

## Advance Information

# 128K x 32 Bit Pipelined BurstRAM Synchronous Fast Static RAM

The MCM63P733A is a 4M-bit synchronous fast static RAM designed to provide a burstable, high performance, secondary cache for the PowerPC™ and other high performance microprocessors. It is organized as 128K words of 32 bits each, fabricated with high performance silicon gate CMOS technology. This device integrates input registers, an output register, a 2-bit address counter, and high speed SRAM onto a single monolithic circuit for reduced parts count in cache data RAM applications. Synchronous design allows precise cycle control with the use of an external clock (K). CMOS circuitry reduces the overall power consumption of the integrated functions for greater reliability.

Addresses (SA), data inputs (DQx), and all control signals except output enable ( $\overline{G}$ ) and Linear Burst Order ( $\overline{LBO}$ ) are clock (K) controlled through positive-edge-triggered noninverting registers.

Bursts can be initiated with either  $\overline{ADSP}$  or  $\overline{ADSC}$  input pins. Subsequent burst addresses can be generated internally by the MCM63P733A (burst sequence operates in linear or interleaved mode dependent upon state of  $\overline{LBO}$ ) and controlled by the burst address advance ( $\overline{ADV}$ ) input pin.

Write cycles are internally self-timed and are initiated by the rising edge of the clock (K) input. This feature eliminates complex off-chip write pulse generation and provides increased timing flexibility for incoming signals.

Synchronous byte write ( $\overline{SBx}$ ), synchronous global write ( $\overline{SGW}$ ), and synchronous write enable ( $\overline{SW}$ ) are provided to allow writes to either individual bytes or to all bytes. The four bytes are designated as "a", "b", "c", and "d".  $\overline{SBa}$  controls DQa,  $\overline{SBb}$  controls DQb, etc. Individual bytes are written if the selected byte writes  $\overline{SBx}$  are asserted with  $\overline{SW}$ . All bytes are written if either  $\overline{SGW}$  is asserted or if all  $\overline{SBx}$  and  $\overline{SW}$  are asserted.

For read cycles, pipelined SRAMs output data is temporarily stored by an edge-triggered output register and then released to the output buffers at the next rising edge of clock (K).

The MCM63P733A operates from a 3.3 V core power supply and all outputs operate on a 2.5 V or 3.3 V power supply. All inputs and outputs are JEDEC standard JESD8-5 compatible.

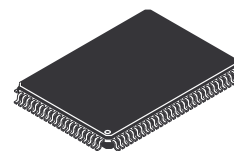
- MCM63P733A-133 = 4 ns Access/7.5 ns Cycle (133 MHz)  
MCM63P733A-117 = 4.2 ns Access/8.5 ns Cycle (117 MHz)  
MCM63P733A-100 = 4.5 ns Access/10 ns Cycle (100 MHz)  
MCM63P733A-90 = 5 ns Access/11 ns Cycle (90 MHz)
- 3.3 V + 10%/– 5% Core, Power Supply, 2.5 V or 3.3 V I/O Supply
- $\overline{ADSP}$ ,  $\overline{ADSC}$ , and  $\overline{ADV}$  Burst Control Pins
- Selectable Burst Sequencing Order (Linear/Interleaved)
- Internally Self-Timed Write Cycle
- Byte Write and Global Write Control
- Single-Cycle Deselect
- Sleep Mode (ZZ)
- 100-Pin TQFP Package

PowerPC is a trademark of IBM Corp.

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

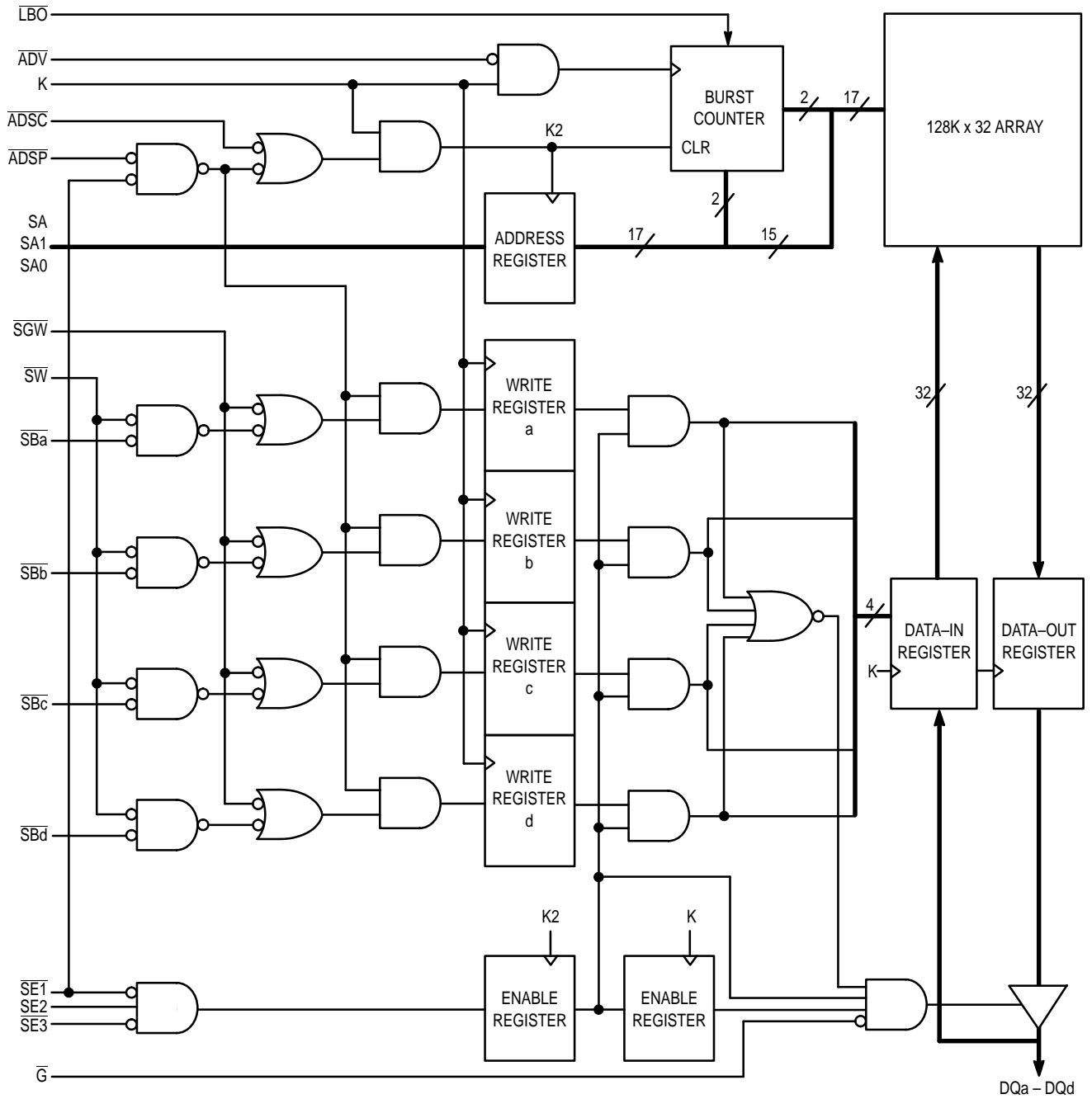
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## MCM63P733A

