

# Product Preview

## 64K x 16 Bit 3.3 V Asynchronous Fast Static RAM

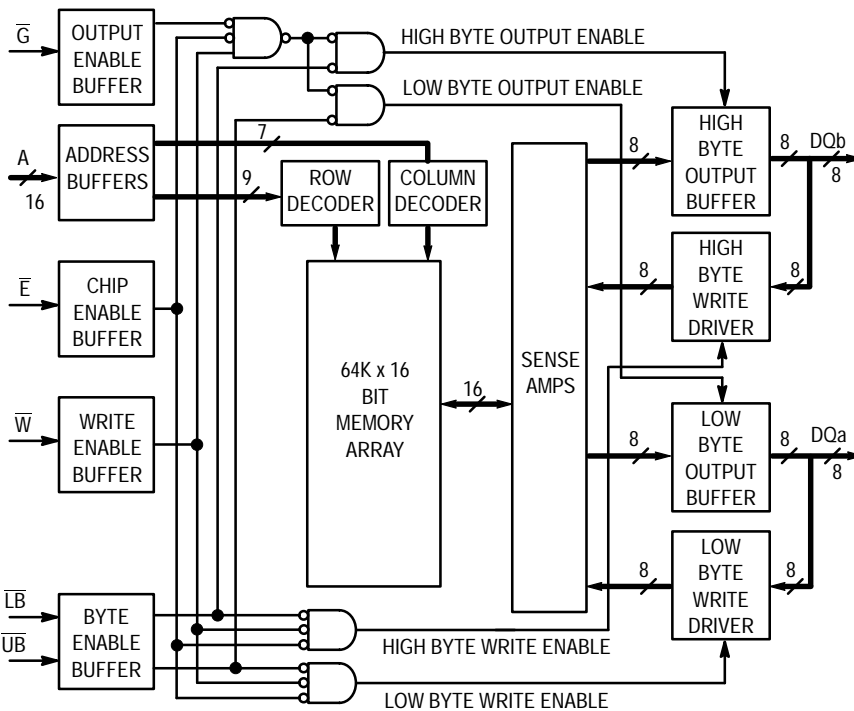
The MCM6323A is a 1,048,576 bit static random access memory organized as 65,536 words of 16 bits. Static design eliminates the need for external clocks or timing strobes; CMOS circuitry reduces power consumption and provides for greater reliability.

The MCM6323A is equipped with chip enable ( $\bar{E}$ ), write enable ( $\bar{W}$ ), and output enable ( $\bar{G}$ ) pins, allowing for greater system flexibility and eliminating bus contention problems. Separate byte enable controls ( $\bar{L}B$  and  $\bar{U}B$ ) allow individual bytes to be written and read.  $\bar{L}B$  controls the 8 DQa bits, while  $\bar{U}B$  controls the 8 DQb bits.

The MCM6323A is available in a 400 mil small-outline J-leaded (SOJ) package and a 44-lead TSOP Type II package in copper leadframe for optimum printed circuit board (PCB) reliability.

- Single 3.3 V  $\pm$  0.3 V Power Supply
  - Fast Access Time: 10, 12, 15 ns
  - Equal Address and Chip Enable Access Time
  - All Inputs and Outputs are TTL Compatible
  - Data Byte Control
  - Fully Static Operation
  - Power Operation: 140/135/130 mA Maximum, Active AC
  - Industrial Temperature Option: - 40 to + 85°C
- Part Number: SCM6323AY10A

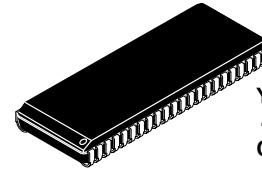
### BLOCK DIAGRAM



This document contains information on a new product under development. Motorola reserves the right to change or discontinue this product without notice.

REV 5  
11/4/98

## MCM6323A



**YJ PACKAGE**  
400 MIL SOJ  
CASE 919-01



**TS PACKAGE**  
44-LEAD  
TSOP TYPE II  
CASE 924A-02

### PIN ASSIGNMENT

A	1	44	A
A	2	43	A
A	3	42	A
A	4	41	G-bar
A	5	40	UB
E-bar	6	39	LB
DQa	7	38	DQb
DQa	8	37	DQb
DQa	9	36	DQb
DQa	10	35	DQb
VDD	11	34	VSS
VSS	12	33	VDD
DQa	13	32	DQb
DQa	14	31	DQb
DQa	15	30	DQb
DQa	16	29	DQb
W-bar	17	28	NC
A	18	27	A
A	19	26	A
A	20	25	A
A	21	24	A
NC	22	23	NC

### PIN NAMES

A	Address Input
E-bar	Chip Enable
W-bar	Write Enable
G-bar	Output Enable
UB	Upper Byte
LB	Lower Byte
DQa	Lower Data Input/Output
DQb	Upper Data Input/Output
VDD	+ 3.3 V Power Supply
VSS	Ground
NC	No Connection

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TRUTH TABLE (X = Don't Care)

