KMCJ616512
512K x 16 / 1M x 8

July 1993

GENERAL DESCRIPTION

The KMCJ616512 is the industry standard SRAM memory card and consists of Samsung's advanced 32 TSOP 1M bits SRAM devices.

The Samsung memory card family is designed to protect the internal circuitry from electrostatic discharge by using metal plates on the top and bottom side of the card, and supports the PCMCIA/JEIDA standard to provide system upgradability and exchangeability.

The memory card features 8K byte EEPROM attribute memory space for card information and voltage detection circuitry to prevent the stored data loosing. The auxiliary rechargeable battery guarantee the data retention during the main battery replacement.

The memory card offers the user to configure x8/16 organization for the ease of system interface, and is designed suitable for the large data storage system of portable type and hand-held application

FEATURES

- Fast Access Time : 150/200/250ns
- Low Power Dissipation
  - Standby Current : 2.0 mA(Typ)
  - Operating Current
    x8 Configuration : 100 mA(Max)
    x16 Configuration : 140 mA(Max)
- Power Supply : Single 5V ± 5%
- Electrostatic Discharge Protection : 15KV
- Industry Standard (PCMCIA2.0/JEIDA4.1)
  - Connector Type : 68 Pin Two Piece Type
  - Card Dimensions : 85.6 x 54.0 x 3.3 (mm)
- Long Life Battery
  - Replaceable Battery : BR2325
  - Rechargeable Battery : AL920
- Attribute Memory : 8K Byte EEPROM
- TTL Compatible Inputs and Outputs
- Three - State Outputs

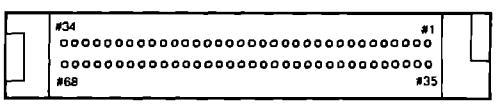
PIN CONFIGURATION

1	GND	18	NC	35	GND	52	NC
2	D3	19	A16	36	/CD1	53	NC
3	D4	20	A15	37	D11	54	NC
4	D5	21	A12	38	D12	55	NC
5	D6	22	A7	39	D13	56	NC
6	D7	23	A6	40	D14	57	NC
7	/CE1	24	A5	41	D15	58	NC
8	A10	25	A4	42	/CE2	59	NC
9	/OE	26	A3	43	NC	60	NC
10	A11	27	A2	44	NC	61	/REG
11	A9	28	A1	45	NC	62	BVD2
12	A8	29	A0	46	A17	63	BVD1
13	A13	30	D0	47	A18	64	D8
14	A14	31	D1	48	A19	65	D9
15	/WE	32	D2	49	NC	66	D10
16	NC	33	WP	50	NC	67	/CD2
17	VCC	34	GND	51	VCC	68	GND

