SYNCHRONOUS SRAM

64K x 32/36 SRAM

+3.3V SUPPLY, +2.5V I/O, PIPELINED, BURST COUNTER AND SINGLE-CYCLE DESELECT

FEATURES

- Fast access times: 4.5, 5, 5.5 and 6ns
- Fast OE# access times: 4.5, 4.8, 5.5 and 6ns
- +3.3V +0.3V/-0.165V power supply (Vcc)
- Separate +2.5V +0.4V/-0.125V isolated output buffer supply (VccQ)
- 3.3V-tolerant inputs
- SNOOZE MODE for reduced power standby
- Single-cycle disable
- Common data inputs and data outputs
- Individual BYTE WRITE control and GLOBAL WRITE
- Three chip enables for simple depth expansion and address pipelining
- Clock controlled, registered, address, data I/O and control for fully pipelined applications
- Internally self-timed WRITE cycle
- Burst control pin (interleaved or linear burst)
- Automatic power-down for portable applications
- 100-lead TQFP package for high density, high speed
- Low capacitive bus loading
- High 30pF output drive capability at rated access time
- DIMMs also available
- x32 and x36 options available

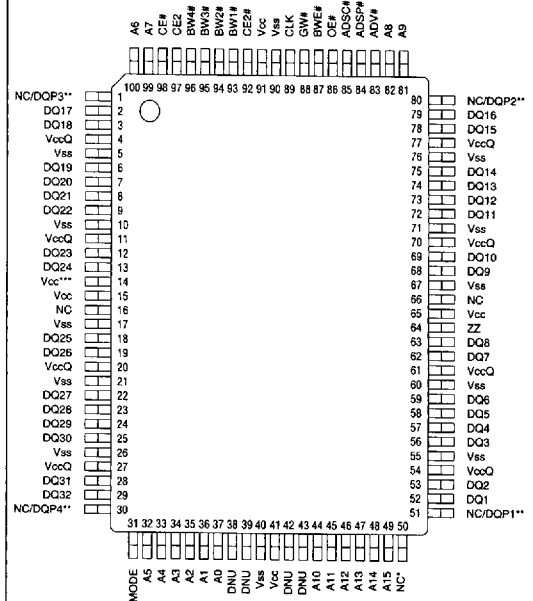
OPTIONS

	MARKING
• Timing	
7ns clock cycle (143 MHz)	-7
7.5ns clock cycle (133 MHz)	-7.5
8.5ns clock cycle (117 MHz)	-8.5
10ns clock cycle (100 MHz)	-10
11ns clock cycle (90 MHz)	-11
• Configurations	
64K x 32	MT58LC64K32G1
64K x 36	MT58LC64K36G1
• Package	
100-pin TQFP	LG

- Part Number Example: MT58LC64K36G1LG-10

PIN ASSIGNMENT (Top View)

100-Pin TQFP
(SA-1)



* Pin 50 is reserved for A16.
** No Connect (NC) is used in the x32 version. Parity (DQPx) is used in the x36 version.
*** Pin 14 does not have to be directly connected to Vcc as long as the input voltage is ≥ VIH.

GENERAL DESCRIPTION

The Micron SyncBurst SRAM family employs high-speed, low-power CMOS designs using a four-transistor memory cell. Micron SRAMs are fabricated using an advanced CMOS process.

The MT58LC64K32/36G1 SRAM integrates a 64K x 32 and 64K x 36 SRAM core with advanced synchronous peripheral circuitry and a 2-bit burst counter. All synchronous inputs pass through registers controlled by a positive-edge-triggered single clock input (CLK). The synchronous inputs include all addresses, all data inputs, active LOW chip enable (CE#), two additional chip enables for easy depth expansion (CE2, CE2#), burst control inputs (ADSC#, ADSP#, ADV#), byte write enables (BW1#, BW2#, BW3#, BW4#, BWE#) and global write (GW#).

Asynchronous inputs include the output enable (OE#), clock (CLK) and snooze enable (ZZ). There is also a burst mode pin (MODE) that selects between interleaved and linear burst modes. The data-out (Q), enabled by OE#, is

GENERAL DESCRIPTION (continued)

also asynchronous. WRITE cycles can be from 1 to 4 bytes wide as controlled by the write control inputs.

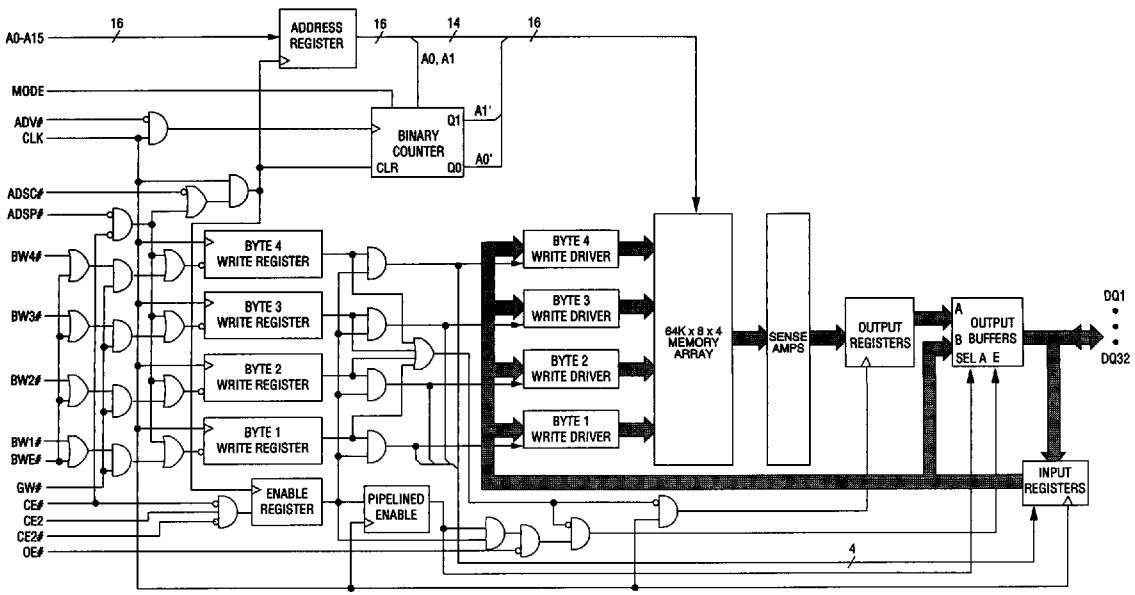
Burst operation can be initiated with either address status processor (ADSP#) or address status controller (ADSC#) input pins. Subsequent burst addresses can be internally generated as controlled by the burst advance pin (ADV#).

