

OKI semiconductor

MSC23B136D-xxBS4/DS4

1,048,576 Word By 36 Bit DYNAMIC RAM MODULE : FAST PAGE MODE

GENERAL DESCRIPTION

The Oki MSC23B136D-xxBS4/DS4 is a fully decoded, 1,048,576 word X 36 bit CMOS dynamic random access memory composed of two 16Mb(1Mx16) DRAMs and two 2Mb(1Mx2) DRAMs in SOJ.

The mounting of four DRAMs together with decoupling capacitors on a 72-pin glass epoxy Single-in-Line Package supports any application where high density and large capacity of storage memory are required.

FEATURES

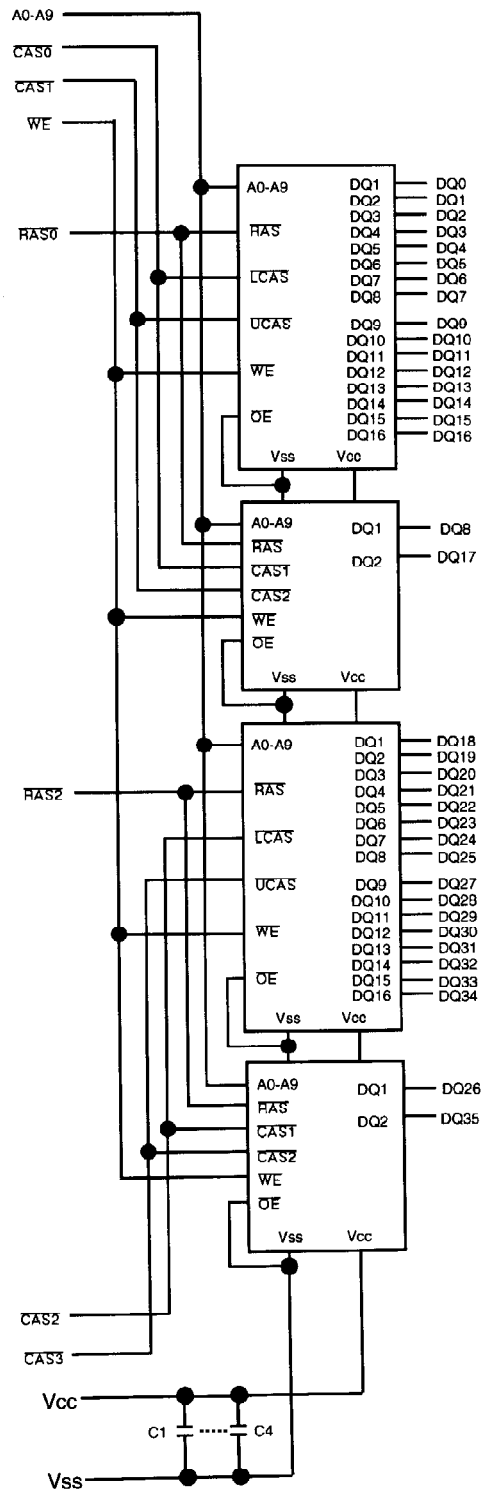
- 1,048,576 word X 36 bit organization
- 72-pin socket insertable module
 - MSC23B136D-xxBS4 : Gold tab
 - MSC23B136D-xxDS4 : Solder tab
- Single +5 V supply $\pm 10\%$ tolerance
- Input : TTL compatible
- Output : TTL compatible, tristate, nonlatch
- Refresh : 1024 cycles/16 ms
- $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh, $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ hidden refresh, $\overline{\text{RAS}}$ only refresh capability

FAMILY ORGANIZATION

FAMILY	ACCESS TIME (MAX)			Cycle Time (MAX)	Power Dissipation	
	t _{RAC}	t _{AA}	t _{CAC}		Operating (MAX)	Standby (Max)
MSC23B136D-60BS4/DS4	60ns	30ns	15ns	110ns	2256mW	22mW
MSC23B136D-70BS4/DS4	70ns	35ns	20ns	130ns	2036mW	

