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FUJITSU
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MB8416
MB8416-X

CMOS 16,384-BIT STATIC RANDOM ACCESS MEMORY

DESCRIPTION

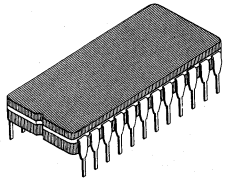
The Fujitsu MB8416/MB8416-X is a 2048 word by 8-bit static random access memory fabricated with high density, high reliability Complementary MOS silicon-gate technology.

The memory utilizes asynchronous circuitry and may be maintained in any state for an indefinite period of time. All input and output pins are TTL-compatible, and a single 5 volt power supply is used. It is possible to retain data at low power supply voltage.

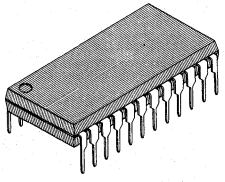
The MB8416/MB8416-X can be optimized for high performance applications such as microcomputer systems where fast access time and ease of use are required. Output Enable ($\overline{OE}$) input permits the disable of all outputs when outputs are OR-tied. The MB8416/MB8416-X is packaged in an industry standard 24-pin dual in-line package.

FEATURES

- **Organized as 2048 words by 8 bits**
- **Fast Access Time: 200ns Max.**
- **Low Power: 55μW Max. Standby**
- **Completely Static Operation, no clocks required**
- **Extended temperature range (MB8416-X): −40°C to +85°C**
- **Single +5 Volt Power Supply, +10% tolerance**
- **TTL compatible Inputs/Outputs**
- **Low Voltage Data Retention: 2.0V Min.**
- **MB8416 is pin compatible with HM6116, TC5517, μPD446**

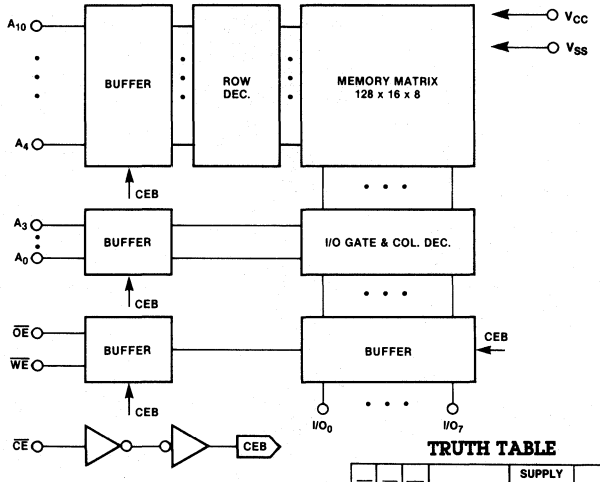


CERDIP PACKAGE
DIP-24C-C03



PLASTIC PACKAGE
DIP-24P-M01

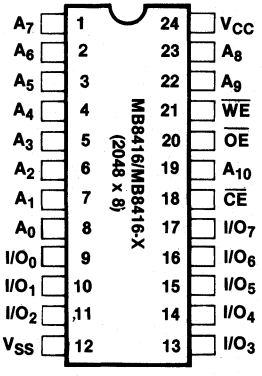
MB8416/MB8416-X BLOCK DIAGRAM



TRUTH TABLE

$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	MODE	SUPPLY CURRENT	I/O PIN
H	X	X	Not Selected	I_{SB}	High-Z
L	H	H	D_{OUT} Disable	I_{CC}	High-Z
L	L	H	Read	I_{CC}	D_{OUT}
L	X	L	Write	I_{CC}	D_{IN}

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.

ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Min	Max	Unit
Storage Temperature	Ceramic	T_{stg}	−65	150	°C
	Plastic		−40	125	
Temperature Under Bias		T_{bias}	−40	85	°C
Supply Voltage		V_{CC}	−0.5	8.0	V
Input Voltage		V_{IN}	−0.5	V_{CC} + 0.5	V
Output Voltage		$V_{I/O}$	−0.5	V_{CC} + 0.5	V

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. 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 applications of any voltage higher than maximum rated voltages to this high impedance circuit.

