

Advance Information

1MB and 2MB Synchronous Fast Static RAM Module

The MCM36F8 (1MB) is configured as 256K x 36 bits and the MCM36F9 (2MB) is configured as 512K x 36 bits. Both are packaged in a 144-pin dual-in-line memory module (DIMM). Each module uses Motorola's 3.3 V 256K x 18 bit flow-through BurstRAMs.

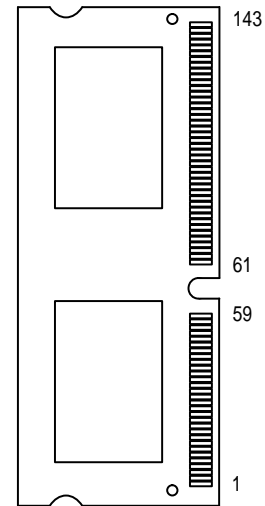
_Address (A), data inputs (DQ, DP), and all control signals except output enable (G) are clock (K) controlled through positive-edge-triggered noninverting registers.

Write cycles are internally self-timed and initiated by the rising edge of the clock (K) input. This feature provides increased timing flexibility for incoming signals. Synchronous byte write (BWx) and global byte write (WE) allows writes to either individual bytes or to both bytes.

- Single 3.3 V + 10%, - 5% Power Supply
- Multiple Clock Pins for Reduced Loading
- All Inputs and Outputs are LVTTTL Compatible
- Byte Write and Global Write Capability
- Fast SRAM Access Times: 10 ns
- Berg Connector, Part Number: 61178-31844
- 144-Pin DIMM Module

MCM36F8
MCM36F9

144-LEAD DIMM
CASE 1154-01
TOP VIEW



This document contains information on a new product. Specifications and information herein are subject to change without notice.

2/10/98

© Motorola, Inc. 1998

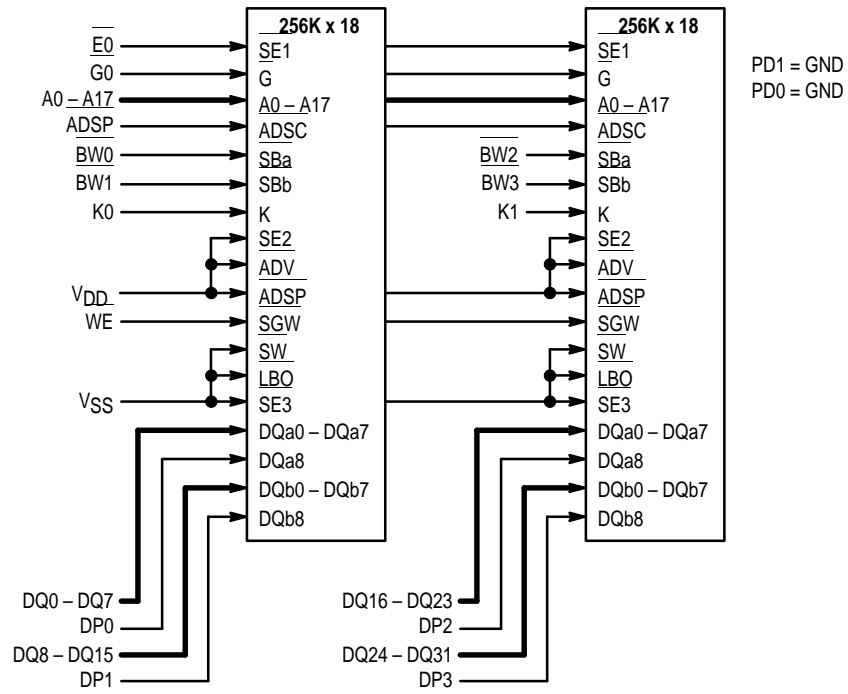
**For More Information On This Product,
Go to: www.freescale.com**



MOTOROLA

Freescale Semiconductor, Inc.

