

# MITSUBISHI MICROCOMPUTERS M35070-XXXSP/FP

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

## DESCRIPTION

The M35070-XXXSP/FP is a character pattern display control IC can display on the CRT display the liquid crystal display and the plasma display. It can display 2 pages (24 characters × 12 lines per 1 page) at the same time. It uses a silicon gate CMOS process and it housed in a 20-pin shrink DIP package (M35070-XXXSP) or a 20-pin shrink SOP package (M35070-XXXFP).

For M35070-002SP/FP that is a standard ROM version of M35070-XXXSP/FP respectively, the character pattern is also mentioned.

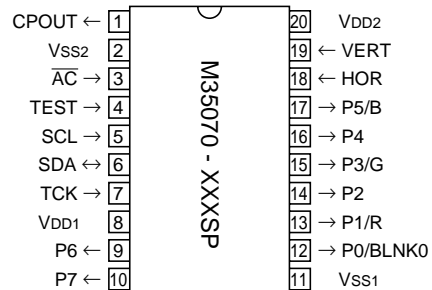
## FEATURES

- Screen composition ..... 24 characters × 12 lines × 2 pages
- Number of characters displayed ..... 288 (Max.) × 2 pages
- Character composition ..... 12 × 18 dot matrix
- Characters available ..... page 0 : 256 characters  
page 1 : 256 characters
- Character sizes available ..... 4 (vertical) × 2 (horizontal)
- Display locations available
  - Horizontal direction ..... 2007 locations
  - Vertical direction ..... 1023 locations
- Blinking ..... Character units
  - Cycle : division of vertical synchronization signal into 32 or 64
  - Duty : 25%, 50%, or 75%
- Data input ..... By the I<sup>2</sup>C-BUS serial input function
- Coloring
  - Character color ..... Character unit
  - Background coloring ..... Character unit
  - Border (shadow) coloring ..... 8 colors (RGB output)  
Specified by register
  - Raster coloring ..... 8 colors (RGB output)  
Specified by register
- Blanking
  - Character size blanking
  - Border size blanking
  - Matrix-outline blanking
  - All blanking (all raster area)
- Output ports
  - 4 shared output ports (toggled between RGB output)
  - 4 dedicated output ports
- Display RAM erase function
- Display input frequency range ..... Fosc = 20MHz to 90MHz
- Horizontal synchronous input frequency  
..... H.sync = 15 kHz to 130 kHz
- Display oscillation stop function

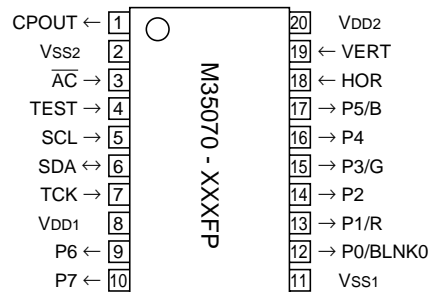
## APPLICATION

CRT display, Liquid crystal display, Plasma display

## PIN CONFIGURATION (TOP VIEW)



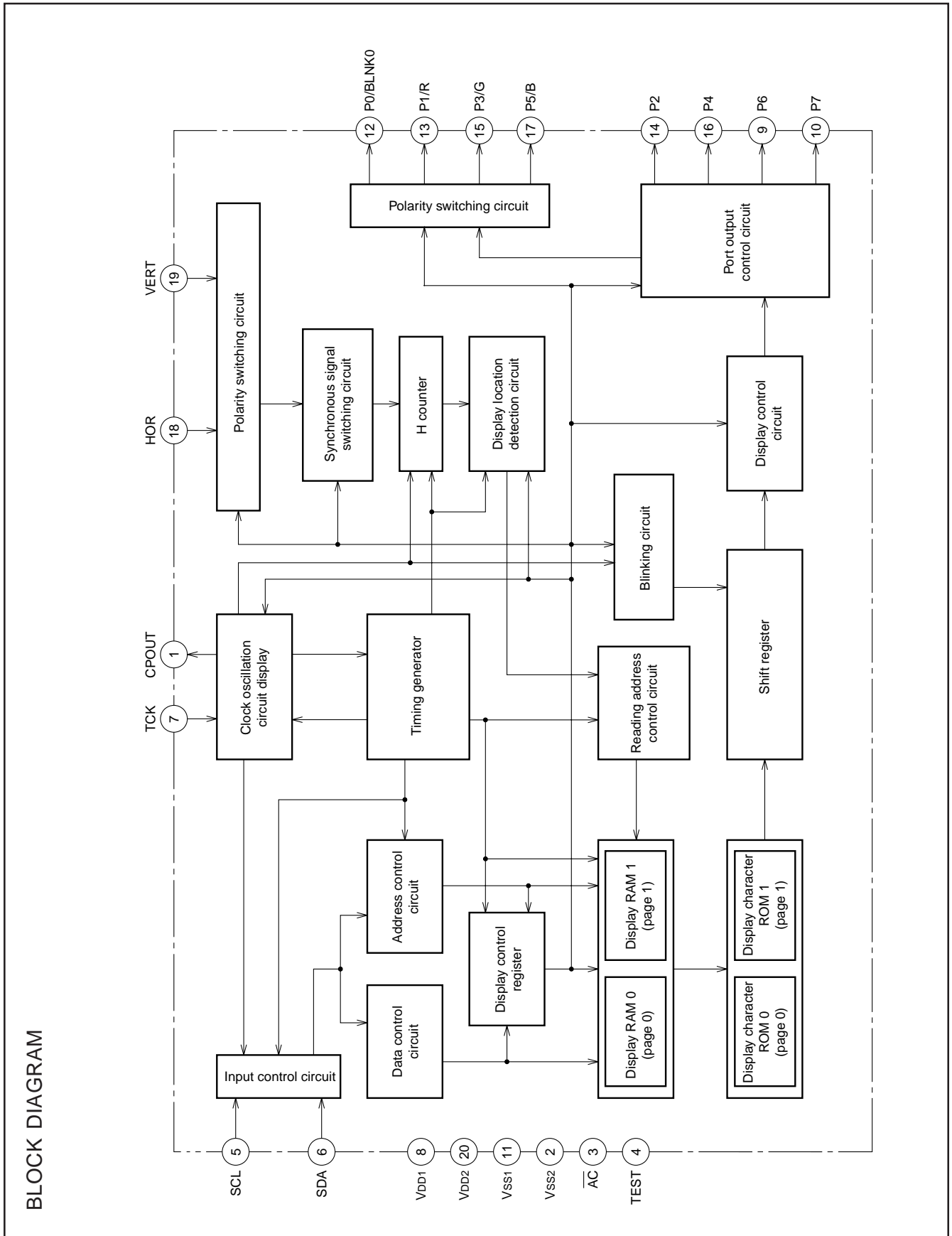
Outline 20P4B



Outline 20P2Q-A

**PIN DESCRIPTION**

| Pin Number | Symbol          | Pin name                            | Input/Output | Function   |
|------------|-----------------|-------------------------------------|--------------|--|
| 1          | CPOUT           | Filter output                       | Output       | Filter output. Connect loop filter to this pin.  |
| 2          | Vss2            | Earthing pin                        | –            | Connect to GND.  |
| 3          | $\overline{AC}$ | Auto-clear input                    | Input        | When "L", this pin resets the internal IC circuit. Hysteresis input. Built-in pull-up resistor.  |
| 4          | TEST            | Test input                          | Input        | Test pin. Connect to +5V.  |
| 5          | SCL             | Clock input                         | Input        | SDA pin serial data is taken in when SCL rises. Hysteresis input.  |
| 6          | SDA             | Data I/O                            | I/O          | This is the pin for serial input of display control register and display RAM data. Also, this pin output acknowledge signal. Hysteresis input. Nch opendrain output. |
| 7          | TCK             | External clock                      | Input        | This is the pin for external clock input.  |
| 8          | VDD1            | Power pin                           | –            | Please connect to +5V with the power pin.  |
| 9          | P6              | Port P6 output                      | Output       | This is the output port.   |
| 10         | P7              | Port P7 output                      | Output       | This is the output port.   |
| 11         | Vss1            | Earthing pin                        | –            | Please connect to GND using circuit earthing pin.  |
| 12         | P0/BLNK0        | Port P0 output                      | Output       | This pin can be toggled between port pin output and BLNK0 signal output.   |
| 13         | P1/R            | Port P1 output                      | Output       | This pin can be toggled between port pin output and R signal output.   |
| 14         | P2              | Port P2 output                      | Output       | This is the output port.   |
| 15         | P3/G            | Port P3 output                      | Output       | This pin can be toggled between port pin output and G signal output.   |
| 16         | P4              | Port P4 output                      | Output       | This is the output port.   |
| 17         | P5/B            | Port P5 output                      | Output       | This pin can be toggled between port pin output and B signal output.   |
| 18         | HOR             | Horizontal synchronous signal input | Input        | This pin inputs the horizontal synchronous signal. Hysteresis input.   |
| 19         | VERT            | Vertical synchronous signal input   | Input        | This pin inputs the vertical synchronous signal. Hysteresis input.   |
| 20         | VDD2            | Power pin                           | –            | Please connect to +5V with the power pin.  |



SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

**MEMORY CONSTITUTION**

Address 000<sub>16</sub> to 11F<sub>16</sub> are assigned to the display RAM, address 120<sub>16</sub> to 128<sub>16</sub> are assigned to the display control registers. The internal circuit is reset and all display control registers (address 120<sub>16</sub> to 128<sub>16</sub>) are set to "0" when the AC pin level is "L". And then, RAM is not erased and be undefined. This memory is consisted of 2

pages : page 0 memory and page 1 memory (their addresses are common), page controlled by DAF bit of each address when writing data. For detail, see "Data input". Memory constitution is shown in Figure 1 and 2.

| Addresses         | DAF | DAE                 | DAD    | DAC    | DAB      | DAA             | DA9    | DA8    | DA7            | DA6   | DA5   | DA4   | DA3   | DA2   | DA1   | DA0   |
|-------------------|-----|---------------------|--------|--------|----------|-----------------|--------|--------|----------------|-------|-------|-------|-------|-------|-------|-------|
| 000 <sub>16</sub> | 0   | BB                  | BG     | BR     | BLINK    | B               | G      | R      | C7             | C6    | C5    | C4    | C3    | C2    | C1    | C0    |
| 001 <sub>16</sub> | 0   | BB                  | BG     | BR     | BLINK    | B               | G      | R      | C7             | C6    | C5    | C4    | C3    | C2    | C1    | C0    |
| ⋮                 | ⋮   | Background coloring |        |        | Blinking | Character color |        |        | Character code |       |       |       |       |       |       |       |
| 11E <sub>16</sub> | 0   | BB                  | BG     | BR     | BLINK    | B               | G      | R      | C7             | C6    | C5    | C4    | C3    | C2    | C1    | C0    |
| 11F <sub>16</sub> | 0   | BB                  | BG     | BR     | BLINK    | B               | G      | R      | C7             | C6    | C5    | C4    | C3    | C2    | C1    | C0    |
| 120 <sub>16</sub> | 0   | EXCK0               | VJT    | DIVS1  | DIVS0    | DIV10           | DIV9   | DIV8   | DIV7           | DIV6  | DIV5  | DIV4  | DIV3  | DIV2  | DIV1  | DIV0  |
| 121 <sub>16</sub> | 0   | RSEL0               | PTD7   | PTD6   | PTD5     | PTD4            | PTD3   | PTD2   | PTD1           | PTD0  | PTC5  | PTC4  | PTC3  | PTC2  | PTC1  | PTC0  |
| 122 <sub>16</sub> | 0   | RSEL1               | SPACE2 | SPACE1 | SPACE0   | HP10            | HP9    | HP8    | HP7            | HP6   | HP5   | HP4   | HP3   | HP2   | HP1   | HP0   |
| 123 <sub>16</sub> | 0   | EXCK1               | TEST3  | TEST2  | TEST1    | TEST0           | VP9    | VP8    | VP7            | VP6   | VP5   | VP4   | VP3   | VP2   | VP1   | VP0   |
| 124 <sub>16</sub> | 0   | TEST9               | TEST5  | TEST4  | DSP11    | DSP10           | DSP9   | DSP8   | DSP7           | DSP6  | DSP5  | DSP4  | DSP3  | DSP2  | DSP1  | DSP0  |
| 125 <sub>16</sub> | 0   | TEST10              | VSZ1H1 | VSZ1H0 | VSZ1L1   | VSZ1L0          | V1SZ1  | V1SZ0  | LIN9           | LIN8  | LIN7  | LIN6  | LIN5  | LIN4  | LIN3  | LIN2  |
| 126 <sub>16</sub> | 0   | POPUP               | VSZ2H1 | VSZ2H0 | VSZ2L1   | VSZ2L0          | V18SZ1 | V18SZ0 | LIN17          | LIN16 | LIN15 | LIN14 | LIN13 | LIN12 | LIN11 | LIN10 |
| 127 <sub>16</sub> | 0   | MODE0               | TEST12 | HSZ20  | TEST11   | HSZ10           | BETA14 | TEST8  | TEST7          | TEST6 | FB    | FG    | FR    | RB    | RG    | RR    |
| 128 <sub>16</sub> | 0   | MODE1               | BLINK2 | BLINK1 | BLINK0   | DSPON           | STOP   | RAMERS | SYAD           | BLK1  | BLK0  | POLH  | POLV  | VMASK | B/F   | BCOL  |

Fig. 1 Memory constitution (page 0 memory)

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

| Addresses         | DAF | DAE                 | DAD    | DAC    | DAB      | DAA             | DA9    | DA8    | DA7   | DA6            | DA5   | DA4   | DA3   | DA2   | DA1   | DA0   |
|-------------------|-----|---------------------|--------|--------|----------|-----------------|--------|--------|-------|----------------|-------|-------|-------|-------|-------|-------|
| 000 <sub>16</sub> | 1   | BB                  | BG     | BR     | BLINK    | B               | G      | R      | C7    | C6             | C5    | C4    | C3    | C2    | C1    | C0    |
| 001 <sub>16</sub> | 1   | BB                  | BG     | BR     | BLINK    | B               | G      | R      | C7    | C6             | C5    | C4    | C3    | C2    | C1    | C0    |
| ⋮                 | ⋮   | Background coloring |        |        | Blinking | Character color |        |        | ⋮     | Character code |       |       |       |       |       |       |
| 11E <sub>16</sub> | 1   | BB                  | BG     | BR     | BLINK    | B               | G      | R      | C7    | C6             | C5    | C4    | C3    | C2    | C1    | C0    |
| 11F <sub>16</sub> | 1   | BB                  | BG     | BR     | BLINK    | B               | G      | R      | C7    | C6             | C5    | C4    | C3    | C2    | C1    | C0    |
| 120 <sub>16</sub> | 1   | -                   | -      | -      | -        | -               | -      | -      | -     | -              | -     | -     | -     | -     | -     | -     |
| 121 <sub>16</sub> | 1   | -                   | -      | -      | -        | -               | -      | -      | -     | -              | -     | -     | -     | -     | -     | -     |
| 122 <sub>16</sub> | 1   | -                   | SPACE2 | SPACE1 | SPACE0   | HP10            | HP9    | HP8    | HP7   | HP6            | HP5   | HP4   | HP3   | HP2   | HP1   | HP0   |
| 123 <sub>16</sub> | 1   | -                   | TEST3  | TEST2  | TEST1    | TEST0           | VP9    | VP8    | VP7   | VP6            | VP5   | VP4   | VP3   | VP2   | VP1   | VP0   |
| 124 <sub>16</sub> | 1   | -                   | -      | TEST4  | DSP11    | DSP10           | DSP9   | DSP8   | DSP7  | DSP6           | DSP5  | DSP4  | DSP3  | DSP2  | DSP1  | DSP0  |
| 125 <sub>16</sub> | 1   | -                   | VSZ1H1 | VSZ1H0 | VSZ1L1   | VSZ1L0          | V1SZ1  | V1SZ0  | LIN9  | LIN8           | LIN7  | LIN6  | LIN5  | LIN4  | LIN3  | LIN2  |
| 126 <sub>16</sub> | 1   | -                   | VSZ2H1 | VSZ2H0 | VSZ2L1   | VSZ2L0          | V18SZ1 | V18SZ0 | LIN17 | LIN16          | LIN15 | LIN14 | LIN13 | LIN12 | LIN11 | LIN10 |
| 127 <sub>16</sub> | 1   | -                   | TEST12 | HSZ20  | TEST11   | HSZ10           | BETA14 | TEST8  | TEST7 | TEST6          | FB    | FG    | FR    | RB    | RG    | RR    |
| 128 <sub>16</sub> | 1   | -                   | BLINK2 | BLINK1 | BLINK0   | DSPON           | TEST13 | RAMERS | SYAD  | BLK1           | BLK0  | -     | -     | -     | -     | BCOL  |

Fig. 2 Memory constitution (page 1 memory)

Note: Page 0 and page 1 registers are found in their respective pages. For example, HP10 to HP0 of the page 0 memory sets the horizontal display start position of page 0, whereas HP10 to HP0 (same register name) of the page 1 memory sets the horizontal display start position of page 1. Also, registers common to both page 0 and page 1 are found only in the page 0 memory. For example, PTC0 is the control register of the P0 pin and is found only in the page 0 memory.

**SCREEN CONSTITUTION**

The screen lines and rows are determined from each address of the display RAM (page 0 and page 1 are common). The screen constitution is shown in Figure 3.

| Row<br>Line | 1                 | 2                 | 3                 | 4                 | 5                 | 6                 | 7                 | 8                 | 9                 | 10                | 11                | 12                | 13                | 14                | 15                | 16                | 17                | 18                | 19                | 20                | 21                | 22                | 23                | 24                |
|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1           | 000 <sub>16</sub> | 001 <sub>16</sub> | 002 <sub>16</sub> | 003 <sub>16</sub> | 004 <sub>16</sub> | 005 <sub>16</sub> | 006 <sub>16</sub> | 007 <sub>16</sub> | 008 <sub>16</sub> | 009 <sub>16</sub> | 00A <sub>16</sub> | 00B <sub>16</sub> | 00C <sub>16</sub> | 00D <sub>16</sub> | 00E <sub>16</sub> | 00F <sub>16</sub> | 010 <sub>16</sub> | 011 <sub>16</sub> | 012 <sub>16</sub> | 013 <sub>16</sub> | 014 <sub>16</sub> | 015 <sub>16</sub> | 016 <sub>16</sub> | 017 <sub>16</sub> |
| 2           | 018 <sub>16</sub> | 019 <sub>16</sub> | 01A <sub>16</sub> | 01B <sub>16</sub> | 01C <sub>16</sub> | 01D <sub>16</sub> | 01E <sub>16</sub> | 01F <sub>16</sub> | 020 <sub>16</sub> | 021 <sub>16</sub> | 022 <sub>16</sub> | 023 <sub>16</sub> | 024 <sub>16</sub> | 025 <sub>16</sub> | 026 <sub>16</sub> | 027 <sub>16</sub> | 028 <sub>16</sub> | 029 <sub>16</sub> | 02A <sub>16</sub> | 02B <sub>16</sub> | 02C <sub>16</sub> | 02D <sub>16</sub> | 02E <sub>16</sub> | 02F <sub>16</sub> |
| 3           | 030 <sub>16</sub> | 031 <sub>16</sub> | 032 <sub>16</sub> | 033 <sub>16</sub> | 034 <sub>16</sub> | 035 <sub>16</sub> | 036 <sub>16</sub> | 037 <sub>16</sub> | 038 <sub>16</sub> | 039 <sub>16</sub> | 03A <sub>16</sub> | 03B <sub>16</sub> | 03C <sub>16</sub> | 03D <sub>16</sub> | 03E <sub>16</sub> | 03F <sub>16</sub> | 040 <sub>16</sub> | 041 <sub>16</sub> | 042 <sub>16</sub> | 043 <sub>16</sub> | 044 <sub>16</sub> | 045 <sub>16</sub> | 046 <sub>16</sub> | 047 <sub>16</sub> |
| 4           | 048 <sub>16</sub> | 049 <sub>16</sub> | 04A <sub>16</sub> | 04B <sub>16</sub> | 04C <sub>16</sub> | 04D <sub>16</sub> | 04E <sub>16</sub> | 04F <sub>16</sub> | 050 <sub>16</sub> | 051 <sub>16</sub> | 052 <sub>16</sub> | 053 <sub>16</sub> | 054 <sub>16</sub> | 055 <sub>16</sub> | 056 <sub>16</sub> | 057 <sub>16</sub> | 058 <sub>16</sub> | 059 <sub>16</sub> | 05A <sub>16</sub> | 05B <sub>16</sub> | 05C <sub>16</sub> | 05D <sub>16</sub> | 05E <sub>16</sub> | 05F <sub>16</sub> |
| 5           | 060 <sub>16</sub> | 061 <sub>16</sub> | 062 <sub>16</sub> | 063 <sub>16</sub> | 064 <sub>16</sub> | 065 <sub>16</sub> | 066 <sub>16</sub> | 067 <sub>16</sub> | 068 <sub>16</sub> | 069 <sub>16</sub> | 06A <sub>16</sub> | 06B <sub>16</sub> | 06C <sub>16</sub> | 06D <sub>16</sub> | 06E <sub>16</sub> | 06F <sub>16</sub> | 070 <sub>16</sub> | 071 <sub>16</sub> | 072 <sub>16</sub> | 073 <sub>16</sub> | 074 <sub>16</sub> | 075 <sub>16</sub> | 076 <sub>16</sub> | 077 <sub>16</sub> |
| 6           | 078 <sub>16</sub> | 079 <sub>16</sub> | 07A <sub>16</sub> | 07B <sub>16</sub> | 07C <sub>16</sub> | 07D <sub>16</sub> | 07E <sub>16</sub> | 07F <sub>16</sub> | 080 <sub>16</sub> | 081 <sub>16</sub> | 082 <sub>16</sub> | 083 <sub>16</sub> | 084 <sub>16</sub> | 085 <sub>16</sub> | 086 <sub>16</sub> | 087 <sub>16</sub> | 088 <sub>16</sub> | 089 <sub>16</sub> | 08A <sub>16</sub> | 08B <sub>16</sub> | 08C <sub>16</sub> | 08D <sub>16</sub> | 08E <sub>16</sub> | 08F <sub>16</sub> |
| 7           | 090 <sub>16</sub> | 091 <sub>16</sub> | 092 <sub>16</sub> | 093 <sub>16</sub> | 094 <sub>16</sub> | 095 <sub>16</sub> | 096 <sub>16</sub> | 097 <sub>16</sub> | 098 <sub>16</sub> | 099 <sub>16</sub> | 09A <sub>16</sub> | 09B <sub>16</sub> | 09C <sub>16</sub> | 09D <sub>16</sub> | 09E <sub>16</sub> | 09F <sub>16</sub> | 0A0 <sub>16</sub> | 0A1 <sub>16</sub> | 0A2 <sub>16</sub> | 0A3 <sub>16</sub> | 0A4 <sub>16</sub> | 0A5 <sub>16</sub> | 0A6 <sub>16</sub> | 0A7 <sub>16</sub> |
| 8           | 0A8 <sub>16</sub> | 0A9 <sub>16</sub> | 0AA <sub>16</sub> | 0AB <sub>16</sub> | 0AC <sub>16</sub> | 0AD <sub>16</sub> | 0AE <sub>16</sub> | 0AF <sub>16</sub> | 0B0 <sub>16</sub> | 0B1 <sub>16</sub> | 0B2 <sub>16</sub> | 0B3 <sub>16</sub> | 0B4 <sub>16</sub> | 0B5 <sub>16</sub> | 0B6 <sub>16</sub> | 0B7 <sub>16</sub> | 0B8 <sub>16</sub> | 0B9 <sub>16</sub> | 0BA <sub>16</sub> | 0BB <sub>16</sub> | 0BC <sub>16</sub> | 0BD <sub>16</sub> | 0BE <sub>16</sub> | 0BF <sub>16</sub> |
| 9           | 0C0 <sub>16</sub> | 0C1 <sub>16</sub> | 0C2 <sub>16</sub> | 0C3 <sub>16</sub> | 0C4 <sub>16</sub> | 0C5 <sub>16</sub> | 0C6 <sub>16</sub> | 0C7 <sub>16</sub> | 0C8 <sub>16</sub> | 0C9 <sub>16</sub> | 0CA <sub>16</sub> | 0CB <sub>16</sub> | 0CC <sub>16</sub> | 0CD <sub>16</sub> | 0CE <sub>16</sub> | 0CF <sub>16</sub> | 0D0 <sub>16</sub> | 0D1 <sub>16</sub> | 0D2 <sub>16</sub> | 0D3 <sub>16</sub> | 0D4 <sub>16</sub> | 0D5 <sub>16</sub> | 0D6 <sub>16</sub> | 0D7 <sub>16</sub> |
| 10          | 0D8 <sub>16</sub> | 0D9 <sub>16</sub> | 0DA <sub>16</sub> | 0DB <sub>16</sub> | 0DC <sub>16</sub> | 0DD <sub>16</sub> | 0DE <sub>16</sub> | 0DF <sub>16</sub> | 0E0 <sub>16</sub> | 0E1 <sub>16</sub> | 0E2 <sub>16</sub> | 0E3 <sub>16</sub> | 0E4 <sub>16</sub> | 0E5 <sub>16</sub> | 0E6 <sub>16</sub> | 0E7 <sub>16</sub> | 0E8 <sub>16</sub> | 0E9 <sub>16</sub> | 0EA <sub>16</sub> | 0EB <sub>16</sub> | 0EC <sub>16</sub> | 0ED <sub>16</sub> | 0EE <sub>16</sub> | 0EF <sub>16</sub> |
| 11          | 0F0 <sub>16</sub> | 0F1 <sub>16</sub> | 0F2 <sub>16</sub> | 0F3 <sub>16</sub> | 0F4 <sub>16</sub> | 0F5 <sub>16</sub> | 0F6 <sub>16</sub> | 0F7 <sub>16</sub> | 0F8 <sub>16</sub> | 0F9 <sub>16</sub> | 0FA <sub>16</sub> | 0FB <sub>16</sub> | 0FC <sub>16</sub> | 0FD <sub>16</sub> | 0FE <sub>16</sub> | 0FF <sub>16</sub> | 100 <sub>16</sub> | 101 <sub>16</sub> | 102 <sub>16</sub> | 103 <sub>16</sub> | 104 <sub>16</sub> | 105 <sub>16</sub> | 106 <sub>16</sub> | 107 <sub>16</sub> |
| 12          | 108 <sub>16</sub> | 109 <sub>16</sub> | 10A <sub>16</sub> | 10B <sub>16</sub> | 10C <sub>16</sub> | 10D <sub>16</sub> | 10E <sub>16</sub> | 10F <sub>16</sub> | 110 <sub>16</sub> | 111 <sub>16</sub> | 112 <sub>16</sub> | 113 <sub>16</sub> | 114 <sub>16</sub> | 115 <sub>16</sub> | 116 <sub>16</sub> | 117 <sub>16</sub> | 118 <sub>16</sub> | 119 <sub>16</sub> | 11A <sub>16</sub> | 11B <sub>16</sub> | 11C <sub>16</sub> | 11D <sub>16</sub> | 11E <sub>16</sub> | 11F <sub>16</sub> |