Address and write control are registered on-chip to simplify WRITE cycles. This allows self-timed WRITE cycles. Individual byte enables allow individual bytes to be written. BW1# controls DQ1-DQ8 and DQP1, BW2# controls DQ9-DQ16 and DQP2, BW3# controls DQ17-DQ24 and DQP3, and BW4# controls DQ25-DQ32 and DQP4, conditioned by BWE# being LOW. GW# LOW causes all bytes to be written. Parity bits are only available on the x36 version. WRITE pass-through makes written data immediately available at the output register during the READ cycle following a WRITE, as controlled solely by OE#, to improve cache system response. The device incorporates an additional pipelined enable register to allow depth expansion without penalizing system performance.

The MT58LC64K32/36G1 operates from a +3.3V power supply and all inputs and outputs can communicate with 2.5V I/O. All inputs are 3.3V-tolerant and can be used in mixed 3.3V and 2.5V systems. The device is ideally suited for systems that benefit from a wide synchronous bus and 2.5V I/O. The device is also ideal in generic 32-, 36-, 64- and 72-bit-wide applications.

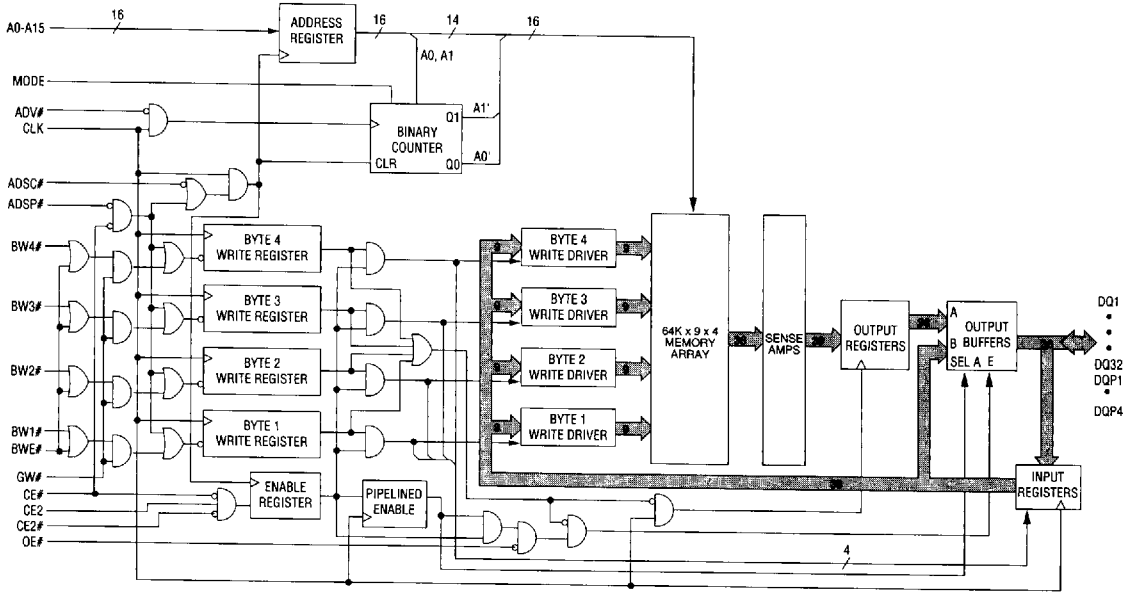
2.5V I/O PIPELINED SCD SRAM

FUNCTIONAL BLOCK DIAGRAM
64K x 32



NOTE: Functional Block Diagrams illustrate simplified device operation. See Truth Table, Pin Descriptions and timing diagrams for detailed information.

FUNCTIONAL BLOCK DIAGRAM
64K x 36



2.5V I/O PIPELINED SCD SRAM

PIN DESCRIPTIONS

TQFP PINS	SYMBOL	TYPE	DESCRIPTION
37, 36, 35, 34, 33, 32, 100, 99, 82, 81, 44, 45, 46, 47, 48, 49	A0-A15	Input	Synchronous Address Inputs: These inputs are registered and must meet the setup and hold times around the rising edge of CLK.
93, 94, 95, 96	BW1#, BW2#, BW3#, BW4#	Input	Synchronous Byte Write Enables: These active LOW inputs allow individual bytes to be written when BWE# is LOW and must meet the setup and hold times around the rising edge of CLK. A Byte Write Enable is LOW for a WRITE cycle and HIGH for a READ cycle. BW1# controls DQ1-DQ8 and DQP1. BW2# controls DQ9-DQ16 and DQP2. BW3# controls DQ17-DQ24 and DQP3. BW4# controls DQ25-DQ32 and DQP4. Data I/O are tristated if any of these four inputs are LOW.
89	CLK	Input	Clock: This signal registers the address, data, chip enables, byte write enables and burst control inputs on its rising edge. All synchronous inputs must meet setup and hold times around the clock's rising edge.
98	CE#	Input	Synchronous Chip Enable: This active LOW input is used to enable the device and conditions the internal use of ADSP#. This input is sampled only when a new external address is loaded.
92	CE2#	Input	Synchronous Chip Enable: This active LOW input is used to enable the device. This input is sampled only when a new external address is loaded. This input can be used for memory depth expansion.
97	CE2	Input	Synchronous Chip Enable: This active HIGH input is used to enable the device. This input is sampled only when a new external address is loaded. This input can be used for memory depth expansion.
86	OE#	Input	Output Enable: This active LOW asynchronous input enables the data I/O output drivers.
83	ADV#	Input	Synchronous Address Advance: This active LOW input is used to advance the internal burst counter, controlling burst access after the external address is loaded. A HIGH on this pin effectively causes wait states to be generated (no address advance). This pin must be HIGH at the rising edge of the first clock after an ADSP# cycle is initiated if a WRITE cycle is desired (to ensure use of correct address).
84	ADSP#	Input	Synchronous Address Status Processor: This active LOW input interrupts any ongoing burst, causing a new external address to be registered. A READ is performed using the new address, independent of the byte write enables and ADSC#, but dependent upon CE2 and CE2#. ADSP# is ignored if CE# is HIGH. Power-down state is entered if CE2 is LOW or CE2# is HIGH.
85	ADSC#	Input	Synchronous Address Status Controller: This active LOW input interrupts any ongoing burst and causes a new external address to be registered. A READ or WRITE is performed using the new address if all chip enables are active. Power-down state is entered if one or more chip enables are inactive.

