MOTOROLA
SEMICONDUCTOR TECHNICAL DATA

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MCM6341

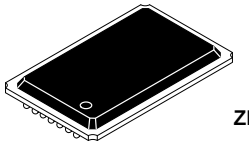
128K x 24 Bit Static Random Access Memory

The MCM6341 is a 3,145,728–bit static random access memory organized as 131,072 words of 24 bits. Static design eliminates the need for external clocks or timing strobes.

The MCM6341 is equipped with chip enable ($\overline{E1}$, E2, $\overline{E3}$) and output enable ($\overline{G}$) pins, allowing for greater system flexibility and eliminating bus contention problems.

The MCM6341 is available in a 119–bump PBGA package.

- Single 3.3 V Power Supply
- Fast Access Time: 10/11/12/15 ns
- Equal Address and Chip Enable Access Time
- All Inputs and Outputs are TTL Compatible
- Three–State Outputs
- Power Operation: 280/275/270/260 mA Maximum, Active AC
- Commercial Temperature (0°C to 70°C) and Industrial Temperature (–40°C to 85°C) Options

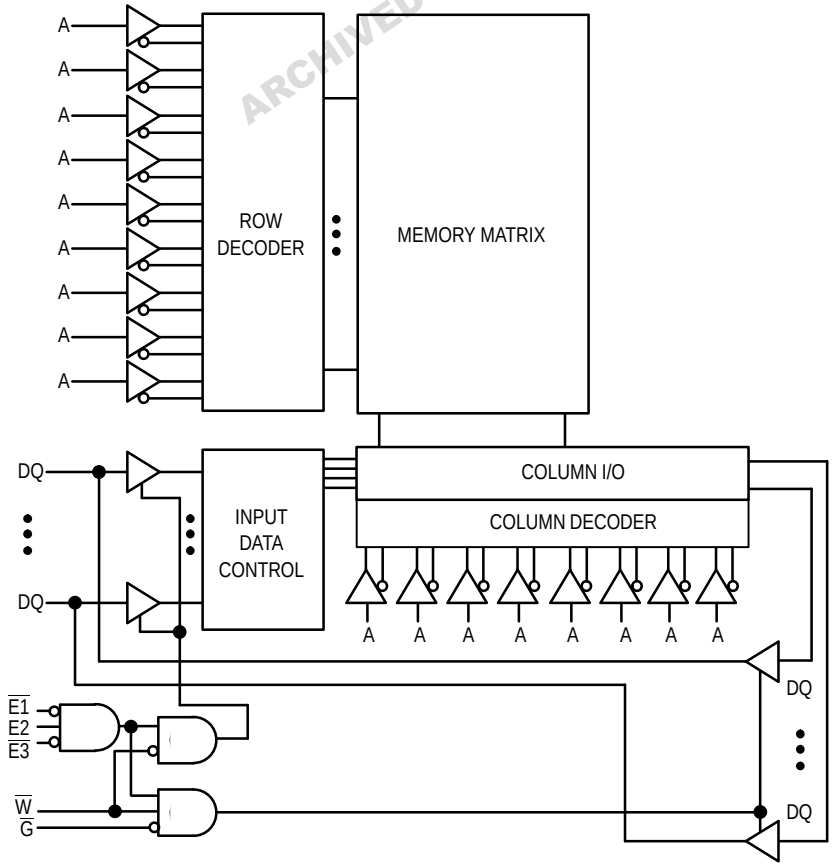


ZP PACKAGE
PBGA
CASE 999–02

PIN NAMES

A	Address Inputs
$\overline{W}$	Write Enable
$\overline{G}$	Output Enable
$\overline{E1}$, E2, $\overline{E3}$	Chip Enable
DQ	Data Input/Output
NC	No Connection
V_{DD}	+ 3.3 V Power Supply
V_{SS}	Ground

