

# OKI Semiconductor

## MSC23CV432D-xxBS8

**4,194,304-word x 32-bit DYNAMIC RAM MODULE : FAST PAGE MODE TYPE**

### DESCRIPTION

The MSC23CV432D-xxBS8 is a fully decoded, 4,194,304-word x 32-bit CMOS dynamic random access memory module composed of eight 16Mb DRAMs (4Mx4) in TSOP packages mounted with eight decoupling capacitors on a 72-pin glass epoxy small outline package. This module supports any application where high density and large capacity of storage memory are required.

### FEATURES

- 4,194,304-word x 32-bit organization
- 72-pin Small Outline Dual In-line Memory module  
     MSC23CV432D-xxBS8 : Gold tab
- Single +3.3V supply  $\pm$  0.3V tolerance
- Input : LVTTTL compatible
- Output : LVTTTL compatible, 3-state
- Refresh : 2048cycles/32ms
- /CAS before /RAS refresh, hidden refresh, /RAS only refresh capability
- Fast page mode capability
- Multi-bit test mode capability
- 11/11 Addressing (Row/Column)

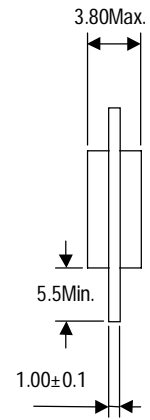
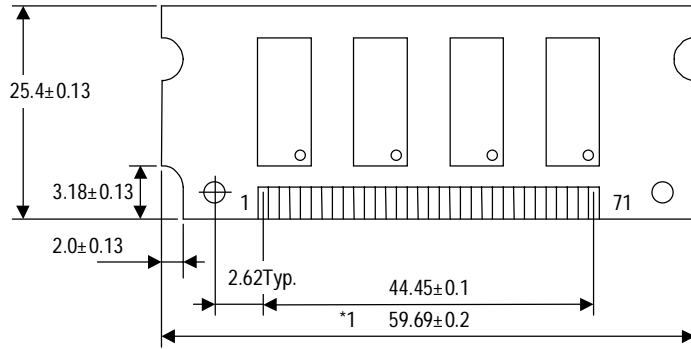
### PRODUCT FAMILY

Family	Access Time (Max.)			Cycle Time (Min.)	Power Dissipation	
	t <sub>RAC</sub>	t <sub>AA</sub>	t <sub>CAC</sub>		Operating (Max.)	Standby (Max.)
MSC23CV432D-60BS8	60ns	30ns	15ns	110ns	2592mW	14.4mW
MSC23CV432D-70BS8	70ns	35ns	20ns	130ns	2304mW	

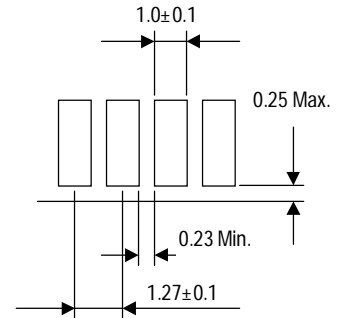
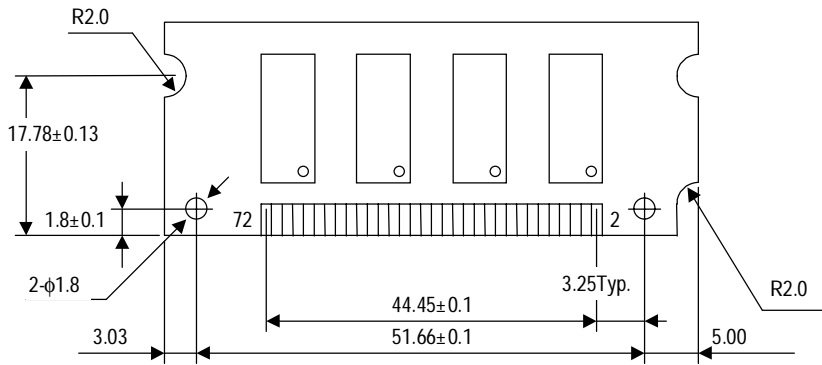
MODULE OUTLINE

MSC23CV432D-xxBS8

(Unit : mm)



\*1 The common size difference of the board width 19.78mm of its height is specified as  $\pm 0.2$ .  
The value above 19.78mm is specified as  $\pm 0.5$ .



