

# FUJITSU

## UV ERASABLE 262144-BIT READ ONLY MEMORY

**MBM 27256-17**  
**MBM 27256-20**  
**MBM 27256-25**

February 1986  
Edition 3.0

### MOS 262144 BIT UV ERASABLE AND ELECTRICALLY PROGRAMMABLE READ ONLY MEMORY

The Fujitsu MBM 27256 is a high speed 262,144-bit static NMOS erasable and electrically reprogrammable read only memory (EPROM). It is especially well suited for applications where rapid turn-around and/or bit pattern experimentation are important.

A 28-pin Dual In-Line package and a 32-pad Leadless Chip Carrier with a transparent lid is used to package the MBM 27256. The transparent lid allows the user to expose the device to ultraviolet light in order to erase the memory bit pattern previously programmed. At the completion of erasure, a new pattern can then be written into the memory.

The MBM 27256 is fabricated using NMOS double polysilicon gate technology with single transistor stacked gate cells. It is organized as 32,768 words by 8 bits for use in microprocessor applications. Single +5V operation greatly facilitates its use in systems.

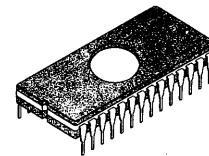
- 32,768 words x 8 bits organization, fully decoded
- Single location programming
- Programmable utilizing the Quick Pro™ algorithm
- Program voltage: 12.5V
- Low power requirement
  - Active: 525mW
  - Standby: 210mW
- No clocks required (fully static operation)
- Output Enable ( $\overline{OE}$ ) pin for simple memory expansion
- Fast access time:
  - 170ns max. (MBM 27256-17)
  - 200ns max. (MBM 27256-20)
  - 250ns max. (MBM 27256-25)
- TTL compatible inputs/outputs
- Three-state output with OR-tie capability
- Single +5V supply,  $\pm 5\%$  tolerance
- Standard 28-pin Ceramic (Cerdip)
  - DIP: Suffix-Z
  - Standard 32-pad Ceramic
  - LCC: Suffix-CV

#### ABSOLUTE MAXIMUM RATINGS (see NOTE)

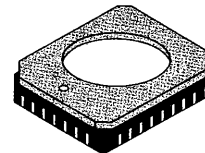
Rating	Symbol	Value	Unit
Supply Voltage with Respect to GND	$V_{CC}$	-0.6 to +7	V
$V_{PP}$ Voltage with Respect to GND	$V_{PP}$	-0.6 to +14	V
Voltage on $A_9$ with Respect to GND	$V_{A9}$	-0.6 to +13.5	V
All Inputs/Outputs Voltage with Respect to GND	$V_{IN}, V_{OUT}$	-0.6 to +7	V
Temperature under Bias	$T_{BIAS}$	-25 to +85	°C
Storage Temperature	$T_{STG}$	-65 to +125	°C

**NOTE:** Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Quick Pro™ is a trade mark of FUJITSU LIMITED

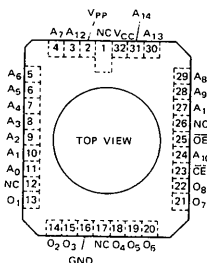
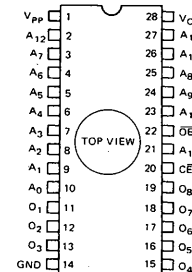


