

# OKI Semiconductor

## MSC23V13258D-xxBS2

**1,048,576-word x 32-bit DYNAMIC RAM MODULE : FAST PAGE MODE TYPE WITH EDO**

### DESCRIPTION

The MSC23V13258D-xxBS2 is an 1,048,576-word x 32-bit CMOS dynamic random access memory module which is composed of two 16Mb(1Mx16) DRAMs in TSOP packages mounted with two decoupling capacitors. This is an 100-pin dual in-line memory module. This module supports any application where high density and large capacity of storage memory are required.

### FEATURES

- 1,048,576-word x 32-bit organization
- 100-pin Dual In-line Memory Module
- Gold tab
- Single 3.3V power supply,  $\pm 0.3V$  tolerance
- Input : LVTTTL compatible
- Output : LVTTTL compatible, 3-state
- Refresh : 1024cycles/16ms
- /CAS before /RAS refresh, hidden refresh, /RAS only refresh capability
- Fast page mode with EDO, read modify write capability
- DQ pins have 10ohm series resistor
- Serial Presence Detect

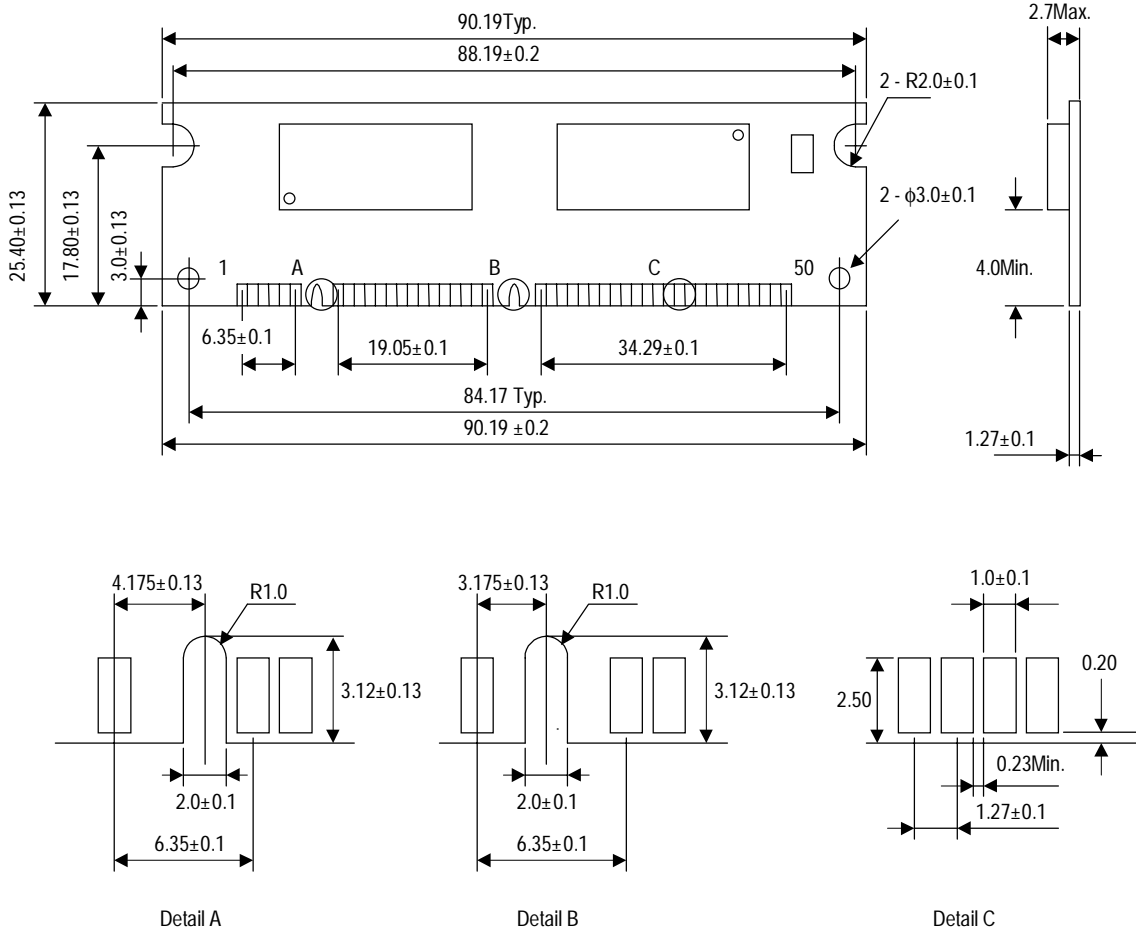
### PRODUCT FAMILY

Family	Access Time (Max.)				Cycle Time (Min.)	Power Dissipation (Max.)	
	t <sub>RAC</sub>	t <sub>AA</sub>	t <sub>CAC</sub>	t <sub>OEA</sub>		Operating	Standby
MSC23V13258D-50BS2	50ns	25ns	13ns	13ns	84ns	900mW	3.6mW
MSC23V13258D-60BS2	60ns	30ns	15ns	15ns	104ns	828mW	
MSC23V13258D-70BS2	70ns	35ns	20ns	20ns	124ns	756mW	