$\bar{E}$	$\bar{G}$	W	LB	$\bar{UB}$	Mode	V <sub>DD</sub> Current	DQa	DQb
H	X	X	X	X	Not Selected	I <sub>SB1</sub> , I <sub>SB2</sub>	High-Z	High-Z
L	H	H	X	X	Output Disabled	I <sub>DDA</sub>	High-Z	High-Z
L	X	X	H	H	Output Disabled	I <sub>DDA</sub>	High-Z	High-Z
L	L	H	L	H	Low Byte Read	I <sub>DDA</sub>	D <sub>out</sub>	High-Z
L	L	H	H	L	High Byte Read	I <sub>DDA</sub>	High-Z	D <sub>out</sub>
L	L	H	L	L	Word Read	I <sub>DDA</sub>	D <sub>out</sub>	D <sub>out</sub>
L	X	L	L	H	Low Byte Write	I <sub>DDA</sub>	D <sub>in</sub>	High-Z
L	X	L	H	L	High Byte Write	I <sub>DDA</sub>	High-Z	D <sub>in</sub>
L	X	L	L	L	Word Write	I <sub>DDA</sub>	D <sub>in</sub>	D <sub>in</sub>

ABSOLUTE MAXIMUM RATINGS (See Notes)

Rating	Symbol	Value	Unit
Supply Voltage	V <sub>DD</sub>	- 0.5 to + 4.6	V
Voltage on Any Pin	V <sub>in</sub>	- 0.5 to V <sub>DD</sub> + 0.5	V
Output Current per Pin	I <sub>out</sub>	± 20	mA
Package Power Dissipation	P <sub>D</sub>	0.75	W
Temperature Under Bias	T <sub>bias</sub>	Commercial Industrial - 10 to + 85 - 45 to + 90	°C
Operating Temperature	T <sub>A</sub>	Commercial Industrial 0 to + 70 - 40 to + 85	°C
Storage Temperature	T <sub>stg</sub>	- 55 to + 150	°C

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 these high-impedance circuits.

This CMOS memory circuit has been designed to meet the dc and ac specifications shown in the tables, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow of at least 500 linear feet per minute is maintained.

NOTES:

1. 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.
2. All voltages are referenced to V<sub>SS</sub>.
3. Power dissipation capability will be dependent upon package characteristics and use environment.

## DC OPERATING CONDITIONS AND CHARACTERISTICS

(V<sub>DD</sub> = 3.3 V ± 0.3 V, T<sub>A</sub> = 0 to 70°C, Unless Otherwise Noted)  
(T<sub>A</sub> = - 40 to + 85°C for Industrial Temperature Offering)

### RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
Power Supply Voltage	V <sub>DD</sub>	3.0	3.3	3.6	V
Input High Voltage	V <sub>IH</sub>	2.2	—	V <sub>DD</sub> + 0.3**	V
Input Low Voltage	V <sub>IL</sub>	- 0.5*	—	0.8	V

\* V<sub>IL</sub> (min) = - 0.5 V dc; V<sub>IL</sub> (min) = - 2.0 V ac (pulse width ≤ 20 ns) for I ≤ 20.0 mA.

\*\* V<sub>IH</sub> (max) = V<sub>DD</sub> + 0.3 V dc; V<sub>IH</sub> (max) = V<sub>DD</sub> + 2.0 V ac (pulse width ≤ 20 ns) for I ≤ 20.0 mA.

### DC CHARACTERISTICS

Parameter	Symbol	Min	Max	Unit
Input Leakage Current (All Inputs, V <sub>in</sub> = 0 to V <sub>DD</sub> )	I <sub>lkg(I)</sub>	—	± 1.0	μA
Output Leakage Current ( $\bar{E}$ = V <sub>IH</sub> , V <sub>out</sub> = 0 to V <sub>DD</sub> )	I <sub>lkg(O)</sub>	—	± 1.0	μA
Output Low Voltage	(I <sub>OL</sub> = + 4.0 mA) (I <sub>OL</sub> = + 100 μA) V <sub>OL</sub>	—	0.4 V <sub>SS</sub> + 0.2	V
Output High Voltage	(I <sub>OH</sub> = - 4.0 mA) (I <sub>OH</sub> = - 100 μA) V <sub>OH</sub>	2.4 V <sub>DD</sub> - 0.2	—	V

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## POWER SUPPLY CURRENTS (See Note 1)

Parameter	Symbol	6323A-10	6323A-12	6323A-15	Unit	Notes
AC Active Supply Current ( $I_{out} = 0$ mA) ( $V_{DD} = \text{Max}$ , $f = f_{max}$ )	$I_{DDA}$	140 150	135 140	130 135	mA	2
AC Standby Current ( $\bar{E} = V_{IH}$ , $V_{DD} = \text{Max}$ , $f = f_{max}$ )	$I_{SB1}$	40 45	35 40	30 35	mA	2
CMOS Standby Current ( $V_{DD} = \text{Max}$ , $f = 0$ MHz, $\bar{E} \geq V_{DD} - 0.2$ V, $V_{in} \leq V_{SS} + 0.2$ V, or $\geq V_{DD} - 0.2$ V)	$I_{SB2}$	5 5	5 5	5 5	mA	

### NOTES:

1. Typical current = 25°C @ 3.3 V.
2. Reference AC Operating Conditions and Characteristics for input and timing ( $V_{IH}/V_{IL}$ ,  $t_r/t_f$ , pulse level 0 to 3.0 V,  $V_{IH} = 3.0$  V,  $V_{IL} = 0$  V).