\* The hexadecimal numbers in the boxes show the display RAM address.

Fig. 3 Screen constitution

**DISPLAY RAM**

Address 000<sub>16</sub> to 11F<sub>16</sub>

| DA | Register | Contents |  | Remarks   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|----|----------|----------|--|---|----|-------|-------|-------|---|---|-------|-------|---|---|-----|-----|---|---|-------|-------|---|---|--------|--------|---|---|------|------|---|---|---------|---------|---|---|------|------|---|---|-------|---|--------------------------------------|
|    |          | Status   | Function   |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 0  | C0       | 0        | Set the displayed ROM character code.  | Set display character   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  | C1       | 0        | To write data into page 0 (Note 2), select the data from the ROM characters (256 types) for page 0 and set the character code. To write data into page 1, do the same from the ROM characters (256 types) for page 1.  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 2  | C2       | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 3  | C3       | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 4  | C4       | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 5  | C5       | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 6  | C6       | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 7  | C7       | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 8  | R        | 0        |  | <table border="1"> <thead> <tr> <th>B</th> <th>G</th> <th>R</th> <th>Color</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>Black</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>Red</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>Green</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>Yellow</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>Blue</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>Magenta</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>Cyan</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>White</td></tr> </tbody> </table> | B  | G     | R     | Color | 0 | 0 | 0     | Black | 0 | 0 | 1   | Red | 0 | 1 | 0     | Green | 0 | 1 | 1      | Yellow | 1 | 0 | 0    | Blue | 1 | 0 | 1       | Magenta | 1 | 1 | 0    | Cyan | 1 | 1 | 1     | White                                     | Set character color (character unit) |
|    |          | B        |  |   | G  | R     | Color |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 0  | 0        | 0        | Black  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 0  | 0        | 1        | Red  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 0  | 1        | 0        | Green  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 0  | 1        | 1        | Yellow   |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  | 0        | 0        | Blue   |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  | 0        | 1        | Magenta  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  | 1        | 0        | Cyan   |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  | 1        | 1        | White  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  |          |          |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 9  | G        | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| A  | B        | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| B  | BLINK    | 0        | Do not blink.  | Set blinking<br>See register BLINK2 to BLINK0 (address 128 <sub>16</sub> )  |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        | Blinking   |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| C  | BR       | 0        | <table border="1"> <thead> <tr> <th>BB</th> <th>BG</th> <th>BR</th> <th>Color</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>Black</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>Red</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>Green</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>Yellow</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>Blue</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>Magenta</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>Cyan</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>White</td></tr> </tbody> </table> | BB  | BG | BR    | Color | 0     | 0 | 0 | Black | 0     | 0 | 1 | Red | 0   | 1 | 0 | Green | 0     | 1 | 1 | Yellow | 1      | 0 | 0 | Blue | 1    | 0 | 1 | Magenta | 1       | 1 | 0 | Cyan | 1    | 1 | 1 | White | Set character background (character unit) |                                      |
|    |          | BB       |  | BG  | BR | Color |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 0  | 0        | 0        |  | Black   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 0  | 0        | 1        |  | Red   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 0  | 1        | 0        |  | Green   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 0  | 1        | 1        |  | Yellow  |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  | 0        | 0        |  | Blue  |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  | 0        | 1        |  | Magenta   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  | 1        | 0        |  | Cyan  |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  | 1        | 1        |  | White   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| 1  |          |          |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| D  | BG       | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
| E  | BB       | 0        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |
|    |          | 1        |  |   |    |       |       |       |   |   |       |       |   |   |     |     |   |   |       |       |   |   |        |        |   |   |      |      |   |   |         |         |   |   |      |      |   |   |       |   |                                      |

Notes 1. The display RAM is undefined state at the AC pin.

2. The display RAM consists of 2 pages, page 0 and page 1 (common address). The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.

**REGISTERS DESCRIPTION**

(1) Address 120<sub>16</sub>

| DA | Register          | Contents                              |   | Remarks  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|----|-------------------|---------------------------------------|---|--|---------------------------------------|-------|---------------------|---|---|---------------------------------------|---|---|----------------------|---|---|------------|---|---|---------------------------------------|---|
|    |                   | Status                                | Function  |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| 0  | DIV0<br>(Note 3)  | 0                                     | Set division value (multiply value) of horizontal oscillation frequency.<br><br>$N1 = \sum_{n=0}^{10} (DIVn \times 2^n)$ N1 : division value (multiply value)   | Set display frequency by division value (multiply value) setting.<br>For details, see REGISTER SUPPLYMENTARY DESCRIPTION (1).<br><br>Also, set the display frequency range by registers DIVS0, DIVS1(address 120 <sub>16</sub> ), RSEL0(address 121 <sub>16</sub> ) and RSEL1(address 122 <sub>16</sub> ) in accordance with the display frequency.<br><br>Any of this settings above is required only when EXCK1 = 0, EXCK0 = 1 and EXCK1 = 1, EXCK0 = 1. |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| B  | DIVS0<br>(Note 3) | 0                                     | For setting, see REGISTER SUPPLYMENTARY DESCRIPTION (2).  | Set display frequency range.   |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| C  | DIVS1<br>(Note 3) | 1                                     |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| D  | VJT<br>(Note 3)   | 0                                     | It is used to "0", normally.  |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   | 1                                     | Alleviates continuous vertical jitters.   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| E  | EXCK0<br>(Note 3) | 0                                     | <table border="1"> <thead> <tr> <th>EXCK1</th> <th>EXCK0</th> <th>Display clock input</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>External synchronous (external clock)</td> </tr> <tr> <td>0</td> <td>1</td> <td>Internal synchronous</td> </tr> <tr> <td>1</td> <td>0</td> <td>Do not set</td> </tr> <tr> <td>1</td> <td>1</td> <td>External synchronous (internal clock)</td> </tr> </tbody> </table> |  | EXCK1                                 | EXCK0 | Display clock input | 0 | 0 | External synchronous (external clock) | 0 | 1 | Internal synchronous | 1 | 0 | Do not set | 1 | 1 | External synchronous (internal clock) | Display clock setting<br>See REGISTER SUPPLYMENTARY DESCRIPTION (1)<br>EXCK1 : address123 <sub>16</sub> |
|    |                   |                                       | EXCK1   | EXCK0  | Display clock input                   |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   |                                       | 0   | 0  | External synchronous (external clock) |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
|    |                   |                                       | 0   | 1  | Internal synchronous                  |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| 1  | 0                 | Do not set                            |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| 1  | 1                 | External synchronous (internal clock) |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| 1  |                   |                                       |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| 1  |                   |                                       |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |
| 1  |                   |                                       |   |  |                                       |       |                     |   |   |                                       |   |   |                      |   |   |            |   |   |                                       |   |

- Notes 1. The mark ○ around the status value means the reset status by the "L" level is input to AC pin.  
 2. The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.  
 3. Registers marked with (Note 3) are found only in page 0, therefore the register value does not change when the DAF bit is set to "1".





SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

(2) Address 121<sub>16</sub>

| DA | Register          | Contents |   | Remarks                      |
|----|-------------------|----------|---|------------------------------|
|    |                   | Status   | Function  |                              |
| 0  | PTC0<br>(Note 3)  | 0        | P0 output (port P0).                                      | P0 pin output control.       |
|    |                   | 1        | BLNK0 output.   |                              |
| 1  | PTC1<br>(Note 3)  | 0        | P1 output (port P1).                                      | P1 pin output control.       |
|    |                   | 1        | R signal output.  |                              |
| 2  | PTC2<br>(Note 3)  | 0        | P2 output (port P2).                                      | P2 pin output control.       |
|    |                   | 1        | Can not be used.  |                              |
| 3  | PTC3<br>(Note 3)  | 0        | P3 output (port P3).                                      | P3 pin output control.       |
|    |                   | 1        | G signal output.  |                              |
| 4  | PTC4<br>(Note 3)  | 0        | P4 output (port P4).                                      | P4 pin output control.       |
|    |                   | 1        | Can not be used.  |                              |
| 5  | PTC5<br>(Note 3)  | 0        | P5 output (port P5).                                      | P5 pin output control.       |
|    |                   | 1        | B signal output.  |                              |
| 6  | PTD0<br>(Note 3)  | 0        | "L" output or negative polarity output (BLNK0 output).    | P0 pin data control.         |
|    |                   | 1        | "H" output or positive polarity output (BLNK0 output).    |                              |
| 7  | PTD1<br>(Note 3)  | 0        | "L" output or negative polarity output (R signal output). | P1 pin data control.         |
|    |                   | 1        | "H" output or positive polarity output (R signal output). |                              |
| 8  | PTD2<br>(Note 3)  | 0        | "L" output.   | P2 pin data control.         |
|    |                   | 1        | "H" output.   |                              |
| 9  | PTD3<br>(Note 3)  | 0        | "L" output or negative polarity output (G signal output). | P3 pin data control.         |
|    |                   | 1        | "H" output or positive polarity output (G signal output). |                              |
| A  | PTD4<br>(Note 3)  | 0        | "L" output.   | P4 pin data control.         |
|    |                   | 1        | "H" output.   |                              |
| B  | PTD5<br>(Note 3)  | 0        | "L" output or negative polarity output (B signal output). | P5 pin data control.         |
|    |                   | 1        | "H" output or positive polarity output (B signal output). |                              |
| C  | PTD6<br>(Note 3)  | 0        | "L" output.   | P6 pin data control.         |
|    |                   | 1        | "H" output.   |                              |
| D  | PTD7<br>(Note 3)  | 0        | "L" output.   | P7 pin data control.         |
|    |                   | 1        | "H" output.   |                              |
| E  | RSEL0<br>(Note 3) | 0        | For setting, see REGISTER SUPPLYMENTARY DESCRIPTION (2).  | Set display frequency range. |
|    |                   | 1        |   |                              |

Notes 1. The mark 0 around the status value means the reset status by the "L" level is input to  $\bar{A}C$  pin.

2. The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.

3. Registers marked with (Note 3) are found only in page 0, therefore the register value does not change when the DAF bit is set to "1".

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

(3) Address 12216

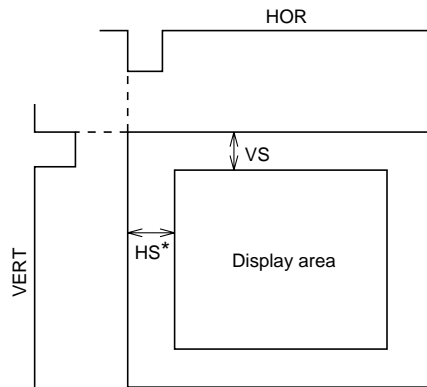
| DA | Register          | Contents |   | Remarks   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|----|-------------------|----------|---|---|---|--|---|---|---|---|---|---|---|----|---|---|---|----------------|---|---|---|---------------|---|---|---|---------------|---|---|---|---------------|---|---|---|---------------|---|---|---|---------|---|---|---|------------|---|
|    |                   | Status   | Function  |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 0  | HP0               | 0        | If HS is the horizontal display start location,<br>$HS = T \times \left( \sum_{n=0}^{10} 2^n HP_n + 6 \right)$  | Horizontal display start location is specified using the 11 bits from HP10 to HP0.<br>HP10 to HP0 = (000000000002) and (000001001112) setting is forbidden. |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 1  | HP1               | 0        | T : Period of display frequency<br>2007 settings are possible.  |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 2  | HP2               | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 3  | HP3               | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 4  | HP4               | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 5  | HP5               | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 6  | HP6               | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 7  | HP7               | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 8  | HP8               | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 9  | HP9               | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| A  | HP10              | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| B  | SPACE0            | 0        | <table border="1"> <thead> <tr> <th colspan="3">SPACE</th> <th rowspan="2">Number of Lines and Space<br/>&lt;(S) represents space&gt;</th> </tr> <tr> <th>2</th> <th>1</th> <th>0</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>12</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1 (S) 10 (S) 1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>2 (S) 8 (S) 2</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>3 (S) 6 (S) 3</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>4 (S) 4 (S) 4</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>5 (S) 2 (S) 5</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>6 (S) 6</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>6 (S)(S) 6</td> </tr> </tbody> </table> <p>(S) represents one line worth of spac</p> | SPACE   |   |  | Number of Lines and Space<br><(S) represents space> | 2 | 1 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 1 | 1 (S) 10 (S) 1 | 0 | 1 | 0 | 2 (S) 8 (S) 2 | 0 | 1 | 1 | 3 (S) 6 (S) 3 | 1 | 0 | 0 | 4 (S) 4 (S) 4 | 1 | 0 | 1 | 5 (S) 2 (S) 5 | 1 | 1 | 0 | 6 (S) 6 | 1 | 1 | 1 | 6 (S)(S) 6 | Leave one line worth of space in the vertical direction.<br>For example, 6 (S) 6 indicates two sets of 6 lines with a line of spaces between lines 6 and 7.<br>A line is 18 × N horizontal scan lines.<br>N is determined by the character size in the vertical direction |
|    |                   | SPACE    |   |   | Number of Lines and Space<br><(S) represents space> |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 2  | 1                 | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 0  | 0                 | 0        |   | 12  |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 0  | 0                 | 1        |   | 1 (S) 10 (S) 1  |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 0  | 1                 | 0        |   | 2 (S) 8 (S) 2   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 0  | 1                 | 1        |   | 3 (S) 6 (S) 3   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 1  | 0                 | 0        |   | 4 (S) 4 (S) 4   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 1  | 0                 | 1        |   | 5 (S) 2 (S) 5   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 1  | 1                 | 0        |   | 6 (S) 6   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 1  | 1                 | 1        |   | 6 (S)(S) 6  |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| 1  |                   |          |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| C  | SPACE1            | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| D  | SPACE2            | 0        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
| E  | RSEL1<br>(Note 3) | 0        | For setting, see REGISTER SUPPLYMENTARY DESCRIPTION (2).  | Set display frequency range.  |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |
|    |                   | 1        |   |   |   |  |   |   |   |   |   |   |   |    |   |   |   |                |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |            |   |

- Notes 1. The mark ○ around the status value means the reset status by the "L" level is input to  $\overline{AC}$  pin.  
 2. The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.  
 3. Registers marked with (Note 3) are found only in page 0, therefore the register value does not change when the DAF bit is set to "1".

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

(4) Address 123<sub>16</sub>

| DA | Register          | Contents |   | Remarks   |
|----|-------------------|----------|---|---|
|    |                   | Status   | Function  |   |
| 0  | VP0               | 0        | If VS is the vertical display start location,                 | The vertical start location is specified using the 10 bits from VP9 to VP0. VP9 to VP0 = (0000000002) setting is forbidden. |
|    |                   | 1        | $VS = H \times \sum_{n=0}^9 2^n VP_n$                         |   |
| 1  | VP1               | 0        | H: Cycle with the horizontal synchronizing pulse              |   |
|    |                   | 1        | 1023 settings are possible.                                   |   |
| 2  | VP2               | 0        |   |   |
|    |                   | 1        |   |   |
| 3  | VP3               | 0        |   |   |
|    |                   | 1        |   |   |
| 4  | VP4               | 0        |   |   |
|    |                   | 1        |   |   |
| 5  | VP5               | 0        |   |   |
|    |                   | 1        |   |   |
| 6  | VP6               | 0        |   |   |
|    |                   | 1        |   |   |
| 7  | VP7               | 0        |   |   |
|    |                   | 1        |   |   |
| 8  | VP8               | 0        |   |   |
|    |                   | 1        |   |   |
| 9  | VP9               | 0        |   |   |
|    |                   | 1        |   |   |
| A  | TEST0             | 0        | It should be fixed to "0".                                    |   |
|    |                   | 1        | Can not be used.  |   |
| B  | TEST1             | 0        | It should be fixed to "0".                                    |   |
|    |                   | 1        | Can not be used.  |   |
| C  | TEST2             | 0        | It should be fixed to "0".                                    |   |
|    |                   | 1        | Can not be used.  |   |
| D  | TEST3             | 0        | It should be fixed to "0".                                    |   |
|    |                   | 1        | Can not be used.  |   |
| E  | EXCK1<br>(Note 3) | 0        | For setting, see Register EXCK0 (address 120 <sub>16</sub> ). | Display clock setting   |
|    |                   | 1        |   |   |



HS\* (shown left) shows horizontal display start location that is register B/F (address 128<sub>16</sub>) = 0 is set.

- Notes 1. The mark ○ around the status value means the reset status by the "L" level is input to  $\bar{A}C$  pin.  
 2. The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.  
 3. Registers marked with (Note 3) are found only in page 0, therefore the register value does not change when the DAF bit is set to "1".

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

(5) Address 124<sub>16</sub>

| DA | Register          | Contents              |  | Remarks                           |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|----|-------------------|-----------------------|--|-----------------------------------|-----------|-----------|-----------|---|---|-----------------------|----------------|---|---|-----------|--------|---|---|--------|----------------|---|---|----------------|-----------|----------------------------------|
|    |                   | Status                | Function   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 0  | DSP0              | 0                     | The display mode (blanking mode) for line n on the display screen is set line-by-line, using DSPn (n = 0 to 11).   | Sets the display mode of line 1.  |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 1  | DSP1              | 0                     | The display mode is determined by the combination of registers BLK1 and BLK0 (address 128 <sub>16</sub> ). Settings are given below.   | Sets the display mode of line 2.  |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 2  | DSP2              | 0                     | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>BLK1</th> <th>BLK0</th> <th>DSPn= "0"</th> <th>DSPn= "1"</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Matrix-outline border</td> <td>Matrix-outline</td> </tr> <tr> <td>0</td> <td>1</td> <td>Character</td> <td>Border</td> </tr> <tr> <td>1</td> <td>0</td> <td>Border</td> <td>Matrix-outline</td> </tr> <tr> <td>1</td> <td>1</td> <td>Matrix-outline</td> <td>Character</td> </tr> </tbody> </table> | BLK1                              | BLK0      | DSPn= "0" | DSPn= "1" | 0 | 0 | Matrix-outline border | Matrix-outline | 0 | 1 | Character | Border | 1 | 0 | Border | Matrix-outline | 1 | 1 | Matrix-outline | Character | Sets the display mode of line 3. |
|    |                   | BLK1                  |  | BLK0                              | DSPn= "0" | DSPn= "1" |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 0  | 0                 | Matrix-outline border | Matrix-outline   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 0  | 1                 | Character             | Border   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 1  | 0                 | Border                | Matrix-outline   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 1  | 1                 | Matrix-outline        | Character  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 1  |                   |                       |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 3  | DSP3              | 0                     | (At register BCOL = "0")   | Sets the display mode of line 4.  |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 4  | DSP4              | 0                     | For detail, see DISPLAY FORM1(1).  | Sets the display mode of line 5.  |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 5  | DSP5              | 0                     |  | Sets the display mode of line 6.  |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 6  | DSP6              | 0                     |  | Sets the display mode of line 7.  |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 7  | DSP7              | 0                     |  | Sets the display mode of line 8.  |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 8  | DSP8              | 0                     |  | Sets the display mode of line 9.  |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| 9  | DSP9              | 0                     |  | Sets the display mode of line 10. |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| A  | DSP10             | 0                     |  | Sets the display mode of line 11. |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| B  | DSP11             | 0                     |  | Sets the display mode of line 12. |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     |  |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| C  | TEST4             | 0                     | It should be fixed to "0".   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     | Can not be used.   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| D  | TEST5<br>(Note 3) | 0                     | It should be fixed to "0".   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     | Can not be used.   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
| E  | TEST9<br>(Note 3) | 0                     | Can not be used.   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |
|    |                   | 1                     | It should be fixed to "1".   |                                   |           |           |           |   |   |                       |                |   |   |           |        |   |   |        |                |   |   |                |           |                                  |

Notes 1. The mark 0 around the status value means the reset status by the "L" level is input to AC pin.

2. The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.

3. Registers marked with (Note 3) are found only in page 0, therefore the register value does not change when the DAF bit is set to "1".