BLOCK DIAGRAM



REV 8
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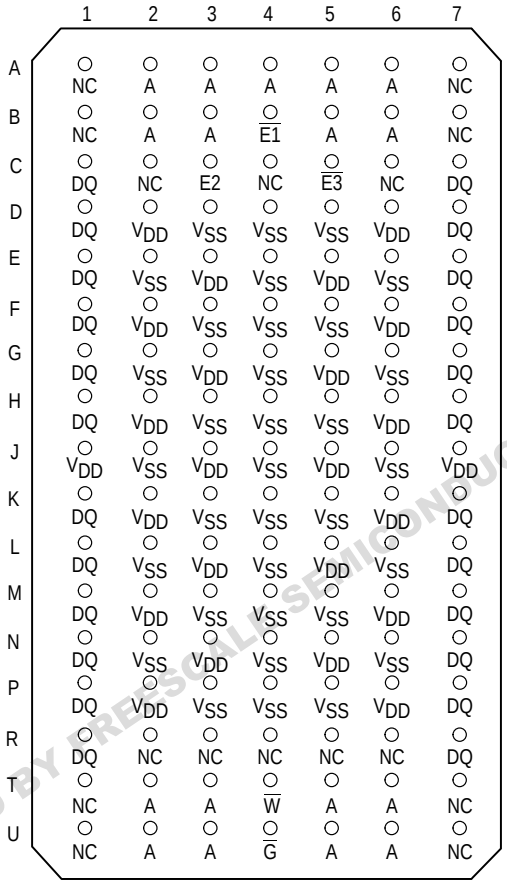
PIN ASSIGNMENT



119–BUMP PBGA
TOP VIEW

TRUTH TABLE (X = Don't Care)

$\overline{E1}$	E2	$\overline{E3}$	$\overline{G}$	$\overline{W}$	Mode	I/O Pin	Cycle	Current
H	X	X	X	X	Not Selected	High–Z	—	I_{SB1}, I_{SB2}
X	L	X	X	X	Not Selected	High–Z	—	I_{SB1}, I_{SB2}
X	X	H	X	X	Not Selected	High–Z	—	I_{SB1}, I_{SB2}
L	H	L	H	H	Output Disabled	High–Z	—	I_{DDA}
L	H	L	L	H	Read	D_{out}	Read	I_{DDA}
L	H	L	X	L	Write	High–Z	Write	I_{DDA}

ABSOLUTE MAXIMUM RATINGS (See Note)

Rating	Symbol	Value	Unit
Power Supply Voltage Relative to V_{SS}	V_{DD}	–0.5 to 5.0	V
Voltage Relative to V_{SS} for Any Pin Except V_{DD}	V_{in}, V_{out}	–0.5 to V_{DD} + 0.5	V
Output Current (per I/O)	I_{out}	±20	mA
Power Dissipation	P_D	1.0	W
Temperature Under Bias Commercial Industrial	T_{bias}	–10 to 85 –45 to 90	°C
Storage Temperature — Plastic	T_{stg}	–55 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.

PRODUCT CONFIGURATIONS

Part No.	Commercial	Industrial	Power Supply	
			+ 10%, – 5%	± 10%
MCM6341ZP10	✓			✓
MCM6341ZP11	✓			✓
MCM6341ZP12	✓			✓
MCM6341ZP15	✓			✓
SCM6341ZP10C		✓	✓	
SCM6341ZP11A		✓		✓
SCM6341ZP12A		✓		✓
SCM6341ZP15A		✓		✓

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.

DC OPERATING CONDITIONS AND CHARACTERISTICS

(V_{DD} = 3.3 V ±10%, T_A = 0° to 70°C)
(T_A = –40° to 85°C for Industrial Temperature Option)
(V_{DD} = 3.3 V +10%, –5% for 10 ns Industrial Device Only)

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage (Operating Voltage Range)	V_{DD}	3.0	3.3	3.6	V
Input High Voltage	V_{IH}	2.2	—	V_{DD} + 0.3**	V
Input Low Voltage	V_{IL}	–0.5*	—	0.8	V

*V_{IL} (min) = –0.5 V dc; V_{IL} (min) = –2.0 V ac (pulse width ≤ 2.0 ns).
**V_{IH} (max) = V_{DD} + 0.3 V dc; V_{IH} (max) = V_{DD} + 2.0 V ac (pulse width ≤ 2.0 ns).

DC CHARACTERISTICS (See Note)

Parameter	Symbol	Min	Max	Unit
Input Leakage Current (All Inputs, V_{in} = 0 to V_{DD})	$I_{lkg(I)}$	—	±1.0	µA
Output Leakage Current ($\overline{E}$ = V_{IH}, V_{out} = 0 to V_{DD})	$I_{lkg(O)}$	—	±1.0	µA
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

NOTE: $\overline{E1}$, E2, and $\overline{E3}$ are represented by $\overline{E}$ in this data sheet. E2 is of opposite polarity to $\overline{E1}$ and $\overline{E3}$.