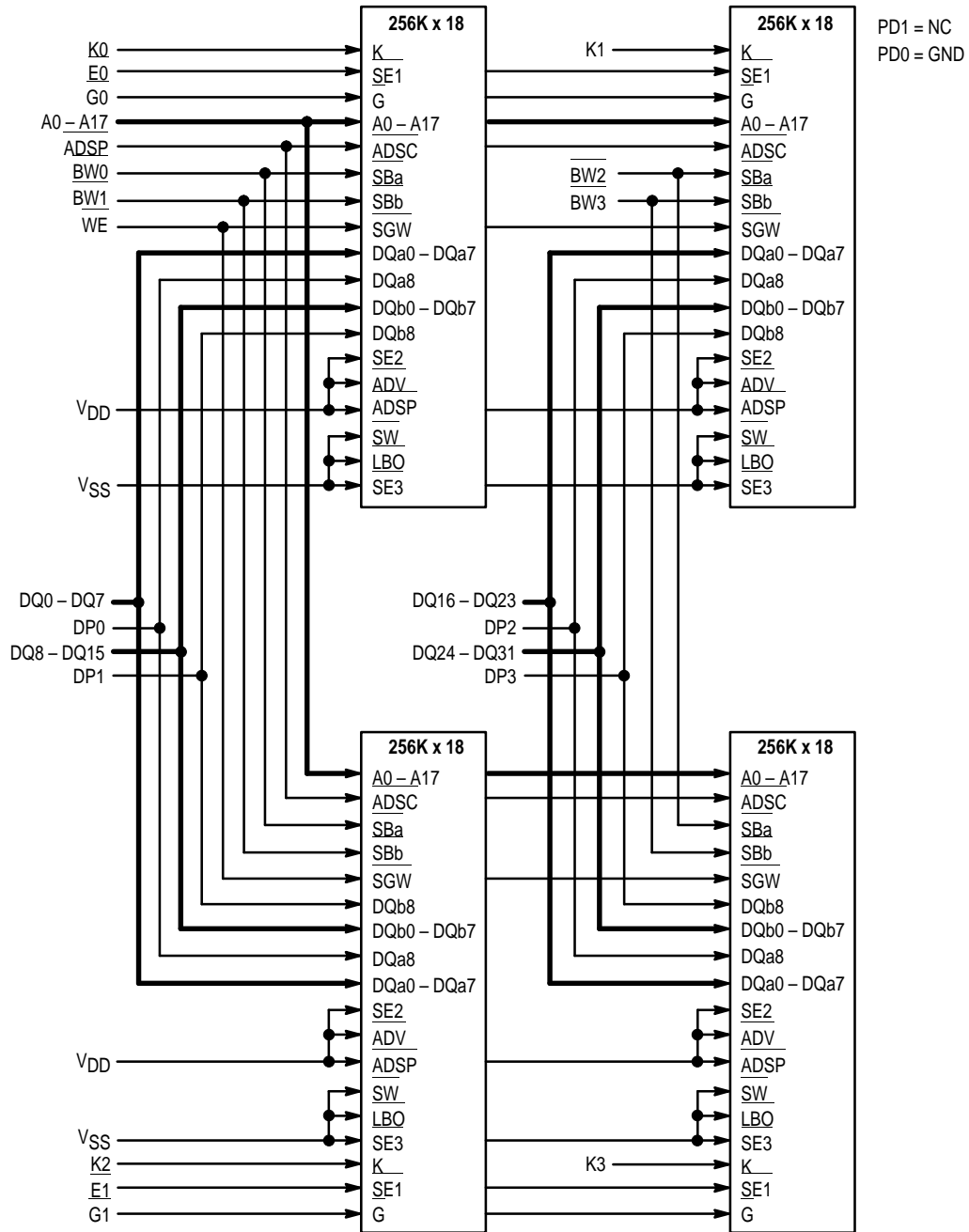
MCM36F8 BLOCK DIAGRAM



Freescale Semiconductor, Inc.

Freescale Semiconductor, Inc.

MCM36F9 BLOCK DIAGRAM



Freescale Semiconductor, Inc.

Freescale Semiconductor, Inc.