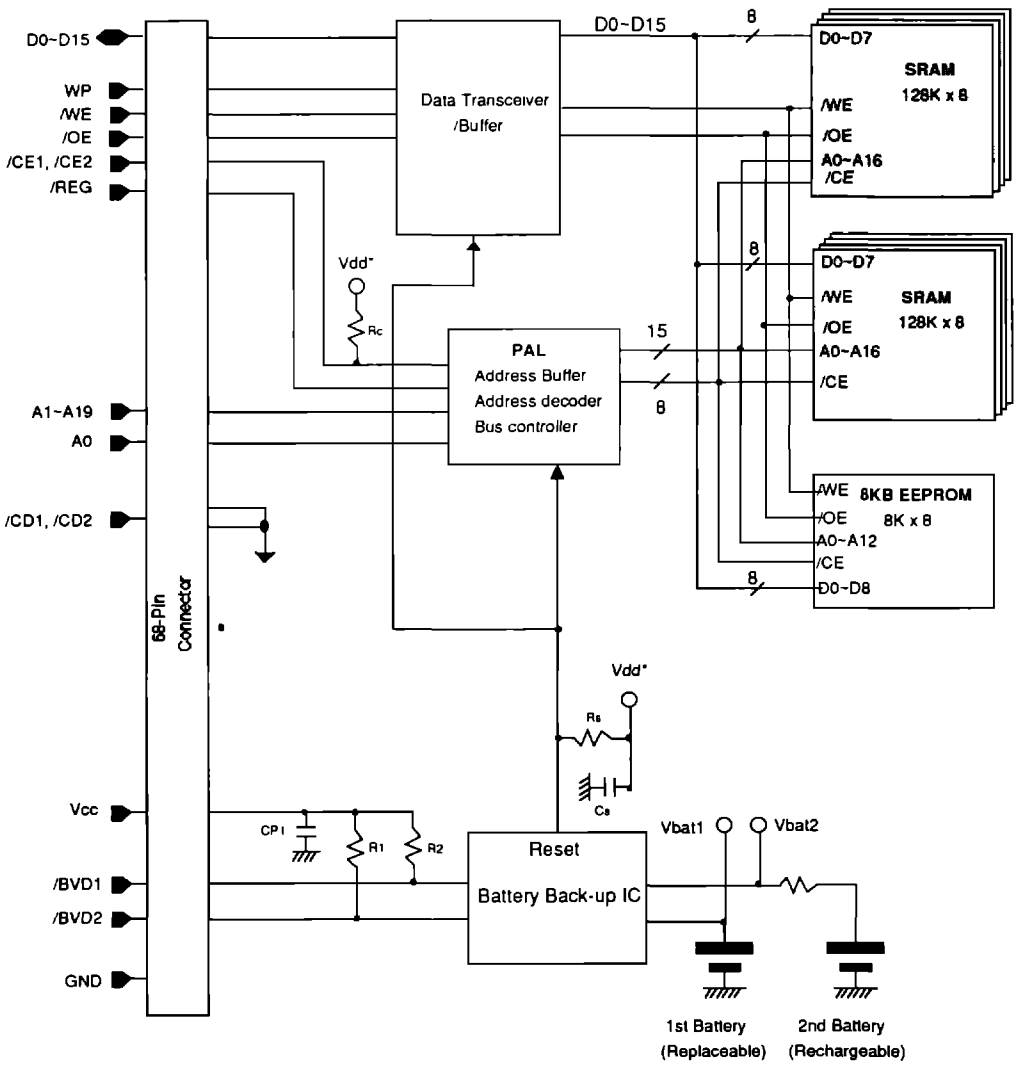
PIN DESCRIPTION

A0~A19	Address Inputs
D0~D15	Data Inputs / Outputs
/CE1, /CE2	Chip Select
/OE	Output Enable
/WE	Write Enable
/REG	EEPROM Enable
WP	Write Protection
/CD1, /CD2	Card Detection
BVD1, BVD2	Battery Detection
VCC	Power Supply (+5V)
GND	Ground
NC	No Connection

PIN CONNECTOR



BLOCK DIAGRAM



Note : Vdd* = Vcc, Vbat1, Vbat2

FUNCTION TRUTH TABLE

COMMON MEMORY READ FUNCTION

Function Mode	/REG	/CE2	/CE1	A0	/OE	/WE	Data Input / Output	
							D15 - D8	D7 - D0
Standby	X	H	H	X	X	X	High-Z	High-Z
Byte Access (8bits)	H	H	L	L	L	H	High-Z	Even-Byte
	H	H	L	H	L	H	High-Z	Odd-Byte
Word Access(16bits)	H	L	L	X	L	H	Odd-Byte	Even-Byte
Odd Byte Only Access	H	L	H	X	L	H	Odd-Byte	High-Z

Note When the IC Card is in common memory read function the Write Protect Switch Position is free

COMMON MEMORY WRITE FUNCTION

Function Mode	/REG	/CE2	/CE1	A0	/OE	/WE	Data Input / Output	
							D15 - D8	D7 - D0
Standby	X	H	H	X	X	X	Don't Care	Don't Care
Byte Access (8bits)	H	H	L	L	H	L	Don't Care	Even-Byte
	H	H	L	H	H	L	Don't Care	Odd-Byte
Word Access(16bits)	H	L	L	X	H	L	Odd-Byte	Even-Byte
Odd Byte Only Access	H	L	H	X	H	L	Odd-Byte	Don't Care

Note When the IC Card is in common memory write function the Write Protect Switch must turn to the left

ATTRIBUTE READ FUNCTION

Function Mode	/REG	/CE2	/CE1	A0	/OE	/WE	Data Input / Output	
							D15 - D8	D7 - D0
Standby	X	H	H	X	X	X	High-Z	High-Z
Byte Access (8bits)	L	H	L	L	L	H	High-Z	Even-Byte
	L	H	L	H	L	H	High-Z	Not Valid
Word Access(16bits)	L	L	L	X	L	H	Not Valid	Even-Byte
Odd Byte Only Access	L	L	H	X	L	H	Not Valid	High-Z

Note When the IC Card is in attribute memory read function the Write Protect Switch Position is free

ATTRIBUTE WRITE FUNCTION

Function Mode	/REG	/CE2	/CE1	A0	/OE	/WE	Data Input / Output	
							D15 - D8	D7 - D0
Standby	X	H	H	X	X	X	Don't Care	Don't Care
Byte Access (8bits)	L	H	L	L	H	L	Don't Care	Even-Byte
	L	H	L	H	H	L	Don't Care	Don't Care
Word Access(16bits)	L	L	L	X	H	L	Don't Care	Even-Byte
Odd Byte Only Access	L	L	H	X	H	L	Don't Care	Don't Care

Note When the IC Card is in attribute memory write function the Write Protect Switch must turn to the left

*Definition H=Vih, L=Vil, X=H or L

ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Conditions	Rating	Units
Supply Voltage	Vcc	With respect to GND	- 0.5 to +6 0	V
Input Voltage	Vin		-0.5 to Vcc + 0 5	V
Output Voltage	Vout		-0.5 to Vcc + 0 5	V
Battery Voltage	Vbat		- 0.5 to +6.0	V
Operating Temperature	Topr	Read / Write Access Data Retention	0 to 60	° C
Storage Temperature	Tstg		- 20 to +65	° C
Ambient Humidity	HA		30 to 90	RH

Note: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the card. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

RECOMMENDED OPERATING CONDITIONS

(Referenced to GND, unless otherwise noted)

Item	Symbol	Min	Typ	Max	Units
Supply voltage	Vcc	4 75	5.0	5.25	V
	GND	—	0	—	
Input High Voltage	Vih	2.4	-	Vcc	V
Input Low Voltage	vil	-0.3	-	0.8	V
Battery voltage	Vbat	2.0	3.0	3.3	V
Operating Ambient Temperature	Topr	0	-	55	°C
Relative Humidity	HA	30	—	90	RH

DC CHARACTERISTICS

(Recommended operating conditions unless otherwise noted.)

