

# FUJITSU

## ECL 16384-BIT BIPOLAR RANDOM ACCESS MEMORY

**MBM 10480-15**  
**MBM 10480-25**

September 1984  
Edition 3.0

### 16384-BIT BIPOLAR ECL RANDOM ACCESS MEMORY

The Fujitsu MBM 10480 is fully decoded 16384-bit ECL read/write random access memory designed for main memory, control and buffer storage applications. This device is organized as 16384 words by one bit, and it features on-chip voltage compensation for improved noise margin.

The MBM 10480 offers extremely small cell and chip size, realized through the use of Fujitsu's patented DOPOS (Doped Polysilicon), as well as IOP-II (Isolation by Oxide and Polysilicon) processing.

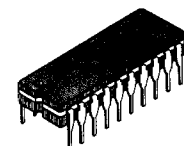
Operation for the MBM 10480 is specified over a temperature range of from 0°C to 75°C ( $T_A$  for DIP,  $T_C$  for Flat Package and LCC). It also features 20-pin Ceramic DIP, Flat Package, or LCC. It is fully compatible with industry-standard 10K-series ECL families.

- 16384 words x 1 bit organization
- On-chip voltage compensation for improved noise margin.
- Fully compatible with industry-standard 10K-series ECL families
- Address access time : 15 ns max. (MBM 10480-15)  
: 25 ns max. (MBM 10480-25)
- Chip select access time : 8 ns max. (MBM 10480-15)  
: 10 ns max. (MBM 10480-25)
- Open emitter output for ease of memory expansion
- Low power dissipation of 0.05 mW/bit
- DOPOS and IOP-II
- Pin compatible with the F10480

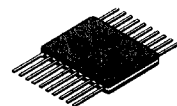
#### ABSOLUTE MAXIMUM RATINGS (See NOTE)

| Rating                               | Symbol                         | Value            | Unit |
|--------------------------------------|--------------------------------|------------------|------|
| $V_{EE}$ Pin Potential to Ground Pin | $V_{EE}$                       | +0.5 to -7.0     | V    |
| Input Voltage                        | $V_{IN}$                       | +0.5 to $V_{EE}$ | V    |
| Output Current (DC, Output High)     | $I_{OUT}$                      | -30              | mA   |
| Temperature under Bias               | $T_A$ for DIP                  | -55 to +125      | °C   |
|                                      | $T_C$ for Flat Package and LCC | -55 to +125      |      |
| Storage Temperature                  | $T_{STG}$                      | -65 to +150      | °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.

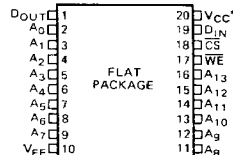
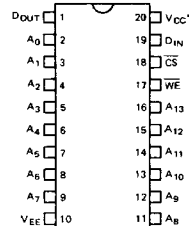


**CERAMIC PACKAGE  
DIP-20C-C03**



**CERAMIC PACKAGE  
FPT-20C-C01  
LCC-20C-F01: See Page 11**

#### PIN ASSIGNMENT

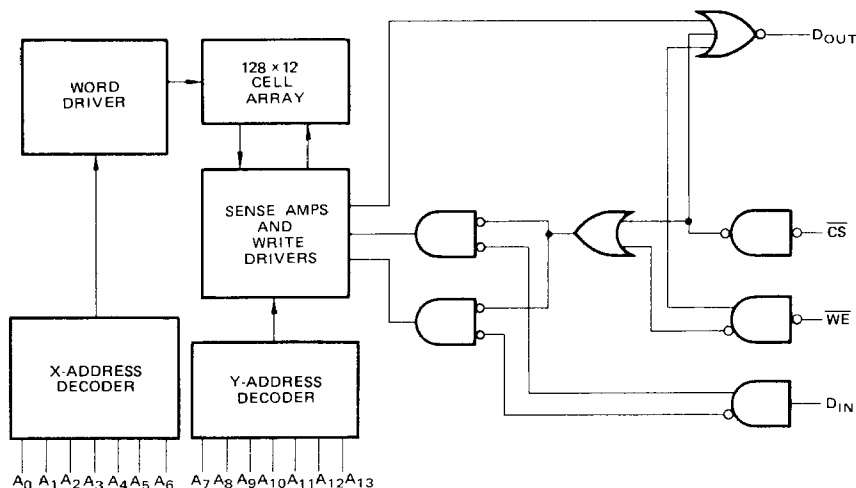


\* $V_{CC}$  grounded

LCC PAD CONFIGURATION: See Page 11

Small geometry bipolar integrated circuits are occasionally susceptible to damage from static voltages or electric fields. It is therefore advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this device.

