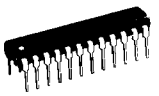
MCM2016H

Fast 16K Bit Static RAM



N PACKAGE
PLASTIC
CASE 724

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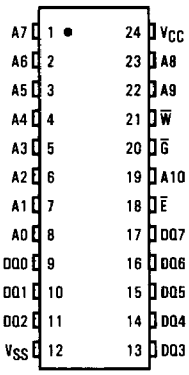
The MCM2016H is a 16,384 bit static random access memory organized as 2048 words by 8 bits, fabricated using Motorola's high-performance silicon-gate MOS (HMOS) technology. It uses an innovative design approach which combines the ease-of-use features of fully static operation (no external clocks or timing strobes required) with the reduced standby power dissipation associated with clocked memories. To the user this means low standby power dissipation without the need for address setup and hold times, nor reduced data rates due to cycle times that are longer than access times. Perfect for cache and sub-100 ns buffer memory systems, this high speed static RAM is intended for applications that demand superior performance and reliability.

Chip enable ($\overline{E}$) controls the power-down feature. It is not a clock but rather a chip control that affects power consumption. In less than a cycle time after $\overline{E}$ goes high, the part automatically reduces its power requirements and remains in this low-power standby mode as long as $\overline{E}$ remains high. This feature provides significant system-level power savings.

The MCM2016H is in a 24-pin dual-in-line 300 mil wide plastic package with the industry standard JEDEC approved pinout.

- Single +5 V Operation, ±10%
- Fully Static: No Clock or Timing Strobe Required
- Fast Access Time: MCM2016H-45 = 45 ns (Maximum)
  MCM2016H-55 = 55 ns (Maximum)
  MCM2016H-70 = 70 ns (Maximum)
- Power Supply Current: 135 mA Maximum (Active)
  20 mA Maximum (Standby)
- Three-State Output

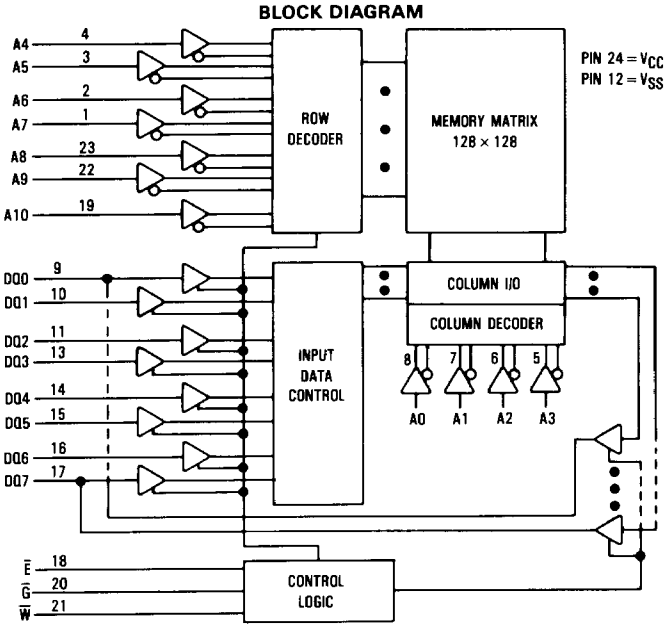
PIN ASSIGNMENT



PIN NAMES

A0-A10	Address Input
DQ0-DQ7	Data Input/Output
$\overline{W}$	Write Enable
$\overline{G}$	Output Enable
$\overline{E}$	Chip Enable
V_{CC}	+5 V Power Supply
V_{SS}	Ground

BLOCK DIAGRAM



MODE SELECTION

Mode	$\overline{E}$	$\overline{G}$	$\overline{W}$	V_{CC} Current	DQ
Standby	H	X	X	I_{SB}	High Z
Read	L	L	H	I_{CC}	Q
Write Cycle	L	X	L	I_{CC}	D

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.

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ABSOLUTE MAXIMUM RATINGS (See Note)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	−0.5 to +7.0	V
Voltage on Any Pin With Respect to V_{SS}	V_{in}, V_{out}	−0.5 to +7.0	V
DC Output Current	I_{out}	±20	mA
Power Dissipation	P_D	1.1	Watt
Temperature Under Bias	T_{bias}	−10 to +80	°C
Operating Temperature Range	T_A	0 to +70	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

NOTE: Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to RECOMMENDED OPERATING CONDITIONS. Exposure to higher than recommended voltages for extended periods of time could affect device reliability.

DC OPERATING CONDITIONS AND CHARACTERISTICS

(V_{CC} = 5.0 V ±10%, T_A = 0 to 70°C, Unless Otherwise Noted)

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage (Operating Voltage Range)	V_{CC}	4.5	5.0	5.5	V
	V_{SS}	0	0	0	V
Input Voltage (50 ns Maximum Address Rise and Fall Times, while the chip is selected)	V_{IH}	2.2	3.0	6.0	V
	V_{IL}	−0.5*	0	0.8	V

*The device will withstand undershoots to the −2.5 volt level with a maximum pulse width of 50 ns. This is periodically sampled rather than 100% tested.