RECOMMENDED OPERATING CONDITIONS (V_{SS} = GND)

Parameter	Symbol	MB8416			MB8416-X			Unit
		Min	Typ	Max	Min	Typ	Max	
Ambient Temperature	T_A	0	—	+70	−40	—	+85	°C
Supply Voltage	V_{CC}	4.5	5.0	5.5	4.5	5.0	5.5	V
Input High Voltage	V_{IH}	2.2	—	V_{CC} + 0.3	2.2	—	V_{CC} + 0.3	V
Input Low Voltage	V_{IL}	−0.3	—	0.8	−0.3	—	0.8	V

CAPACITANCE

(T_A = 25°C, f = 1 MHz)

Parameter	Symbol	Min	Max	Unit	Condition
Input Capacitance	C_{IN}	—	7	pF	V_{IN} = 0V
Input / Output Capacitance	$C_{I/O}$	—	10	pF	$V_{I/O}$ = 0V

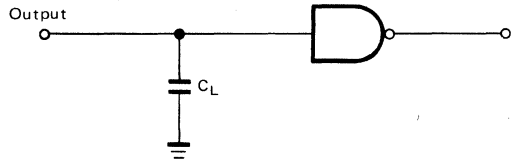
STATIC CHARACTERISTICS

(Recommended operating conditions unless otherwise noted.)

Parameter	Condition	Symbol	Min	Max	Units
Standby Supply Current	$\overline{CE}$ = V_{CC} − 0.2 to V_{CC} +0.2V V_{IN} = −0.2V to V_{CC} +0.2V	I_{SB1}	—	10	μA
Standby Supply Current	$\overline{CE}$ = V_{IH} V_{IN} = −0.2V to V_{CC} +0.2V	I_{SB2}	—	2	mA
Active Supply Current	$\overline{CE}$ = V_{IL} V_{IN} = V_{IL} or V_{IH}; I_{OUT} = 0	I_{CC1}	—	60	mA
Operating Supply Current	Cycle = Min, Duty = 100% I_{OUT} = 0	I_{CC2}	—	60	mA
Input Leakage Current	V_{IN} = 0V to V_{CC}	I_{LI}	−1.0	1.0	μA
Output Leakage Current	$V_{I/O}$ = 0V to V_{CC} $\overline{CE}$ = V_{IH}	I_{LO}	−1.0	1.0	μA
Output High Voltage	I_{OUT} = −1.0 mA	V_{OH}	2.4	—	V
Output Low Voltage	I_{OUT} = 4.0 mA	V_{OL}	—	0.4	V

AC TEST CONDITIONS

Input Pulse Levels:	**0.6V to 2.4V**
Input Pulse Rise and Fall Times:	**10 ns**
Input Timing Reference Level:	**0.8V to 2.2V**
Output Timing Reference Level:	**0.8V to 2.2V**
Output Load:	**1 TTL Gate and C_L = 100 pF**