CERAMIC PACKAGE  
DIP-28C-C01



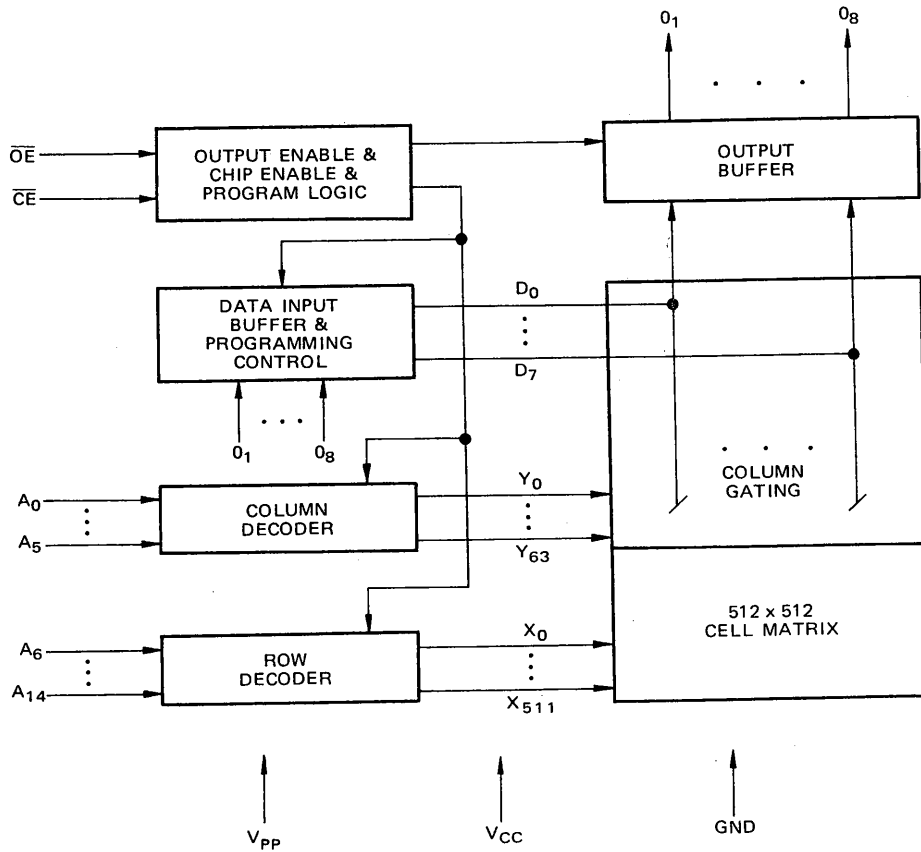
CERAMIC PACKAGE  
LCC-32C-A01

#### PIN ASSIGNMENT



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

Fig. 1 – MBM 27256 BLOCK DIAGRAM



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

Parameter	Symbol	Min	Typ	Max	Unit
Input Capacitance ( $V_{IN} = 0V$ )	$C_{IN}$		4	6	pF
Output Capacitance ( $V_{OUT} = 0V$ )	$C_{OUT}$		8	12	pF

## FUNCTIONS AND PIN CONNECTIONS

Mode \ Function (Pin No.)	Address Input (2 ~ 10, 21, 23, 25 ~ 27)	A <sub>9</sub> (24)	Data I/O (11 ~ 13, 15 ~ 19)	$\overline{CE}$ (20)	$\overline{OE}$ (22)	V <sub>CC</sub> (28)	V <sub>PP</sub> (1)	GND (14)
Read	A <sub>IN</sub>	A <sub>IN</sub>	D <sub>OUT</sub>	V <sub>IL</sub>	V <sub>IL</sub>	+5V	+5V	GND
Output Disable	A <sub>IN</sub>	A <sub>IN</sub>	High-Z	V <sub>IL</sub>	V <sub>IH</sub>	+5V	+5V	GND
Standby	Don't Care	Don't Care	High-Z	V <sub>IH</sub>	Don't Care	+5V	+5V	GND
Program	A <sub>IN</sub>	A <sub>IN</sub>	D <sub>IN</sub>	V <sub>IL</sub>	V <sub>IH</sub>	+6V	+12.5V	GND
Program Verify	A <sub>IN</sub>	A <sub>IN</sub>	D <sub>OUT</sub>	Don't Care	V <sub>IL</sub>	+6V	+12.5V	GND
Program Inhibit	Don't Care	Don't Care	High-Z	V <sub>IH</sub>	V <sub>IH</sub>	+6V	+12.5V	GND
Electronic Signature	A <sub>IN</sub>	+12V	Code	V <sub>IL</sub>	V <sub>IL</sub>	+5V	+5V	GND

## RECOMMENDED OPERATING CONDITIONS

(Referenced to GND)

Parameter	Symbol	Min	Typ	Max	Unit
V <sub>CC</sub> Supply Voltage*	V <sub>CC</sub>	4.75	5.0	5.25	V
V <sub>PP</sub> Supply Voltage	V <sub>PP</sub>	V <sub>CC</sub> - 0.6		V <sub>CC</sub> + 0.6	V
Input High Voltage	V <sub>IH</sub>	2.0		V <sub>CC</sub> + 1	V
Input Low Voltage	V <sub>IL</sub>	-0.1		0.8	V
Operating Temperature	T <sub>A</sub>	0		70	°C

Note:\* V<sub>CC</sub> must be applied either before or coincident with V<sub>PP</sub> and removed either after or coincident with V<sub>PP</sub>.