## CAPACITANCE (f = 1.0 MHz, dV = 3.0 V, $T_A = 25^\circ\text{C}$ , Periodically Sampled Rather Than 100% Tested)

Parameter	Symbol	Typ	Max	Unit
Address Input Capacitance	$C_{in}$	—	6	pF
Control Input Capacitance	$C_{in}$	—	6	pF
Input/Output Capacitance	$C_{I/O}$	—	8	pF

## AC OPERATING CONDITIONS AND CHARACTERISTICS

( $V_{DD} = 3.3$  V  $\pm$  0.3 V,  $T_A = 0$  to  $+70^\circ\text{C}$ , Unless Otherwise Noted)

( $T_A = -40$  to  $+85^\circ\text{C}$  for Industrial Temperature Offering)

Logic Input Timing Measurement Reference Level . . . . .	1.50 V	Output Timing Reference Level . . . . .	1.50 V
Logic Input Pulse Levels . . . . .	0 to 3.0 V	Output Load . . . . .	See Figure 1
Input Rise/Fall Time . . . . .	2 ns		

## READ CYCLE TIMING (See Notes 1, 2, 3, and 4)

Parameter	Symbol	MCM6323A-10		MCM6323A-12		MCM6323A-15		Unit	Notes
		Min	Max	Min	Max	Min	Max		
Read Cycle Time	$t_{AVAV}$	10	—	12	—	15	—	ns	5
Address Access Time	$t_{AVQV}$	—	10	—	12	—	15	ns	
Enable Access Time	$t_{ELQV}$	—	10	—	12	—	15	ns	
Output Enable Access Time	$t_{GLQV}$	—	4	—	5	—	6	ns	6
Output Hold from Address Change	$t_{AXQX}$	3	—	3	—	3	—	ns	
Enable Low to Output Active	$t_{ELQX}$	3	—	3	—	3	—	ns	6, 7, 8
Output Enable Low to Output Active	$t_{GLQX}$	0	—	0	—	0	—	ns	6, 7, 8
Enable High to Output High-Z	$t_{EHQZ}$	—	4	—	5	—	6	ns	6, 7, 8
Output Enable High to Output High-Z	$t_{GHQZ}$	—	4	—	5	—	6	ns	6, 7, 8
Byte Enable Access Time	$t_{BLQV}$	—	4	—	5	—	6	ns	
Byte Enable Low to Output Active	$t_{BLQX}$	0	—	0	—	0	—	ns	6, 7, 8
Byte High to Output High-Z	$t_{BHQZ}$	0	5	0	5	0	5	ns	6, 7, 8

### NOTES:

1.  $\bar{W}$  is high for read cycle.
2. For common I/O applications, minimization or elimination of bus contention conditions is necessary during read and write cycles.
3. Device is continuously selected ( $\bar{E} = V_{IL}$ ,  $G = V_{IL}$ , and  $\text{LB}$  and/or  $\text{UB} = V_{IL}$ ).
4. Addresses valid prior to or coincident with  $\bar{E}$  going low.
5. All read cycle timings are referenced from the last valid address to the first transitioning address.
6. Transition is measured 200 mV from steady-state voltage.
7. At any given voltage and temperature,  $t_{EHQZ}(\text{max}) < t_{ELQX}(\text{min})$ , and  $t_{GHQZ}(\text{max}) < t_{GLQX}(\text{min})$ , both for a given device and from device to device.
8. This parameter is sampled and not 100% tested.

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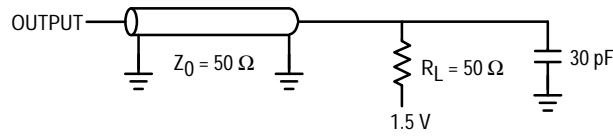