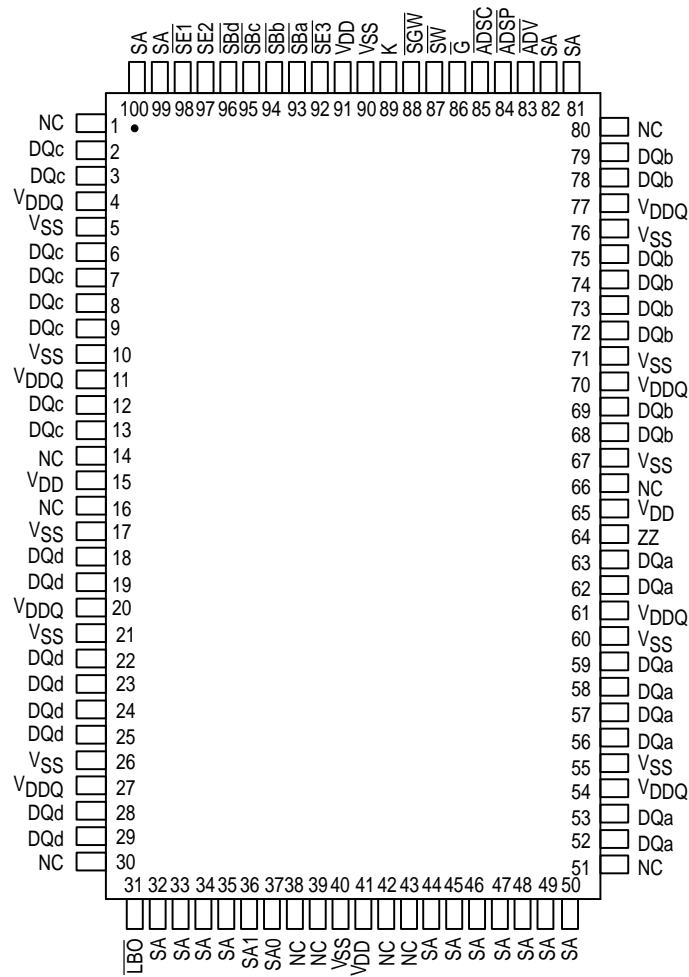


TQ PACKAGE  
TQFP  
CASE 983A-01

### FUNCTIONAL BLOCK DIAGRAM



## PIN ASSIGNMENT



## PIN DESCRIPTIONS

Pin Locations	Symbol	Type	Description
85	$\overline{ADSC}$	Input	Synchronous Address Status Controller: Active low, interrupts any ongoing burst and latches a new external address. Used to initiate a READ, WRITE, or chip deselect.
84	$\overline{ADSP}$	Input	Synchronous Address Status Processor: Active low, interrupts any ongoing burst and latches a new external address. Used to initiate a new READ, WRITE, or chip deselect (exception — chip deselect does not occur when ADSP is asserted and SE1 is high).
83	$\overline{ADV}$	Input	Synchronous Address Advance: Increments address count in accordance with counter type selected (linear/interleaved).
(a) 51, 52, 53, 56, 57, 58, 59, 62, 63 (b) 68, 69, 72, 73, 74, 75, 78, 79, 80 (c) 1, 2, 3, 6, 7, 8, 9, 12, 13 (d) 18, 19, 22, 23, 24, 25, 28, 29, 30	DQx	I/O	Synchronous Data I/O: "x" refers to the byte being read or written (byte a, b, c, d).
86	$\overline{G}$	Input	Asynchronous Output Enable Input.
89	K	Input	Clock: This signal registers the address, data in, and all control signals except $\overline{G}$ , $\overline{LBO}$ , and ZZ.
31	$\overline{LBO}$	Input	Linear Burst Order Input: This pin may be left floating; it will default as interleaved. Low — linear burst counter (68K/PowerPC). High — interleaved burst counter (486/i960/Pentium).
32, 33, 34, 35, 44, 45, 46, 47, 48, 49, 50, 81, 82, 99, 100	SA	Input	Synchronous Address Inputs: These inputs are registered and must meet setup and hold times.
36, 37	SA1, SA0	Input	Synchronous Address Inputs: These pins must be wired to the two LSBs of the address bus for proper burst operation. These inputs are registered and must meet setup and hold times.
93, 94, 95, 96 (a) (b) (c) (d)	$\overline{SBx}$	Input	Synchronous Byte Write Inputs: "x" refers to the byte being written (byte a, b, c, d). $\overline{SGW}$ overrides $\overline{SBx}$ .
98	$\overline{SE1}$	Input	Synchronous Chip Enable: Active low to enable chip. Negated high — blocks $\overline{ADSP}$ or deselects chip when $\overline{ADSC}$ is asserted.
97	SE2	Input	Synchronous Chip Enable: Active high for depth expansion.
92	$\overline{SE3}$	Input	Synchronous Chip Enable: Active low for depth expansion.
88	$\overline{SGW}$	Input	Synchronous Global Write: This signal writes all bytes regardless of the status of the $\overline{SBx}$ and SW signals. If only byte write signals $\overline{SBx}$ are being used, tie this pin high.
87	$\overline{SW}$	Input	Synchronous Write: This signal writes only those bytes that have been selected using the byte write $\overline{SBx}$ pins. If only byte write signals $\overline{SBx}$ are being used, tie this pin low.
64	ZZ	Input	Sleep Mode: This active high asynchronous signal places the RAM into the lowest power mode. The ZZ pin disables the RAMs internal clock when placed in this mode. When ZZ is negated, the RAM remains in low power mode until it is commanded to READ or WRITE. Data integrity is maintained upon returning to normal operation.
15, 41, 65, 91	VDD	Supply	Core Power Supply.
4, 11, 20, 27, 54, 61, 70, 77	VDDQ	Supply	I/O Power Supply.
5, 10, 17, 21, 26, 40, 55, 60, 67, 71, 76, 90	VSS	Supply	Ground.
14, 16, 38, 39, 42, 43, 66	NC	—	No Connection: There is no connection to the chip.