Fig. 1 – MBM 10480 BLOCK DIAGRAM



TRUTH TABLE

| INPUT           |                 |          | OUTPUT    | MODE      |
|-----------------|-----------------|----------|-----------|-----------|
| $\overline{CS}$ | $\overline{WE}$ | $D_{IN}$ |           |           |
| H               | X               | X        | L         | DISABLED  |
| L               | L               | H        | L         | WRITE "H" |
| L               | L               | L        | L         | WRITE "L" |
| L               | H               | X        | $D_{OUT}$ | READ      |

H = High Voltage Level  
L = Low Voltage Level  
X = Don't care

## FUNCTIONAL DESCRIPTION

The Fujitsu MBM 10480 is fully decoded 16384 bit read/write random access memory organized as 16384 words by one bit. Memory cell selection is achieved by means of a 14-bit address designated  $A_0$  through  $A_{13}$ . The active low Chip Select ( $\overline{CS}$ ) input is provided for memory expansion. The read and write operations are controlled by the state of the

active low Write Enable ( $\overline{WE}$ ) input. With  $\overline{WE}$  and  $\overline{CS}$  held low, the data in  $D_{IN}$  is written into the addressed location. To read,  $\overline{WE}$  is held high, while  $\overline{CS}$  is held low. Data at the addressed location is then transferred to  $D_{OUT}$  and read out non-inverted. Open emitter outputs are provided to allow for maximum flexibility in output wired-or connection.

## GUARANTEED OPERATING CONDITIONS

(Referenced to  $V_{CC}$ )

| Parameter      | Symbol   | Min   | Typ  | Max   | Unit | Ambient Temperature for DIP, Case Temperature for Flat Package and LCC |
|----------------|----------|-------|------|-------|------|------------------------------------------------------------------------|
| Supply Voltage | $V_{EE}$ | -5.46 | -5.2 | -4.94 | V    | 0°C to 75°C                                                            |

1

## DC CHARACTERISTICS

( $V_{CC} = 0V$ ,  $V_{EE} = -5.2V$ , Output Load =  $50\Omega$  and  $30pF$  to  $-2.0V$ ,  $T_A = 0^\circ C$  to  $75^\circ C$  for DIP, Airflow  $\geq 2.5m/s$ ,  $T_C = 0^\circ C$  to  $75^\circ C$  for Flat Package and LCC, unless otherwise noted.)

