

OKI Semiconductor

MSC23B236D-xxBS8/DS8

2,097,152-word x 36-bit DYNAMIC RAM MODULE : FAST PAGE MODE TYPE

DESCRIPTION

The MSC23B236D-xxBS8/DS8 is a fully decoded, 2,097,152-word x 36-bit CMOS dynamic random access memory module composed of four 16Mb DRAMs in SOJ packages and four 2Mb DRAMs in SOJ packages mounted with eight decoupling capacitors on a 72-pin glass epoxy single-inline package. This module supports any application where high density and large capacity of storage memory are required.

FEATURES

- 2,097,152-word x 36-bit organization
- 72-pin Single Inline Memory Module
 - MSC23B236D-xxBS8 : Gold tab
 - MSC23B236D-xxDS8 : Solder tab
- Single +5V supply $\pm 10\%$ tolerance
- Input : TTL compatible
- Output : TTL compatible, 3-state
- Refresh : 1024cycles/16ms
- /CAS before /RAS refresh, hidden refresh, /RAS only refresh capability
- Fast page mode capability

PRODUCT FAMILY

Family	Access Time (Max.)			Cycle Time (Min.)	Power Dissipation	
	t _{RAC}	t _{AA}	t _{CAC}		Operating (Max.)	Standby (Max.)
MSC23B236D-60BS8/DS8	60ns	30ns	15ns	110ns	2365mW	44mW
MSC23B236D-70BS8/DS8	70ns	35ns	20ns	130ns	2145mW	