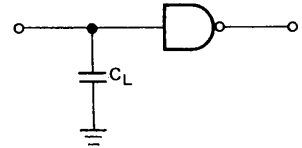
## DC CHARACTERISTICS

(Recommended operating conditions unless otherwise noted)

Parameter	Symbol	Min	Typ	Max	Unit
Input Load Current (V <sub>IN</sub> = 5.25V)	I <sub>LI</sub>			10	μA
Output Leakage Current (V <sub>OUT</sub> = 5.25V)	I <sub>LO</sub>			10	μA
V <sub>CC</sub> Standby Current ( $\overline{CE} = V_{IH}$ )	I <sub>CC1</sub>			40	mA
V <sub>CC</sub> Supply Current ( $\overline{CE} = V_{IL}$ )	I <sub>CC2</sub>			100	mA
V <sub>PP</sub> Supply Current (V <sub>PP</sub> = V <sub>CC</sub> ± 0.6V)	I <sub>PP1</sub>			5	mA
Output Low Voltage (I <sub>OL</sub> = 2.1mA)	V <sub>OL</sub>			0.45	V
Output High Voltage (I <sub>OH</sub> = -400μA)	V <sub>OH</sub>	2.4			V

Fig. 2 – AC TEST CONDITIONS (INCLUDING PROGRAMMING)

Input Pulse Levels: 0.45V to 2.4V  
 Input Rise and Fall Times:  $\leq 20\text{ns}$   
 Timing Measurement Reference Levels: 0.8V and 2.0V for inputs  
 0.8V and 2.0V for outputs  
 Output Load: 1 TTL gate and  $C_L = 100\text{pF}$



## AC CHARACTERISTICS

(Recommended operating conditions unless otherwise noted)

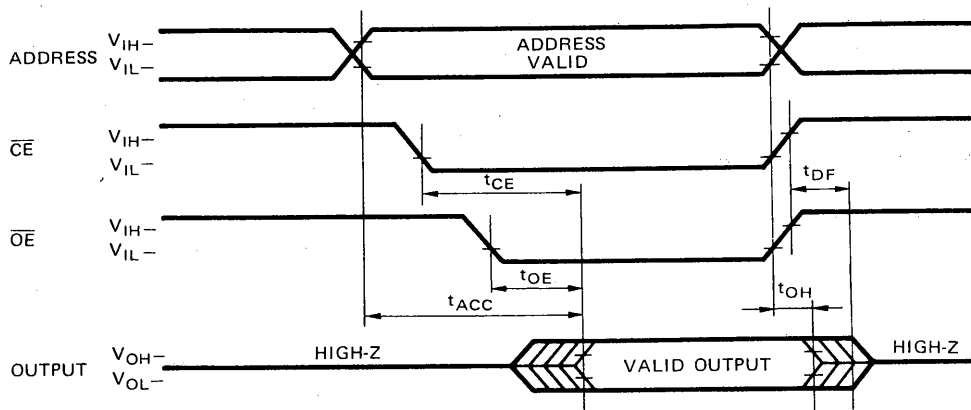
Parameter	Symbol	MBM 27256-17			MBM 27256-20			MBM 27256-25			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Address Access Time*1 ( $\overline{CE} = \overline{OE} = V_{IL}$ )	$t_{ACC}$			170			200			250	ns
$\overline{CE}$ to Output Delay ( $\overline{OE} = V_{IL}$ )	$t_{CE}$			170			200			250	ns
$\overline{OE}$ to Output Delay*1 ( $\overline{CE} = V_{IL}$ )	$t_{OE}$			75			75			100	ns
Address to Output Hold	$t_{OH}$	0			0			0			ns
Output Enable High to Output Float*2	$t_{DF}$	0		60	0		60	0		105	ns

Notes: \*1  $\overline{OE}$  may be delayed up to  $t_{ACC} - t_{OE}$  after the falling edge of  $\overline{CE}$  without impact on  $t_{ACC}$ .

\*2  $t_{DF}$  is specified from  $\overline{OE}$  or  $\overline{CE}$ , whichever occurs first.

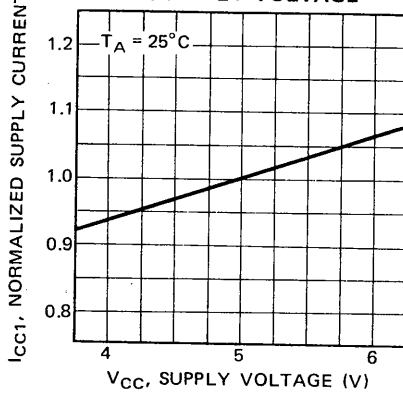
Output Float is defined as the point where data is no longer driven.