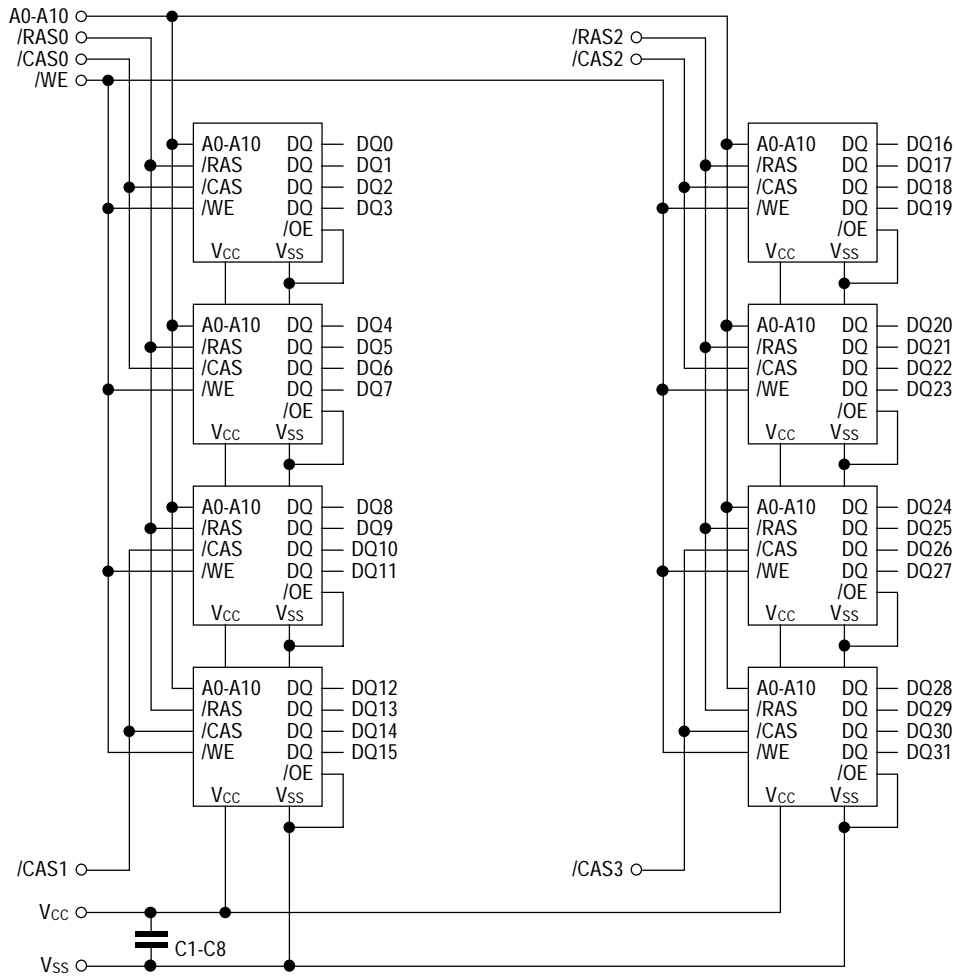
## PIN CONFIGURATION

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>	37	DQ16	2	DQ0	38	DQ17
3	DQ1	39	V <sub>SS</sub>	4	DQ2	40	/CAS0
5	DQ3	41	/CAS2	6	DQ4	42	/CAS3
7	DQ5	43	/CAS1	8	DQ6	44	/RAS0
9	DQ7	45	NC	10	V <sub>CC</sub>	46	NC
11	PD1	47	/WE	12	A0	48	NC
13	A1	49	DQ18	14	A2	50	DQ19
15	A3	51	DQ20	16	A4	52	DQ21
17	A5	53	DQ22	18	A6	54	DQ23
19	A10	55	NC	20	NC	56	DQ24
21	DQ8	57	DQ25	22	DQ9	58	DQ26
23	DQ10	59	DQ27	24	DQ11	60	DQ28
25	DQ12	61	V <sub>CC</sub>	26	DQ13	62	DQ29
27	DQ14	63	DQ30	28	A7	64	DQ31
29	NC	65	NC	30	V <sub>CC</sub>	66	PD2
31	A8	67	PD3	32	A9	68	PD4
33	NC	69	PD5	34	/RAS2	70	PD6
35	DQ15	71	PD7	36	NC	72	V <sub>SS</sub>