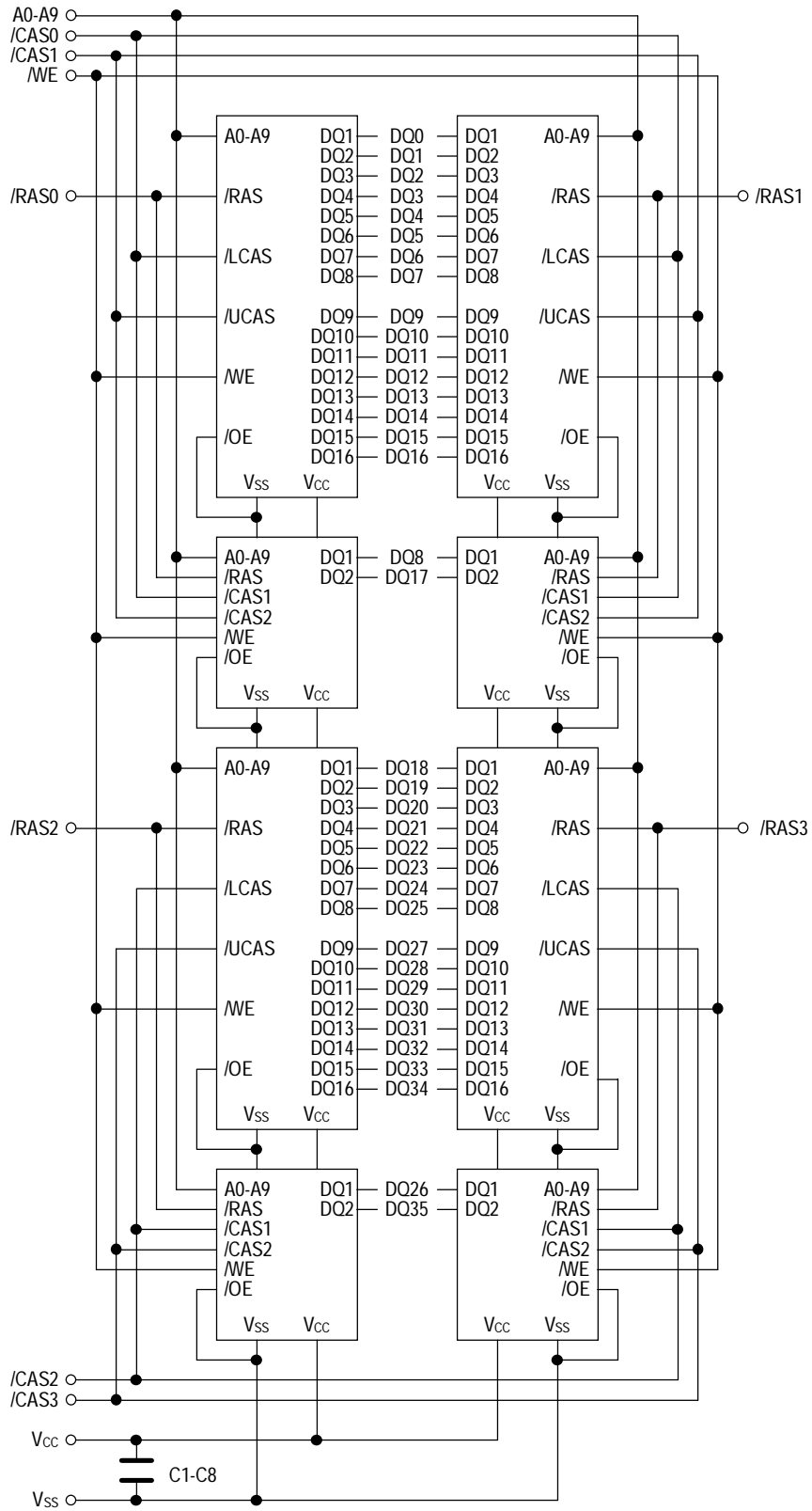
PIN CONFIGURATION

Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	V _{SS}	19	NC	37	DQ17	55	DQ12
2	DQ0	20	DQ4	38	DQ35	56	DQ30
3	DQ18	21	DQ22	39	V _{SS}	57	DQ13
4	DQ1	22	DQ5	40	/CAS0	58	DQ31
5	DQ19	23	DQ23	41	/CAS2	59	V _{CC}
6	DQ2	24	DQ6	42	/CAS3	60	DQ32
7	DQ20	25	DQ24	43	/CAS1	61	DQ14
8	DQ3	26	DQ7	44	/RAS0	62	DQ33
9	DQ21	27	DQ25	45	/RAS1	63	DQ15
10	V _{CC}	28	A7	46	NC	64	DQ34
11	NC	29	NC	47	/WE	65	DQ16
12	A0	30	V _{CC}	48	NC	66	NC
13	A1	31	A8	49	DQ9	67	PD1
14	A2	32	A9	50	DQ27	68	PD2
15	A3	33	/RAS3	51	DQ10	69	PD3
16	A4	34	/RAS2	52	DQ28	70	PD4
17	A5	35	DQ26	53	DQ11	71	NC
18	A6	36	DQ8	54	DQ29	72	V _{SS}

Presence Detect Pins

Pin No.	Pin Name	MSC23B236D -60BS8/DS8	MSC23B236D -70BS8/DS8
67	PD1	NC	NC
68	PD2	NC	NC
69	PD3	NC	V _{SS}
70	PD4	NC	NC

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Voltage on Any Pin Relative to V_{SS}	V_{IN}, V_{OUT}	-1.0 to +7.0	V
Voltage on V_{CC} Supply Relative to V_{SS}	V_{CC}	-1.0 to +7.0	V
Short Circuit Output Current	I_{OS}	50	mA
Power Dissipation	P_D *	8	W
Operating Temperature	T_{OPR}	0 to +70	°C
Storage Temperature	T_{STG}	-40 to +125	°C

* $T_a = 25^\circ\text{C}$

Recommended Operating Conditions

($T_a = 0^\circ\text{C}$ to $+70^\circ\text{C}$)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{CC}	4.5	5.0	5.5	V
	V_{SS}	0	0	0	V
Input High Voltage	V_{IH}	2.4	-	6.5	V
Input Low Voltage	V_{IL}	-1.0	-	0.8	V

Capacitance

($V_{CC} = 5V \pm 10\%$, $T_a = 25^\circ\text{C}$, $f = 1\text{ MHz}$)

Parameter	Symbol	Typ.	Max.	Unit
Input Capacitance (A0 - A9)	C_{IN1}	-	53	pF
Input Capacitance (/WE)	C_{IN2}	-	65	pF
Input Capacitance (/RAS0- /RAS3)	C_{IN3}	-	20	pF
Input Capacitance (/CAS0- /CAS3)	C_{IN4}	-	35	pF
I/O Capacitance (DQ0 - DQ35)	C_{DQ}	-	20	pF

Note: Capacitance measured with Boonton Meter.

