

## ■ MB7151E/H, MB7152E/H/Y

### Schottky TTL 16,384-Bit Bipolar Programmable Read-Only Memory

#### Description

The Fujitsu MB7151 and MB7152 are high speed Schottky TTL electrically field programmable read only memories organized as 4096 words by 4-bits. With uncommitted collector outputs provided on the MB7151 and three-state outputs on the MB7152, memory expansion is simple.

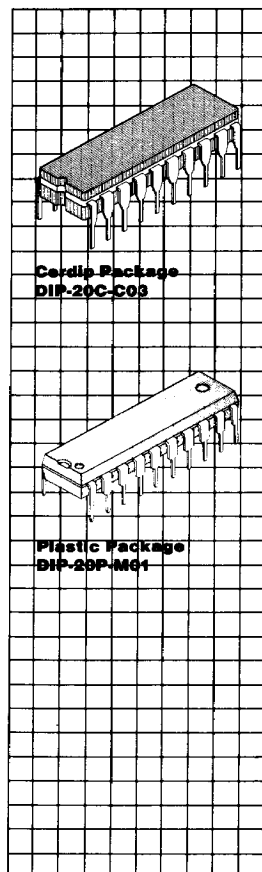
The memory is fabricated with all logic "zeros" (positive logic). Logic level "ones" can be programmed by the highly reliable DEAP™ (Diffused Eutectic Aluminum Process) according to simple programming procedures.

The sophisticated passive isolation termed IOP (Isolation by Oxide and Polysilicon) with thin epitaxial layer and Schottky TTL process permits minimal chip size and fast access time.

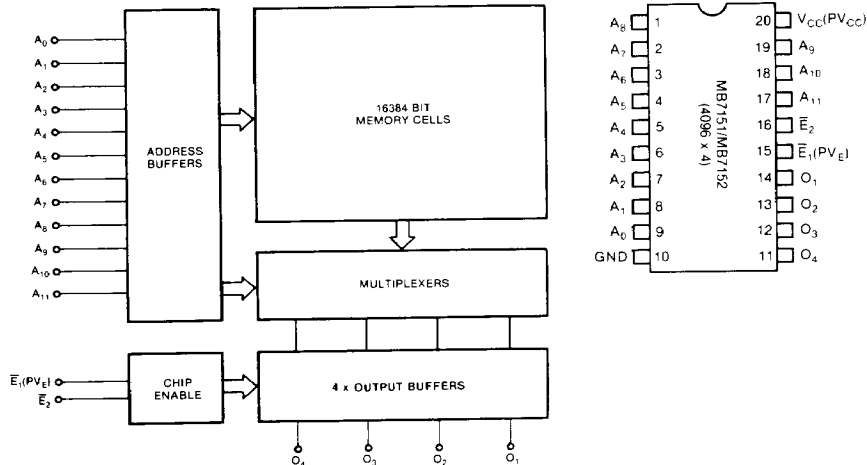
The extra test cells and unique testing methods provide enhanced correlation between programmed and unprogrammed circuits in order to perform AC, DC and programming test prior to shipment. This results in extremely high programmability.

#### Features

- Single +5V supply voltage
- Organized as 4096 words by 4-bits, fully decoded
- Proven higher programmability and reliability
- Programming by DEAP™ (Diffused Eutectic Aluminum Process)
- Simplified and lower power programming
- Low current PNP inputs
- AC characteristics guaranteed over full operating voltage and temperature range via unique testing techniques
- Fast access time, 35nsec typ.
  - E—55nsec max.
  - H—45nsec max.
  - Y—35nsec max.
- TTL compatible inputs and outputs
- Open collector outputs, MB7151
- Three-state outputs, MB7152
- Two chip enables for simplified memory expansion
- 300mil 20-pin DIP package



Block Diagram and  
Pin Assignment



Absolute Maximum Ratings  
(See Note)

Rating	Symbol	Value	Unit
Power Supply Voltage	$V_{CC}$	-0.5 to +7.0	V
Power Supply Voltage (during programming)	$V_{CC}$	-0.5 to +7.5	V
Input Voltage	$V_{IN}$	-1.5 to +5.5	V
Input Voltage (during programming)	$V_{PRG}$	22.5	V
Output Voltage (during programming)	$V_{PRG}$	-0.5 to +22.5	V
Input Current	$I_{IN}$	-20	mA
Input Current (during programming)	$I_{PRG}$	+270	mA
Output Current	$I_{OUT}$	+100	mA
Output Current (during programming)	$I_{PRG}$	+150	mA
Storage Temperature	$T_{stg}$	-65 to +150 Ceramic: Plastic:	°C
Output Voltage	$V_{OUT}$	-0.5 to $V_{CC}$	V

