

# **ID244L01**

20M B Flash M em ory C ard

M odelN o.: ID 244L01)

Spec N o.: EL108044

Issue D ate: August 6, 1998

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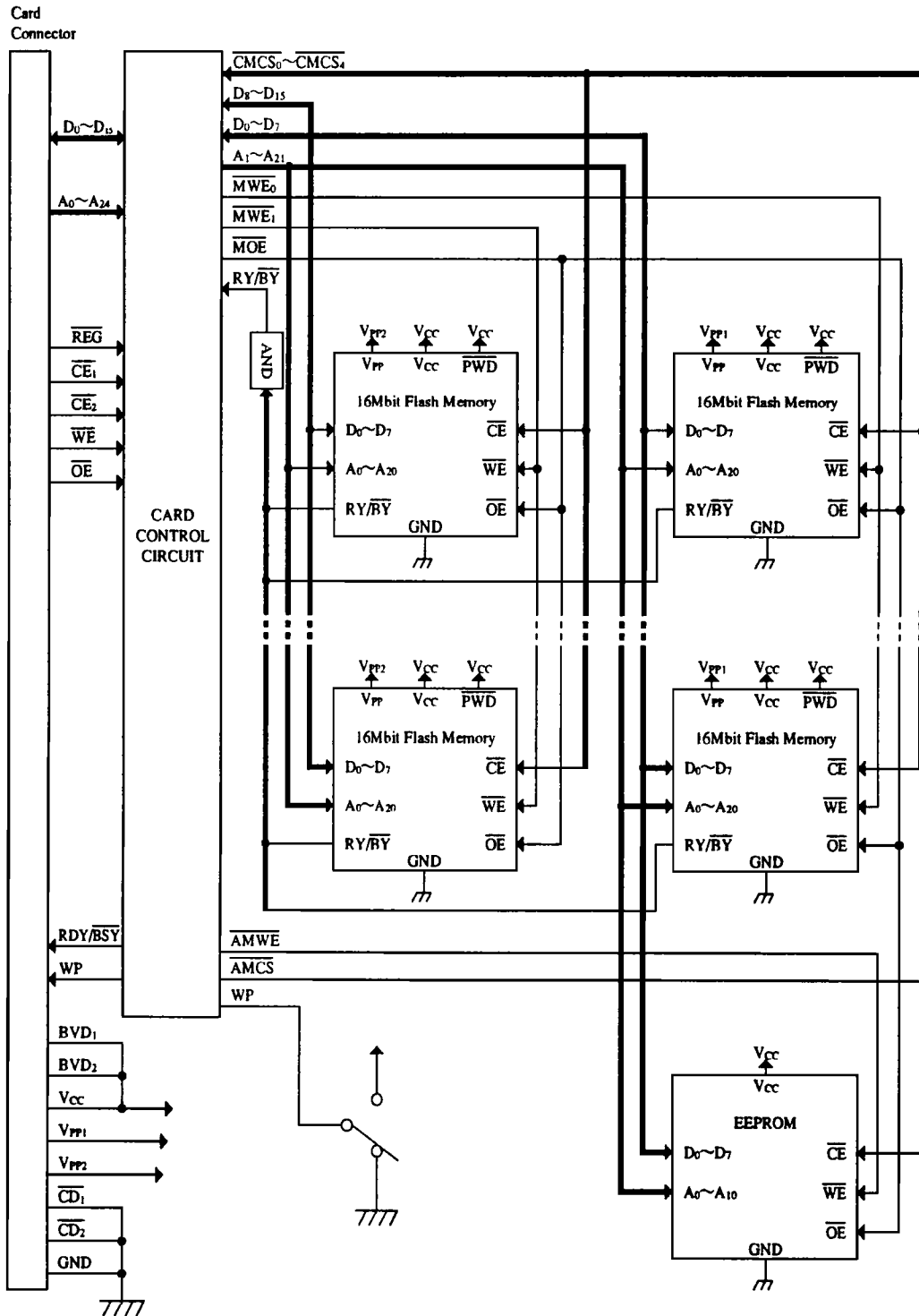
## 1. General Descriptions

The SHARP ID244L01, which panel design is SHARP standard, is a 20MB Flash Memory PC Card conforms to PCMCIA Release 2.0 and is offered to customers giving aim to confirm an external shape or electrical performances of the card. Before mass production, we will create a new product name dedicated for a customer and also present a specification which implies customer's request including panel design.

## 2. Features

- |      |   |  |
|------|---|--|
| 2.1  | Type                                      | 20MB Flash Memory Card<br>(Conforms to PCMCIA Rel.2.0)   |
| 2.2  | Memory Capacity                           | 20M words × 8 bits or 10M words × 16 bits  |
|      | Common Memory                             | EEPROM Model 2k words × 8 bits read/write  |
|      | Attribute Memory                          | No EEPROM Model. (5 words × 8 bits read only in card's control circuit)  |
|      | Note)                                     | We have another type of attribute memory as follows.<br>Sample card name: ID244L02. Customers can choose one model from two.               |
| 2.3  | Supply Voltage                            | $V_{CC} = 5 \pm 0.5V$ , $V_{PP1}, V_{PP2} = 0 \sim 1.5V$   |
|      | Read Cycle                                | $V_{CC} = 5 \pm 0.5V$ , $V_{PP1}, V_{PP2} = 5.0V \pm 0.5V / 12.0V \pm 0.6V$  |
|      | Read/Program/Erase Cycle                  | Block<br>(64k bytes/byte access, 128k bytes/word access)   |
| 2.4  | Erase Unit                                | 100,000 cycles   |
| 2.5  | Program/Erase Cycles                      | Parallel I/O Interface   |
| 2.6  | Interface                                 | See Function Table in page. 6  |
| 2.7  | Function Table                            | 54 × 85.6 × 3.3 mm   |
| 2.8  | External Dimensions                       | See Pin Connections in page. 4   |
| 2.9  | Pin Connections                           | Conforms to PCMCIA Re1.2.0 Card Use Connector<br>(Card connector: JC20-J68S-NB3 JAE or FCN-568J068-G/0 Fujitsu or ICM-C68S-TS13-5035A JST) |
| 2.10 | Type of Connector                         | 30g  |
| 2.11 | Average Weight                            | 0 to 60°C  |
| 2.12 | Operating Temp Range                      | -20 to 65°C  |
| 2.13 | Storage Temp Range                        | External appearance shall be free of any dirt, cratches and abnormalities that could adversely affect sales.                               |
| 2.14 | External Appearance                       | The manufacturer's code shall be printed on the memory card directly or on the seal which is then attached to the memory card.             |
| 2.15 | Manufacturer's Code                       | The user's brand name will be used.  |
| 2.16 | Brand Name                                | Not designed or rated radiation hardened.  |
| 2.17 | Not designed or rated radiation hardened. |  |

## 3. Block Diagram



## 4. Pin Connections

| PIN | SIGNAL                          | PIN | SIGNAL           | PIN | SIGNAL            | PIN | SIGNAL               |
|-----|---------------------------------|-----|------------------|-----|-------------------|-----|----------------------|
| 1   | GND                             | 18  | V <sub>PP1</sub> | 35  | GND               | 52  | V <sub>PP2</sub>     |
| 2   | D <sub>3</sub>                  | 19  | A <sub>16</sub>  | 36  | $\overline{CD}_1$ | 53  | A <sub>22</sub>      |
| 3   | D <sub>4</sub>                  | 20  | A <sub>15</sub>  | 37  | D <sub>11</sub>   | 54  | A <sub>23</sub>      |
| 4   | D <sub>5</sub>                  | 21  | A <sub>12</sub>  | 38  | D <sub>12</sub>   | 55  | A <sub>24</sub>      |
| 5   | D <sub>6</sub>                  | 22  | A <sub>7</sub>   | 39  | D <sub>13</sub>   | 56  | A <sub>25</sub> (NC) |
| 6   | D <sub>7</sub>                  | 23  | A <sub>6</sub>   | 40  | D <sub>14</sub>   | 57  | NC                   |
| 7   | $\overline{CE}_1$               | 24  | A <sub>5</sub>   | 41  | D <sub>15</sub>   | 58  | NC                   |
| 8   | A <sub>10</sub>                 | 25  | A <sub>4</sub>   | 42  | $\overline{CE}_2$ | 59  | NC                   |
| 9   | $\overline{OE}$                 | 26  | A <sub>3</sub>   | 43  | NC                | 60  | NC                   |
| 10  | A <sub>11</sub>                 | 27  | A <sub>2</sub>   | 44  | NC                | 61  | $\overline{REG}$     |
| 11  | A <sub>9</sub>                  | 28  | A <sub>1</sub>   | 45  | NC                | 62  | BVD <sub>2</sub>     |
| 12  | A <sub>8</sub>                  | 29  | A <sub>0</sub>   | 46  | A <sub>17</sub>   | 63  | BVD <sub>1</sub>     |
| 13  | A <sub>13</sub>                 | 30  | D <sub>0</sub>   | 47  | A <sub>18</sub>   | 64  | D <sub>8</sub>       |
| 14  | A <sub>14</sub>                 | 31  | D <sub>1</sub>   | 48  | A <sub>19</sub>   | 65  | D <sub>9</sub>       |
| 15  | $\overline{WE}/\overline{PGM}$  | 32  | D <sub>2</sub>   | 49  | A <sub>20</sub>   | 66  | D <sub>10</sub>      |
| 16  | $\overline{RDY}/\overline{BSY}$ | 33  | WP               | 50  | A <sub>21</sub>   | 67  | $\overline{CD}_2$    |
| 17  | V <sub>CC</sub>                 | 34  | GND              | 51  | V <sub>CC</sub>   | 68  | GND                  |

## Pin Descriptions :

|                                     |  |
|-------------------------------------|--|
| D <sub>0</sub> ~D <sub>7</sub>      | Data Bus (Input/output)  |
| D <sub>8</sub> ~D <sub>15</sub>     | Data Bus (Input/output)  |
| A <sub>0</sub> ~A <sub>24</sub>     | Address Bus (Input)  |
| $\overline{CE}_1, \overline{CE}_2$  | Card Enable (Input)  |
| $\overline{OE}$                     | Output Enable (Input)  |
| $\overline{WE}/\overline{PGM}$      | Write Enable/Program (Input)   |
| $\overline{CD}_1, \overline{CD}_2$  | Card Detect (Output) (Card Inserted Detection Signal)                          |
| WP                                  | Write Protect (Output) (in write protect mode, the WP output signal is "HIGH") |
| V <sub>PP1</sub>                    | Program/Erase Power Supply (Even Byte)   |
| V <sub>PP2</sub>                    | Program/Erase Power Supply (Odd Byte)  |
| $\overline{REG}$                    | Register Select (Input)  |
| BVD <sub>1</sub> , BVD <sub>2</sub> | Battery Voltage Detect (Always "HIGH")   |
| $\overline{RDY}/\overline{BSY}$     | Ready/Busy (Output)  |

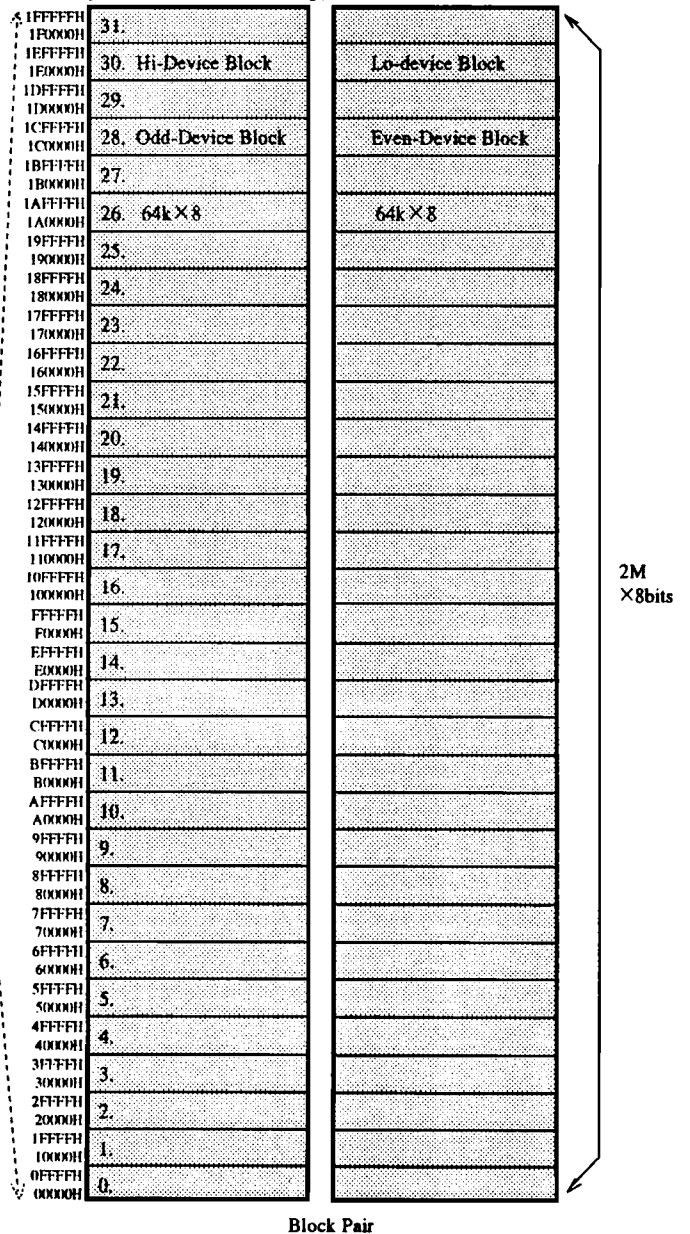
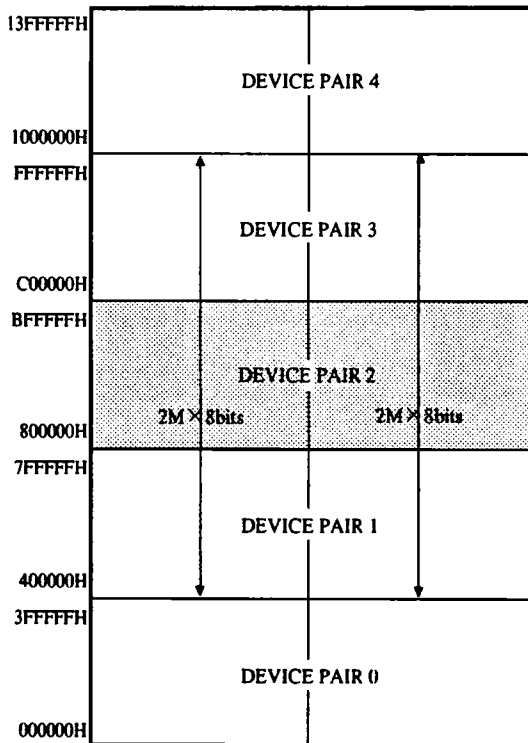
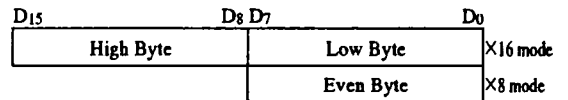
## 5. Function

