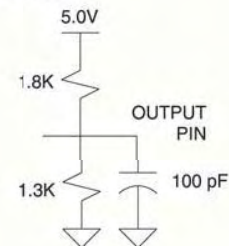


- Notes:
- $\overline{CE}$  may be delayed up to  $t_{ACC} - t_{CE}$  after the address transition without impact on  $t_{ACC}$ .
  - $\overline{OE}$  may be delayed up to  $t_{CE} - t_{OE}$  after the falling edge of  $\overline{CE}$  without impact on  $t_{CE}$  or by  $t_{ACC} - t_{OE}$  after an 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 characterised and is not 100% tested.

### Input Test Waveforms and Measurement Level



### Output Test Load



### Pin Capacitance

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

Symbol	Typ	Max	Units	Conditions
$C_{IN}$	4	6	pF	$V_{IN} = 0V$
$C_{OUT}$	8	12	pF	$V_{OUT} = 0V$

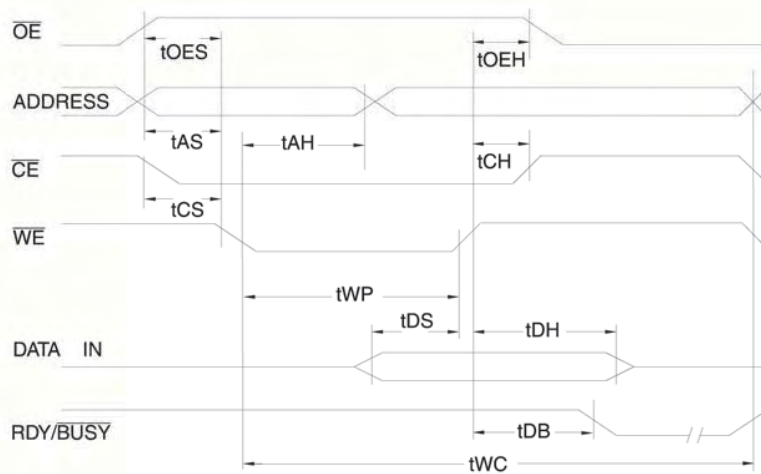
Note: 1. This parameter is characterised and is not 100% tested.

### AC Write Characteristics

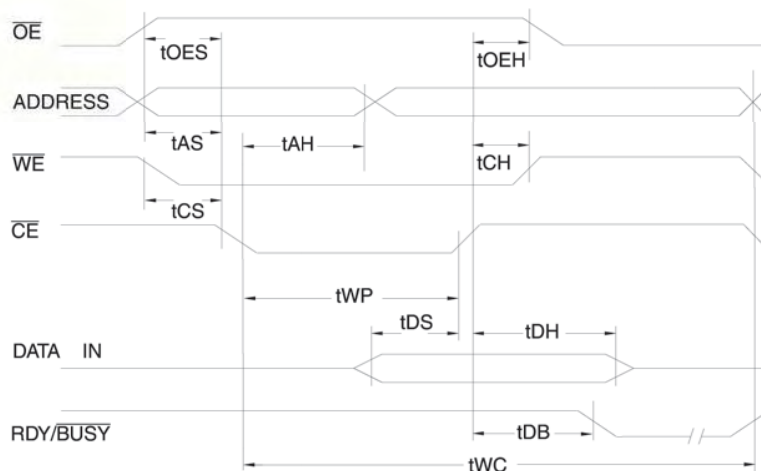
Symbol	Parameter	Min	Typ	Max	Units
$t_{AS}, t_{OES}$	Address, $\overline{OE}$ Set-up Time	10			ns
$t_{AH}$	Address Hold Time	50			ns
$t_{WP}$	Write Pulse Width ( $\overline{WE}$ or $\overline{CE}$ )	100		1000	ns
$t_{DS}$	Data Set-up Time	50			ns
$t_{DH}, t_{OEH}$	Data, $\overline{OE}$ Hold Time	10			ns
$t_{CS}, t_{CH}$	$\overline{CE}$ to $\overline{WE}$ and $\overline{WE}$ to $\overline{CE}$ Set-up and Hold Time	0			ns
$t_{DB}$	Time to Device Busy			50	ns
$t_{WC}$	Write Cycle Time		0.5	1.0	ms