Note: Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to conditions as detailed in the operational sections of this data sheet. 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  
(f = 1MHz,  $V_{CC}$  = +5V,  
 $V_{IN}$  = +2V,  $T_A$  = 25 °C)

Parameter	Symbol	Min	Typ	Max	Unit
Input Capacitance	$C_I$			10	pF
Output Capacitance	$C_O$			15	pF

Guaranteed Operating  
Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$	4.75	5.0	5.25	V
Input Low Voltage	$V_{IL}$	0		0.8	V
Input High Voltage	$V_{IH}$	2.0		$V_{CC}$	V
Ambient Temperature	$T_A$	0		75	°C

FUJITSU

### DC Characteristics

(Full guaranteed operating conditions unless otherwise noted.)

Parameter	Symbol	Min	Typ	Max	Unit
Input Leakage Current ( $V_{IH} = 5.5\text{ V}$ )	$I_R$			40	$\mu\text{A}$
Input Load Current ( $V_{IL} = 0.45\text{ V}$ )	$I_F$			-250	$\mu\text{A}$
Output Low Voltage ( $I_{OL} = 10\text{ mA}$ )	$V_{OL}$			0.45	V
Output Low Voltage ( $I_{OL} = 16\text{ mA}$ )	$V_{OL}$			0.50	V
Output Leakage Current ( $V_O = 2.4\text{ V}$ , Chip disabled)	MB7151 $I_{OLK}$			40	$\mu\text{A}$
Output Leakage Current ( $V_O = 2.4\text{ V}$ , Chip disabled)	MB7152 $I_{OIH}$			40	$\mu\text{A}$
Output Leakage Current ( $V_O = 0.45\text{ V}$ , chip disabled)	MB7152 $I_{OIL}$			-40	$\mu\text{A}$
Input Clamp Voltage ( $I_{IN} = -18\text{ mA}$ )	$V_{IC}$			-1.2	V
Power Supply Current ( $V_{IN} = \text{OPEN or GND}$ )	$I_{CC}$		120	170	mA
Output High Voltage ( $I_O = -2.4\text{ mA}$ )	MB7152 $V_{OH}^*$	2.4			V
Output Short Circuit Current ( $V_O = \text{GND}$ )	MB7152 $I_{OS}^*$	-15		-60	mA

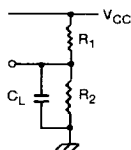
\*Note: Denotes guaranteed characteristics of the output high-level (ON) state when the chip is enabled ( $V_{ICE} = 0.4\text{ V}$ ) and the programmed bit is addressed. These characteristics cannot be tested prior to programming, but are guaranteed by factory testing.

### AC Characteristics

(Full guaranteed operating conditions unless otherwise noted.)

Parameter	Symbol	E		H		MB7152Y		Unit
		Typ	Max	Typ	Max	Typ	Max	
Access Time (via address input)	$t_{AA}$	35	55	35	45	28	35	ns
Output Disable Time	$t_{DIS}$		40		40		30	ns
Output Enable Time	$t_{EN}$		40		40		30	ns

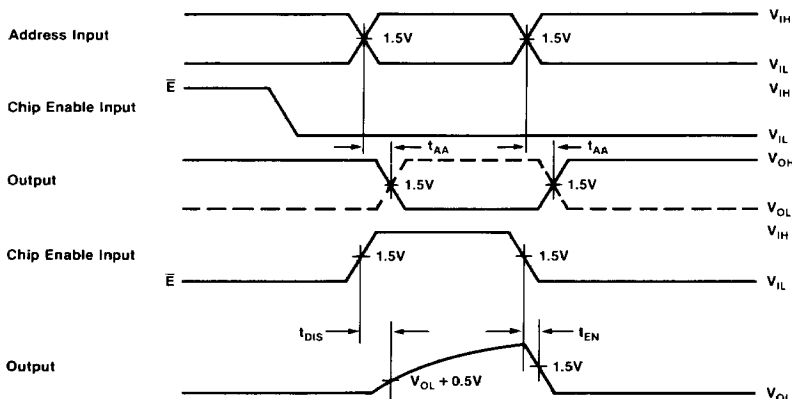
### AC Test Conditions



Input Conditions  
Amplitude: 0V to 3V  
Rise and Fall Time: 5ns from 1V to 2V  
Frequency: 1MHz

