

PCMCIA/JEIDA STATIC RAM WITH SUB-BATTERY

1. VARIATION

Part Number	Memory Size	Description
WWB065ES**	64K BYTE	32K × 16 bit MIX CMOS SRAM CARD WITH SUB-BATTERY
WWB129ES**	128K BYTE	64K × 16 bit MIX CMOS SRAM CARD WITH SUB-BATTERY
WWB257ES**	256K BYTE	128K × 16 bit MIX CMOS SRAM CARD WITH SUB-BATTERY
WWB513ES**	512K BYTE	256K × 16 bit MIX CMOS SRAM CARD WITH SUB-BATTERY
WWB101ES**	1M BYTE	512K × 16 bit MIX CMOS SRAM CARD WITH SUB-BATTERY
WWB201ES**	2M BYTE	1M × 16 bit MIX CMOS SRAM CARD WITH SUB-BATTERY

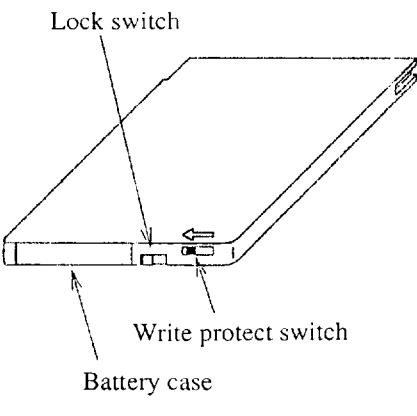
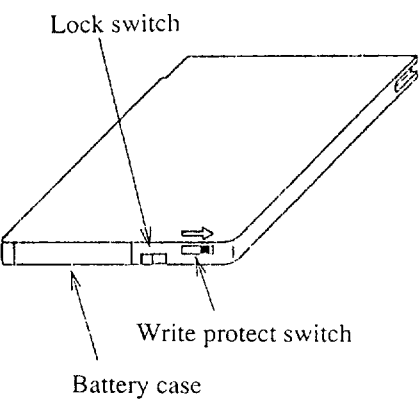
2. OUTLINE OF FUNCTIONS AND FEATURES

- (1) This memory card conforms to PCMCIA/JEIDA.
- (2) Size of the card: 85.6 × 54.0 × 3.3 mm
- (3) Includes exclusive IC's for the control of I/O and power functions.
- (4) Supports 2 types of exclusive attribute memory.
 - (4-1) WWB***ES2* : With 2K Bytes EEPROM which can be read/written
 - (4-2) WWB***ES4* : Without exclusive attribute memory (output "FFh", read only)
- (5) Two digital outputs (BVD1 and BVD2) for the condition of battery voltage.

BVD1	BVD2	Battery Voltage Detect Level	Comment
VOH	VOH	2.65V or more	Normal battery voltage condition
VOH	VOL	2.64V ~ 2.37V	Data is protected but the battery must be replaced.
VOL	VOL	2.36V or less	Data cannot be protected and the battery must be replaced.

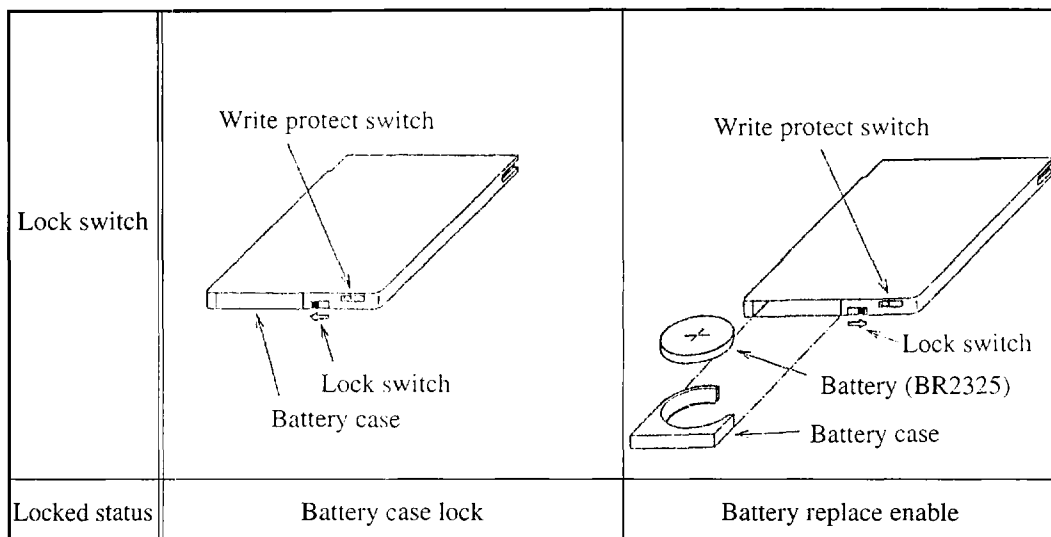
Note: The battery voltage detect level is TYP value.