DC CHARACTERISTICS

Parameter	Symbol	Min	Max	Unit
Input Leakage Current (V_{CC} = 5.5 V, V_{in} = GND to V_{CC})	$I_{lkg(I)}$	−1.0	1.0	μA
Output Leakage Current ($\overline{E}$ = V_{IH} or $\overline{G}$ = V_{IH}, $V_{I/O}$ = GND to V_{CC})	$I_{lkg(O)}$	−1.0	1.0	μA
Operating Power Supply Current ($\overline{E}$ = V_{IL}, $I_{I/O}$ = 0 mA)	I_{CC}	—	135	mA
Standby Power Supply Current ($\overline{E}$ = V_{IH})	I_{SB}	—	20	mA
Output Low Voltage (I_{OL} = 8.0 mA)	V_{OL}	—	0.4	V
Output High Voltage (I_{OH} = −4.0 mA)	V_{OH}	2.4	—	V

CAPACITANCE (f = 1.0 MHz, T_A = 25°C, Periodically Sampled Rather Than 100% Tested)

Characteristic		Symbol	Typ	Max	Unit
Input Capacitance	All Inputs Except $\overline{E}$ and DQ	C_{in}	3	5	pF
	$\overline{E}$		5	7	
I/O Capacitance	DQ	$C_{I/O}$	5	7	pF

AC OPERATING CONDITIONS AND CHARACTERISTICS

(V_{CC} = 5 V ±10%, T_A = 0 to +70°C, Unless Otherwise Noted)

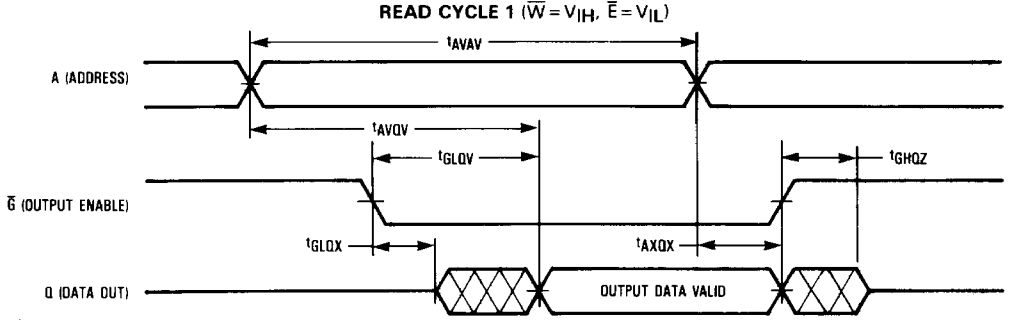
Input Pulse Levels . . . . . 0 and 3.0 V
Input Rise and Fall Times . . . . . 5 ns
Input and Output Timing Measurement Reference Levels . . . 1.5 V
Output Load . . . . . See Figure 1

READ CYCLE (See Note 1)

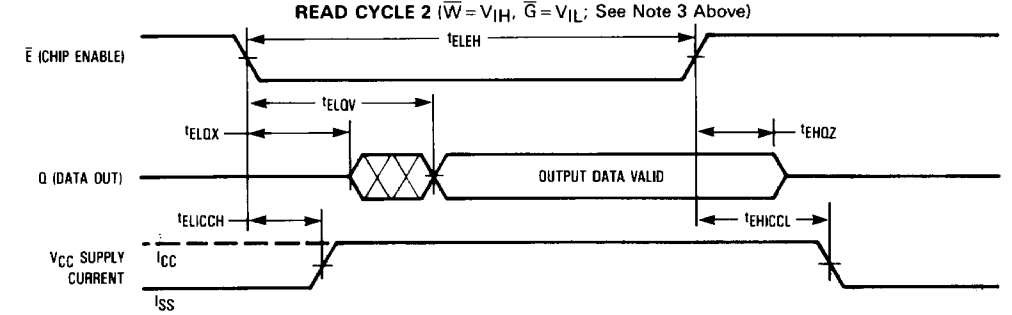
Parameter	Symbol		MCM2016H-45		MCM2016H-55		MCM2016H-70		Units	Notes
	Standard	Alternate	Min	Max	Min	Max	Min	Max		
Address Valid to Address Valid (Read Cycle Time)	t_{AVAV}	t_{RC}	45	–	55	–	70	–	ns	
Address Valid to Output Valid (Address Access Time)	t_{AVQV}	t_{AC}	–	45	–	55	–	70	ns	
Chip Enable Low to Chip Enable High (Read Cycle Time)	t_{ELEH}	t_{RC}	45	–	55	–	70	–	ns	
Chip Enable Low to Output Valid (Chip Enable Access Time)	t_{ELQV}	t_{ACS}	–	45	–	55	–	70	ns	
Output Enable Low to Output Valid (Output Enable Access Time)	t_{GLQV}	t_{OE}	–	20	–	25	–	30	ns	
Chip Enable Low to Output Invalid (Chip Enable to Output Active)	t_{ELQX}	t_{CLZ}	5	–	5	–	5	–	ns	2
Chip Enable High to Output High Z (Chip Disable to Output Disable)	t_{EHQZ}	t_{CHZ}	0	20	0	20	0	20	ns	2
Output Enable Low to Output Invalid (Output Enable to Output Active)	t_{GLQX}	t_{OLZ}	0	–	0	–	0	–	ns	2
Output Enable High to Output High Z (Output Disable to Output Disable)	t_{GHQZ}	t_{OHZ}	0	20	0	20	0	20	ns	2
Address Invalid to Output Invalid (Output Hold Time)	t_{AXQX}	t_{OH}	5	–	5	–	5	–	ns	
Chip Enable Low to Power Up	t_{ELICCH}	t_{PU}	0	–	0	–	0	–	ns	
Chip Enable High to Power Down	t_{EHICCL}	t_{PD}	–	20	–	20	–	20	ns	