Figure 1. Equivalent AC Test Load

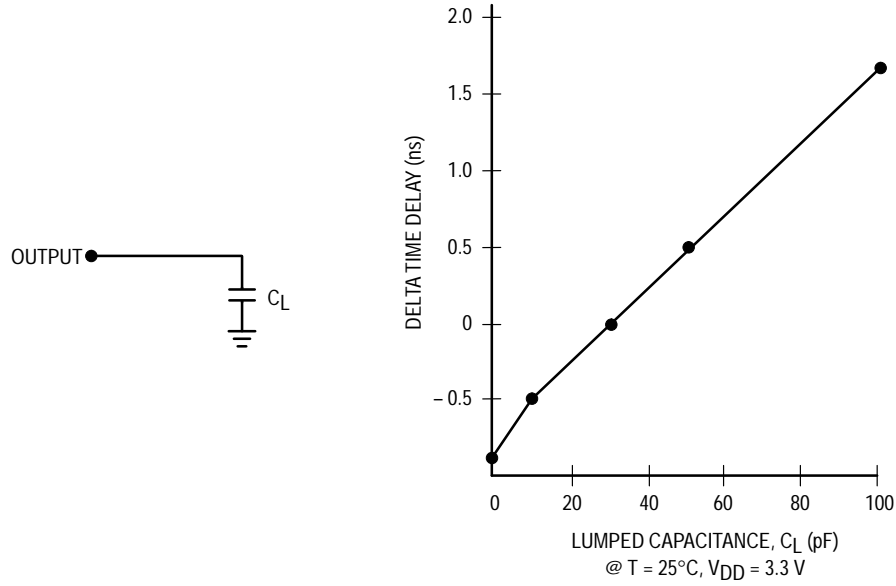


Figure 2. Lumped Capacitive Load and Typical Derating Curve

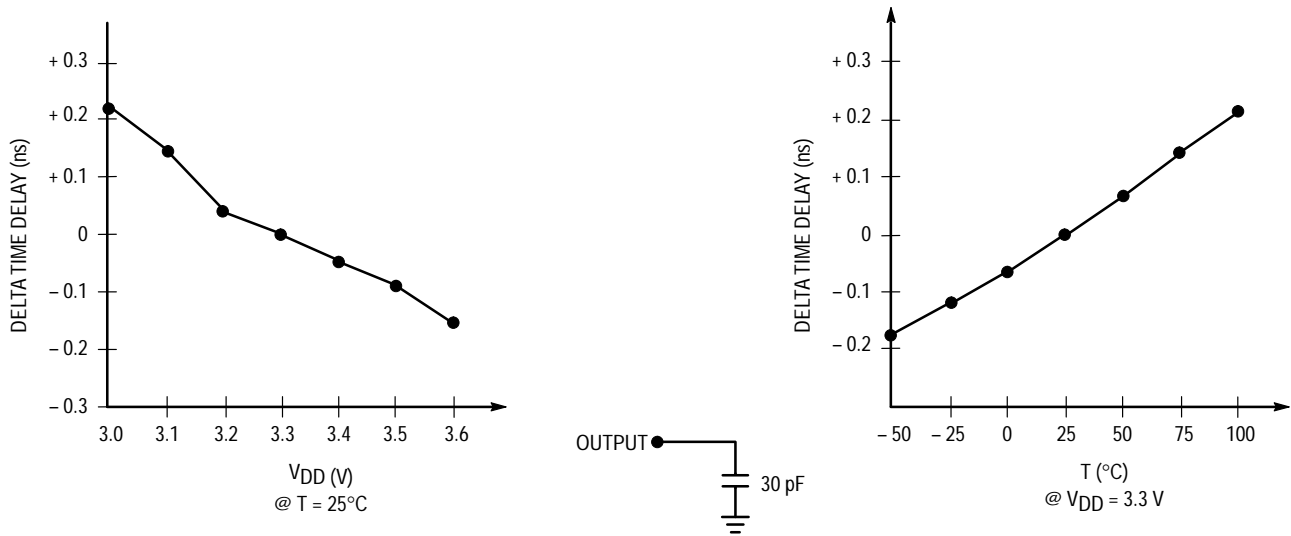
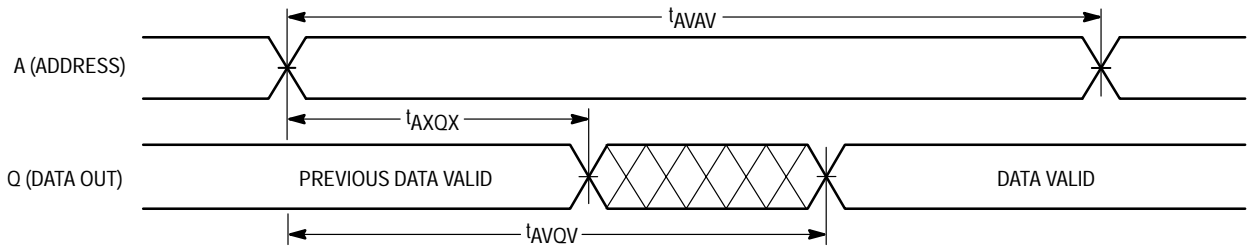


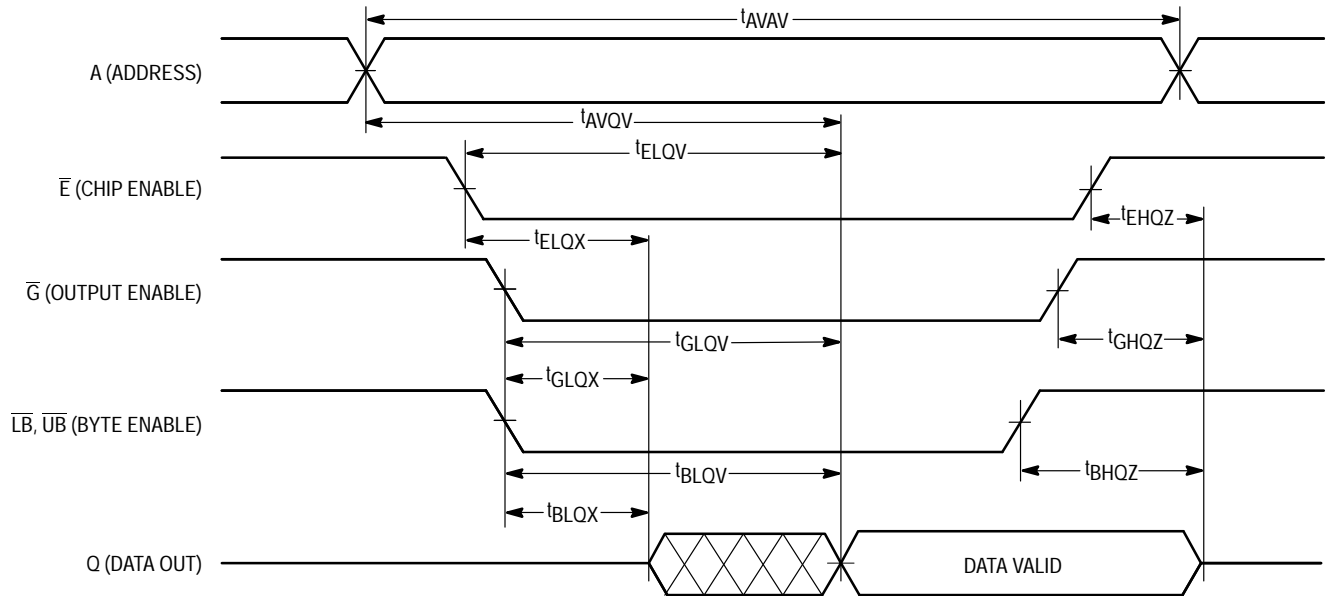
Figure 3. Derating Across Temperature and Voltage