### OPERATION TIMING DIAGRAM

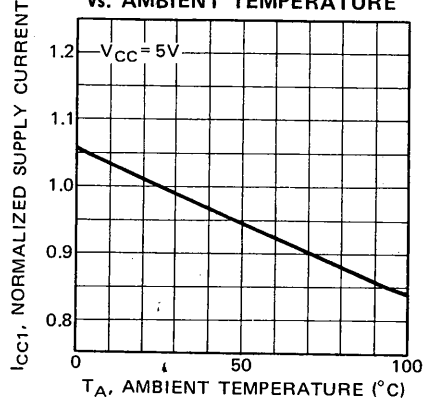


# CHARACTERISTICS CURVES

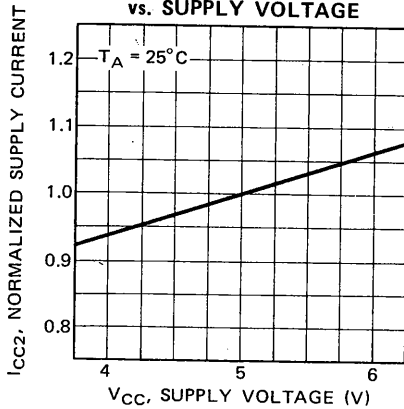
**Fig. 3 – SUPPLY CURRENT (STANDBY) vs. SUPPLY VOLTAGE**



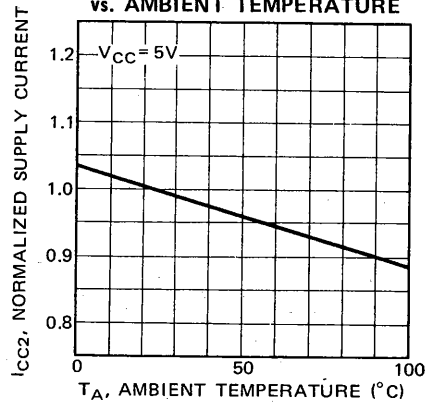
**Fig. 4 – SUPPLY CURRENT (STANDBY) vs. AMBIENT TEMPERATURE**



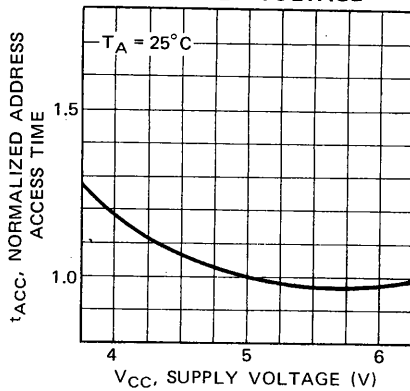
**Fig. 5 – SUPPLY CURRENT (ACTIVE) vs. SUPPLY VOLTAGE**



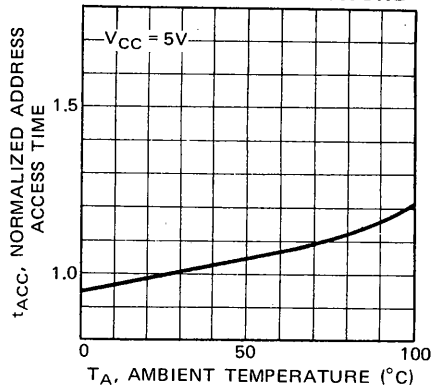
**Fig. 6 – SUPPLY CURRENT (ACTIVE) vs. AMBIENT TEMPERATURE**



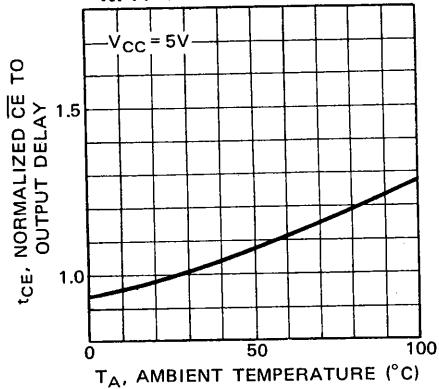
**Fig. 7 – ADDRESS ACCESS TIME vs. SUPPLY VOLTAGE**



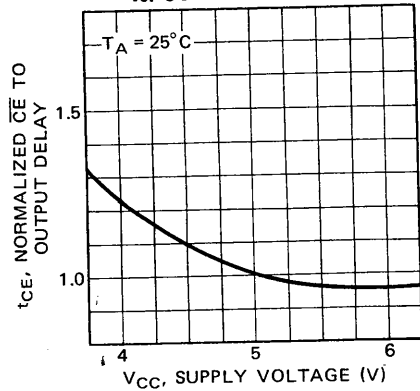
**Fig. 8 – ADDRESS ACCESS TIME vs. AMBIENT TEMPERATURE**