(0 °C ≤ Ta ≤ 55°C Vcc=5.0V ± 5%)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Standby Supply Current	Isb1	/CE1 = /CE2≤Vcc-0.2V Other Inputs ≤ 0 2V or ≥ Vcc-0.2		-	2 0	2.5	mA
Standby Supply Current	Isb2	/CE1 = /CE2 =Vih Other Inputs Vih or Vil Outputs=open		-	-	8	mA
Active Supply Current	Icc1*	Cycle=250,/CE1=/CE2≥Vcc-0.2 Others Input Outputs=open	x8	-	90	110	mA
			x16	-	130	150	mA
Average Operating Current	Icc2**	Cycle = 250, /CE1=/CE2 =Vil Others Input Vih or Vil, Output=open	x8	-	80	100	mA
			x16	-	120	140	mA
Battery Back-up Current	Iccdr	Vbat = 3V Input / Output Open		-	3 0	100	uA
Input Leakage Current	Ili***	/CE1=/CE2=Vih or /OE=Vih or /WE=Vih /or REG=Vih Vi/o= 0 to Vcc		-10	-	10	uA
I/O Leakage Current	Ili/o	Vi/o = 0V to Vcc /CE1 = /CE2 = Vih /OE = Vih or /WE = Vil		-10	-	10	uA
Output High Voltage (Except /BVD1, /BVD2)	Voh	Ioh = -2 0 mA		3.8	—	Vcc	V
Output Low Voltage (Except /CD1, /CD2)	Vol	I ol = 2.1mA		0	—	0.4	V

Note * This parameter is measured in the configuration of x16
** This parameter is measured in the configuration of x16
*** Max value of /OE, /WE, /CE /REG is 70uA

CAPACITANCE (Ta = 25°C, f= 1MHz, Vin = Vout = GND)

Parameter	Symbol	Min	Max	Units
Input Capacitance (A0~A20, /CE1, /CE2, /WE, /OE, /REG)	Cin		20	pF
I/O Capacitance (D0~D15, except /CD1, /CD2, /BVD1, /BVD2)	Cin/out		45	pF

Note Capacitance is sampled not 100% tested

AC CHARACTERISTICS
(Recommended operating conditions unless otherwise noted.)

COMMON MEMORY TIMING (READ CYCLE - /WE=/REG=Vih)* (0 °C ≤ Ta ≤ 55°C Vcc=5.0V ± 5%)

Parameter	Symbol	150ns		200ns		250ns		Units
		Min	Max	Min	Max	Min	Max	
Read Cycle Time	tcR	150	-	200	-	250	-	ns
Address Access Time	ta(A)	-	150	-	200	-	250	ns
Card Enable Access Time	ta(CE)	-	150	-	200	-	250	ns
Output Enable Access Time	ta(OE)	-	75	-	100	-	125	ns
Output Disable Time From /CE **	tdis(CE)	-	75	-	90	-	100	ns
Output Disable Time From /OE **	tdis(OE)	-	75	-	90	-	100	ns
Output Enable Time From /CE**	ten(CE)	5	-	5	-	5	-	ns
Output Enable Time From /OE **	ten(OE)	5	-	5	-	5	-	ns
Output Hold Time From Address Change	tv(A)	0	-	0	-	0	-	ns

Note * /WE is high for Read cycle
** Transition is measured at the point of ± 500mV from state voltage

*ATTRIBUTE MEMORY TIMING * (READ CYCLE-/WE=Vih)* (0 °C ≤ Ta ≤ 55°C Vcc=5.0V ± 5%)

Parameter	Symbol	Min	Typ	Max	Units
Read Cycle Time	tcR	300	-	-	ns
Address Access Time	ta(A)	-	-	300	ns
Card Enable Access Time	ta(CE)	-	-	300	ns
Output Enable Access Time	ta(OE)	-	-	150	ns
Output Disable Time From /CE**	tdis(CE)	-	-	100	ns
Output Disable Time From /OE **	tdis(OE)	-	-	100	ns
Output Enable Time From /CE **	ten(CE)	5	-	-	ns
Output Enable Time From /OE **	ten(OE)	5	-	-	ns
Output Hold Time From Address Change	tv(A)	0	-	-	ns

Note * /WE is high for Read cycle
** Transition is measured at the point of ± 500mV from state voltage

AC CHARACTERISTICS

(Recommended operating conditions unless otherwise noted.)