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## READ CYCLE 1 (See Note 7)



## READ CYCLE 2 (See Note 8)



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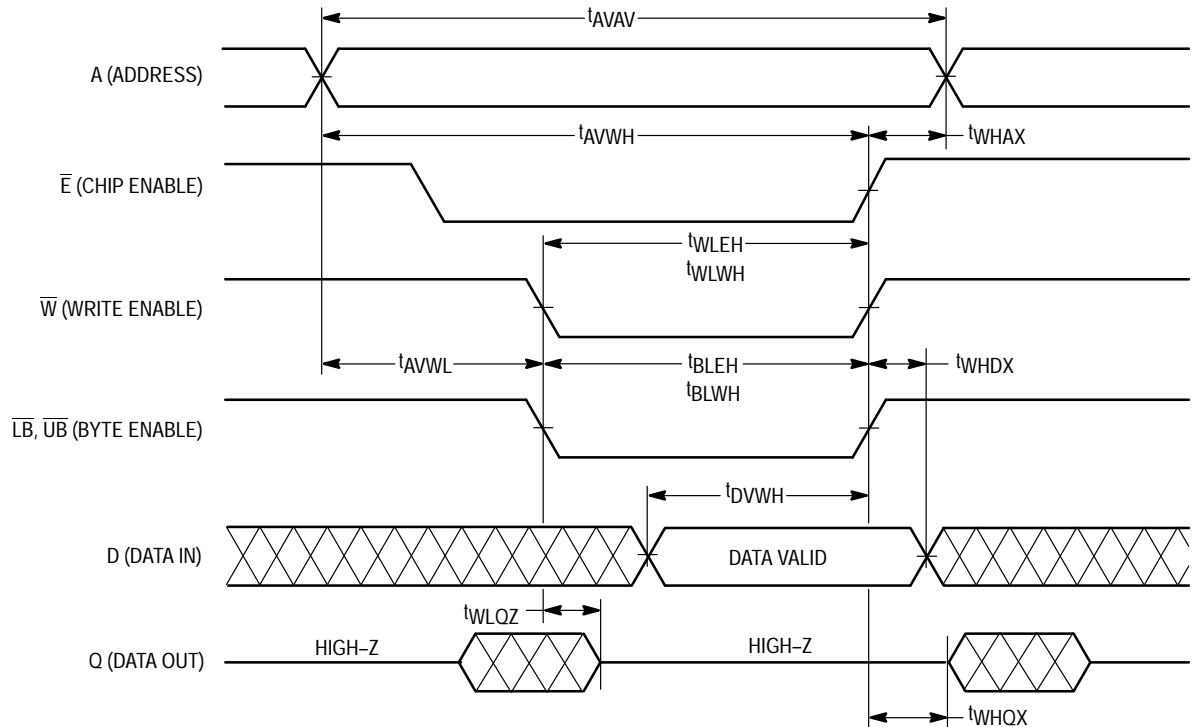
## WRITE CYCLE 1 ( $\overline{W}$ Controlled, See Notes 1 and 2)

Parameter	Symbol	MCM6323A-10		MCM6323A-12		MCM6323A-15		Unit	Notes
		Min	Max	Min	Max	Min	Max		
Write Cycle Time	$t_{AVAV}$	10	—	12	—	15	—	ns	3
Address Setup Time	$t_{AVWL}$	0	—	0	—	0	—	ns	
Address Valid to End of Write	$t_{AVWH}$	8	—	9	—	10	—	ns	
Write Pulse Width	$t_{WLWH}$ , $t_{WLEH}$	7	—	8	—	10	—	ns	
Byte Pulse Width	$t_{BLWH}$ , $t_{BLEH}$	7	—	8	—	10	—	ns	
Data Valid to End of Write	$t_{DVWH}$	4	—	5	—	6	—	ns	
Data Hold Time	$t_{WHDX}$	0	—	0	—	0	—	ns	
Write Low to Data High-Z	$t_{WLQZ}$	0	4	0	5	0	6	ns	4, 5, 6
Write High to Output Active	$t_{WHQX}$	3	—	3	—	3	—	ns	4, 5, 6
Write Recovery Time	$t_{WHAX}$	0	—	0	—	0	—	ns	

### NOTES:

1. A write occurs during the overlap of  $\overline{E}$  low,  $\overline{W}$  low, and  $\overline{LB}$  and/or  $\overline{UB}$  low.
2. For common I/O applications, minimization or elimination of bus contention conditions is necessary during read and write cycles.
3. All write cycle timings are referenced from the last valid address to the first transitioning address.
4. Transition is measured 200 mV from steady-state voltage.
5. At any given voltage and temperature,  $t_{WLQZ} \max < t_{WHQX} \min$  both for a given device and from device to device.
6. This parameter is sampled and not 100% tested.