PIN DESCRIPTIONS (continued)

TQFP PINS	SYMBOL	TYPE	DESCRIPTION
87	BWE#	Input	Byte Write Enable: This active LOW input permits byte write operations and must meet the setup and hold times around the rising edge of CLK.
88	GW#	Input	Global Write: This active LOW input allows a full 32- or 36-bit WRITE to occur independent of the BWE# and BWn# lines and must meet the setup and hold times around the rising edge of CLK.
64	ZZ	Input	Snooze Enable: This active HIGH asynchronous input causes the device to enter a low-power standby mode in which all data in the memory array is retained. When active, all other inputs are ignored.
16, 50, 66	NC	-	No Connect: These signals are not internally connected. These signals may be connected to ground to improve package heat dissipation.
38, 39, 42, 43	DNU	-	Do Not Use: These signals may either be unconnected or wired to GND to improve package heat dissipation.
52, 53, 56, 57, 58, 59, 62, 63, 68, 69, 72, 73, 74, 75, 78, 79, 2, 3, 6, 7, 8, 9, 12, 13, 18, 19, 22, 23, 24, 25, 28, 29	DQ1-DQ32	Input/ Output	SRAM Data I/O: Byte 1 is DQ1-DQ8; Byte 2 is DQ9-DQ16; Byte 3 is DQ17-DQ24; Byte 4 is DQ25-DQ32. Input data must meet setup and hold times around the rising edge of CLK.
51, 80, 1, 30	NC/DQP1-NC/DQP4	NC/ I/O	No Connect/Parity Data I/O: On the x36 version, Byte 1 Parity is DQP1; Byte 2 Parity is DQP2; Byte 3 Parity is DQP3; Byte 4 Parity is DQP4. On the x32 version, these pins are No Connect (NC).
31	MODE	Input	Mode: This input selects the burst sequence. A LOW on this pin selects LINEAR BURST. NC or HIGH on this pin selects INTERLEAVED BURST. Do not alter input state while device is operating.
15, 41, 65, 91	V_{CC}	Supply	Power Supply: +3.3V +0.3V/-0.165V.
14	V_{CC}	Input	Pin 14 does not have to be directly connected to V_{CC} as long as the input voltage is $\geq V_{IH}$. This input is not connected to the V_{CC} bus internally.
4, 11, 20, 27, 54, 61, 70, 77	$V_{CC}Q$	Supply	Isolated Output Buffer Supply: +2.5V +0.4V/-0.125V.
5, 10, 17, 21, 26, 40, 55, 60, 67, 71, 76, 90	V_{SS}	Supply	Ground: GND.

INTERLEAVED BURST ADDRESS TABLE (MODE = NC OR HIGH)

First Address (External)	Second Address (Internal)	Third Address (Internal)	Fourth 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

LINEAR BURST ADDRESS TABLE (MODE = GND)

First Address (External)	Second Address (Internal)	Third Address (Internal)	Fourth 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

PARTIAL TRUTH TABLE FOR WRITE COMMANDS

Function	GW#	BWE#	BW1#	BW2#	BW3#	BW4#
READ	H	H	X	X	X	X
READ	H	L	H	H	H	H
WRITE Byte 1	H	L	L	H	H	H
WRITE all bytes	H	L	L	L	L	L
WRITE all bytes	L	X	X	X	X	X

NOTE: Using BWE# and BW1# through BW4#, any one or more bytes may be written.

TRUTH TABLE

OPERATION	ADDRESS USED	CE#	CE2#	CE2	ZZ	ADSP#	ADSC#	ADV#	WRITE#	OE#	CLK	DQ
Deselected Cycle, Power-down	None	H	X	X	L	X	L	X	X	X	L-H	High-Z
Deselected Cycle, Power-down	None	L	X	L	L	L	X	X	X	X	L-H	High-Z
Deselected Cycle, Power-down	None	L	H	X	L	L	X	X	X	X	L-H	High-Z
Deselected Cycle, Power-down	None	L	X	L	L	H	L	X	X	X	L-H	High-Z
Deselected Cycle, Power-down	None	L	H	X	L	H	L	X	X	X	L-H	High-Z
SNOOZE MODE, Power-down	None	X	X	X	H	X	X	X	X	X	X	High-Z
READ Cycle, Begin Burst	External	L	L	H	L	L	X	X	X	L	L-H	Q
READ Cycle, Begin Burst	External	L	L	H	L	L	X	X	X	H	L-H	High-Z
WRITE Cycle, Begin Burst	External	L	L	H	L	H	L	X	L	X	L-H	D
READ Cycle, Begin Burst	External	L	L	H	L	H	L	X	H	L	L-H	Q
READ Cycle, Begin Burst	External	L	L	H	L	H	L	X	H	H	L-H	High-Z
READ Cycle, Continue Burst	Next	X	X	X	L	H	H	L	H	L	L-H	Q
READ Cycle, Continue Burst	Next	X	X	X	L	H	H	L	H	H	L-H	High-Z
READ Cycle, Continue Burst	Next	H	X	X	L	X	H	L	H	L	L-H	Q
READ Cycle, Continue Burst	Next	H	X	X	L	X	H	L	H	H	L-H	High-Z
WRITE Cycle, Continue Burst	Next	X	X	X	L	H	H	L	L	X	L-H	D
WRITE Cycle, Continue Burst	Next	H	X	X	L	X	H	L	L	X	L-H	D
READ Cycle, Suspend Burst	Current	X	X	X	L	H	H	H	H	L	L-H	Q
READ Cycle, Suspend Burst	Current	X	X	X	L	H	H	H	H	H	L-H	High-Z
READ Cycle, Suspend Burst	Current	H	X	X	L	X	H	H	H	L	L-H	Q
READ Cycle, Suspend Burst	Current	H	X	X	L	X	H	H	H	H	L-H	High-Z
WRITE Cycle, Suspend Burst	Current	X	X	X	L	H	H	H	L	X	L-H	D
WRITE Cycle, Suspend Burst	Current	H	X	X	L	X	H	H	L	X	L-H	D

NOTE:
1. X means "don't care." H means logic HIGH. L means logic LOW. WRITE#=L means any one or more byte write enable signals (BW1#, BW2#, BW3# or BW4#) and BWE# are LOW or GW# is LOW. WRITE#=H means all byte write enable signals are HIGH.
2. BW1# enables WRITEs to Byte 1 (DQ1-DQ8, DQP1). BW2# enables WRITEs to Byte 2 (DQ9-DQ16, DQP2). BW3# enables WRITEs to Byte 3 (DQ17-DQ24, DQP3). BW4# enables WRITEs to Byte 4 (DQ25-DQ32, DQP4). DQP1, DQP2, DQP3 and DQP4 only available on the x36 version.
3. All inputs except OE# and ZZ must meet setup and hold times around the rising edge (LOW to HIGH) of CLK.
4. Wait states are inserted by suspending burst.
5. For a WRITE operation following a READ operation, OE# must be HIGH before the input data setup time and held HIGH throughout the input data hold time.
6. This device contains circuitry that will ensure the outputs will be in High-Z during power-up.
7. ADSP# LOW always initiates an internal READ at the L-H edge of CLK. A WRITE is performed by setting one or more byte write enable signals and BWE# LOW or GW# LOW for the subsequent L-H edge of CLK. Refer to WRITE timing diagram for clarification.