| Parameter                                                            | Symbol       | Min                     | Typ | Max                     | Unit    | $T_A/T_C$           |
|----------------------------------------------------------------------|--------------|-------------------------|-----|-------------------------|---------|---------------------|
| Output High Voltage<br>( $V_{IN} = V_{IH\ max}$ or $V_{IL\ min}$ )   | $V_{OH}$     | -1000<br>-960<br>-900   |     | -840<br>-810<br>-720    | mV      | 0°C<br>25°C<br>75°C |
| Output Low Voltage<br>( $V_{IN} = V_{IH\ max}$ or $V_{IL\ min}$ )    | $V_{OL}$     | -1870<br>-1850<br>-1830 |     | -1665<br>-1650<br>-1625 | mV      | 0°C<br>25°C<br>75°C |
| Output High Voltage<br>( $V_{IN} = V_{IH\ min}$ or $V_{IL\ max}$ )   | $V_{OHC}$    | -1020<br>-980<br>-920   |     |                         | mV      | 0°C<br>25°C<br>75°C |
| Output Low Voltage<br>( $V_{IN} = V_{IH\ min}$ or $V_{IL\ max}$ )    | $V_{OLC}$    |                         |     | -1645<br>-1630<br>-1605 | mV      | 0°C<br>25°C<br>75°C |
| Input High Voltage<br>(Guaranteed Input Voltage High for All Inputs) | $V_{IH}$     | -1145<br>-1105<br>-1045 |     | -840<br>-810<br>-720    | mV      | 0°C<br>25°C<br>75°C |
| Input Low Voltage<br>(Guaranteed Input Voltage Low for All Inputs)   | $V_{IL}$     | -1870<br>-1850<br>-1830 |     | -1490<br>-1475<br>-1450 | mV      | 0°C<br>25°C<br>75°C |
| Input High Current ( $V_{IN} = V_{IH\ max}$ )                        | $I_{IH}$     |                         |     | 220                     | $\mu A$ | 0°C to 75°C         |
| Input Low Current ( $V_{IN} = V_{IL\ min}$ )                         | $I_{IL}$     | -50                     |     |                         | $\mu A$ | 0°C to 75°C         |
| CS Input Low Current ( $V_{IN} = V_{IL\ min}$ )                      | $I_{IL}$     | 0.5                     |     | 170                     | $\mu A$ | 0°C to 75°C         |
| Power Supply Current<br>(All Inputs and Output Open)                 | $I_{EE}$     | -220<br>-200            |     |                         | mA      | 0°C to 75°C         |
|                                                                      | MBM 10480-15 |                         |     |                         |         |                     |
|                                                                      | MBM 10480-25 |                         |     |                         |         |                     |

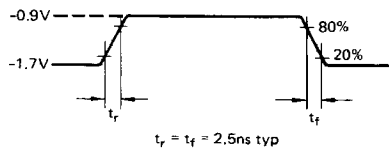
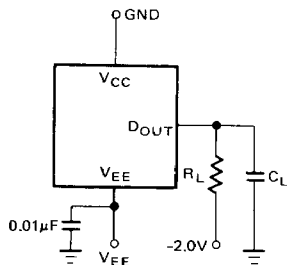
## CAPACITANCE

| Parameter              | Symbol    | Min | Typ | Max | Unit |
|------------------------|-----------|-----|-----|-----|------|
| Input Pin Capacitance  | $C_{IN}$  |     | 5   |     | pF   |
| Output Pin Capacitance | $C_{OUT}$ |     | 6   |     | pF   |

## AC CHARACTERISTICS

( $V_{CC}=0V$ ,  $V_{EE}=-5.2V \pm 5\%$ , Output Load =  $50\Omega$  to  $-2.0V$  and  $30pF$  to GND,  $T_A=0^\circ C$  to  $75^\circ C$  for DIP, Airflow  $\geq 2.5m/s$ ,  $T_C=0^\circ C$  to  $75^\circ C$  for Flat Package and LCC, unless otherwise noted.)

Fig. 2 - AC TEST CONDITIONS



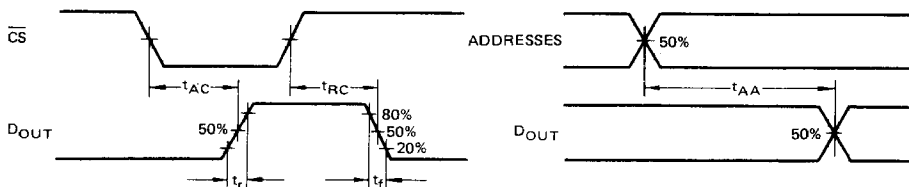
Output Load:  $R_L = 50\Omega$   
 $C_L = 30pF$   
(including spce and jig)

NOTE: All timing measurements referenced to 50% input levels.