- (6) A write protect switch for protection from accidental overwriting
 The WP pin outputs VOL in the write enable status and VOH in the write inhibit status when the VCC supply voltage is applied to the card.
 The write protect switch interlocks with only the common memory. The exclusive attribute memory (2K Bytes EEPROM) is in the write enable status regardless of the condition of the write protect switch.

<p>Write protect switch</p>		
<p>Common memory</p>	<p>Write enable</p>	<p>Write inhibit</p>
<p>WP</p>	<p>VOL</p>	<p>VOH</p>

(7) Locking mechanism for battery case

Keep the lock switch set on the ON side at data back-up so that data destruction may not be caused by a fall-out of the battery case, for example, when carrying the memory card. When the lock switch is set to the OFF side, the battery can be easily replaced in the status where the card is inserted in the connector on the main unit side.



(8) Sub-battery

In the status where the power supply VCC is applied ($V_{CC} = 4.5 \text{ V}$ or more), the sub-battery is automatically charged.

In the status where the sub-battery has been charged, the battery can be replaced without feeding the power supply VCC to the card.

3. ELECTRICAL CHARACTERISTICS

3-1. Maximum Rating

Symbol	Description	Value	Unit
V _{CC}	SYPPLY VOLTAGE	-0.3 ~ 7.0	V
V _{IN}	INPUT SIGNAL VOLTAGE (*1)	-0.3 ~ V _{CC} +0.5	V
V _{OUT}	OUTPUT SIGNAL VOLTAGE	-0.3 ~ V _{CC}	V
T _{OPR}	OPERATING TEMPERATURE	0 ~ 60	°C
T _{STR}	STORAGE TEMPERATURE (*2)	-20 ~ 65	°C
HUM	HUMIDITY (*3)	10 ~ 95	%
PD	POWER DISSIPATION	1	W
V _{BAT}	BATTERY SUPPLY VOLTAGE	-0.3 ~ V _{CC}	V

*1: V_{IN}: Under 7.0 V

*2: Without data back-up at T_{STR} = -20 ~ 0 and 60 ~ 65°C

*3: No dew condition

3-2. Capacitance (T_a = 25°C, V_{IN}/OUT = 0 V, f = 1 MHz)

Symbol	Description	Min	Typ	Max	Unit
C ₁	INPUT CAPACITANCE	—	14	20	pF
C ₂	I/O CAPACITANCE	—	14	20	pF

3-3. Allowable DC Operating Conditions (T_a = 0 ~ 60°C)

Symbol	Description	Min	Typ	Max	Unit
V _{CC}	V _{CC} SUPPLY VOLTAGE	4.50	5.0	5.50	V
V _{BAT}	BATTERY SUPPLY VOLTAGE	2.5	—	5.5	V
V _{IH}	HIGH LEVEL INPUT VOLTAGE	V _{CC} ×0.8	—	V _{CC} +0.3	V
V _{IL}	LOW LEVEL INPUT VOLTAGE	-0.1	—	V _{CC} ×0.1	V

3-4. I/O DC Characteristics (Ta = 0 ~ 60°C, VCC = 5 V ±10%)

Symbol	Description	Object	Condition	Min	Typ	Max	Unit
ILI	LOW LEVEL INPUT CURRENT	1,3	VIN=0V	-10	—	10	μA
		2		-60	—	-40	μA
IHI1	HIGH LEVEL INPUT CURRENT 1	1,2	VIN=VCC	-10	—	10	μA
		3		15	—	65	μA
IHI2	HIGH LEVEL INPUT CURRENT 2	1,2	VCC=VIN=4V	20	—	73	μA
		3		10	—	40	μA
VOH	HIGH LEVEL OUTPUT VOLTAGE	3,4	I _{OH} =-2.0 mA	VCC-0.4	—	—	V
VOL	LOW LEVEL OUTPUT VOLTAGE	3,4	I _{OL} =6.0 mA	—	—	VSS +0.4	V

1: A0 ~ A20

2: /CE1, /CE2, /OE, /WE, /REG

3: D0 ~ D15

4: BVD1, BVD2, WP

/CE1, /CE2, /OE, /WE, /REG

: Pull-up to VCC through 100 KΩ in the card

D0 ~ D15 : Pull-down through 100 KΩ in the control IC.