ABSOLUTE MAXIMUM RATINGS*

Voltage on V_{CC} Supply Relative to V_{SS} ..... -0.5V to +4.6V
Voltage on $V_{CC}Q$ Supply Relative to V_{SS} .... -0.5V to +4.6V
V_{IN} (DQxx) ..... -0.5V to $V_{CC}Q$+0.5V
V_{IN} (inputs) ..... -0.5V to V_{CC}+0.5V
Storage Temperature (plastic) ..... -55°C to +150°C
Junction Temperature** ..... +150°C
Short Circuit Output Current 100mA

*Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

**Maximum junction temperature depends upon package type, cycle time, loading, ambient temperature and airflow. See Micron Technical Note TN-05-14 for more information.

2.5V I/O PIPELINED SCD SRAM

ELECTRICAL CHARACTERISTICS AND RECOMMENDED DC OPERATING CONDITIONS

(0°C ≤ T_A ≤ 70°C; V_{CC} = +3.3V +0.3V/-0.165V; $V_{CC}Q$ = +2.5V +0.4V/-0.125V unless otherwise noted)

DESCRIPTION	CONDITIONS	SYMBOL	MIN	MAX	UNITS	NOTES
Input High (Logic 1) Voltage	Data bus (DQxx)	$V_{IH}Q$	1.7	$V_{CC}Q$+0.3	V	1, 2
	Inputs	V_{IH}	1.7	V_{CC}+0.3	V	1, 2
Input Low (Logic 0) Voltage		V_{IL}	-0.3	0.7	V	1, 2
Input Leakage Current	0V ≤ V_{IN} ≤ V_{CC}	I_{LI}	-1	1	µA	14
Output Leakage Current	Output(s) disabled, 0V ≤ V_{IN} ≤ $V_{CC}Q$ (DQxx)	I_{LO}	-1	1	µA	
Output High Voltage	I_{OH} = -2.0mA	V_{OH}	1.7		V	1
	I_{OH} = -1.0mA	V_{OH}	2.0		V	1
Output Low Voltage	I_{OL} = 2.0mA	V_{OL}		0.7	V	1
	I_{OL} = 1.0mA	V_{OL}		0.4	V	1
Supply Voltage		V_{CC}	3.135	3.6	V	1
Isolated Output Buffer Supply		$V_{CC}Q$	2.375	2.9	V	1

ELECTRICAL CHARACTERISTICS AND RECOMMENDED DC OPERATING CONDITIONS

(0°C ≤ T_A ≤ 70°C; V_{CC} = +3.3V +0.3V/-0.165V; $V_{CC}Q$ = +2.5V +0.4V/-0.125V unless otherwise noted)

				MAX						
DESCRIPTION	CONDITIONS	SYM	TYP	-7	-7.5	-8.5	-10	-11	UNITS	NOTES
Power Supply Current: Operating	Device selected; All inputs ≤ V_{IL} or ≥ V_{IH}; Cycle time ≥ ^tKC MIN; $V_{CC}Q$ = MAX; V_{CC} = MAX; Outputs open	I_{CC}	TBD	300	270	260	250	240	mA	3, 12, 13
Power Supply Suspend Mode	Device selected; V_{CC} = MAX; $V_{CC}Q$ = MAX; ADSC#, ADSP#, ADV#, OE#, GW#, BWE# ≥ V_{IH}; Inputs ≤ 0.2V; Data (DQxx) ≤ 0.2V; Freq = MAX; Outputs disabled	I_{SUS}	TBD	50	50	50	50	50	mA	12, 13, 15
Idle Mode	Device selected; V_{CC} = MAX; $V_{CC}Q$ = MAX; ADSC#, ADSP# ≥ V_{IH}; Inputs ≤ 0.2V; Data (DQxx) ≤ 0.2V; Outputs disabled; Freq = 0	I_{IDLE}	TBD	TBD	TBD	TBD	TBD	TBD	mA	12, 13
Standby Mode	Device deselected; V_{CC} = MAX; $V_{CC}Q$ = MAX; All inputs ≤ 0.2V; Outputs disabled; Freq = 0; Data (DQxx) ≤ 0.2V	I_{STBY}	TBD	5	5	5	5	5	mA	12, 13

CAPACITANCE

DESCRIPTION	CONDITIONS	SYMBOL	TYP	MAX	UNITS	NOTES
Control Input Capacitance	T_A = 25°C; f = 1 MHz	C_I	3	4	pF	4
Input/Output Capacitance (DQ)	Vcc = 3.3V	C_O	4	5	pF	4
Address Capacitance		C_A	3	3.5	pF	4
Clock Capacitance		C_{CK}	2.5	3	pF	4

THERMAL CONSIDERATIONS

DESCRIPTION	CONDITIONS	SYMBOL	TQFP TYP	UNITS	NOTES
Thermal resistance - Junction to Ambient	Still air, soldered on 4.25 x	θ_{JA}	25	°C/W	4
Thermal resistance - Junction to Case	1.125-inch, 4-layer printed circuit board	θ_{JC}	2	°C/W	4

ELECTRICAL CHARACTERISTICS AND RECOMMENDED AC OPERATING CONDITIONS

(Note 5) (0°C ≤ T_A ≤ 70°C; Vcc = +3.3V +0.3V/-0.165V; VccQ = +2.5V +0.4V/-0.125V)

DESCRIPTION		-7		-7.5		-8.5		-10		-11			
	SYM	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNITS	NOTES
Clock													
Clock cycle time	^tKC	7		7.5		8.5		10		11		ns	
Clock frequency	^tKF		143		133		117		100		90	MHz	
Clock HIGH time	^tKH	1.9		1.9		2.5		3.2		3.8		ns	
Clock LOW time	^tKL	1.9		1.9		2.5		3.2		3.8		ns	
Output Times													
Clock to output valid	^tKQ		4.5		5		5		5.5		6	ns	
Clock to output invalid	^tKQX	1.5		1.5		1.5		1.5		1.5		ns	6
Clock to output in Low-Z	^tKQLZ	1.5		1.5		1.5		1.5		1.5		ns	4, 6, 7, 8
Clock to output in High-Z	^tKQHZ	1.5	4.5	1.5	4.8	1.5	4.8	1.5	5.5	1.5	6	ns	4, 6, 7, 8
OE# to output valid	^tOEQ		4.5		4.8		4.8		5.5		6	ns	10
OE# to output in Low-Z	^tOELZ	0		0		0		0		0		ns	4, 6, 7, 8
OE# to output in High-Z	^tOEHZ		4.5		4.8		4.8		5.5		6	ns	4, 6, 7, 8
Setup Times													
Address	^tAS	2		2		2		2		2		ns	9, 11
Address Status (ADSC#, ADSP#)	^tADSS	2		2		2		2		2		ns	9, 11
Address Advance (ADV#)	^tAAS	2		2		2		2		2		ns	9, 11
Write Signals (BW1#-BW4#, BWE#, GW#)	^tWS	2		2		2		2		2		ns	9, 11
Data-in	^tDS	2		2		2		2		2		ns	9, 11
Chip Enables (CE#, CE2#, CE2)	^tCES	2		2		2		2		2		ns	9, 11
Hold Times													
Address	^tAH	0.5		0.5		0.5		0.5		0.5		ns	9, 11
Address Status (ADSC#, ADSP#)	^tADSH	0.5		0.5		0.5		0.5		0.5		ns	9, 11
Address Advance (ADV#)	^tAAH	0.5		0.5		0.5		0.5		0.5		ns	9, 11
Write Signals (BW1#-BW4#, BWE#, GW#)	^tWH	0.5		0.5		0.5		0.5		0.5		ns	9, 11
Data-in	^tDH	0.5		0.5		0.5		0.5		0.5		ns	9, 11
Chip Enables (CE#, CE2#, CE2)	^tCEH	0.5		0.5		0.5		0.5		0.5		ns	9, 11