## Presence Detect Pins

Pin No.	Pin Name	-60	-70
11	PD1	NC	NC
66	PD2	NC	NC
67	PD3	V <sub>SS</sub>	V <sub>SS</sub>
68	PD4	NC	NC
69	PD5	NC	V <sub>SS</sub>
70	PD6	NC	NC
71	PD7	NC	NC

**BLOCK DIAGRAM**



## ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Voltage on Any Pin Relative to $V_{SS}$	$V_{IN}, V_{OUT}$	-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	$P_D$ *	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	$V_{CC}$	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

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

Parameter	Symbol	Typ.	Max.	Unit
Input Capacitance (A0 - A10)	$C_{IN1}$	-	57	pF
Input Capacitance (/WE)	$C_{IN2}$	-	65	pF
Input Capacitance (/RAS0, /RAS2)	$C_{IN3}$	-	35	pF
Input Capacitance (/CAS0- /CAS3)	$C_{IN4}$	-	20	pF
I/O Capacitance (DQ0 - DQ31)	$C_{DQ}$	-	16	pF

## DC Characteristics

(V<sub>CC</sub> = 3.3V ± 0.3V, Ta = 0°C to +70°C )

Parameter	Symbol	Condition	-60		-70		Unit	Note
			Min.	Max.	Min.	Max.		
Input Leakage Current	I <sub>LI</sub>	0V ≤ V <sub>IN</sub> ≤ V <sub>CC</sub> +0.3V; All other pins not under test = 0V	-80	80	-80	80	μA	
Output Leakage Current	I <sub>LO</sub>	DQ disable 0V ≤ V <sub>OUT</sub> ≤ V <sub>CC</sub>	-10	10	-10	10	μA	
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -2.0mA	2.4	V <sub>CC</sub>	2.4	V <sub>CC</sub>	V	
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 2.0mA	0	0.4	0	0.4	V	
Average Power Supply Current (Operating)	I <sub>CC1</sub>	/RAS, /CAS cycling, t <sub>RC</sub> = Min.	-	720	-	640	mA	1, 2
Power supply current (Standby)	I <sub>CC2</sub>	/RAS, /CAS = V <sub>IH</sub>	-	16	-	16	mA	1
		/RAS, /CAS ≥ V <sub>CC</sub> -0.2V	-	4	-	4	mA	1
Average Power Supply Current (/RAS only refresh)	I <sub>CC3</sub>	/RAS cycling, /CAS = V <sub>IH</sub> , t <sub>RC</sub> = Min.	-	720	-	640	mA	1, 2
Average Power Supply Current (/CAS before /RAS refresh)	I <sub>CC6</sub>	/RAS cycling, /CAS before /RAS	-	720	-	640	mA	1, 2
Average Power Supply Current (Fast Page Mode)	I <sub>CC7</sub>	/RAS = V <sub>IL</sub> , /CAS cycling, t <sub>PC</sub> = Min.	-	560	-	520	mA	1, 3

- Notes: 1. I<sub>CC</sub> Max. is specified as I<sub>CC</sub> for output open condition.  
2. The address can be changed once or less while /RAS = V<sub>IL</sub>.  
3. The address can be changed once or less while /CAS = V<sub>IH</sub>.