**TRUTH TABLE** (See Notes 1 through 5)

Next Cycle	Address Used	$\overline{SE1}$	SE2	$\overline{SE3}$	$\overline{ADSP}$	$\overline{ADSC}$	$\overline{ADV}$	$\overline{G}^3$	DQx	Write 2, 4
Deselect	None	1	X	X	X	0	X	X	High-Z	X
Deselect	None	0	X	1	0	X	X	X	High-Z	X
Deselect	None	0	0	X	0	X	X	X	High-Z	X
Deselect	None	X	X	1	1	0	X	X	High-Z	X
Deselect	None	X	0	X	1	0	X	X	High-Z	X
Begin Read	External	0	1	0	0	X	X	X	High-Z	X
Begin Read	External	0	1	0	1	0	X	X	High-Z	READ
Continue Read	Next	X	X	X	1	1	0	1	High-Z	READ
Continue Read	Next	X	X	X	1	1	0	0	DQ	READ
Continue Read	Next	1	X	X	X	1	0	1	High-Z	READ
Continue Read	Next	1	X	X	X	1	0	0	DQ	READ
Suspend Read	Current	X	X	X	1	1	1	1	High-Z	READ
Suspend Read	Current	X	X	X	1	1	1	0	DQ	READ
Suspend Read	Current	1	X	X	X	1	1	1	High-Z	READ
Suspend Read	Current	1	X	X	X	1	1	0	DQ	READ
Begin Write	External	0	1	0	1	0	X	X	High-Z	WRITE
Continue Write	Next	X	X	X	1	1	0	X	High-Z	WRITE
Continue Write	Next	1	X	X	X	1	0	X	High-Z	WRITE
Suspend Write	Current	X	X	X	1	1	1	X	High-Z	WRITE
Suspend Write	Current	1	X	X	X	1	1	X	High-Z	WRITE

**NOTES:**

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

**ASYNCHRONOUS TRUTH TABLE**

Operation	ZZ	$\overline{G}$	I/O Status
Read	L	L	Data Out (DQx)
Read	L	H	High-Z
Write	L	X	High-Z
Deselected	L	X	High-Z
Selected	H	X	High-Z

**LINEAR BURST ADDRESS TABLE** ( $\overline{LB0} = V_{SS}$ )

1st Address (External)	2nd Address (Internal)	3rd Address (Internal)	4th Address (Internal)
X ... X00	X ... X01	X ... X10	X ... X11
X ... X01	X ... X10	X ... X11	X ... X00
X ... X10	X ... X11	X ... X00	X ... X01
X ... X11	X ... X00	X ... X01	X ... X10

**INTERLEAVED BURST ADDRESS TABLE** ( $\overline{LBO} = V_{DD}$ )

1st Address (External)	2nd Address (Internal)	3rd Address (Internal)	4th Address (Internal)
X . . . X00	X . . . X01	X . . . X10	X . . . X11
X . . . X01	X . . . X00	X . . . X11	X . . . X10
X . . . X10	X . . . X11	X . . . X00	X . . . X01
X . . . X11	X . . . X10	X . . . X01	X . . . X00

**WRITE TRUTH TABLE**

Cycle Type	SGW	SW	SB $\bar{a}$	SB $\bar{b}$	SB $\bar{c}$	SB $\bar{d}$
Read	H	H	X	X	X	X
Read	H	L	H	H	H	H
Write Byte a	H	L	L	H	H	H
Write Byte b	H	L	H	L	H	H
Write Byte c	H	L	H	H	L	H
Write Byte d	H	L	H	H	H	L
Write All Bytes	H	L	L	L	L	L
Write All Bytes	L	X	X	X	X	X

**ABSOLUTE MAXIMUM RATINGS** (See Note 1)

Rating	Symbol	Value	Unit	Notes
Power Supply Voltage	$V_{DD}$	- 0.5 to + 4.6	V	
I/O Supply Voltage	$V_{DDQ}$	$V_{SS} - 0.5$ to $V_{DD}$	V	2
Input Voltage Relative to $V_{SS}$ for Any Pin Except $V_{DD}$	$V_{in}, V_{out}$	- 0.5 to $V_{DD} + 0.5$	V	2
Input Voltage (Three-State I/O)	$V_{IT}$	- 0.5 to $V_{DDQ} + 0.5$	V	2
Output Current (per I/O)	$I_{out}$	$\pm 20$	mA	
Package Power Dissipation	$P_D$	1.2	W	3
Temperature Under Bias	$T_{bias}$	- 10 to + 85	$^{\circ}C$	
Storage Temperature	$T_{stg}$	- 55 to + 125	$^{\circ}C$	

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 this high-impedance circuit.

**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. This is a steady-state DC parameter that is in effect after the power supply has achieved its nominal operating level. Power sequencing is not necessary.
3. Power dissipation capability is dependent upon package characteristics and use environment. See Package Thermal Characteristics.