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

(6) Address 125<sub>16</sub>

| DA               | Register                   | Contents                   |  | Remarks  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|------------------|----------------------------|----------------------------|--|--|-------------------------|-------------------------|----------|----------------------------|----------------------------|------------------|----------------------------|----------------------------|--|---|--------|---|---|--------|--|
|                  |                            | Status                     | Function   |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 0                | LIN2                       | 0                          | The vertical dot size for line n in the character dot lines (18 vertical lines) is set using LINn (n = 2 to 17).   | Character size setting in the vertical direction for the 2nd line.   |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                | LIN3                       | 0                          | Dot size can be selected between 2 types for each dot line.  | Character size setting in the vertical direction for the 3rd line.   |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 2                | LIN4                       | 0                          | For dot size, see the below registers. Line 1 and lines 2 to 12 can be set independent of one another.   | Character size setting in the vertical direction for the 4th line.   |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 3                | LIN5                       | 0                          | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>LINn = "0"</th> <th>LINn = "1"</th> </tr> </thead> <tbody> <tr> <td>1st line</td> <td>Refer to VSZ1L0 and VSZ1L1</td> <td>Refer to VSZ1H0 and VSZ1H1</td> </tr> <tr> <td>2nd to 12th line</td> <td>Refer to VSZ2L0 and VSZ2L1</td> <td>Refer to VSZ2H0 and VSZ2H1</td> </tr> </tbody> </table>  |  | LINn = "0"              | LINn = "1"              | 1st line | Refer to VSZ1L0 and VSZ1L1 | Refer to VSZ1H0 and VSZ1H1 | 2nd to 12th line | Refer to VSZ2L0 and VSZ2L1 | Refer to VSZ2H0 and VSZ2H1 | Character size setting in the vertical direction for the 5th line. |   |        |   |   |        |  |
|                  |                            |                            |  | LINn = "0"   | LINn = "1"              |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1st line         | Refer to VSZ1L0 and VSZ1L1 | Refer to VSZ1H0 and VSZ1H1 |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 2nd to 12th line | Refer to VSZ2L0 and VSZ2L1 | Refer to VSZ2H0 and VSZ2H1 |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                |                            |                            |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 4                | LIN6                       | 0                          |  | Character size setting in the vertical direction for the 6th line.   |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 5                | LIN7                       | 0                          |  | Character size setting in the vertical direction for the 7th line.   |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 6                | LIN8                       | 0                          |  | Character size setting in the vertical direction for the 8th line.   |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 7                | LIN9                       | 0                          |  | Character size setting in the vertical direction for the 9th line.   |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 8                | V1SZ0                      | 0                          | H: Cycle with the horizontal synchronizing pulse   | Character size setting in the vertical direction for the 1st line. (display monitor 1 to 12 line)  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 9                | V1SZ1                      | 0                          | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>V1SZ1</th> <th>V1SZ0</th> <th>Vertical direction size</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1H/dot</td> </tr> <tr> <td>0</td> <td>1</td> <td>2H/dot</td> </tr> <tr> <td>1</td> <td>0</td> <td>3H/dot</td> </tr> <tr> <td>1</td> <td>1</td> <td>4H/dot</td> </tr> </tbody> </table>   | V1SZ1  | V1SZ0                   | Vertical direction size | 0        | 0                          | 1H/dot                     | 0                | 1                          | 2H/dot                     | 1  | 0 | 3H/dot | 1 | 1 | 4H/dot |  |
|                  |                            | V1SZ1                      |  | V1SZ0  | Vertical direction size |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 0                | 0                          | 1H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 0                | 1                          | 2H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                | 0                          | 3H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                | 1                          | 4H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                |                            |                            |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| A                | VSZ1L0                     | 0                          | H: Cycle with the horizontal synchronizing pulse   | Character size setting in the vertical direction (display monitor 1 line) at "0" state in register LIN2 to LIN17 (address 125 <sub>16</sub> , 126 <sub>16</sub> ). |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| B                | VSZ1L1                     | 0                          | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>VSZ1L1</th> <th>VSZ1L0</th> <th>Vertical direction size</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1H/dot</td> </tr> <tr> <td>0</td> <td>1</td> <td>2H/dot</td> </tr> <tr> <td>1</td> <td>0</td> <td>3H/dot</td> </tr> <tr> <td>1</td> <td>1</td> <td>4H/dot</td> </tr> </tbody> </table> | VSZ1L1   | VSZ1L0                  | Vertical direction size | 0        | 0                          | 1H/dot                     | 0                | 1                          | 2H/dot                     | 1  | 0 | 3H/dot | 1 | 1 | 4H/dot |  |
|                  |                            | VSZ1L1                     |  | VSZ1L0   | Vertical direction size |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 0                | 0                          | 1H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 0                | 1                          | 2H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                | 0                          | 3H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                | 1                          | 4H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                |                            |                            |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| C                | VSZ1H0                     | 0                          | H: Cycle with the horizontal synchronizing pulse   | Character size setting in the vertical direction (display monitor 1 line) at "1" state in register LIN2 to LIN17 (address 125 <sub>16</sub> , 126 <sub>16</sub> ). |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| D                | VSZ1H1                     | 0                          | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>VSZ1H1</th> <th>VSZ1H0</th> <th>Vertical direction size</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1H/dot</td> </tr> <tr> <td>0</td> <td>1</td> <td>2H/dot</td> </tr> <tr> <td>1</td> <td>0</td> <td>3H/dot</td> </tr> <tr> <td>1</td> <td>1</td> <td>4H/dot</td> </tr> </tbody> </table> | VSZ1H1   | VSZ1H0                  | Vertical direction size | 0        | 0                          | 1H/dot                     | 0                | 1                          | 2H/dot                     | 1  | 0 | 3H/dot | 1 | 1 | 4H/dot |  |
|                  |                            | VSZ1H1                     |  | VSZ1H0   | Vertical direction size |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 0                | 0                          | 1H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 0                | 1                          | 2H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                | 0                          | 3H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                | 1                          | 4H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| 1                |                            |                            |  |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
| E                | TEST10<br>(Note 3)         | 0                          | It should be fixed to "0".   |  |                         |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |
|                  |                            | 1                          |  |  | Can not be used.        |                         |          |                            |                            |                  |                            |                            |  |   |        |   |   |        |  |

Notes 1. The mark ○ around the status value means the reset status by the "L" level is input to AC pin.

2. The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.

3. Registers marked with (Note 3) are found only in page 0, therefore the register value does not change when the DAF bit is set to "1".

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

(7) Address 126<sub>16</sub>

| DA               | Register                   | Contents                   |  | Remarks  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|------------------|----------------------------|----------------------------|--|--|-------------------------|-------------------------|----------|----------------------------|----------------------------|------------------|----------------------------|----------------------------|---|---|--------|---|---|--------|--|
|                  |                            | Status                     | Function   |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 0                | LIN10                      | 0                          | The vertical dot size for line n in the character dot lines (18 vertical lines) is set using LINn (n = 2 to 17).   | Character size setting in the vertical direction for the 10th line.  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                | LIN11                      | 0                          | Dot size can be selected between 2 types for each dot line.  | Character size setting in the vertical direction for the 11th line.  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 2                | LIN12                      | 0                          | For dot size, see the below registers. Line 1 and lines 2 to 12 can be set independent of one another.   | Character size setting in the vertical direction for the 12th line.  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 3                | LIN13                      | 0                          | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>LINn = "0"</th> <th>LINn = "1"</th> </tr> </thead> <tbody> <tr> <td>1st line</td> <td>Refer to VSZ1L0 and VSZ1L1</td> <td>Refer to VSZ1H0 and VSZ1H1</td> </tr> <tr> <td>2nd to 12th line</td> <td>Refer to VSZ2L0 and VSZ2L1</td> <td>Refer to VSZ2H0 and VSZ2H1</td> </tr> </tbody> </table>  |  | LINn = "0"              | LINn = "1"              | 1st line | Refer to VSZ1L0 and VSZ1L1 | Refer to VSZ1H0 and VSZ1H1 | 2nd to 12th line | Refer to VSZ2L0 and VSZ2L1 | Refer to VSZ2H0 and VSZ2H1 | Character size setting in the vertical direction for the 13th line. |   |        |   |   |        |  |
|                  |                            |                            |  | LINn = "0"   | LINn = "1"              |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1st line         | Refer to VSZ1L0 and VSZ1L1 | Refer to VSZ1H0 and VSZ1H1 |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 2nd to 12th line | Refer to VSZ2L0 and VSZ2L1 | Refer to VSZ2H0 and VSZ2H1 |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                |                            |                            |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 4                | LIN14                      | 0                          |  | Character size setting in the vertical direction for the 14th line.  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 5                | LIN15                      | 0                          |  | Character size setting in the vertical direction for the 15th line.  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 6                | LIN16                      | 0                          |  | Character size setting in the vertical direction for the 16th line.  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 7                | LIN17                      | 0                          |  | Character size setting in the vertical direction for the 17th line.  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 8                | V18SZ0                     | 0                          | H: Cycle with the horizontal synchronizing pulse   | Character size setting in the vertical direction for the 18th line. (display monitor 1 to 12 line)   |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 9                | V18SZ1                     | 0                          | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>V18SZ1</th> <th>V18SZ0</th> <th>Vertical direction size</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1H/dot</td> </tr> <tr> <td>0</td> <td>1</td> <td>2H/dot</td> </tr> <tr> <td>1</td> <td>0</td> <td>3H/dot</td> </tr> <tr> <td>1</td> <td>1</td> <td>4H/dot</td> </tr> </tbody> </table> | V18SZ1   | V18SZ0                  | Vertical direction size | 0        | 0                          | 1H/dot                     | 0                | 1                          | 2H/dot                     | 1   | 0 | 3H/dot | 1 | 1 | 4H/dot |  |
|                  |                            | V18SZ1                     |  | V18SZ0   | Vertical direction size |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 0                | 0                          | 1H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 0                | 1                          | 2H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                | 0                          | 3H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                | 1                          | 4H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                |                            |                            |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| A                | VSZ2L0                     | 0                          | H: Cycle with the horizontal synchronizing pulse   | Character size setting in the vertical direction (display monitor for 2 to 12 line) at "0" state in register LIN2 to LIN17 (address 125 <sub>16</sub> , 126 <sub>16</sub> ).                   |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| B                | VSZ2L1                     | 0                          | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>VSZ2L1</th> <th>VSZ2L0</th> <th>Vertical direction size</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1H/dot</td> </tr> <tr> <td>0</td> <td>1</td> <td>2H/dot</td> </tr> <tr> <td>1</td> <td>0</td> <td>3H/dot</td> </tr> <tr> <td>1</td> <td>1</td> <td>4H/dot</td> </tr> </tbody> </table> | VSZ2L1   | VSZ2L0                  | Vertical direction size | 0        | 0                          | 1H/dot                     | 0                | 1                          | 2H/dot                     | 1   | 0 | 3H/dot | 1 | 1 | 4H/dot |  |
|                  |                            | VSZ2L1                     |  | VSZ2L0   | Vertical direction size |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 0                | 0                          | 1H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 0                | 1                          | 2H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                | 0                          | 3H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                | 1                          | 4H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                |                            |                            |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| C                | VSZ2H0                     | 0                          | H: Cycle with the horizontal synchronizing pulse   | Character size setting in the vertical direction (display monitor for 2 to 12 line) at "0" state in register LIN2 to LIN17 (address 125 <sub>16</sub> , 126 <sub>16</sub> ).                   |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| D                | VSZ2H1                     | 0                          | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>VSZ2H1</th> <th>VSZ2H0</th> <th>Vertical direction size</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1H/dot</td> </tr> <tr> <td>0</td> <td>1</td> <td>2H/dot</td> </tr> <tr> <td>1</td> <td>0</td> <td>3H/dot</td> </tr> <tr> <td>1</td> <td>1</td> <td>4H/dot</td> </tr> </tbody> </table> | VSZ2H1   | VSZ2H0                  | Vertical direction size | 0        | 0                          | 1H/dot                     | 0                | 1                          | 2H/dot                     | 1   | 0 | 3H/dot | 1 | 1 | 4H/dot |  |
|                  |                            | VSZ2H1                     |  | VSZ2H0   | Vertical direction size |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 0                | 0                          | 1H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 0                | 1                          | 2H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                | 0                          | 3H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                | 1                          | 4H/dot                     |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| 1                |                            |                            |  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
| E                | POPUP<br>(Note 3)          | 0                          | Page 1 priority display  | Sets the priority page for when 2 pages are displayed at the same time. The setting is effective only when the standard display mode is set as MODE0 = "0", MODE1 = "0". See "DISPLAY FORM 2". |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |
|                  |                            | 1                          | Page 0 priority display  |  |                         |                         |          |                            |                            |                  |                            |                            |   |   |        |   |   |        |  |

- Notes 1. The mark ○ around the status value means the reset status by the "L" level is input to AC pin.  
 2. The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.  
 3. Registers marked with (Note 3) are found only in page 0, therefore the register value does not change when the DAF bit is set to "1".

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

(8) Address 127<sub>16</sub>

| DA | Register          | Contents         |  |              |       | Remarks  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|----|-------------------|------------------|--|--------------|-------|--|---------------------------|--------------|--------|---|------------------|---|-------|-----|---|---|------|---|---|----|--|---|---|---|--------|---|---|---|------|---|---|---|---------|---|---|---|------|---|---|---|-------|---|
|    |                   | Status           | Function   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | RR                | 0                | <table border="1"> <thead> <tr> <th>RB</th> <th>RG</th> <th>RR</th> <th>Color</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Black</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Red</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Green</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Yellow</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Blue</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Magenta</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Cyan</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>White</td> </tr> </tbody> </table> |              |       | RB   | RG                        | RR           | Color  | 0 | 0                | 0   | Black | 0   | 0 | 1 | Red  | 0 | 1 | 0  | Green  | 0 | 1 | 1 | Yellow | 1 | 0 | 0 | Blue | 1 | 0 | 1 | Magenta | 1 | 1 | 0 | Cyan | 1 | 1 | 1 | White | Sets the raster color of all blankings.                         |
|    |                   | RB               | RG   | RR           | Color |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 0                 | 0                | Black  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 0                 | 1                | Red  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 1                 | 0                | Green  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 1                 | 1                | Yellow   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 0                 | 0                | Blue   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 0                 | 1                | Magenta  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 1                 | 0                | Cyan   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 1                 | 1                | White  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  |                   |                  |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | RG                | 0                |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 2  | RB                | 0                |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 3  | FR                | 0                | <table border="1"> <thead> <tr> <th>FB</th> <th>FG</th> <th>FR</th> <th>Color</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Black</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Red</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Green</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Yellow</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Blue</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Magenta</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Cyan</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>White</td> </tr> </tbody> </table> |              |       | FB   | FG                        | FR           | Color  | 0 | 0                | 0   | Black | 0   | 0 | 1 | Red  | 0 | 1 | 0  | Green  | 0 | 1 | 1 | Yellow | 1 | 0 | 0 | Blue | 1 | 0 | 1 | Magenta | 1 | 1 | 0 | Cyan | 1 | 1 | 1 | White | Sets the blanking color of the Border size, or the shadow size. |
|    |                   | FB               | FG   | FR           | Color |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 0                 | 0                | Black  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 0                 | 1                | Red  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 1                 | 0                | Green  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 1                 | 1                | Yellow   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 0                 | 0                | Blue   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 0                 | 1                | Magenta  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 1                 | 0                | Cyan   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 1                 | 1                | White  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  |                   |                  |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 4  | FG                | 0                |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 5  | FB                | 0                |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 6  | TEST6             | 0                | It should be fixed to "0".   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                | Can not be used.   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 7  | TEST7             | 0                | It should be fixed to "0".   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                | Can not be used.   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 8  | TEST8             | 0                | It should be fixed to "0".   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                | Can not be used.   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 9  | BETA14            | 0                | Matrix-outline display (12 × 18 dot)   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                | Matrix-outline display (14 × 18 dot)   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| A  | HSZ10             | 0                | <table border="1"> <thead> <tr> <th>HSZ10</th> <th>Horizontal direction size</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1T/dot</td> </tr> <tr> <td>1</td> <td>2T/dot</td> </tr> </tbody> </table>   |              |       | HSZ10  | Horizontal direction size | 0            | 1T/dot | 1 | 2T/dot           | Character size setting in the horizontal direction for the first line.<br>T : Display frequency cycle |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | HSZ10            | Horizontal direction size  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 1T/dot            |                  |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 2T/dot            |                  |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  |                   |                  |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| B  | TEST11            | 0                | It should be fixed to "0".   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                | Can not be used.   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| C  | HSZ20             | 0                | <table border="1"> <thead> <tr> <th>HSZ20</th> <th>Horizontal direction size</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1T/dot</td> </tr> <tr> <td>1</td> <td>2T/dot</td> </tr> </tbody> </table>   |              |       | HSZ20  | Horizontal direction size | 0            | 1T/dot | 1 | 2T/dot           |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | HSZ20            | Horizontal direction size  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 1T/dot            |                  |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 2T/dot            |                  |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  |                   |                  |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| D  | TEST12            | 0                | It should be fixed to "0".   |              |       | Character size setting in the horizontal direction for the 2nd line to 12th line.<br>T : Display frequency cycle |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | 1                | Can not be used.   |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| E  | MODE0<br>(Note 3) | 0                | <table border="1"> <thead> <tr> <th>MODE1</th> <th>MODE0</th> <th>Display mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Standard.(Note4)</td> </tr> <tr> <td>0</td> <td>1</td> <td>AND</td> </tr> <tr> <td>1</td> <td>0</td> <td>EXOR</td> </tr> <tr> <td>1</td> <td>1</td> <td>OR</td> </tr> </tbody> </table>  |              |       | MODE1  | MODE0                     | Display mode | 0      | 0 | Standard.(Note4) | 0   | 1     | AND | 1 | 0 | EXOR | 1 | 1 | OR | Sets the display mode for when 2 pages are displayed at the same time. See "DISPLAY FORM 2".<br>MODE1(address128 <sub>16</sub> ) . |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
|    |                   | MODE1            | MODE0  | Display mode |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 0                 | Standard.(Note4) |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 0  | 1                 | AND              |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 0                 | EXOR             |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  | 1                 | OR               |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |
| 1  |                   |                  |  |              |       |  |                           |              |        |   |                  |   |       |     |   |   |      |   |   |    |  |   |   |   |        |   |   |   |      |   |   |   |         |   |   |   |      |   |   |   |       |   |

- Notes 1. The mark 0 around the status value means the reset status by the "L" level is input to  $\bar{A}C$  pin.  
 2. The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.  
 3. Registers marked with (Note 3) are found only in page 0, therefore the register value does not change when the DAF bit is set to "1".  
 4. 2 way settings are available by POPUP (address 126<sub>16</sub>).

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

(9) Address 128<sub>16</sub>

| DA     | Register                                       | Contents            |  | Remarks  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|--------|--|---------------------|--|--|--------|---------------|---|---|---------------------|---|---|----------------|---|-----|-------------|---|-----|---------------------|--|-----|--------------------------|
|        |  | Status              | Function   |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 0      | BCOL   | 0                   | Blanking of BLK0, BLK1   | Sets all raster blanking   |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | All raster blanking  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 1      | B/F<br>(Note 3)                                | 0                   | Synchronize with the leading edge of horizontal synchronization.   | Synchronize with the front porch or back porch of the horizontal synchronazation signal. |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | Synchronize with the trailing edge of horizontal synchronization.  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 2      | VMASK<br>(Note 3)                              | 0                   | Do not mask by VERT input signal   | Set mask at phase comparison operating.  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | Mask by VERT input signal  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 3      | POLV<br>(Note 3)                               | 0                   | VERT pin is negative polarity  | Set VERT pin polarity.   |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | VERT pin is positive polarity  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 4      | POLH<br>(Note 3)                               | 0                   | HOR pin is negative polarity   | Set HOR pin polarity.  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | HOR pin is positive polarity   |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 5      | BLK0   | 0                   | <table border="1"> <thead> <tr> <th>BLINK1</th> <th>BLINK0</th> <th>Blanking mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Matrix-outline size</td> </tr> <tr> <td>0</td> <td>1</td> <td>Character size</td> </tr> <tr> <td>1</td> <td>0</td> <td>Border size</td> </tr> <tr> <td>1</td> <td>1</td> <td>Matrix-outline size</td> </tr> </tbody> </table> | BLINK1   | BLINK0 | Blanking mode | 0 | 0 | Matrix-outline size | 0 | 1 | Character size | 1 | 0   | Border size | 1 | 1   | Matrix-outline size | Set blanking mode.<br>See "DISPLAY SHAPE 2". |     |                          |
| BLINK1 | BLINK0   | Blanking mode       |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 0      | 0  | Matrix-outline size |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 0      | 1  | Character size      |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 1      | 0  | Border size         |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 1      | 1  | Matrix-outline size |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 1      | (When DSPn (address 124 <sub>16</sub> ) = "0") |                     |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 6      | BLK1   | 0                   |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 7      | SYAD   | 0                   | Border display of character  | See "DISPLAY FORM1 (2)".   |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | Shadow display of character  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 8      | RAMERS   | 0                   | RAM not erased   | There is no need to reset because there is no register for this bit.                     |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | RAM erased   |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 9      | STOP   | 0                   | Oscillation of clock for display   | It is a test bit (TEST13) in the page 1 register, therefore fix it to "0".               |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | Stop the oscillation of clock for display  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| A      | DSPON  | 0                   | Display OFF  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | Display ON   |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| B      | BLINK0   | 0                   | <table border="1"> <thead> <tr> <th colspan="2">BLINK</th> <th>Duty</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0</td> <td rowspan="2">Blinking OFF</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>25%</td> </tr> <tr> <td>1</td> <td>0</td> <td>50%</td> </tr> <tr> <td>1</td> <td>1</td> <td>75%</td> </tr> </tbody> </table>            | BLINK  |        | Duty          | 1 | 0 | Blinking OFF        | 0 | 0 | 0              | 1 | 25% | 1           | 0 | 50% | 1                   | 1  | 75% | Set blinking duty ratio. |
|        |  | BLINK               |  | Duty   |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 1      | 0  | Blinking OFF        |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 0      | 0  |                     |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 0      | 1  | 25%                 |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 1      | 0  | 50%                 |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 1      | 1  | 75%                 |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| 1      |  |                     |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| C      | BLINK1   | 0                   |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| D      | BLINK2   | 0                   | Divided into 64 of vertical synchronous signal   | Set blinking frequency.  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   | Divided into 32 of vertical synchronous signal   |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
| E      | MODE1<br>(Note 3)                              | 0                   | For setting, see MODE0 (address 127 <sub>16</sub> ).   | Sets the display mode for when 2 pages are displayed at the same time.                   |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |
|        |  | 1                   |  |  |        |               |   |   |                     |   |   |                |   |     |             |   |     |                     |  |     |                          |

Notes 1. The mark 0 around the status value means the reset status by the "L" level is input to AC pin.  
 2. The page in which data is written is controlled by the DAF bit. When set to "0", data is written into page 0, whereas when set to "1", data is written into page 1.  
 3. Registers marked with (Note 3) are found only in page 0, therefore the register value does not change when the DAF bit is set to "1".



**REGISTER SUPPLEMENTARY DESCRIPTION**

(1) Setting external clock input and display frequency mode  
 Setting external clock input and display frequency mode (by use of EXCK0 (120<sub>16</sub>), EXCK1 (123<sub>16</sub>) and DIV10 to DIV0 (120<sub>16</sub>), as explained here following.