## READ CYCLE

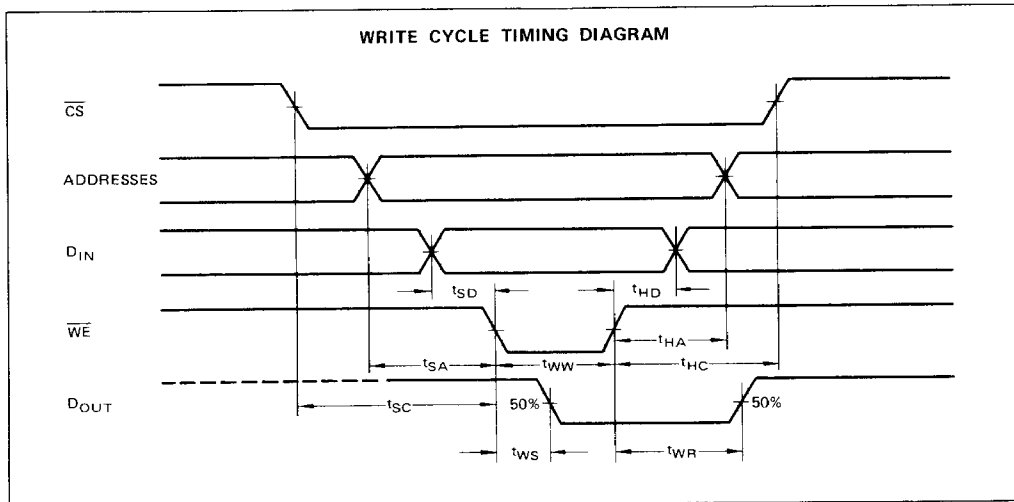
| Parameter                 | Symbol   | MBM 10480-15 |     |     | MBM 10480-25 |     |     | Unit |
|---------------------------|----------|--------------|-----|-----|--------------|-----|-----|------|
|                           |          | Min          | Typ | Max | Min          | Typ | Max |      |
| Address Access Time       | $t_{AA}$ |              |     | 15  |              |     | 25  | ns   |
| Chip Select Access Time   | $t_{AC}$ |              |     | 8   |              |     | 10  | ns   |
| Chip Select Recovery Time | $t_{RC}$ |              |     | 8   |              |     | 10  | ns   |

## READ CYCLE TIMING DIAGRAMS



# WRITE CYCLE

| Parameter               | Symbol   | MBM 10480-15 |     |     | MBM 10480-25 |     |     | Unit |
|-------------------------|----------|--------------|-----|-----|--------------|-----|-----|------|
|                         |          | Min          | Typ | Max | Min          | Typ | Max |      |
| Write Pulse Width       | $t_{WW}$ | 15           |     |     | 25           |     |     | ns   |
| Write Disable Time      | $t_{WS}$ |              |     | 8   |              |     | 10  | ns   |
| Write Recovery Time     | $t_{WR}$ |              |     | 18  |              |     | 20  | ns   |
| Address Set Up Time     | $t_{SA}$ | 2            |     |     | 5            |     |     | ns   |
| Chip Select Set Up Time | $t_{SC}$ | 2            |     |     | 5            |     |     | ns   |
| Data Set Up Time        | $t_{SD}$ | 2            |     |     | 5            |     |     | ns   |
| Address Hold Time       | $t_{HA}$ | 3            |     |     | 5            |     |     | ns   |
| Chip Select Hold Time   | $t_{HC}$ | 3            |     |     | 5            |     |     | ns   |
| Data Hold Time          | $t_{HD}$ | 3            |     |     | 5            |     |     | ns   |



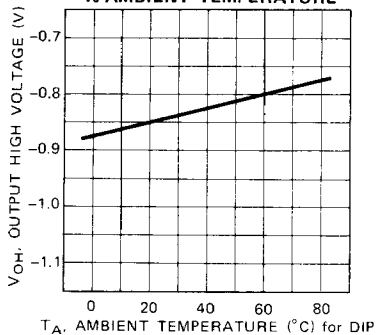
## RISE TIME and FALL TIME

| Parameter        | Symbol | Min | Typ | Max | Unit |
|------------------|--------|-----|-----|-----|------|
| Output Rise Time | $t_r$  |     | 3   |     | ns   |
| Output Fall Time | $t_f$  |     | 3   |     | ns   |