POWER SUPPLY CURRENTS (See Note)

Parameter		Symbol	0 to 70°C	– 40 to 85°C	Unit
AC Active Supply Current (I_{out} = 0 mA, V_{DD} = max)	MCM6341–10	I_{DD}	250	290	mA
	MCM6341–11		240	285	
	MCM6341–12		230	280	
	MCM6341–15		220	270	
AC Standby Current (V_{DD} = max, $\overline{E}$ = V_{IH}, No other restrictions on other inputs)	MCM6341–10	I_{SB1}	50	55	mA
	MCM6341–11		50	55	
	MCM6341–12		50	55	
	MCM6341–15		45	50	
CMOS Standby Current ($\overline{E}$ ≥ V_{DD} – 0.2 V, V_{in} ≤ V_{SS} + 0.2 V or ≥ V_{DD} – 0.2 V) (V_{DD} = max, f = 0 MHz)		I_{SB2}	10	10	mA

NOTE: $\overline{E1}$, E2, and $\overline{E3}$ are represented by $\overline{E}$ in this data sheet. E2 is of opposite polarity to $\overline{E1}$ and $\overline{E3}$.

CAPACITANCE (f = 1.0 MHz, dV = 3.0 V, T_A = 25°C, Periodically Sampled Rather Than 100% Tested)

Parameter		Symbol	Typ	Max	Unit
Input Capacitance	All Inputs Except Clocks and DQs	C_{in}	4	6	pF
	$\overline{E}$, $\overline{G}$, $\overline{W}$	C_{ck}	5	8	
Input/Output Capacitance	DQ	$C_{I/O}$	5	8	pF

AC OPERATING CONDITIONS AND CHARACTERISTICS

(V_{DD} = 3.3 V ±10%, T_A = 0° to 70°C)
(T_A = –40° to 85°C for Industrial Temperature Option)
(V_{DD} = 3.3 V +10%, –5% for 10 ns Industrial Device Only)

Input Pulse Levels . . . . . 0 to 3.0 V
Input Rise/Fall Time . . . . . 2 ns
Input Timing Measurement Reference Level . . . . . 1.5 V
Output Timing Measurement Reference Level . . . . . 1.5 V
Output Load . . . . . See Figure 1

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

Parameter	Symbol	MCM6341–10		MCM6341–11		MCM6341–12		MCM6341–15		Unit	Notes
		Min	Max	Min	Max	Min	Max	Min	Max		
Read Cycle Time	t_{AVAV}	10	—	11	—	12	—	15	—	ns	4
Address Access Time	t_{AVQV}	—	10	—	11	—	12	—	15	ns	
Enable Access Time	t_{ELQV}	—	10	—	11	—	12	—	15	ns	5
Output Enable Access Time	t_{GLQV}	—	4	—	4	—	4	—	4	ns	
Output Hold from Address Change	t_{AXQX}	3	—	3	—	3	—	3	—	ns	
Enable Low to Output Active	t_{ELQX}	3	—	3	—	3	—	3	—	ns	6, 7, 8
Output Enable Low to Output Active	t_{GLQX}	0	—	0	—	0	—	0	—	ns	6, 7, 8
Enable High to Output High–Z	t_{EHQZ}	0	5	0	6	0	6	0	7	ns	6, 7, 8
Output Enable High to Output High–Z	t_{GHQZ}	0	5	0	6	0	6	0	7	ns	6, 7, 8

NOTES:
1. $\overline{W}$ is high for read cycle.
2. Product sensitivities to noise require proper grounding and decoupling of power supplies as well as minimization or elimination of bus contention conditions during read and write cycles.
3. $\overline{E1}$, E2, and $\overline{E3}$ are represented by $\overline{E}$ in this data sheet. E2 is of opposite polarity to $\overline{E1}$ and $\overline{E3}$.
4. All read cycle timings are referenced from the last valid address to the first transitioning address.
5. Addresses valid prior to or coincident with $\overline{E}$ going low.
6. At any given voltage and temperature, t_{EHQZ} max < t_{ELQX} min, and t_{GHQZ} max < t_{GLQX} min, both for a given device and from device to device.
7. Transition is measured ±200 mV from steady–state voltage.
8. This parameter is sampled and not 100% tested.
9. Device is continuously selected ($\overline{E} \le V_{IL}$, $\overline{G} \le V_{IL}$).

