

OKI Semiconductor

MSC23B1321D-xxBS2/DS2

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

DESCRIPTION

The MSC23B1321D-xxBS2/DS2 is a fully decoded, 1,048,576-word x 32-bit CMOS dynamic random access memory module composed of two 16Mb DRAMs in SOJ packages mounted with four 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

- 1,048,576-word x 32-bit organization
- 72-pin socket insertable module
 - MSC23B1321D-xxBS2 : Gold tab
 - MSC23B1321D-xxDS2 : 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

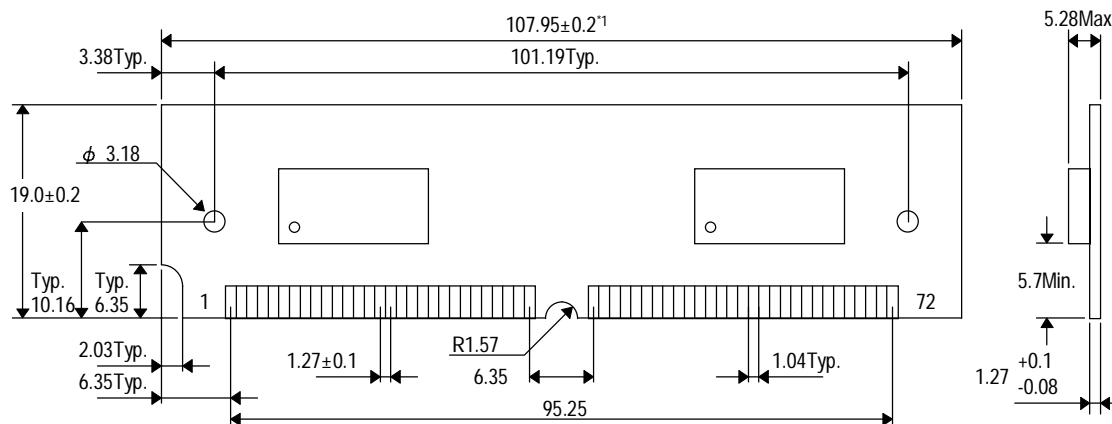
PRODUCT FAMILY

| Family | Access Time (Max.) | | | Cycle Time (Min.) | Power Dissipation | |
|-----------------------|--------------------|-----------------|------------------|-------------------|-------------------|---------------|
| | t _{RAC} | t _{AA} | t _{CAC} | | Operating(Max.) | Standby(Max.) |
| MSC23B1321D-60BS2/DS2 | 60ns | 30ns | 15ns | 110ns | 1375mW | 11mW |
| MSC23B1321D-70BS2/DS2 | 70ns | 35ns | 20ns | 130ns | 1265mW | |

MODULE OUTLINE

MSC23B1321D-xxBS2/DS2

(Unit : mm)



*1 The common size difference of the board width 12.5mm of its height is specified as ± 0.2 .
The value above 12.5mm is specified as ± 0.5 .