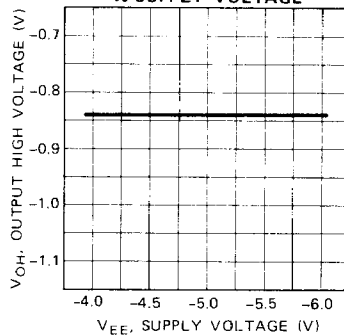


## CHARACTERISTICS CURVES

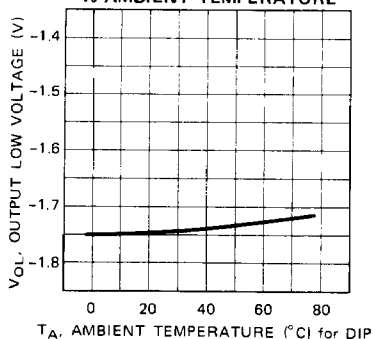
**Fig. 3 – OUTPUT HIGH VOLTAGE  
vs AMBIENT TEMPERATURE**



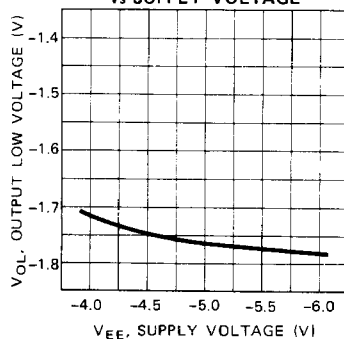
**Fig. 4 – OUTPUT HIGH VOLTAGE  
vs SUPPLY VOLTAGE**



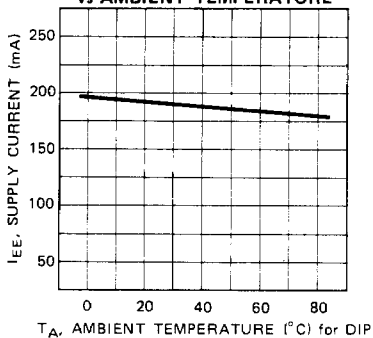
**Fig. 5 – OUTPUT LOW VOLTAGE  
vs AMBIENT TEMPERATURE**



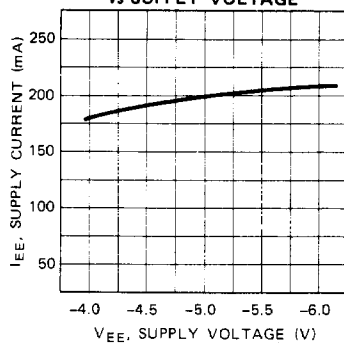
**Fig. 6 – OUTPUT LOW VOLTAGE  
vs SUPPLY VOLTAGE**

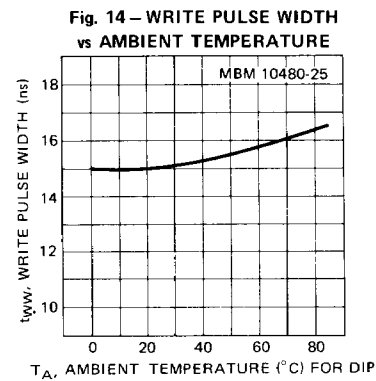
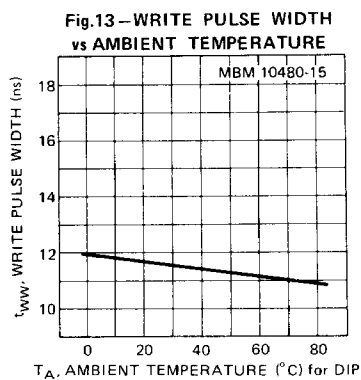
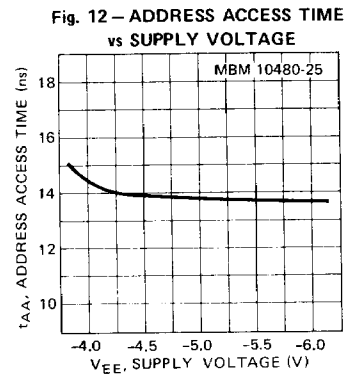
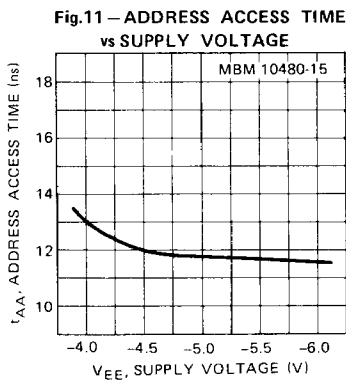
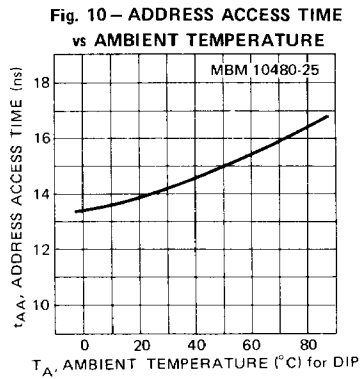
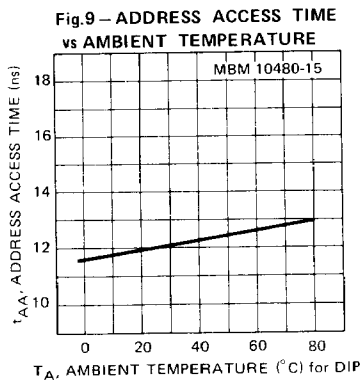