*COMMON MEMORY TIMING * (WRITE CYCLE - /REG=Vih)* (0 ≤ Ta ≤ 55°C, Vcc=5.0 ± 5%)

Parameter	Symbol	150ns		200ns		250ns		Units
		Min	Max	Min	Max	Min	Max	
Write Cycle Time	tcW	150	-	200	-	250	-	ns
Write Pulse Width	tw(WE)	80	-	120	-	150	-	ns
Address Setup Time for /WE(H --> L)	tsu(A-WEL)	20	-	20	-	30	-	ns
Address Setup Time for /WE(L --> H)	tsu(A-WEH)	100	-	140	-	180	-	ns
Card Enable Setup Time for /WE	tsu(CE-WEH)	100	-	140	-	180	-	ns
Data Setup Time for /CE	tsu(D-WEH)	50	-	60	-	80	-	ns
Address Setup Time for /CE	tsu(A-CLS)	50	-	60	-	80	-	ns
Data Hold Time	th(D)	20	-	30	-	30	-	ns
Write Enable Recovery Time	trec(WE)	20	-	30	-	30	-	ns
Output Disable Time from /WE *	tdis(WE)	-	75		90		100	ns
Output Disable Time from /OE *	tdis(OE)	-	75		90		100	ns
Output Enable Time from WE *	ten(WE)	5	-	5	-	5	-	ns
Output Enable Time from /OE *	ten(OE)	5	-	5	-	5	-	ns
Output Enable Setup from /WE *	tsu(OE-WE)	-	10	10	-	10	-	ns
Output Enable Hold from /WE *	th(OE-WE)	-	10	10	-	10	-	

Note * Transition is measured at the point of ± 500mV from state voltage

*ATTRIBUTE MEMORY TIMING * (WRITE CYCLE)* (0 ≤ Ta ≤ 55°C, Vcc=5.0 ± 5%)

Parameter	Symbol	Min	Typ	Max	Units
Write Cycle Time	tcW	10	-	-	ms
Data Setup Time	tsu(D-WE)	200	-	-	ns
Data Hold Time	th(D-WE)	100	-	-	ns
Write Pulse Width	tw(WE)	300	-	-	ns
Add Setup Time	tsu(A-WE)	20	-	-	ns
Add Hold Time	th(WEH-A)	200	-	-	ns
/CE Setup Time	tsu(CE-WE)	10	-	-	ns
/CE Hold Time	th(CE-WE)	10	-	-	ns
/OE Setup Time	tsu(OE-WE)	10	-	-	ns
/OE Hold Time	th(OE-WE)	0	-	-	ns

Note * Transition is measured at the point of ± 500mV from state voltage

AC TEST CONDITIONS

Input Pulse Description

Input Pulse Level	0 6V to 2 5V	
Input Rise & Fall Time	5ns	
Timing Reference Level	Input	Vil=0.8V, Vih=2.4V
	Output	Vol=0.8V, Voh=2.0V

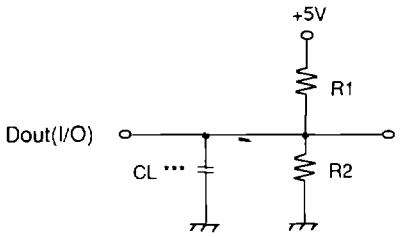


Fig. A.C Test Load

Test Load Description

	R1	R2	CL	Measured Parameters
LoadI	2K	1KΩ	100pF	All parameters except High-Z/Low-Z
LoadII	2K	1KΩ	5pF	Only High-Z/Low-Z parameters

REPLACING THE BATTERY & WRITE PROTECT SWITCH

Replaceable Battery

Part Number	BR2325
Diameter	23.0 mm
Thickness	2.5mm

Replacing the Battery

1. Slide Battery lock to the right using a ball-point pen. ; See Fig. Battery Lock.
2. Carefully pull the Battery holder straight out of the card.
3. Remove an old battery from the Battery holder.
4. Place a new Battery - with the +(plus sign) side up - into the Battery holder.
5. Insert the Battery holder into the memory card.
6. Slide Battery lock to the left for lock using a ball-point pen. ; See Fig. Battery lock

Write Protect Switch

Write Protect Switch	WP(#33)
PROTECT (Right side)	H
NON PROTECT (Left side)	L

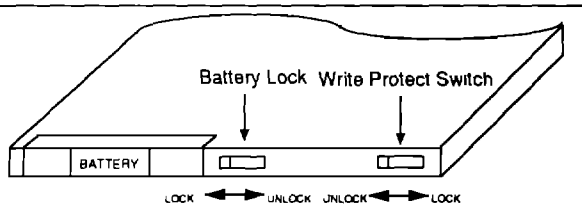


Fig. Battery Lock and Write Protect

Battery Voltage Detect

BVD1(#63)	BVD2(#62)	COMMENTS
H	H	Battery Operational*
H	L	Battery Should be replaced. Data is OK*
L	H	Battery & Data Integrity is not guaranteed*.
L	L	Battery & Data Integrity is not guaranteed.*