AC TEST CONDITIONS

Input pulse levels	Vss to 2.5V
Input rise and fall times	2.5ns
Input timing reference levels	1.25V
Output reference levels	1.25V
Output load	See Figures 1 and 2

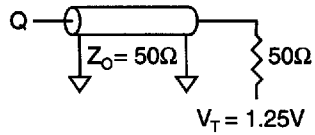


Figure 1
OUTPUT LOAD EQUIVALENT

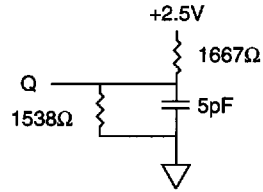


Figure 2
OUTPUT LOAD EQUIVALENT

NOTES

1. All voltages referenced to Vss (GND).
2. Overshoot: $V_{IH} \leq +4.6V$ for $t \leq {}^tKC/2$ for $I \leq 20mA$
   Undershoot: $V_{IL} \geq -0.7V$ for $t \leq {}^tKC/2$ for $I \leq 20mA$
   Power-up: $V_{IH} \leq +3.6V$ and $V_{CC} \leq 3.135V$ for $t \leq 200ms$
3. Icc is given with no output current. Icc increases with greater output loading and faster cycle times.
4. This parameter is sampled.
5. Test conditions as specified with the output loading as shown in Figure 1 unless otherwise noted.
6. Output loading is specified using Figure 2 with C_L = 5pF (for I_{OH} = -2mA and I_{OL} = 2mA).
7. Transition is measured ±150mV from steady state voltage.
8. Reference Technical Note TN-58-09, "Synchronous SRAM Bus Contention Design Considerations," for a more thorough discussion on these parameters.
9. A WRITE cycle is defined by at least one byte write enable LOW and ADSP# HIGH for the required setup and hold times. A READ cycle is defined by all byte write enables HIGH and (ADSC# or ADV# LOW) or ADSP# LOW for the required setup and hold times.
10. OE# is a "don't care" when a byte write enable is sampled LOW.
11. This is a synchronous device. All addresses must meet the specified setup and hold times for all rising edges of CLK when either ADSP# or ADSC# is LOW and chip enabled. All other synchronous inputs must meet the setup and hold times with stable logic levels for all rising edges of clock (CLK) when the chip is enabled. Chip enable must be valid at each rising edge of CLK (when either ADSP# or ADSC# is LOW) to remain enabled.
12. "Device Deselected" means device is in POWER-DOWN mode as defined in the Truth Table. "Device Selected" means device is active (not in POWER-DOWN mode).
13. Typical values are measured at Vcc = 3.3V, VccQ = 2.5V, 25°C and 11ns cycle time.
14. MODE pin has an internal pull-up and exhibits an input leakage current of ±10µA.
15. Isus specifies a maximum current for suspend mode as defined in the truth table (for READ suspend burst mode).

LOAD DERATING CURVES

Micron 64K x 32 and 64K x 36 Synchronous SRAM timing is dependent upon the capacitive loading on the outputs. The data sheet is written assuming a load of 30pF.

Consult the factory for copies of I/O current versus voltage curves. For capacitive loading derating curves, see Micron Technical Note TN-58-11, "3.3V Synchronous SRAM Capacitive Loading."

SNOOZE MODE

SNOOZE MODE is a low current, "power-down" mode in which the device is deselected and current is reduced to I_{SB2}. The duration of SNOOZE MODE is dictated by the length of time the ZZ pin is in a HIGH state. After entering SNOOZE MODE, all inputs except ZZ become gated inputs and are ignored.

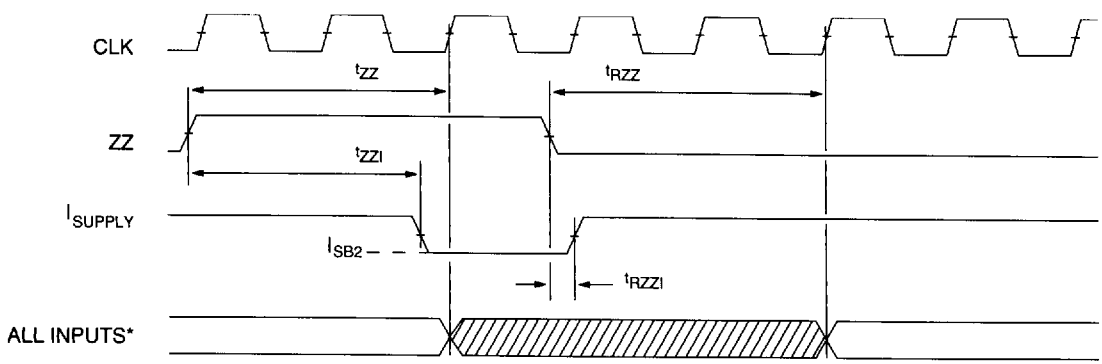
The ZZ pin (pin 64) is an asynchronous, active HIGH input that causes the device to enter SNOOZE MODE. When the ZZ pin becomes a logic HIGH, I_{SB2} is guaranteed after the setup time ^tZZ is met. Any access pending when entering SNOOZE MODE is not guaranteed to successfully complete. Therefore, SNOOZE MODE must not be initiated until valid pending operations are completed.

SNOOZE MODE ELECTRICAL CHARACTERISTICS

DESCRIPTION	CONDITIONS	SYMBOL	MIN	MAX	UNITS	NOTES
Current during SNOOZE MODE	ZZ ≥ V_{IH}	I_{SB2Z}		5	mA	
ZZ active to input ignored		^tZZ		2(^tKC)	ns	1
ZZ inactive to input sampled		^tRZZ	2(^tKC)		ns	1
ZZ active to snooze current		^tZZI		2(^tKC)	ns	1
ZZ inactive to exit snooze current		^tRZZI	0		ns	1

NOTE: 1. This parameter is sampled.

