DATA SHEET



MBM27C512-20-X CMOS 512K-BIT UV EPROM

CMOS 524.288 BIT UV ERASABLE AND ELECTRICALLY PROGRAMMABLE READ ONLY MEMORY

The Fujitsu MBM27C512 is a high speed 524,288 bit static CMOS erasable and electrically reprogrammable read only memory (EPROM). It is especially well suited for application where rapid turn-around and/or bit pattern experimentation, and low-power consumption are important.

A 28-pin dual-in line package with a transparent lid and 32-PadLeadless Chip Carrier (LCC) are used to package the MBM27C512. 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 MBM27C512 is fabricated using CMOS double polysilicon gate technology with single transistor stacked gate cells. It is organized as 65,536 words by 8 bits foruse in microprocessor applications. Single +5V operation greatly facilitates its use in systems. This specification is applied to "HW"-version.

- CMOS power consumption Standby: 550µW max. Active: 165mW max.
- 65,536 words x 8 bits organization, fully decoded
- Single location programming
- Programmable utilizing the Quick Programming Algorithm
- No clocks required (fully static operation)
- TTL compatible inputs/outputs

200ns max.(MBM27C512-20-X)

- Three-state output with OR-tie capability
- Output Enable (OE) pin for simplified memory expansion
- Single +5V supply, ±10% tolerance
- (Suffix: Z)
- Standard 32-pad Ceramic LCC:

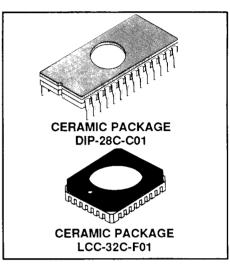
Fast access time:

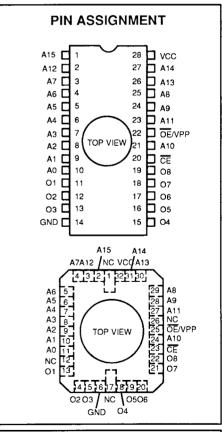
- Standard 28-pin Ceramic DIP:
- (Suffix: TV)

ABSOLUTE MAXIMUM RATINGS (see NOTE)

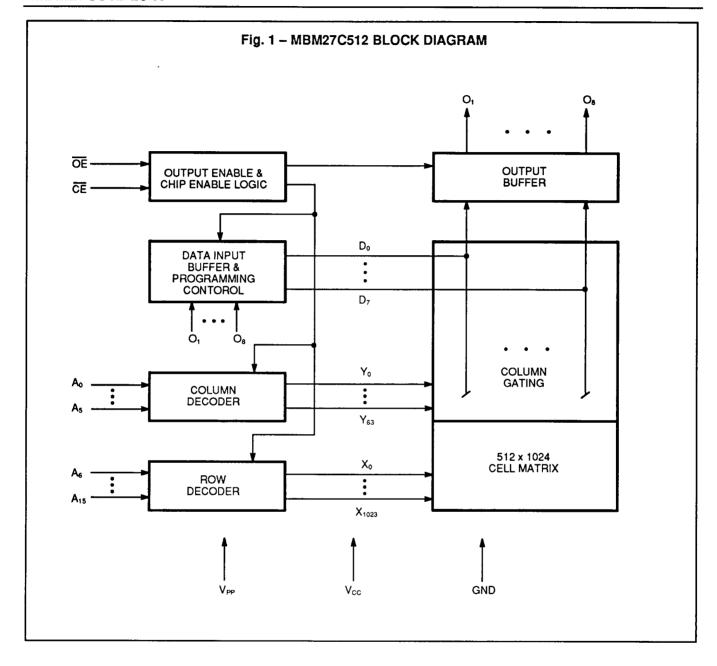
Rating	Symbol	Value	Unit
Temperature under Bias	TBIAS	-50 to +95	°C
Storage Temperature	TSTG	-65 to +125	°C
All Inputs/Outputs Voltage with respect to GND	VIN, VOUT	-0.6 to VCC +0.3	>
Voltage on A9 with respect to GND	VA9	-0.6 to +13.5	V
VPP Voltage with respect to GND	VPP	-0.6 to +14	٧
Supply Voltage with respect to GND	vcc	-0.6 to +7	٧

Permanent device damage may occur if the above Absolute Maximum Ratings are NOTE: 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.