(a) When (EXCK1, EXCK0) = (0, 0) .....External synchronous 1 (External clock display) ... Fosc = 20 to 70 MHz  
 Input from the TCK pin a constant-period continuous external clock that synchronizes with the horizontal synchronous signal. And input from HOR pin a constant period continuous horizontal synchronous signal.  
 Never stop inputting the clock while displaying.  
 Do not have to set a display frequency because the clock just as it is entered from outside is used as the display clock.

(b) When (EXCK1, EXCK0) = (0, 1) .....Internal synchronous... Fosc = 20 to 90 MHz  
 Clock input from the TCK pin is unnecessary. The multiply clock of the internally generated horizontal synchronous signal is used as the display clock.  
 The display frequency is set by setting the multiply value of the horizontal synchronous frequency (of the display frequency) in DIV10 to DIV0 (address 120<sub>16</sub>). Also, set the display frequency range. (See the next page.)  
 Display frequency is calculated using the below expression.

$$\text{Display frequency} = \text{Horizontal synchronous frequency} \times \text{Multiply value}$$

(c) When (EXCK1, EXCK0) = (1, 0) ..... Setting disabled

(d) When (EXCK1, EXCK0) = (1, 1) .....External synchronous 2 (Internal oscillation clock display) ... Fosc = 20 to 90 MHz  
 Input from the TCK pin a constant-period continuous external clock that synchronizes with the horizontal synchronous signal. And input from HOR pin a constant-period continuous horizontal synchronous signal.

Never stop inputting the clock while displaying.  
 An internal clock which is in sync with the external input clock is used as the display clock.

Because the display frequency equals the external clock frequency, set N1 (division value) that satisfies the below expressions to DIV10 to DIV0 (address 120<sub>16</sub>) for make the display frequency is equal to the external clock frequency.

$$N1 = \frac{\text{external clock frequency}}{\text{horizontal synchronous frequency}}$$

$$N1 = \sum_{n=0}^{10} 2^n \text{DIV}_n$$

Also, set the display frequency range. (See the next page.)

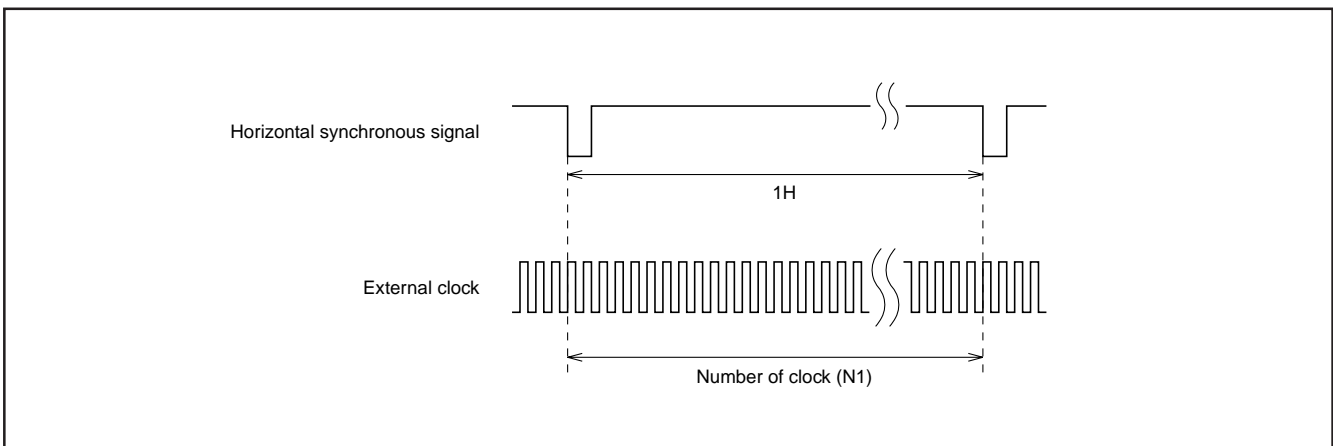


Fig. 4 Example of external clock input

(2) To set display frequency range

Whenever setting display frequency (when EXCK1 = "0", EXCK0 = "1", or EXCK1 = "1", EXCK0 = "1"), always set the display frequency range in accordance with the display frequency. This range is set from DIVS0, DIVS1 (address 120<sub>16</sub>), RSEL0 address 121<sub>16</sub>) and RSEL1 (address 122<sub>16</sub>). Frequency ranges are given here below.

| RSEL1 | RSEL0 | DIVS1 | DIVS0 | Display frequency range (MHz) |
|-------|-------|-------|-------|-------------------------------|
| 1     | 1     | 0     | 0     | 87.0 to 90.0                  |
| 1     | 0     | 0     | 0     | 67.0 to 87.0                  |
| 0     | 1     | 0     | 0     | 54.0 to 67.0                  |
| 1     | 0     | 0     | 1     | 47.0 to 54.0                  |
| 0     | 0     | 0     | 0     | 40.0 to 47.0                  |
| 1     | 0     | 1     | 0     | 34.0 to 40.0                  |
| 0     | 0     | 0     | 1     | 30.0 to 34.0                  |
| 0     | 1     | 1     | 0     | 26.0 to 30.0                  |
| 1     | 0     | 1     | 1     | 23.0 to 26.0                  |
| 0     | 0     | 1     | 0     | 20.0 to 23.0                  |

(3) Notes on setting display frequency

To change external clock (display) frequency or horizontal synchronization frequency, always use the following procedures.

To set EXCK1 = "0", EXCK0 = "1"

- (a) Turn the display OFF. ... DSPON (address 128<sub>16</sub>) = "0"
- (b) Set the display frequency. ... Set from DIV10 to DIV0, DIVS0, DIVS1 (address 120<sub>16</sub>), RSEL0 (address 121<sub>16</sub>) and RSEL1 (address 122<sub>16</sub>).
- (c) Wait 20 ms while the horizontal synchronization signal is being input.
- (d) Turn the display ON. ... DSPON (address 128<sub>16</sub>) = "1"

To set EXCK1 = "1", EXCK0 = "1"

- (a) Turn the display OFF. ... DSPON (address 128<sub>16</sub>) = "0"
- (b) Set the display frequency. ... Set from DIV10 to DIV0, DIVS0, DIVS1 (address 120<sub>16</sub>), RSEL0 (address 121<sub>16</sub>) and RSEL1 (address 122<sub>16</sub>).
- (c) Wait 20 ms while the horizontal synchronization signal and external clock are being input.
- (d) Turn the display ON. ... DSPON (address 128<sub>16</sub>) = "1"

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

**DISPLAY FORM 1**

M35070-XXXSP/FP has the following four display forms.

(1) Blanking mode

Character size

: Blanking same as the character size.

Border size

: Blanking the background as a size from character.

Matrix-outline size

: Blanking the background 12 × 18 dot.

All blanking size

: When set register BCOL to "1", all raster area is blanking.

The display mode and blanking mode can be set line-by-line, as follows, from registers BCOL, BLK1, BLK0 (address 128<sub>16</sub>), DSP0 to DSP11 (address 124<sub>16</sub>).

| BCOL | BLK1 | BLK0 | Line of DSPn = "0"                |                         | Line of DSPn = "1"         |                         |
|------|------|------|-----------------------------------|-------------------------|----------------------------|-------------------------|
|      |      |      | Display mode                      | Blanking mode           | Display mode               | Blanking mode           |
| 0    | 0    | 0    | All matrix-outline border display | All matrix-outline size | All matrix-outline display | All matrix-outline size |
|      | 0    | 1    | Character display                 | Character size          | Border display             | Border size             |
|      | 1    | 0    | Border display                    | Border size             | All matrix-outline display | All matrix-outlinesize  |
|      | 1    | 1    | All matrix-outline display        | All matrix-outline size | Character display          | Character size          |
| 1    | 0    | 0    | All matrix-outline border display | All blanking size       | All matrix-outline display | All blanking size       |
|      | 0    | 1    | Character display                 |                         | Border display             |                         |
|      | 1    | 0    | Border display                    |                         | All matrix-outline display |                         |
|      | 1    | 1    | All matrix-outline display        |                         | Character display          |                         |

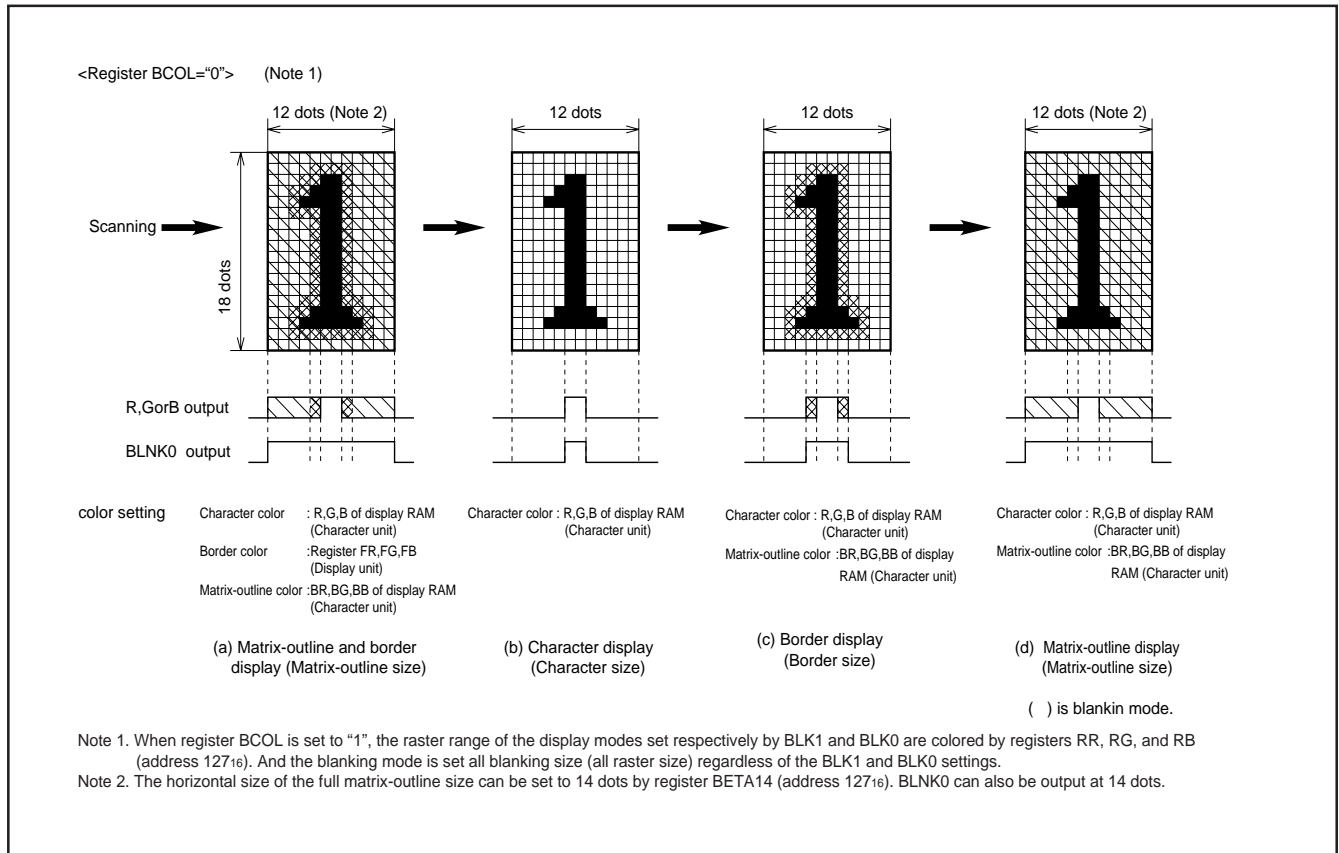


Fig. 5 Display form

(2) Shadow display

When border display mode, if set SYAD (address 128<sub>16</sub>) = "0" to "1", it change to shadow display mode.

Border and shadow display are shown below.

Set shadow display color by BR, BG or BB of display RAM or by register FR, FG and FB (address 127<sub>16</sub>).

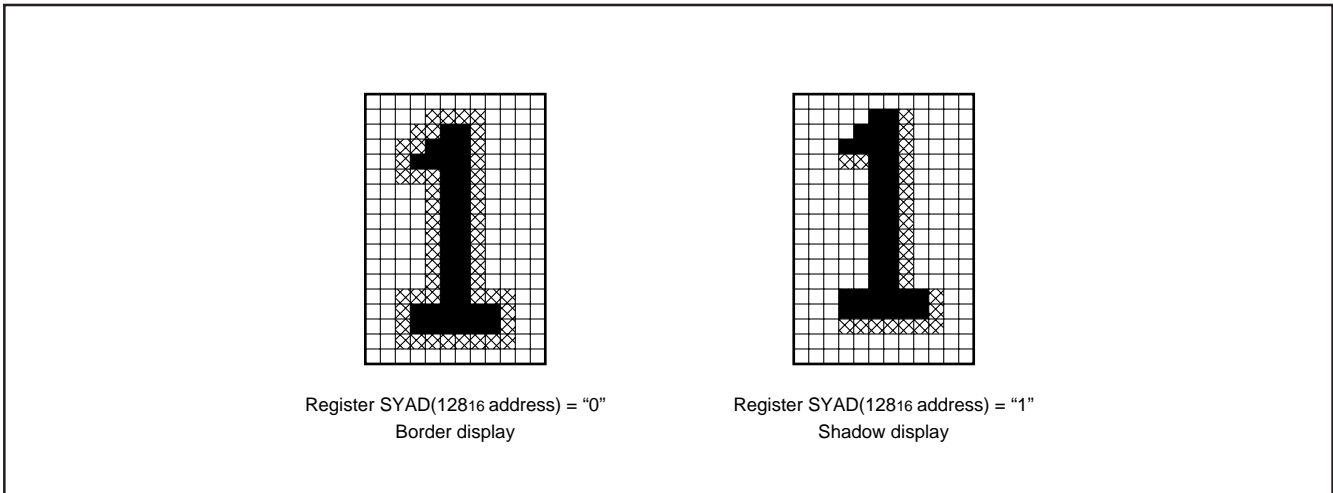


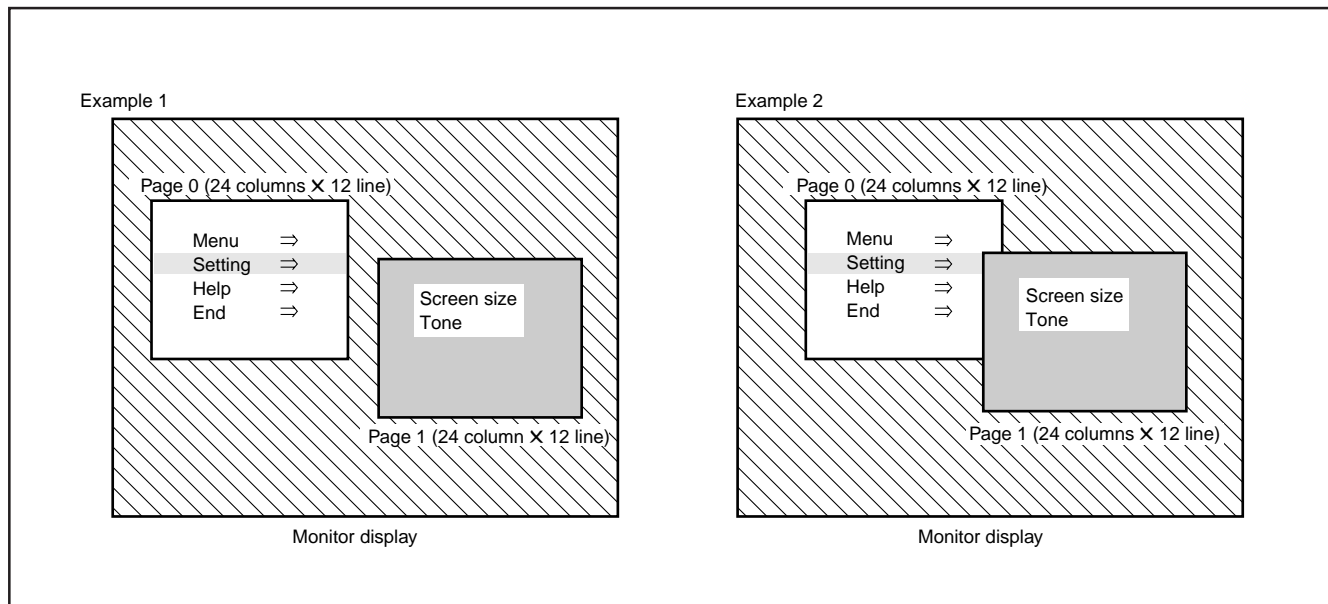
Fig. 6 Border and shadow display

**DISPLAY FORM 2**

This IC can display both page 0 and page 1 at the same time.

Page 0: Set the DAF bit in each addresses to "0".

Page 1: Set the DAF bit in each addresses to "1".



**Fig. 7 Example of 2 pages display**

Example 1: Display position, display size, color, etc., can be freely set for each page, and the 2 pages can be displayed on top of each other or side-by-side.

Example 2: When the display range of the 2 pages overlap on the monitor screen, they can be displayed in the 5 below ways using registers MODE0 (address 127<sub>16</sub>), MODE1 (address 128<sub>16</sub>) and POPUP (address 126<sub>16</sub>). (The POPUP register is effective only when MODE0 = "0" and MODE1 = "0".)

| MODE1 | MODE0 | POPUP | Display mode               |
|-------|-------|-------|----------------------------|
| 0     | 0     | 0     | Standard (Page 1 priority) |
|       |       | 1     | Standard (Page 0 priority) |
| 0     | 1     | —     | AND                        |
| 1     | 0     | —     | EXOR                       |
| 1     | 1     | —     | OR                         |

- (1) Standard (page 1 priority) ... Page 1 has priority in overlapping areas. Page 0 is not displayed in those areas.
- (2) Standard (page 0 priority) ... Page 0 has priority in overlapping areas. Page 1 is not displayed in those areas.
- (3) AND ..... In overlapping areas, the RGB output of the 2 pages is AND processed and output.
- (4) EXOR ..... In overlapping areas, the RGB output of the 2 pages is EXOR processed and output.
- (5) OR ..... In overlapping areas, the RGB output of the 2 pages is OR processed and output.

**CHARACTER FONT**

Images are composed on a 12 X 18 dot matrix, and characters can be linked vertically and horizontally with other characters to allow the display the continuous symbols.

Character code FF<sub>16</sub> is fixed as a blank without background. Therefore, cannot register a character font in this code.

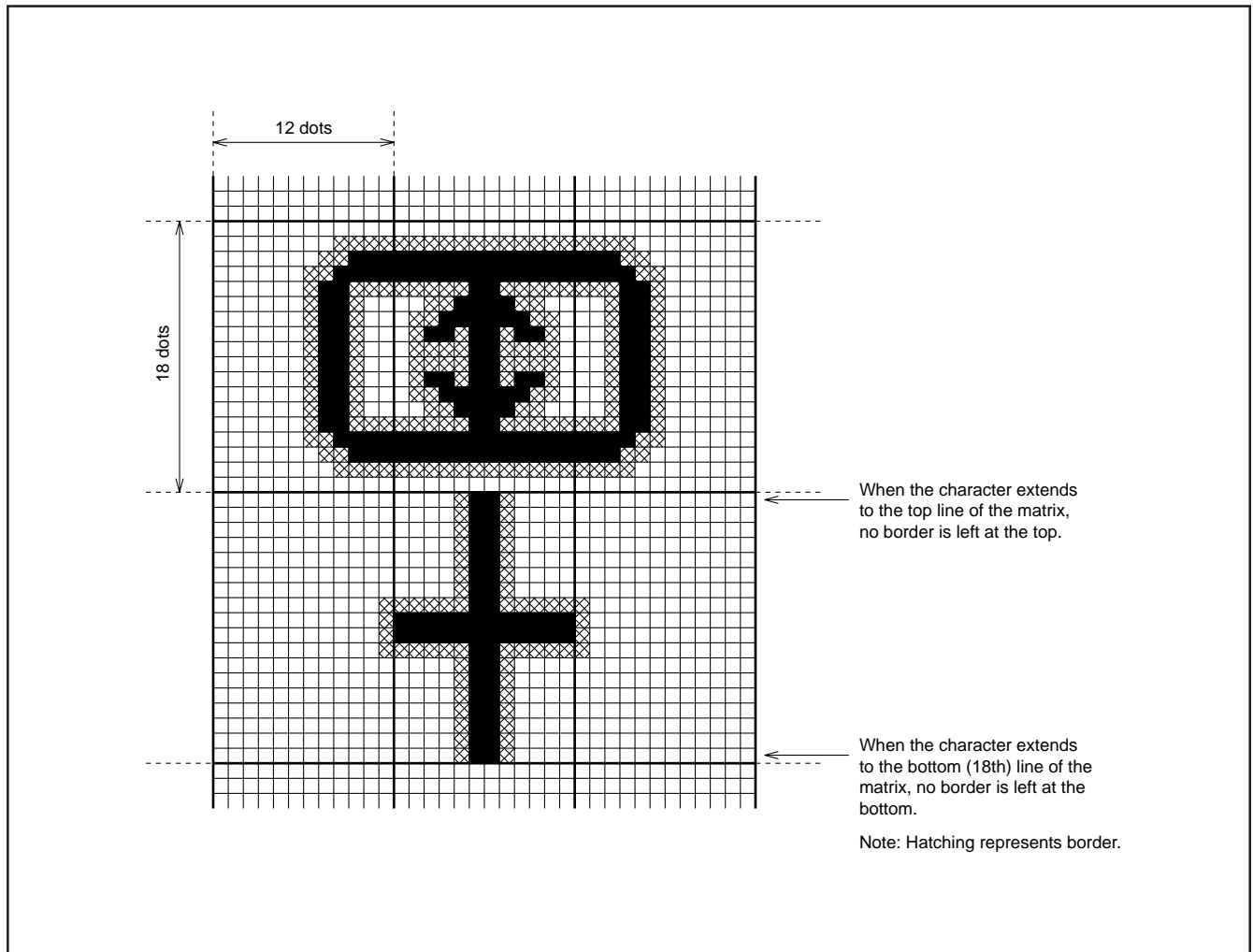


Fig. 8 Example of border display

**DATA INPUT EXAMPLE**

Data of display RAM and display control registers can be set by the I<sup>2</sup>C-BUS serial input function. Example of data setting is shown in Figure 9 (at EXCK0 = "1", EXCK1 = "0" setting).