MODULE OUTLINE

MSC23V13258D-xxBS2

(Unit : mm)



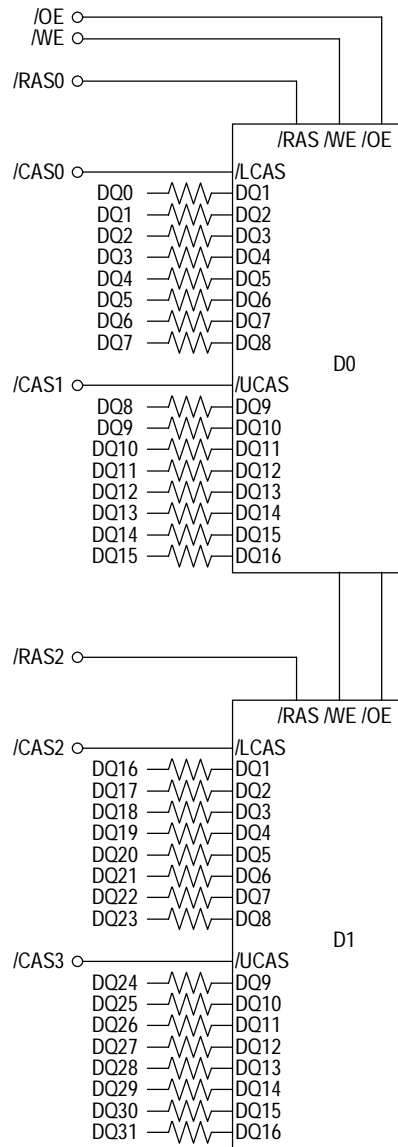
## PIN CONFIGURATION

Front Side		Back Side		Front Side		Back Side	
Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	V <sub>SS</sub>	51	V <sub>SS</sub>	26	V <sub>SS</sub>	76	V <sub>SS</sub>
2	DQ0	52	DQ8	27	NC	77	NC
3	DQ1	53	DQ9	28	/WE	78	/OE
4	DQ2	54	DQ10	29	/RAS0	79	NC
5	DQ3	55	DQ11	30	/RAS2	80	NC
6	V <sub>CC</sub>	56	V <sub>CC</sub>	31	V <sub>CC</sub>	81	V <sub>CC</sub>
7	DQ4	57	DQ12	32	NC	82	NC
8	DQ5	58	DQ13	33	NC	83	NC
9	DQ6	59	DQ14	34	NC	84	NC
10	DQ7	60	DQ15	35	NC	85	NC
11	/CAS0	61	/CAS1	36	V <sub>SS</sub>	86	V <sub>SS</sub>
12	V <sub>SS</sub>	62	V <sub>SS</sub>	37	/CAS2	87	/CAS3
13	A0	63	A1	38	DQ16	88	DQ24
14	A2	64	A3	39	DQ17	89	DQ25
15	A4	65	A5	40	DQ18	90	DQ26
16	A6	66	A7	41	DQ19	91	DQ27
17	A8	67	A9	42	V <sub>CC</sub>	92	V <sub>CC</sub>
18	NC	68	NC	43	DQ20	93	DQ28
19	NC	69	NC	44	DQ21	94	DQ29
20	NC	70	NC	45	DQ22	95	DQ30
21	V <sub>CC</sub>	71	V <sub>CC</sub>	46	DQ23	96	DQ31
22	NC	72	NC	47	V <sub>SS</sub>	97	V <sub>SS</sub>
23	NC	73	NC	48	SDA	98	SA0
24	NC	74	NC	49	SCL	99	SA1
25	NC	75	NC	50	V <sub>CC</sub>	100	SA2

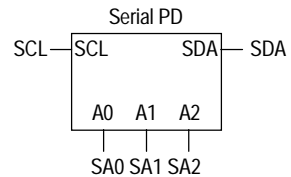
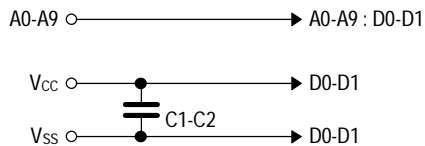
## Serial PD Matrix