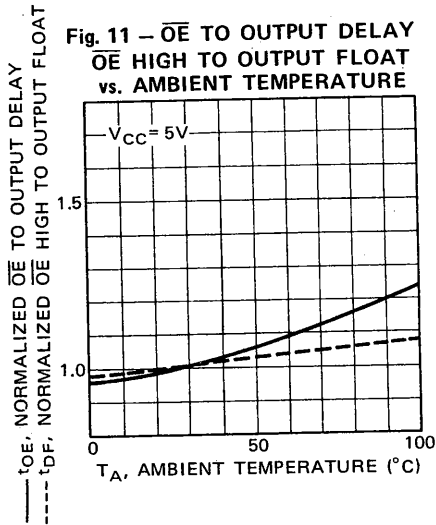
**Fig. 9 -  $\overline{CE}$  TO OUTPUT DELAY vs. AMBIENT TEMPERATURE**



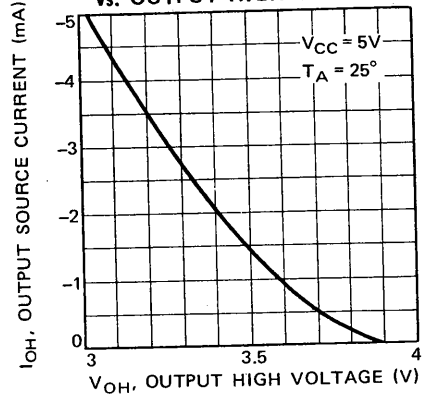
**Fig. 10 -  $\overline{CE}$  TO OUTPUT DELAY vs. SUPPLY VOLTAGE**



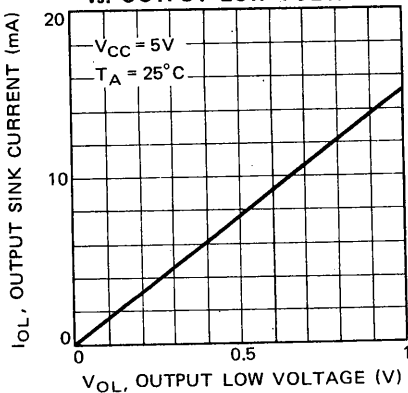
**Fig. 11 -  $\overline{OE}$  HIGH TO OUTPUT FLOAT vs. AMBIENT TEMPERATURE**



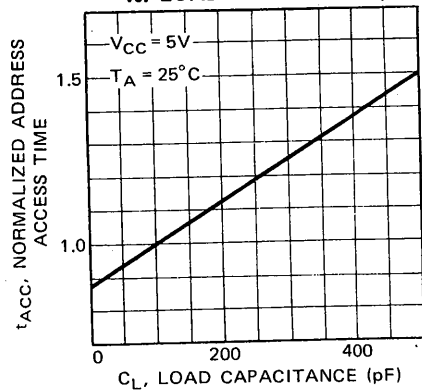
**Fig. 12 - OUTPUT SOURCE CURRENT vs. OUTPUT HIGH VOLTAGE**



**Fig. 13 - OUTPUT SINK CURRENT vs. OUTPUT LOW VOLTAGE**



**Fig. 14 - ADDRESS ACCESS TIME vs. LOAD CAPACITANCE**



## PROGRAMMING/ERASING INFORMATION

### PROGRAMMING

Upon delivery from Fujitsu, or after each erasure (see Erasure section), the MBM 27256 has all 262,144 bits in the "1", or high state. "0's" are loaded into the MBM 27256 through the procedure of programming.

The MBM 27256 is programmed with a fast programming algorithm designed by Fujitsu called Quick Pro™. The programming mode is entered when +12.5V and +6V are applied to  $V_{PP}$  and  $V_{CC}$  respectively, and  $\overline{CE}$  and  $\overline{OE}$  are  $V_{IH}$ . A 0.1 $\mu$ F capacitor between  $V_{PP}$  and GND is needed to prevent excessive voltage transients which could damage the device. The address to be programmed is applied to the proper address pins. The 8 bit data pattern to be written is placed on the respective data output pins. The voltage levels should be standard TTL levels. When both the address and data are stable, a 1ms programming pulse is applied to

$\overline{CE}$  and after that one additional pulse which is 3 times as wide as previous pulse is applied to  $\overline{CE}$  to accomplish the programming.

Procedure of Quick Pro™ (Refer to the attached flowchart.)

- 1) Set the start address (=G) at the address pins.
- 2) Set  $V_{CC} = 6V$ ,  $V_{PP} = 12.5V$  and  $\overline{CE} = V_{IH}$ .
- 3) Clear the programming pulse counter ( $X \leftarrow 0$ ).
- 4) Input data to respective pins.
- 5) Apply ONE programming pulse ( $t_{PW} = 1ms$  Typ.) to  $\overline{CE}$ .
- 6) Increment the counter ( $X \leftarrow X+1$ ).
- 7) Compare the number (=X) of applied programming pulse with 25 and then verify the programmed data. If programmed data is verified, go to the next step regardless of X value. If  $X = 25$  and programmed data is not verified, the

device fails. If  $X = 25$  and programmed data is not verified, go back to the step 5).