PIN ASSIGNMENT 144-LEAD DIMM TOP VIEW

VSS	1	2	VSS
A0	3	4	A1
A2	5	6	A3
A4	7	8	A5
VDD	9	10	VDD
NC	11	12	NC
NC	13	14	NC
VSS	15	16	VSS
A6	17	18	A7
A8	19	20	A9
A10	21	22	A11
NC	23	24	NC
VDD	25	26	VDD
A12	27	28	A13
A14	29	30	A15
A16	31	32	A17
VSS	33	34	VSS
PD0	35	36	PD1
VSS	37	38	VSS
BW0	39	40	BW1
E0	41	42	G0
VSS	43	44	VSS
K1	45	46	K0
VSS	47	48	VSS
DQ0	49	50	DQ1
VDD	51	52	VDD
DQ2	53	54	DQ3
DQ4	55	56	DQ5
DQ6	57	58	DQ7
VSS	59	60	VSS
VDD	61	62	VDD
DQ8	63	64	DQ9
DQ10	65	66	DQ11
VSS	67	68	VSS
DQ12	69	70	DQ13
DQ14	71	72	DQ15
DP0	73	74	DP1
NC	75	76	NC
NC	77	78	NC
VSS	79	80	VSS
WE	81	82	ADSP
NC	83	84	NC
VDD	85	86	VDD
NC	87	88	NC
NC	89	90	NC
NC	91	92	NC
VDD	93	94	VDD
NC	95	96	NC
NC	97	98	NC
NC	99	100	NC
VSS	101	102	VSS
BW2	103	104	BW3
E1	105	106	G1
VDD	107	108	VDD
DQ16	109	110	DQ17
DQ18	111	112	DQ19
NC	113	114	NC
NC	115	116	NC
NC	117	118	NC
VSS	119	120	VSS
K3	121	122	K2
VSS	123	124	VSS
DQ20	125	126	DQ21
VSS	127	128	VSS
DQ22	129	130	DQ23
DQ24	131	132	DQ25
DQ26	133	134	DQ27
DQ28	135	136	DQ29
VDD	137	138	VDD
DQ30	139	140	DQ31
DP2	141	142	DP3
VSS	143	144	VSS

Freescale Semiconductor, Inc.

PIN DESCRIPTIONS

Pin Locations	Symbol	Type	Description
3, 4, 5, 6, 7, 8, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32	A0 – A17	Input	Synchronous Address Inputs: These inputs are registered and must meet setup and hold times.
82	ADSP	Input	Synchronous Address Status Controller: Initiates read, write, or chip deselection cycle.
39, 40, 103, 104	BW0 – BW3	Input	Synchronous Byte Write Inputs: x refers to the byte being written (byte a, b, c, d). WE overrides BWx.
73, 74, 141, 142	DP0 – DP3		Synchronous Parity Data Inputs/Outputs.
(a) 49, 50, 53, 54, 55, 56, 57, 58, (b) 63, 64, 65, 66, 69, 70, 71, 72 (c) 109, 110, 111, 112, 125, 126, 129, 130 (d) 131, 132, 133, 134, 135, 136, 139, 140	DQ0 – DQ31	I/O	Synchronous Data Inputs/Outputs.
41, 105	E0, E1	Input	Synchronous Chip Enable: <u>Active low</u> to enable chip. Negated high — deselection chip when ADSP is asserted.
42, 106	G0, G1	Input	Asynchronous Output Enable Input.
46, 45, 122, 121	K0 – K3	Input	Clock: This signal registers the address, data in, and all control signals except G.
35, 36	PD0, PD1	Output	Presence Detect Bits.
81	WE	Input	Synchronous Global Write: This signal writes all bytes regardless of the status of the BWx signals. If only byte write signals SBx are being used, tie this pin high.
9, 10, 25, 26, 51, 52, 61, 62, 85, 86, 93, 94, 107, 108, 137, 138	V _{DD}	Supply	Power Supply: 3.3 V + 10%, – 5%.
1, 2, 15, 16, 33, 34, 37, 38, 43, 44, 47, 48, 59, 60, 67, 68, 79, 80, 101, 102, 119, 120, 123, 124, 127, 128, 143, 144	V _{SS}	Supply	Ground.
11, 12, 13, 14, 23, 24, 75, 76, 77, 78, 83, 84, 87, 88, 89, 90, 91, 92, 95, 96, 97, 98, 99, 100, 113, 114, 115, 116, 117, 118	NC	—	No Connection: There is no connection to the chip.