### 5.1 Memory Block

5.1.1 Memory Configuration      16Mbits Flash Memory × 10 Devices.

5.1.2 Memory Erase Unit      Block Erase

Block:      Byte Mode      64k bytes  
             Word Mode      128k bytes



Device Pair

Block Pair

## 5.2 Function Table

| $\overline{CE}_1$ | $\overline{CE}_2$ | $A_0$ | $\overline{WE}$ | $\overline{OE}$ | REG | $V_{PP1}$ | $V_{PP2}$ | $V_{CC}$ | Operation      | $D_0-D_7$  | $D_8-D_{15}$ | Status  |
|-------------------|-------------------|-------|-----------------|-----------------|-----|-----------|-----------|----------|----------------|------------|--------------|---------|
| H                 | H                 | ×     | ×               | ×               | H   | $V_{PPL}$ | $V_{PPL}$ | $V_{CC}$ |                | Hi-Z       | Hi-Z         | Standby |
| L                 | H                 | L     | H               | L               | H   | $V_{PPL}$ | $V_{PPL}$ | $V_{CC}$ | Read (×8)      | Do (Even)  | Hi-Z         | Byte    |
| L                 | H                 | H     | H               | L               | H   | $V_{PPL}$ | $V_{PPL}$ | $V_{CC}$ | Read (×8)      | Do (Odd)   | Hi-Z         | Byte    |
| L                 | L                 | ×     | H               | L               | H   | $V_{PPL}$ | $V_{PPL}$ | $V_{CC}$ | Read (×16)     | Do (Even)  | Do (Odd)     | Word    |
| H                 | L                 | ×     | H               | L               | H   | $V_{PPL}$ | $V_{PPL}$ | $V_{CC}$ | Read (×8)      | Hi-Z       | Do (Odd)     | Byte    |
| L                 | ×                 | ×     | ×               | H               | H   | $V_{PPL}$ | $V_{PPL}$ | $V_{CC}$ | Output Disable | Hi-Z       | Hi-Z         | Byte    |
| H                 | L                 | ×     | ×               | H               | H   | $V_{PPL}$ | $V_{PPL}$ | $V_{CC}$ | Output Disable | Hi-Z       | Hi-Z         | Byte    |
| L                 | H                 | L     | L               | H               | H   | $V_{PPH}$ | $V_{PPX}$ | $V_{CC}$ | Program (×8)   | Di (Even)  | Don't care   | Byte    |
| L                 | H                 | H     | L               | H               | H   | $V_{PPX}$ | $V_{PPH}$ | $V_{CC}$ | Program (×8)   | Di (Odd)   | Don't care   | Byte    |
| L                 | L                 | ×     | L               | H               | H   | $V_{PPH}$ | $V_{PPH}$ | $V_{CC}$ | Program (×16)  | Di (Even)  | Di (Odd)     | Word    |
| H                 | L                 | ×     | L               | H               | H   | $V_{PPX}$ | $V_{PPH}$ | $V_{CC}$ | Program (×8)   | Don't care | Di (Odd)     | Byte    |
| L                 | H                 | L     | H               | L               | H   | $V_{PPH}$ | $V_{PPX}$ | $V_{CC}$ | Verify (×8)    | Do (Even)  | Hi-Z         | Byte    |
| L                 | H                 | H     | H               | L               | H   | $V_{PPX}$ | $V_{PPH}$ | $V_{CC}$ | Verify (×8)    | Do (Odd)   | Hi-Z         | Byte    |
| L                 | L                 | ×     | H               | L               | H   | $V_{PPH}$ | $V_{PPH}$ | $V_{CC}$ | Verify (×16)   | Do (Even)  | Do (Odd)     | Word    |
| H                 | L                 | ×     | H               | L               | H   | $V_{PPX}$ | $V_{PPH}$ | $V_{CC}$ | Verify (×8)    | Hi-Z       | Do (Odd)     | Byte    |
| L                 | H                 | H     | L               | L               | H   | $V_{PPH}$ | $V_{PPX}$ | $V_{CC}$ | *1 Prohibited  | —          | —            | —       |
| L                 | H                 | L     | L               | L               | H   | $V_{PPX}$ | $V_{PPH}$ | $V_{CC}$ | *1 Prohibited  | —          | —            | —       |
| L                 | L                 | ×     | L               | L               | H   | $V_{PPH}$ | $V_{PPH}$ | $V_{CC}$ | *1 Prohibited  | —          | —            | —       |
| H                 | L                 | ×     | L               | L               | H   | $V_{PPX}$ | $V_{PPH}$ | $V_{CC}$ | *1 Prohibited  | —          | —            | —       |

\*1. Do not use this mode as it will result in write errors.

H : High                      L : Low                      × : Don't Care  
 Di : Input Data              Do : Output Data          Hi-Z : High Impedance  
 $V_{CC}$  : 4.5 ~ 5.5V               $V_{PPL}$  : 0.0 ~ 1.5V           $V_{PPH}$  : 4.5 ~ 5.5V/11.4 ~ 12.6V  
 $V_{PPX}$  :  $V_{PPL}$  or  $V_{PPH}$

Caution: When the write Protect switch is in protect-mode, the WP signal is "HIGH" and write operation are not allowed.

### 5.3 Software Command (8/16 Bits Operation ( ) : 16 Bits Operation)

| Command                          | Bus Cycles | First Bus Cycle |         |                 | Second Bus Cycle |         |                 |             |
|----------------------------------|------------|-----------------|---------|-----------------|------------------|---------|-----------------|-------------|
|                                  |            | Operation       | Address | Data            | Operation        | Address | Data Input      | Data Output |
| Read Array/Reset                 | 1          | Write           | RA      | FFH/<br>(FFFFH) | —                | —       | —               | —           |
| Read Intelligent Identifier      | 3          | Write           | DA      | 90H/<br>(9090H) | Read             | IA      | —               | IID         |
| Read Status Register             | 2          | Write           | DA      | 70H/<br>(7070H) | Read             | DA      | —               | SRD         |
| Clear Status Register            | 1          | Write           | DA      | 50H/<br>(5050H) | —                | —       | —               | —           |
| Erase Setup/Erase Confirm        | 2          | Write           | BA      | 20H/<br>(2020H) | Write            | BA      | D0H/<br>(D0D0H) | —           |
| Erase Suspend/Erase Resume       | 2          | Write           | BA      | B0H/<br>(B0B0H) | Write            | BA      | D0H/<br>(D0D0H) | —           |
| Byte Write Setup/Write           | 2          | Write           | WA      | 40H/<br>(4040H) | Write            | WA      | WD              | —           |
| Alternate Byte Write Setup/Write | 2          | Write           | WA      | 10H/<br>(1010H) | Write            | WA      | WD              | —           |

Note) 1. This Table shows the basic form of Erase, Verify and Program Verify.

Refer Programming Flowchart, Erase Algorithm in detail.

2. Bus operations are defined in function table in page 6.

3. IA : Device Identifier Address      IID : Device Identifier Data

|                   | DA               | IA                     |                       |         | IID             |                  |
|-------------------|------------------|------------------------|-----------------------|---------|-----------------|------------------|
|                   |                  | 8Bits<br>(Even Device) | 8Bits<br>(Odd Device) | 16Bits  | Byte<br>(8Bits) | Word<br>(16Bits) |
| Manufacturer Code | 000000H~3FFFFFFH | 000000H                | 000001H               | 000000H | 89H             | 8989H            |
| Device Code       | 000000H~3FFFFFFH | 000002H                | 000003H               | 000001H | AAH             | AAAAH            |

RA : Read Address      WA : Write Address      WD : Write Data

DA : Device Address (Any Address in device is acceptable.)

BA : Erase Block Address (Erase Size is 64k Bytes.)

SRD : Status Register Data

4. Either 40H (4040H) or 10H (1010H) are recognized by the WSM as the Byte Write Setup Command.

a) Read Array/Reset Command: (FFH/FFFFH)

By writing this command, device. Devices pair become read mode. The device remains enable for reads until the Command User Interface contents are altered.

b) Intelligent Identifier Command: (90H/9090H):

After writing this command into the Command User Interface, a read cycle retrieves the manufacturer Code and device Code. To terminate the Operation, it is necessary to write another valid command into the register.

c) Read Status Register Command: (70H/7070H):

By Writing this command, the Status Register may be read at any time to determine when a byte or block erase operation is complete, and whether that operation completed successfully.

Refer to Status Register definition in page. 9. After writing this command, all subsequent read operations output data from the Status Register, until another valid command is written to the Command User Interface.

d) Clear Status Register Command: (50H/5050H)

Status bits which show error, the Erase Status (SR. 5), Byte Write Status (SR. 4) bits and the  $V_{PP}$  Status bit (SR. 3) can be reset by the Clear Status Machine Register Command.

e) Erase Setup/Erase Command: (20H/2020H) (D0H/D0D0H): Erase is executed one block (64kB for 1 device, 128kB for 2 devices) at a time.

This command is functional when  $V_{PP} = V_{PPH}$  and an Erase Setup Command is first written to the Command User Interface, followed by the Erase Confirm Command. After that, the device automatically outputs Status Register data when read.

The CPU can detect the completion of the erase event by analyzing the output of the  $RDY/\overline{BSY}$  pin, or the WSM Status bit of the Status Register. When erase is completed, the Erase Status bit should be checked. If erase error is detected, the Status Register should be cleared.

f) Erase Suspend/Erase Resume Command: (B0H/B0B0H) / (D0H/D0D0H)

The Erase Suspend command allows block erase interruption in order to read data from another block of memory. The device continues to output Status Register data when read, after the Erase Suspend Command is written. Polling the WSM Status and Erase Suspend Status bits will determine when the erase operation has been suspended.  $RDY/\overline{BSY}$  pin will also transition to  $V_{OH}$ . At this point, a Read Array Command can be written to the Command User Interface to read data from blocks other than that which is suspended.  $V_{PP}$  must remain at  $V_{PPH}$  while device is in Erase Suspend.

Erase Resume Command, at which time the WSM will continue with the erase process. The Erase Suspend Status and WSM Status bits of the Status Register will be automatically cleared and  $RDY/\overline{BSY}$  pin will return to  $V_{OL}$ . After the Erase Resume is written, the device automatically output Status Register data when read.

g) Byte Write Setup/Write Command: (40H/4040H) or (10H/1010H)

This command is functional when  $V_{PP} = V_{PPH}$  and an Byte Write Setup Command is first written to the Command User Interface, followed by a second write specifying the address and data to be written. The WSM then take over, controlling the byte write and write verify algorithms internally. After the two command byte sequence is written to it, the device automatically outputs Status Register data when read. The CPU can detect the completion of the byte write event by analyzing the output of the  $RDY/\overline{BSY}$  pin, or the WSM Status bits of the Status Register.

## 5.4 Status Register

The memory devices in this card have Status Register which shows state of the device.

### Byte Access × 8 Bits

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|------|------|------|------|------|------|------|------|
| SR.7 | SR.6 | SR.5 | SR.4 | SR.3 | SR.2 | SR.1 | SR.0 |
| WSMS | ESS  | ES   | BWS  | VPPS | RFU  | RFU  | RFU  |

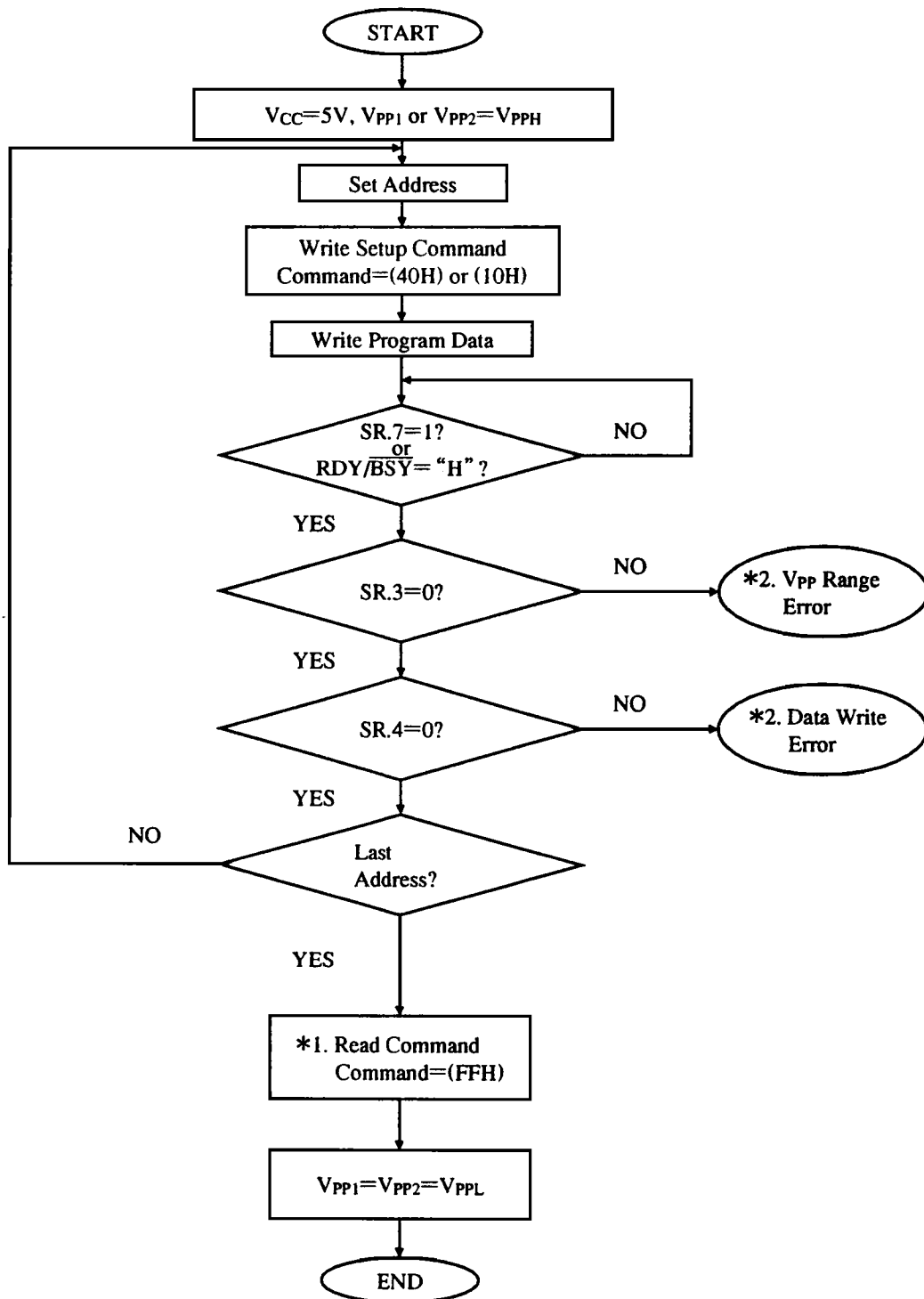
| Register  | Contents  |
|---|---|
| SR.7=Write State Machine Status<br>1=Ready<br>0=Busy  | When set "1" s, read, erase, data write is acceptable.  |
| SR.6=Eraser Suspend Status<br>1=Eraser Suspend<br>0=Eraser In Progress/Completed                      | Check whether Eraser Suspend Command is executed or not.  |
| SR.5=Eraser Status<br>1=Error In Block Eraser<br>0=Successful Block Eraser                            | Set "1" s when fail to Eraser.<br>Reset by the Clear Status Register Command.   |
| SR.4=Byte Write Status<br>1=Error In Byte Write<br>0=Successful Byte Write                            | Set "1" s when fail to Byte Write.<br>Reset by the Clear Status Register Command.   |
| SR.3=V <sub>pp</sub> Status<br>1=V <sub>pp</sub> Low Detect ; Operation Abort<br>0=V <sub>pp</sub> OK | Set "1" s when V <sub>pp</sub> , which is needed in Byte Write or Eraser operation, is below V <sub>ppH</sub> . Reset by the Clear Status Register Command. |
| SR.2~SR.0=Reserved for Future Use   |   |