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.



CAPACITANCE (T_A = 25°C, f = 1MHz)

	•				
Parameter	Symbol	Min	Тур	Max	Unit
Input Capacitance (V _{IN} = 0V, except \overline{OE}/V_{PP})	Cint	_	4	6	pF
OE/V _{PP} Input Capacitance (V _{IN} = 0V)	C _{IN2}	_	_	20	pF
Output Capacitance (Vout = 0V)	Соит	-	8	12	ρF

FUNCTIONS AND PIN CONNECTIONS

Function Mode	Address Input	Data I/O	CE	ŌĒ/V _{PP}	V _{cc}	GND
Read	Ain	Dout	V _{IL}	V _{IL}	5V	GND
Output Disable	Ain	High-Z	V _{IL}	V _{iH}	5V	GND
Standby	Don't Care	High-Z	V _{iH}	Don't Care	5V	GND
Program	Ain	D _{IN}	V _{IL}	12.5V	6V	GND
Program Verify	A _{IN}	D _{out}	V _{IL}	V _{IL}	6V	GND
Program Inhibit	Don't Care	High-Z	V _{IH}	12.5V	6V	GND

RECOMMENDED OPERATING CONDITIONS

(Referenced to GND)

Parameter	Combal		11. 7.		
Parameter	Symbol	Min	Тур	Мах	Unit
V _{cc} Supply Voltage	V _{cc}	4.5	5.0	5.5	٧
Operating Temperature	T _A	-40		+85	°C

DC CHARACTERISTICS

(Recommended operating conditions unless otherwise noted)

December	0.1.1		Value			
Parameter	Symbol	Min	Тур	Max	Unit	
Input Leakage Current (V _{IN} = 5.5V)	Hul			10	μΑ	
Output Leakage Current (V _{OUT} = 5.5V)	I _{LO}			10	μА	
V _{CC} Standby Current (CE = V _{IH})	I _{SB1}			1	mA	
V _{cc} Standby Current (CE = V _{cc} ±0.3V, I _{out} = 0mA)	I _{SB2}		1	100	μΑ	
V _{CC} Active Current ($\overline{CE} = V_{IL}, I_{OUT} = 0$ mA)	I _{cc1}		4	30	mA	
V _{cc} Operation Current (f = 4MHz, I _{out} = 0mA)	lcc2		10	30	mA	
Input High Voltage	V _{IH}	2.0		V _{cc} +0.3	V	
Input Low Voltage	V _{IL}	-0.1		0.8	V	
Output Low Voltage (I _{OL} = 2.1mA)	VoL			0.45	٧	
Output High Voltage (I _{OH} = -400μA)	V _{OH1}	2.4			٧	
Output High Voltage (I _{OH} = -100μA)	V _{OH2}	V _{cc} -0.7			٧	

Fig. 2 – AC TEST CONDITIONS (INCLUDING PROGAMMING)

Input Pulse Levels:

0.45V to 2.4V

Input Rise/Fall Times:

≤20ns

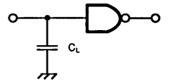
Timing Measurement Reference Levels:

0.8V and 2.0V for inputs

0.8V and 2.0V for outputs

Output Load:

1 TTL gate and C_L = 100pF



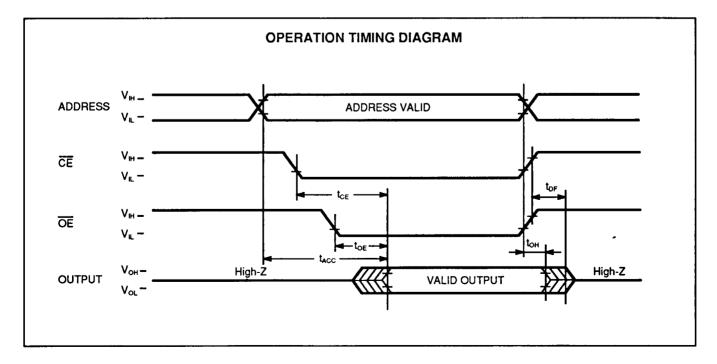
AC CHARACTERISTICS

(Recommended operating conditions unless otherwise noted)

		м			
Parameter	Symbol	Min	Тур	Max	Unit
Address Access Time*1	tacc			200	ns
CE to Output Delay	tce			200	ns
OE to Output Delay*1	t _{OE}			70	ns
Address to Output Hold	t _{он}	0			ns
Output Enable High to Output Float*2	tor	0		60	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.



PROGRAMMING/ERASING INFORMATION

PROGRAMMING

Upon delivery from Fujitsu, or after each erasure (see Erasure section), the MBM27C512 has all 524,288 bits in the "1", or high state. "0's" are loaded into the MBM27C512 through the procedure of programming.

The MBM27C512 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 VPP and Vcc respectively, and CE is V_{IH}. A 0.1µF 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 1 ms programming pulse is applied to 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 Programming (Refer to the attached flowchart.)

- Set the start address (=G) at the address pins.
- 2) Set $V_{CC} = 6V$, $V_{PP} = 12.5V$ and $\overline{CE} = V_{HH}$.
- Clear the programming pulse counter (X←0).
- 4) Input data to respective pins.
- 5) Apply ONE Programming pulse (t_{PW} = 1ms Typ.) to CE.
- 6) Increment the counter (X←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 $\overline{\text{CE}}$ (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 ← 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 and V_{CC} = 6V) 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 MBM27C512-W to an ultraviolet light source. A dosage of 15 W–seconds/ cm² is required to completely erase an MBM27C512. This dosage can be obtained by exposure to an ultraviolet lamp (wavelength of 2537 Angstroms (A)) with intensity of 12000μW/cm² for 15 to 21

minutes. The MBM27C512 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 MBM27C512 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 MBM27C512, 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 MBM27C512 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 corresponding pro-

gramming algorithm.

The electronic signature is activated when +12V is applied to address line A₉ (pin 24) of the MBM27C512. Two identifier bytes

are readed out from the outputs by togging address line A_0 (pin 10) from $V_{\rm IL}$ to $V_{\rm H}$. The address lines from A_1 to A_{13} must be hold at $V_{\rm IL}$ to keep the electronic signature mode. See the table below.

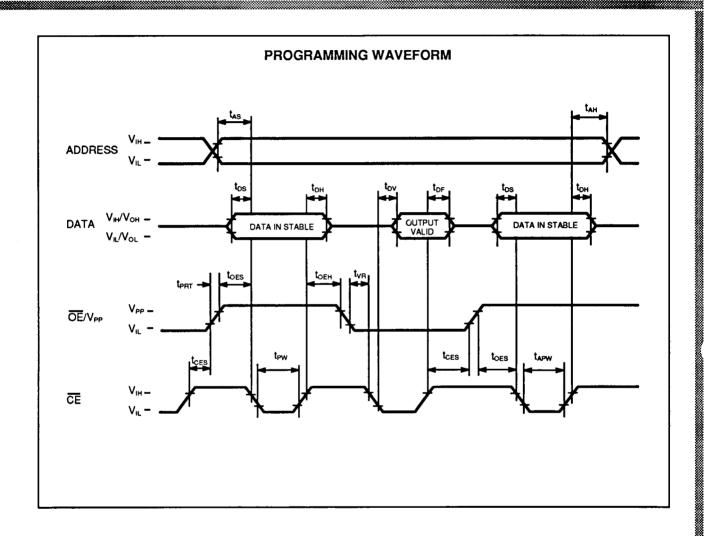
Ao	O ₁	O₂	O ₃	O ₄	O ₅	O ₆	O ₇	O ₈	Definition
V _{IL}	0	0	1	0	0	0	0	0	Manufacture
V _{IH}	1	1	0	0	0	1	1	1	Deviœ