Freescale Semiconductor, Inc.

TRUTH TABLE (See Notes 1 through 4)

Next Cycle	Address Used	Ex	ADSP	Gx	DQx	WRITE ^{2, 4}
Deselect	None	1	0	X	High-Z	X
Begin Read	External	0	0	0	DQ	Read
Read	Current	X	1	1	High-Z	Read
Read	Current	X	1	0	DQ	Read
Begin Write	External	0	0	X	High-Z	Write
Write	Current	X	1	X	High-Z	Write

NOTES:

1. X = don't care, 1 = logic high, 0 = logic low.
2. Write is defined as either any BWx or WE low.
3. Gx is an asynchronous signal and is not sampled by the clock K. Gx drives the bus immediately (t_{GLQX}) following Gx going low.
4. On write cycles that follow read cycles, Gx must be negated prior to the start of the write cycle to ensure proper write data setup times. Gx must also remain negated at the completion of the write cycle to ensure proper write data hold times.

ABSOLUTE MAXIMUM RATINGS (Voltages Referenced to $V_{SS} = 0$ V)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{DD}	- 0.5 to + 4.6	V
Voltage Relative to V_{SS}	V_{in}, V_{out}	- 0.5 to $V_{DD} + 0.5$	V
Output Current (per I/O)	I_{out}	± 20	mA
Temperature Under Bias	T_{bias}	- 10 to + 85	°C
Storage Temperature	T_{stg}	- 55 to + 125	°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.

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.

This BiCMOS memory circuit has been designed to meet the dc and ac specifications shown in the tables, after thermal equilibrium has been established.

This device contains circuitry that will ensure the output devices are in High-Z at power up.

Freescale Semiconductor, Inc.

DC OPERATING CONDITIONS AND CHARACTERISTICS ($V_{DD} = 3.3\text{ V} \pm 10\%, -5\%$, $T_A = 0\text{ to }70^\circ\text{C}$, Unless Otherwise Noted)

RECOMMENDED OPERATING CONDITIONS (Voltages Referenced to $V_{SS} = 0\text{ V}$)

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{DD}	3.135	3.3	3.6	V
Input High Voltage	V_{IH}	2.0	—	$V_{DD} + 0.5$	V
Input Low Voltage	V_{IL}	-0.5*	—	0.8	V

* $V_{IL} \geq -2.0\text{ V}$ for $t \leq t_{KHKH}/2$.

DC CHARACTERISTICS

Parameter	Symbol	Min	Max	Unit
Input Leakage Current ($0\text{ V} \leq V_{in} \leq V_{DD}$)	$I_{kg(I)}$	—	± 1.0	μA
Output Leakage Current ($0\text{ V} \leq V_{in} \leq V_{DD}$)	$I_{kg(O)}$	—	± 1.0	μA
Output Low Voltage ($I_{OL} = +8.0\text{ mA}$)	V_{OL}	—	0.4	V
Output High Voltage ($I_{OH} = -4.0\text{ mA}$)	V_{OH}	2.4	—	V

POWER SUPPLY CURRENTS

Parameter	Symbol	Min	Max	Unit	Notes
AC Supply Current (Device Selected, All Outputs Open, Cycle Time $\geq t_{KHKH}$ min)	I_{DDA}	—	550 860	mA	1, 2, 3
CMOS Standby Supply Current (Deselected, Clock (K) Cycle Time $\geq t_{KHKH}$, All Inputs Toggling at CMOS Levels $V_{in} \leq V_{SS} + 0.2\text{ V}$ or $\geq V_{DD} - 0.2\text{ V}$)	I_{SB1}	—	310 620	mA	
Clock Running Supply Current (Deselected, Clock (K) Cycle Time $\geq t_{KHKH}$, All Other Inputs Held to Static CMOS Levels $V_{in} \leq V_{SS} + 0.2\text{ V}$ or $\geq V_{DD} - 0.2\text{ V}$)	I_{SB2}	—	190 380	mA	4

NOTES:

- 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, $V_{IH} = 3.0\text{ V}$).
- All addresses transition simultaneously low (LSB) and then high (HSB).
- Data states are all zero.
- Device in deselected mode as defined by the Truth Table.