Note *If BVD2 is not supported BVD2 is held to Vcc and only one reference voltage is required

Data Retention Time with Battery

(Condition : Temp=25°C Humidity=60%RH)

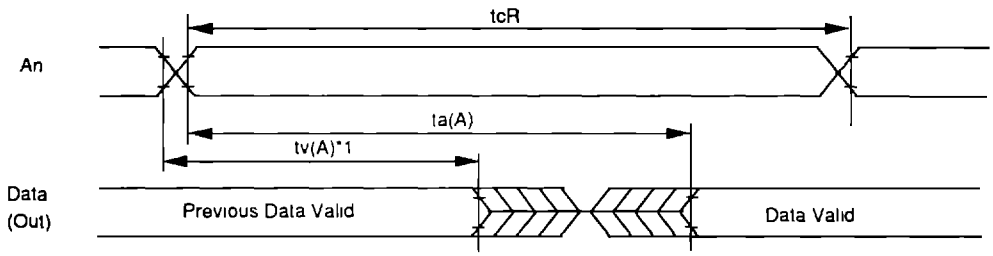
Product NO.	Capacity	Approximate Data Retention Time (Ta=25°C)	
		Replaceable (BR2325)	Rechargeable(AL920)
KMCJ616512	1MB	3.0 years Typ.	30 Hours Typ.

AC CHARACTERISTICS
(Recommended operating conditions unless otherwise noted)

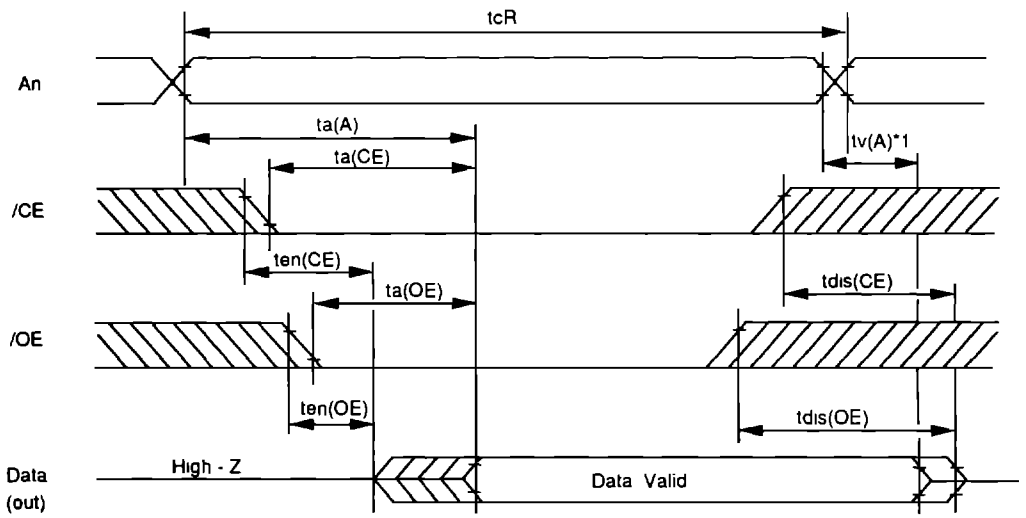
COMMON MEMORY MODE

Bus configuration : /CE1 = Vih , /CE2 =Vil : x8 bit Data Bus
: /CE1 = /CE2 = Vil : x16bit Data Bus

READ CYCLE TIMING DIAGRAM (/WE = /REG=Vih, /OE=/CE=Vil)



READ CYCLE TIMING DIAGRAM (/WE =/REG=Vih)



Note1 : The /REG signal timing is identical to address signal timing.

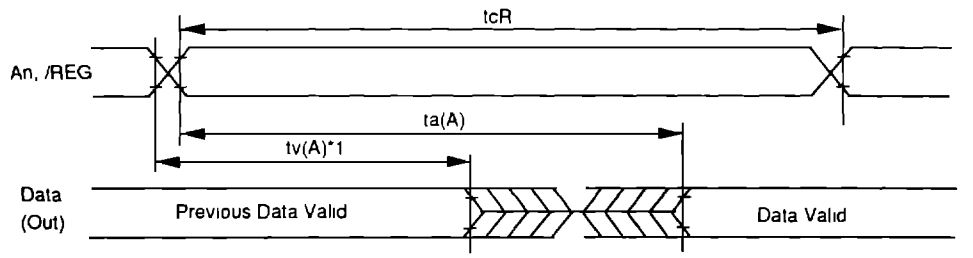
: Invalid : Either Vil or Vih

AC CHARACTERISTICS
(Recommended operating conditions unless otherwise noted.)