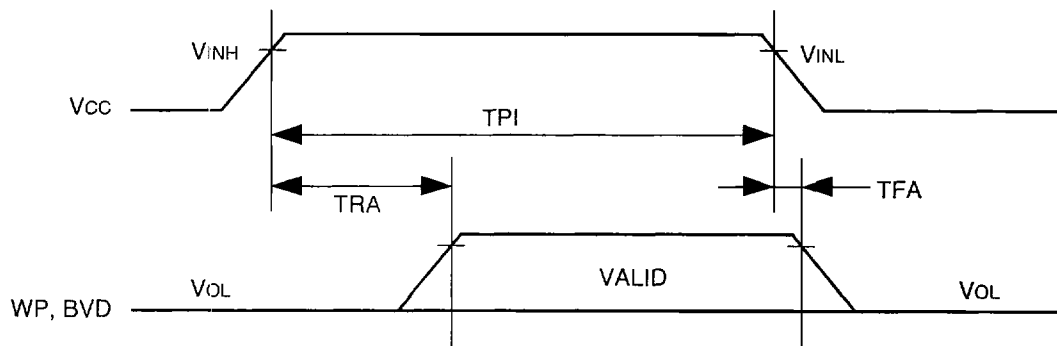
[VCC < Approx. 4.2 V: A0-A20, /CE1, /CE2, /OE, /WE, /REG = Pull-down in the control IC
VCC > Approx. 4.2 V: A0-A20, /CE1, /CE2, /OE, /WE, /REG = No pull-down in the control IC]

3-5. Current Consumption and Battery Voltage Detection
 (Ta = 0 ~ 60°C, VCC = 5 V ±10%)

Symbol	Description	Condition	Min	Typ	Max	Unit	
ISTBY 1	STANDBY CURRENT 1 The sub-battery is full charged.	/CE1=/CE2=/WE=/OE=/REG=Vcc-0.4V OTHERS=0.4V/Vcc-0.4V	—	—	1.5	mA	
ISTBY 2	STANDBY CURRENT 2 The sub-battery is not charged.	/CE1=/CE2=/WE=/OE=/REG=Vcc-0.4V OTHERS=0.4V/Vcc-0.4V	—	4.0	8.0	mA	
I _{ACT}	ACTIVE CURRENT	/CE1=/CE2=0.4V, I _{OUT} =0mA OTHERS=0.4V/Vcc-0.4 INPUT PULSE LEVEL (0.4V/Vcc-0.4V)	f=1μS	—	—	55	mA
			f=200nS	—	—	140	mA
IBAT 1	BACKUP CURRENT 1 Ta=25°C	Vcc=0V, VBB=3V : 64K BYTES : 128K BYTES : 256K BYTES : 512K BYTES : 1M BYTES : 2M BYTES	—	1.0	4.0	μA	
			—	2.0	8.0	μA	
			—	2.3	7.0	μA	
			—	4.5	14.0	μA	
			—	9.0	28.0	μA	
			—	18.0	56.0	μA	
IBAT2	BACKUP CURRENT 2 Ta=0 ~ 60°C	Vcc=0V, VBB=3V : 64K BYTES : 128K BYTES : 256K BYTES : 512K BYTES : 1M BYTES : 2M BYTES	—	—	20	μA	
			—	—	40	μA	
			—	—	15	μA	
			—	—	30	μA	
			—	—	60	μA	
			—	—	120	μA	
V _{INL}	Vcc VOLTAGE DETECT LEVEL	Vcc= 5V→0V	4.10	4.20	4.30	V	
V _{INH}		Vcc= 0V→5V	4.20	4.30	4.40	V	
BVD 2	BATTERY VOLTAGE DETECT 2	VBB= 3V→0V	2.55	2.65	2.75	V	
BVD 1	BATTERY VOLTAGE DETECT 1	VBB= 3V→0V	2.27	2.37	2.47	V	

3-6. AC Electrical Characteristics of Power Control
 ($T_a = 0 \sim 60^\circ\text{C}$, $V_{CC} = 5\text{ V} \pm 10\%$)