SNOOZE MODE WAVEFORM

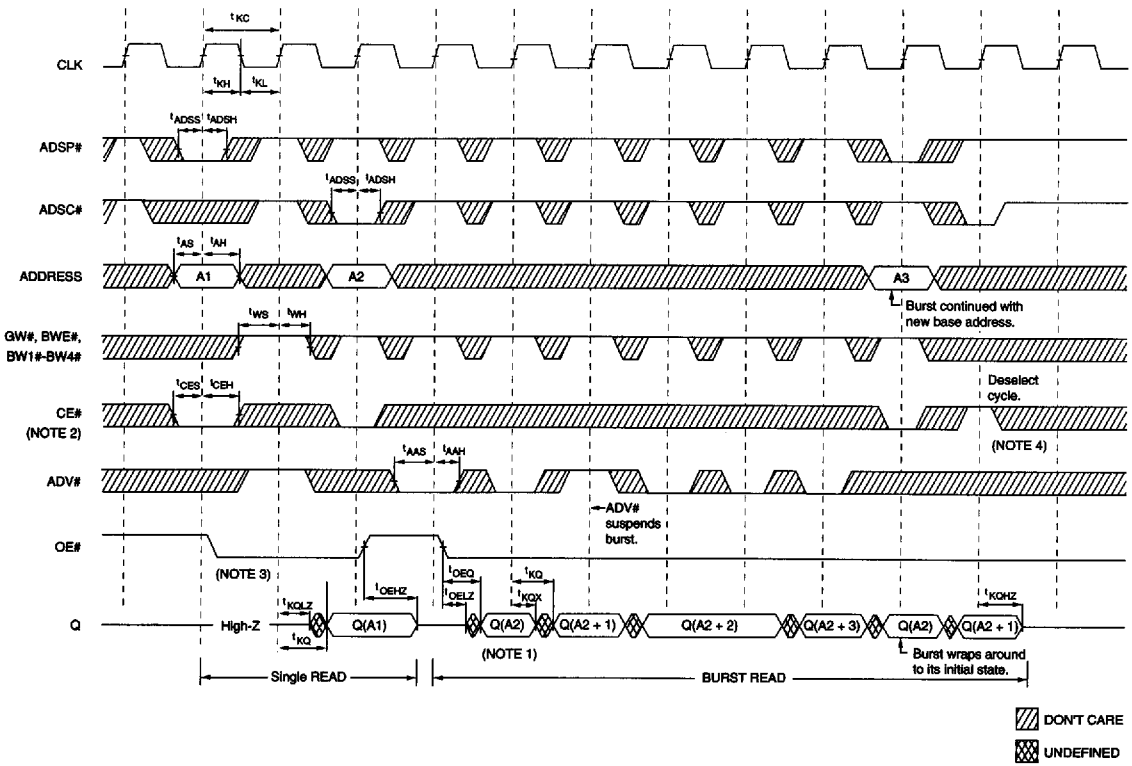


* Except ZZ

DON'T CARE

2.5V I/O PIPELINED SCD SRAM

READ TIMING



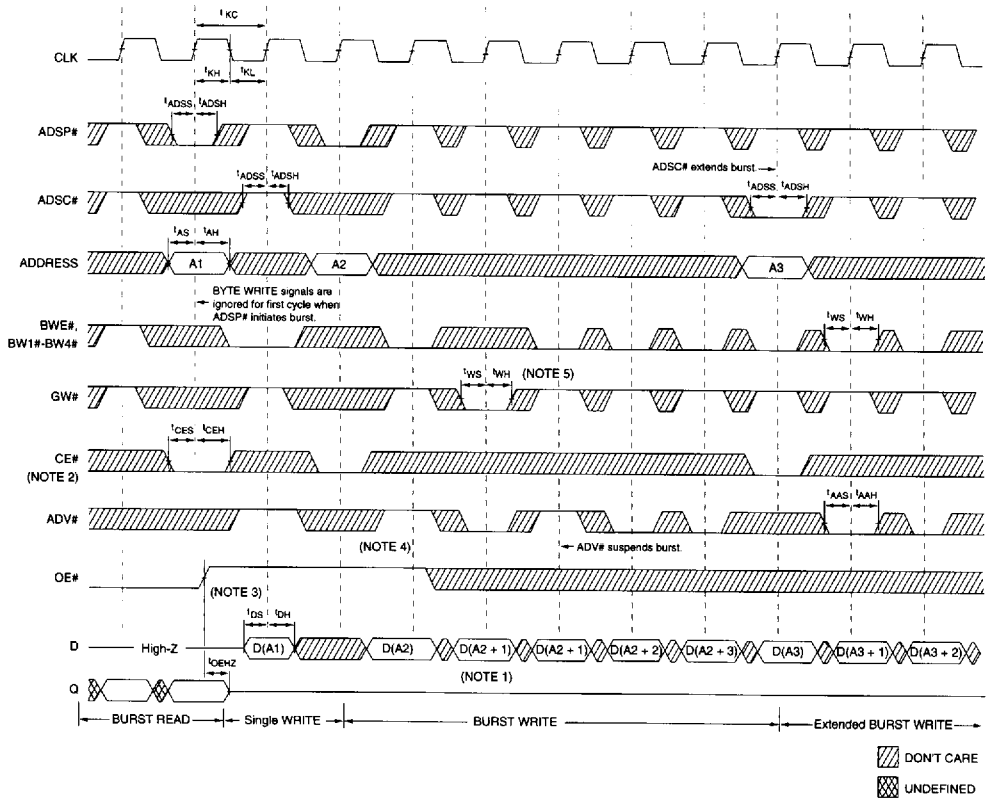
READ TIMING PARAMETERS

	-7		-7.5		-8.5		-10		-11		
SYM	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
tKC	7		7.5		8.5		10		11		ns
tKF		143		133		117		100		90	MHz
tKH	1.9		1.9		2.5		3.2		3.8		ns
tKL	1.9		1.9		2.5		3.2		3.8		ns
tKQ		4.5		5		5		5.5		6	ns
tKQX	1.5		1.5		1.5		1.5		1.5		ns
tKQLZ	1.5		1.5		1.5		1.5		1.5		ns
tKQHZ	1.5	4.5	1.5	4.8	1.5	4.8	1.5	5.5	1.5	6	ns
tOEQ		4.5		4.8		4.8		5.5		6	ns
tOELZ	0		0		0		0		0		ns
tOEHZ		4.5		4.8		4.8		5.5		6	ns