	MB7151/MB7152		
	$R_1$	$R_2$	$C_L$
$t_{AA}$	300 $\Omega$	600 $\Omega$	30pF
$t_{DIS}$	300 $\Omega$	600 $\Omega$	30pF
$t_{EN}$	300 $\Omega$	600 $\Omega$	30pF

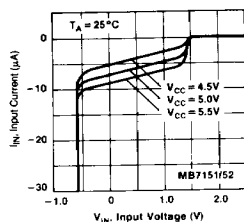
### Operation Timing Diagram



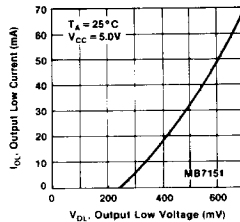
Note: Output disable time is the time taken for the output to reach a high resistance state when the chip enable is taken high (disabled). Output enable time is the time taken for the output to become active when all of chip enables are taken low (enabled). The high resistance state is defined as a point on the output waveform equal to a  $\Delta V$  of 0.5V from the active output level.

**Typical Characteristics Curves**

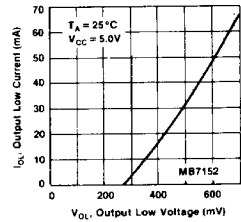
**$I_{IN}$  Input Current vs.  $V_{IN}$  Input Voltage**



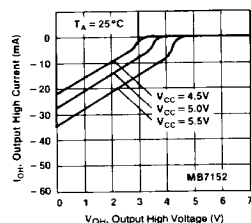
**$I_{OL}$  Output Low Current vs.  $V_{OL}$  Output Low Voltage**



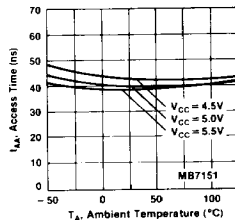
**$I_{OL}$  Output Low Current vs.  $V_{OL}$  Output Low Voltage**



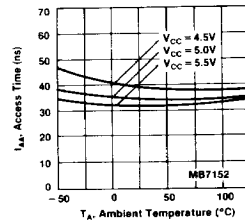
**$I_{OH}$  Output High Current vs.  $V_{OH}$  Output High Voltage**



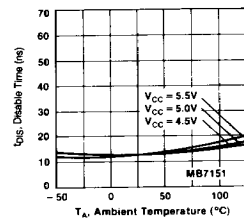
**$t_{AA}$  Access Time vs. Ambient Temperature**



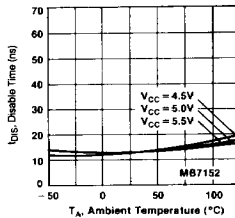
**$t_{AA}$  Access Time vs. Ambient Temperature**



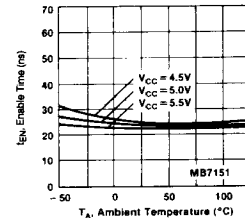
**$t_{DIS}$  Disable Time vs. Ambient Temperature**



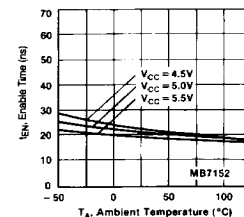
**$t_{DIS}$  Disable Time vs. Ambient Temperature**



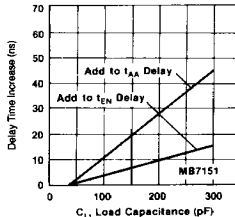
**$t_{EN}$  Enable Time vs. Ambient Temperature**



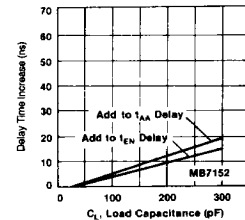
**$t_{EN}$  Access Time vs. Ambient Temperature**



**Delay Time Increase vs.  $C_L$  Load Capacitance**



**Delay Time Increase vs.  $C_L$  Load Capacitance**



## Input/Output Circuit Information

### Input Circuit

Schottky TTL circuit technology is used in the input circuit to achieve high-speed operation. A PNP transistor in the first stage of input circuit improves input high/low current characteristics remarkably. The input circuit also includes a protection diode for reliable operation.