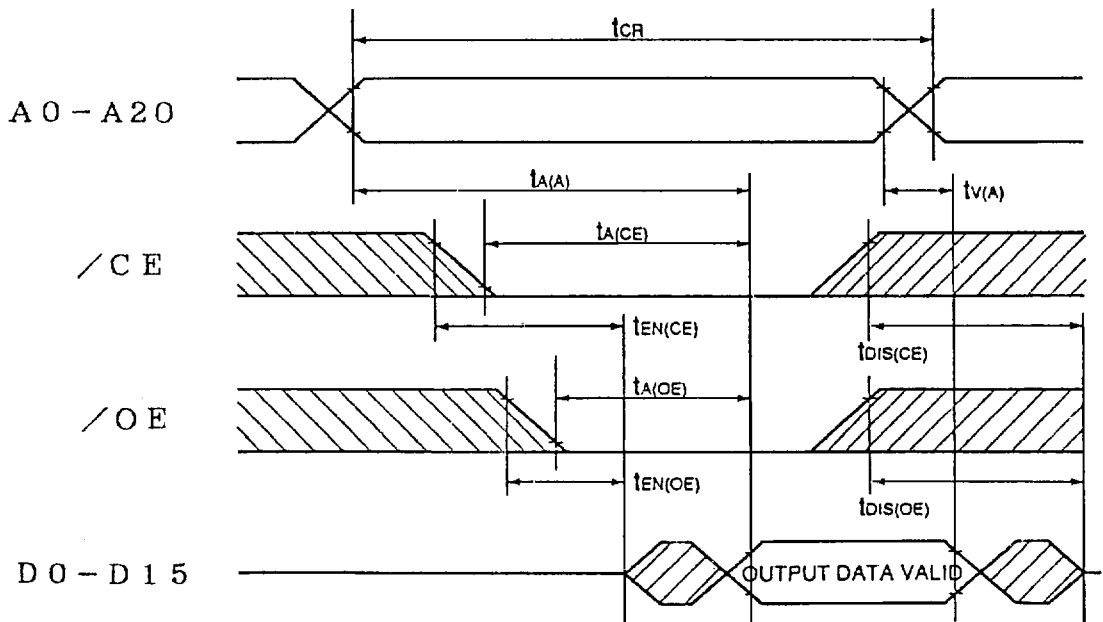
Symbol	Description	Condition	Min	Typ	Max	Unit
TPI	INPUT PULSE WIDTH	—	1	—	—	ms
TRA	RISING TIME OF ALARM	$V_{CC}=0 \rightarrow 5\text{V}$	0.5	1.0	1.5	ms
TFA	FALLING TIME OF ALARM	$V_{CC}=5\text{V} \rightarrow 0\text{V}$	—	—	5.0	μs



3-7. AC Electrical Characteristics at Read of Common Memory
 ($T_a = 0 \sim 60^\circ\text{C}$, $V_{CC} = 5\text{ V} \pm 10\%$)

Symbol	Description	Min	Max	Unit
TCR	READ CYCLE TIME	200	—	ns
TA (A)	ADDRESS ACCESS TIME	—	200	ns
TA (CE)	/CE ACCESS TIME	—	200	ns
TA (OE)	/OE ACCESS TIME	—	100	ns
TDIS (CE)	OUTPUT DISABLE TIME FROM /CE	—	90	ns
TDIS (OE)	OUTPUT DISABLE TIME FROM /OE	—	90	ns
TEN (CE)	OUTPUT ENABLE TIME FROM /CE	5	—	ns
TEN (OE)	OUTPUT ENABLE TIME FROM /OE	5	—	ns
TV (A)	VALID DATA HOLD TIME FROM ADDRESS INVALID	0	—	ns