**PACKAGE THERMAL CHARACTERISTICS**

Rating	Symbol	Max	Unit	Notes
Junction to Ambient (@ 200 lfm)	$R_{\theta JA}$	40 25	$^{\circ}C/W$	1, 2
Junction to Board (Bottom)	$R_{\theta JB}$	17	$^{\circ}C/W$	3
Junction to Case (Top)	$R_{\theta JC}$	9	$^{\circ}C/W$	4

**NOTES:**

1. Junction temperature is a function of on-chip power dissipation, package thermal resistance, mounting site (board) temperature, ambient temperature, air flow, board population, and board thermal resistance.
2. Per SEMI G38-87.
3. Indicates the average thermal resistance between the die and the printed circuit board.
4. Indicates the average thermal resistance between the die and the case top surface via the cold plate method (MIL SPEC-883 Method 1012.1).

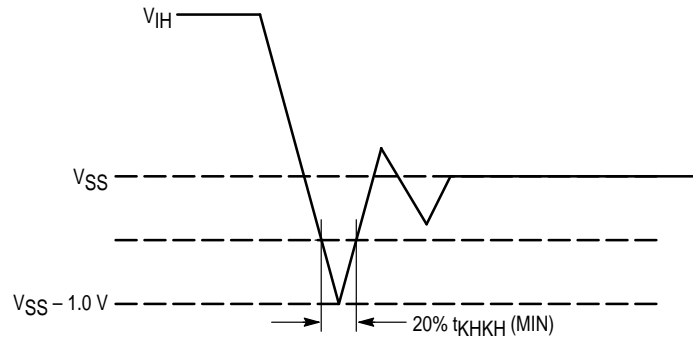
**DC OPERATING CONDITIONS AND CHARACTERISTICS**  
 ( $V_{DD} = 3.3\text{ V} + 10\%, -5\%$ ,  $T_A = 0\text{ to }70^\circ\text{C}$ , Unless Otherwise Noted)

**RECOMMENDED OPERATING CONDITIONS: 2.5 V I/O Supply** (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
I/O Supply Voltage	$V_{DDQ}$	2.375	2.5	2.9	V
Input Low Voltage	$V_{IL}$	-0.3	—	0.7	V
Input High Voltage	$V_{IH}$	1.7	—	$V_{DD} + 0.3$	V
Input High Voltage (I/O Pins)	$V_{IH2}$	1.7	—	$V_{DDQ} + 0.3$	V
Output Low Voltage ( $I_{OL} = 2\text{ mA}$ )	$V_{OL}$	—	—	0.7	V
Output High Voltage ( $I_{OH} = -2\text{ mA}$ )	$V_{OH}$	1.7	—	—	V

**RECOMMENDED OPERATING CONDITIONS: 3.3 V I/O Supply** (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
I/O Supply Voltage	$V_{DDQ}$	3.135	3.3	$V_{DD}$	V
Input Low Voltage	$V_{IL}$	-0.5	—	0.8	V
Input High Voltage	$V_{IH}$	2	—	$V_{DD} + 0.5$	V
Input High Voltage (I/O Pins)	$V_{IH2}$	2	—	$V_{DDQ} + 0.5$	V
Output Low Voltage ( $I_{OL} = 8\text{ mA}$ )	$V_{OL}$	—	—	0.4	V
Output High Voltage ( $I_{OH} = -4\text{ mA}$ )	$V_{OH}$	2.4	—	—	V



**Figure 1. Undershoot Voltage**

## SUPPLY CURRENTS

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Input Leakage Current ( $0\text{ V} \leq V_{in} \leq V_{DD}$ )	$I_{kg(I)}$	—	—	$\pm 1$	$\mu\text{A}$	1, 2
Output Leakage Current ( $0\text{ V} \leq V_{in} \leq V_{DDQ}$ )	$I_{kg(O)}$	—	—	$\pm 1$	$\mu\text{A}$	
AC Supply Current (Device Selected, All Outputs Open, Freq = Max) Includes $V_{DD}$ Only	MCM63P733A-133 MCM63P733A-117 MCM63P733A-100 MCM63P733A-90 $I_{DDA}$	—	—	TBD	mA	3, 4, 5
CMOS Standby Supply Current (Device Deselected, Freq = 0, $V_{DD} = \text{Max}$ , All Inputs Static at CMOS Levels)	$I_{SB2}$	—	—	TBD	mA	6, 8
Sleep Mode Supply Current (Sleep Mode, Freq = Max, $V_{DD} = \text{Max}$ , All Other Inputs Static at CMOS Levels, $ZZ \geq V_{DD} - 0.2\text{ V}$ )	$I_{ZZ}$	—	—	2	mA	2, 7, 8
TTL Standby Supply Current (Device Deselected, Freq = 0, $V_{DD} = \text{Max}$ , All Inputs Static at TTL Levels)	$I_{SB3}$	—	—	TBD	mA	6, 9
Clock Running (Device Deselected, Freq = Max, $V_{DD} = \text{Max}$ , All Inputs Toggling at CMOS Levels)	MCM63P733A-133 MCM63P733A-117 MCM63P733A-100 MCM63P733A-90 $I_{SB4}$	—	—	TBD	mA	3, 4, 5, 6, 8
Static Clock Running (Device Deselected, Freq = Max, $V_{DD} = \text{Max}$ , All Inputs Static at TTL Levels)	MCM63P733A-133 MCM63P733A-117 MCM63P733A-100 MCM63P733A-90 $I_{SB5}$	—	—	TBD	mA	6, 9

### NOTES:

- $\overline{LBO}$  pin has an internal pullup and will exhibit leakage currents of  $\pm 5\ \mu\text{A}$ .
- ZZ pin has an internal pulldown and will exhibit leakage currents of  $\pm 5\ \mu\text{A}$ .
- Reference AC Operating Conditions and Characteristics for input and timing.
- All addresses transition simultaneously low (LSB) then high (MSB).
- Data states are all zero.
- Device is deselected as defined by the Truth Table.
- Device in Sleep Mode as defined by the Asynchronous Truth Table.
- CMOS levels for I/O's are  $V_{IT} \leq V_{SS} + 0.2\text{ V}$  or  $\geq V_{DDQ} - 0.2\text{ V}$ . CMOS levels for other inputs are  $V_{in} \leq V_{SS} + 0.2\text{ V}$  or  $\geq V_{DD} - 0.2\text{ V}$ .
- TTL levels for I/O's are  $V_{IT} \leq V_{IL}$  or  $\geq V_{IH2}$ . TTL levels for other inputs are  $V_{in} \leq V_{IL}$  or  $\geq V_{IH}$ .