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

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

 $A_{14} = A_{15} = Either V_{IL} \text{ or } V_{IH}$

PROGRAMMING/ERASING INFORMATION (Continued)



DC CHARACTERISTICS

 $(T_A = 25\pm5^{\circ}C, V_{CC}^{*1} = 6V\pm0.25V, V_{PP}^{*2} = 12.5V\pm0.3V)$

B			Value		1114
Parameter	Symbol	Min	Тур	Max	Unit
Input Leakage Current (V _{IN} = 6.25V/0.45V)	liul			10	μА
V _{PP} Supply Current During Programming Pulse (CE = V _{IL})	Ірр			50	mA
V _{cc} Supply Current	lcc			30	mA
Input Low Level	V _{IL}	-0.1		0.8	٧
Input High Level	V _{IH}	2.0		V _{cc} +0.3	٧
Output Low Voltage During Verify (I _{OL} = 2.1 mA)	V _{OL}			0.45	V
Output High Voltage During Verify (I _{он} = -400µA)	V _{он}	2.4			V

Note: *1 Vcc must be applied either coincidently or before VPP and removed either coincidently or after VPP.

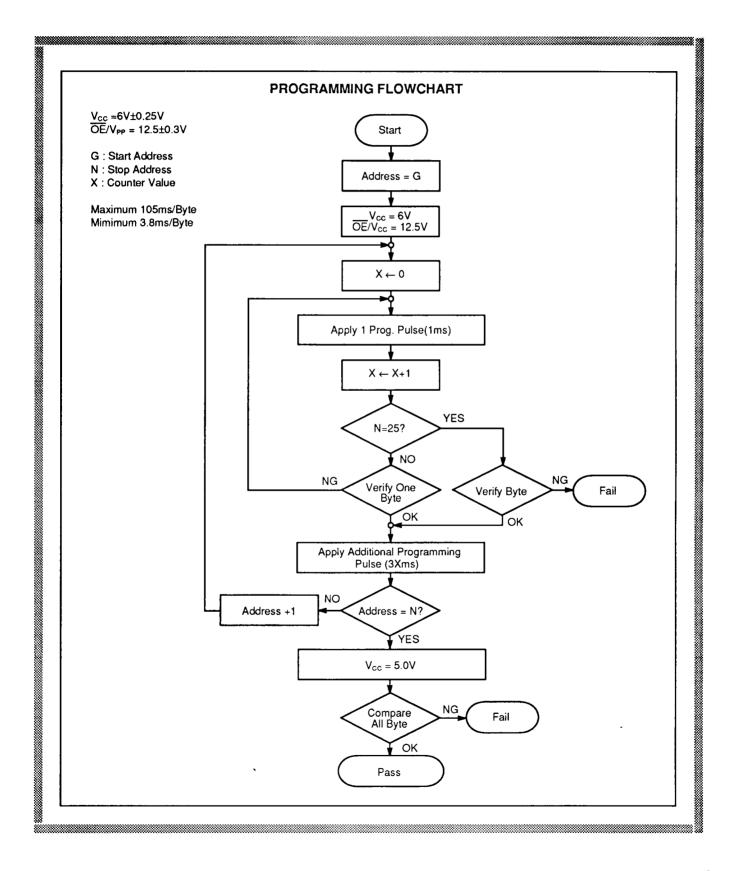
^{*2} V_{PP} must not be 13 volts or more including overshoot. Permanent device damage may occur if the device is taken out or put into socket remaining V_{PP} = 12.5 volts. Also, during $\overline{CE} = V_{IL}$, V_{PP} must not be switched from 5 to 12.5 volts or vice—versa.