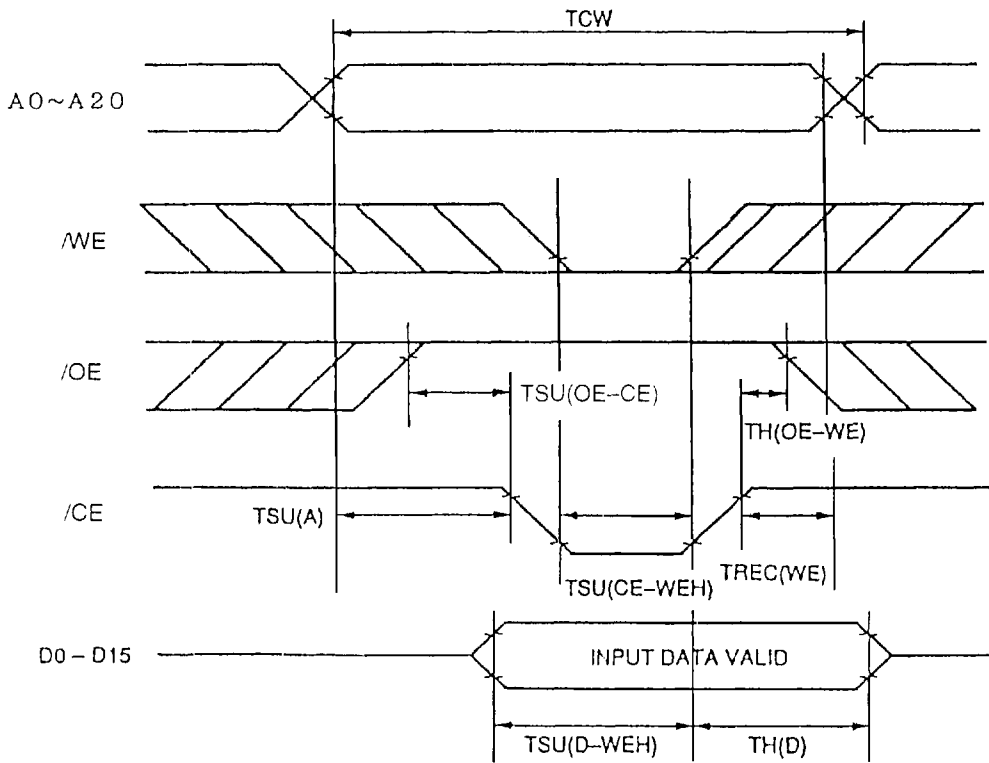
3-8. Read Timing of Common Memory



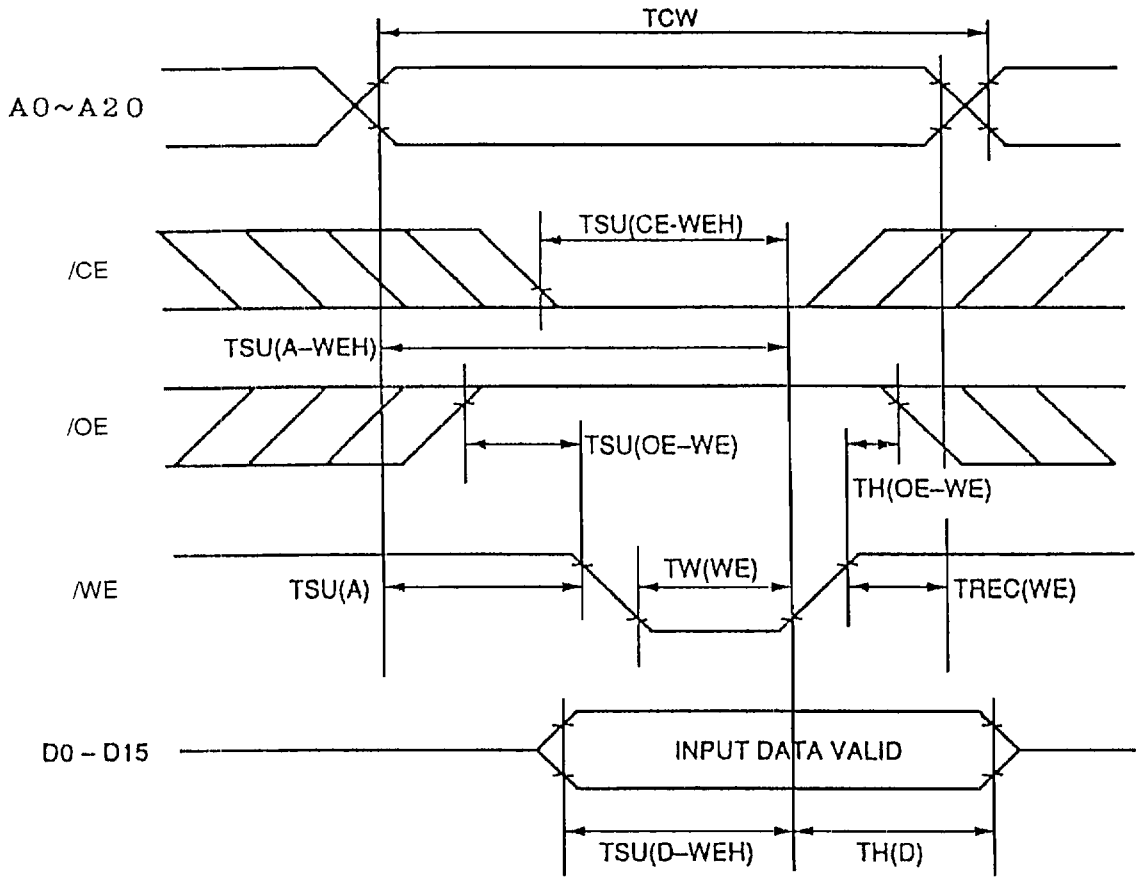
3-9. Write Timing of Common Memory ($T_a = 0 \sim 60^\circ\text{C}$, $V_{CC} = 5\text{ V} \pm 10\%$)

Symbol	Description	Min	Max	Unit
TCW	WRITE CYCLE TIME	200	—	ns
TW (WE)	WRITE PULSE WIDTH	120	—	ns
TSU (A)	ADDRESS SETUP TIME	20	—	ns
TSU (A-WEH)	ADDRESS SETUP TIME TO/WE	140	—	ns
TSU (CE-WEH)	/CE SETUP TIME	140	—	ns
TSU (D-WEH)	DATA SETUP TIME	60	—	ns
TD (D)	DATA HOLD TIME	30	—	ns
TREC (WE)	WRITE RECOVERY TIME	30	—	ns
TSU (OE-WE)	/OE SETUP TIME FROM /WE	10	—	ns
TH (OE-WE)	/OE HOLD TIME FROM /WE	10	—	ns
TSU (OE-CE)	/OE SETUP TIME FROM /CE	10	—	ns

3-10. Write Timing of Common Memory (/CE Controlled Write)