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



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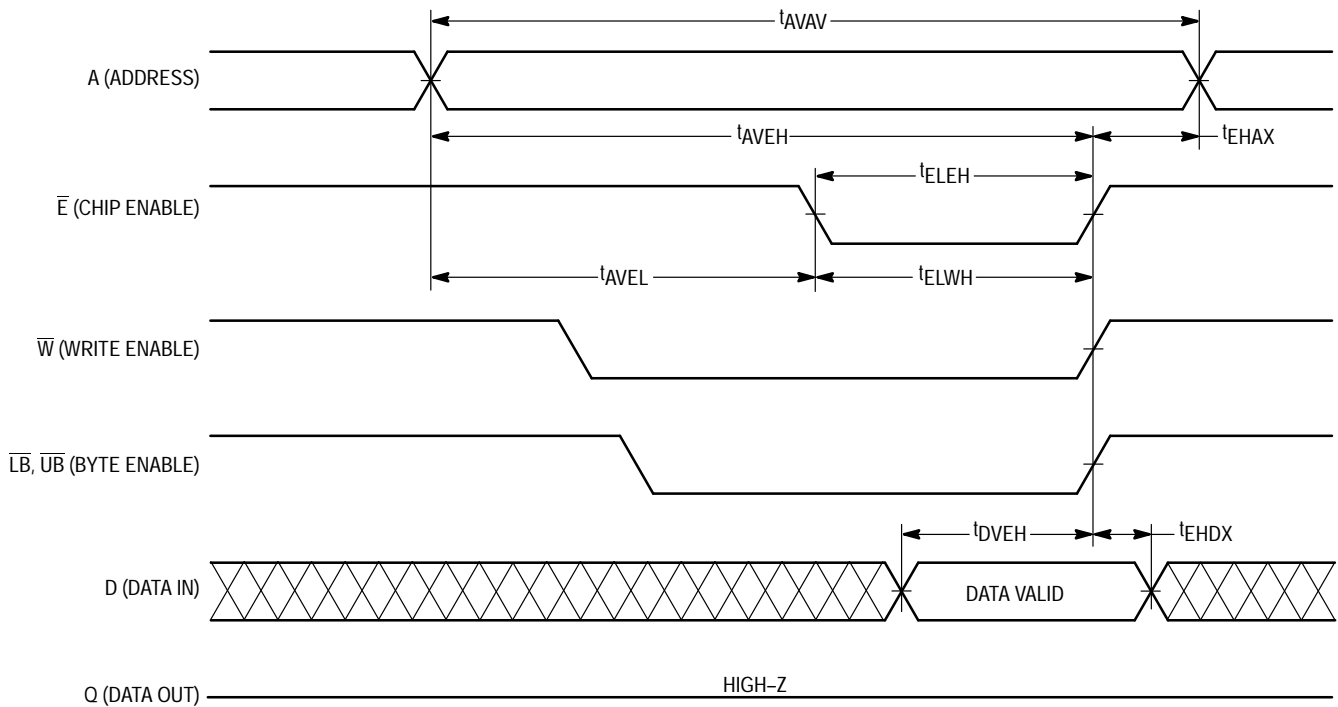
## WRITE CYCLE 2 ( $\bar{E}$ Controlled, See Notes 1 and 2)

Parameter	Symbol	MCM6323A-10		MCM6323A-12		MCM6323A-15		Unit	Notes
		Min	Max	Min	Max	Min	Max		
Write Cycle Time	$t_{AVAV}$	10	—	12	—	15	—	ns	3
Address Setup Time	$t_{AVEL}$	0	—	0	—	0	—	ns	
Address Valid to End of Write	$t_{AVEH}$	8	—	9	—	10	—	ns	
Enable to End of Write	$t_{ELEH}$ , $t_{ELWH}$	7	—	8	—	10	—	ns	4, 5
Data Valid to End of Write	$t_{DVEH}$	4	—	5	—	6	—	ns	
Data Hold Time	$t_{EHDX}$	0	—	0	—	0	—	ns	
Write Recovery Time	$t_{EHAX}$	0	—	0	—	0	—	ns	

### NOTES:

1. A write occurs during the overlap of  $\bar{E}$  low,  $\bar{W}$  low, and  $\bar{L}\bar{B}$  and/or  $\bar{U}\bar{B}$  low.
2. For common I/O applications, minimization or elimination of bus contention is necessary during read and write cycles.
3. All write cycle timings are referenced from the last valid address to the first transitioning address.
4. If  $\bar{E}$  goes low coincident with or after  $\bar{W}$  goes low, the output will remain in a high-impedance condition.
5. If  $\bar{E}$  goes high coincident with or before  $\bar{W}$  goes high, the output will remain in a high-impedance condition.

### WRITE CYCLE 2 ( $\bar{E}$ Controlled)



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## WRITE CYCLE 3 ( $\bar{B}$ Controlled, See Notes 1 and 2)