### AC Write Waveforms

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



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

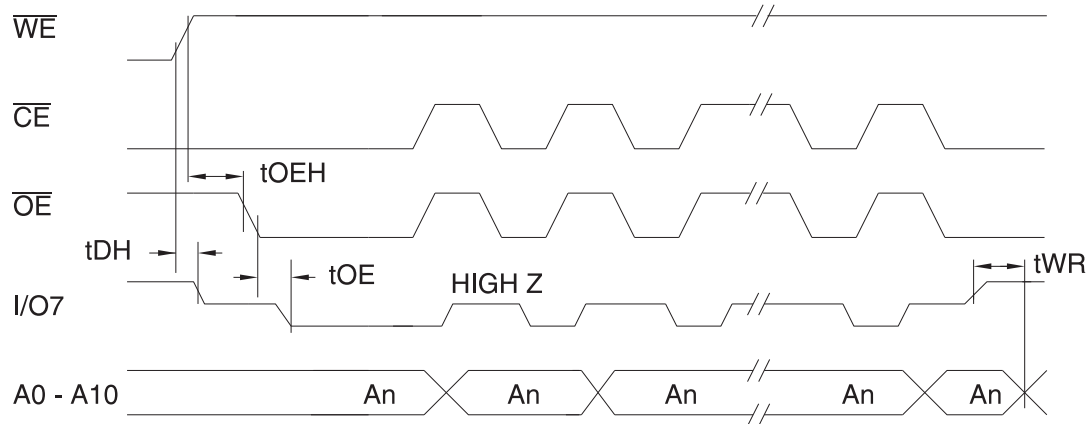


### Data Polling Characteristics<sup>BC</sup>

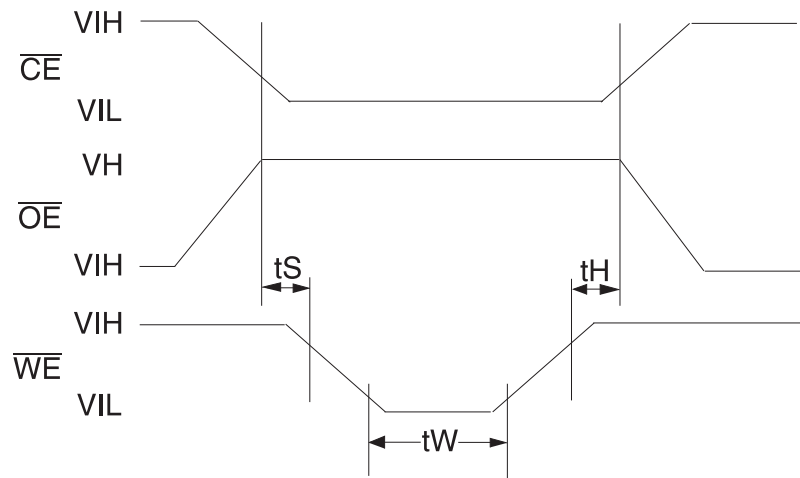
Symbol	Parameter	Min	Typ	Max	Units
$t_{OE}$	$t_{OE}$	4			
$t_{DH}$	$t_{DH}$	4			
$t_{OE}$	$t_{OE}$				
$t_{WR}$	$t_{WR}$	4			

1 = ! 44H !  
! , !