| Data input example (M35070-XXXSP/FP) |                |                     |      |       |           |                 |      |      |                |      |      |      |      |      |      |      |  |
|--------------------------------------|----------------|---------------------|------|-------|-----------|-----------------|------|------|----------------|------|------|------|------|------|------|------|--|
| Address/data                         | DAF<br>(Note1) | DAE                 | DAD  | DAC   | DAB       | DAA             | DA9  | DA8  | DA7            | DA6  | DA5  | DA4  | DA3  | DA2  | DA1  | DA0  | Remarks  |
| 200m sec hold                        |                |                     |      |       |           |                 |      |      |                |      |      |      |      |      |      |      |  |
| System set up (Note 4)               |                |                     |      |       |           |                 |      |      |                |      |      |      |      |      |      |      |  |
| Address 12016                        | 0              | 0                   | 0    | 0     | 0         | 0               | 0    | 1    | 0              | 0    | 1    | 0    | 0    | 0    | 0    | 0    | Address setting                                    |
| Data 12016                           | 0              | 1                   | 0    | DIVS1 | DIVS0     | DIV10           | DIV9 | DIV8 | DIV7           | DIV6 | DIV5 | DIV4 | DIV3 | DIV2 | DIV1 | DIV0 | Frequency value setting (Note2)                    |
| Data 12116                           | 0              | RSEL0               | PTD7 | PTD6  | 1         | PTD4            | 1    | PTD2 | 1              | 1    | 1    | 0    | 1    | 0    | 1    | 1    | Output setting                                     |
| Data 12216                           | 0              | RSEL1               | 0    | 0     | 0         | HP10            | HP9  | HP8  | HP7            | HP6  | HP5  | HP4  | HP3  | HP2  | HP1  | HP0  | Horizontal display location setting                |
| Data 12316                           | 0              | 0                   | 0    | 0     | 0         | 0               | VP9  | VP8  | VP7            | VP6  | VP5  | VP4  | VP3  | VP2  | VP1  | VP0  | Vertical display location setting                  |
| Data 12416                           | 0              | 1                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Display form setting                               |
| Data 12516                           | 0              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Character size setting                             |
| Data 12616                           | 0              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Character size setting                             |
| Data 12716                           | 0              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Color, character size setting                      |
| Data 12816                           | 0              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | POLH | POLV | 0    | 0    | 0    | Page 0 display OFF                                 |
| Address 12216                        | 0              | 0                   | 0    | 0     | 0         | 0               | 0    | 1    | 0              | 0    | 1    | 0    | 0    | 0    | 1    | 0    | Address setting                                    |
| Data 12216                           | 1              | 0                   | 0    | 0     | 0         | HP10            | HP9  | HP8  | HP7            | HP6  | HP5  | HP4  | HP3  | HP2  | HP1  | HP0  | Horizontal display location setting                |
| Data 12316                           | 1              | 0                   | 0    | 0     | 0         | 0               | VP9  | VP8  | VP7            | VP6  | VP5  | VP4  | VP3  | VP2  | VP1  | VP0  | Vertical display location setting                  |
| Data 12416                           | 1              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Display form setting                               |
| Data 12516                           | 1              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Character size setting                             |
| Data 12616                           | 1              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Character size setting                             |
| Data 12716                           | 1              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Color, character size setting                      |
| Data 12816                           | 1              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Page 1 display OFF                                 |
| 200m sec hold                        |                |                     |      |       |           |                 |      |      |                |      |      |      |      |      |      |      |  |
| Be stable / Waiting time             |                |                     |      |       |           |                 |      |      |                |      |      |      |      |      |      |      |  |
| Data 00016                           | 0              | BB                  | BG   | BR    | BLINK     | B               | G    | R    | C7             | C6   | C5   | C4   | C3   | C2   | C1   | C0   | Character setting                                  |
| ⋮                                    | ⋮              | Background coloring |      |       | Blink-ing | Character color |      |      | Character code |      |      |      |      |      |      |      |  |
| Data 11F16                           | 0              | BB                  | BG   | BR    | BLINK     | B               | G    | R    | C7             | C6   | C5   | C4   | C3   | C2   | C1   | C0   |  |
| Address 00016                        | 0              | 0                   | 0    | 0     | 0         | 0               | 0    | 0    | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | Character setting                                  |
| Data 00016                           | 1              | BB                  | BG   | BR    | BLINK     | B               | G    | R    | C7             | C6   | C5   | C4   | C3   | C2   | C1   | C0   |  |
| ⋮                                    | ⋮              | Background coloring |      |       | Blink-ing | Character color |      |      | Character code |      |      |      |      |      |      |      |  |
| Data 11F16                           | 1              | BB                  | BG   | BR    | BLINK     | B               | 0    | R    | C7             | C6   | C5   | C4   | C3   | C2   | C1   | C0   | Character setting                                  |
| Address 12816                        | 0              | 0                   | 0    | 0     | 0         | 0               | 0    | 1    | 0              | 0    | 1    | 0    | 1    | 0    | 0    | 0    |  |
| Data 12816                           | 1              | 0                   | 0    | 0     | 0         | 1               | 0    | 0    | 0              | 1    | 1    | 0    | 0    | 0    | 0    | 0    |  |
| Address 12816                        | 0              | 0                   | 0    | 0     | 0         | 0               | 0    | 1    | 0              | 0    | 1    | 0    | 1    | 0    | 0    | 0    | Address setting                                    |
| Data 12816                           | 0              | 0                   | 0    | 0     | 0         | 1               | 0    | 0    | 0              | 1    | 1    | POLH | POLV | 0    | 0    | 0    | Page 0 display ON<br>Display form setting (Note 3) |

- Notes 1 : The page in which data is written is controlled by the address. To write data into page 0, set "0". To write data into page 1, set "1".  
 2 : Input a continuous clock of constant period from the TCK pin. Also, input a horizontal synchronous signal into the HOR pin and a vertical synchronous signal into the VERT pin.  
 3 : Matrix-outline display in this data.  
 4 : Secure the waiting time of 200ms after releasing AC, and set data from setting the display frequency (setting of the register).

Fig 9. Example of data setting

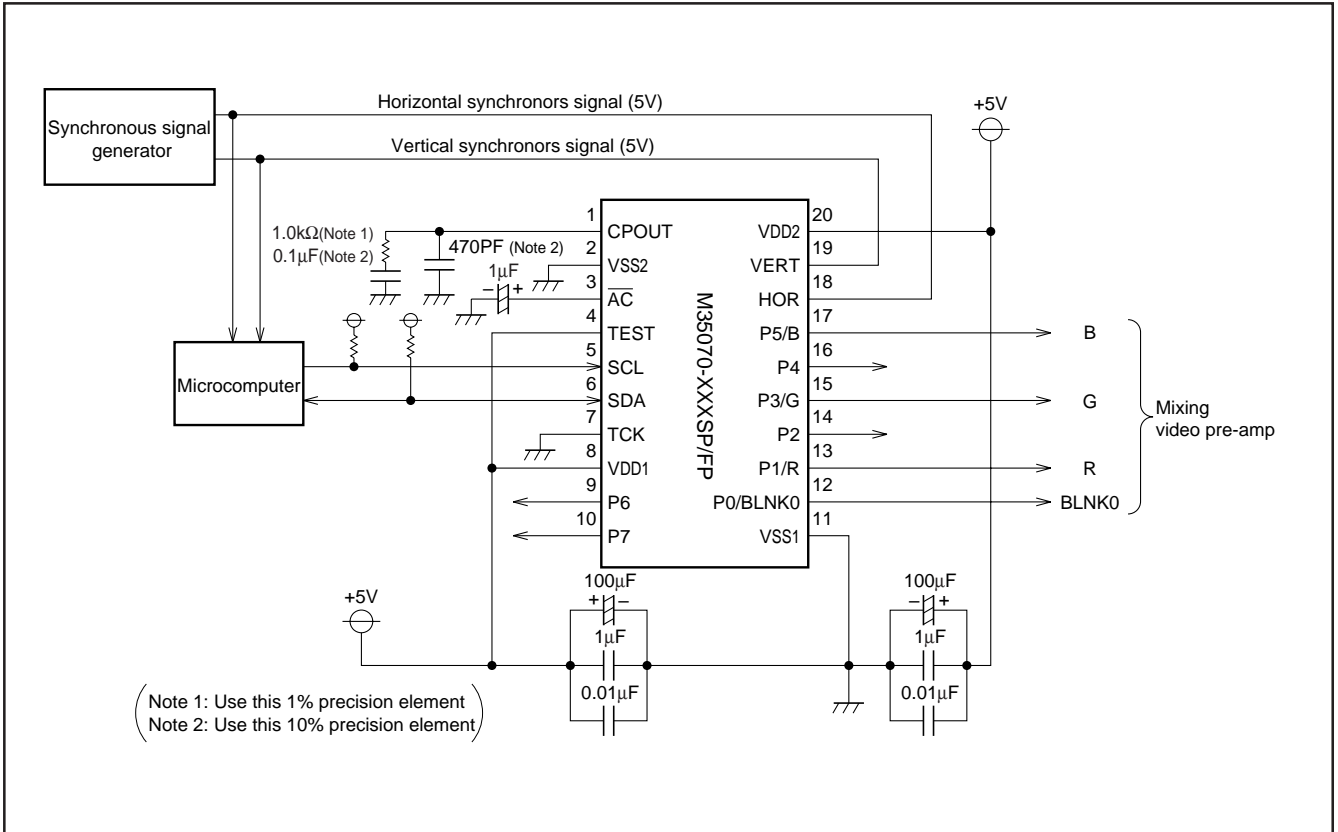


Fig. 10 Example of the M35070-XXXSP/FP peripheral circuit (Internal synchronous. At EXCK1 = "0", EXCK0 = "1")

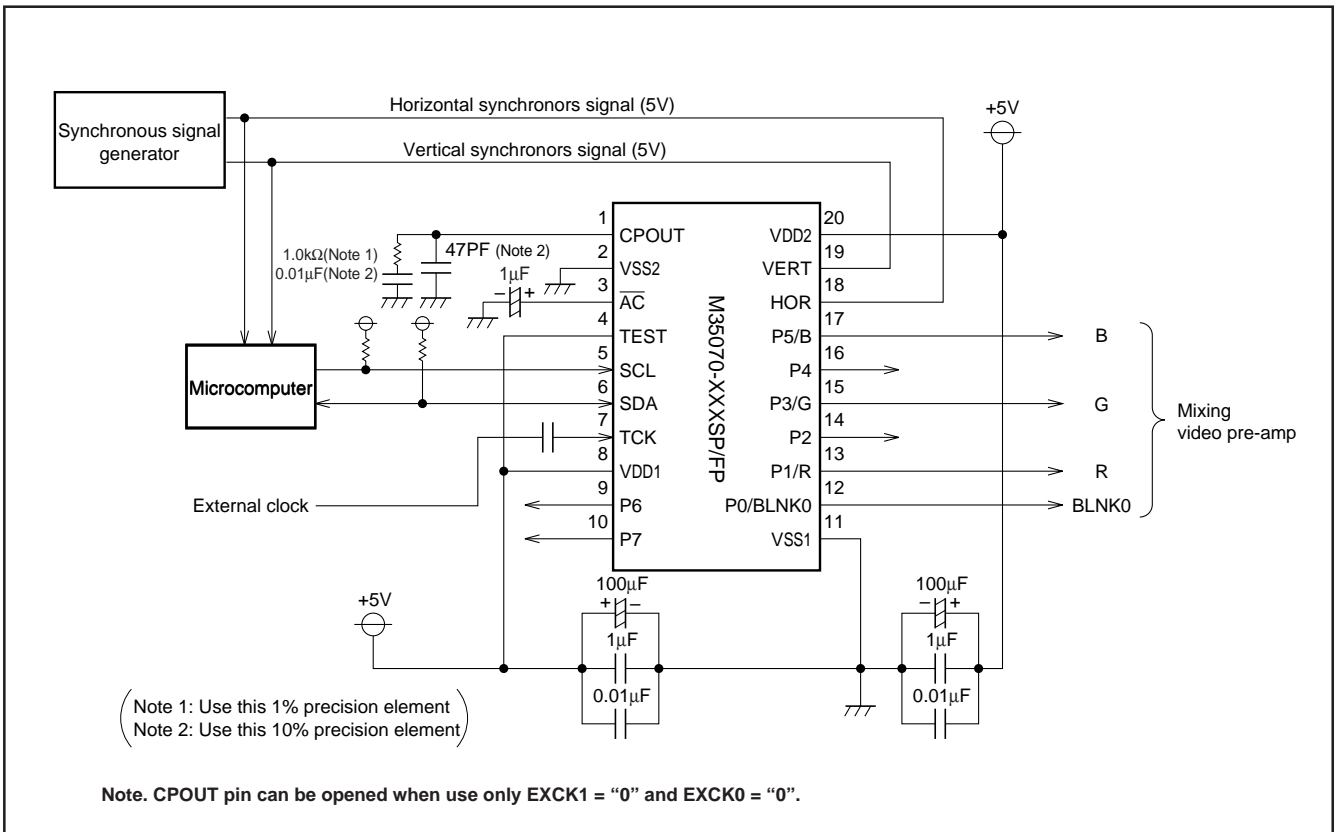


Fig. 11 Example of the M35070-XXXSP/FP peripheral circuit (External synchronous. At EXCK1 = "1", EXCK0 = "1")



**DATA INPUT**

(1) I<sup>2</sup>C-Bus communication function

This IC has a built-in data transmission interface which utilizes 2 unidirectional buses. In communications, this IC functions as a slave reception device.

The IC is synchronized with the serial clock (SCL) sent from the master device and receives the data (SDA). Communications are controlled from the start/stop states. Also, always input the control byte after attaining the start state.

The below chart shows the start/stop state and control byte configuration.

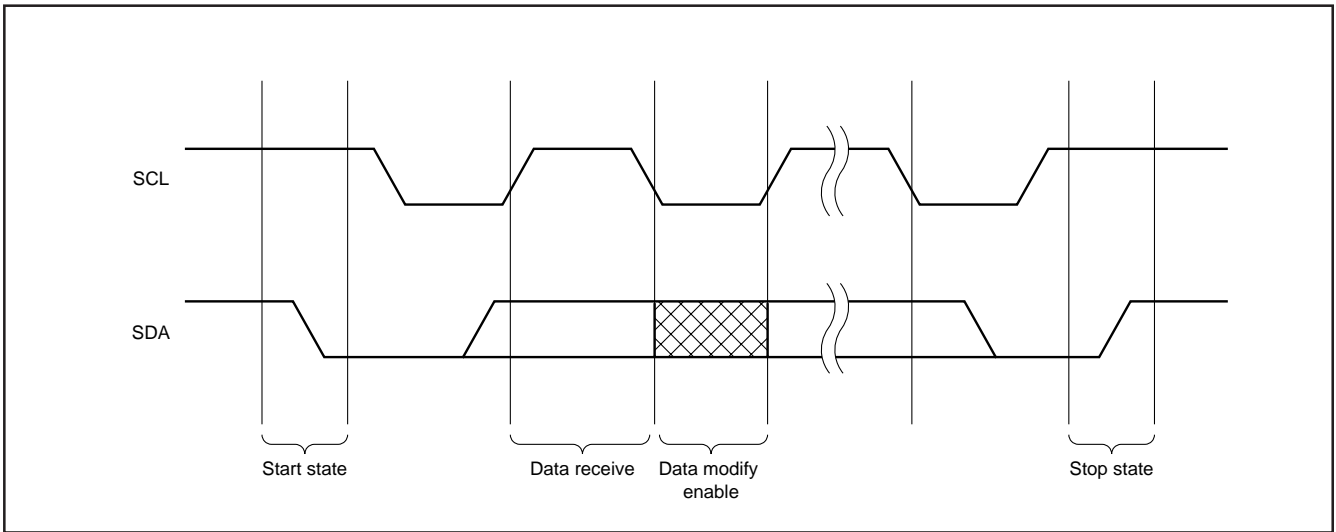


Fig. 12 Start state / Stop state

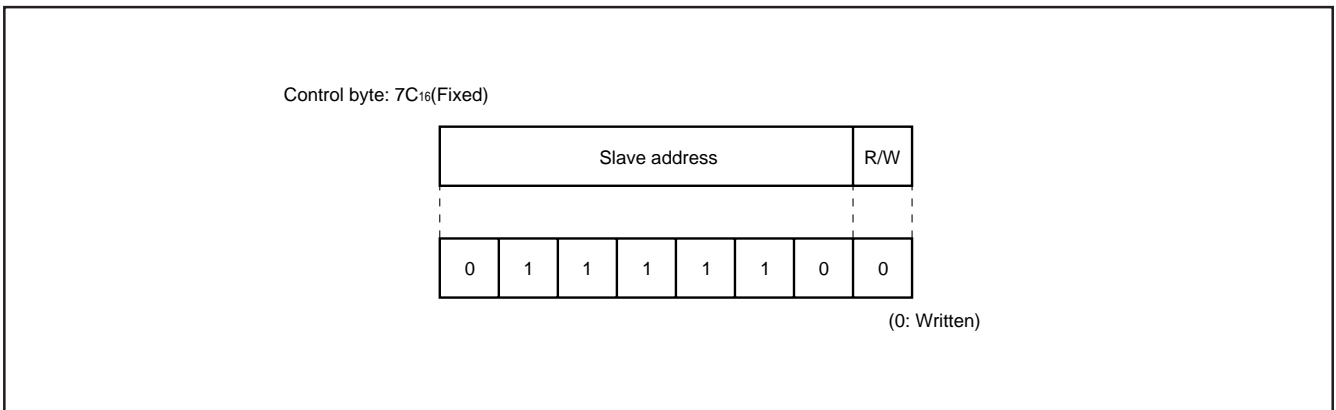


Fig. 13 Control byte configuration

(2) Data input (Sequence)

- (a) Addresses are consists of 16 bits.
- (b) Data is consists of 16 bits.
- (c) Addresses and data are communicated in 8-bit units. Input the lower 8 bits before the upper 8 bits. Make input from the MSB side.
- (d) After the start state has been attained and the control byte (7CH) received, the next 16 bits (2 bytes) are for inputting the address. Addresses are increased in increments for every 16 bits (2 bytes) of data input thereafter. As a result, it is not necessary to input the address from the second data.

Note: During external synchronous, stop the external clock input from the TCK pin while inputting data.

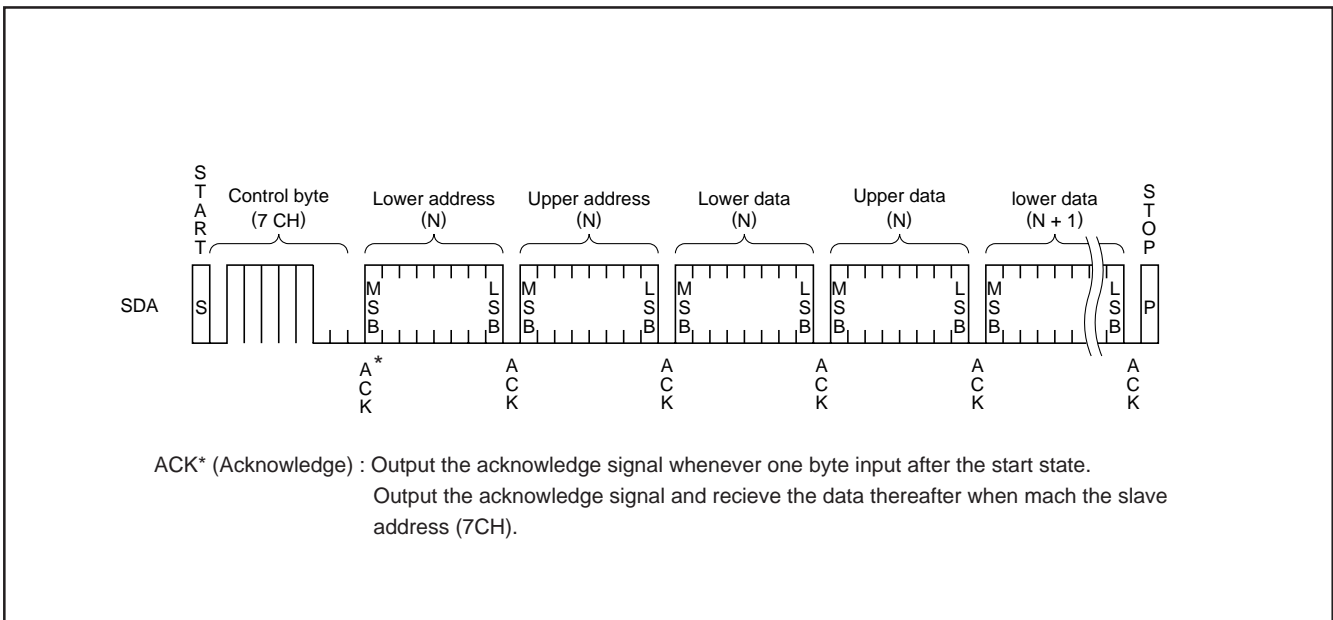


Fig. 14 Data input sequence

**TIMING REQUIREMENTS**

Data input

| Symbol    | Parameter                                     | Limits    |      |                    |      | Unit | Remarks  |
|-----------|---|-----------|------|--------------------|------|------|--|
|           |   | Typ. mode |      | High-speed mode    |      |      |  |
|           |   | Min.      | Max. | Min.               | Max. |      |  |
| fCLK      | Clock frequency                               | 0         | 100  | 0                  | 400  | KHz  |  |
| tHIGH     | HIGH period of Clock                          | 4000      | –    | 600                | –    | ns   |  |
| tLOW      | LOW period of Clock                           | 4700      | –    | 1300               | –    | ns   |  |
| tR        | SDA & SCL rise time                           | –         | 1000 | 20+(Note)<br>0.1Cb | 300  | ns   |  |
| tF        | SDA & SCL fall time                           | –         | 300  | 20+(Note)<br>0.1Cb | 300  | ns   |  |
| tHD : STA | Hold time at START status                     | 4000      | –    | 600                | –    | ns   |  |
| tsu : STA | Set up time at START status                   | 4700      | –    | 600                | –    | ns   | Only at START state repeating generation           |
| tHD : DAT | Data input hold time                          | 0         | –    | 0                  | –    | ns   |  |
| tsu : DAT | Data input setup time                         | 250       | –    | 100                | –    | ns   |  |
| tsu : STO | Set up time at STOP state                     | 4000      | –    | 600                | –    | ns   |  |
| tBUF      | Bus release time                              | 4700      | –    | 1300               | –    | ns   | Time must be released bus before next transmission |
| tSP       | Input filter / spike suppress (SDA & SCL pin) | N/A       | N/A  | 0                  | 50   | ns   |  |

Note. Cb = total capacitance of 1 bus line.