MCM36F8 CAPACITANCE ($f = 1.0\text{ MHz}$, $dV = 3.0\text{ V}$, $T_A = 0\text{ to }70^\circ\text{C}$, Periodically Sampled Rather Than 100% Tested)

Parameter	Symbol	Typ	Max	Unit	
Input Capacitance	BWx, K Other Inputs	C_{in}	— —	10 15	pF
I/O Capacitance	$C_{I/O}$	—	13	pF	

MCM36F9 CAPACITANCE ($f = 1.0\text{ MHz}$, $dV = 3.0\text{ V}$, $T_A = 0\text{ to }70^\circ\text{C}$, Periodically Sampled Rather Than 100% Tested)

Parameter	Symbol	Typ	Max	Unit	
Input Capacitance	_____K Addr, ADSP, WE Other Inputs	C_{in}	— — —	10 25 15	pF
I/O Capacitance	$C_{I/O}$	—	21	pF	

Freescale Semiconductor, Inc.

AC OPERATING CONDITIONS AND CHARACTERISTICS ($V_{DD} = 3.3\text{ V} + 10\%, -5\%$, $T_A = 0\text{ to }70^\circ\text{C}$, Unless Otherwise Noted)

Input Timing Measurement Reference Level 1.25 V
 Input Pulse Levels 0 to 2.5 V
 Input Rise/Fall Time 1 V/ns (20 to 80%)

Output Timing Reference Level 1.25 V
 Output Load See Figure 1 Unless Otherwise Noted

DATA RAM READ/WRITE CYCLE TIMING (See Notes 1, 2, 3, and 4)

Parameter	Symbol	MCM36F8 – 10 MCM36F9 – 10		Unit	Notes	
		Min	Max			
Cycle Time	t_{KHKH}	15	—	ns		
Clock Access Time	t_{KHQV}	—	10	ns		
Output Enable to Output Valid	t_{GLQV}	—	3.5	ns		
Clock High to Output Active	t_{KHQX1}	0	—	ns	5	
Clock High to Output Change	t_{KHQX2}	2	—	ns	5	
Output Enable to Output Active	t_{GLQX}	0	—	ns	5	
Output Disable to Q High–Z	t_{GHQZ}	—	3.5	ns	5, 6	
Clock High to Q High–Z	t_{KHQZ}	2	3.5	ns	5, 6	
Clock High Pulse Width	t_{KHKL}	4.5	—	ns		
Clock Low Pulse Width	t_{KLKH}	4.5	—	ns		
Setup Times:	Address ADSP Data In Write Chip Enable	t_{AVKH} t_{ADKH} t_{DVKH} t_{WVKH} t_{EVKH}	2	—	ns	
Hold Times:	Address ADSP, ADSC, ADV Data In Write Chip Enable	t_{KHAX} t_{KHADX} t_{KHDX} $t_{KH WX}$ t_{KHEX}	0.5	—	ns	

NOTES:

- Write is defined as either any \overline{BWx} and \overline{SW} low or \overline{WE} is low.
- Chip Enable is defined as E0 low, SE2 high, and SE3 low whenever ADSP or ADSC is asserted.
- All read and write cycle timings are referenced from K0 or G0.
- G0 is a don't care after write cycle begins. To prevent bus contention, G0 should be negated prior to start of write cycle.
- This parameter is sampled and not 100% tested.
- Measured at $\pm 200\text{ mV}$ from steady state.

TIMING LIMITS

The table of timing values shows either a minimum or a maximum limit for each parameter. Input requirements are specified from the external system point of view. Thus, address setup time is shown as a minimum since the system must supply at least that much time (even though most devices do not require it). On the other hand, responses from the memory are specified from the device point of view. Thus, the access time is shown as a maximum since the device never provides data later than that time.