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

Parameter	Symbol	Min	Typ	Max	Unit
Input Capacitance	$C_{in}$	—	4	5	pF
Input/Output Capacitance	$C_{I/O}$	—	7	8	pF



## AC OPERATING CONDITIONS AND CHARACTERISTICS

(V<sub>DD</sub> = 3.3 V + 10%, - 5%, T<sub>A</sub> = 0 to 70°C, Unless Otherwise Noted)

Input Timing Measurement Reference Level ..... 1.25 V  
 Input Pulse Levels ..... 0 to 2.5 V  
 Input Rise/Fall Time ..... 1.0 V/ns (20 to 80%)

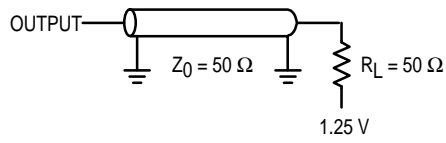
Output Timing Reference Level ..... 1.25 V  
 Output Load ..... See Figure 2 Unless Otherwise Noted

### READ/WRITE CYCLE TIMING (See Notes 1 through 4)

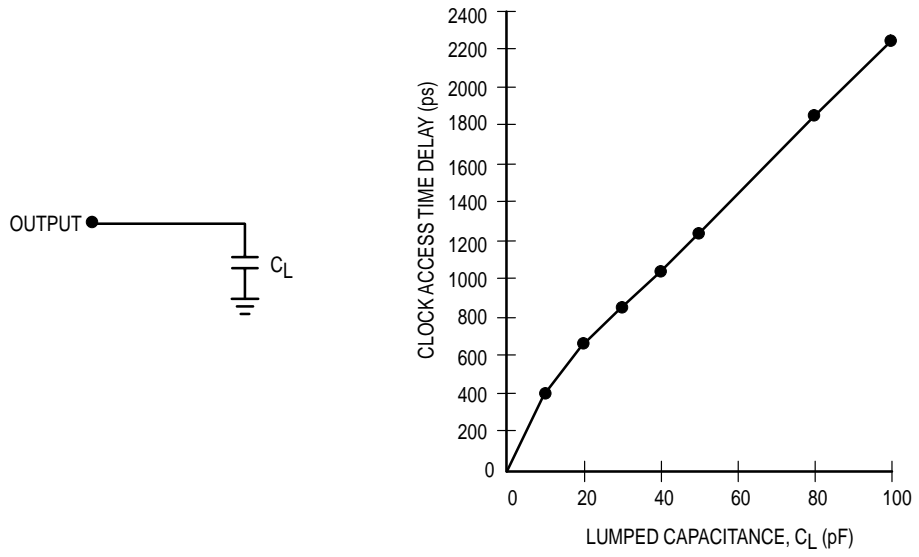
Parameter	Symbol	63P733A-133 133 MHz		63P733A-117 117 MHz		63P733A-100 100 MHz		63P733A-90 90 MHz		Unit	Notes
		Min	Max	Min	Max	Min	Max	Min	Max		
Cycle Time	t <sub>KHKH</sub>	7.5	—	8.5	—	10	—	11	—	ns	
Clock High Pulse Width	t <sub>KHKL</sub>	3	—	3.4	—	4	—	4.4	—	ns	
Clock Low Pulse Width	t <sub>KLKH</sub>	3	—	3.4	—	4	—	4.4	—	ns	
Clock Access Time	t <sub>KHQV</sub>	—	4	—	4.2	—	4.5	—	5	ns	
Output Enable to Output Valid	t <sub>GLQV</sub>	—	3.8	—	3.8	—	4.5	—	5	ns	
Clock High to Output Active	t <sub>KHQX1</sub>	0	—	0	—	0	—	0	—	ns	5, 6
Clock High to Output Change	t <sub>KHQX2</sub>	1.5	—	1.5	—	1.5	—	1.5	—	ns	6
Output Enable to Output Active	t <sub>GLQX</sub>	0	—	0	—	0	—	0	—	ns	5, 6
Output Disable to Q High-Z	t <sub>GHQZ</sub>	—	3.8	—	3.8	—	4.5	—	5	ns	5, 6
Clock High to Q High-Z	t <sub>KHQZ</sub>	1.5	7.5	1.5	8.5	1.5	10	1.5	11	ns	5, 6
Setup Times: Address ADSP, ADSC, ADV Data In Write Chip Enable	t <sub>ADKH</sub> t <sub>ADSKH</sub> t <sub>DVKH</sub> t <sub>WVKH</sub> t <sub>EVKH</sub>	2	—	2	—	2	—	2	—	ns	
Hold Times: Address ADSP, ADSC, ADV Data In Write Chip Enable	t <sub>KHAX</sub> t <sub>KHADSX</sub> t <sub>KHDX</sub> t <sub>KHWX</sub> t <sub>KHEX</sub>	0.5	—	0.5	—	0.5	—	0.5	—	ns	
Sleep Mode Standby	t <sub>ZZS</sub>	—	2 x t <sub>KHKH</sub>	—	2 x t <sub>KHKH</sub>	—	2 x t <sub>KHKH</sub>	—	2 x t <sub>KHKH</sub>	ns	
Sleep Mode Recovery	t <sub>ZZREC</sub>	2 x t <sub>KHKH</sub>	—	2 x t <sub>KHKH</sub>	—	2 x t <sub>KHKH</sub>	—	2 x t <sub>KHKH</sub>	—	ns	
Sleep Mode High to Q High-Z	t <sub>ZZQZ</sub>	—	15	—	15	—	15	—	15	ns	

#### NOTES:

- Write is defined as either any  $\overline{SBx}$  and  $\overline{SW}$  low or  $\overline{SGW}$  is low. Chip Enable is defined as  $\overline{SE1}$  low, SE2 high, and  $\overline{SE3}$  low whenever  $\overline{ADSP}$  or  $\overline{ADSC}$  is asserted.
- All read and write cycle timings are referenced from K or  $\overline{G}$ .
- $\overline{G}$  is a don't care after write cycle begins. To prevent bus contention,  $\overline{G}$  should be negated prior to start of write cycle.
- In order to reduce test correlation issues and to reduce the effects of application specific input edge rate variations on correlation between data sheet parameters and actual system performance, FSRAM AC parametric specifications are always specified at V<sub>DDQ</sub>/2. In some design exercises, it is desirable to evaluate timing using other reference levels. Since the maximum test input edge rate is known and is given in the AC Test Conditions section of the data sheet as 1 V/ns, one can easily interpolate timing values to other reference levels.
- This parameter is sampled and not 100% tested.
- Measured at ± 200 mV from steady state.