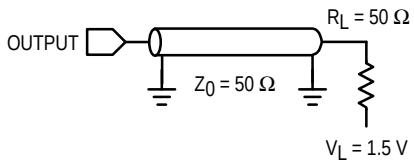
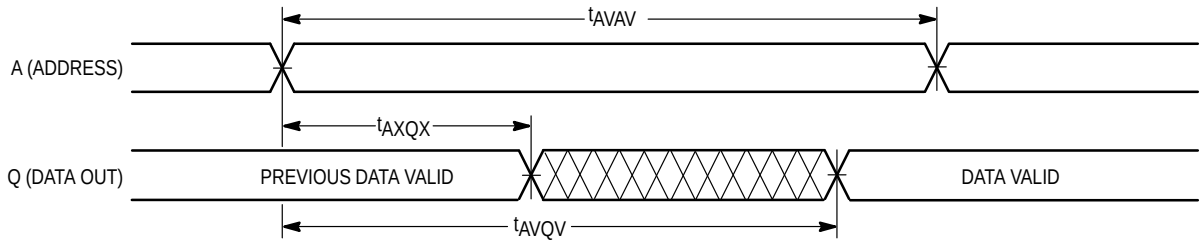
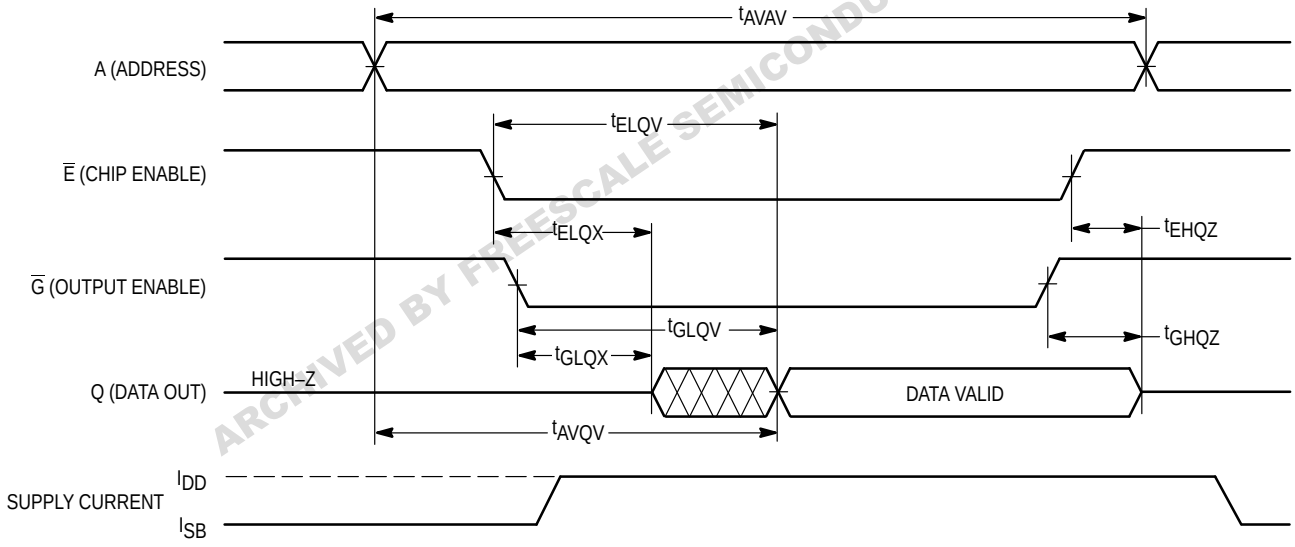


Figure 1. AC Test Load

READ CYCLE 1 (See Note 9)



READ CYCLE 2 (See Notes 3 and 5)