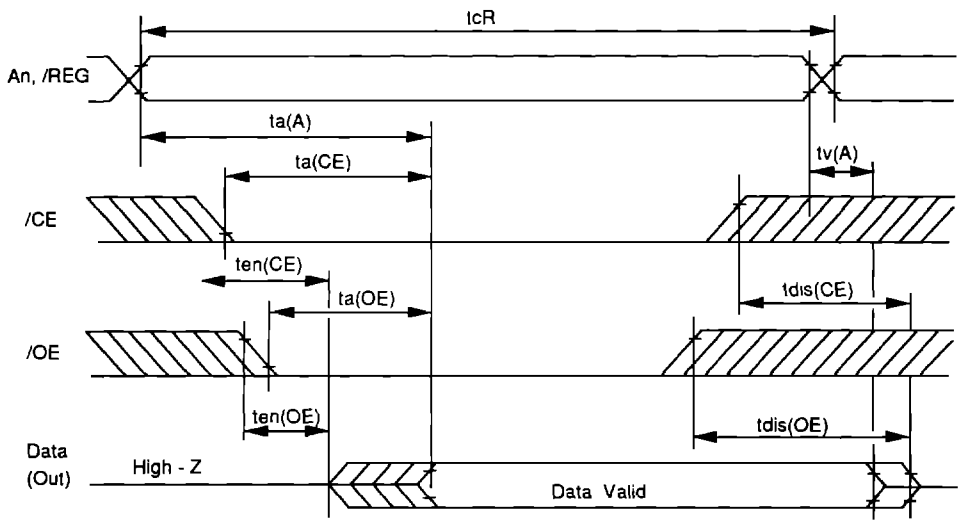
ATTRIBUTE MEMORY MODE

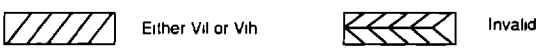
Bus configuration : /CE1 = Vih , /CE2 =Vil . x8 bit Data Bus
: /CE1 = /CE2 = Vil : x16bit Data Bus

READ CYCLE TIMING DIAGRAM (/WE =Vih, /OE=/CE=Vil)



READ CYCLE TIMING DIAGRAM (/WE = Vih)



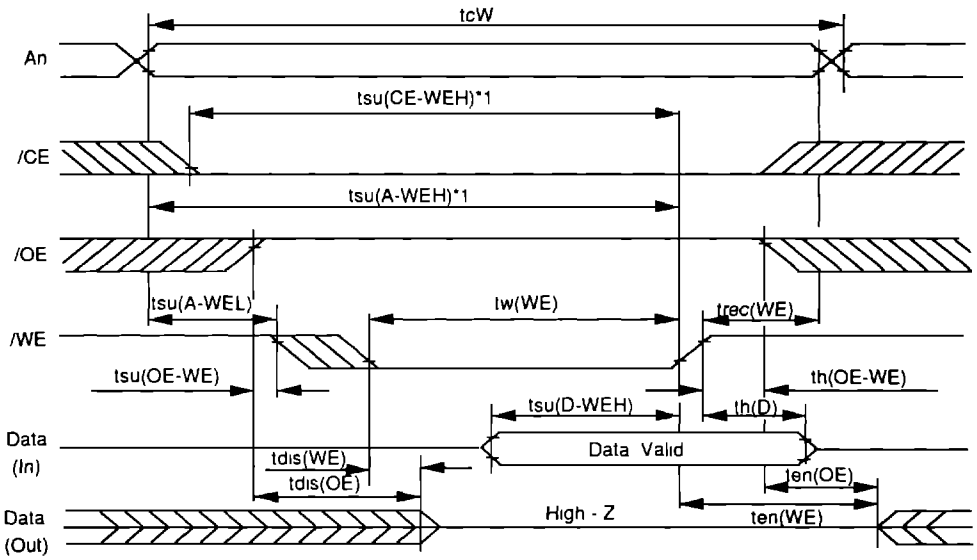


AC CHARACTERISTICS

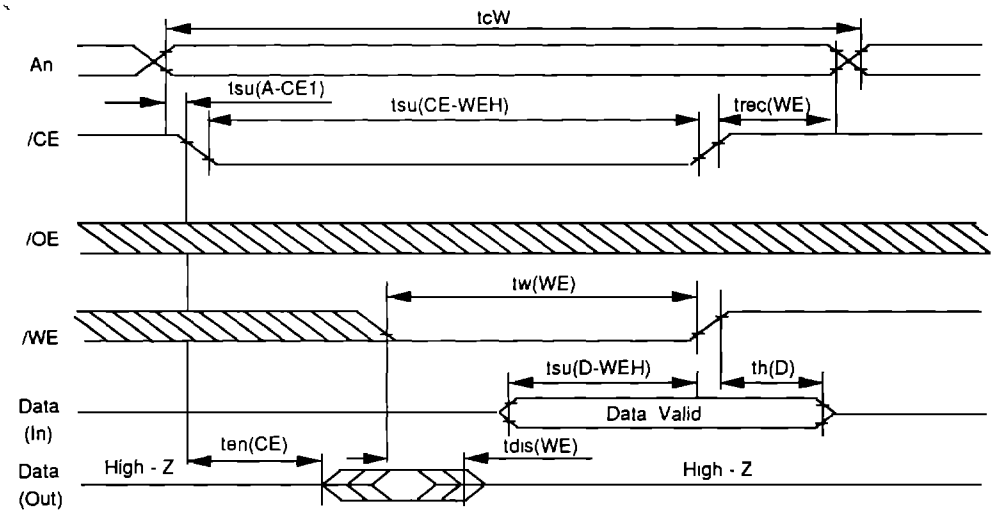
COMMON MEMORY MODE

Bus configuration : /CE1=Vil, /CE2 = VIH x8bit Data Bus
/CE1=Vil, /CE2 = Vil x16bit Data Bus