## 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, 9, 10

Parameter	Symbol	-60		-70		Unit	Note
		Min.	Max.	Min.	Max.		
Random Read or Write Cycle Time	t <sub>RC</sub>	110	-	130	-	ns	
Fast Page Mode Cycle Time	t <sub>PC</sub>	40	-	45	-	ns	
Access Time from /RAS	t <sub>RAC</sub>	-	60	-	70	ns	4, 5, 6
Access Time from /CAS	t <sub>CAC</sub>	-	15	-	20	ns	4, 5
Access Time from Column Address	t <sub>AA</sub>	-	30	-	35	ns	4, 6
Access Time from /CAS Precharge	t <sub>CPA</sub>	-	35	-	40	ns	4
Output Low Impedance Time from /CAS	t <sub>CLZ</sub>	0	-	0	-	ns	4
/CAS to Data Output Buffer Turn-off Delay Time	t <sub>OFF</sub>	0	15	0	20	ns	7
Transition Time	t <sub>T</sub>	3	50	3	50	ns	3
Refresh Period	t <sub>REF</sub>	-	32	-	32	ms	
/RAS Precharge Time	t <sub>RP</sub>	40	-	50	-	ns	
/RAS Pulse Width	t <sub>RAS</sub>	60	10K	70	10K	ns	
/RAS Pulse Width (Fast Page Mode)	t <sub>RASP</sub>	60	100K	70	100K	ns	
/RAS Hold Time	t <sub>RSH</sub>	15	-	20	-	ns	
/CAS Precharge Time (Fast Page Mode)	t <sub>CP</sub>	10	-	10	-	ns	
/CAS Pulse Width	t <sub>CAS</sub>	15	10K	20	10K	ns	
/CAS Hold Time	t <sub>CSH</sub>	60	-	70	-	ns	
/CAS to /RAS Precharge Time	t <sub>CRP</sub>	5	-	5	-	ns	
/RAS Hold Time from /CAS Precharge	t <sub>RHCP</sub>	35	-	40	-	ns	
/RAS to /CAS Delay Time	t <sub>RCD</sub>	20	45	20	50	ns	5
/RAS to Column Address Delay Time	t <sub>RAD</sub>	15	30	15	35	ns	6
Row Address Set-up Time	t <sub>ASR</sub>	0	-	0	-	ns	
Row Address Hold Time	t <sub>RAH</sub>	10	-	10	-	ns	
Column Address Set-up Time	t <sub>ASC</sub>	0	-	0	-	ns	
Column Address Hold Time	t <sub>CAH</sub>	10	-	15	-	ns	
Column Address to /RAS Lead Time	t <sub>RAL</sub>	30	-	35	-	ns	
Read Command Set-up Time	t <sub>RCS</sub>	0	-	0	-	ns	
Read Command Hold Time	t <sub>RCH</sub>	0	-	0	-	ns	8
Read Command Hold Time referenced to /RAS	t <sub>RRH</sub>	0	-	0	-	ns	8

## 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, 9, 10

Parameter	Symbol	-60		-70		Unit	Note
		Min.	Max.	Min.	Max.		
Write Command Set-up Time	t <sub>WCS</sub>	0	-	0	-	ns	
Write Command Hold Time	t <sub>WCH</sub>	10	-	15	-	ns	
Write Command Pulse Width	t <sub>WCP</sub>	10	-	10	-	ns	
Write Command to /RAS Lead Time	t <sub>RWL</sub>	15	-	20	-	ns	
Write Command to /CAS Lead Time	t <sub>CWL</sub>	15	-	20	-	ns	
Data-in Set-up Time	t <sub>DS</sub>	0	-	0	-	ns	
Data-in Hold Time	t <sub>DH</sub>	10	-	15	-	ns	
/CAS Active Delay Time from /RAS Precharge	t <sub>RPC</sub>	5	-	5	-	ns	
/RAS to /CAS Set-up Time (/CAS before /RAS)	t <sub>CSR</sub>	10	-	10	-	ns	
/RAS to /CAS Hold Time (/CAS before /RAS)	t <sub>CHR</sub>	10	-	10	-	ns	
/WE to /RAS Precharge Time (/CAS before /RAS)	t <sub>WRP</sub>	10	-	10	-	ns	
/WE Hold Time from /RAS (/CAS before /RAS)	t <sub>WRH</sub>	10	-	10	-	ns	
/RAS to /WE Set-up Time (Test Mode)	t <sub>WTS</sub>	10	-	10	-	ns	
/RAS to /WE Hold Time (Test Mode)	t <sub>WTH</sub>	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 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 1TTL loads 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.  $t_{OFF}(\text{Max.})$  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.
  9. The test mode is initiated by performing a /WE and /CAS before /RAS refresh cycle. This mode is latched and remains in effect until the exit cycle is generated. The test mode specified in this data sheet is a 4-bit parallel test function. In a test mode CA0 and CA1 is not used. In a read cycle, if all internal bits are equal, the DQ pin will indicate a high level. If any internal bits are not equal, the DQ pin will indicate a low level. The test mode is cleared and the memory device returned to its normal operating state by performing a /RAS only refresh cycle or a /CAS before /RAS refresh cycle.
  10. In a test mode read cycle, the value of access time parameters is delayed for 5ns for the specified value. These parameters should be specified in test mode cycle by adding the above value to the specified value in this data sheet.