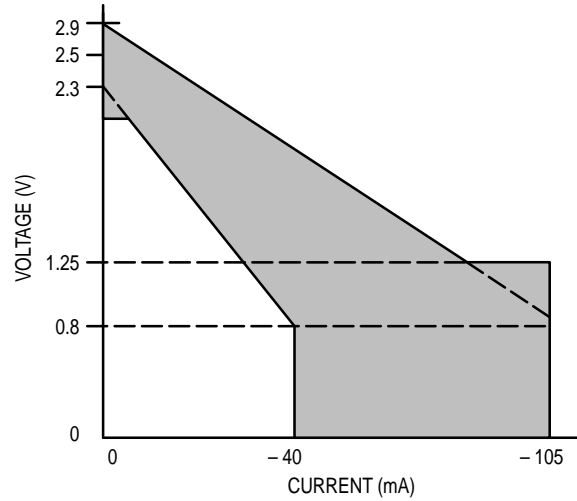


**Figure 2. AC Test Load**



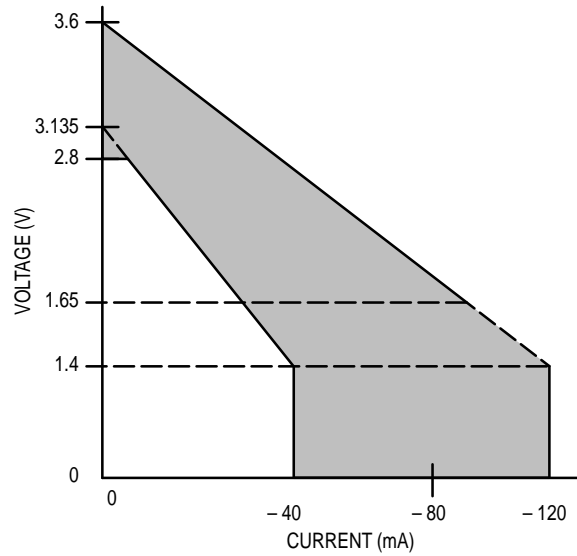
**Figure 3. Lumped Capacitive Load and Typical Derating Curve**

PULL-UP		
VOLTAGE (V)	I (mA) MIN	I (mA) MAX
-0.5	-38	-105
0	-38	-105
0.8	-38	-105
1.25	-30	-83
1.5	-27	-75
2.3	0	-40
2.7	0	-15
2.9	0	0



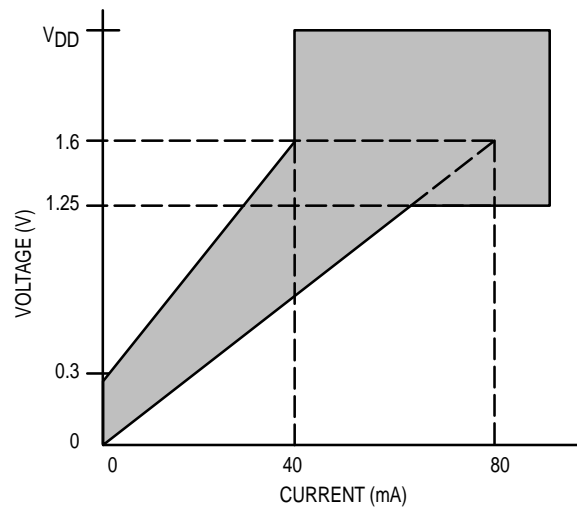
(a) Pull-Up for  $V_{DDQ} = 2.5 \text{ V}$

PULL-UP		
VOLTAGE (V)	I (mA) MIN	I (mA) MAX
-0.5	-40	-120
0	-40	-120
1.4	-40	-120
1.65	-37	-108
2.0	-28	-81
3.135	0	-20
3.6	0	0