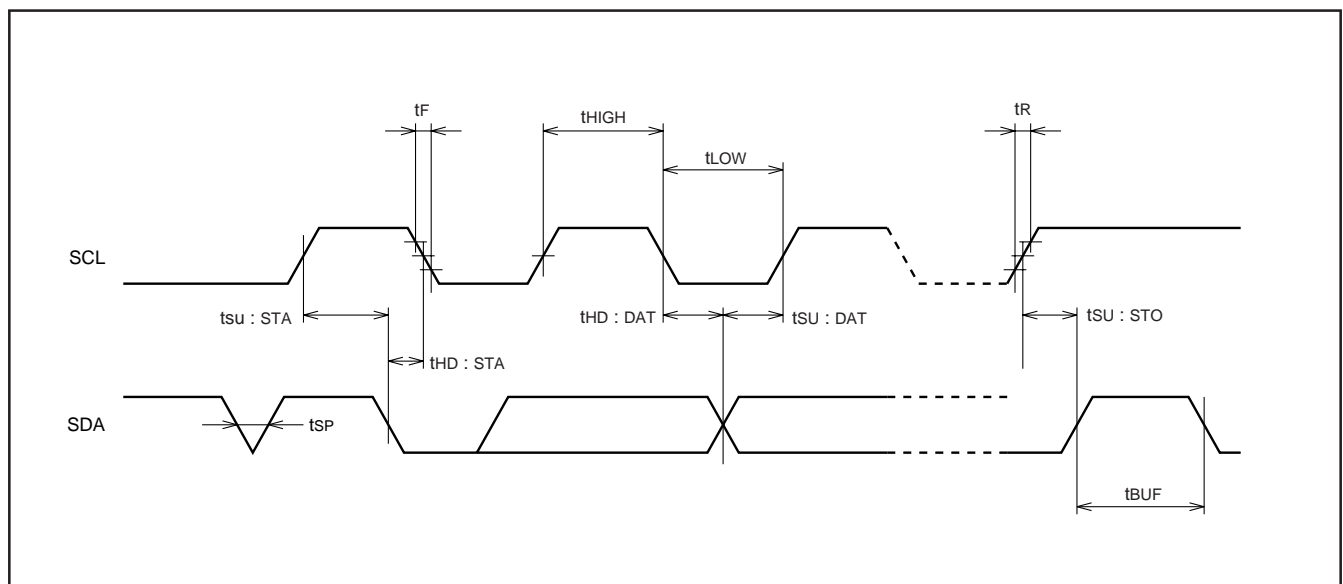


Fig. 15 Data input timing

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

**ABSOLUTE MAXIMUM RATINGS** ( $V_{DD} = 5.00V$ ,  $T_a = -20$  to  $+85^\circ C$ , unless otherwise noted)

| Symbol | Parameter             | Conditions           | Ratings                                   | Unit |
|--------|-----------------------|----------------------|---|------|
| VDD    | Supply voltage        | With respect to VSS. | -0.3 to +6.0                              | V    |
| VI     | Input voltage         |                      | $V_{SS} - 0.3 \leq V_I \leq V_{DD} + 0.3$ | V    |
| VO     | Output voltage        |                      | $V_{SS} \leq V_O \leq V_{DD}$             | V    |
| Pd     | Power dissipation     | $T_a = +25^\circ C$  | +300                                      | mW   |
| Topr   | Operating temperature |                      | -20 to +85                                | °C   |
| Tstg   | Storage temperature   |                      | -40 to +125                               | °C   |

**RECOMMENDED OPERATING CONDITIONS** ( $V_{DD} = 5.00V$ ,  $T_a = -20$  to  $+85^\circ C$ , unless otherwise noted)

| Symbol | Parameter                                     |                           | Limits |      |        | Unit |
|--------|---|---------------------------|--------|------|--------|------|
|        |   |                           | Min.   | Typ. | Max.   |      |
| VDD    | Supply voltage                                |                           | 4.75   | 5.0  | 5.25   | V    |
| VIH    | “H” level input voltage                       | $\overline{AC}$ HOR, VERT | 0.8VDD | VDD  | VDD    | V    |
|        |   | SCL, SDA                  | 0.7VDD | VDD  | VDD    | V    |
| VIL    | “L” level input voltage                       | $\overline{AC}$ HOR, VERT | 0      | 0    | 0.2VDD | V    |
|        |   | SCL, SDA                  | 0      | 0    | 0.3VDD | V    |
| FOSC   | Oscillating frequency for display             |                           | 20.0   | —    | 90.0   | MHz  |
| H.sync | Horizontal synchronous signal input frequency |                           | 15.0   | —    | 130.0  | kHz  |

**ELECTRICAL CHARACTERISTICS** ( $V_{DD} = 5.00V$ ,  $T_a = 25^\circ C$ , unless otherwise noted)

| Symbol | Parameter                          |                  | Test conditions                       | Limits |      |        | Unit |
|--------|------------------------------------|------------------|---------------------------------------|--------|------|--------|------|
|        |                                    |                  |                                       | Min.   | Typ. | Max.   |      |
| VDD    | Supply voltage                     |                  | $T_a = -20$ to $+85^\circ C$          | 4.75   | 5.0  | 5.25   | V    |
| IDD    | Supply current                     |                  | $V_{DD} = 5.00V$                      | —      | 40   | 60     | mA   |
| VOH    | “H” level output voltage           | P0 to P7 (Note1) | $V_{DD} = 4.75V$ , $I_{OH} = -0.4mA$  | 3.5    | —    | —      | V    |
|        |                                    | CPOUT            | $V_{DD} = 4.75V$ , $I_{OH} = -0.05mA$ |        |      |        |      |
| VOL    | “L” level output voltage           | P0 to P7 (Note2) | $V_{DD} = 4.75V$ , $I_{OL} = 0.4mA$   | —      | —    | 0.4    | V    |
|        |                                    | CPOUT            | $V_{DD} = 4.75V$ , $I_{OL} = 0.05mA$  |        |      |        |      |
|        |                                    | SDA              | $V_{DD} = 4.75V$ , $I_{OL} = 3.0mA$   |        |      |        |      |
| Ri     | Pull-up resistance $\overline{AC}$ |                  | $V_{DD} = 5.00V$                      | 10     | 30   | 100    | kΩ   |
| VTCK   | External clock input width         |                  | $4.75V \leq V_{DD} \leq 5.25V$        | 0.6VDD | —    | 0.9VDD | V    |

- Notes 1. The current from the IC must not exceed - 0.4 mA/port at any of the port pins (P0 to P7).  
 2. The current flowing into the IC must not exceed 0.4 mA/port at any of port pins (P0 to P7).

**NOTE FOR SUPPLYING POWER**

(1)Timing of power supplying to AC pin

The internal circuit of M35070-XXXSP/FP is reset when the level of the auto clear input pin  $\overline{AC}$  is "L". This pin is hysteresis input with the pull-up resistor.

The timing about power supplying of  $\overline{AC}$  pin is shown in Figure 16.

After supplying the power ( $V_{DD}$  and  $V_{SS}$ ) to M35070-XXXSP/FP and the supply voltage becomes more than  $0.8 \times V_{DD}$ , it needs to keep  $V_{IL}$  time;  $t_w$  of the  $\overline{AC}$  pin for more than 1ms.

Start inputting from microcomputer after  $\overline{AC}$  pin supply voltage becomes more than  $0.8 \times V_{DD}$  and keeping 200ms wait time.

(2)Timing of power supplying to  $V_{DD1}$  and  $V_{DD2}$ .

Supply power to  $V_{DD1}$  and  $V_{DD2}$  at the same time.

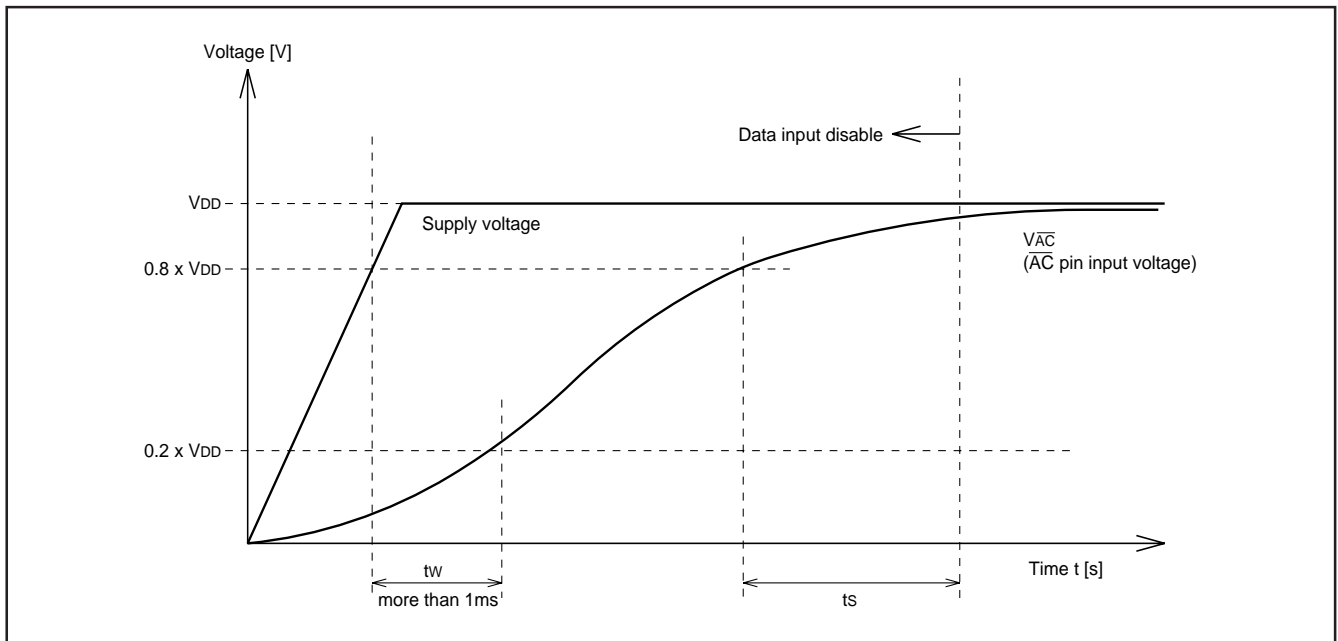


Fig. 16 Timing of power supplying to AC pin

**PRECAUTION FOR USE**

Notes on noise and latch-up

In order to avoid noise and latch-up, connect a bypass capacitor ( $\approx 0.1\mu F$ ) directly between the  $V_{DD1}$  pin and  $V_{SS1}$  pin, and the  $V_{DD2}$  pin and  $V_{SS2}$  pin using a heavy wire.

Note for waveform timing of the horizontal signals to the HOR pin

Set horizontal synchronous signal\* waveform timing to under 5ns and input to HOR pin.

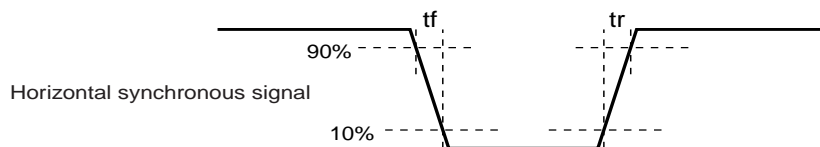
Set only the side which set by B/F register waveform timing under 5ns and input to HOR pin.

\*: Set front porch edge or back porch edge by B/F register.

**DATA REQUIRED FOR MASK ROM ORDERING**

Please send the following data for mask orders.

- (1) M35070-XXXSP/FP mask ROM order confirmation form
- (2) 20P4B mask specification form
- (3) 20P2Q-A mask specification form
- (4) ROM data (EPROM 3 sets)
- (5) Floppy disks containing the character font generating program + character data



**STANDARD ROM TYPE : M35070-002SP/FP**

M35070-002SP/FP is a standard ROM type of M35070-XXXSP/FP.

The character patterns for 0 page are fixed to the contents of Figure 17 to 20, the character patterns for page 1 are fixed to the contents of Figure 21 and 24.

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

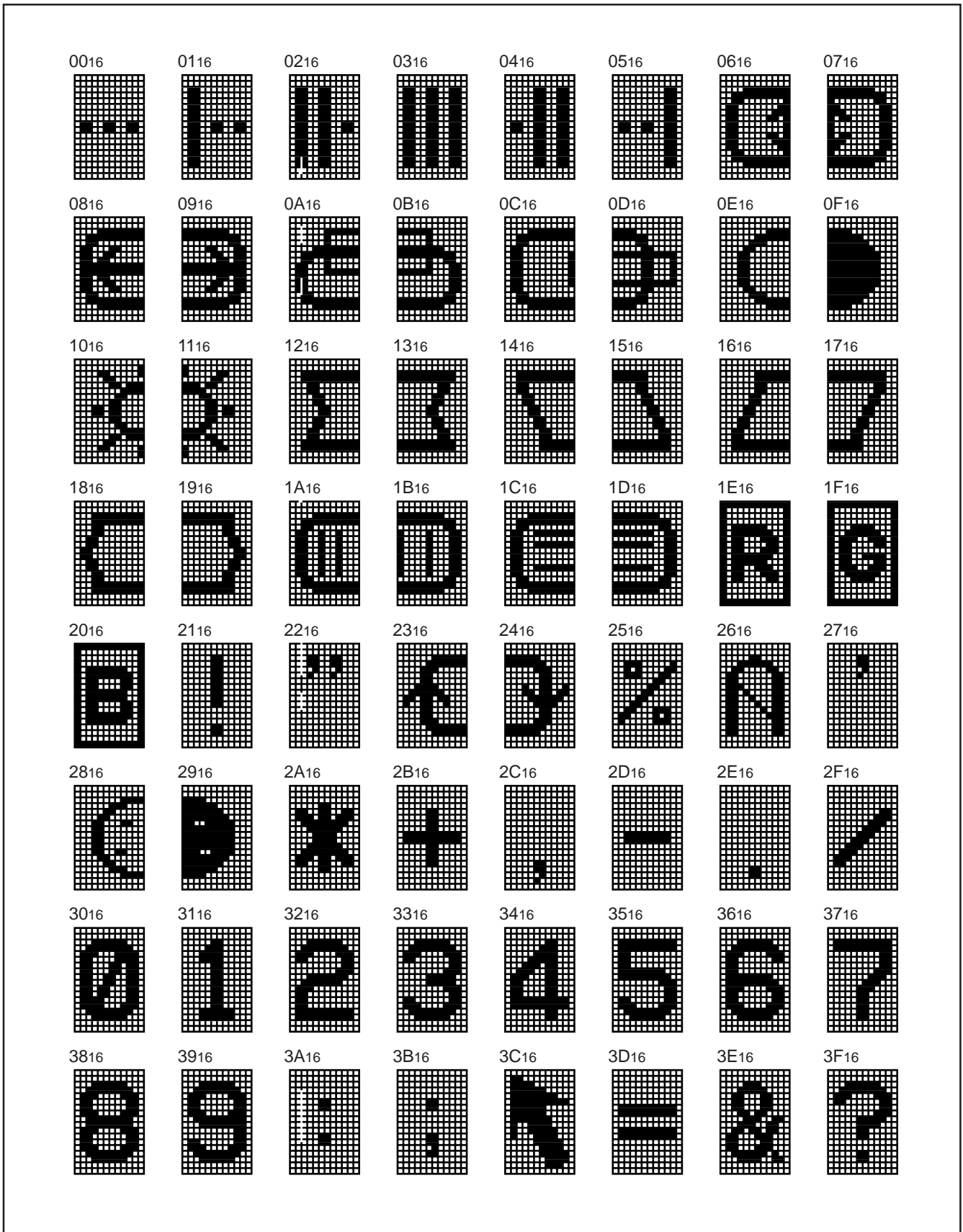


Fig. 17 M35070-002SP/FP character pattern for page 0 (1)

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS



Fig. 18 M35070-002SP/FP character pattern for page 0 (2)



SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

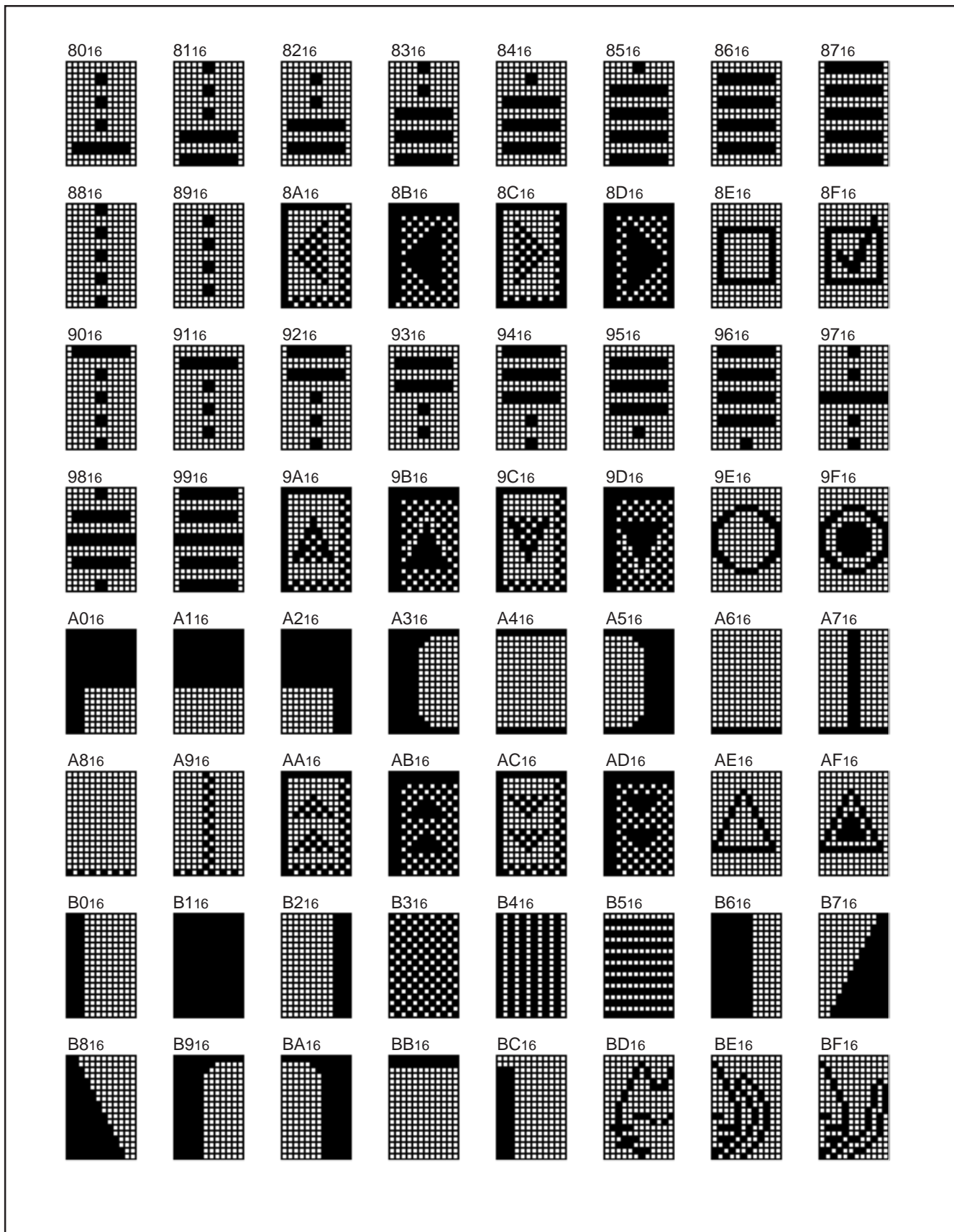


Fig. 19 M35070-002SP/FP character pattern for page 0 (3)

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

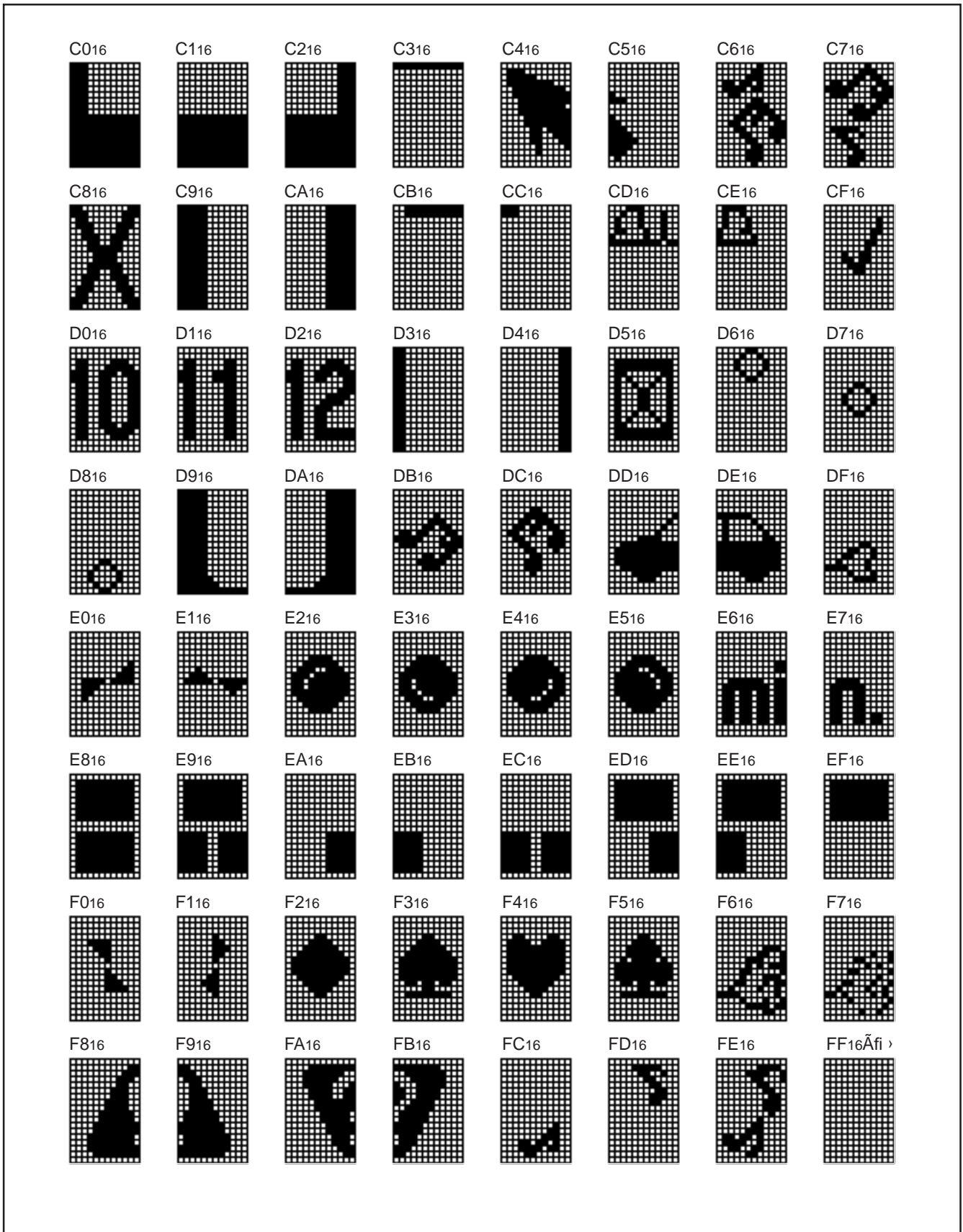


Fig. 20 M35070-002SP/FP character pattern for page 0 (4)

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

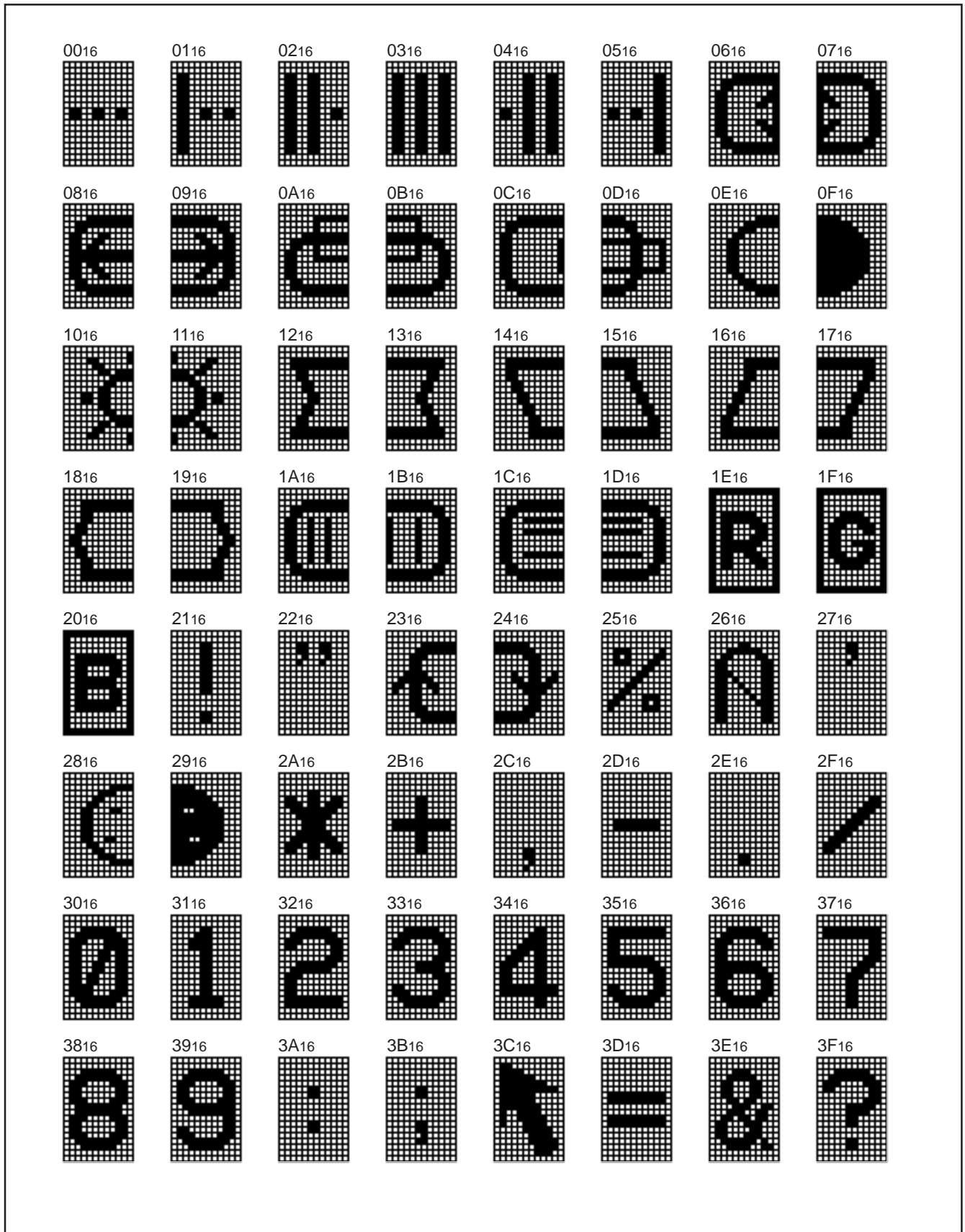


Fig. 21 M35070-002SP/FP character pattern for page 1 (1)