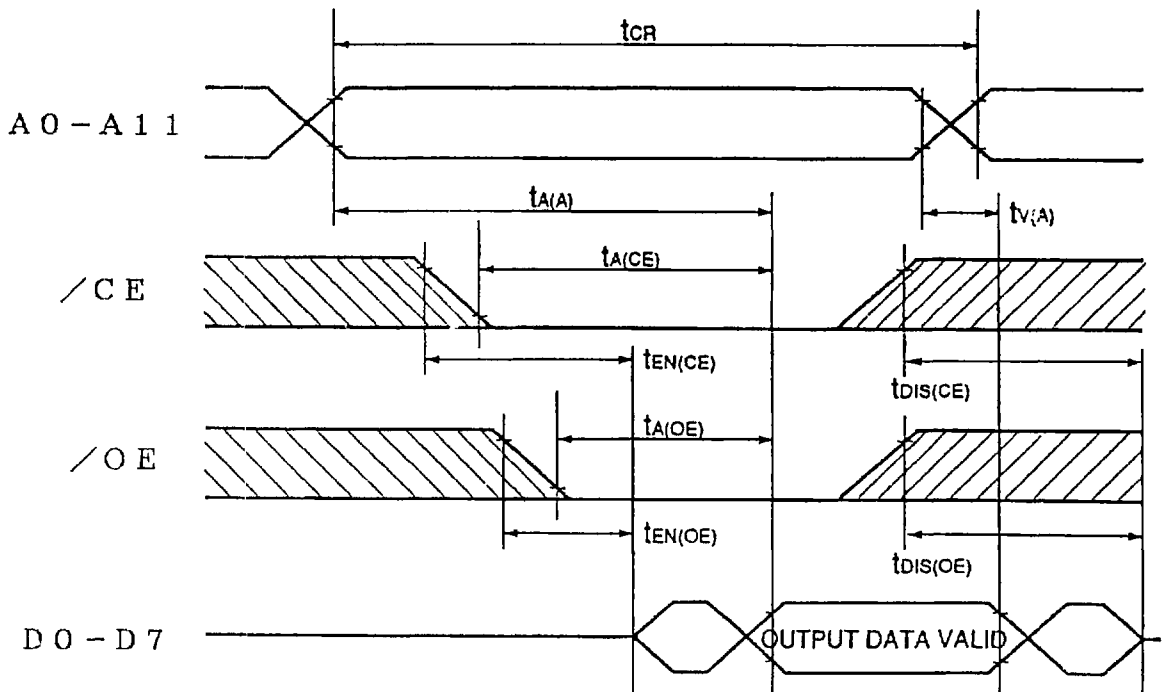
3-11. Write Timing of Common Memory (/WE Controlled Write)



3-12. AC Electrical Characteristics at Read of Attribute Memory
 ($T_a = 0 \sim 60^\circ\text{C}$, $V_{CC} = 5\text{ V} \pm 10\%$)

Symbol	Description	Min	Max	Unit
TCR	READ CYCLE TIME	300	—	ns
TA (A)	ADDRESS ACCESS TIME	—	300	ns
TA (CE)	/CE ACCESS TIME	—	300	ns
TA (OE)	/OE ACCESS TIME	—	150	ns
TDIS (CE)	OUTPUT DISABLE TIME FROM /CE	—	100	ns
TDIS (OE)	OUTPUT DISABLE TIME FROM /OE	—	100	ns
TEN (CE)	OUTPUT ENABLE TIME FROM /CE	5	—	ns
TEN (OE)	OUTPUT ENABLE TIME FROM /OE	5	—	ns
TV (A)	VALID DATA HOLD TIME FROM ADDRESS INVALID	0	—	ns