FUNCTIONAL BLOCK DIAGRAM

MSC23B136D-xxBS4/DS4



PIN CONFIGURATION

MSC23B136D-xxBS4/DS4

Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	Vss	19	NC	37	DQ17	55	DQ12
2	DQ0	20	DQ4	38	DQ35	56	DQ30
3	DQ18	21	DQ22	39	Vss	57	DQ13
4	DQ1	22	DQ5	40	CAS0	58	DQ31
5	DQ19	23	DQ23	41	CAS2	59	Vcc
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	NC	63	DQ15
10	Vcc	28	A7	46	NC	64	DQ34
11	NC	29	NC	47	WE	65	DQ16
12	A0	30	Vcc	48	NC	66	NC
13	A1	31	A8	49	DQ9	67	PD1
14	A2	32	A9	50	DQ27	68	PD2
15	A3	33	NC	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	Vss

PRESENCE DETECT PINS

Pin No.	Pin name	-60	-70
67	PD1	Vss	Vss
68	PD2	Vss	Vss
69	PD3	NC	Vss
70	PD4	NC	NC

ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Voltage on any pin relative to Vss	V _{IN} , V _{OUT}	- 1.0 ~ + 7.0	V
Voltage Vcc supply relative to Vss	V _{CC}	- 1.0 ~ + 7.0	V
Short circuit output current	I _{OS}	50	mA
Power dissipation	P _D	4	W
Operating temperature	T _{OPR}	- 0 ~ + 70	°C
Storage temperature	T _{STG}	- 40 ~ + 125	°C

NOTE:

Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted within the limits as specified in this data sheet. Exposure to absolute maximum rating conditions for extended period may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN	TYPE	MAX	UNIT	Operating temperature 0 °C ~ + 70 °C
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

Parameter	Symbol	Typ.	MAX	Unit
Input Capacitance(A0-A9)	C _{IN1}	-	29	pF
Input Capacitance(WE)	C _{IN2}	-	35	pF
Input Capacitance(RAS0, RAS2)	C _{IN3}	-	20	pF
Input Capacitance(CAS0-CAS3)	C _{IN4}	-	20	pF
I/O Capacitance(DQ0-DQ35)	C _{DQ}	-	13	pF

Capacitance measured with Boonton Meter.

DC CHARACTERISTICS

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

Parameter	Symbol	Condition	MSC23B136D-60BS4/DS4		MSC23B136D-70BS4/DS4		Unit	Note	
			Min	Max	Min	Max			
Input Leakage Current	I_{LI}	$0V \leq V_{in} \leq 6.5V$: All other pins not under test = $0V$	-40	40	-40	40	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 $t_{RC} = \min$	-	410	-	370	mA	1,2	
Power supply current (Standby)	I_{CC2}	RAS = V_{IH} CAS = V_{IH}	TTL	-	8	-	8	mA	
			MOS	-	4	-	4	mA	
Average power supply current (RAS only refresh)	I_{CC3}	RAS cycling, CAS = V_{IL} $t_{RC} = \min$	-	410	-	370	mA	1	
Average power supply current (CAS before RAS refresh)	I_{CC6}	$t_{RC} = \min$.	-	410	-	370	mA	1	
Average power supply current (Fast page)	I_{CC7}	RAS = V_{IL} , CAS cycling $t_{PC} = \min$.	-	370	-	340	mA	1,3	

NOTE:

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 CHARACTERISTIC

(V_{CC} = 5V ± 10%, T_a = 0 ~ 70 °C)

NOTE 1.2.3

Parameter	Symbol	MSC23B136D-60BS4/DS4		MSC23B136D-70BS4/DS4		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 $\overline{\text{RAS}}$	t _{RAC}	-	60	-	70	ns	4,5,6
Access time from $\overline{\text{CAS}}$	t _{CAC}	-	15	-	20	ns	4,5
Access time from column address	t _{AA}	-	30	-	35	ns	4,6
Access time from $\overline{\text{CAS}}$ precharge	t _{CPA}	-	35	-	40	ns	4,11
$\overline{\text{CAS}}$ to output in Low-Z	t _{CLZ}	0	-	0	-	ns	4
Output buffer turn-off delay	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	
$\overline{\text{RAS}}$ precharge time	t _{RP}	40	-	50	-	ns	
$\overline{\text{RAS}}$ pulse width	t _{RAS}	60	10K	70	10K	ns	
$\overline{\text{RAS}}$ pulse width (Fast page mode)	t _{RASP}	60	100K	70	100K	ns	
$\overline{\text{RAS}}$ hold time	t _{RSH}	15	-	20	-	ns	
$\overline{\text{CAS}}$ precharge time	t _{CP}	10	-	10	-	ns	13
$\overline{\text{CAS}}$ pulse width	t _{CAS}	15	10K	20	10K	ns	
$\overline{\text{CAS}}$ hold time	t _{CSH}	60	-	70	-	ns	
$\overline{\text{CAS}}$ to $\overline{\text{RAS}}$ precharge time	t _{CRP}	5	-	5	-	ns	11
$\overline{\text{RAS}}$ hold time from $\overline{\text{CAS}}$ precharge	t _{RHCP}	35	-	40	-	ns	11
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ delay time	t _{RCD}	20	45	20	50	ns	5
$\overline{\text{RAS}}$ 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	10
Column address hold time	t _{CAH}	15	-	15	-	ns	10
Column address to $\overline{\text{RAS}}$ load time	t _{RAL}	30	-	35	-	ns	