### Word Access × 16 bits

| bit15           |       |       |       |       |       |      |      | bit8             |      | bit7 |      | bit0 |      |      |      |
|-----------------|-------|-------|-------|-------|-------|------|------|------------------|------|------|------|------|------|------|------|
| SR.15           | SR.14 | SR.13 | SR.12 | SR.11 | SR.10 | SR.9 | SR.8 | SR.7             | SR.6 | SR.5 | SR.4 | SR.3 | SR.2 | SR.1 | SR.0 |
| Odd Byte device |       |       |       |       |       |      |      | Even Byte device |      |      |      |      |      |      |      |

## 5.5 Programming Flowchart

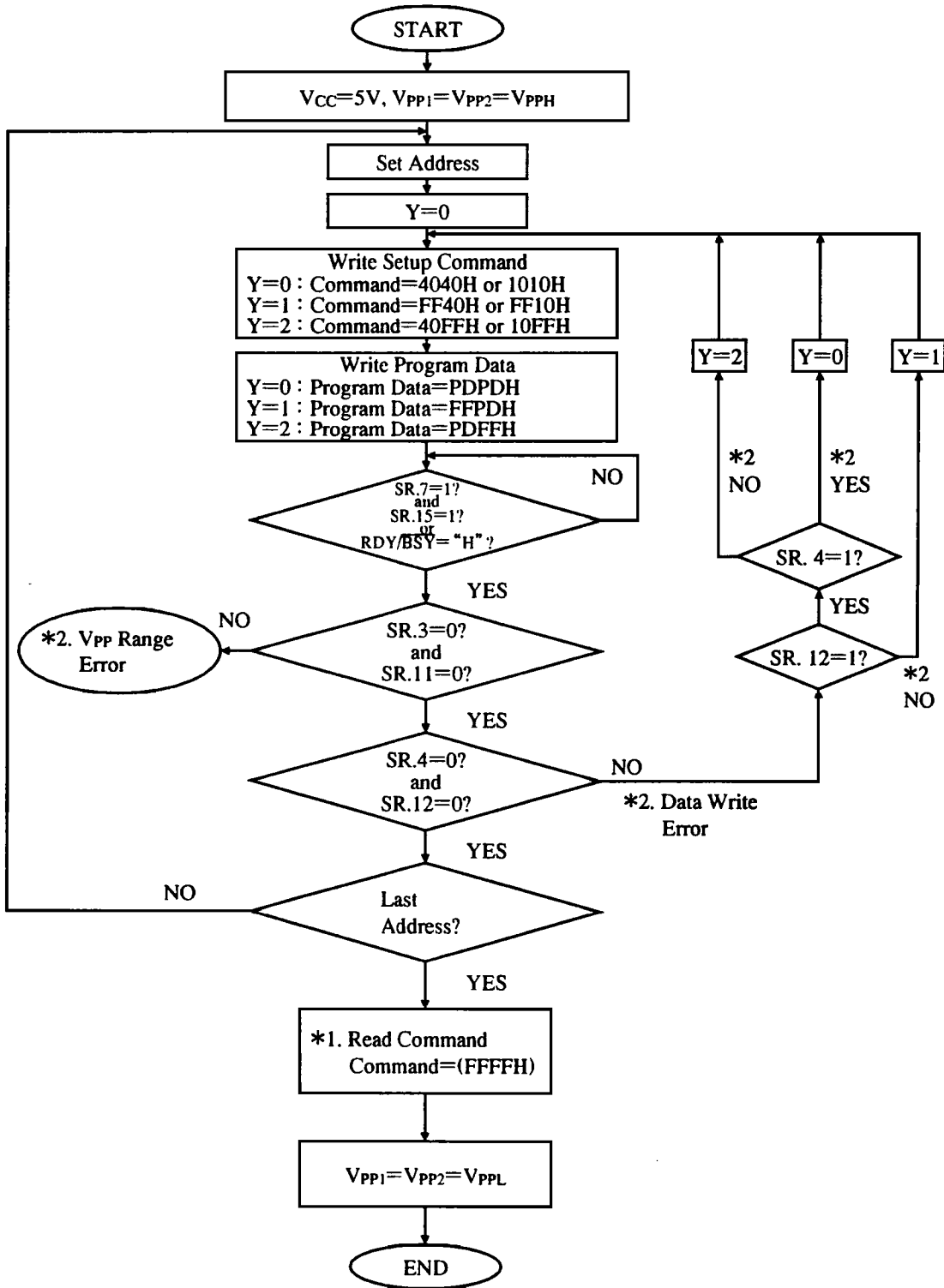
(Byte Mode)



Note) \* 1. Write FFH after the last block write operation to reset the device to Read Array Mode.

\* 2. If error is detected, clear the Status Register before attempting retry or other error recovery.

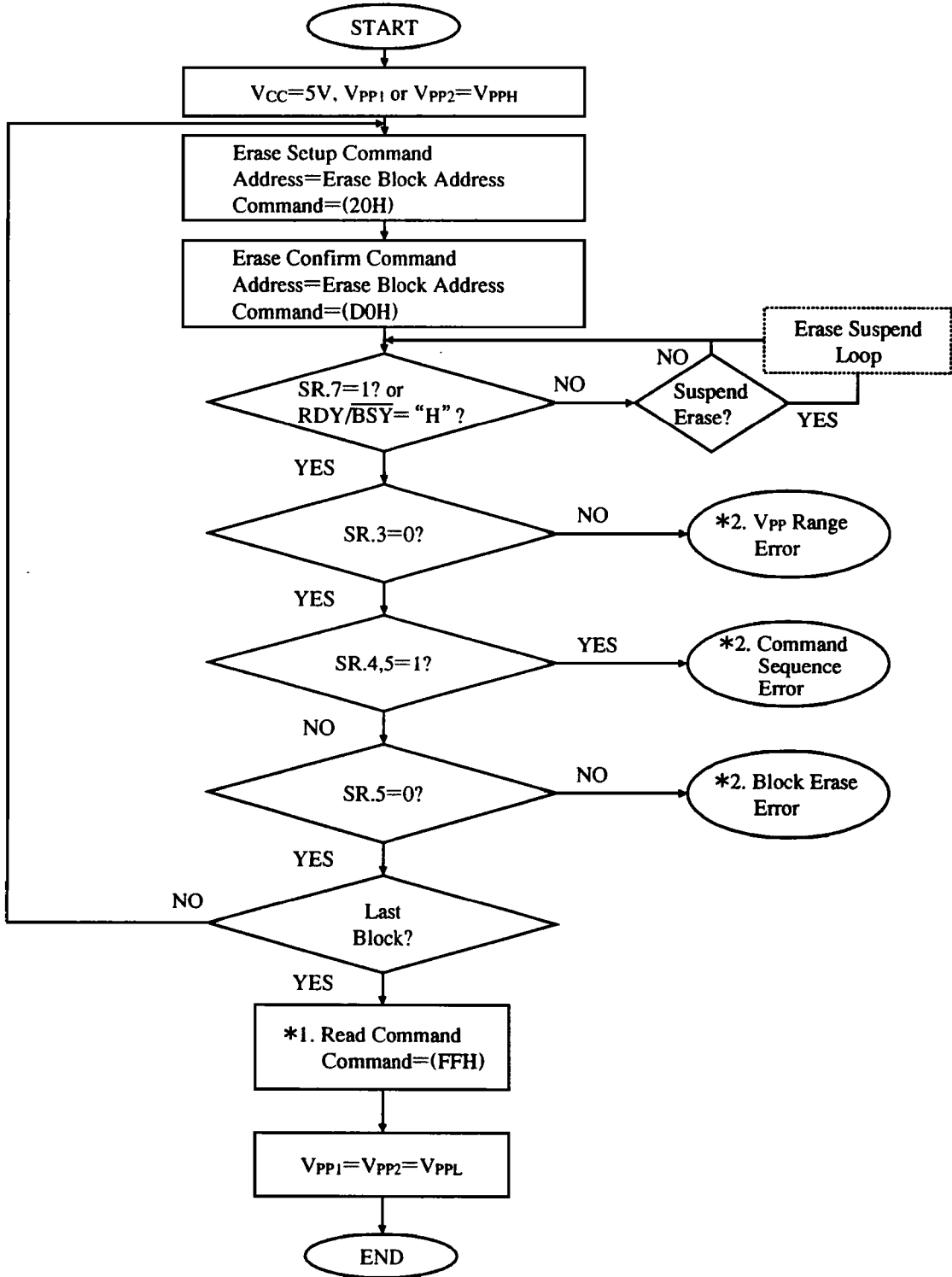
**Programming Flowchart**  
(Word Mode)



Note) \*1. Write FFFFH after the last block write operation to reset the device to Read Array Mode.  
 \*2. If error is detected, clear the Status Register before attempting retry or other error recovery.

## 5.6 Erase Algorithm

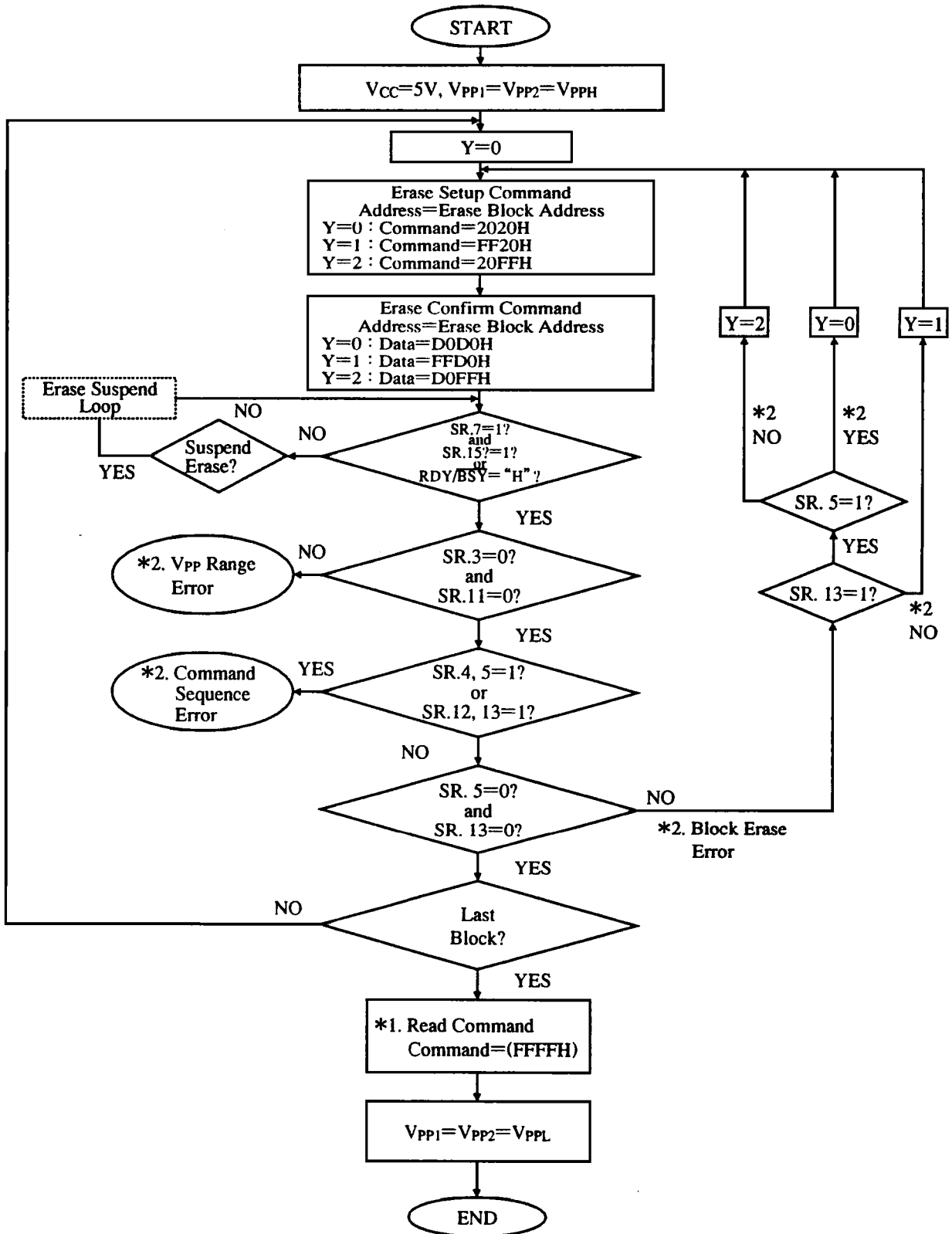
(Byte Mode)



Note) \* 1. Write FFH after the last block write operation to reset the device to Read Array Mode.