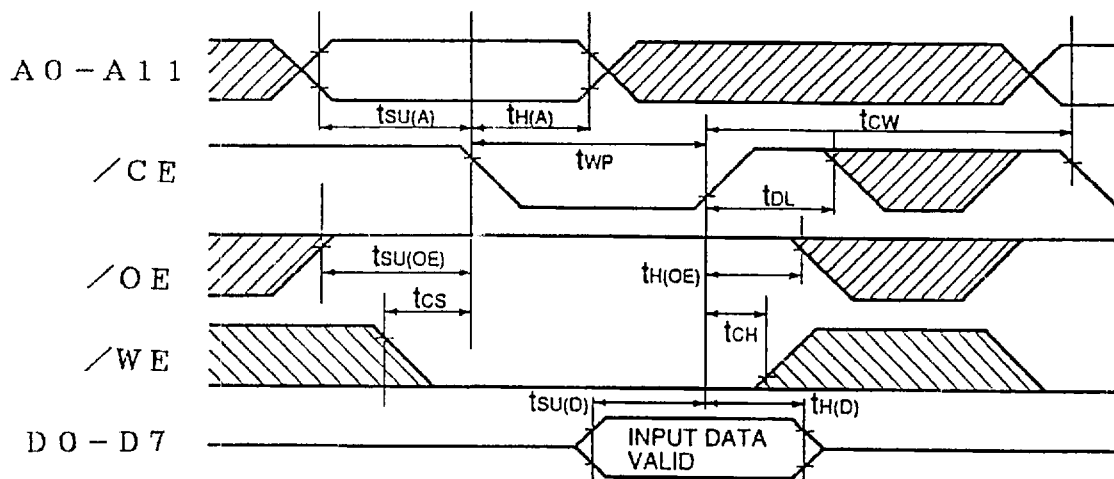
3-13. Read Timing of Attribute Memory



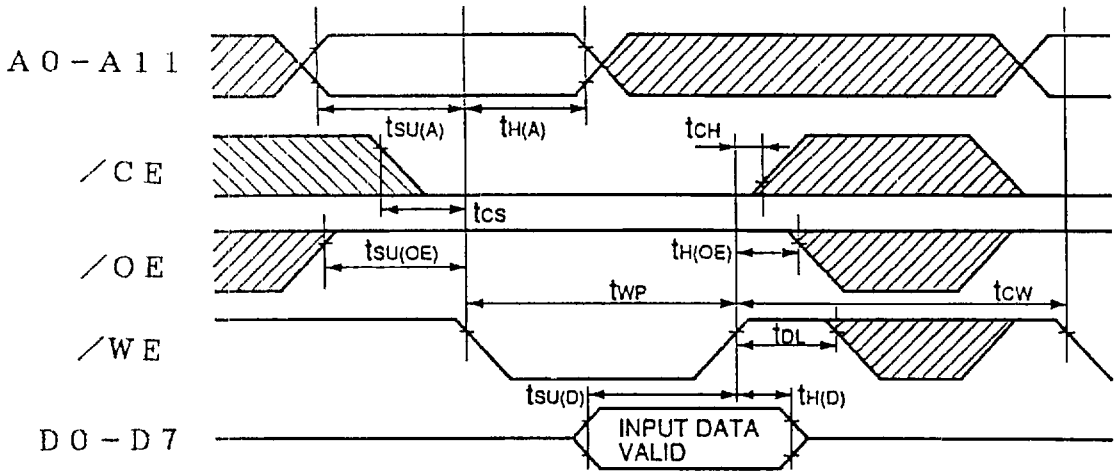
3-14. AC Electrical Characteristics of Attribute Memory (2K Bytes EEPROM)
 (Ta = 0 ~ 60°C, VCC = 5 V ±10%)

Symbol	Description	Min	Max	Unit
TCW	WRITE CYCLE TIME	15	—	ms
TWP	WRITE PULSE WIDTH	150	—	ns
TSU (A)	ADDRESS SETUP TIME	30	—	ns
TSU (D)	DATA SETUP TIME	80	—	ns
TH (D)	DATA HOLD TIME	30	—	ns
TSU (OE)	/OE SETUP TIME	15	—	ns
TH (OE)	/OE HOLD TIME	15	—	ns
TH (A)	ADDRESS HOLD TIME	100	—	ns
TCS	WRITE SETUP TIME	30	—	ns
TCH	WRITE HOLD TIME	0	—	ns
TDL	DATA LATCH TIME	50	—	ns

3-15. Write Timing of Attribute Memory (2K Bytes EEPROM) (/CE Control)



3-16. Write Timing of Attribute Memory (2K Bytes EEPROM) (/WE Control)



3-17. AC Test Conditions

VCC	: 5 V \pm 10%
Ta	: 0 ~ 60°C
Input pulse level	: $V_{IH} = V_{CC} \times 0.8$ V $V_{IL} = V_{CC} \times 0.1$ V
I/O timing reference level	: 1.5 V
Output load	: 100 pF + 1 TTL gate (including oscilloscope and jig)

3-18. Approximate Battery Life and Recommended Battery

CARD Type	TYP Value	Unit
WWB065ES **	10	years
WWB129ES **	9.4	years
WWB257ES **	8.2	years
WWB513ES **	4.2	years
WWB101ES **	2.1	years
WWB201ES **	1.0	years

Note: The numeric values are reference ones at normal temperature.

<Expression>

Battery life = Battery capacitance \div (back-up current 1 \times 24 H \times 365 days)

Battery type: BR2325 165 mAh

3-19. Sub-Battery

Battery capacitance : 150 μ AH (full charged status)

Approximate battery life : 10 minutes

Charging time : After the sub-battery is charged for one hour or more at
 $V_{CC} = 5$ V \pm 10%, replace the main battery quickly.

When replacing the battery, set the primary battery at once.