DC Characteristics

(V_{CC} = 5V ± 10%, Ta = 0°C to +70°C)

Parameter	Symbol	Condition	MSC23B236D -60BS8/DS8		MSC23B236D -70BS8/DS8		Unit	Note
			Min.	Max.	Min.	Max.		
Input Leakage Current	I _{LI}	0V ≤ V _{IN} ≤ 6.5V; All other pins not under test = 0V	-80	80	-80	80	μA	
Output Leakage Current	I _{LO}	DQ disable 0V ≤ V _{OUT} ≤ 5.5V	-20	20	-20	20	μA	
Output High Voltage	V _{OH}	I _{OH} = -5.0mA	2.4	V _{CC}	2.4	V _{CC}	V	
Output Low Voltage	V _{OL}	I _{OL} = 4.2mA	0	0.4	0	0.4	V	
Average Power Supply Current (Operating)	I _{CC1}	/RAS, /CAS cycling, t _{RC} = min.	-	430	-	390	mA	1, 2
Power supply current (Standby)	I _{CC2}	/RAS, /CAS = V _{IH}	-	16	-	16	mA	1
		/RAS, /CAS ≥ V _{CC} - 0.2V	-	8	-	8	mA	1
Average Power Supply Current (/RAS only refresh)	I _{CC3}	/RAS cycling, /CAS = V _{IH} , t _{RC} = min.	-	430	-	390	mA	1, 2
Average Power Supply Current (/CAS before /RAS refresh)	I _{CC6}	/RAS cycling, /CAS before /RAS	-	430	-	390	mA	1, 2
Average Power Supply Current (Fast Page Mode)	I _{CC7}	/RAS = V _{IL} , /CAS cycling, t _{PC} = min.	-	390	-	360	mA	1, 3

- Notes: 1. I_{CC} Max. is specified as I_{CC} for output open condition.
2. Address can be changed once or less while /RAS = V_{IL}.
3. Address can be changed once or less while /CAS = V_{IH}.

AC Characteristics (1/2)