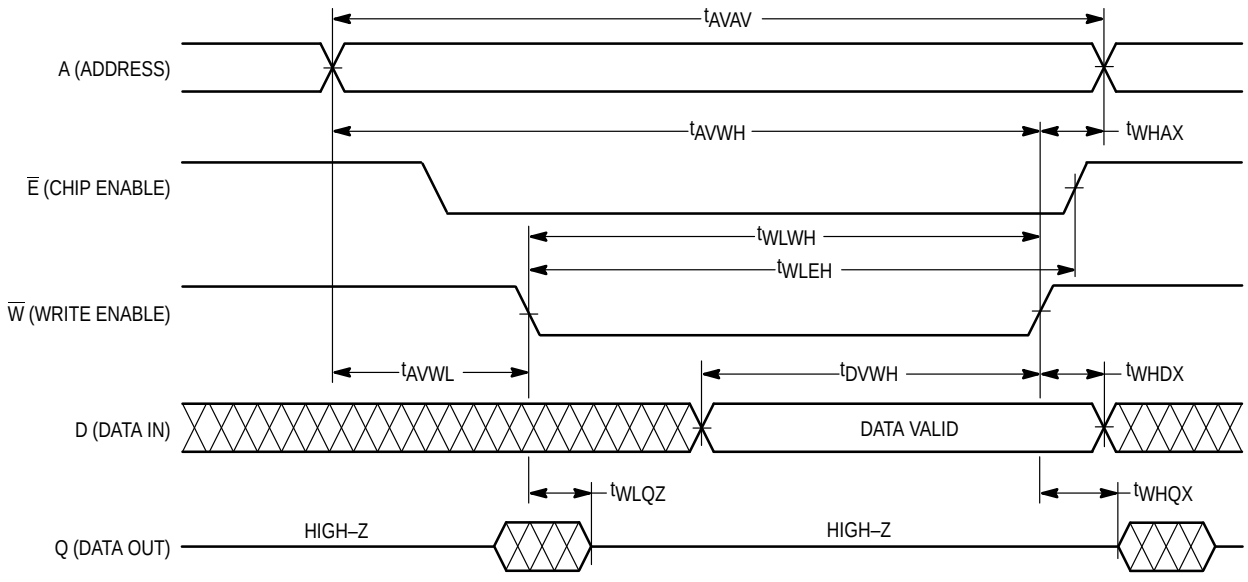


WRITE CYCLE 1 ($\overline{W}$ Controlled; See Notes 1, 2, 3, and 4)

Parameter	Symbol	MCM6341–10		MCM6341–11		MCM6341–12		MCM6341–15		Unit	Notes
		Min	Max	Min	Max	Min	Max	Min	Max		
Write Cycle Time	t_{AVAV}	10	—	11	—	12	—	15	—	ns	5
Address Setup Time	t_{AVWL}	0	—	0	—	0	—	0	—	ns	
Address Valid to End of Write	t_{AVWH}	9	—	10	—	10	—	12	—	ns	
Address Valid to End of Write ($\overline{G}$ High)	t_{AVWH}	8	—	9	—	9	—	10	—	ns	
Write Pulse Width	t_{WLWH} t_{WLEH}	9	—	10	—	10	—	12	—	ns	
Write Pulse Width ($\overline{G}$ High)	t_{WLWH} t_{WLEH}	8	—	9	—	9	—	10	—	ns	
Data Valid to End of Write	t_{DVWH}	4	—	5	—	5	—	6	—	ns	
Data Hold Time	t_{WHDX}	0	—	0	—	0	—	0	—	ns	
Write Low to Data High–Z	t_{WLQZ}	0	3.5	0	3.5	0	3.5	0	3.5	ns	6, 7, 8
Write High to Output Active	t_{WHQX}	3	—	3		3	—	3	—	ns	6, 7, 8
Write Recovery Time	t_{WHAX}	0	—	0	—	0	—	0	—	ns	

NOTES:
1. A write occurs during the overlap of $\overline{E}$ low and $\overline{W}$ low.
2. Product sensitivities to noise require proper grounding and decoupling of power supplies as well as minimization or elimination of bus contention conditions during read and write cycles.
3. If $\overline{G}$ goes low coincident with or after $\overline{W}$ goes low, the output will remain in a high–impedance state.
4. $\overline{E1}$, E2, and $\overline{E3}$ are represented by $\overline{E}$ in this data sheet. E2 is of opposite polarity to $\overline{E1}$ and $\overline{E3}$.
5. All write 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. This parameter is sampled and not 100% tested.
8. At any given voltage and temperature, t_{WLQZ} max < t_{WHQX} min both for a given device and from device to device.