\* 2. If error is detected, clear the Status Register before attempting retry or other error recovery.

Erase Algorithm  
(Word Mode)



Note) \*1. Write FFFFH after the last block erase operation to reset the device to Read Array Mode.

\*2. If error is detected, clear the Status Register before attempting retry or other error recovery.

## 6. Absolute Maximum Ratings

| PARAMETER             | SYMBOL    | RATING                           | UNIT |
|-----------------------|-----------|----------------------------------|------|
| Supply Voltage        | $V_{CC}$  | -0.3 to 7.0                      | V    |
| Input Voltage         | $V_{IN}$  | -0.3 to $V_{CC}+0.3$ (Max : 7.0) | V    |
| Output Voltage        | $V_{OUT}$ | -0.3 to $V_{CC}+0.3$ (Max : 7.0) | V    |
| Operating Temperature | $T_{OPR}$ | 0 to +60                         | °C   |
| Storage Temperature   | $T_{STG}$ | -20 to +65                       | °C   |

## 7. Recommended Operating Conditions

| PARAMETER             | SYMBOL    | Min. | Max.         | UNIT |
|-----------------------|-----------|------|--------------|------|
| Operating Temperature | $T_{OPR}$ | 0    | +60          | °C   |
| Supply Voltage        | $V_{CC}$  | 4.5  | 5.5          | V    |
| Input Voltage High    | $V_{IH}$  | 3.5  | $V_{CC}+0.3$ | V    |
| Input Voltage Low     | $V_{IL}$  | -0.3 | 1.5          | V    |

## 8. Capacitance

| PARAMETER                | SYMBOL   | Min. | TYP | Max. | UNIT | CONDITION  |
|--------------------------|----------|------|-----|------|------|--|
| Input Capacitance        | $C_{IN}$ | —    | 17  | —    | pF   | $V_{CC}=5V \pm 10\%$<br>$f=1MHz, T_a=25^\circ C$ |
| Input/Output Capacitance | $C_{IO}$ | —    | 17  | —    | pF   |  |

## 9. Read Operation

### 9.1 DC Characteristics

( $V_{CC}=4.5\sim 5.5V$ ,  $T_a=0\sim 60^\circ C$ )

| PARAMETER                          |  | SYMBOL    | Min.             | TYP | Max.         | UNIT    | CONDITION                                     |
|------------------------------------|--|-----------|------------------|-----|--------------|---------|---|
| Operating Voltage                  | High Temperature   | $V_{CC}$  | 4.5              | —   | 5.5          | V       |   |
|                                    | Low Temperature  |           |                  |     |              |         |   |
| Current Consumption * <sup>1</sup> | Static Operatin Current  | $I_{SB}$  | —                | —   | 2.0          | mA      | X16, Address : PingPong                       |
|                                    | Dynamic Operating Current  | $I_{CC}$  | —                | —   | 80           |         |   |
| Input Voltage                      | Input Voltage Level High   | $V_{IH}$  | 3.5              | —   | $V_{CC}+0.3$ | V       | $V_{CC}=4.5\sim 5.5V$                         |
|                                    | Input Voltage Level Low  | $V_{IL}$  | -0.3             | —   | 1.5          |         |   |
| Input Current                      | $A_0\sim A_{24}, D_0\sim D_{15}$   | $I_{I,1}$ | -10              | —   | 70           | $\mu A$ | $V_1=V_{CC}, 0V$                              |
|                                    | $\overline{CE}_1, \overline{CE}_2, \overline{OE}, \overline{WE}, \overline{REG}$ |           | -70              | —   | 10           |         |   |
| Output Voltage                     | High   | $V_{OH}$  | $V_{CC}\sim 0.5$ | —   | —            | V       | $I_{OH}=-2mA (*^2)$<br>$I_{OH}=-4\mu A (*^3)$ |
|                                    | Low  | $V_{OL}$  | —                | —   | 0.4          |         | $I_{OL}=4mA$                                  |

PingPong : Scan the target address, with accessing the target and another address alternately.

- \* 1 (1) Static Operating Current : With the memory card's voltage at 5.5V and the  $\overline{CE}_1, \overline{CE}_2, \overline{OE}, \overline{WE}$  and  $\overline{REG}$  signals "HIGH" ( $V_{IH}=V_{CC}-0.2V$ ),  $A_0$  signal "LOW" ( $V_{IL}\leq 0.2V$ ) the current consumption is measured with the output open.
- (2) Dynamic Operating Current : With the memory card's  $V_{CC}$  at 5.5V and  $V_{PP1}=V_{PP2}$  at 12.6V, current consumption during access is measured with the output open.  
(Access time : 200ns) The current depends on addressing.
- \* 2  $D_0\sim D_{15}$
- \* 3  $BVD_1, BVD_2, RDY/\overline{BSY}, WP$

### 9.2 AC Characteristics ( $V_{CC}=4.5\sim 5.5V$ , $V_{PP}=0.0\sim 1.5V$ , $T_a=0\sim 60^\circ C$ )

Testing Conditions:

- 1) Input Pulse Level : 0.8~3.5V
- 2) Input Rise/Fall Time : 10ns
- 3) Input/Output Timing Reference Level : 1.5V
- 4) Output Load : 1TTL +  $C_L$  (100pF) (including scope and jig capacitance)

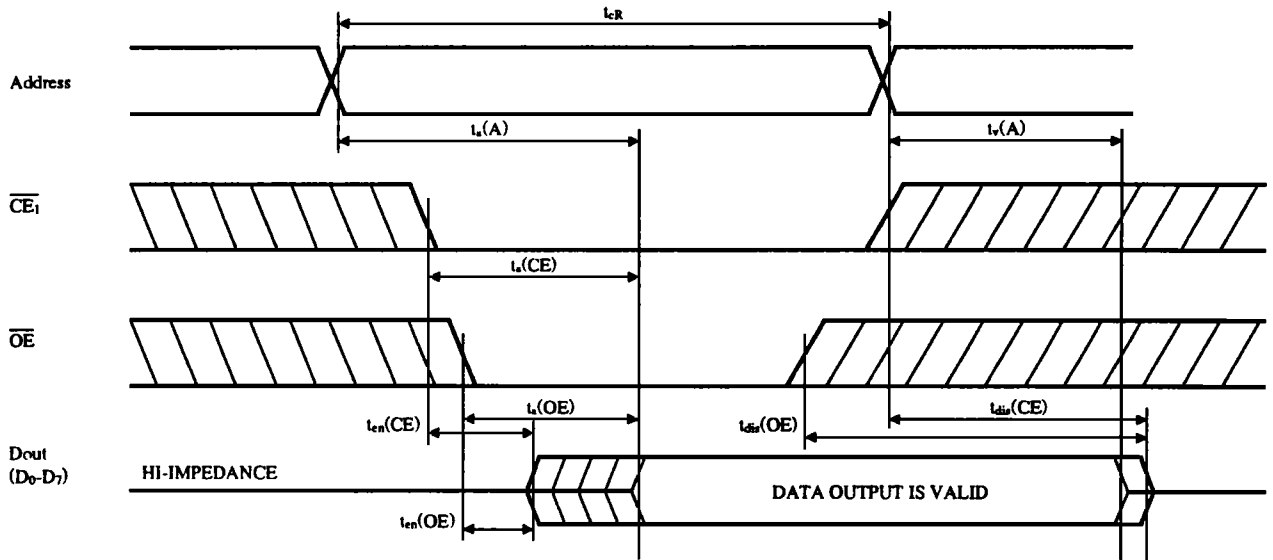
#### 9.2.1 Read Cycle

( $V_{CC}=4.5\sim 5.5V$ ,  $V_{PP}=0.0\sim 1.5V$ ,  $T_a=0\sim 60^\circ C$ )

| PARAMETER                                  | SYMBOL     | SYMBOL (PCMCIA) | Min. | Max. | UNIT |
|--|------------|-----------------|------|------|------|
| Read Cycle Time                            | $t_{AVAV}$ | $t_{CR}$        | 200  | —    | ns   |
| Address Access Time                        | $t_{AVQV}$ | $t_a (A)$       | —    | 200  |      |
| Card Enable Access Time                    | $t_{ELQV}$ | $t_a (CE)$      | —    | 200  |      |
| Output Enable Access Time                  | $t_{GLQV}$ | $t_a (OE)$      | —    | 100  |      |
| Output Disable Time from $\overline{CE}$ * | $t_{EHQV}$ | $t_{dis} (CE)$  | —    | 90   |      |
| Output Disable Time from $\overline{OE}$ * | $t_{GHQZ}$ | $t_{dis} (OE)$  | —    | 90   |      |
| Output Enable Time from $\overline{CE}$    | $t_{ELQX}$ | $t_{en} (CE)$   | 5    | —    |      |
| Output Enable Time form $\overline{OE}$    | $t_{GLQX}$ | $t_{en} (OE)$   | 5    | —    |      |
| Data Valid from Add Change                 |            | $t_v (A)$       | 0    | —    |      |

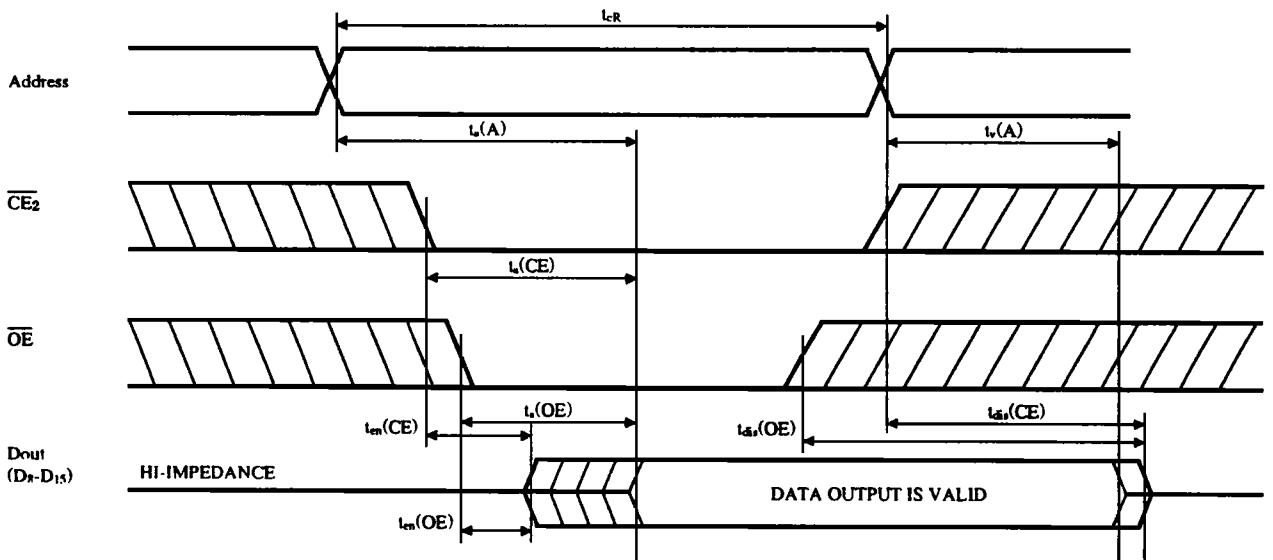
\* Time until output becomes floating. (The output voltage is not defined.)

○Read CYCLE (1) ( $\overline{CE}_2 = V_{IH}$  Fixed), 8bits Output



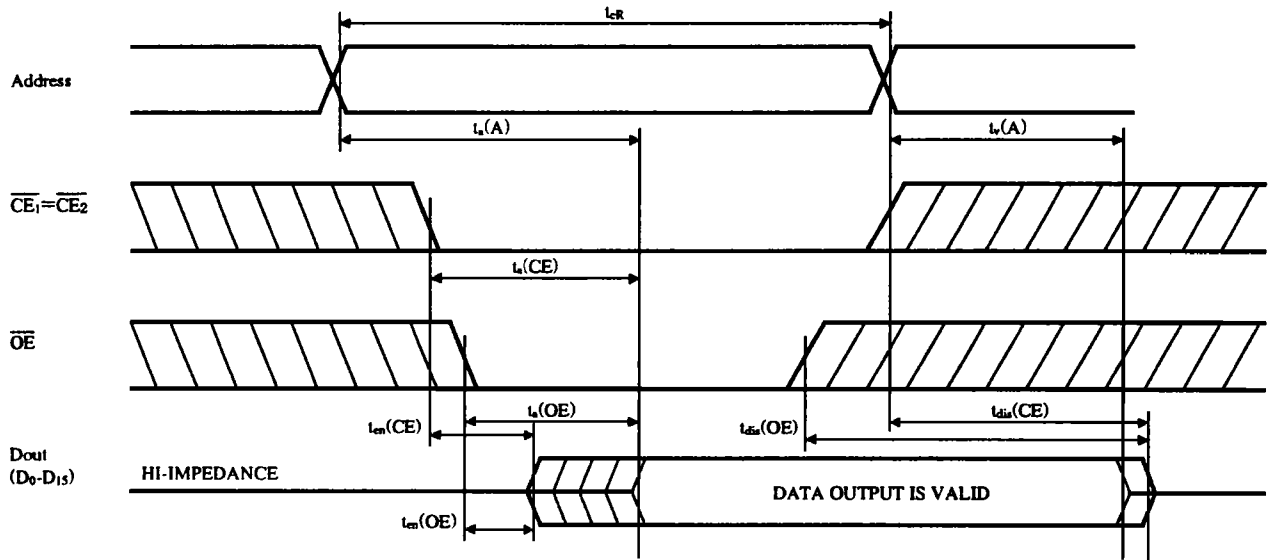
- Note) 1.  $\overline{WE} = \text{"HIGH"}$ , during a read cycle.  
 2. Either "HIGH" or "LOW" in diagonal areas.  
 3. The output data becomes valid when last interval,  $t_L(A)$ ,  $t_L(CE)$  or  $t_L(OE)$  have concluded.

○Read Cycle (2) ( $\overline{CE}_1 = V_{IH}$  Fixed), 8Bits Output



- Note) 1.  $\overline{WE} = \text{"HIGH"}$ , during a read cycle.  
 2. Either "HIGH" or "LOW" in diagonal areas.  
 3. The output data becomes valid when last interval,  $t_L(A)$ ,  $t_L(CE)$  or  $t_L(OE)$  have concluded.