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS



Fig. 22 M35070-002SP/FP character pattern for page 1 (2)

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

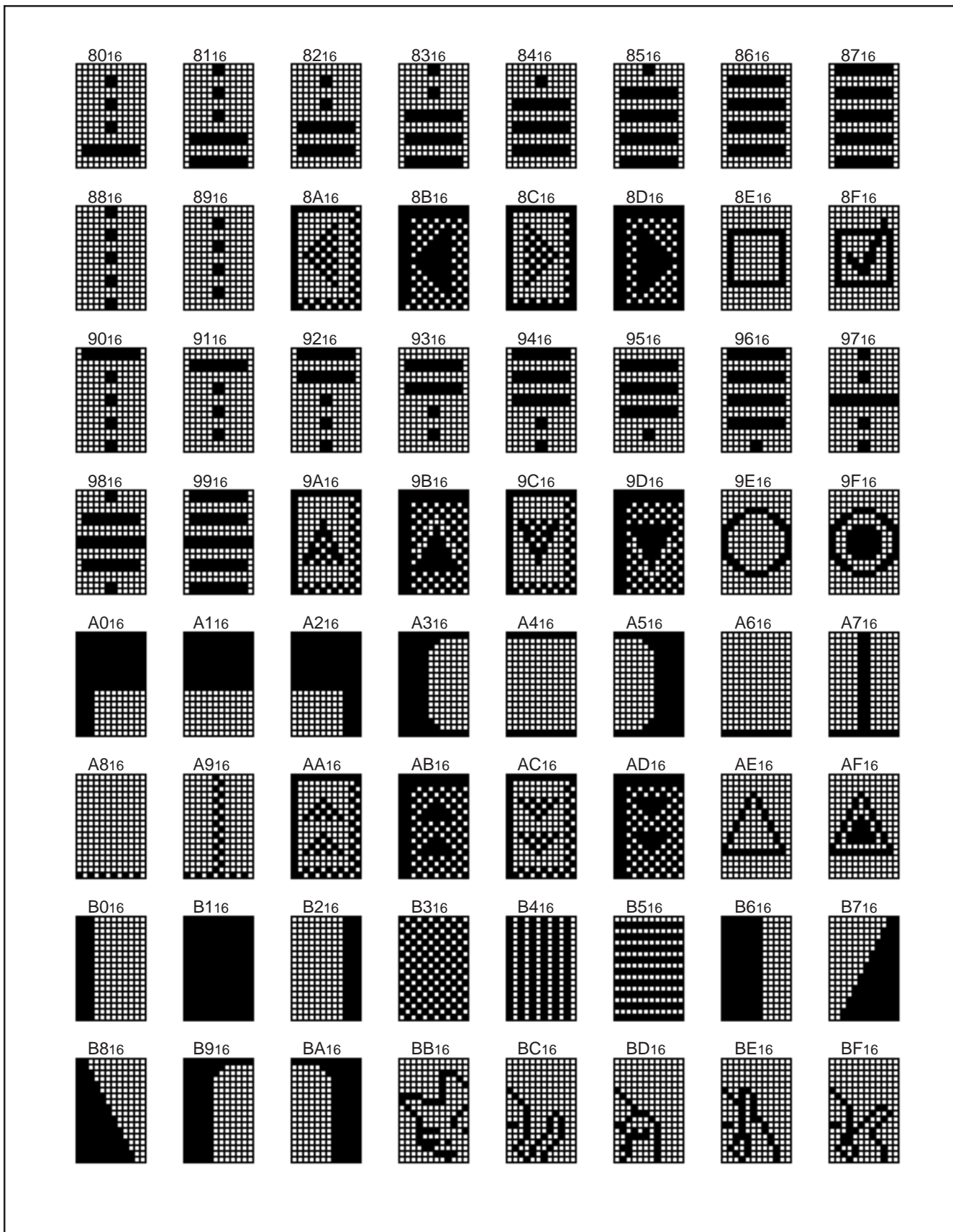


Fig. 23 M35070-002SP/FP character pattern for page 1 (3)

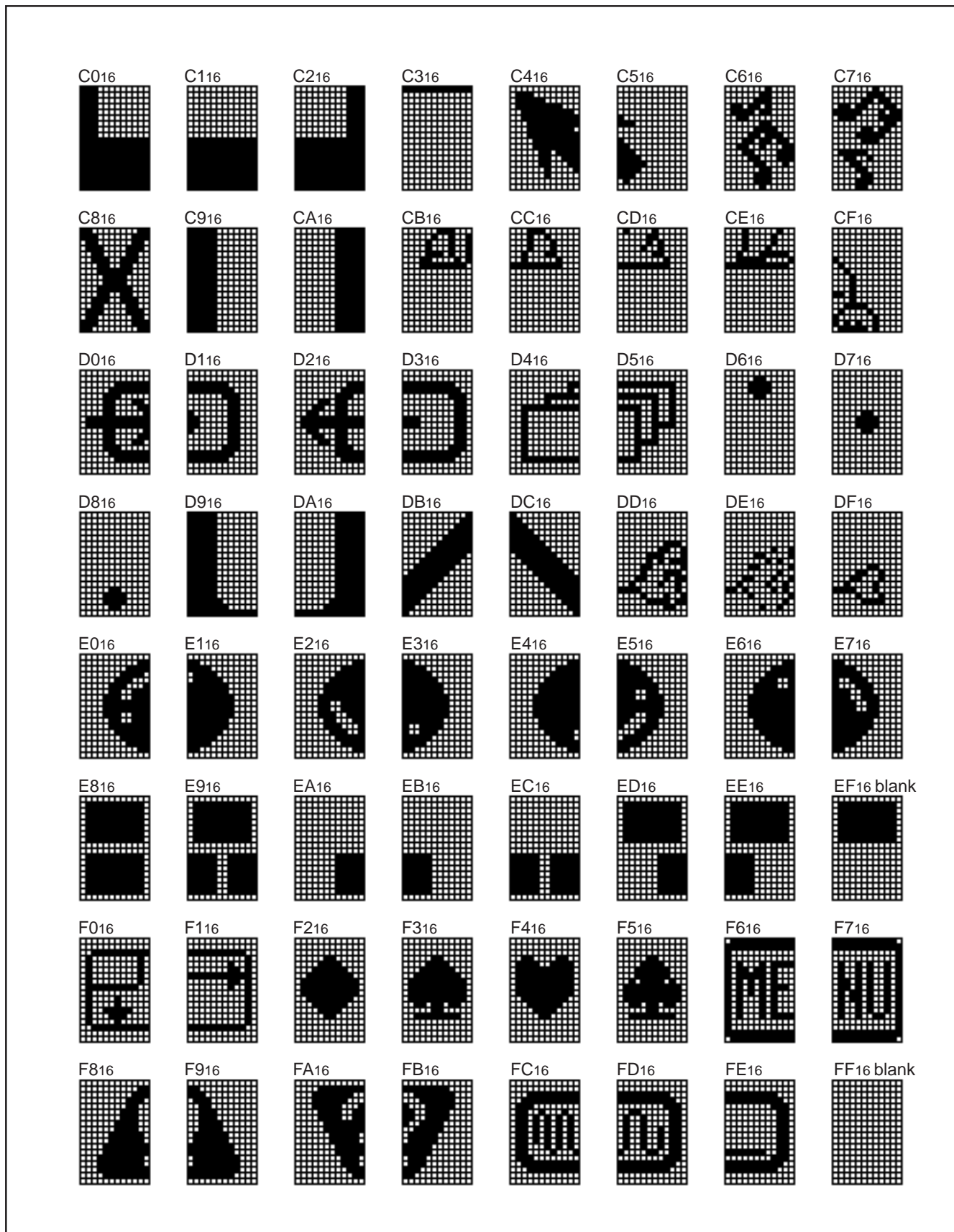


Fig. 24 M35070-002SP/FP character pattern for page 1 (4)



**MASK ROM ORDER CONFIRMATION FORM**

GZZ-SH52-71B<84A0>

|                 |  |
|-----------------|--|
| Mask ROM number |  |
|-----------------|--|

**MASK ROM ORDER CONFIRMATION FORM  
SCREEN DISPLAY IC M35070-XXXSP/FP  
MITSUBISHI ELECTRIC**

|         |                        |                      |
|---------|------------------------|----------------------|
| Receipt | Data :                 |                      |
|         | Section head signature | Supervisor signature |
|         |                        |                      |

Note : Please fill in all items marked \*, .

|            |              |         |                    |          |              |         |
|------------|--------------|---------|--------------------|----------|--------------|---------|
| * Customer | Company name | TEL ( ) | Issuance signature | Approval | Verification | Framing |
|            | Data issued  | Date :  |                    |          |              |         |

|                        |          |
|------------------------|----------|
| * Program version name | M070R .V |
|------------------------|----------|

\* Remarks

- Return the Character Font Preparation Program after use.
- Three EPROMs are required. Specify the type of EPROMs submitted. (All the three EPROMs must be same types. Check in the appropriate box.)

27512

- (1) The font data prepared by the Character Font Preparation Program is saved as a binary type object file (addresses 0000h to FFFFh) and a hex type object file . Three sets of these EPROMs are required.
- (2) Attach the erase protect seals on three EPROMs. Each seal bears the type name (M35070), and ROM No. (-...SP/FP).

- Write the checksum code (hexadecimal notation) for entire EPROM areas.

Checksum 

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|

- Select the marking type (Check  in the appropriate box).

Special Mark  ..... Fill in the Mark Specification Form (20P4B for M35070-XXXSP, 20P2Q-A for M35070-XXXFP) and attach to the Mask ROM Order Confirmation Form.

Standard Mark  ..... No writing is required.

- Select the package type (Check  in the appropriate box).

..... SDIP type (M35070-XXXSP)

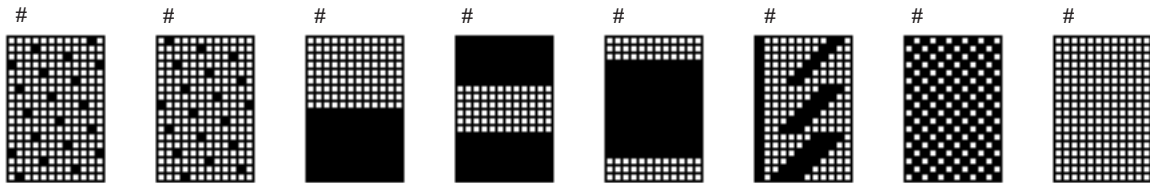
..... SSOP type (M35070-XXXFP)

\* ● Comments

GZZ-SH52-71B<84A0>

|                 |  |
|-----------------|--|
| Mask ROM number |  |
|-----------------|--|

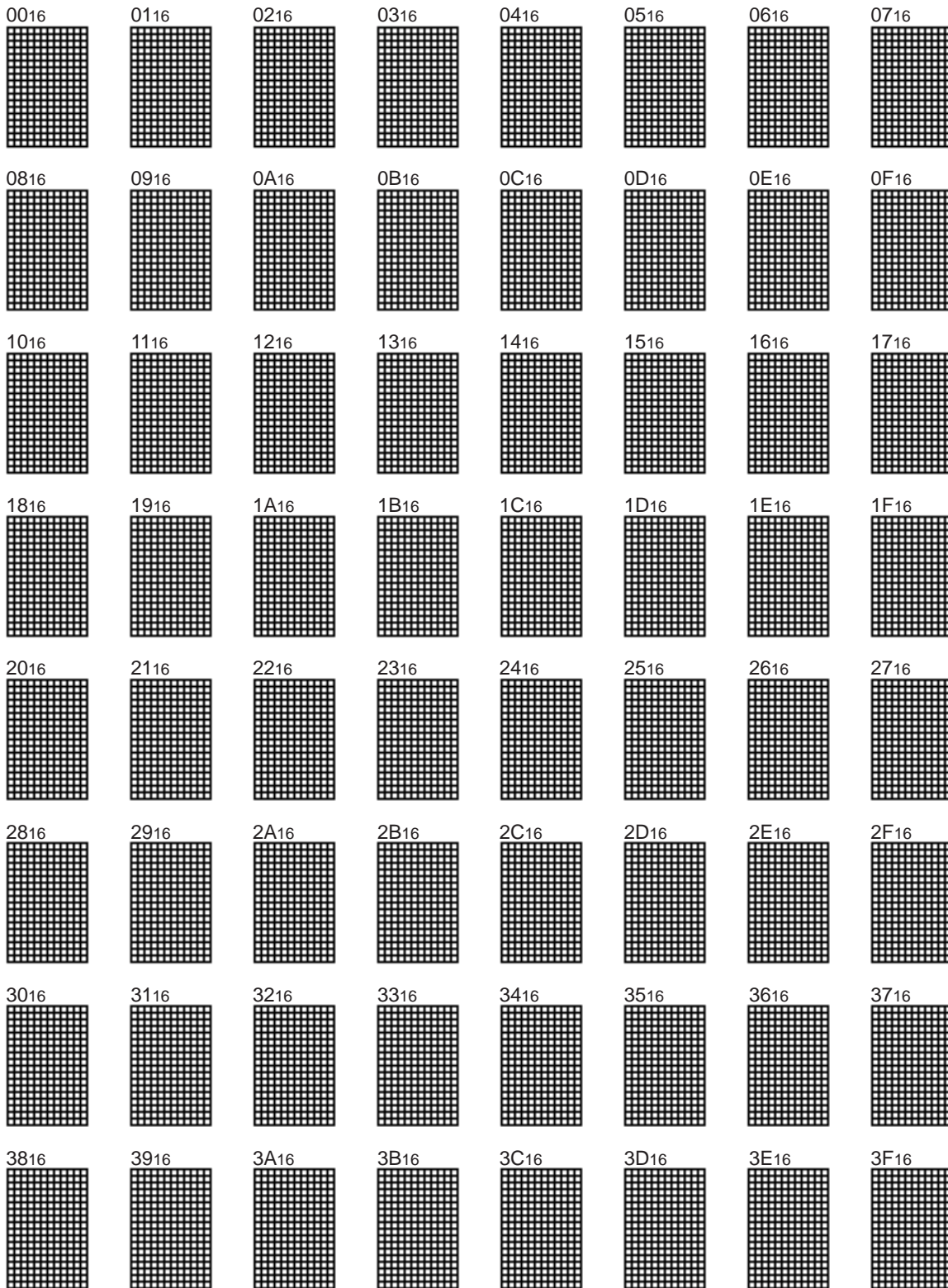
1.(Page 0) Test patterns



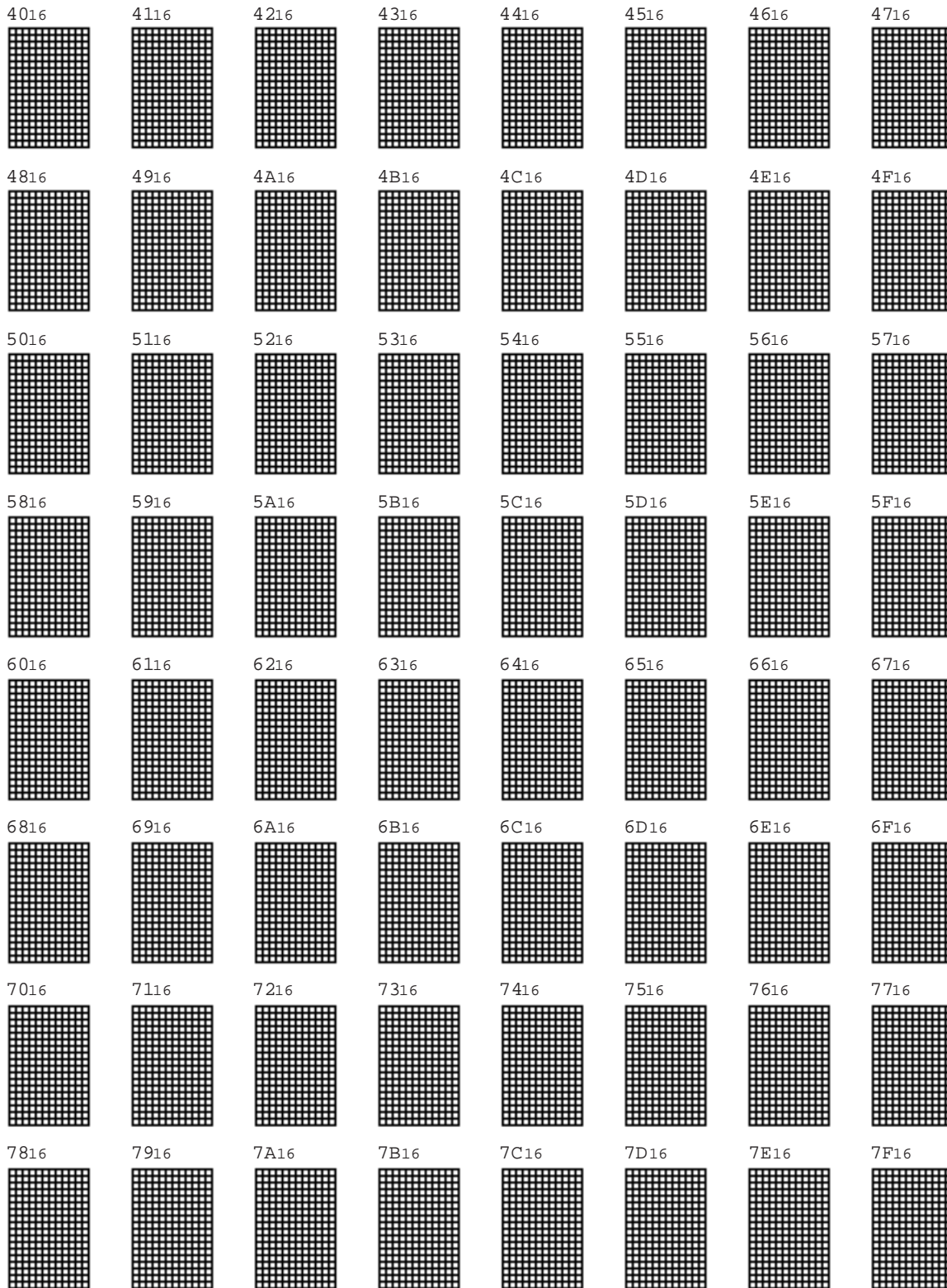
2.(Page 0) Character patterns  
(See the next page)



SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS



SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS



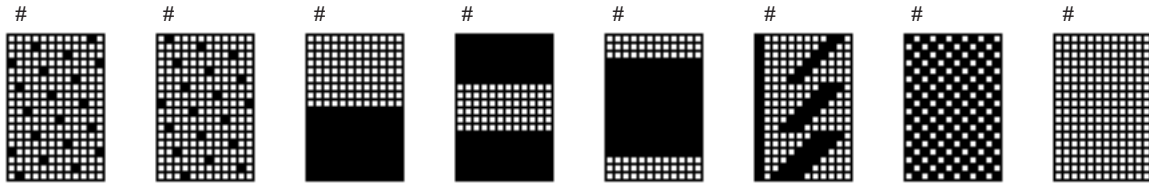
SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

|      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|
| 8016 | 8116 | 8216 | 8316 | 8416 | 8516 | 8616 | 8716 |
| 8816 | 8916 | 8A16 | 8B16 | 8C16 | 8D16 | 8E16 | 8F16 |
| 9016 | 9116 | 9216 | 9316 | 9416 | 9516 | 9616 | 9716 |
| 9816 | 9916 | 9A16 | 9B16 | 9C16 | 9D16 | 9E16 | 9F16 |
| A016 | A116 | A216 | A316 | A416 | A516 | A616 | A716 |
| A816 | A916 | AA16 | AB16 | AC16 | AD16 | AE16 | AF16 |
| B016 | B116 | B216 | B316 | B416 | B516 | B616 | B716 |
| B816 | B916 | BA16 | BB16 | BC16 | BD16 | BE16 | BF16 |

SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

|      |      |      |      |      |      |      |            |
|------|------|------|------|------|------|------|------------|
| C016 | C116 | C216 | C316 | C416 | C516 | C616 | C716       |
| C816 | C916 | CA16 | CB16 | CC16 | CD16 | CE16 | CF16       |
| D016 | D116 | D216 | D316 | D416 | D516 | D616 | D716       |
| D816 | D916 | DA16 | DB16 | DC16 | DD16 | DE16 | DF16       |
| E016 | E116 | E216 | E316 | E416 | E516 | E616 | E716       |
| E816 | E916 | EA16 | EB16 | EC16 | ED16 | EE16 | EF16       |
| F016 | F116 | F216 | F316 | F416 | F516 | F616 | F716       |
| F816 | F916 | FA16 | FB16 | FC16 | FD16 | FE16 | FF16 blank |