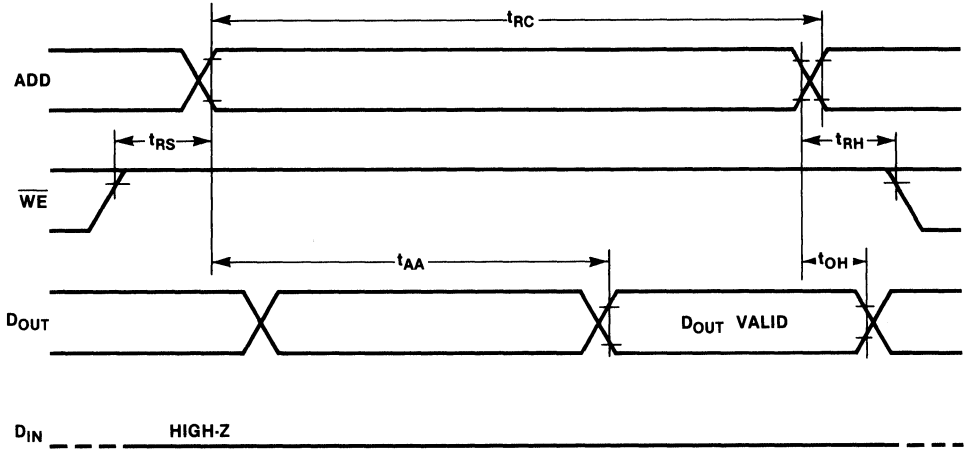
DYNAMIC CHARACTERISTICS

Parameter	Symbol	Min	Max	Unit
Read Cycle Time	t_{RC}	200	—	ns
Write Cycle Time	t_{WC}	200	—	ns
Address Access Time	t_{AA}	—	200	ns
Chip Enable Access Time	t_{ACE}	—	200	ns
Output Hold from Address Change	t_{OH}	15	—	ns
Output Low Z from $\overline{CE}$	t_{CLZ}	15	—	ns
Output High Z from $\overline{CE}$	t_{CHZ}	—	60	ns
Output Low Z from $\overline{OE}$	t_{OLZ}	15	—	ns
Output High Z from $\overline{OE}$	t_{OHZ}	—	60	ns
Output Low Z from $\overline{WE}$	t_{WLZ}	15	—	ns
Output High Z from $\overline{WE}$	t_{WHZ}	—	60	ns
Output Enable to Output Valid	t_{OE}	—	100	ns
Address Set Up Time	t_{AS}	0	—	ns
Read Set Up Time	t_{RS}	0	—	ns
Read Hold Time	t_{RH}	0	—	ns
Write Set Up Time	t_{WS}	0	—	ns
Write Hold Time	t_{WH}	0	—	ns
Address Valid to End of Write	t_{AW}	160	—	ns
Chip Enable to End of Write	t_{CEW}	160	—	ns
Write Pulse Width	t_{WP}	140	—	ns
Write Recovery Time	t_{WR}	10	—	ns
Data Set Up Time	t_{DS}	60	—	ns
Data Hold Time	t_{DH}	0	—	ns

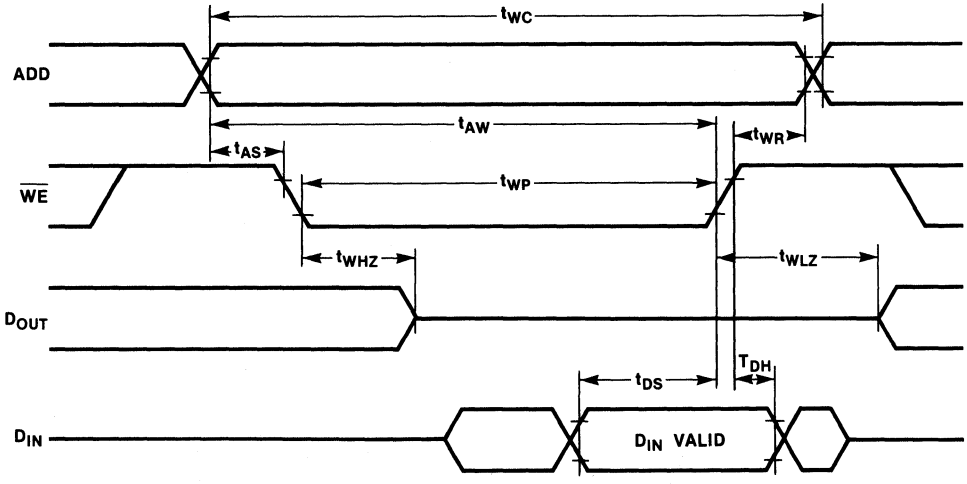
WAVEFORMS

MODE 1: $\overline{WE}$ Controlled: ($\overline{CE}$ = Low, $\overline{OE}$ = Low)