NOTES:
1. Transition time specification applies for all input signals. In addition to meeting the transition rate specification, all input signals must transition between V_{IL} and V_{IH} (or between V_{IH} and V_{IL}) in a monotonic manner.
2. Transition is measured ±200 mV from the steady state output voltage with the output loading specified in Figure 1.
3. In read cycle 2, all addresses are valid prior to or coincident with chip enable ($\overline{E}$) transition low.

READ CYCLE 1 ($\overline{W} = V_{IH}$, $\overline{E} = V_{IL}$)



READ CYCLE 2 ($\overline{W} = V_{IH}$, $\overline{G} = V_{IL}$; See Note 3 Above)

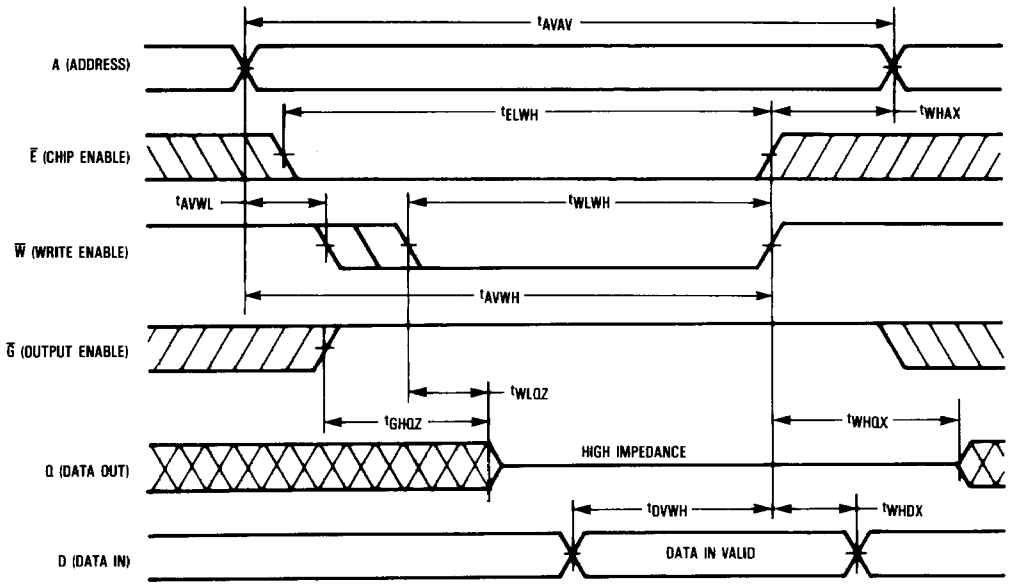


WRITE CYCLE (See Notes 1 and 2)