(b) Pull-Up:  $V_{DDQ} = 3.3 \text{ V}$

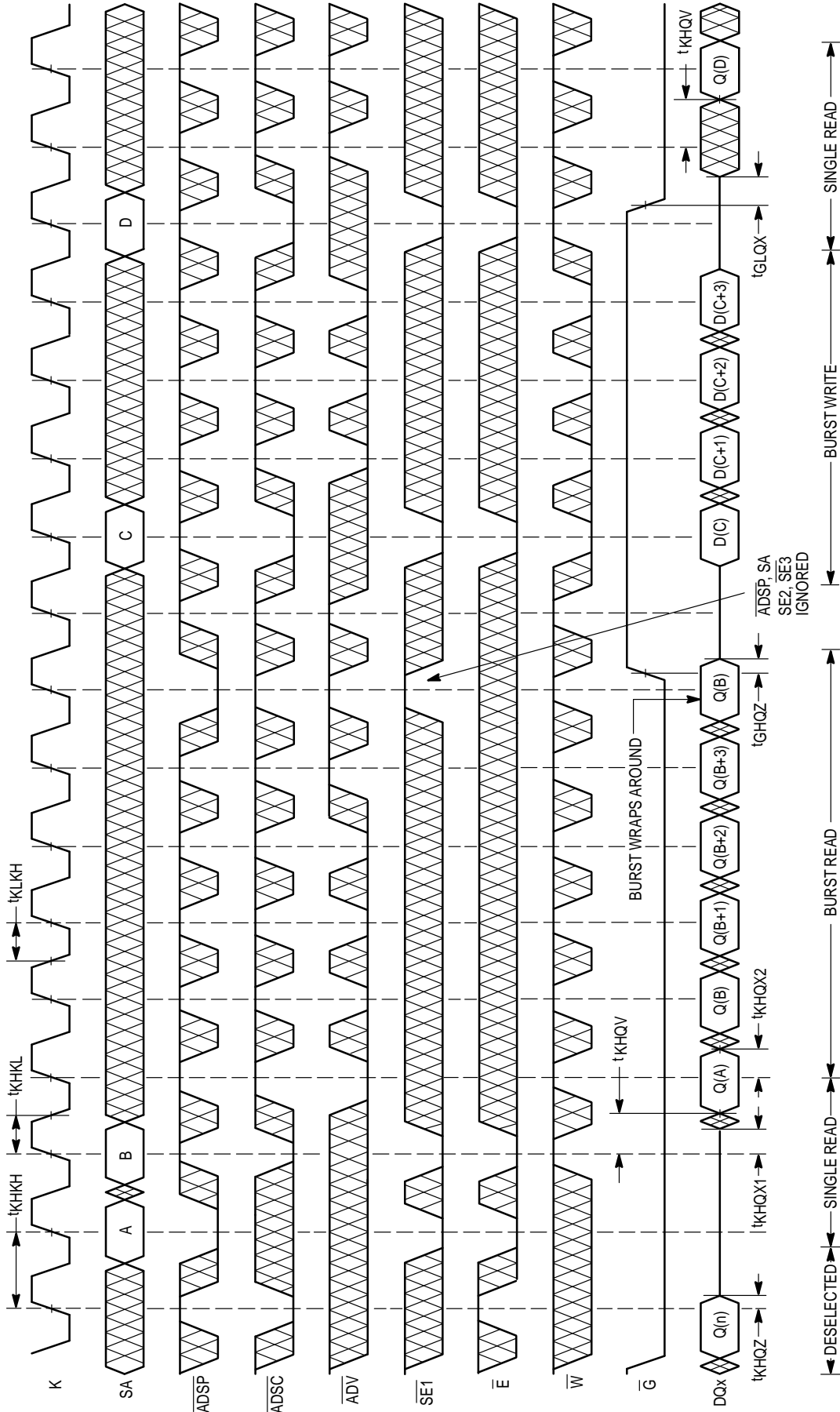
PULL-DOWN		
VOLTAGE (V)	I (mA) MIN	I (mA) MAX
-0.5	0	0
0	0	0
0.4	10	20
0.8	20	40
1.25	31	63
1.6	40	80
2.8	40	80
3.2	40	80
3.4	40	80



(c) Pull-Down

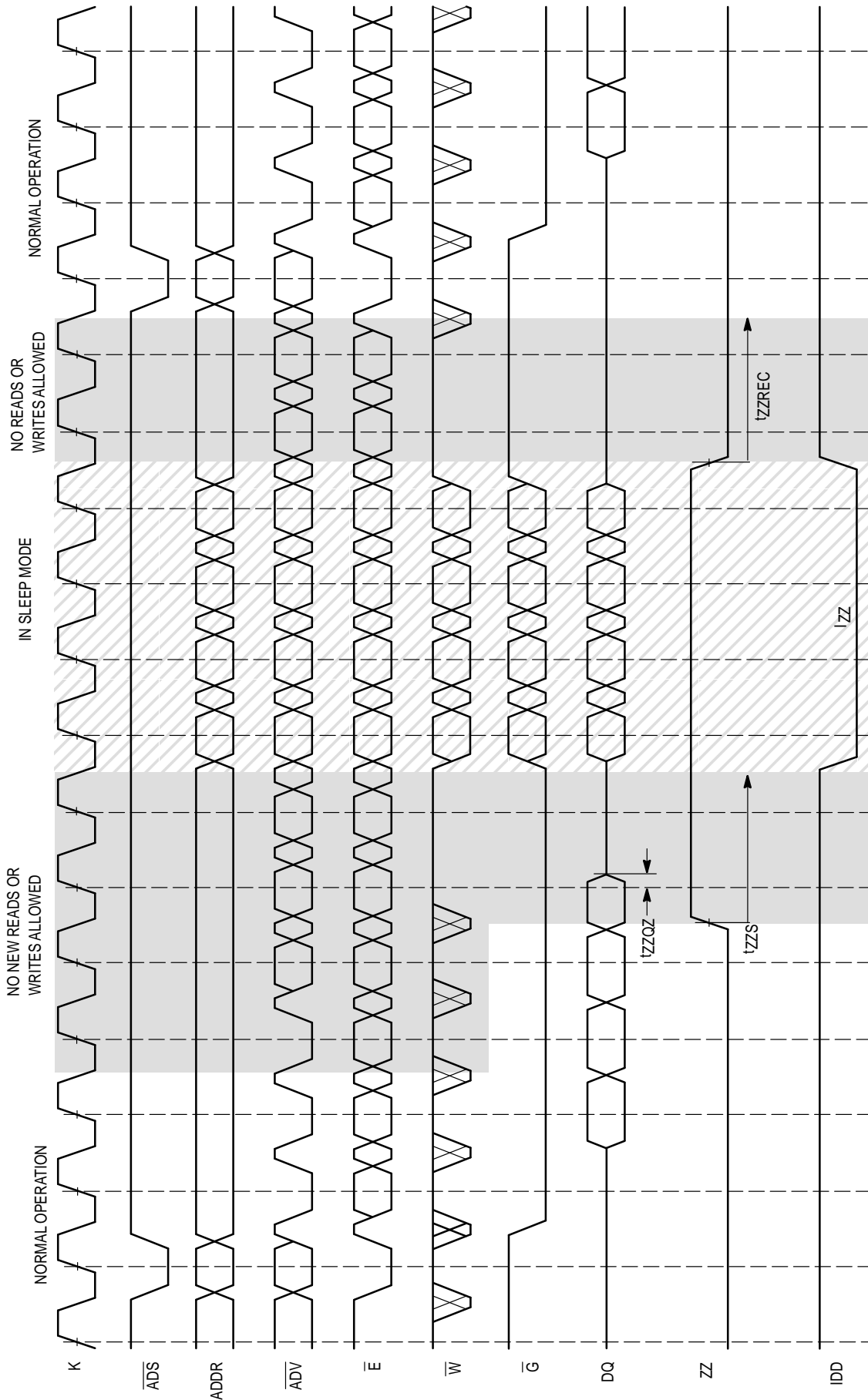
Figure 4. Typical Output Buffer Characteristics

READ/WRITE CYCLES



NOTE:  $\overline{E}$  low = SE2 high and SE3 low.  
 $\overline{W}$  low = SGW low and / or SW and SBx low.