WRITE CYCLE TIMING DIAGRAM (/WE = Controlled, /REG=Vih)



WRITE CYCLE TIMING DIAGRAM (/CE= Controlled, /REG=Vih)



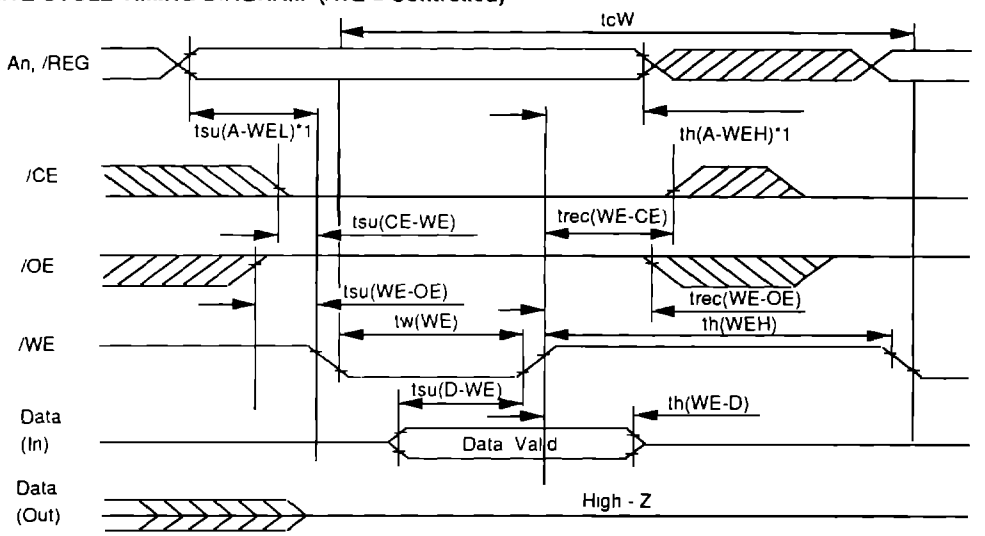
: Either Vil or Vih : Invalid

AC CHARACTERISTICS

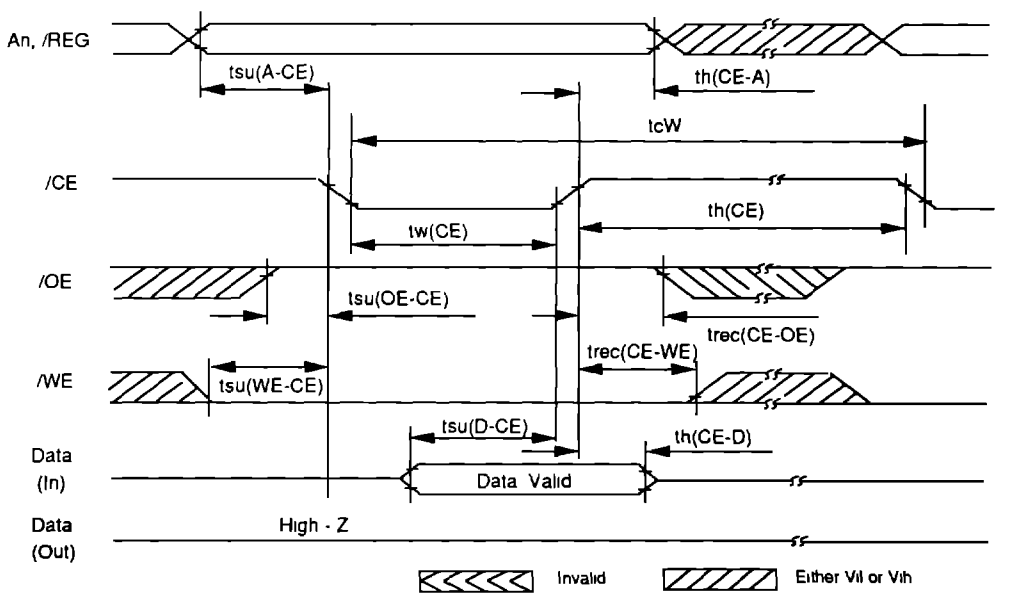
ATTRIBUTE MEMORY MODE

Bus configuration /CE1=Vil, /CE2 = Vih x8bit Data Bus
/CE1=Vil, /CE2 = Vil x16bit Data Bus

WRITE CYCLE TIMING DIAGRAM (/WE = Controlled)



WRITE CYCLE TIMING DIAGRAM (/CE = CONTROLLED)



BATTERY ALARM CHARACTERISTICS

/BVD2(#62)	/BVD1(#63)	Comment
H	H	Battery Operational.
L	H	Battery Operational, but Battery should be replaced.
H	L	Battery &Data integrity is not kept.
L	L	Battery &Data integrity is not kept.