○Read Cycle (3), 16Bits Output



- Note) 1.  $\overline{WE}$  = "HIGH", during a read cycle.  
 2. Either "HIGH" or "LOW" in diagonal areas.  
 3. Change  $\overline{CE}_1$  and  $\overline{CE}_2$  at the same time.  
 4. The output data becomes valid when last interval,  $t_{A(A)}$ ,  $t_{A(CE)}$  or  $t_{A(OE)}$  have concluded.

## 10. Programming Operation

### 10.1 DC Characteristics

( $V_{CC}=4.5\sim 5.5V$ ,  $V_{PP}=4.5\sim 5.5V/11.4\sim 12.6V$ ,  $T_a=0\sim 60^\circ C$ )

| PARAMETER                                       | SYMBOL  | Min.      | Max.         | UNIT         | CONDITION |
|---|---------|-----------|--------------|--------------|-----------|
| $V_{PP1}, V_{PP2}$ operating Voltage            | Read    | $V_{PPL}$ | 0            | 1.5          | V         |
|   | Program | $V_{PPH}$ | 4.5<br>11.4  | 5.5<br>12.6  |           |
| $V_{PP1}, V_{PP2}$ operating Current (×16 Mode) | Read    | $I_{SB2}$ | —            | 1.6          | mA        |
|   | Program | $I_{PP}$  | —            | 45<br>20     |           |
| $V_{CC}$ operating Current                      | Standby | $I_{SB1}$ | —            | 2            | ×16 Mode  |
|   | Program | $I_{CC}$  | —            | 75           |           |
| Input Voltage                                   |         | $V_{IL}$  | -0.3         | 1.5          | V         |
|   |         | $V_{IH}$  | 3.5          | $V_{CC}+0.3$ |           |
| Output Voltage During Verify                    |         | $V_{OL}$  | —            | 0.4          | V         |
|   |         | $V_{OH}$  | $V_{CC}-0.5$ | —            |           |

- Note) 1. Power on  $V_{CC}$  before power on  $V_{PP}$ , power off  $V_{CC}$  after power off  $V_{PP}$ .  
 2. Keep  $V_{PP}$  including its overshoot, below 13V.  
 3. Card insertion or removal while applying  $V_{PP}=12V$  may cause a loss of integrity.  
 4. Do not turn on or turn off during  $\overline{CE} = \text{"LOW"}$ .  
 5. If  $V_{IH}$  goes above  $V_{CC}+0.3V$ , normal operation is not assured.

10.2 AC Characteristics ( $V_{CC}=4.5\sim 5.5V$ ,  $V_{PP}=4.5\sim 5.5V/11.4\sim 12.6V$ ,  $T_a=0\sim 60^\circ C$ )

## Testing Conditions:

- 1) Input Pulse Level : 0.8~3.5V
- 2) Input Rise/Fall Time : 10ns
- 3) Input/Output Timing Reference Level : 1.5V
- 4) Output Load : 1TTL +  $C_L$  (100pF) (including scope and jig capacitance)

## 10.2.1 Program Cycle

 $\overline{WE}$  Controlled( $V_{CC}=4.5\sim 5.5V$ ,  $V_{PP}=4.5\sim 5.5V/11.4\sim 12.6V$ ,  $T_a=0\sim 60^\circ C$ )

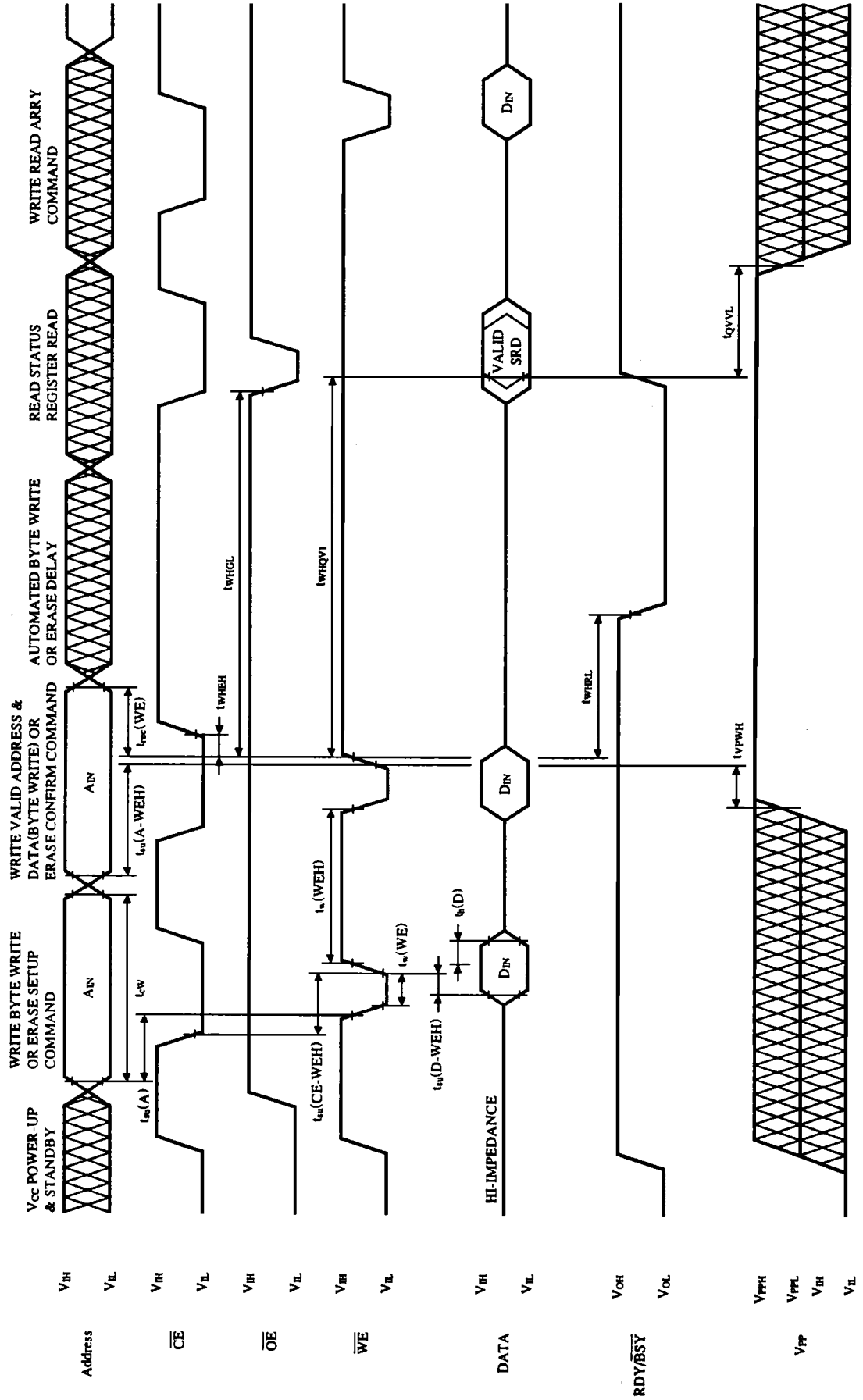
| PARAMETER  | SYMBOL   | SYMBOL (PCMCIA)  | Min. | Max. | UNIT    |
|--|--|------------------|------|------|---------|
| Write Cycle Time   | $t_{AVAV}$                                       | $t_{cW}$         | 200  | —    | ns      |
| Address Setup Time                                       | $t_{AVWL}$                                       | $t_{su}(A)$      | 20   | —    |         |
| Write Recovery Time                                      | $t_{WHAX}$                                       | $t_{rec}(WE)$    | 30   | —    |         |
| Data Setup Time for $\overline{WE}$                      | $t_{DVWH}$                                       | $t_{su}(D-WEH)$  | 60   | —    |         |
| Data Hold Time   | $t_{WHDX}$                                       | $t_h(D)$         | 30   | —    |         |
| Write Recovery Before Read                               | $t_{WHGL}$                                       |                  | 10   | —    |         |
| Card Enable Setup time for $\overline{WE}$               | $t_{ELWH}$                                       | $t_{su}(CE-WEH)$ | 140  | —    |         |
| Address Setup for $\overline{WE}$                        | $t_{AVWH}$                                       | $t_{su}(A-WEH)$  | 140  | —    |         |
| Card Enable Hold Time                                    | $t_{WHEH}$                                       |                  | 15   | —    |         |
| Write Pulse Width  | $t_{WLWH}$                                       | $t_w(WE)$        | 120  | —    |         |
| Write Pulse Width High                                   | $t_{WHWL}$                                       | $t_w(WEH)$       | 30   | —    |         |
| $\overline{WE}$ High to RDY/ $\overline{BSY}$ Going Low  | $t_{WHRL}$                                       |                  | —    | 150  |         |
| Duration of write operation                              | $V_{PP}=4.5\sim 5.5V$<br>$V_{PP}=11.4\sim 12.6V$ | $t_{WHQVI}$      | 6.5  | —    | $\mu S$ |
|  |  |                  | 4.8  | —    |         |
| $V_{PP}$ Setup to $\overline{WE}$ Going High             | $t_{VPWH}$                                       |                  | 100  | —    | ns      |
| $V_{PP}$ Hold from Valid SRD, RDY/ $\overline{BSY}$ High | $t_{QVVL}$                                       |                  | 0    | —    |         |

 $\overline{CE}$  Controlled( $V_{CC}=4.5\sim 5.5V$ ,  $V_{PP}=4.5\sim 5.5V/11.4\sim 12.6V$ ,  $T_a=0\sim 60^\circ C$ )

| PARAMETER  | SYMBOL   | SYMBOL (PCMCIA)  | Min. | Max. | UNIT    |
|--|--|------------------|------|------|---------|
| Write Cycle Time   | $t_{AVAV}$                                       | $t_{cW}$         | 200  | —    | ns      |
| Address Setup Time                                       | $t_{AVEL}$                                       | $t_{su}(A)$      | 20   | —    |         |
| Write Recovery Time                                      | $t_{EIAAX}$                                      | $t_{rec}(CE)$    | 30   | —    |         |
| Data Setup Time for $\overline{CE}$                      | $t_{DVEH}$                                       | $t_{su}(D-CEH)$  | 60   | —    |         |
| Data Hold Time   | $t_{EHDX}$                                       | $t_h(D)$         | 30   | —    |         |
| Write Recovery Before Read                               | $t_{EHGL}$                                       |                  | 10   | —    |         |
| Write Enable Setup time for $\overline{CE}$              | $t_{WLEH}$                                       | $t_{su}(WE-CEH)$ | 140  | —    |         |
| Address Setup for $\overline{CE}$                        | $t_{AVEH}$                                       | $t_{su}(A-CEH)$  | 140  | —    |         |
| Write Enable Hold Time                                   | $t_{EHWL}$                                       |                  | 0    | —    |         |
| Write Pulse Width  | $t_{ELEH}$                                       | $t_w(CE)$        | 120  | —    |         |
| Write Pulse Width High                                   | $t_{EHEL}$                                       | $t_w(CEH)$       | 30   | —    |         |
| $\overline{WE}$ High to RDY/ $\overline{BSY}$ Going Low  | $t_{EHRL}$                                       |                  | —    | 150  |         |
| Duration of write operation                              | $V_{PP}=4.5\sim 5.5V$<br>$V_{PP}=11.4\sim 12.6V$ | $t_{EHQVI}$      | 6.5  | —    | $\mu S$ |
|  |  |                  | 4.8  | —    |         |
| $V_{PP}$ Setup to $\overline{WE}$ Going High             | $t_{VPEH}$                                       |                  | 100  | —    | ns      |
| $V_{PP}$ Hold from Valid SRD, RDY/ $\overline{BSY}$ High | $t_{QVVL}$                                       |                  | 0    | —    |         |

1. Set  $\overline{CE}_1$ ,  $\overline{CE}_2$ ,  $\overline{OE}$  and  $\overline{WE}$  "HIGH", when  $V_{PP}$  changes from  $V_{PPL}$  to  $V_{PPH}$  or vice versa.

Program Cycle (WE Controlled)



Note) While the data signal is in output mode, do not apply an opposite phase signal.



## 11. Erase Operation

### 11.1 DC Characteristics

( $V_{CC}=4.5\sim 5.5V$ ,  $V_{PP}=4.5\sim 5.5V/11.4\sim 12.6V$ ,  $T_a=0\sim 60^\circ C$ )

| PARAMETER  |               | SYMBOL     | Min.         | Max.         | UNIT  | CONDITION               |   |
|--|---------------|------------|--------------|--------------|---|-------------------------|---|
| $V_{PP1}, V_{PP2}$<br>Operating Voltage                        | Read          | $V_{PPL}$  | 0            | 1.5          | V   |                         |   |
|  | Program       | $V_{PPHE}$ | 4.5          | 5.5          |   | $V_{PP}=4.5\sim 5.5V$   |   |
|  |               |            | 11.4         | 12.6         |   | $V_{PP}=11.4\sim 12.6V$ |   |
| $V_{PP1}, V_{PP2}$<br>Operating Current<br>( $\times 16$ Mode) | Standby       | $I_{SB2}$  | —            | 1.6          | mA  | I/O open                |   |
|  | Erase         | $I_{PP}$   | —            | 45           |   | RMS                     | $V_{PP}=4.5\sim 5.5V$                             |
|  |               |            | —            | 20           |   |                         | $V_{PP}=11.4\sim 12.6V$                           |
| Erase Suspend  | $I_{PPS}$     | —          | 1.6          |              | $\overline{CE}_1, \overline{CE}_2 = V_{IH}$ , RMS |                         |   |
| $V_{CC}$ Operating<br>Current<br>( $\times 16$ Mode)           | Standby       | $I_{SB1}$  | —            | 2.0          | V   | I/O open                |   |
|  | Erase         | $I_{CCE}$  | —            | 75           |   | RMS                     |   |
|  | Erase Suspend | $I_{CCES}$ | —            | 22           |   |                         | $\overline{CE}_1, \overline{CE}_2 = V_{IH}$ , RMS |
| Input Voltage  |               | $V_{IL}$   | -0.3         | 1.5          | V   |                         |   |
|  |               | $V_{IH}$   | 3.5          | $V_{CC}+0.3$ |   |                         |   |
| Output Voltage<br>During Verify                                |               | $V_{OL}$   | —            | 0.4          | V   | $I_{OL}=4mA$            |   |
|  |               | $V_{OH}$   | $V_{CC}-0.5$ | —            |   |                         | $I_{OH}=-2mA$                                     |

Note) Power on  $V_{CC}$  before power on  $V_{PP}$ , power off  $V_{CC}$  after power off  $V_{PP}$ . Keep  $V_{PP}$  including its overshoot, below 13V Card insertion or removal while applying  $V_{PP}=12V$  may cause a loss of integrity. Do not turn on or turn off during  $\overline{CE} = "LOW"$ .