WRITE CYCLE 1 ($\overline{W}$ Controlled; See Notes 1, 2, 3, and 4)

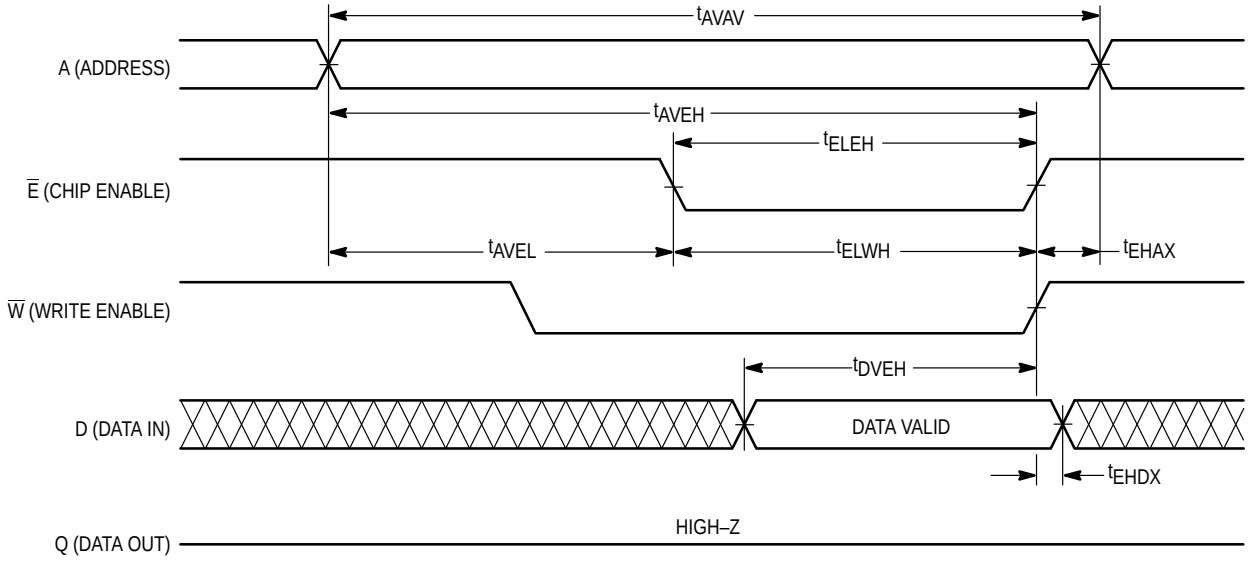


WRITE CYCLE 2 ($\overline{E}$ Controlled; See Notes 1, 2, 3, and 4)

Parameter	Symbol	MCM6341–10		MCM6341–11		MCM6341–12		MCM6341–15		Unit	Notes
		Min	Max	Min	Max	Min	Max	Min	Max		
Write Cycle Time	t_{AVAV}	10	—	11	—	12	—	15	—	ns	5
Address Setup Time	t_{AVEL}	0	—	0	—	0	—	0	—	ns	
Address Valid to End of Write	t_{AVEH}	9	—	10	—	10	—	12	—	ns	
Address Valid to End of Write ($\overline{G}$ High)	t_{AVEH}	8	—	9	—	9	—	10	—	ns	
Enable Pulse Width	t_{ELEH}, t_{ELWH}	9	—	10	—	10	—	12	—	ns	6, 7
Enable Pulse Width ($\overline{G}$ High)	t_{ELEH}, t_{ELWH}	8	—	9	—	9	—	10	—	ns	6, 7
Data Valid to End of Write	t_{DVEH}	4	—	5	—	5	—	6	—	ns	
Data Hold Time	t_{EHDX}	0	—	0	—	0	—	0	—	ns	
Write Recovery Time	t_{EHAX}	0	—	0	—	0	—	0	—	ns	