- 8) Apply one additional wide programming pulse to  $\overline{CE}$  (3X ms).
- 9) Compare the address with an end address (=N). If the programmed address is the end address, proceed to the next step. If not, increment the address ( $G \leftarrow G+1$ ) and then go to the step 3) for the next address.
- 10) Set  $V_{CC} = V_{PP} = 5V$ .
- 11) Verify the all programmed data. If the verification succeeds, the programming completes. If any programmed data is not the same as original data, the device fails.

A continuous TTL low level should not apply to  $\overline{CE}$  input pin during the program mode ( $V_{PP} = 12.5V$ ,  $V_{CC} = 6V$  and  $\overline{OE} = V_{IH}$ ) because it is required that one programming pulse width does not exceed 78.75 ms at each address.

### ERASURE

In order to clear all locations of their programmed contents it is necessary to expose the MBM 27256 to an ultraviolet light source. A dosage of 15 W-seconds/cm<sup>2</sup> is required to completely erase an MBM 27256. This dosage can be obtained by exposure to an ultraviolet lamp (wavelength of 2537 Angstroms (Å)) with intensity of 12000 $\mu$ W/cm<sup>2</sup> for 15 to 21 minutes.

The MBM 27256 should be about one inch from the source and all filters should be removed from the UV light source prior to erasure.

It is important to note that the MBM 27256 and similar devices, will erase with light sources having wavelengths shorter than 4000Å. Although erasure time will be much longer than

with UV source at 2537Å, nevertheless the exposure to fluorescent light and sunlight will eventually erase the MBM 27256, and exposure to them should be prevented to realize maximum system reliability. If used in such an environment, the package windows should be covered by an opaque label or substance.

### ELECTRONIC SIGNATURE

The MBM 27256 has electronic signature mode which is intended for use by programming equipment for the purpose of automatically matching the device to be programmed with its cor-

responding programming algorithm.

The electronic signature is activated when +12V is applied to address line  $A_9$  (pin 24) of the MBM 27256. Two identifier bytes are readed out from the

outputs by toggling address line  $A_0$  (pin 10) from  $V_{IL}$  to  $V_{IH}$ . The address lines from  $A_1$  to  $A_{13}$  must be hold at  $V_{IL}$  to keep the electronic signature mode. See the table below.

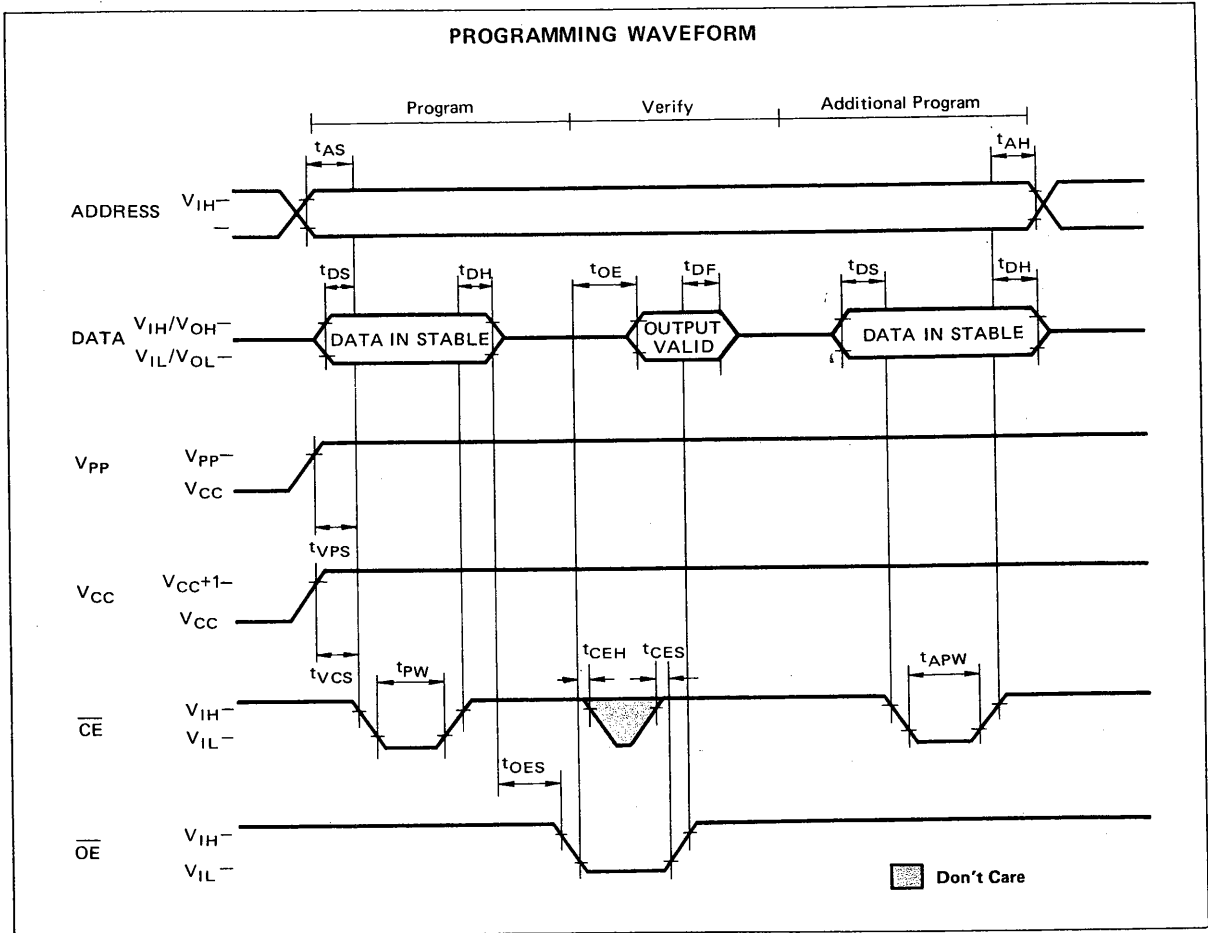
$A_0$	$O_1$	$O_2$	$O_3$	$O_4$	$O_5$	$O_6$	$O_7$	$O_8$	Definition
$V_{IL}$	0	0	1	0	0	0	0	0	Manufacture
$V_{IH}$	0	1	0	0	0	0	0	0	Device