Byte No.	Function described	SPD Value (Hex)	Note	
0	Number of Byte used	80	128 Bytes	
1	Total SPD Memory size	08	256 Bytes	
2	Memory type	02	EDO	
3	Number of Rows	0A	10	
4	Number of Columns	0A	10	
5	Number of Banks	01	1	
6	Module Data Width	20	32	
7	Module Data Width Continued	00	0	
8	Supply Voltage	01	LVTTL	
9	/RAS Access Time	-50	32	50ns
		-60	3C	60ns
		-70	46	70ns
10	/CAS Access Time	-50	0D	13ns
		-60	0F	15ns
		-70	14	20ns
11	DIMM Configuration type	00	Non-parity	
12	Refresh Rate/Type	00	Normal Refresh	
13	Primary DRAM Width	10	x16	
14	Error Checking DRAM Width	00		
15-61	Superset Information	00	Reserved	
62	SPD Data Revision Code	01	1	
63	Checksum for Byte 0-62	-50	10	
		-60	1C	
		-70	2B	
64-127	Reserved	00		
128-255	Unused Storage Location (Reserved)	FF		

**BLOCK DIAGRAM**



Note: All Resistors Values are 10ohms



## ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Voltage on Any Pin Relative to $V_{SS}$	$V_{IN}, V_{OUT}$	-0.5 to 4.6	V
Voltage on $V_{CC}$ Supply Relative to $V_{SS}$	$V_{CC}$	-0.5 to 4.6	V
Short Circuit Output Current	$I_{OS}$	50	mA
Power Dissipation	$P_D^*$	2	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	$V_{CC}$	3.0	3.3	3.6	V
	$V_{SS}$	0	0	0	V
Input High Voltage	$V_{IH}$	2.0	-	$V_{CC}+0.3$	V
Input Low Voltage	$V_{IL}$	-0.3	-	0.8	V

### Capacitance

( $V_{CC} = 3.3V \pm 0.3V$ ,  $T_a = 25^\circ\text{C}$ ,  $f = 1\text{ MHz}$ )

Parameter	Symbol	Typ.	Max.	Unit
Input Capacitance (A0 - A9)	$C_{IN1}$	-	16	pF
Input Capacitance (/RAS0, /RAS2)	$C_{IN2}$	-	13	pF
Input Capacitance (/CAS0 - /CAS3)	$C_{IN3}$	-	13	pF
Input Capacitance (/WE)	$C_{IN4}$	-	20	pF
I/O Capacitance (DQ0 - DQ31)	$C_{I/O}$	-	13	pF

DC Characteristics

( $V_{CC} = 3.3V \pm 0.3V$ ,  $T_a = 0^\circ C$  to  $70^\circ C$ )

Parameter	Symbol	Condition	-50		-60		-70		Unit	Note
			Min.	Max.	Min.	Max.	Min.	Max.		
Output High Voltage	$V_{OH}$	$I_{OH} = -2.0mA$	2.4	$V_{CC}$	2.4	$V_{CC}$	2.4	$V_{CC}$	V	
Output Low Voltage	$V_{OL}$	$I_{OL} = 2.0mA$	0	0.4	0	0.4	0	0.4	V	
Input Leakage Current	$I_{LI}$	$0V \leq V_{IN} \leq V_{CC}+0.3V$ ; All other pins not under test = 0V	-20	20	-20	20	-20	20	$\mu A$	
Output Leakage Current	$I_{LO}$	DQ disable $0V \leq V_{OUT} \leq V_{CC}$	-10	10	-10	10	-10	10	$\mu A$	
Average Power Supply Current (Operating)	$I_{CC1}$	/RAS, /CAS cycling, $t_{RC} = \text{Min.}$	-	250	-	230	-	210	mA	1, 2
Power Supply Current (Standby)	$I_{CC2}$	/RAS, /CAS = $V_{IH}$	-	4	-	4	-	4	mA	1
		/RAS, /CAS $\geq V_{CC}-0.2V$	-	1	-	1	-	1	mA	
Average Power Supply Current (/RAS only refresh)	$I_{CC3}$	/RAS cycling, /CAS = $V_{IH}$ , $t_{RC} = \text{Min.}$	-	250	-	230	-	210	mA	1, 2
Average Power Supply Current (/CAS before /RAS refresh)	$I_{CC6}$	/RAS cycling, /CAS before /RAS	-	250	-	230	-	210	mA	1, 2
Average Power Supply Current (Fast Page Mode)	$I_{CC7}$	/RAS = $V_{IL}$ , /CAS cycling, $t_{HPC} = \text{Min.}$	-	250	-	230	-	210	mA	1, 3