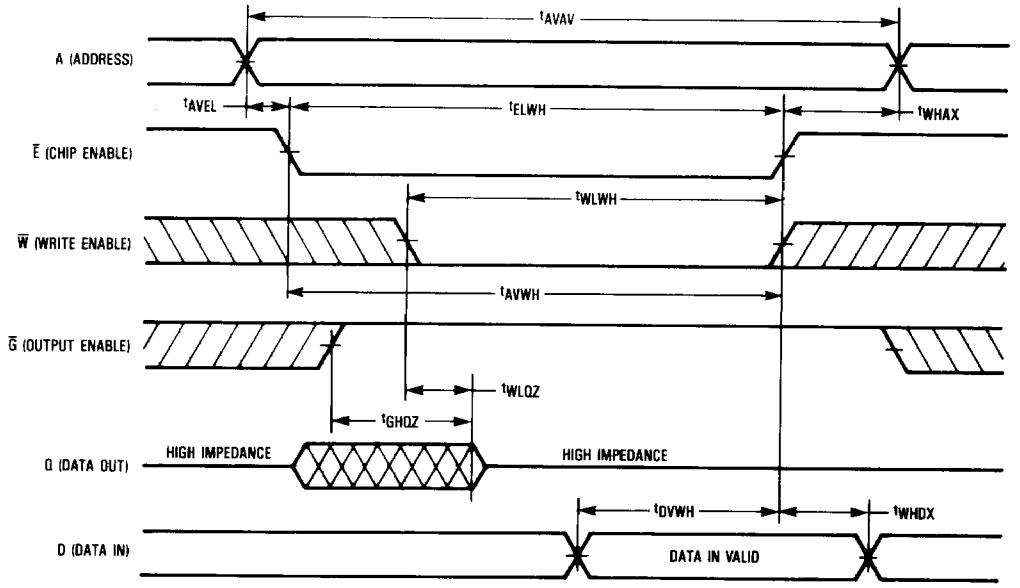
Parameter	Symbol		MCM2016H-45		MCM2016H-55		MCM2016H-70		Units	Notes
	Standard	Alternate	Min	Max	Min	Max	Min	Max		
Address Valid to Address Valid (Write Cycle Time)	t_{AVAV}	t_{WC}	45	–	55	–	70	–	ns	
Chip Enable Low to Write High (Chip Enable to End of Write)	t_{ELWH}	t_{EW}	40	–	50	–	65	–	ns	
Address Valid to Chip Enable Low (Address Setup to Chip Enable)	t_{AVEL}	t_{AS}	0	–	0	–	0	–	ns	
Address Valid to Write Low (Address Setup to Write)	t_{AVWL}	t_{AS}	0	–	0	–	0	–	ns	
Address Valid to Write High	t_{AVWH}	t_{AW}	40	–	50	–	65	–	ns	3
Write Low to Write High (Write Pulse Width)	t_{WLWH}	t_{WP}	35	–	40	–	40	–	ns	
Write High to Address Don't Care (Address Hold After End of Write)	t_{WHAX}	t_{WR}	0	–	0	–	0	–	ns	4
Write High to Output Don't Care (Output Active After End of Write)	t_{WHQX}	t_{WLZ}	0	–	0	–	0	–	ns	5
Write Low to Output High Z (Write Enable to Output Disable)	t_{WLQZ}	t_{WHZ}	0	20	0	20	0	20	ns	5
Data Valid to Write High (Data Setup to End of Write)	t_{DVWH}	t_{DS}	20	–	25	–	30	–	ns	3
Write High to Data Don't Care (Data Hold After End of Write)	t_{WHDX}	t_{DH}	0	–	0	–	0	–	ns	3, 5
Output Enable High to Output High Z	t_{GHQZ}	t_{OHZ}	0	20	0	20	0	20	ns	

NOTES:
1. Write enable ($\overline{W}$) must be high during all address transitions.
2. If the chip enable ($\overline{E}$) low transition occurs simultaneously with the write enable ($\overline{W}$) transition, the output remains in a high impedance state.
3. Both chip enable ($\overline{E}$) and write enable ($\overline{W}$) must be active (low) to write data into the memory. Either signal can terminate the write cycle by going high. Data in setup and hold timing should be referenced to the rising edge of the signal that terminates the write.
4. t_{WHAX} is measured from the earlier of, chip enable ($\overline{E}$) or write enable ($\overline{W}$) going high to the end of write cycle.
5. Output enable ($\overline{G}$) can be either low or high during a write cycle. If chip enable ($\overline{E}$) and $\overline{G}$ are both low during this period then the data input/output (DQ) pins are in the output state. Under these conditions input signals of opposite phase to the outputs must not be applied.

WRITE CYCLE 1 ($\overline{W}$ Controlled)



WRITE CYCLE 2 ($\overline{E}$ Controlled)



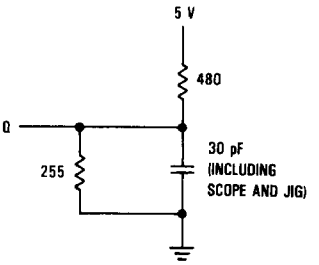


Figure 1. Output Load

ORDERING INFORMATION
(Order by Full Part Number)

MCM 2016H X XX

- Motorola Memory Prefix
- Part Number
- Speed (45 = 45 ns, 55 = 55 ns, 70 = 70 ns)
- Package (N = 300-mil Plastic)

Full Part Numbers — MCM2016HN45 MCM2016HN55 MCM2016HN70