PROGRAMMING/ERASING INFORMATION (Continued)

AC CHARACTERISTICS

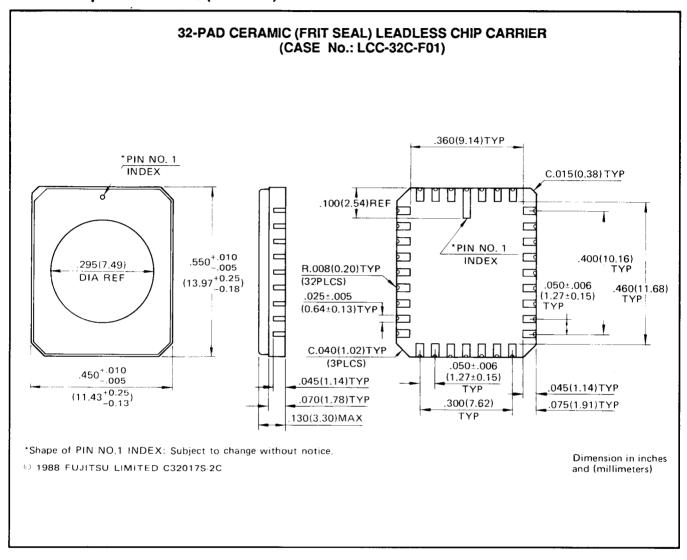
 $(T_A = 25\pm5^{\circ}C, V_{CC} = 6V\pm25V, V_{PP} = 12.5V\pm0.3V)$

_			Value		
Parameter	Symbol	Min	Тур	Max	Unit
Address Setup Time	tas	2			με
Chip Enable Setup Time	tces	2			μs
Output Enable Setup Time	toes	2			μs
Data Setup Time	tos	2			μs
Vcc Setup Time	tvs	. 2			μs
Address Hold Time	tah	2			μs
Data Hold Time	t DH	2			μs
Output Enable Hold Time	tOEH	2			μs
VPP Recovery Time	tvr	2			μs
Chip Enable to Data Valid	tov			1	μs
Output Disable to Output Float Delay	tor	0		130	ns
VPP Program Pulse Rise Time	tPRT	50			ns
Programming Pulse Width	tPW	0.95	1	1.05	ms
Additional Programming Pulse Width	tapw	2.85		78.75	ms



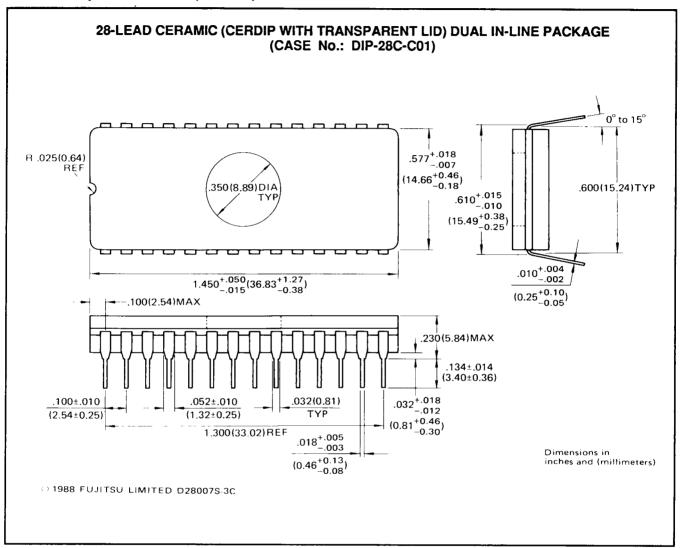
PACKAGE DIMENSIONS

Standard 32-pad Ceramic LCC (Suffix: TV)



PACKAGE DIMENSIONS (Continued)

Standard 28-pin Ceramic DIP (Suffix: Z)



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