Note:  $A_9 = 12V \pm 0.5V$

$A_1$  thru  $A_8 = A_{10}$  thru  $A_{13} = \overline{CE} = \overline{OE} = V_{IL}$

$A_{14} = \text{Either } V_{IL} \text{ or } V_{IH}$

## PROGRAMMING/ERASING INFORMATION (Cont'd)





**DC CHARACTERISTICS**

( $T_A = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} *1 = 6V \pm 0.25V$ ,  $V_{PP} *2 = 12.5V \pm 0.3V$ )

Parameter	Symbol	Min	Typ	Max	Unit
Input Leakage Current ( $V_{IN} = 6.25V/0.45V$ )	$ I_{LI} $			10	$\mu\text{A}$
$V_{PP}$ Supply Current ( $\overline{CE} = V_{IL}$ , $\overline{OE} = V_{IH}$ )	$I_{PP2}$			50	mA
$V_{PP}$ Supply Current ( $\overline{OE} = V_{IL}$ )	$I_{PP3}$			5	mA
$V_{CC}$ Supply Current	$I_{CC3}$			100	mA
Input Low Level	$V_{IL}$	-0.1		0.8	V
Input High Level	$V_{IH}$	2.0		$V_{CC} + 1$	V
Output Low Voltage During Verify ( $I_{OL} = 2.1\text{mA}$ )	$V_{OL}$			0.45	V
Output High Voltage During Verify ( $I_{OH} = -400\mu\text{A}$ )	$V_{OH}$	2.4			V

Note: \*1  $V_{CC}$  must be applied either coincidentally or before  $V_{PP}$  and removed either coincidentally or after  $V_{PP}$ .  
 \*2  $V_{PP}$  must not be greater than 14 volts including overshoot. Permanent device damage may occur if the device is taken out or put into socket remaining  $V_{PP} = 12.5$  volts. Also, during  $\overline{CE} = V_{IL}$ ,  $\overline{OE} = V_{IH}$ ,  $V_{PP}$  must not be switched from  $V_{CC}$  to  $V_{PP}$  volts or vice versa.