3-20. Operating Modes of Common Memory

Mode	/REG	A0	/CE1	/CE2	/OE	/WE	D0 ~ D7	D8 ~ D15
STANDBY	*	*	V _{IH}	V _{IH}	*	*	Hi-Z	Hi-Z
EVEN DATA READ	V _{IH}	V _{IL}	V _{IL}	V _{IH}	V _{IL}	V _{IH}	OUTPUT	Hi-Z
ODD DATA READ 1	V _{IH}	V _{IH}	V _{IL}	V _{IH}	V _{IL}	V _{IH}	OUTPUT	Hi-Z
ODD DATA READ 2	V _{IH}	*	V _{IH}	V _{IL}	V _{IL}	V _{IH}	Hi-Z	OUTPUT
EVEN DATA WRITE	V _{IH}	V _{IL}	V _{IL}	V _{IH}	V _{IH}	V _{IL}	INPUT	Hi-Z
ODD DATA WRITE 1	V _{IH}	V _{IH}	V _{IL}	V _{IH}	V _{IH}	V _{IL}	INPUT	Hi-Z
ODD DATA WRITE 2	V _{IH}	*	V _{IH}	V _{IL}	V _{IH}	V _{IL}	Hi-Z	INPUT
WORD READ	V _{IH}	*	V _{IL}	V _{IL}	V _{IL}	V _{IH}	OUTPUT	OUTPUT
WORD WRITE	V _{IH}	*	V _{IL}	V _{IL}	V _{IH}	V _{IL}	INPUT	INPUT

Hi-Z : High impedance (pull-down to GND through 100 K Ω in the card)

* : V_{IH} or V_{IL}

3-21. Operating Modes of Attribute Memory

Mode	/REG	A0	/CE1	/CE2	/OE	/WE	D0 ~ D7	D8 ~ D15
BYTE DATA READ	V _{IL}	V _{IL}	V _{IL}	V _{IH}	V _{IL}	V _{IH}	OUTPUT	Hi-Z
	V _{IL}	V _{IH}	V _{IL}	V _{IH}	V _{IL}	V _{IH}	Hi-Z	Hi-Z
WORD DATA READ	V _{IL}	*	V _{IL}	V _{IL}	V _{IL}	V _{IH}	OUTPUT	Hi-Z
BYTE DATA WRITE	V _{IL}	V _{IL}	V _{IL}	V _{IH}	V _{IH}	V _{IL}	INPUT	Hi-Z
	V _{IL}	V _{IH}	V _{IL}	V _{IH}	V _{IH}	V _{IL}	INVALID	Hi-Z
WORD DATA WRITE	V _{IL}	*	V _{IL}	V _{IL}	V _{IH}	V _{IL}	INPUT	INVALID

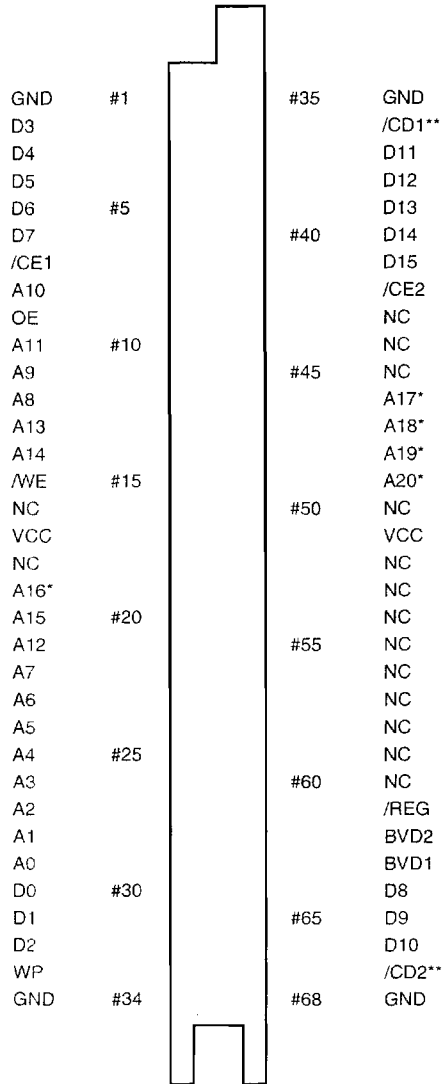
Hi-Z : High impedance (pull-down to GND through 100 K Ω in the card)

* : V_{IH} or V_{IL}

RECOMMENDED BATTERY

Use lithium battery BR2325 or equivalent.

4. PIN ASSIGNMENT



Notes: A16*: WWB129, WWB257, WWB513, WWB101, WWB201
 A17*: WWB257, WWB513, WWB101, WWB201
 A18*: WWB513, WWB101, WWB201
 A19*: WWB101, WWB201
 A20*: WWB201

/CD1**, /CD2**

: Connect to GND in the card.
 NC: No connect