### Open Collector Output

The open—collector output is often utilized in high-speed applications where power dissipation must be minimized. When the device is switched, there is no current sourced from the supply rail. Consequently, the current spike normally associated with TTL totem-pole outputs is eliminated. In high-frequency applications, this minimizes noise problems (false triggering) as well as power drain. For example, the transient current (low impedance high-level to low impedance low-level) is typically 30mA for the MB7152 (three-state) compared to 0mA for the MB7151 (open-collector).

### Three-State Output

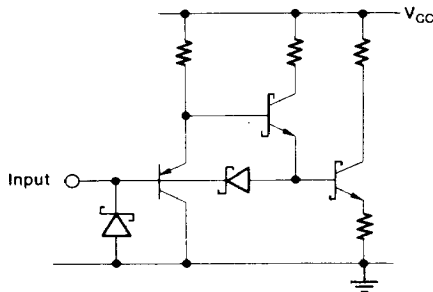
A "three-state" output is a logic element which has three distinct output states of ZERO, ONE and OFF (wherein OFF represents a high-impedance condition which can neither sink nor source current at a definable logic level). Effectively, then, the device has all the desirable features of a totem-pole TTL output (e.g., greater noise immunity, good rise time, line driving capacity), plus the ability to connect to bus-organized systems.

In the case where two devices are on at the same time, the possibility exists that they may be in opposite low impedance states simultaneously; thus, the short circuit current from one enabled device may flow through the other enabled device. While physical damage under these conditions is unlikely, system noise problems could result. Therefore, the system designer should consider these factors to ensure that this condition does not exist.

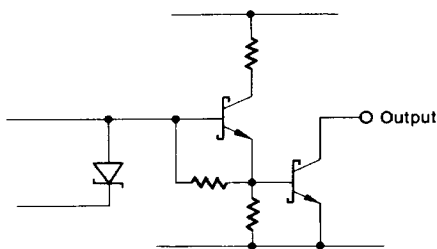
Schottky TTL circuit technology is also used in the output circuit to achieve high-speed operation. A PNP transistor is

also provided in the output circuit and is effective in decreasing a load for the chip enable circuit.

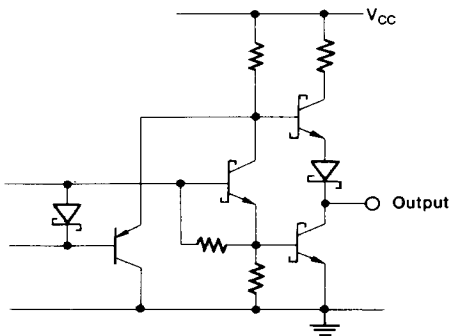
### Common Input Circuit



### Common Open Collector Output Circuit



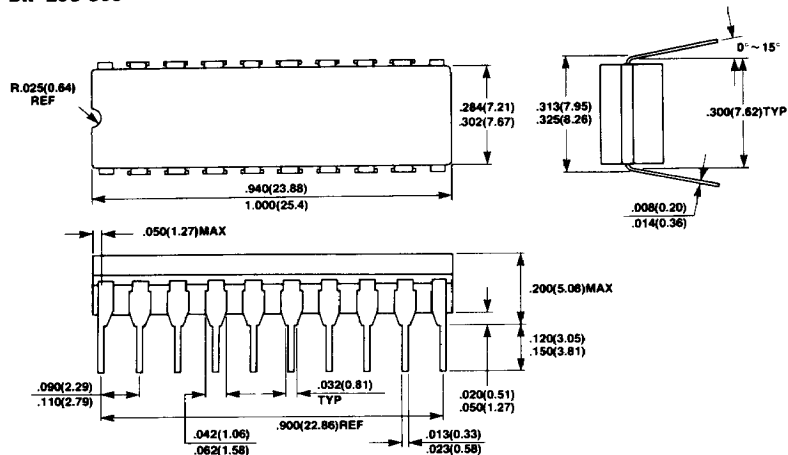
### Common Three-State Output Circuit



MB7151E/H  
MB7152E/H/Y

**Package Dimensions**  
Dimensions in inches  
(millimeters)

**20-Pin Cerdip Dual In-Line Package**  
**DIP-20C-C03**



**Package Dimensions**  
(Continued)  
Dimensions in inches  
(millimeters)

**20-Pin Plastic Dual In-Line Package**  
**DIP-20P-M01**