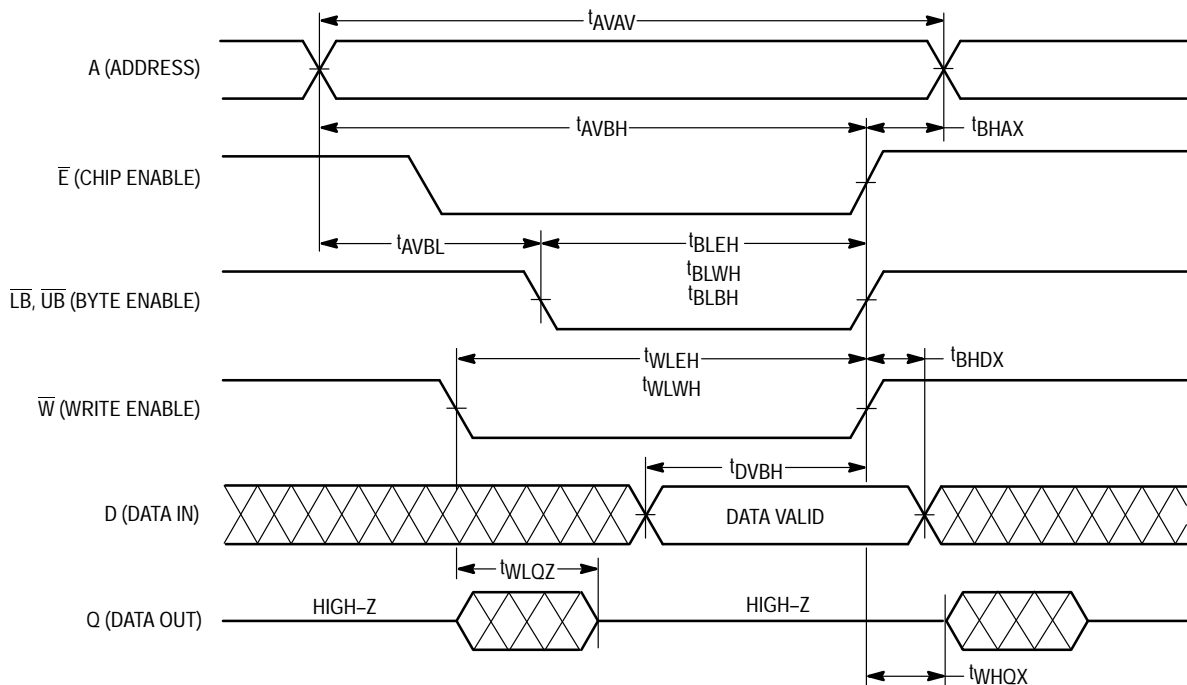
Parameter	Symbol	MCM6323A-10		MCM6323A-12		MCM6323A-15		Unit	Notes
		Min	Max	Min	Max	Min	Max		
Write Cycle Time	$t_{AVAV}$	10	—	12	—	15	—	ns	3
Address Setup Time	$t_{AVBL}$	0	—	0	—	0	—	ns	
Address Valid to End of Write	$t_{AVBH}$	8	—	9	—	10	—	ns	
Write Pulse Width	$t_{WLWH}$ , $t_{WLEH}$	7	—	8	—	10	—	ns	
Byte Pulse Width	$t_{BLWH}$ , $t_{BLEH}$ , $t_{BLBH}$	7	—	8	—	10	—	ns	
Data Valid to End of Write	$t_{DVBH}$	5	—	6	—	7	—	ns	
Data Hold Time	$t_{BHDX}$	0	—	0	—	0	—	ns	
Write Low to Data High-Z	$t_{WLQZ}$	0	4	0	5	0	6	ns	4, 5, 6
Write High to Output Active	$t_{WHQX}$	3	—	3	—	3	—	ns	4, 5, 6
Write Recovery Time	$t_{BHAX}$	0	—	0	—	0	—	ns	

### NOTES:

1. A write occurs during the overlap of  $\bar{E}$  low,  $\bar{W}$  low, and  $\bar{L}\bar{B}$  and/or  $\bar{U}\bar{B}$  low.
2. For common I/O applications, minimization or elimination of bus contention conditions is necessary during read and write cycles.
3. All write cycle timings are referenced from the last valid address to the first transitioning address.
4. Transition is measured 200 mV from steady-state voltage.
5. At any given voltage and temperature,  $t_{WLQZ}$  max <  $t_{WHQX}$  min both for a given device and from device to device.
6. This parameter is sampled and not 100% tested.

### WRITE CYCLE 3

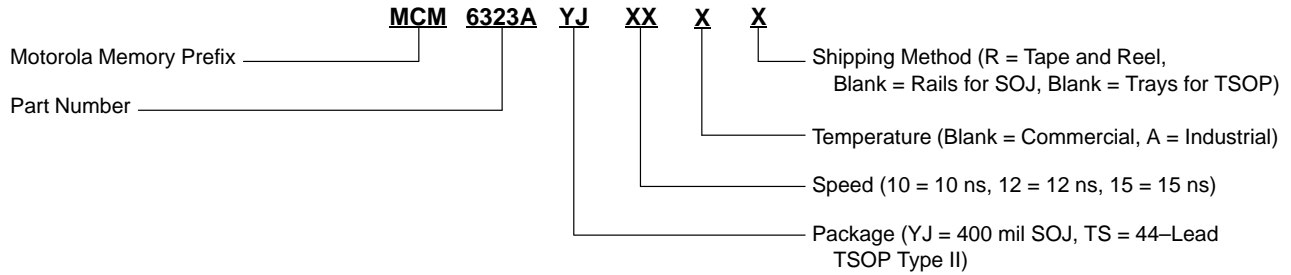
( $\bar{B}$  Controlled)



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## ORDERING INFORMATION

(Order by Full Part Number)