AC CHARACTERISTICS (Continued)
(V_{cc} = 5V ± 10%, T_a = 0 ~70 °C)

Parameter	Symbol	MSC23B136D-60BS4/DS4		MSC23B136D-70BS4/DS4		UNIT	NOTE
		MIN	MAX	MIN	MAX		
Read command set-up time	t _{RCS}	0	-	0	-	ns	10
Read command hold time	t _{RCH}	0	-	0	-	ns	8,10
Read command hold time reference to RAS	t _{RRH}	0	-	0	-	ns	8
Write command set-up time	t _{WCS}	0	-	0	-	ns	10
Write command hold time	t _{WCH}	10	-	15	-	ns	10
Write command pulse width	t _{WP}	10	-	10	-	ns	
Write command to RAS read time	t _{RWL}	15	-	20	-	ns	
Write command to CAS read time	t _{CWL}	15	-	20	-	ns	12
Data-in set-up time	t _{DS}	0	-	0	-	ns	9,10
Data-in hold time	t _{DH}	15	-	15	-	ns	9,10
CAS precharge WE delay time	t _{CPWD}	60	-	70	-	ns	
CAS active delay time from RAS precharge	t _{RPC}	5	-	5	-	ns	10
RAS to CAS set-up time (CAS before RAS)	t _{CSR}	10	-	10	-	ns	10
CAS hold time (CAS before RAS)	t _{CHR}	10	-	10	-	ns	11

- NOTES:
- 1) An initial pause of 200 μ s is required after power-up followed by a minimum of 8 initialization cycles (examples: $\overline{\text{RAS}}$ only refresh or $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh) before proper device operation is achieved.
 - 2) The AC measurements assume the transition time (t_T) = 5 ns.
 - 3) V_{IH} (min.) and V_{IL} (max.) are reference levels for measuring the timing of the input signals. Transition times are measured between V_{IH} and V_{IL} .
 - 4) Measured by using an equivalent load circuit of 2 TTL loads and 100 pF.
 - 5) Operation within the t_{RCD} (max) limit ensures that t_{RAC} (max) can be met. t_{RCD} (max) is specified as a reference point only: if t_{RCD} is greater than the specified t_{RCD} (max) limit, then access time is controlled by t_{CAC} .
 - 6) Operation within the t_{RAD} (max) limit ensures that t_{RAC} (max) can be met. t_{RAD} (max) is specified as a reference point only: if t_{RAD} is greater than the specified t_{RAD} (max) limit, then access time is controlled by t_{AA} .
 - 7) The t_{OFF} (max.) spec. defines at which time the output data achieves a high impedance state and is not referenced to output voltage levels.
 - 8) Either the t_{RRH} or the t_{RCH} spec. must be satisfied for proper read cycle.
 - 9) These parameters are referenced to $\overline{\text{UCAS}}$ and $\overline{\text{LCAS}}$ leading edge in an early write cycle.
 - 10) These parameters are determined by the earlier falling edge of $\overline{\text{UCAS}}$ or $\overline{\text{LCAS}}$.
 - 11) These parameters are determined by the later rising edge of $\overline{\text{UCAS}}$ or $\overline{\text{LCAS}}$.
 - 12) t_{CWL} should be satisfied by both $\overline{\text{UCAS}}$ or $\overline{\text{LCAS}}$.
 - 13) t_{CP} is determined by the time of both $\overline{\text{UCAS}}$ or $\overline{\text{LCAS}}$ are high.