If  $V_{IH}$  goes above  $V_{CC}+0.3V$ , normal operation is not assured.

### 11.2 AC Characteristics ( $V_{CC}=4.5\sim 5.5V$ , $V_{PP}=4.5\sim 5.5V/11.4\sim 12.6V$ , $T_a=0\sim 60^\circ C$ )

Testing Conditions:

- 1) Input Pulse Level : 0.8~3.5V
- 2) Input Rise/Fall Time : 10ns
- 3) Input/Output Timing Reference Level : 1.5V
- 4) Output Load : 1TTL +  $C_L$  (100pF) (including scope and jig capacitance)

#### 11.2.1 Erase Cycle

$\overline{WE}$  Controlled

( $V_{CC}=4.5\sim 5.5V$ ,  $V_{PP}=4.5\sim 5.5V/11.4\sim 12.6V$ ,  $T_a=0\sim 60^\circ C$ )

| PARAMETER  | SYMBOL                  | SYMBOL (PCMCIA)  | Min. | Max. | UNIT |
|--|-------------------------|------------------|------|------|------|
| Write Cycle Time   | $t_{AVAV}$              | $t_{LW}$         | 200  | —    | ns   |
| Address Setup Time                                       | $t_{AVWL}$              | $t_{su}(A)$      | 20   | —    |      |
| Write Recovery Time                                      | $t_{WHAX}$              | $t_{rec}(WE)$    | 30   | —    |      |
| Data Setup Time for $\overline{WE}$                      | $t_{DVWH}$              | $t_{su}(D-WEH)$  | 60   | —    |      |
| Data Hold Time   | $t_{WHDX}$              | $t_h(D)$         | 30   | —    |      |
| Write Recovery Before Read                               | $t_{WHGL}$              |                  | 10   | —    |      |
| Card Enable Setup time for $\overline{WE}$               | $t_{ELWH}$              | $t_{su}(CE-WEH)$ | 140  | —    |      |
| Address Setup for $\overline{WE}$                        | $t_{AVWH}$              | $t_{su}(A-WEH)$  | 140  | —    |      |
| Card Enable Hold Time                                    | $t_{WHEH}$              |                  | 15   | —    |      |
| Write Pulse Width  | $t_{WLWH}$              | $t_w(WE)$        | 120  | —    |      |
| Write Pulse Width High                                   | $t_{WHWL}$              | $t_w(WEH)$       | 30   | —    |      |
| $\overline{WE}$ High to RDY/ $\overline{BSY}$ Going Low  | $t_{WHRL}$              |                  | —    | 150  |      |
| Duration of Erase operation                              | $V_{PP}=4.5\sim 5.5V$   | $t_{WHQV2}$      | 0.9  | —    |      |
|  | $V_{PP}=11.4\sim 12.6V$ |                  | 0.3  | —    |      |
| $V_{PP}$ Setup to $\overline{WE}$ Going High             | $t_{VPWH}$              |                  | 100  | —    | ns   |
| $V_{PP}$ Hold from Valid SRD, RDY/ $\overline{BSY}$ High | $t_{QVVL}$              |                  | 0    | —    |      |

$\overline{CE}$  Controlled

( $V_{CC}=4.5\sim 5.5V$ ,  $V_{PP}=4.5\sim 5.5V/11.4\sim 12.6V$ ,  $T_a=0\sim 60^\circ C$ )

| PARAMETER   | SYMBOL                  | SYMBOL (JEIDA)   | Min. | Max. | UNIT |
|---|-------------------------|------------------|------|------|------|
| Write Cycle Time  | $t_{AVAV}$              | $t_{cw}$         | 200  | —    | ns   |
| Address Setup Time                                      | $t_{AVEH}$              | $t_{su}(A)$      | 20   | —    |      |
| Write Recovery Time                                     | $t_{EHAX}$              | $t_{rec}(CE)$    | 30   | —    |      |
| Data Setup Time for $\overline{CE}$                     | $t_{DVEH}$              | $t_{su}(D-CEH)$  | 60   | —    |      |
| Data Hold Time  | $t_{EHDX}$              | $t_h(D)$         | 30   | —    |      |
| Write Recovery Before Read                              | $t_{EHGL}$              |                  | 10   | —    |      |
| Write Enable Setup time for $\overline{CE}$             | $t_{WLEH}$              | $t_{su}(WE-CEH)$ | 140  | —    |      |
| Address Setup for $\overline{CE}$                       | $t_{AVEH}$              | $t_{su}(A-CEH)$  | 140  | —    |      |
| Write Enable Hold Time                                  | $t_{EWHH}$              |                  | 0    | —    |      |
| Write Pulse Width                                       | $t_{ELEH}$              | $t_w(CE)$        | 120  | —    |      |
| Write Pulse Width High                                  | $t_{EHHL}$              | $t_w(CEH)$       | 30   | —    |      |
| $\overline{WE}$ High to $RDY/\overline{BSY}$ Going Low  | $t_{EHRL}$              |                  | —    | 150  |      |
| Duration of Erase operation                             | $V_{PP}=4.5\sim 5.5V$   | $t_{EHQV2}$      | 0.9  | —    | s    |
|   | $V_{PP}=11.4\sim 12.6V$ | $t_{EHQV2}$      | 0.3  | —    |      |
| $V_{PP}$ Setup to $\overline{WE}$ Going High            | $t_{VPEH}$              |                  | 100  | —    | ns   |
| $V_{PP}$ Hold from Valid $SRD, RDY/\overline{BSY}$ High | $t_{OVVL}$              |                  | 0    | —    |      |

1. Set  $\overline{CE}_1, \overline{CE}_2, \overline{OE}$  and  $\overline{WE}$  "HIGH", when  $V_{PP}$  changes from  $V_{PPL}$  to  $V_{PPH}$  or vice versa.



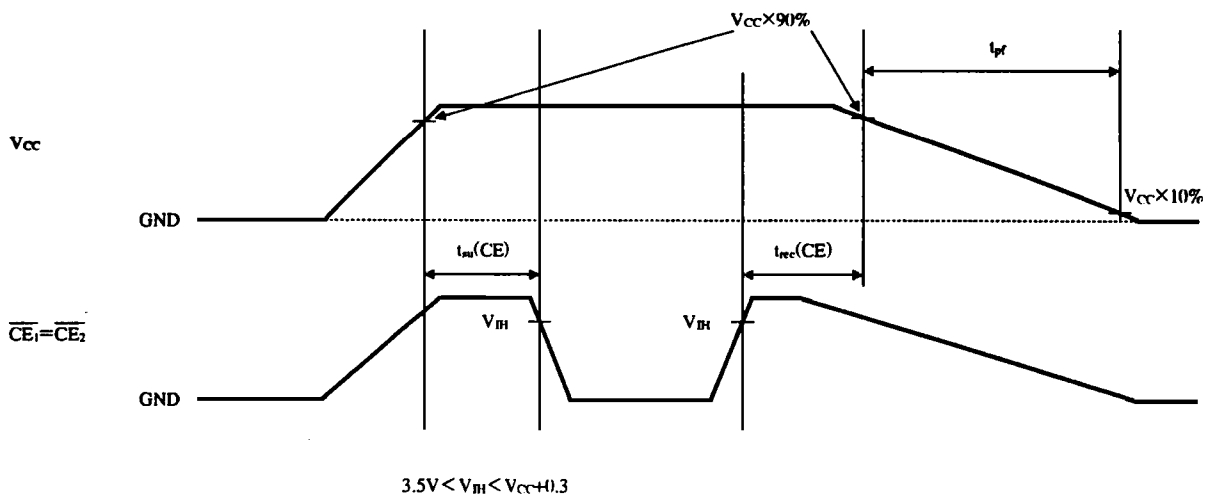


## 12. Block Erase and Data Write Characteristics

( $V_{CC}=4.5\sim 5.5V$ ,  $V_{PP}=4.5\sim 5.5V/11.4\sim 12.6V$ ,  $T_a=0\sim 60^\circ C$ )

| PARAMETER             |                        | Min. | Typ. | Max. | UNIT |
|-----------------------|------------------------|------|------|------|------|
| Block Pair Erase Time | $V_{PP}=4.5\sim 5.5V$  | —    | 1.1  | 10   | s    |
|                       | $V_{PP}=11.4\sim 12.6$ | —    | 1.0  | 10   |      |
| Block Pair Write Time | $V_{PP}=4.5\sim 5.5V$  | —    | 0.5  | 2.1  |      |
|                       | $V_{PP}=11.4\sim 12.6$ | —    | 0.4  | 2.1  |      |

## 13. Voltage Timing ( $T_a=25^\circ C$ )



| PARAMETER                     | SYMBOL        | Min. | Max. | UNIT    |
|-------------------------------|---------------|------|------|---------|
| $\overline{CE}$ Setup Time    | $t_{su}(CE)$  | 4.0  | —    | ms      |
| $\overline{CE}$ Recovery Time | $t_{rec}(CE)$ | 1.0  | —    | $\mu s$ |
| $V_{CC}$ Falling Time         | $t_{pf}$      | 3.0  | 300  | ms      |

Note) 1. When  $V_{CC}$  (4.5~5.5V) is applied to the memory card and you are inserting or removing the card,  $\overline{CE}_1$ ,  $\overline{CE}_2$  should both be high-impedance. At such a time, other signal line should also be hi-impedance. After inserting the memory card, do not access it during the  $\overline{CE}$  setup time (minimum of 4ms).

(During this time, neither  $\overline{CE}_1$  nor  $\overline{CE}_2 = \text{“LOW”}$ .)

2. When  $V_{CC}$  is turn on, if the condition (for example,  $V_{CC}$  rising time. etc) is not sufficient to as specified, it is possible that device's Status Register is not cleared or device not becomes to Read Array Mode. To prevent these, it is recommended that using software command, reset the Status Register or set the device to Read Array Mode.

ex.

Reset the Status Register    50H (5050H)  
 Set to Read Array Mode    FFH (FFFFH)

## 14. Attribute Memory

The attribute memory holds the attribute information of the card such as the type of card, bit configuration, speed and so on.

### EEPROM Model

Card has 2k bytes of EEPROM attribute memory. To read the attribute memory, set  $\overline{REG}$  = "LOW" and perform a read with the same access timing as common memory read.

For this operation, access time is 300ns maximum. To allow 2k bytes of attribute memory, even addresses from 0 to 4096 are reserved. Since only the even-numbered bytes are used, reading odd-numbered bytes will result in invalid data.

Note) We have another type of attribute memory as follows,

No EEPROM Model. (Model no.ID244L02: 5 bytes device informations in even address 0 to 8, read only in card's control circuit, with the same access timing as common memory read.

### 14.1 Attribute Memory Read/Write Function Chart

| $\overline{CE}_1$ | $\overline{CE}_2$ | $A_0$ | $\overline{WE}$ | $\overline{OE}$ | $\overline{REG}$ | MODE                         | $D_0 \sim D_7$    | $D_8 \sim D_{15}$ | STAATUS     |
|-------------------|-------------------|-------|-----------------|-----------------|------------------|------------------------------|-------------------|-------------------|-------------|
| H                 | H                 | X     | X               | X               | X                |                              | High-Z            | High-Z            | Standby     |
| L                 | H                 | L     | H               | L               | L                | Read (×8)                    | $D_0$ (even byte) | High-Z            | Byte Access |
| L                 | H                 | H     | H               | L               | L                |                              | High-Z            | High-Z            | Standby     |
| L                 | L                 | X     | H               | L               | L                | Read (×8)                    | $D_0$ (even byte) | High-Z            | Byte Access |
| H                 | L                 | X     | H               | L               | L                |                              | High-Z            | High-Z            | Standby     |
| L                 | H                 | L     | L               | H               | L                | Write (×8)                   | $D_1$ (even byte) | ×××               | Byte Access |
| L                 | H                 | H     | L               | H               | L                |                              | ×××               | ×××               | Standby     |
| L                 | L                 | X     | L               | H               | L                | Write (×8)                   | $D_1$ (even byte) | ×××               | Byte Access |
| H                 | L                 | X     | L               | H               | L                |                              | ×××               | ×××               | Standby     |
| L                 | X                 | X     | H               | L               | L                | Attribute Memory Address 0~8 | $D_0$             | High-Z            | Byte Access |

H : High

L : Low

X : High/Low not applicable

$D_i$  : Input Data

$D_o$  : Output Data

Hi-Z : High Impedance    ××× : Don't Care

Notes : 1) When the write protect switch is in protect-mode, the WP output signal is "HIGH" and write operations (including attribute memory) are not allowed.

2)  $A_0 \sim A_{11}$  are attribute memory address. Addresses after  $A_{12}$  are not decoded, so care should be taken.