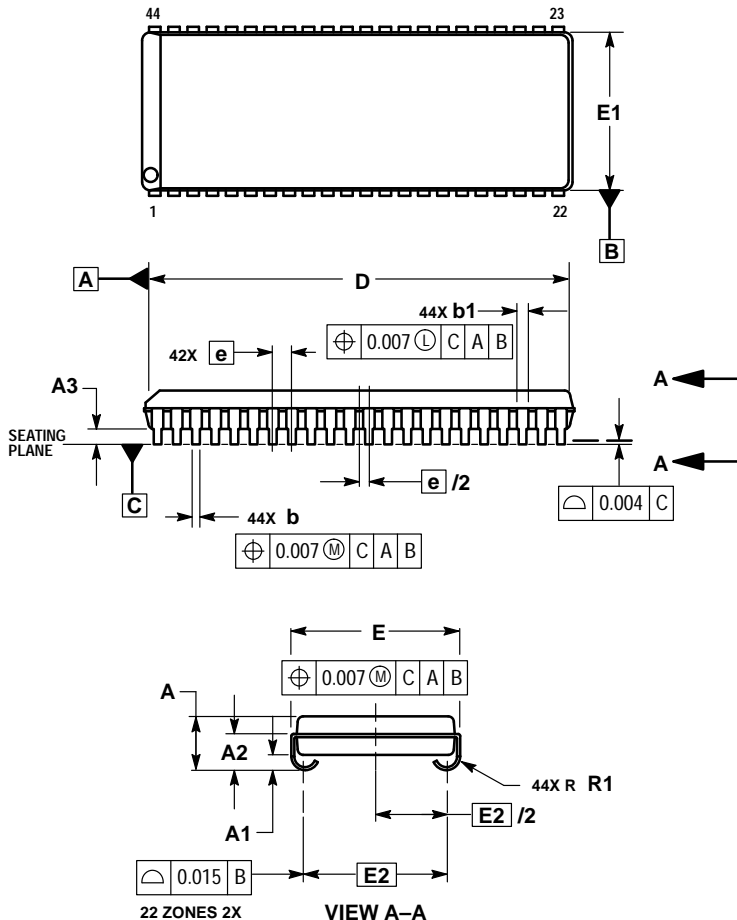


Full Commercial Part Numbers — MCM6323AYJ10 MCM6323AYJ12 MCM6323AYJ15  
MCM6323AYJ10R MCM6323AYJ12R MCM6323AYJ15R  
MCM6323ATS10 MCM6323ATS12 MCM6323ATS15  
MCM6323ATS10R MCM6323ATS12R MCM6323ATS15R

Full Industrial Part Numbers — SCM6323AYJ10A SCM6323AYJ12A SCM6323AYJ15A  
SCM6323AYJ10AR SCM6323AYJ12AR SCM6323AYJ15AR  
SCM6323ATS10A SCM6323ATS12A SCM6323ATS15A  
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## PACKAGE DIMENSIONS

YJ PACKAGE  
400 MIL SOJ  
CASE 919-01



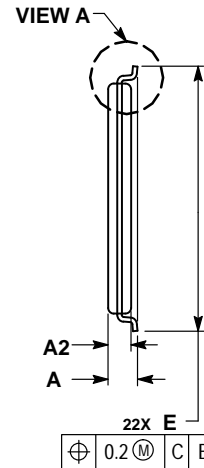
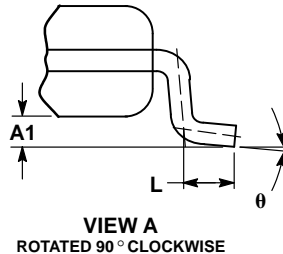
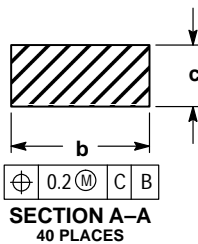
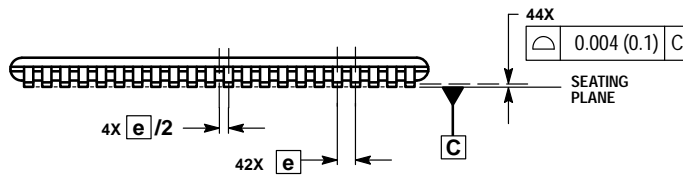
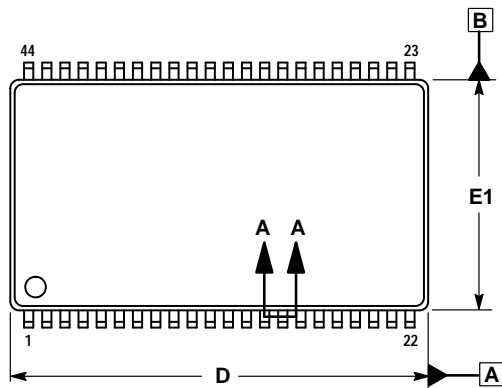
### NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: INCH.
- DIMENSION D DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006 PER END. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010 PER SIDE.
- THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM. DIMENSIONS D AND E1 AND, HENCE, DATUMS A AND B, ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
- DIMENSION b1 DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE SHOULDER WIDTH TO EXCEED b1 MAX BY MORE THAN 0.005. THE DAMBAR INTRUSION(S) SHALL NOT REDUCE THE SHOULDER WIDTH TO LESS THAN 0.001 BELOW b1 MIN.

DIM	INCHES	
	MIN	MAX
A	0.128	0.148
A1	0.025	---
A2	0.082	---
A3	0.035	0.045
b	0.015	0.020
b1	0.026	0.032
D	1.120	1.130
E	0.435	0.445
E1	0.395	0.405
E2	0.370 BSC	
e	0.050 BSC	
R1	0.030	0.040

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TS PACKAGE  
44-LEAD  
TSOP TYPE II  
CASE 924A-02



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS IN MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.15 PER SIDE.
4. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSIONS. DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED 0.58.

DIM	MILLIMETERS	
	MIN	MAX
A	—	1.20
A1	0.05	0.15
A2	0.95	1.05
b	0.30	0.45
c	0.12	0.21
D	18.28	18.54
e	0.80 BSC	
E	11.56	11.96
E1	10.03	10.29
L	0.40	0.60
θ	0°	5°

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