	-7		-7.5		-8.5		-10		-11		
SYM	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
tAS	2		2		2		2		2		ns
tADSS	2		2		2		2		2		ns
tAAS	2		2		2		2		2		ns
tWS	2		2		2		2		2		ns
tCES	2		2		2		2		2		ns
tAH	0.5		0.5		0.5		0.5		0.5		ns
tADSH	0.5		0.5		0.5		0.5		0.5		ns
tAAH	0.5		0.5		0.5		0.5		0.5		ns
tWH	0.5		0.5		0.5		0.5		0.5		ns
tCEH	0.5		0.5		0.5		0.5		0.5		ns

NOTE:
1. Q(A2) refers to output from address A2. Q(A2+1) refers to output from the next internal burst address following A2.
2. CE2# and CE2 have timing identical to CE#. On this diagram, when CE# is LOW, CE2# is LOW and CE2 is HIGH. When CE# is HIGH, CE2# is HIGH and CE2 is LOW.
3. Timing is shown assuming that the device was not enabled before entering into this sequence. OE# does not cause Q to be driven until after the following clock rising edge.
4. Outputs are disabled within one clock cycle after deselect.

WRITE TIMING



WRITE TIMING PARAMETERS

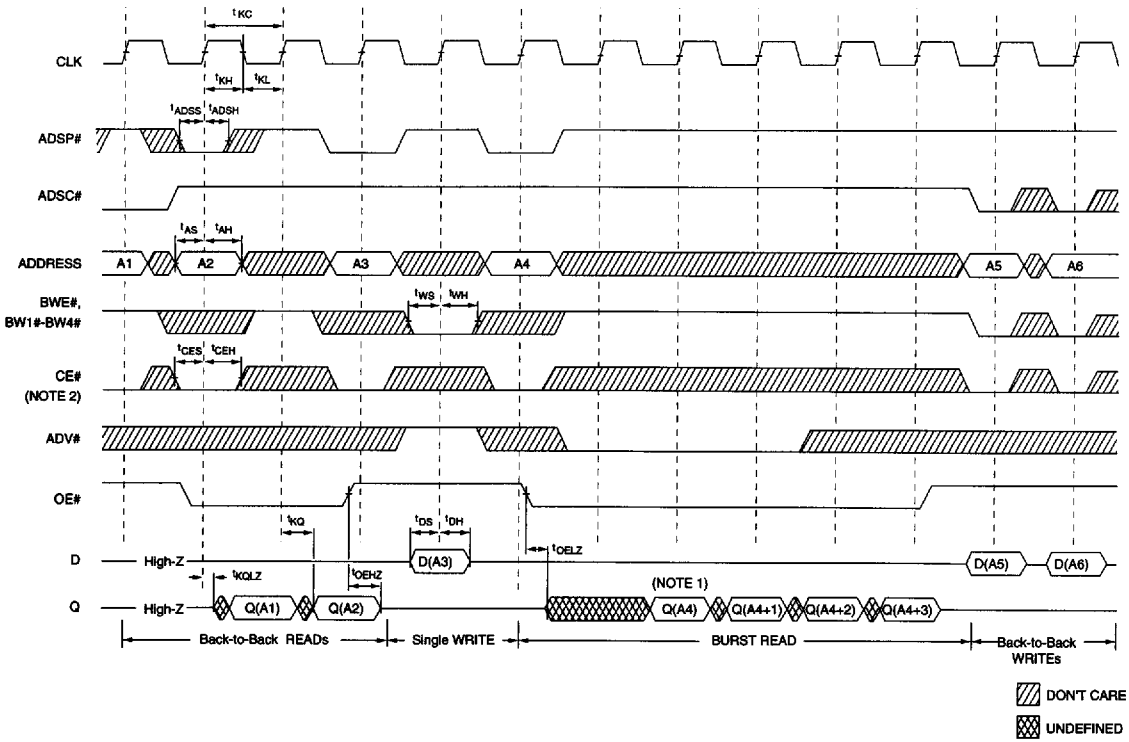
	-7		-7.5		-8.5		-10		-11		
SYM	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
tKC	7		7.5		8.5		10		11		ns
tKF		143		133		117		100		90	MHz
tKH	1.9		1.9		2.5		3.2		3.8		ns
tKL	1.9		1.9		2.5		3.2		3.8		ns
tOEHZ		4.5		4.8		4.8		5.5		6	ns
tAS	2		2		2		2		2		ns
tADSS	2		2		2		2		2		ns
tAAS	2		2		2		2		2		ns
tWS	2		2		2		2		2		ns

	-7		-7.5		-8.5		-10		-11		
SYM	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
tDS	2		2		2		2		2		ns
tCES	2		2		2		2		2		ns
tAH	0.5		0.5		0.5		0.5		0.5		ns
tADSH	0.5		0.5		0.5		0.5		0.5		ns
tAAH	0.5		0.5		0.5		0.5		0.5		ns
tWH	0.5		0.5		0.5		0.5		0.5		ns
tDH	0.5		0.5		0.5		0.5		0.5		ns
tCEH	0.5		0.5		0.5		0.5		0.5		ns

NOTE:
1. D(A2) refers to input for address A2. D(A2+1) refers to input for the next internal burst address following A2.
2. CE2# and CE2 have timing identical to CE#. On this diagram, when CE# is LOW, CE2# is LOW and CE2 is HIGH. When CE# is HIGH, CE2# is HIGH and CE2 is LOW.
3. OE# must be HIGH before the input data setup and held HIGH throughout the data hold time. This prevents input/output data contention for the time period prior to the byte write enable inputs being sampled.
4. ADV# must be HIGH to permit a WRITE to the loaded address.
5. Full-width WRITE can be initiated by GW# LOW or GW# HIGH and BWE#, BW1#-BW4# LOW.