### Data Polling Waveforms



### Chip Erase Waveforms



, | E | μ B !C  
5 | 4 B !C  
A<sub>E</sub> | !4 ±4!3A



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

t <sub>ACC</sub> (ns)	I <sub>CC</sub> (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
150	30	0.1	FT28C17(E)-15JC	32J	Commercial (0°C to 70°C)
			FT28C17(E)-15PC	28P6	
			FT28C17(E)-15SC	28S	
	45	0.1	FT28C17(E)-15JI	32J	Industrial (-40°C to 85°C)
			FT28C17(E)-15PI	28P6	
			FT28C17(E)-15SI	28S	Military/883 M5004 (-55°C to 125°C)
		FT28C17(E)-15DMB	28D6		
200	30	0.1	FT28C17(E)-20DC	32J	Commercial (0°C to 70°C)
			FT28C17(E)-20JC	28P6	
			FT28C17(E)-20PC	28S	
200	45	0.1	FT28C17(E)-20DI	32J	Industrial (-40°C to 85°C)
			FT28C17(E)-20JI	28P6	
			FT28C17(E)-20PI	28S	Military/883 M5004 (-55°C to 125°C)
		FT28C17(E)-20DMI	28D6		
250	30	0.1	FT28C17(E)-25DC	32J	Commercial (0°C to 70°C)
			FT28C17(E)-25JC	28P6	
			FT28C17(E)-25PC	28S	
250	45	0.1	FT28C17(E)-25DI	32J	Industrial (-40°C to 85°C)
			FT28C17(E)-25DI	28P6	
			FT28C17(E)-25PI	28S	Military/883 M5004 (-55°C to 125°C)
		FT28C17(E)-25SI	28D6		

Note : 1. See Valid Part Number Table On Next Page



### Valid Part Numbers

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

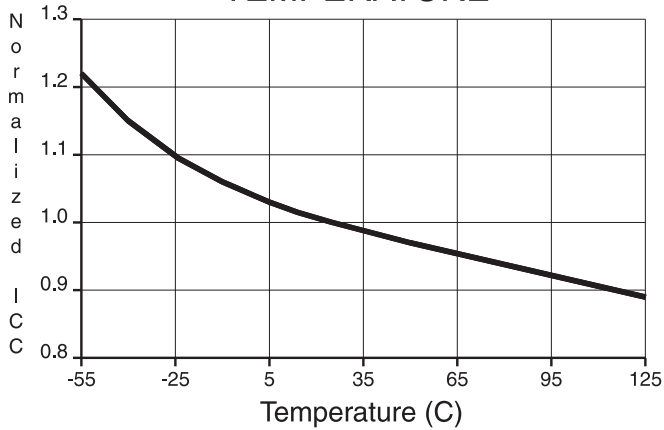
Device Numbers	Speed	Package and Temperature Combinations
FT28C17	15	DC,JC,JI,PC,PI,SC,SI,DM/DMB
FT28C17E	15	DC,JC,JI,PC,PI,SC,SI,DM/DMB
FT7C17	20	DC,JC,JI,PC,PI,SC,SI,DM/DMB
FT28C17E	20	DC,JC,JI,PC,PI,SC,SI,DM/DMB
FT28C17	25	DC,JC,JI,PC,PI,SC,SI,DM/DMB
FT28C17E	25	DC,JC,JI,PC,PI,SC,SI,DM/DMB
FT7C17	35	DC,JC,JI,PC,PI,SC,SI,DM/DMB
FT28C17E	35	DC,JC,JI,PC,PI,SC,SI,DM/DMB

### Die Products

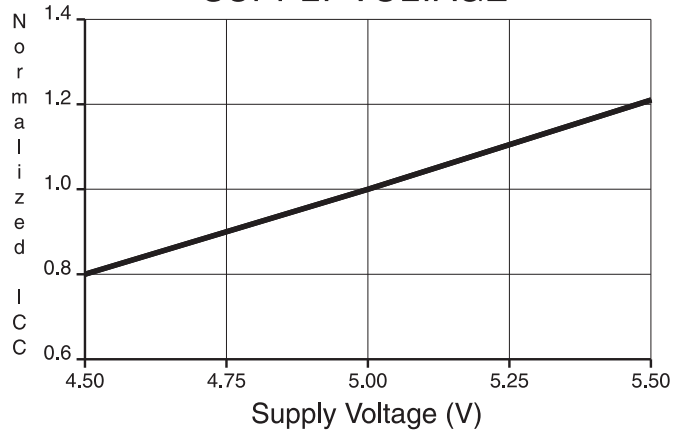
Reference Section: Parallel EEPROM Die Products	
Package Type	
32J	32-Lead, Plastic J-Leaded Chip Carrier (PLCC)
28P6	28-Lead, 0.600" Wide, Plastic Dull Inline Package (PDIP)
28S	28-Lead, 0.300" Wide, Plastic Gull Wing, Small Outline (SOIC)
Options	
Blank	Standard Device: Endurance = 10K Write Cycles; Write Time = 1 ms
E	High Endurance Option: Endurance = 100K Write Cycles