Note If the Battery is removed /ALM1, /ALM2 will not work properly

POWER SUPPLY SEQUENCE CHARACTERISTICS

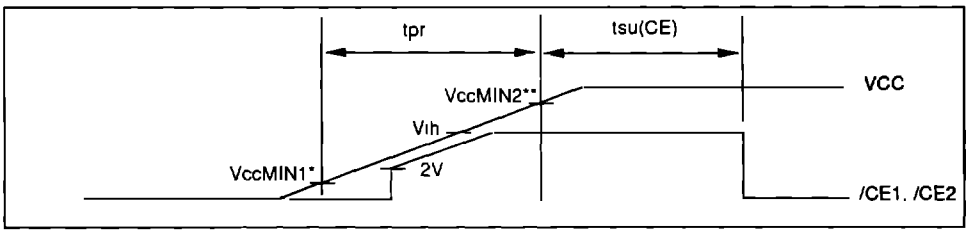
Parameter	Symbol	Condition	Min	Max	Units
/CE Signal Level*	V_{I}(CE)	0V<Vcc<2.0V	0	ViMAX	V
		2.0V<Vcc<Vih	Vcc-0.1	ViMAX	
		Vih<Vcc	Vih	ViMAX	
/CE Setup Time	tsu(Vcc)		20		ms
/CE Recovery Time	trec(Vcc)		0.001		ms
Vcc Rising Time**	tpr	10%-->90% of (Vcc+5%)	0.1	300	ms
Vcc Falling Time**	tpf	90% of (Vcc-5%)-->10%	3.0	300	ms

Note *ViMAX means Absolute Maximum Voltage for input in the period of 0V<Vcc<2.0V V_{I}(CE) is only 0V~ViMAX

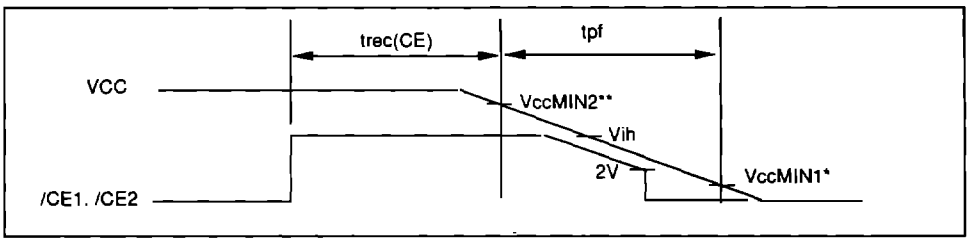
**The tpr and tpf are defined as 'Linear waveform in the period of 10% to 90% or vice versa

Even if the waveform is not 'Linear wave form' it's rising and falling time must be met this specification

POWER-ON TIMING DIAGRAM



POWER-OFF TIMING DIAGRAM



Note *VccMIN1 means 90% of supply voltage, Vcc

**VccMIN2 means 10% of supply voltage Vcc

Attribute Information

Address	Data	Information	Address	Data	Information
0000H	01H	Device Information (Common)	0032H	45H	"E"
0002H	03H	Pointer to the next tuple	0034H	43H	"C"
0004H	63H	Ram with battery back-up, 150ns	0036H	54H	"T"
0006H	3CH	1MB	0038H	52H	"R"
0008H	FFH	End of device information	003AH	4FH	"O"
000AH	17H	Device information (Attribute)	003CH	4EH	"N"
000CH	04H	Pointer to the next tuple	003EH	49H	"I"
000EH	4FH	Speed expansion of	0040H	43H	"C"
		EEPROM	0042H	53H	"S"
0010H	3AH	Speed 250ns	0044H	00H	"End of maker information"
0012H	09H	Density : 64K bit	0046H	4BH	"K"
0014H	FFH	End of device information	0048H	4DH	"M"
0016H	15H	Level 1 tuple information	004AH	43H	"C"
0018H	2FH	Pointer to the next tuple	004CH	4AH	"J"
001AH	04H	Ver 4.1	004EH	36H	"6"
001CH	01H	Ver	0050H	31H	"1"
001EH	53H	"S"	0052H	36H	"6"
0020H	41H	"A"	0054H	35H	"5"
0022H	4DH	"M"	0056H	31H	"1"
0024H	53H	"S"	0058H	32H	"2"
0026H	55H	"U"	005AH	2DH	"-"
0028H	4EH	"N"	005CH	31H	"1"
002AH	47H	"G"	005EH	35H	"5"
002CH	20H	"Space"	0060H	00H	
002EH	45H	"E"	0062H	FFH	End of level 1 information
0030H	4CH	"L"			

CARD DIMENSION(Unit : mm)