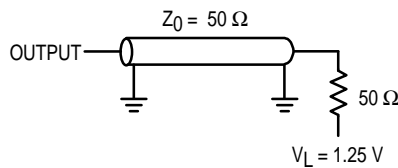
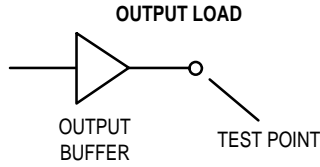
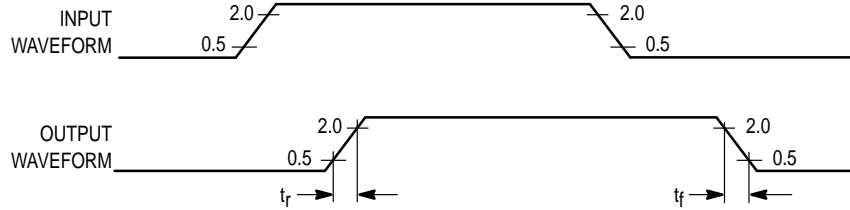


Figure 1. AC Test Load



UNLOADED RISE AND FALL TIME MEASUREMENT

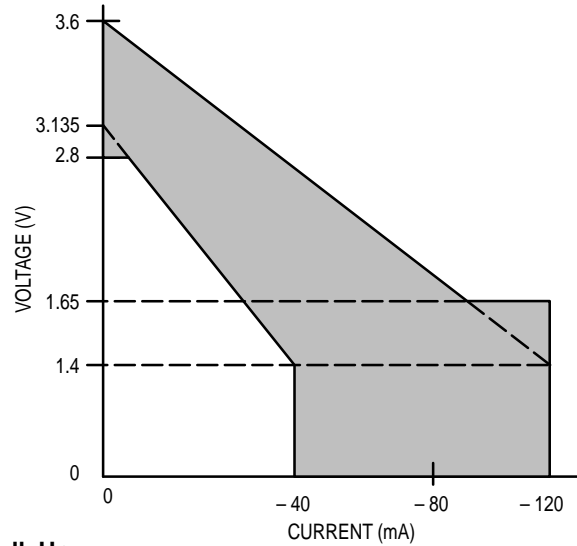


NOTES:

1. Input waveform has a slew rate of 1 V/ns.
2. Rise time is measured from 0.5 to 2.0 V unloaded.
3. Fall time is measured from 2.0 to 0.5 V unloaded.

Figure 2. Unloaded Rise and Fall Time Characterization

PULL-UP		
VOLTAGE (V)	I (mA) MIN	I (mA) MAX
-0.5	-50	-150
0	-50	-150
1.4	-50	-150
1.65	-46	-130
2.0	-35	-101
3.135	0	-25



PULL-DOWN		
VOLTAGE (V)	I (mA) MIN	I (mA) MAX
-0.5	0	0
0	0	0
0.4	10	20
0.8	20	40
1.25	31	63
1.6	40	80
2.8	40	80
3.2	40	80
3.4	40	80
3.6	46	120