### SLEEP MODE TIMING



NOTE: ADS low = ADSC low or ADSP low.  
 ADS high = both ADSC, ADSP high.  
 E low = SE1 low, SE2 high, SE3 low.  
 IZZ (max) specifications will not be met if inputs toggle.

## APPLICATION INFORMATION

### SLEEP MODE

A sleep mode feature, the ZZ pin, has been implemented on the MCM63P733A. It allows the system designer to place the RAM in the lowest possible power condition by asserting ZZ. The sleep mode timing diagram shows the different modes of operation: Normal Operation, No READ/WRITE Allowed, and Sleep Mode. Each mode has its own set of constraints and conditions that are allowed.

**Normal Operation:** All inputs must meet setup and hold times prior to sleep and  $t_{ZZREC}$  nanoseconds after recovering from sleep. Clock (K) must also meet cycle, high, and low times during these periods. Two cycles prior to sleep, initiation of either a read or write operation is not allowed.

**No READ/WRITE:** During the period of time just prior to sleep and during recovery from sleep, the assertion of either ADSC, ADSP, or any write signal is not allowed. If a write operation occurs during these periods, the memory array may be corrupted. Validity of data out from the RAM can not be guaranteed immediately after ZZ is asserted (prior to being in sleep).

**Sleep Mode:** The RAM automatically deselects itself. The RAM disconnects its internal clock buffer. The external clock

may continue to run without impacting the RAMs sleep current ( $I_{ZZ}$ ). All inputs are allowed to toggle — the RAM will not be selected and perform any reads or writes. However, if inputs toggle, the  $I_{ZZ}$  (max) specification will not be met.

### NON-BURST SYNCHRONOUS OPERATION

Although this BurstRAM has been designed for PowerPC — and other high end MPU-based systems, these SRAMs can be used in other high speed L2 cache or memory applications that do not require the burst address feature. Most L2 caches designed with a synchronous interface can make use of the MCM63P733A. The burst counter feature of the BurstRAM can be disabled, and the SRAM can be configured to act upon a continuous stream of addresses. See Figure 4.

### CONTROL PIN TIE VALUES EXAMPLE ( $H \geq V_{IH}$ , $L \leq V_{IL}$ )

Non-Burst	ADSP	ADSC	ADV	SE1	SE2	LBO
Sync Non-Burst, Pipelined SRAM	H	L	H	L	H	X

NOTE: Although X is specified in the table as a don't care, the pin must be tied either high or low.

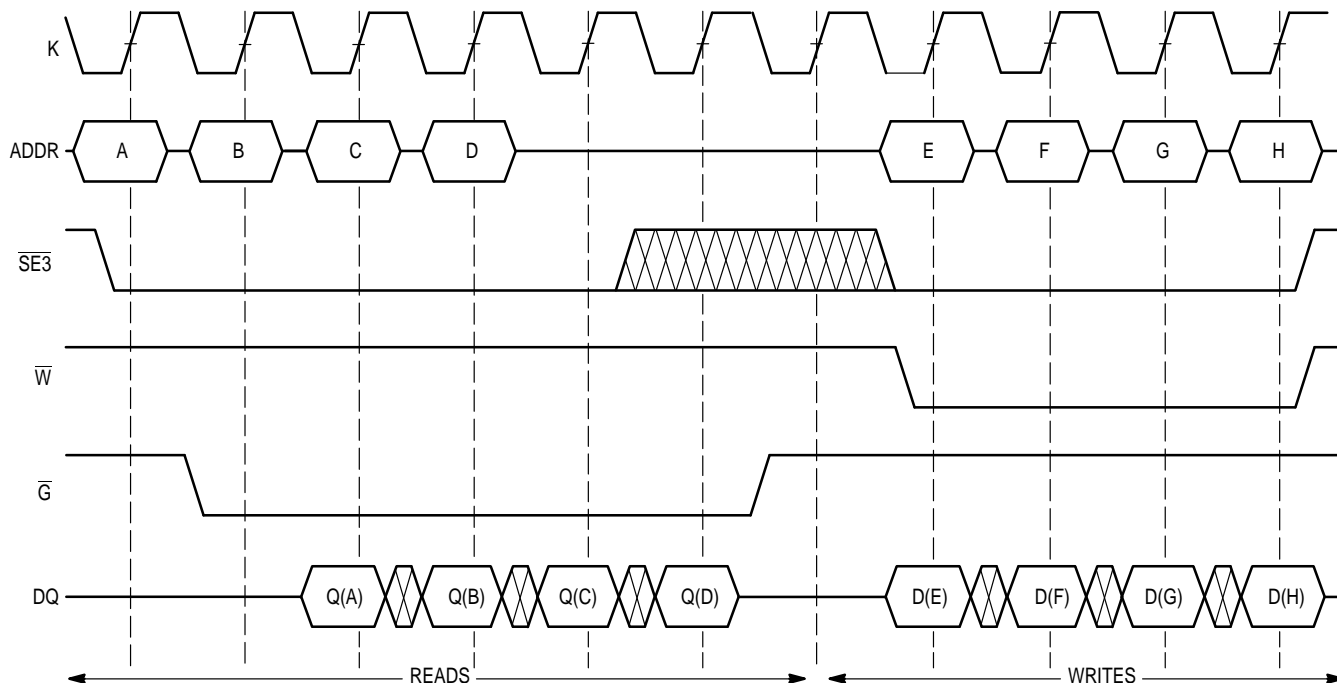



Figure 5. Example Configuration as Non-Burst Synchronous SRAM

### ORDERING INFORMATION (Order by Full Part Number)

<b>MCM</b>	<b>63P733A</b>	<b>XX</b>	<b>X</b>	<b>X</b>	
Motorola Memory Prefix	Part Number				Blank = Trays, R = Tape and Reel
					Speed (133 = 133 MHz, 117 = 117 MHz, 100 = 100 MHz, 90 = 90 MHz)
					Package (TQ = TQFP)
Full Part Numbers —	MCM63P733ATQ133	MCM63P733ATQ117	MCM63P733ATQ100	MCM63P733ATQ90	
	MCM63P733ATQ133R	MCM63P733ATQ117R	MCM63P733ATQ100R	MCM63P733ATQ90R	



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