Read Cycle



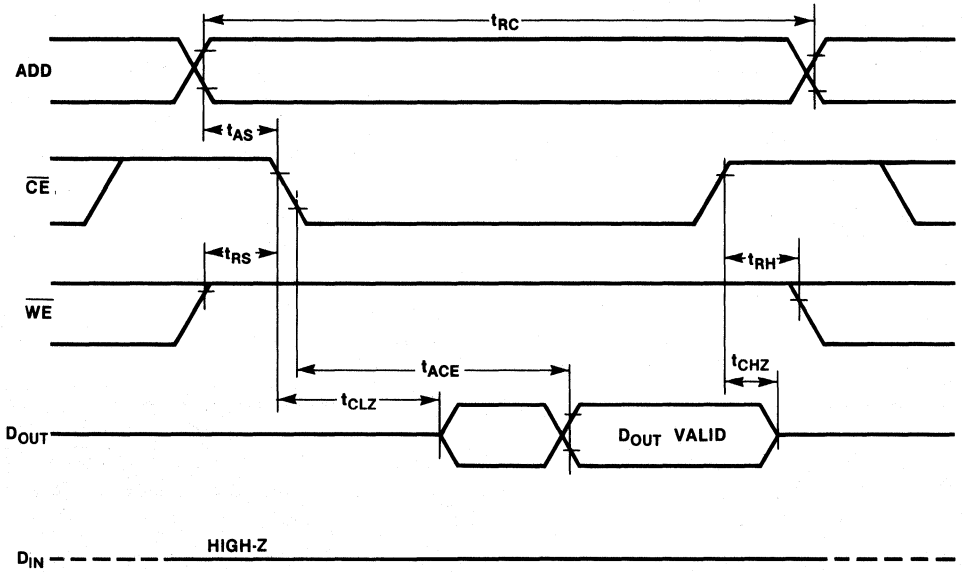
Write Cycle



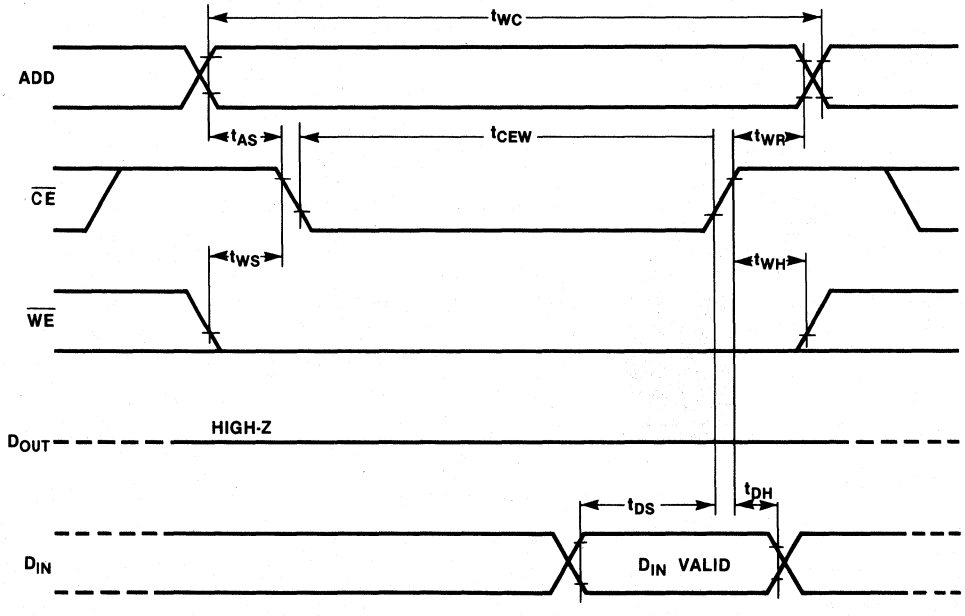
WAVEFORMS (Continued)

MODE 2: $\overline{CE}$ Controlled, ($\overline{OE}$ = Low)

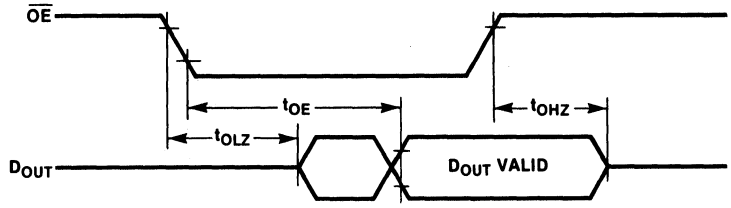
Read Cycle



Write Cycle



WAVEFORMS (Continued)
Enable/Disable $\overline{OE}$ Controlled; ($\overline{CE}$ = Low, $\overline{WE}$ = High)