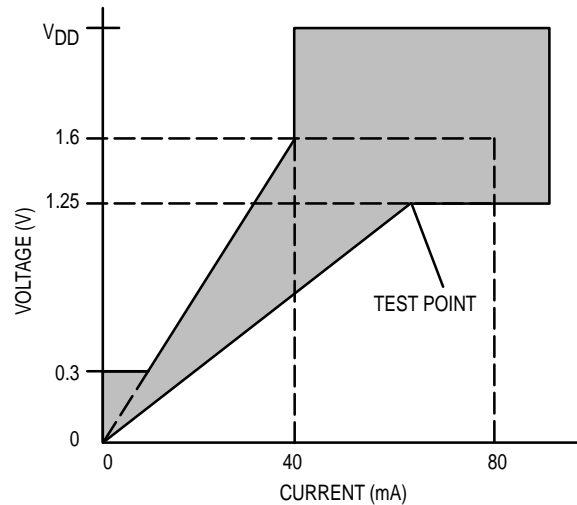
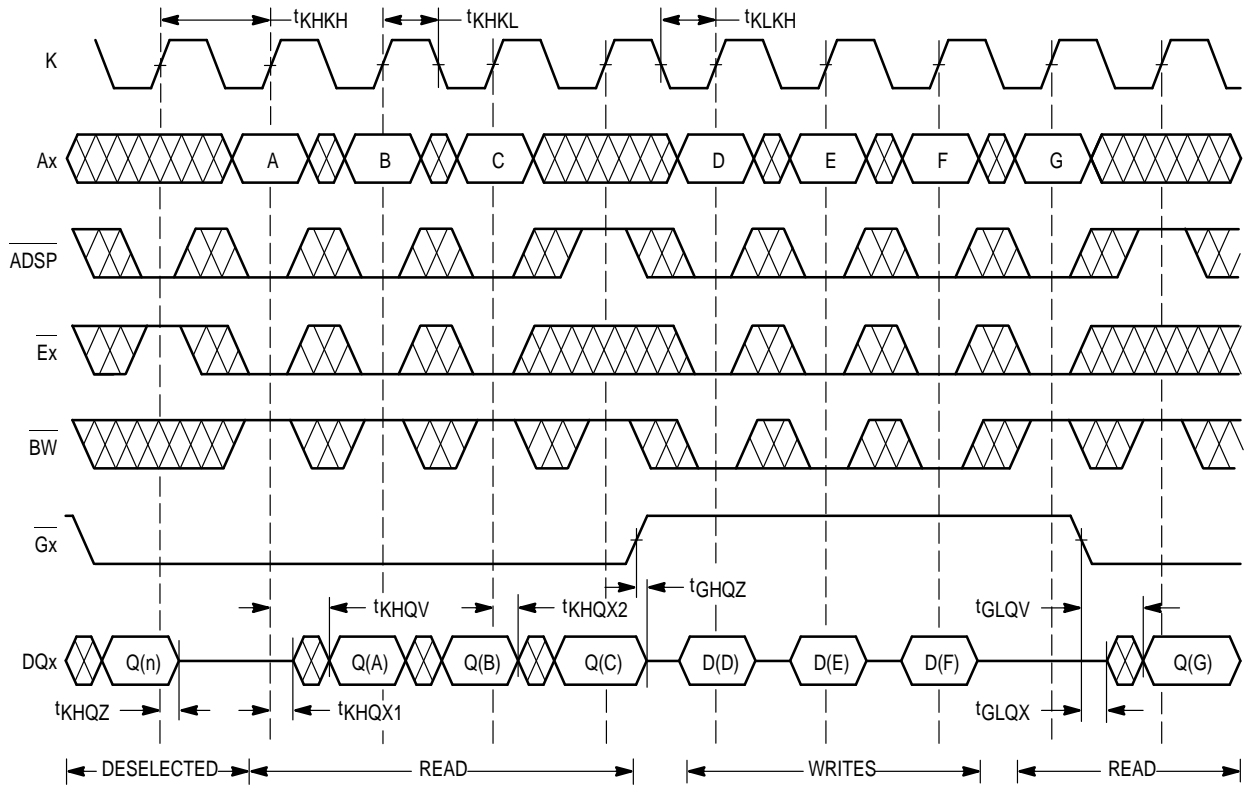
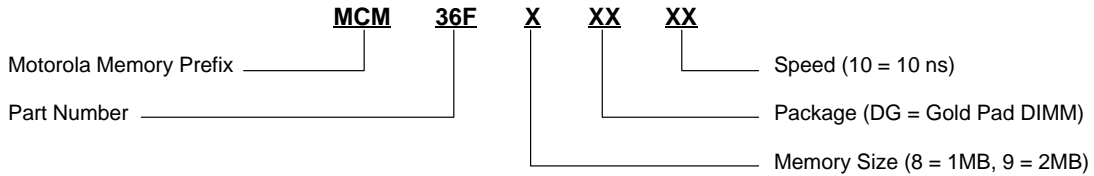


Figure 3. Output Buffer Characteristics

READ/WRITE CYCLES



ORDERING INFORMATION
(Order by Full Part Number)



Full Part Numbers — MCM36F8DG10 MCM36F9DG10

Freescale Semiconductor, Inc.