### 14.2 AC Characteristics ( $V_{CC} = 4.5V \sim 5.5V$ , $T_a = 0 \sim 60^\circ C$ )

#### Testing Conditions

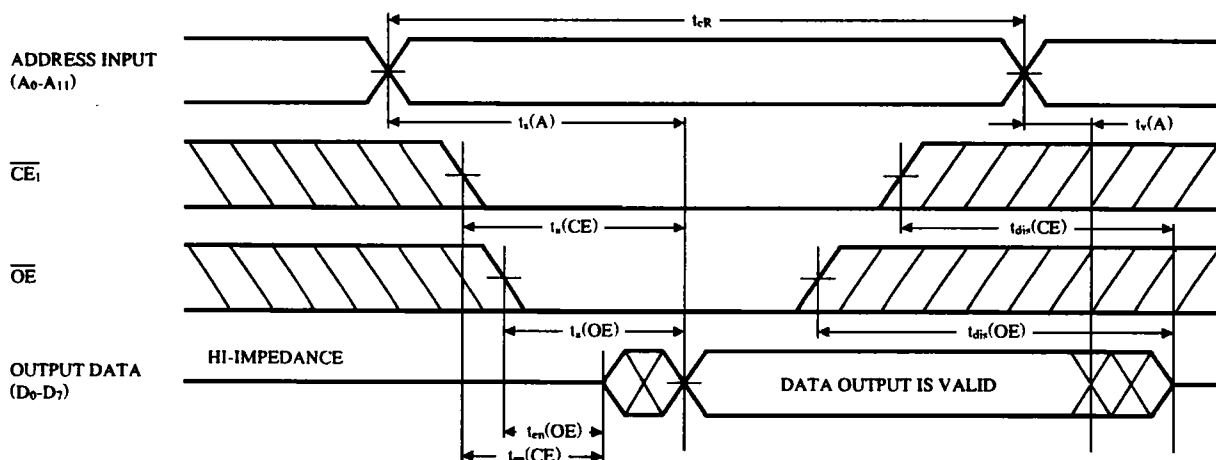
- 1) Input Pulse Level : 0.8~3.5V
- 2) Input Rise/Fall Time : 10ns
- 3) Input/Output Timing Reference Level : 1.5V
- 4) Output Load Capacitance : 1TTL +  $C_L$  (100pF)  
(including scope and jig capacitance)

### 14.3 Attribute Memory Read Cycle

( $V_{CC}=4.5\sim 5.5V$ ,  $T_a=0\sim 60^{\circ}C$ )

| PARAMETER                                | SYMBOL    | SYMBOL (PCMCIA) | Min. | Max. | UNIT |
|--|-----------|-----------------|------|------|------|
| Read Cycle Time                          | $t_{CR}$  | $t_{cR}$        | 300  | —    | ns   |
| Address Access Time                      | $t_{ACC}$ | $t_a (A)$       | —    | 300  |      |
| Card Enable Access Time                  | $t_{CE}$  | $t_a (CE)$      | —    | 300  |      |
| Output Enable Access Time                | $t_{OE}$  | $t_a (OE)$      | —    | 150  |      |
| Output Disable Time from $\overline{CE}$ |           | $t_{dis} (CE)$  | —    | 100  |      |
| Output Disable Time from $\overline{OE}$ | $t_{DF}$  | $t_{dis} (OE)$  | —    | 100  |      |
| Output Enable Time from $\overline{CE}$  |           | $t_{en} (CE)$   | 5    | —    |      |
| Output Enable Time from $\overline{OE}$  |           | $t_{en} (OE)$   | 5    | —    |      |
| Data Valid from Add Change               | $t_{OH}$  | $t_v (A)$       | 0    | —    |      |

#### ○ Attribute Memory Read Cycle



- Note:
1. To read attribute memory,  $\overline{REG} = \text{"LOW"}$ ,  $\overline{WE} = \text{"HIGH"}$  and either  $\overline{CE}_2 = \text{"LOW"}$  or else  $\overline{CE}_2 = \text{"HIGH"}$  and  $A_0 = \text{"LOW"}$ .
  2. The output data becomes valid when last interval,  $t_a(A)$ ,  $t_a(CE)$  or  $t_a(OE)$  have concluded.

## 14.4 Attribute Memory Write Cycle

WE Controlled

(V<sub>CC</sub>=4.5V~5.5V, Ta=0~60°C)

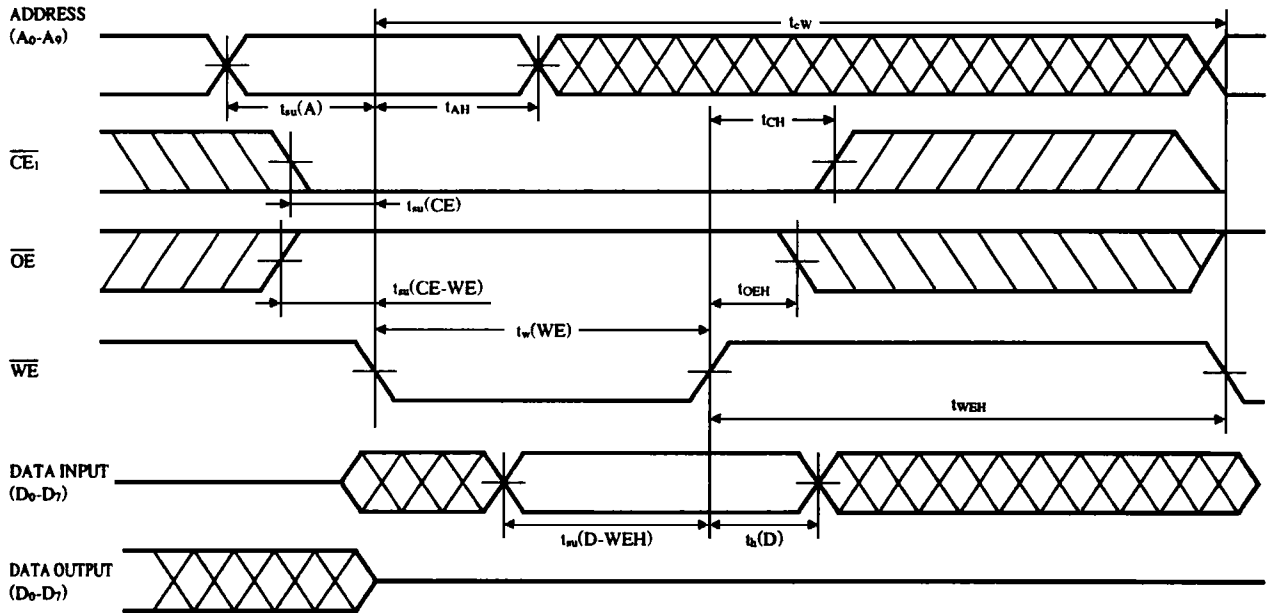
| PARAMETER                           | SYMBOL           | SYMBOL (PCMCIA)         | Min. | Max. | UNIT |
|-------------------------------------|------------------|-------------------------|------|------|------|
| Write Cycle Time                    | t <sub>WC</sub>  | t <sub>cw</sub>         | 10   | —    | ms   |
| Write Pulse Width                   | t <sub>WP</sub>  | t <sub>w</sub> (WE)     | 180  | —    | ns   |
| Address Setup Time                  | t <sub>AS</sub>  | t <sub>su</sub> (A)     | 10   | —    |      |
| Data Setup Time for $\overline{WE}$ | t <sub>DS</sub>  | t <sub>su</sub> (D-WEH) | 100  | —    |      |
| Card Enable Setup Time              | t <sub>CES</sub> | t <sub>su</sub> (CE)    | 0    | —    |      |
| Output Enable Setup Time            | t <sub>OES</sub> | t <sub>su</sub> (OE-WE) | 45   | —    |      |
| Address Hold Time                   | t <sub>AH</sub>  |                         | 260  | —    |      |
| Write Hold Time                     | t <sub>CH</sub>  |                         | 0    | —    |      |
| Output Enable Hold Time             | t <sub>OEH</sub> |                         | 70   | —    |      |
| $\overline{WE}$ HIGH Hold Time      | t <sub>WEH</sub> |                         | 9.9  | —    | ms   |
| Data Hold Time                      | t <sub>DH</sub>  | t <sub>h</sub> (D)      | 80   | —    | ns   |

$\overline{CE}$  Controlled

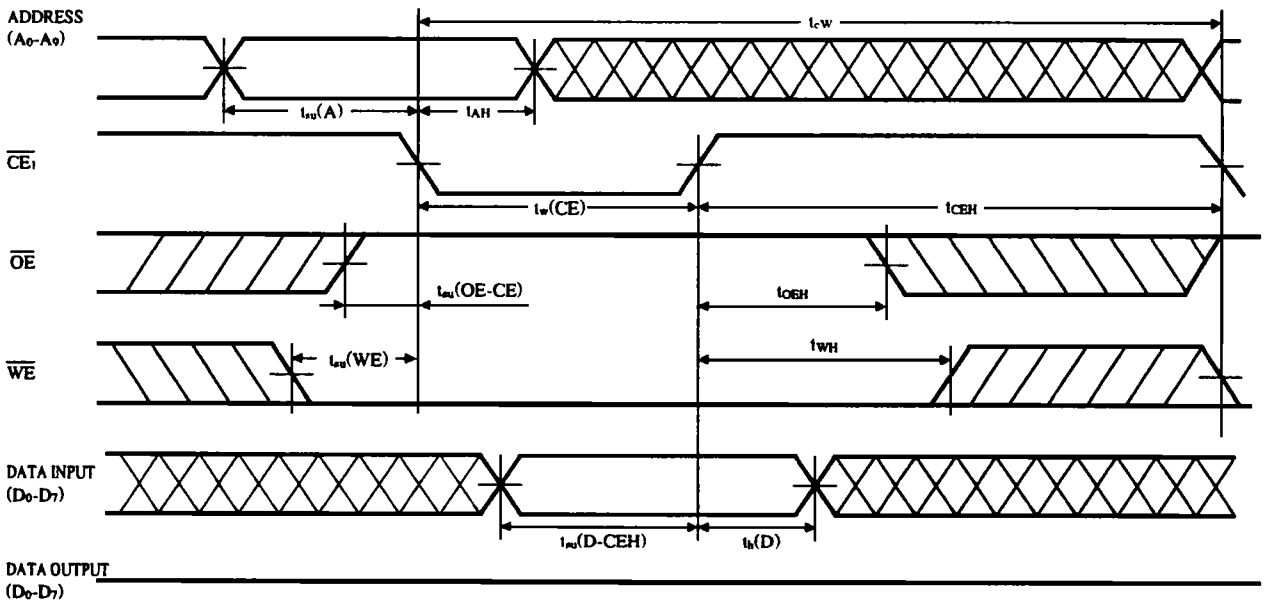
(V<sub>CC</sub>=4.5V~5.5V, Ta=0~60°C)

| PARAMETER                           | SYMBOL           | SYMBOL (PCMCIA)         | Min. | Max. | UNIT |
|-------------------------------------|------------------|-------------------------|------|------|------|
| Write Cycle Time                    | t <sub>WC</sub>  | t <sub>cw</sub>         | 10   | —    | ms   |
| Write Pulse Width                   | t <sub>WP</sub>  | t <sub>w</sub> (CE)     | 210  | —    | ns   |
| Address Setup Time                  | t <sub>AS</sub>  | t <sub>su</sub> (A)     | 10   | —    |      |
| Data Setup Time for $\overline{CE}$ | t <sub>DS</sub>  | t <sub>su</sub> (D-CEH) | 100  | —    |      |
| Write Enable Setup Time             | t <sub>WES</sub> | t <sub>su</sub> (WE)    | 0    | —    |      |
| Output Enable Setup Time            | t <sub>OES</sub> | t <sub>su</sub> (OE-CE) | 45   | —    |      |
| Address Hold Time                   | t <sub>AH</sub>  |                         | 260  | —    |      |
| Write Hold Time                     | t <sub>WH</sub>  |                         | 0    | —    |      |
| Output Enable Hold Time             | t <sub>OEH</sub> |                         | 70   | —    |      |
| $\overline{CE}$ HIGH Hold Time      | t <sub>CEH</sub> |                         | 9.9  | —    | ms   |
| Data Hold Time                      | t <sub>DH</sub>  | t <sub>h</sub> (D)      | 80   | —    | ns   |

○ Attribute Memory Write Cycle ( $\overline{WE}$  Controlled)



○ Attribute Memory Write Cycle ( $\overline{CE}_2$  Controlled)



Note: 1. To write attribute memory,  $\overline{REG} = \text{"LOW"}$  and either  $\overline{CE}_2 = \text{"LOW"}$  or else  $\overline{CE}_2 = \text{"HIGH"}$  and  $A_0 = \text{"LOW"}$

## 15. Specification Changes

Specifications may be changed upon discussion and agreement between both parties.

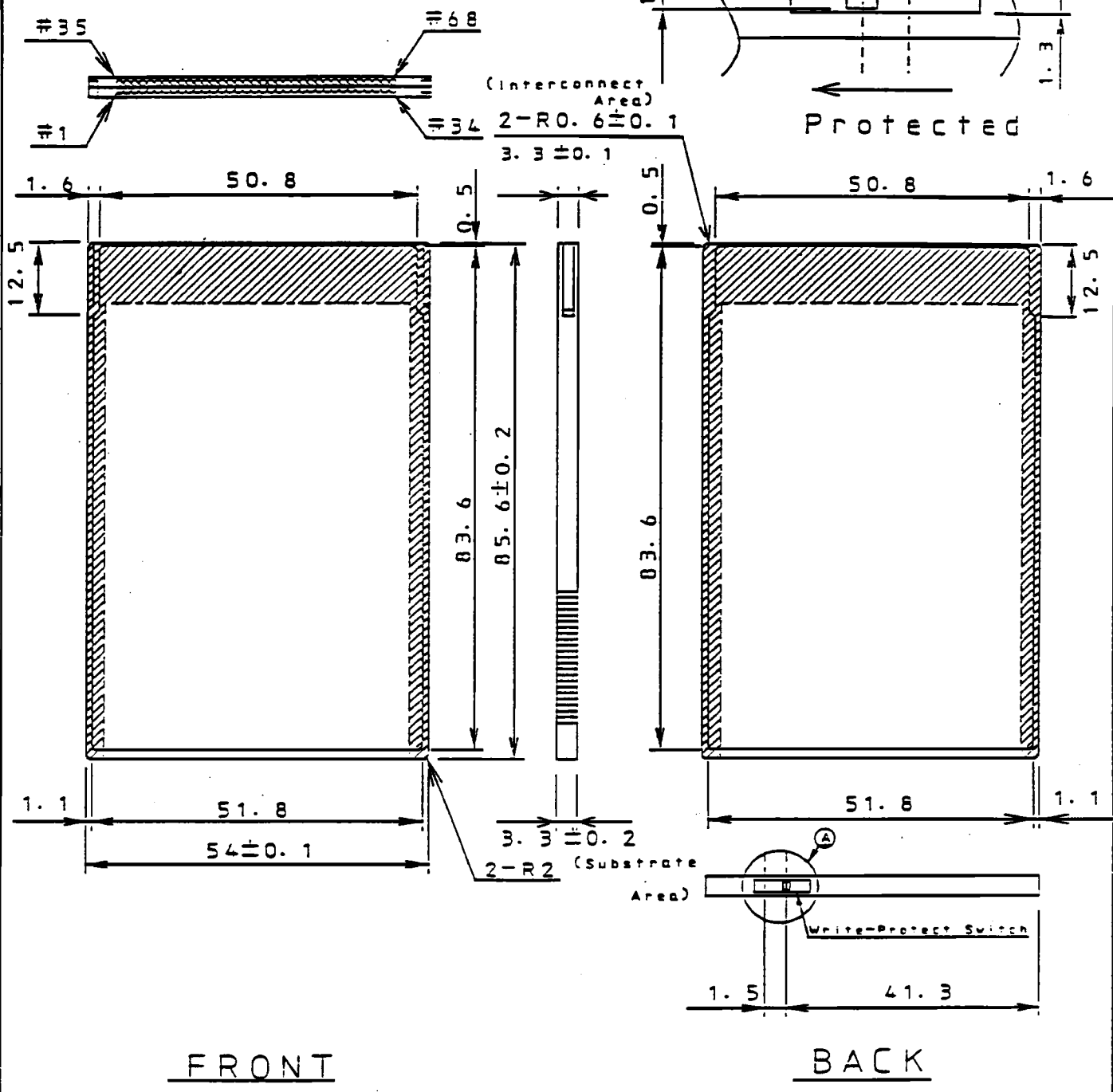
## 16. Othes Precautions

- Permanent damage occurs if the memory card is stressed beyond Absolute Maximum Ratings. Operation beyond the Recommended Operating Conditions is not recommended and extended exposure beyond the Recommended Operating Conditions may affect device reliability.
- Writing to the memory card can be prevented by switching on the write protect switch on the end of the memory card.
- Avoid allowing the memory card connectors to come in contact with metals and avoid touching the connectors, as the internal circuits can be damaged by static electricity.
- Avoid storing in direct sunlight, high temperatures (do not place near heaters or radiators), high humidity and dusty areas.
- Avoid subjecting the memory card to strong physical abuse. Dropping, bending, smashing or throwing the card can result in loss of function.
- When the memory card is not being used, return it to its protective case.
- Do not allow the memory card to come in contact with fire.