(V_{CC} = 5V ± 10%, T_a = 0°C to +70°C) Note: 1, 2, 3

Parameter	Symbol	MSC23B236D -60BS8/DS8		MSC23B236D -70BS8/DS8		Unit	Note
		Min.	Max.	Min.	Max.		
Random Read or Write Cycle Time	t _{RC}	110	-	130	-	ns	
Fast Page Mode Cycle Time	t _{PC}	40	-	45	-	ns	
Access Time from /RAS	t _{RAC}	-	60	-	70	ns	4, 5, 6
Access Time from /CAS	t _{CAC}	-	15	-	20	ns	4, 5
Access Time from Column Address	t _{AA}	-	30	-	35	ns	4, 6
Access Time from /CAS Precharge	t _{CPA}	-	35	-	40	ns	4
Output Low Impedance Time from /CAS	t _{CLZ}	0	-	0	-	ns	4
/CAS to Data Output Buffer Turn-off Delay Time	t _{OFF}	0	15	0	20	ns	7
Transition Time	t _T	3	50	3	50	ns	3
Refresh Period	t _{REF}	-	16	-	16	ms	
/RAS Precharge Time	t _{RP}	40	-	50	-	ns	
/RAS Pulse Width	t _{RAS}	60	10K	70	10K	ns	
/RAS Pulse Width (Fast Page Mode)	t _{RASP}	60	100K	70	100K	ns	
/RAS Hold Time	t _{RSH}	15	-	20	-	ns	
/CAS Precharge Time (Fast Page Mode)	t _{CP}	10	-	10	-	ns	
/CAS Pulse Width	t _{CAS}	15	10K	20	10K	ns	
/CAS Hold Time	t _{CSH}	60	-	70	-	ns	
/CAS to /RAS Precharge Time	t _{CRP}	5	-	5	-	ns	
/RAS Hold Time from /CAS Precharge	t _{RHCP}	35	-	40	-	ns	
/RAS to /CAS Delay Time	t _{RCD}	20	45	20	50	ns	5
/RAS to Column Address Delay Time	t _{RAD}	15	30	15	35	ns	6
Row Address Set-up Time	t _{ASR}	0	-	0	-	ns	
Row Address Hold Time	t _{RAH}	10	-	10	-	ns	
Column Address Set-up Time	t _{ASC}	0	-	0	-	ns	
Column Address Hold Time	t _{CAH}	15	-	15	-	ns	
Column Address to /RAS Lead Time	t _{RAL}	30	-	35	-	ns	
Read Command Set-up Time	t _{RCS}	0	-	0	-	ns	
Read Command Hold Time	t _{RCH}	0	-	0	-	ns	8
Read Command Hold Time referenced to /RAS	t _{RRH}	0	-	0	-	ns	8

AC Characteristics (2/2)

(V_{CC} = 5V ± 10%, T_a = 0°C to +70°C) Note: 1, 2, 3

Parameter	Symbol	MSC23B236D -60BS8/DS8		MSC23B236D -70BS8/DS8		Unit	Note
		Min.	Max.	Min.	Max.		
Write Command Set-up Time	t _{WCS}	0	-	0	-	ns	
Write Command Hold Time	t _{WCH}	10	-	15	-	ns	
Write Command Pulse Width	t _{WCP}	10	-	10	-	ns	
Write Command to /RAS Lead Time	t _{RWL}	15	-	20	-	ns	
Write Command to /CAS Lead Time	t _{CWL}	15	-	20	-	ns	
Data-in Set-up Time	t _{DS}	0	-	0	-	ns	
Data-in Hold Time	t _{DH}	15	-	15	-	ns	
/CAS Active Delay Time from /RAS Precharge	t _{RPC}	5	-	5	-	ns	
/RAS to /CAS Set-up Time (/CAS before /RAS)	t _{CSR}	10	-	10	-	ns	
/RAS to /CAS Hold Time (/CAS before /RAS)	t _{CHR}	10	-	10	-	ns	

- Notes:
1. A start-up delay of 200 μ s is required after power-up, followed by a minimum of eight initialization cycles (/RAS only refresh or /CAS before /RAS refresh) before proper device operation is achieved.
 2. The AC characteristics assumes $t_T = 5$ ns.
 3. $V_{IH}(\text{Min.})$ and $V_{IL}(\text{Max.})$ are reference levels for measuring input timing signals. Transition time (t_T) are measured between V_{IH} and V_{IL} .
 4. This parameter is measured with a load circuit equivalent to 2TTL loads and 100pF.
 5. Operation within the $t_{RCD}(\text{Max.})$ limit ensures that $t_{RAC}(\text{Max.})$ can be met. $t_{RCD}(\text{Max.})$ is specified as a reference point only. If t_{RCD} is greater than the specified $t_{RCD}(\text{Max.})$ limit, then the access time is controlled by t_{CAC} .
 6. Operation within the $t_{RAD}(\text{Max.})$ limit ensures that $t_{RAC}(\text{Max.})$ can be met. $t_{RAD}(\text{Max.})$ is specified as a reference point only. If t_{RAD} is greater than the specified $t_{RAD}(\text{Max.})$ limit, then the access time is controlled by t_{AA} .
 7. $t_{OFF}(\text{Max.})$ define the time at which the output achieves the open circuit condition and are not referenced to output voltage levels.
 8. t_{RCH} or t_{RRH} must be satisfied for a read cycle.