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

AC Characteristics (1/2)

(V<sub>CC</sub> = 3.3V ± 0.3V, T<sub>a</sub> = 0°C to 70°C) Note: 1, 2, 3

Parameter	Symbol	-50		-60		-70		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
Random Read or Write Cycle Time	t <sub>RC</sub>	84	-	104	-	124	-	ns	
Read Modify Write Cycle Time	t <sub>RWC</sub>	110	-	135	-	160	-	ns	
Fast Page Mode Cycle Time	t <sub>HPC</sub>	20	-	25	-	30	-	ns	
Fast Page Mode Read Modify Write Cycle Time	t <sub>HPRWC</sub>	58	-	68	-	78	-	ns	
Access Time from /RAS	t <sub>RAC</sub>	-	50	-	60	-	70	ns	4, 5, 6
Access Time from /CAS	t <sub>CAC</sub>	-	13	-	15	-	20	ns	4, 5
Access Time from Column Address	t <sub>AA</sub>	-	25	-	30	-	35	ns	4, 6
Access Time from /CAS Precharge	t <sub>CPA</sub>	-	30	-	35	-	40	ns	4
Access Time from /OE	t <sub>OEA</sub>	-	13	-	15	-	20	ns	4
Output Low Impedance Time from /CAS	t <sub>CLZ</sub>	0	-	0	-	0	-	ns	4
Data Output Hold After /CAS Low	t <sub>DOH</sub>	5	-	5	-	5	-	ns	
/CAS to Data Output Buffer Turn-off Delay Time	t <sub>CEZ</sub>	0	13	0	15	0	20	ns	7, 8
/RAS to Data Output Buffer Turn-off Delay Time	t <sub>REZ</sub>	0	13	0	15	0	20	ns	7, 8
/OE to Data Output Buffer Turn-off Delay Time	t <sub>OEZ</sub>	0	13	0	15	0	20	ns	7
/WE to Data Output Buffer Turn-off Delay Time	t <sub>WEZ</sub>	0	13	0	15	0	20	ns	7
Transition Time	t <sub>T</sub>	1	50	1	50	1	50	ns	3
Refresh Period	t <sub>REF</sub>	-	16	-	16	-	16	ms	
/RAS Precharge Time	t <sub>RP</sub>	30	-	40	-	50	-	ns	
/RAS Pulse Width	t <sub>RAS</sub>	50	10K	60	10K	70	10K	ns	
/RAS Pulse Width (Fast Page Mode with EDO)	t <sub>RASP</sub>	50	100K	60	100K	70	100K	ns	
/RAS Hold Time	t <sub>RSH</sub>	7	-	10	-	13	-	ns	
/RAS Hold Time referenced to /OE	t <sub>ROH</sub>	7	-	10	-	13	-	ns	
/CAS Precharge Time (Fast Page Mode with EDO)	t <sub>CP</sub>	7	-	10	-	10	-	ns	
/CAS Pulse Width	t <sub>CAS</sub>	7	10K	10	10K	13	10K	ns	
/CAS Hold Time	t <sub>CSH</sub>	35	-	40	-	45	-	ns	
/CAS to /RAS Precharge Time	t <sub>CRP</sub>	5	-	5	-	5	-	ns	
/RAS Hold Time from /CAS Precharge	t <sub>RHCP</sub>	30	-	35	-	40	-	ns	
/OE Hold Time from /CAS (DQ Disable)	t <sub>CHO</sub>	5	-	5	-	5	-	ns	
/RAS to /CAS Delay Time	t <sub>RCD</sub>	11	37	14	45	14	50	ns	5
/RAS to Column Address Delay Time	t <sub>RAD</sub>	9	25	12	30	12	35	ns	6
Row Address Set-up Time	t <sub>ASR</sub>	0	-	0	-	0	-	ns	
Row Address Hold Time	t <sub>RAH</sub>	7	-	10	-	10	-	ns	
Column Address Set-up Time	t <sub>ASC</sub>	0	-	0	-	0	-	ns	
Column Address Hold Time	t <sub>CAH</sub>	7	-	10	-	13	-	ns	
Column Address to /RAS Lead Time	t <sub>RAL</sub>	25	-	30	-	35	-	ns	