2.5V I/O PIPELINED SCD SRAM

READ/WRITE TIMING



READ/WRITE TIMING PARAMETERS

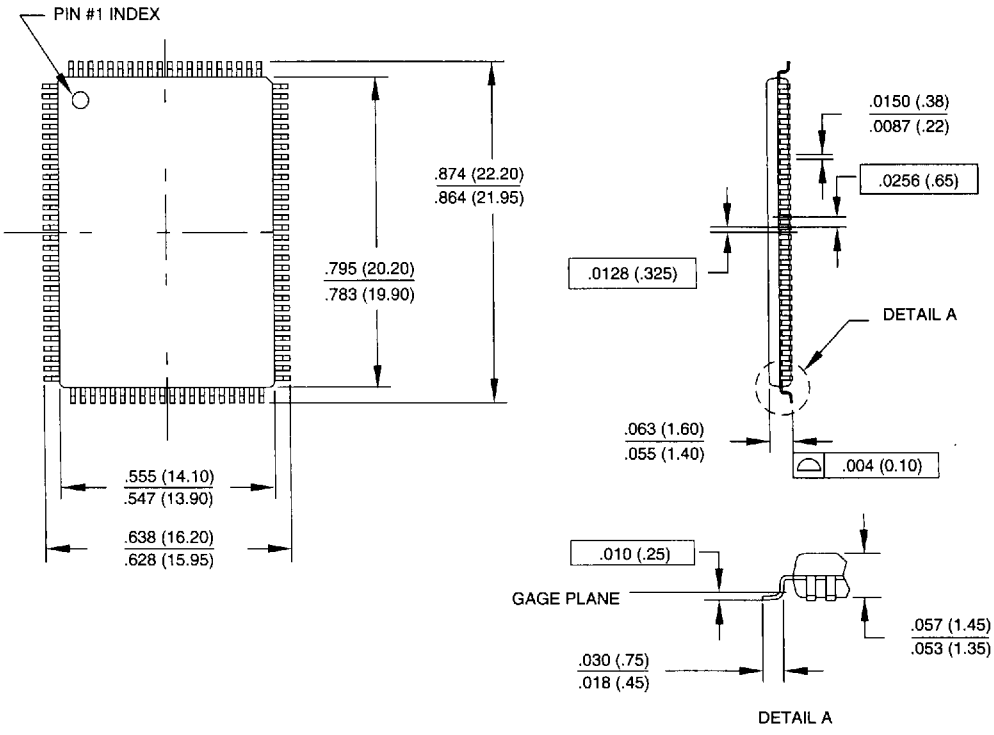
	-7		-7.5		-8.5		-10		-11		
SYM	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
tKC	7		7.5		8.5		10		11		ns
tKF		143		133		117		100		90	MHz
tKH	1.9		1.9		2.5		3.2		3.8		ns
tKL	1.9		1.9		2.5		3.2		3.8		ns
tKQ		4.5		5		5		5.5		6	ns
tKQLZ	1.5		1.5		1.5		1.5		1.5		ns
tOELZ	0		0		0		0		0		ns
tOEHZ		4.5		4.8		4.8		5.5		6	ns
tAS			2		2		2		2		ns

	-7		-7.5		-8.5		-10		-11		
SYM	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
tADSS	2		2		2		2		2		ns
tWS	2		2		2		2		2		ns
tDS	2		2		2		2		2		ns
tCES	2		2		2		2		2		ns
tAH	0.5		0.5		0.5		0.5		0.5		ns
tADSH	0.5		0.5		0.5		0.5		0.5		ns
tWH	0.5		0.5		0.5		0.5		0.5		ns
tDH	0.5		0.5		0.5		0.5		0.5		ns
tCEH	0.5		0.5		0.5		0.5		0.5		ns

NOTE:
1. Q(A4) refers to output from address A4. Q(A4+1) refers to output from the next internal burst address following A4.
2. CE2# and CE2 have timing identical to CE#. On this diagram, when CE# is LOW, CE2# is LOW and CE2 is HIGH. When CE# is HIGH, CE2# is HIGH and CE2 is LOW.
3. The data bus (Q) remains in High-Z following a WRITE cycle unless an ADSP#, ADSC# or ADV# cycle is performed.
4. GW# is HIGH.
5. Back-to-back READs may be controlled by either ADSP# or ADSC#.

100-PIN TQFP

SA-1

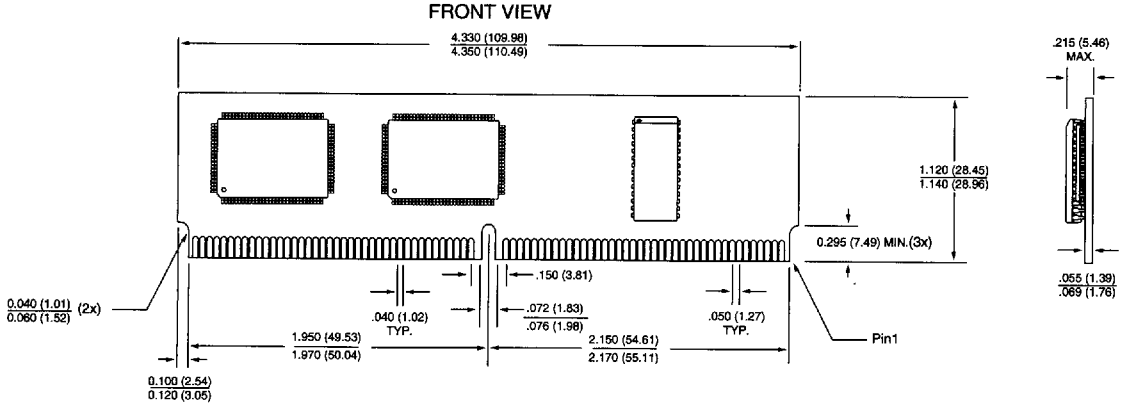


NOTE: 1. All dimensions in inches (millimeters) $\frac{\text{MAX}}{\text{MIN}}$ or typical where noted.

2. Package width and length do not include mold protrusion; allowable mold protrusion is .01" per side.

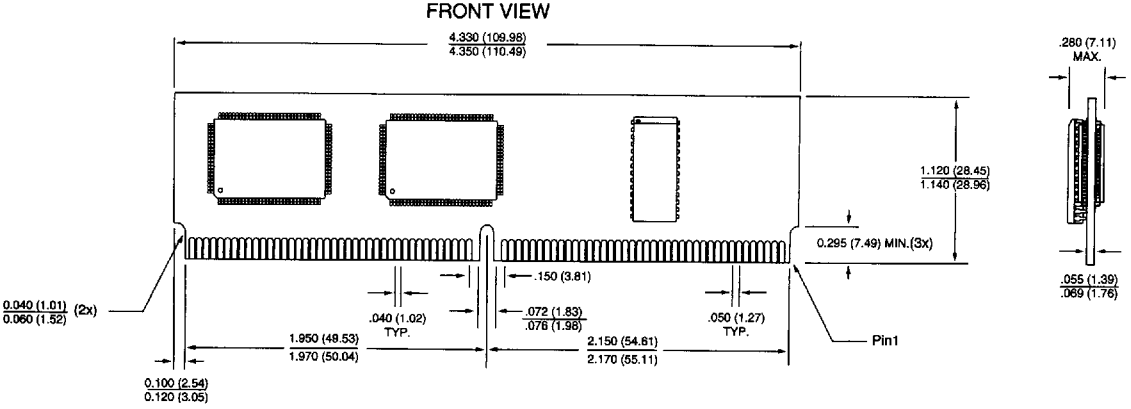
160-PIN MODULE DIMM

SB-1



160-PIN MODULE DIMM

SB-2



PACKAGE INFORMATION

NOTE: 1. All dimensions in inches (millimeters) $\frac{\text{MAX}}{\text{MIN}}$ or typical where noted.