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**AC CHARACTERISTICS**

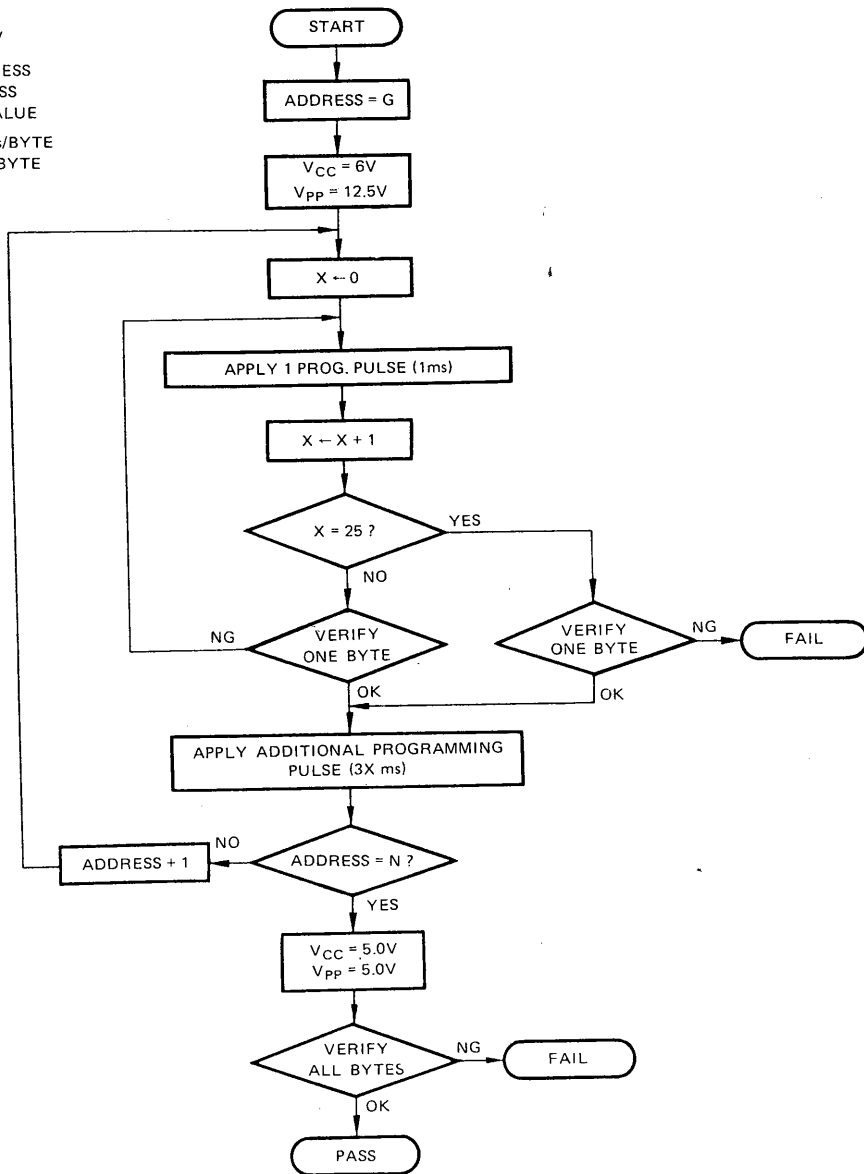
( $T_A = 25 \pm 5^\circ\text{C}$ ,  $V_{CC} = 6V \pm 0.25V$ ,  $V_{PP} = 12.5V \pm 0.3V$ )

Parameter	Symbol	Min	Typ	Max	Unit
Address Setup Time	$t_{AS}$	2			$\mu\text{s}$
Output Enable Setup Time	$t_{OES}$	2			$\mu\text{s}$
Chip Enable Setup Time	$t_{CES}$	2			$\mu\text{s}$
Data Setup Time	$t_{DS}$	2			$\mu\text{s}$
$V_{PP}$ Setup Time	$t_{VPS}$	2			$\mu\text{s}$
$V_{CC}$ Setup Time	$t_{VCS}$	2			$\mu\text{s}$
Address Hold Time	$t_{AH}$	2			$\mu\text{s}$
Data Hold Time	$t_{DH}$	2			$\mu\text{s}$
Chip Enable Hold Time	$t_{CEH}$	2			$\mu\text{s}$
Output Enable to Output Valid	$t_{OE}$			120	ns
Output Disable to Output Float Delay	$t_{DF}$			105	ns
Programming Pulse Width	$t_{PW}$	0.95	1	1.05	ms
Programming Pulse Number		1		25	times
Additional Programming Pulse width	$t_{APW}$	2.85		78.75	ms

## PROGRAMMING/ERASING INFORMATION (Cont'd)

PROGRAMMING FLOW CHART

$V_{CC} = 6V \pm 0.25V$   
 $V_{PP} = 12.5V \pm 0.3V$   
 G : START ADDRESS  
 N : STOP ADDRESS  
 X : COUNTER VALUE  
 MAXIMUM 105 ms/BYTE  
 MINIMUM 3.8 ms/BYTE



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# PACKAGE DIMENSIONS

Standard 28-pin Ceramic DIP (Suffix : -Z)