NOTES:
1. A write occurs during the overlap of $\overline{E}$ low and $\overline{W}$ low.
2. Product sensitivities to noise require proper grounding and decoupling of power supplies as well as minimization or elimination of bus contention conditions during read and write cycles.
3. If $\overline{G}$ goes low coincident with or after $\overline{W}$ goes low, the output will remain in a high–impedance state.
4. $\overline{E1}$, E2, and $\overline{E3}$ are represented by $\overline{E}$ in this data sheet. E2 is of opposite polarity to $\overline{E1}$ and $\overline{E3}$.
5. All write cycle timing is referenced from the last valid address to the first transitioning address.
6. If $\overline{E}$ goes low coincident with or after $\overline{W}$ goes low, the output will remain in a high–impedance condition.
7. If $\overline{E}$ goes high coincident with or before $\overline{W}$ goes high, the output will remain in a high–impedance condition.

WRITE CYCLE 2 ($\overline{E}$ Controlled; See Notes 1, 2, 3, and 4)



ORDERING INFORMATION
(Order by Full Part Number)

MCM 6341 XX XX X X

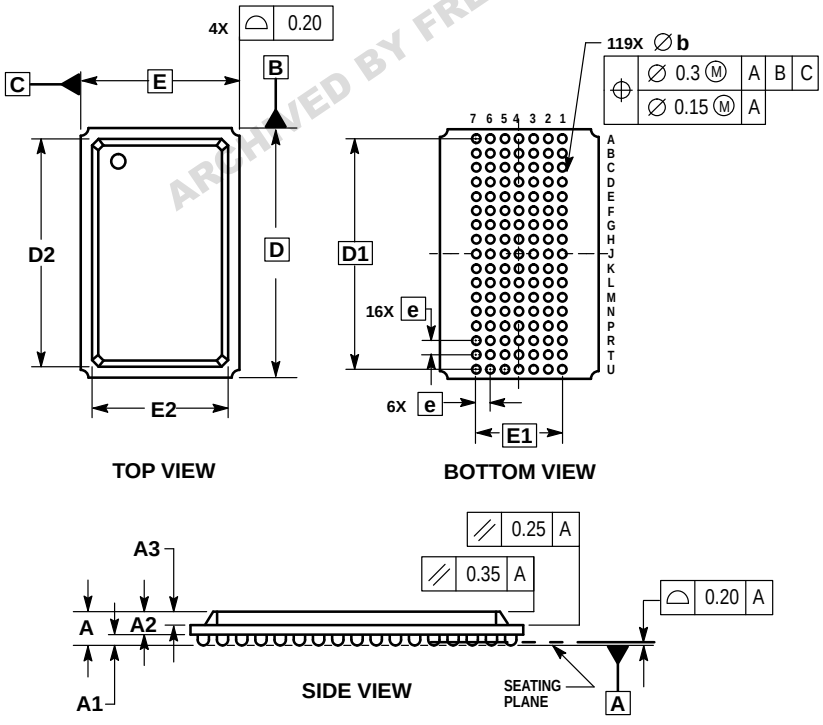
- Motorola Memory Prefix
- Part Number
- Shipping Method (PBGA Standard)
- Supply Tolerance (A = 10% Industrial, B = 5% Commercial, C = +10%, –5% Industrial, Blank = 10% Commercial)
- Speed (10 = 10 ns, 11 = 11 ns, 12 = 12 ns, 15 = 15 ns)
- Package (ZP = PBGA)

Full Commercial Part Numbers — MCM6341ZP10, MCM6341ZP11, MCM6341ZP12, MCM6341ZP15

Full Industrial Temperature Part Numbers — SCM6341ZP10C, SCM6341ZP11A, SCM6341ZP12A, SCM6341ZP15A

PACKAGE DIMENSIONS

ZP PACKAGE
119–PBGA
CASE 999–02



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. ALL DIMENSIONS IN MILLIMETERS.
3. DIMENSION b IS THE MAXIMUM SOLDER BALL DIAMETER MEASURED PARALLEL TO DATUM A.
4. DATUM A, THE SEATING PLANE, IS DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

	MILLIMETERS	
DIM	MIN	MAX
A	—	2.40
A1	0.50	0.70
A2	1.30	1.70
A3	0.80	1.00
D	22.00 BSC	
D1	20.32 BSC	
D2	19.40	19.60
E	14.00 BSC	
E1	7.62 BSC	
E2	11.90	12.10
b	0.60	0.90
e	1.27 BSC	

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