**Fig. 7 – SUPPLY CURRENT  
vs AMBIENT TEMPERATURE**



**Fig. 8 – SUPPLY CURRENT  
vs SUPPLY VOLTAGE**







**FUJITSU** MBM 10480-15  
MBM 10480-25

1

Fig.15 – WRITE PULSE WIDTH  
vs SUPPLY VOLTAGE

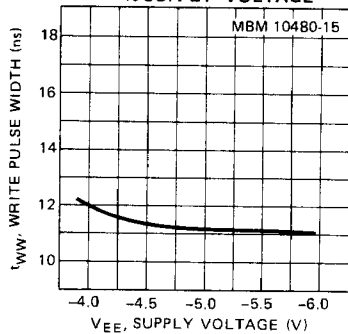
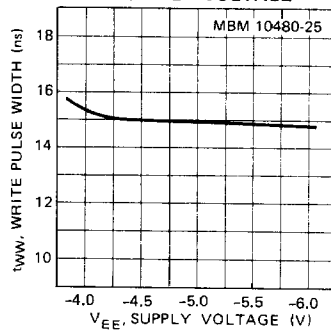
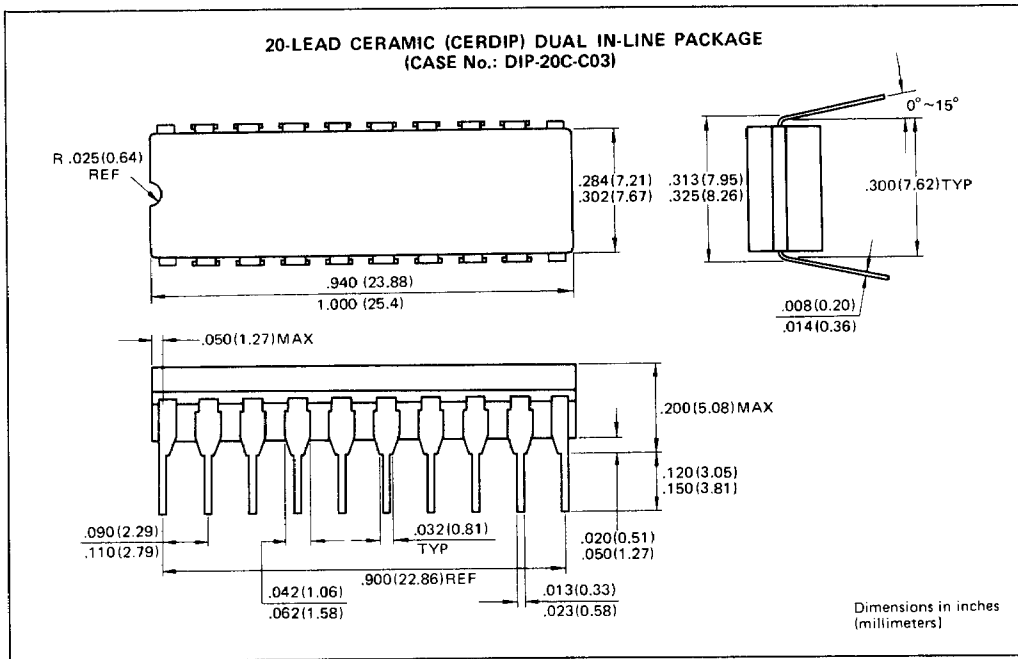