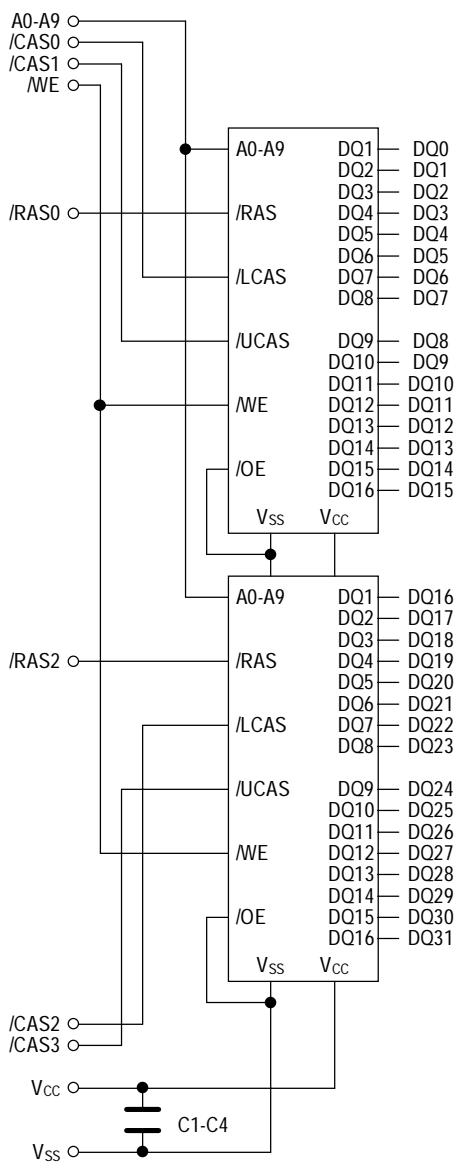
PIN CONFIGURATION

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

Presence Detect Pins

| Pin No. | Pin Name | MSC23B1321D -60BS2/DS2 | MSC23B1321D -70BS2/DS2 |
|---------|----------|---------------------------|---------------------------|
| 67 | PD1 | V _{SS} | V _{SS} |
| 68 | PD2 | V _{SS} | V _{SS} |
| 69 | PD3 | NC | V _{SS} |
| 70 | PD4 | NC | NC |

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

(Ta = 25°C)

| 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 | 2 | W |
| Operating Temperature | T _{OPR} | 0 to +70 | °C |
| Storage Temperature | T _{STG} | -40 to +125 | °C |

Recommended Operating Conditions

(Ta = 0°C to +70°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 ± 10%, Ta = 25°C, f = 1 MHz)

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

Note: Capacitance measured with Boonton Meter.

DC Characteristics

($V_{CC} = 5V \pm 10\%$, $T_a = 0^{\circ}C$ to $+70^{\circ}C$)

| Parameter | Symbol | Condition | MSC23B1321D -60BS2/DS2 | | MSC23B1321D -70BS2/DS2 | | Unit | Note | |
|---|-----------|--|---------------------------|----------|---------------------------|----------|---------|------|---|
| | | | Min. | Max. | Min. | Max. | | | |
| Input Leakage Current | I_{LI} | $0V \leq V_{IN} \leq 6.5V$: All other pins not under test = 0V | -20 | 20 | -20 | 20 | μA | | |
| Output Leakage Current | I_{LO} | Data out is disable $0V \leq V_{OUT} \leq 5.5V$ | -10 | 10 | -10 | 10 | 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 cycling, /CAS cycling, $t_{RC} = \text{min.}$ | - | 250 | - | 230 | mA | 1, 2 | |
| Power supply current (Standby) | I_{CC2} | /RAS = V_{IH} /CAS = V_{IH} | TTL | - | 4 | - | 4 | mA | 1 |
| | | | MOS | - | 2 | - | 2 | mA | 1 |
| Average Power Supply Current (/RAS only refresh) | I_{CC3} | /RAS cycling, /CAS = V_{IH} , $t_{RC} = \text{min.}$ | - | 250 | - | 230 | mA | 1, 2 | |
| Average Power Supply Current (/CAS before /RAS refresh) | I_{CC6} | $t_{RC} = \text{min.}$ | - | 250 | - | 230 | mA | 1, 2 | |
| Average Power Supply Current (Fast Page Mode) | I_{CC7} | /RAS = V_{IL} , /CAS cycling, $t_{PC} = \text{min.}$ | - | 250 | - | 230 | mA | 1, 3 | |

- Notes: 1. I_{CC} is dependent on output loading and cycles rates. Specified values are obtained with the output open.
 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 | MSC23B1321D -60BS2/DS2 | | MSC23B1321D -70BS2/DS2 | | 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} | 10 | - | 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 | MSC23B1321D -60BS2/DS2 | | MSC23B1321D -70BS2/DS2 | | 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 _{WP} | 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} | 10 | - | 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.