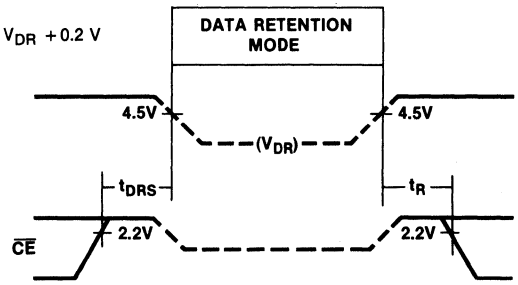
DYNAMIC CHARACTERISTICS

Data Retention Characteristics, Notes 1,2

Parameter	Notes	Symbol	Min	Max	Unit
Data Retention Supply Voltage	1	V_{DR}	2.0	5.5	V
Data Retention Supply Current	2	I_{DR}	—	10	μA
Data Retention Set Up Time		t_{DRS}	60	—	ns
Recovery Time		t_R	60	—	ns

NOTES:

1. $V_{CC} = V_{DR}$, $\overline{CE} = V_{DR} - 0.2$ V to $V_{DR} + 0.2$ V, $V_{IN} = -0.2$ V to $V_{DR} + 0.2$ V
2. When V_{DR} = 2.5V to 5.5V,
   $\overline{CE}$ = 2.2V to V_{DR} + 0.3V
   When V_{DR} = 2.0V to 2.5V
   $\overline{CE} = V_{DR} - 0.3$V to $V_{DR} + 0.3$V



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MB8416A-12
MB8416A-15

CMOS 16,384-BIT STATIC RANDOM ACCESS MEMORY

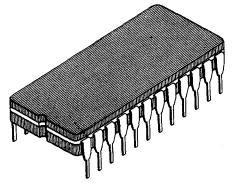
ADVANCE INFORMATION

DESCRIPTION

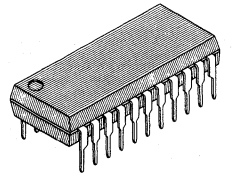
The Fujitsu MB8416A is a 2048 word by 8-bit static random access memory fabricated with high density, high reliability Complementary MOS silicon-gate technology.

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CERDIP PACKAGE
DIP-24C-C03

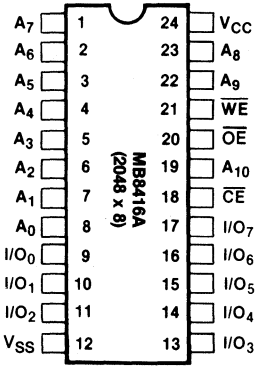


PLASTIC PACKAGE
DIP-24C-M01

FEATURES

- **Organized as 2048 words by 8-bits**
- **Address Access Time:**
  MB8416A-12 120ns Max.
  MB8416A-15 150ns Max.
- **Low Power Dissipation:**
  I_{CC} (Active) = 60mA Max.
  I_{SB} (Standby) = 4mA Max.
  I_{DR} (Data Retention) = 2mA Max.
- **Completely static operation, no clocks required**
- **Single +5 Volt Power Supply, ±10% tolerance**
- **TTL compatible inputs/outputs**
- **Data Retention: 2.0V Min.**
- **Equal Access and Cycle Times**
- **Output timing reference levels: 0.8V to 2.2V**
- **Plug-in compatible with 16K EPROMs**
- **Pin compatible with HM6116, TC5517, μPD446**

PIN ASSIGNMENT



TRUTH TABLE

DEVICE NUMBER	MB8416A				
PIN NUMBER	18	20	21	24	9-11 13-17
PIN NAME MODE	CE	OE	WE	SUPPLY CURRENT	I/O
WRITE	L	X	L	I_{CC}	D_{IN}
READ	L	L	H	I_{CC}	D_{OUT}
OUTPUT DISABLE	L	H	H	I_{CC}	HIGH Z
STANDBY	H	X	X	I_{SB}	HIGH Z

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