### 16K (2K x 8) Parallel EEPROMs

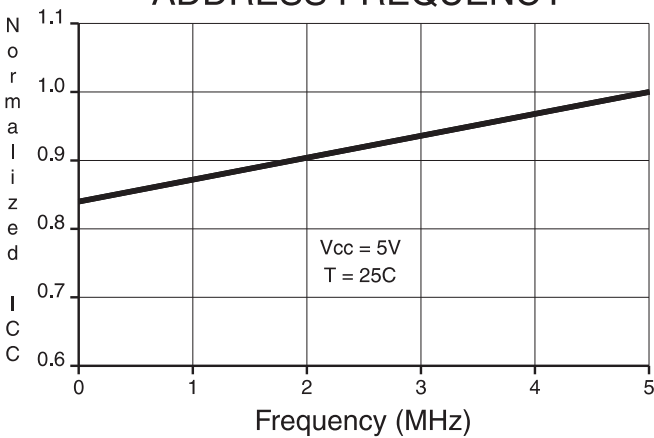
NORMALIZED SUPPLY CURRENT vs.  
TEMPERATURE



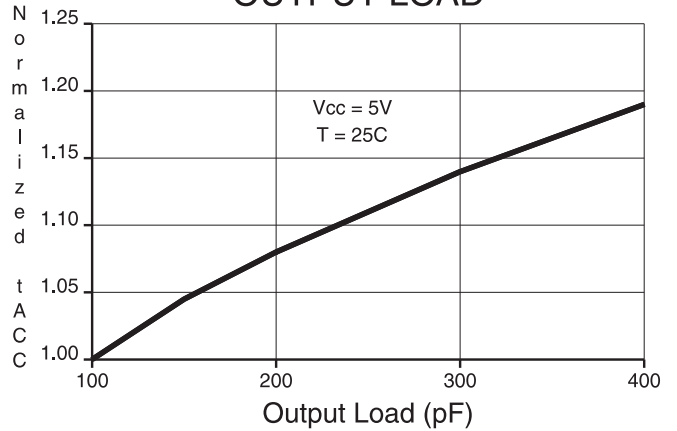
NORMALIZED SUPPLY CURRENT vs.  
SUPPLY VOLTAGE



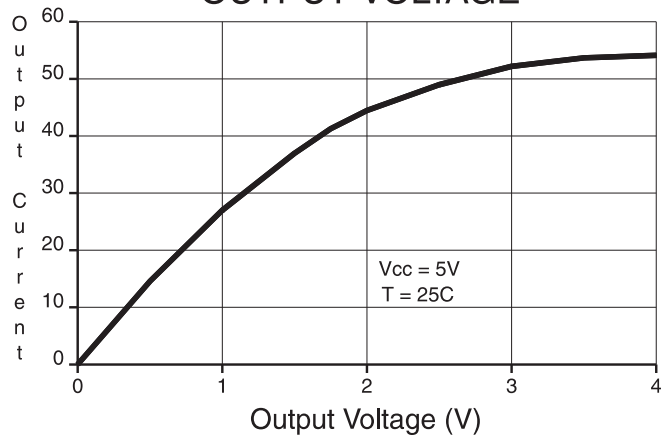
NORMALIZED SUPPLY CURRENT vs.  
ADDRESS FREQUENCY



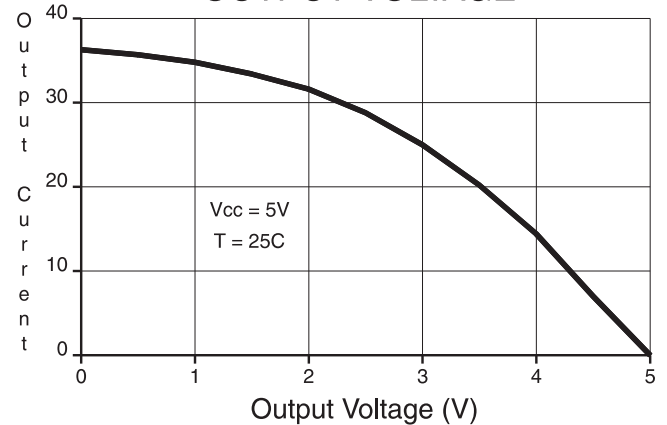
NORMALIZED ACCESS TIME vs.  
OUTPUT LOAD