## AC Characteristics (2/2)

(V<sub>CC</sub> = 3.3V ± 0.3V, T<sub>a</sub> = 0°C to 70°C) Note: 1, 2, 3

Parameter	Symbol	-50		-60		-70		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
Read Command Set-up Time	t <sub>RCS</sub>	0	-	0	-	0	-	ns	
Read Command Hold Time	t <sub>RCH</sub>	0	-	0	-	0	-	ns	9
Read Command Hold Time referenced to /RAS	t <sub>RRH</sub>	0	-	0	-	0	-	ns	9
Write Command Set-up Time	t <sub>WCS</sub>	0	-	0	-	0	-	ns	10
Write Command Hold Time	t <sub>WCH</sub>	7	-	10	-	13	-	ns	
Write Command Pulse Width	t <sub>WP</sub>	7	-	10	-	10	-	ns	
/WE Pulse Width (DQ Disable)	t <sub>WPE</sub>	7	-	10	-	10	-	ns	
/OE Command Hold Time	t <sub>OEH</sub>	7	-	10	-	13	-	ns	
/OE Precharge Time	t <sub>OEP</sub>	7	-	10	-	10	-	ns	
/OE Command Hold Time	t <sub>OCH</sub>	7	-	10	-	10	-	ns	
Write Command to /RAS Lead Time	t <sub>RWL</sub>	7	-	10	-	13	-	ns	
Write Command to /CAS Lead Time	t <sub>CWL</sub>	7	-	10	-	13	-	ns	
Data-in Set-up Time	t <sub>DS</sub>	0	-	0	-	0	-	ns	
Data-in Hold Time	t <sub>DH</sub>	7	-	10	-	13	-	ns	
/OE to Data-in Delay Time	t <sub>OED</sub>	13	-	15	-	20	-	ns	
/CAS to /WE Delay Time	t <sub>CWD</sub>	30	-	34	-	44	-	ns	10
Column Address to /WE Delay Time	t <sub>AWD</sub>	42	-	49	-	59	-	ns	10
/RAS to /WE Delay Time	t <sub>RWD</sub>	67	-	79	-	94	-	ns	10
/CAS Precharge /WE Delay Time	t <sub>CPWD</sub>	47	-	54	-	64	-	ns	10
/CAS Active Delay Time from /RAS Precharge	t <sub>RPC</sub>	5	-	5	-	5	-	ns	
/RAS to /CAS Set-up Time (/CAS before /RAS)	t <sub>CSR</sub>	5	-	5	-	5	-	ns	
/RAS to /CAS Hold Time (/CAS before /RAS)	t <sub>CHR</sub>	10	-	10	-	10	-	ns	

- Notes:
1. A start-up delay of 200 $\mu$ 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 assume  $t_T = 2$ ns.
  3.  $V_{IH}(\text{Min.})$  and  $V_{IL}(\text{Max.})$  are reference levels for measuring input timing signals. Transition times ( $t_T$ ) are measured between  $V_{IH}$  and  $V_{IL}$ .
  4. This parameter is measured with a load circuit equivalent to 1 TTL load and 100pF. The output timing reference levels are  $V_{OH} = 2.0$ V and  $V_{OL} = 0.8$ V.
  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.  $t_{CEZ}(\text{Max.})$ ,  $t_{REZ}(\text{Max.})$ ,  $t_{WEZ}(\text{Max.})$  and  $t_{OEZ}(\text{Max.})$  define the time at which the output achieves the open circuit condition and are not referenced to output voltage levels.
  8.  $t_{CEZ}$  or  $t_{REZ}$  must be satisfied for open circuit condition.
  9.  $t_{RCH}$  or  $t_{RRH}$  must be satisfied for a read cycle.
  10.  $t_{WCS}$ ,  $t_{CWD}$ ,  $t_{RWD}$ ,  $t_{AWD}$  and  $t_{CPWD}$  are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only. If  $t_{WCS} \geq t_{WCS}(\text{Min.})$ , then the cycle is an early write cycle and the data out will remain open circuit (high impedance) throughout the entire cycle. If  $t_{CWD} \geq t_{CWD}(\text{Min.})$ ,  $t_{RWD} \geq t_{RWD}(\text{Min.})$ ,  $t_{AWD} \geq t_{AWD}(\text{Min.})$  and  $t_{CPWD} \geq t_{CPWD}(\text{Min.})$ , then the cycle is a read modify write cycle and data out will contain data read from the selected cell; if neither of the above sets of conditions is satisfied, then the condition of the data out (at access time) is indeterminate.