Fig. 16 – WRITE PULSE WIDTH  
vs SUPPLY VOLTAGE





## PACKAGE DIMENSIONS

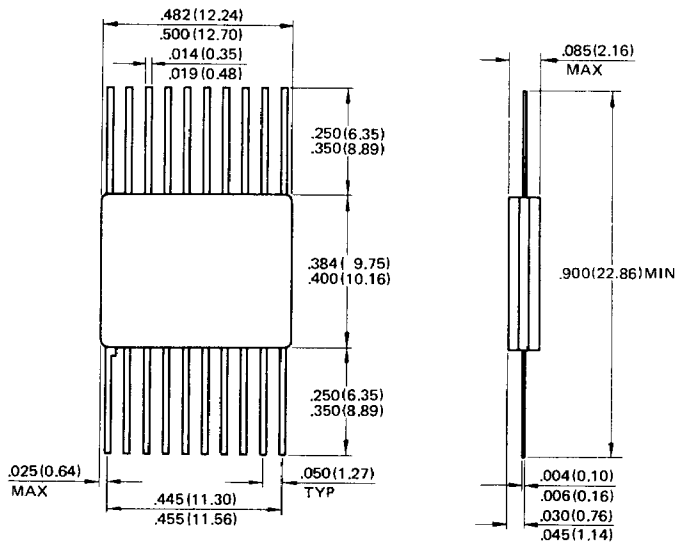




**FUJITSU** MBM 10480-15  
MBM 10480-25

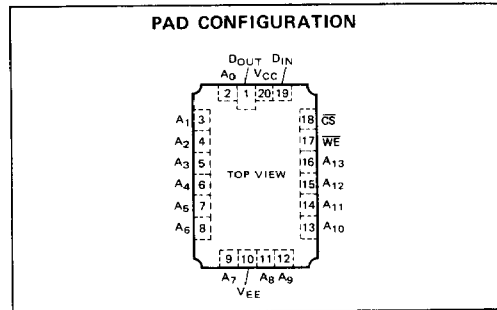
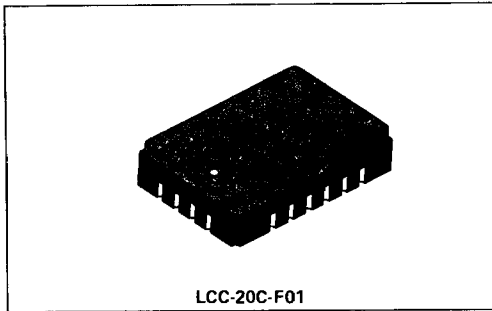
## PACKAGE DIMENSIONS

20-LEAD CERAMIC (CERDIP) FLAT PACKAGE  
(CASE No.: FPT-20C-C01)



Dimensions in  
inches (millimeters)

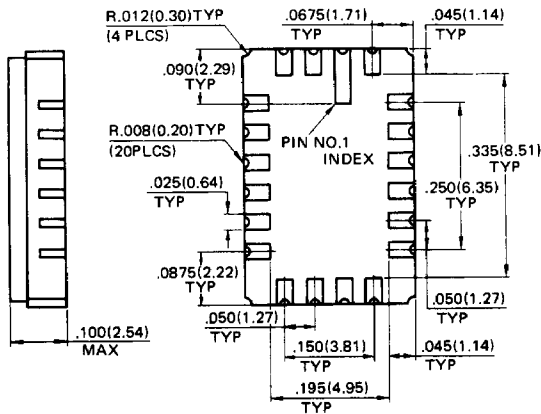
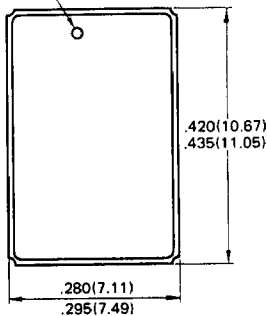
## PACKAGE DIMENSIONS



1

### 20-PAD CERAMIC (FRIT SEAL) LEADLESS CHIP CARRIER (CASE No.: LCC-20C-F01)

PIN NO.1 INDEX



Dimension in  
inches (millimeters)