OUTPUT SINK CURRENT vs.  
OUTPUT VOLTAGE



OUTPUT SOURCE CURRENT vs.  
OUTPUT VOLTAGE

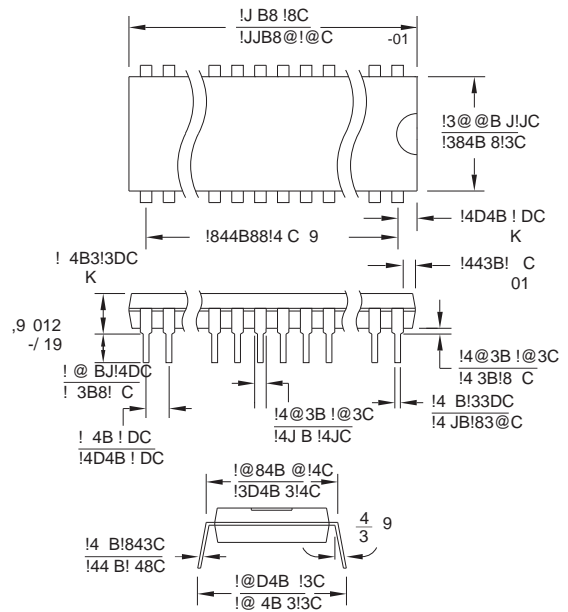
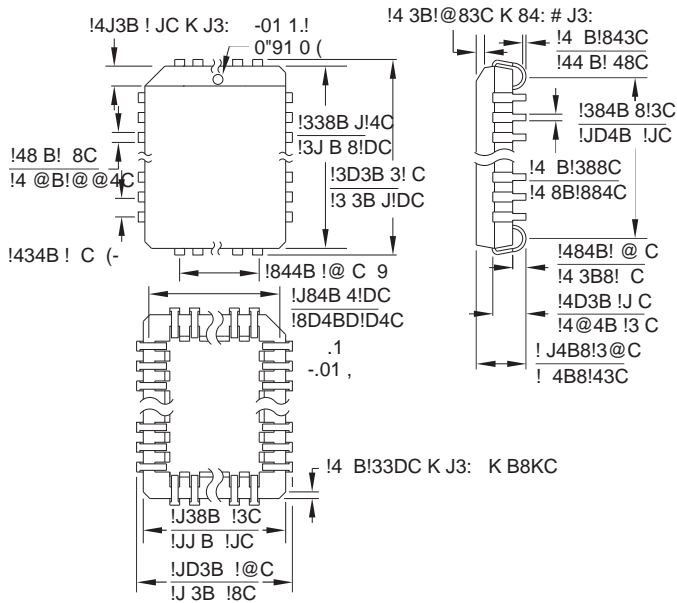


### 16K (2K x 8) Parallel EEPROMs

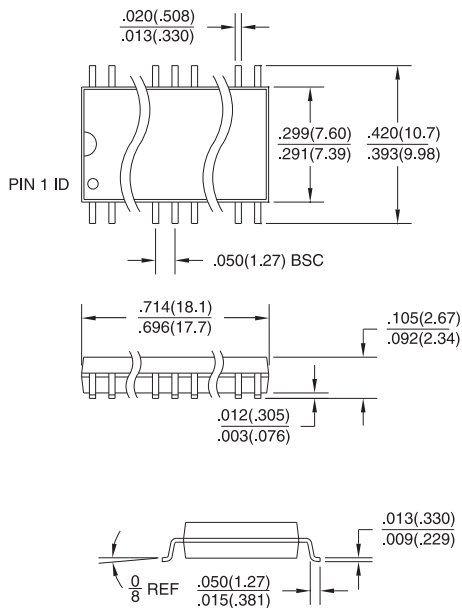
#### Packaging Information

32J& 8 #/ & - L#/ B-/ C  
" 0 B C  
L9"9 , 1" " ,#4

28P6& #/ & 4!@44M 5 & - " 0  
- \$ B-"0-C  
" 0 B C  
L9"9 , 1" " ,#4 \*



28S& J#/ & 4!844M 5 & - 2 5 \$ ,  
" B,.0 C  
" 0 B C





& E &  
% \$ & 5 & ,1 8 E +N  
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