**SHARP**

Ⓐ ENLARGEMENT OF THE  
WRITE-PROTECT SWITCH

17. External Diagrams



FRONT

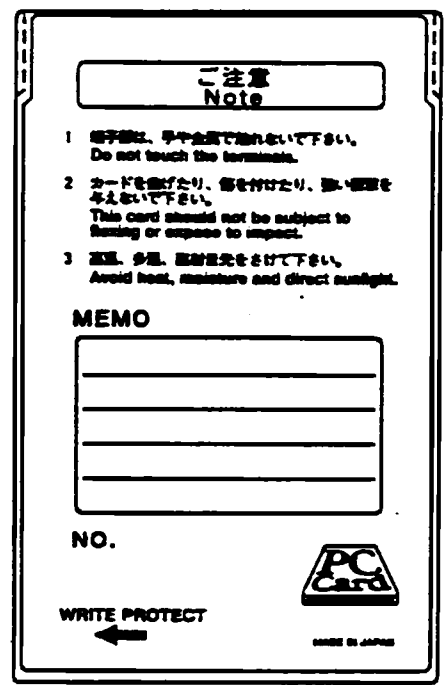
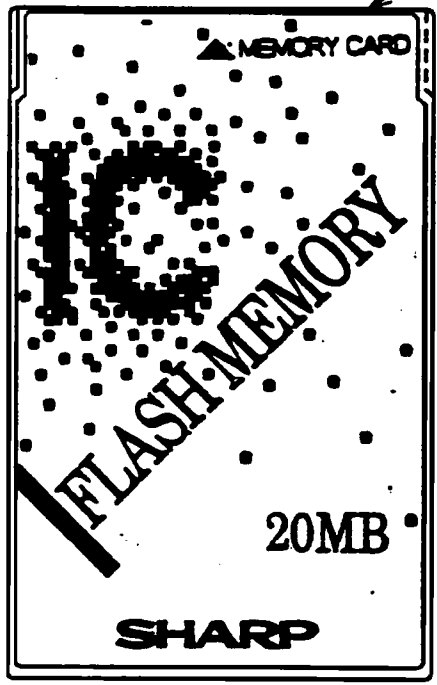
BACK

|                                   |              |          |        |             |                       |
|-----------------------------------|--------------|----------|--------|-------------|-----------------------|
| APPLICABLE                        |              | SCALE    | UNIT   | Ⓐ           |                       |
| MODEL                             |              | 1 / 1    | mm     | CM. DATE    | REVISE                |
| THICKNESS                         |              | MATERIAL | FINISH | NAME        |                       |
| DATE                              | 1996. 11. 16 |          |        | MEMORY CARD |                       |
| DESIGN                            | DRAW         | TRACE    | CHECK  | APPROVE     | EXTERNAL DIAGRAM      |
| Memory Card Business Project Team |              |          |        |             | PCMCIA Rel. 2.0 TYPE: |
| TENRI IC GROUP                    |              |          |        |             | DRAWING NO.           |
| SHARP CORPORATION                 |              |          |        |             | IMC001-A102           |

# SHARP

## 19. EXTERNAL APPEARANCES.

CONNECTOR SIDE



Labeling position

### FRONT PANEL

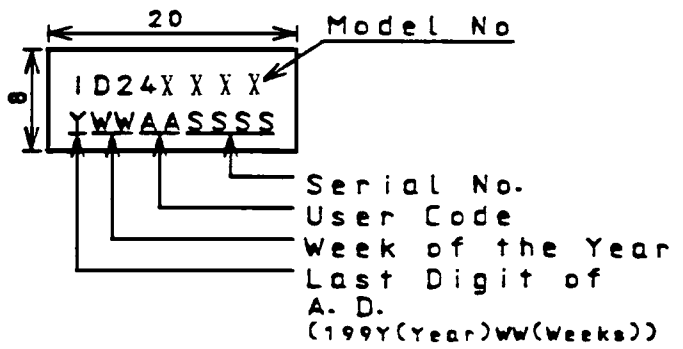
|  |                       |
|--|-----------------------|
| Part No                                      | PA-R1-FF-045          |
| Back Ground                                  | DIC No. 290 Ver. 1    |
| "IC" Text                                    | DIC No. 906 Ver. 5    |
| Other Characters                             |                       |
| MEMORY CARD<br>FLASH MEMORY<br>10MB<br>SHARP | DIC No. 651           |
| Design                                       | Refer to above figure |

### BACK PANEL

|                     |                       |
|---------------------|-----------------------|
| Part No             | PA-R1-FR-001          |
| Back Ground         | DIC No. 290 Ver. 1    |
| Text                | Colorless             |
| Characters On label | Black                 |
| Design              | Refer to above figure |

Frame Part No: FR-R1-10  
Color : Black

### Label Size and Denotations



|                  |            |                             |        |      |                   |                     |        |        |
|------------------|------------|-----------------------------|--------|------|-------------------|---------------------|--------|--------|
| APPLICABLE MODEL | ID24XXXX   | SCALE                       | 1/1    | UNIT | mm                | DATE                | REVISE | CHANGE |
| THICKNESS        | DEPERNCE   | MATERIAL                    | FINISH | NAME | ID24XXXX          | EXTENAL APPEARANCES |        |        |
| DATE             | 1998. 7. 6 | SYSTEM MODULE BUSINESS P. T |        |      | DRAWING NO.       | IMC203-P100         |        |        |
|                  |            | INTEGRATED CIRCUITS GROUP   |        |      | SHARP CORPORATION |                     |        |        |

# 18. PACKING SPECIFICATION

## Parts List

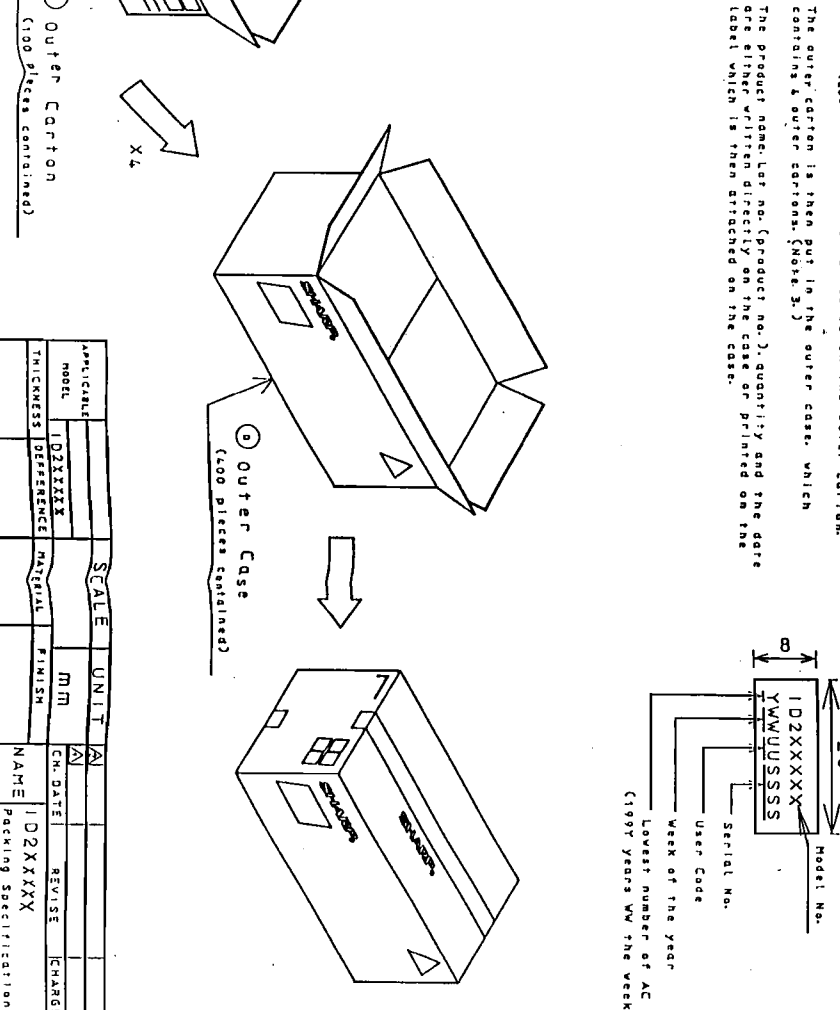
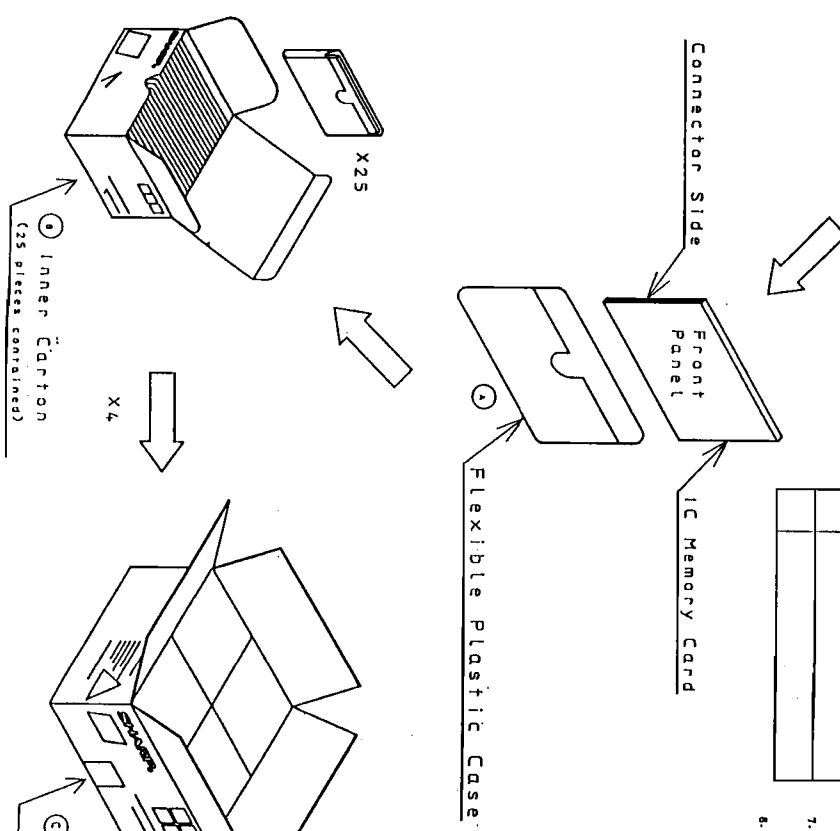
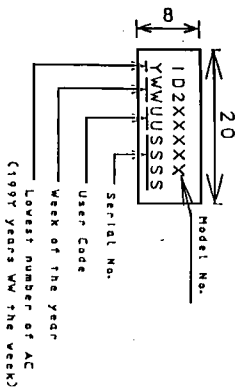
| Parts Name                            | Quantity |
|---------------------------------------|----------|
| A Flexible Plastic Case               | 1        |
| B Inner Carton (25 pieces contained)  | 1        |
| C Outer Carton (100 pieces contained) | 1        |
| D Outer Case (400 pieces contained)   | 1        |
|                                       |          |
|                                       |          |
|                                       |          |
|                                       |          |
|                                       |          |

## Packing Specification

- Label the model No. and Manufacturing No. on the back panel of the case.
- Each memory card is contained in the flexible plastic case. The front side of the card comes to the place where the card points to the connector side is placed against to this in the figure.
- The inner carton contains 25 pieces of the card with the case. (Note 1.)
- The product name, lot no. (product no.), quantity and the date are either written directly on the inner carton or printed on the label which is then attached on inner carton.
- The outer carton contains 4 inner cartons. (Note 2.)
- The product name, lot no. (product no.), quantity and the date are either written directly on the outer carton or printed on the label which is then attached on the outer carton.
- The outer carton is then put in the outer case, which contains 4 outer cartons. (Note 3.)
- The product name, lot no. (product no.), quantity and the date are either written directly on the case or printed on the label which is then attached on the case.

Note 1: The least packing unit is 25 pieces in the inner carton.

- The space inside the outer carton is filled card boards.
- The other size of outer case may be used if there is no room for the outer carton which can contain 4 outer cartons.
- Size of label and dimensions are following [unit: mm]



| APPLICABLE  | MODEL      | THICKNESS | REFERENCE | MATERIAL | FINISH | NAME     | REVISION | CHARGE |
|---|------------|-----------|-----------|----------|--------|----------|----------|--------|
|   | 1D2XXXXX   |           |           |          |        | 1D2XXXXX |          |        |
| DATE  | 1995.10.10 |           |           |          |        |          |          |        |
| DRAWING NO. IMC025-J300<br>SHARP CORPORATION<br>DRAWING NO. IMC025-J300 |            |           |           |          |        |          |          |        |

Series 2+, 20 MB, PCMCIA, Flash Card, ID244L01, Type 1