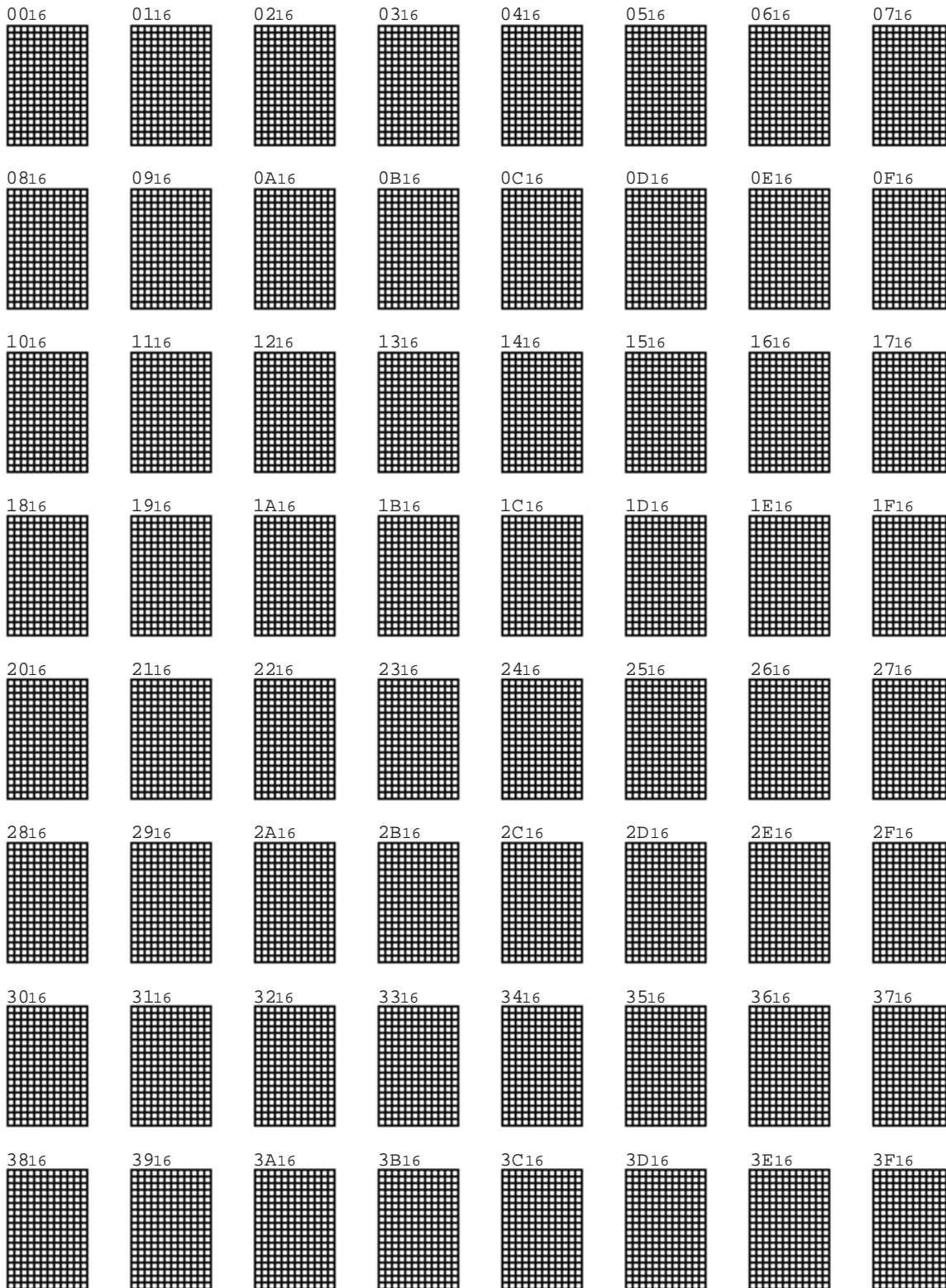
3.(Page 1) Test patterns



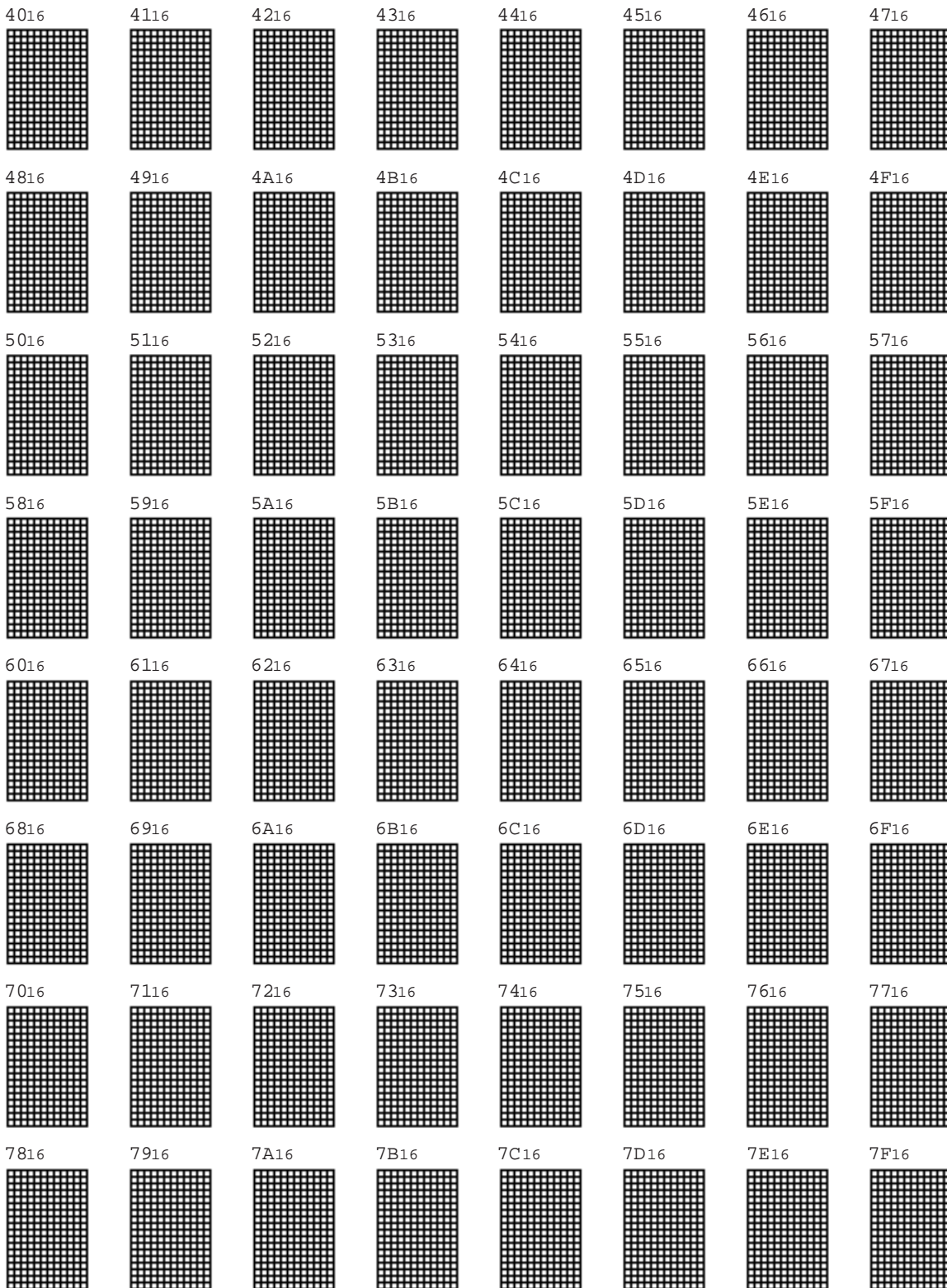
2.(Page 1) Character patterns  
(See the next page)



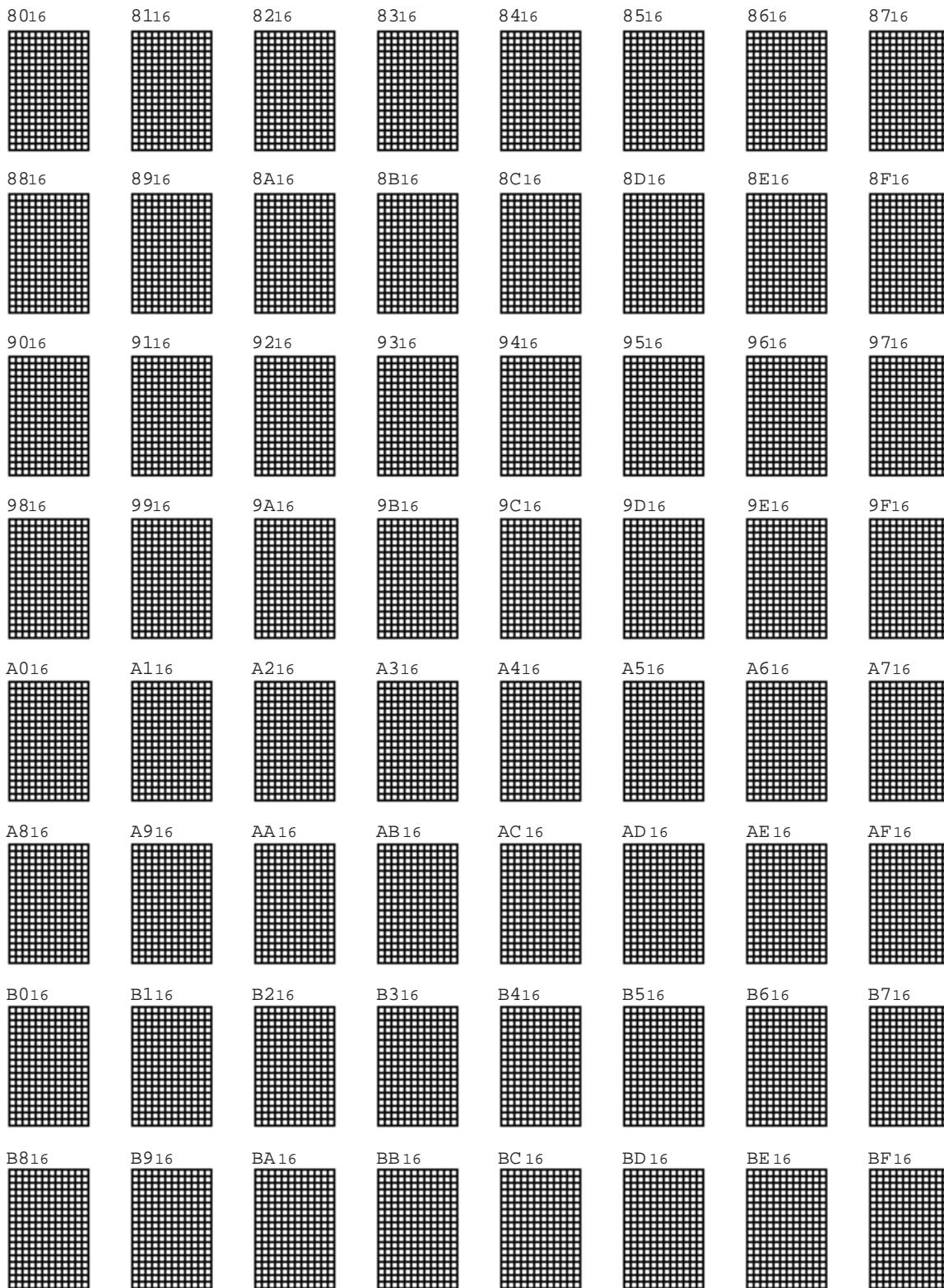
SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS



SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS



SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS





SCREEN CHARACTER and PATTERN DISPLAY CONTROLLERS

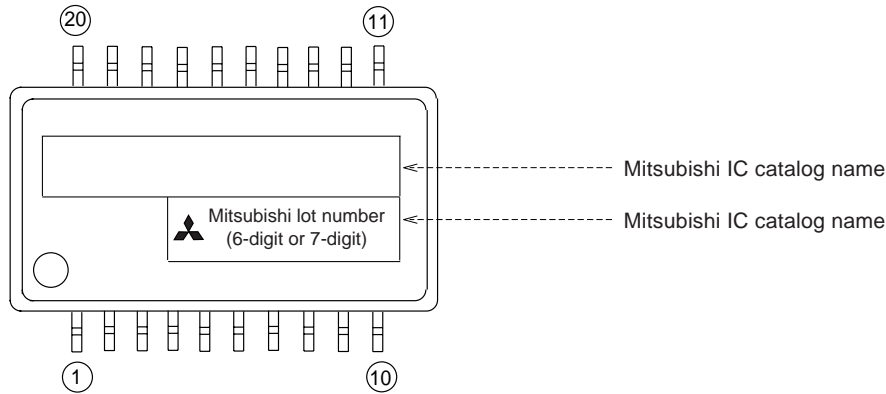
|      |      |      |      |      |      |      |            |
|------|------|------|------|------|------|------|------------|
| C016 | C116 | C216 | C316 | C416 | C516 | C616 | C716       |
| C816 | C916 | CA16 | CB16 | CC16 | CD16 | CE16 | CF16       |
| D016 | D116 | D216 | D316 | D416 | D516 | D616 | D716       |
| D816 | D916 | DA16 | DB16 | DC16 | DD16 | DE16 | DF16       |
| E016 | E116 | E216 | E316 | E416 | E516 | E616 | E716       |
| E816 | E916 | EA16 | EB16 | EC16 | ED16 | EE16 | EF16       |
| F016 | F116 | F216 | F316 | F416 | F516 | F616 | F716       |
| F816 | F916 | FA16 | FB16 | FC16 | FD16 | FE16 | FF16 blank |

20P2Q-A (20-PIN SSOP) MARK SPECIFICATION FORM

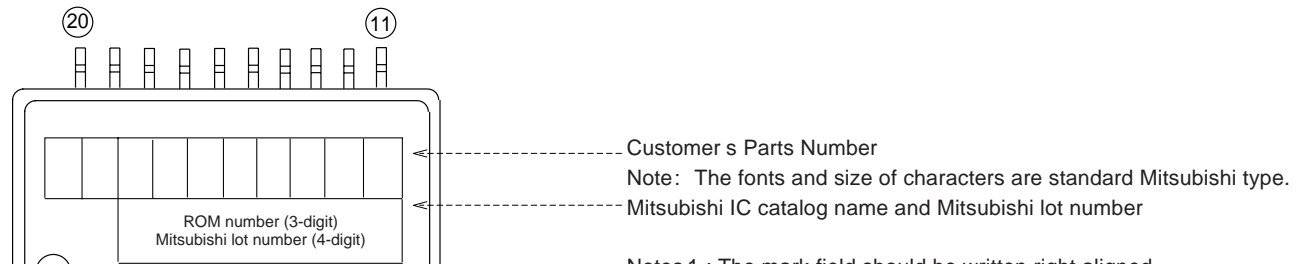
Mitsubishi IC catalog name

Please choose one of the marking types below (A, B, C), and enter the Mitsubishi IC catalog name and the special mark (if needed).

A. Standard Mitsubishi Mark



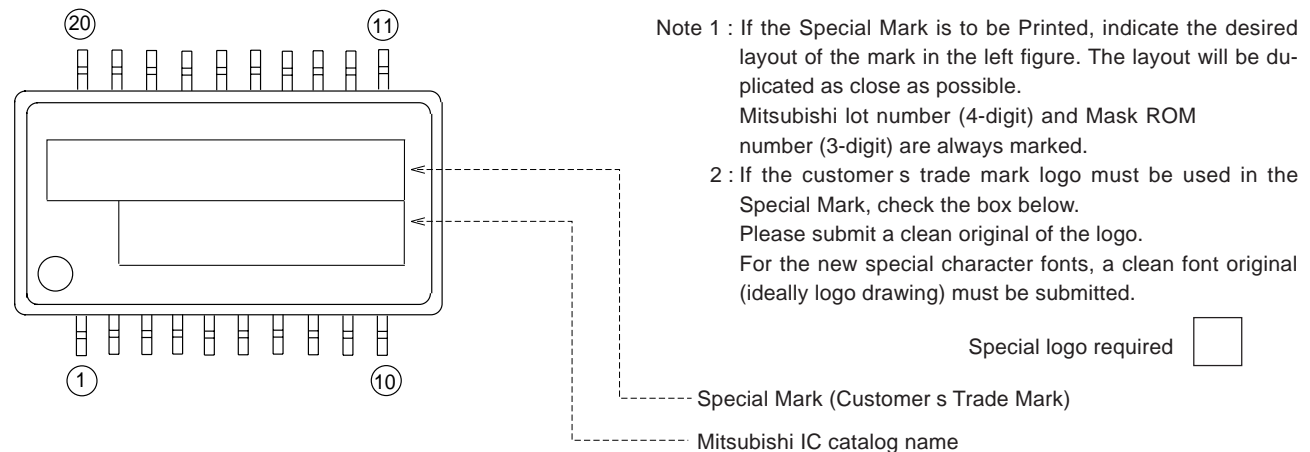
B. Customer's Parts Number + Mitsubishi IC Catalog Name



- Notes 1 : The mark field should be written right aligned.  
 2 : The fonts and size of characters are standard Mitsubishi type.  
 3 : Customer's Parts Number can be up to 10 characters: Only 0 to 9, A to Z, +, -, /, (, ), &, ' , . (period), and , (comma) are usable.  
 4 : If the Mitsubishi logo is not required, check the box below.

Mitsubishi logo is not required

C. Special Mark Required



- Note 1 : If the Special Mark is to be Printed, indicate the desired layout of the mark in the left figure. The layout will be duplicated as close as possible.  
 Mitsubishi lot number (4-digit) and Mask ROM number (3-digit) are always marked.  
 2 : If the customer's trade mark logo must be used in the Special Mark, check the box below.  
 Please submit a clean original of the logo.  
 For the new special character fonts, a clean font original (ideally logo drawing) must be submitted.

Special logo required

Special Mark (Customer's Trade Mark)

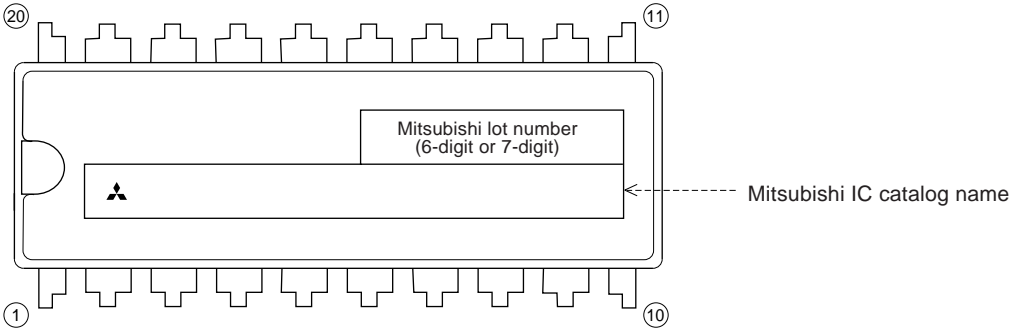
Mitsubishi IC catalog name

**20P4B (20-PIN DIP) MARK SPECIFICATION FORM**

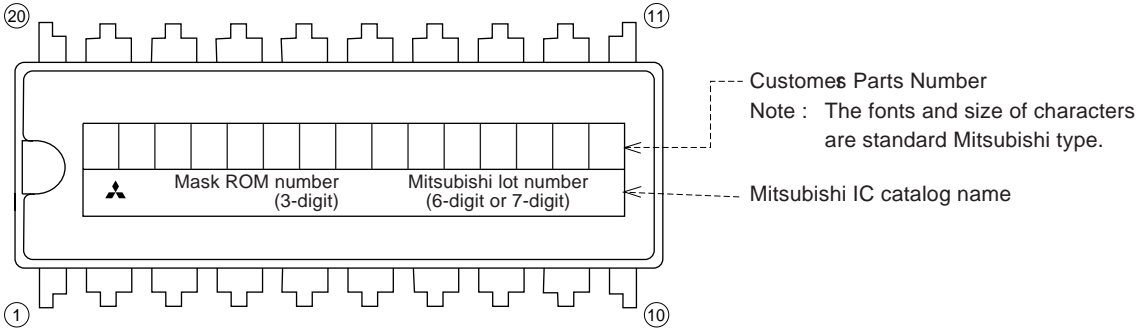
Mitsubishi IC catalog name

Please choose one of the marking types below (A, B, C), and enter the Mitsubishi catalog name and the special mark (if needed).

**A. Standard Mitsubishi Mark**



**B. Customer's Parts Number + Mitsubishi catalog name**



Note1: The mark field should be written right aligned.

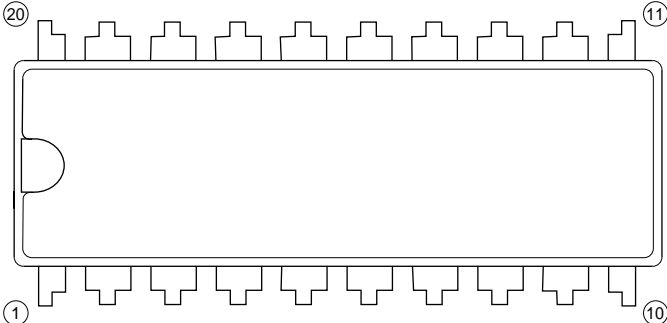
2: The fonts and size of characters are standard Mitsubishi type.

3: Customer's Parts Number can be up to 15 characters: Only 0 ~ 9, A ~ Z, +, -, /, (, ), &, @, ., (periods), and , (commas) are usable.

4: If the Mitsubishi logo is not required, check the box on the right.

Mitsubishi logo is not required

**C. Special Mark Required**



Note1: If the Special Mark is to be Printed, indicate the desired layout of the mark in the upper figure. The layout will be duplicated as close as possible. Mitsubishi lot number (6-digit or 7-digit) and Mask ROM number (3-digit) are always marked.

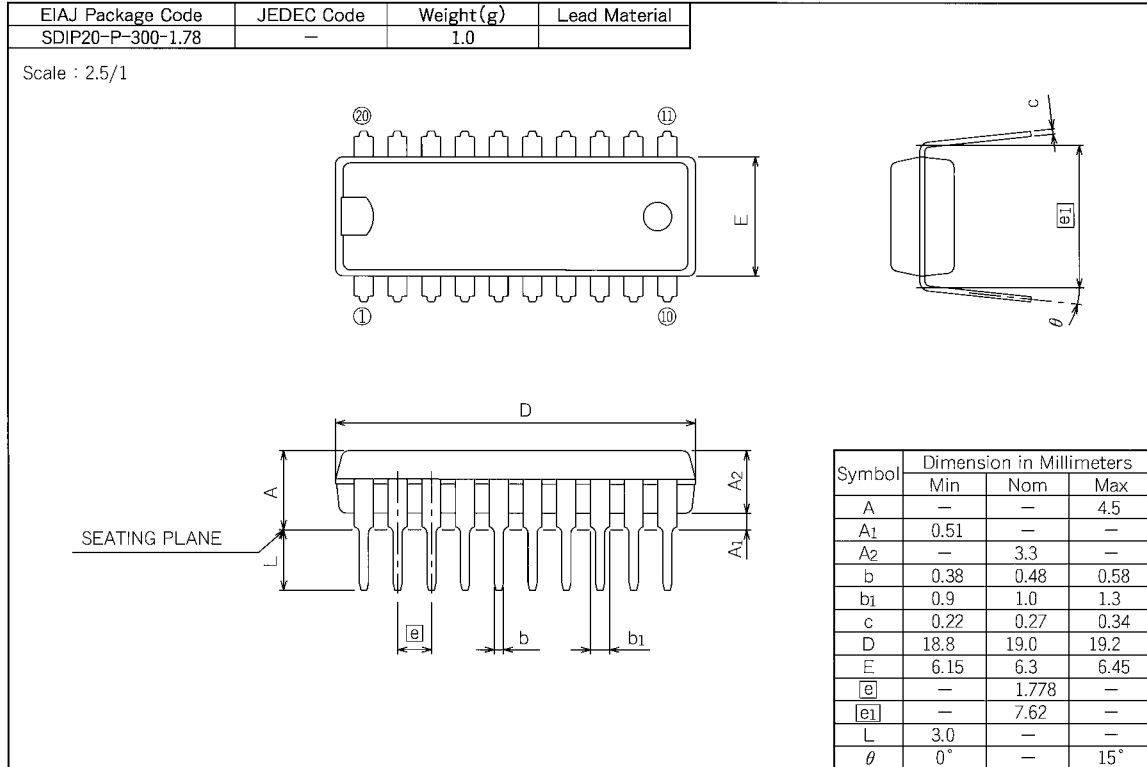
2: If the customer's trade mark logo must be used in the Special Mark, check the box on the right. Please submit a clean original of the logo. For the new special character fonts a clean font original (ideally logo drawing) must be submitted.

Special logo required

PACKAGE OUTLINE

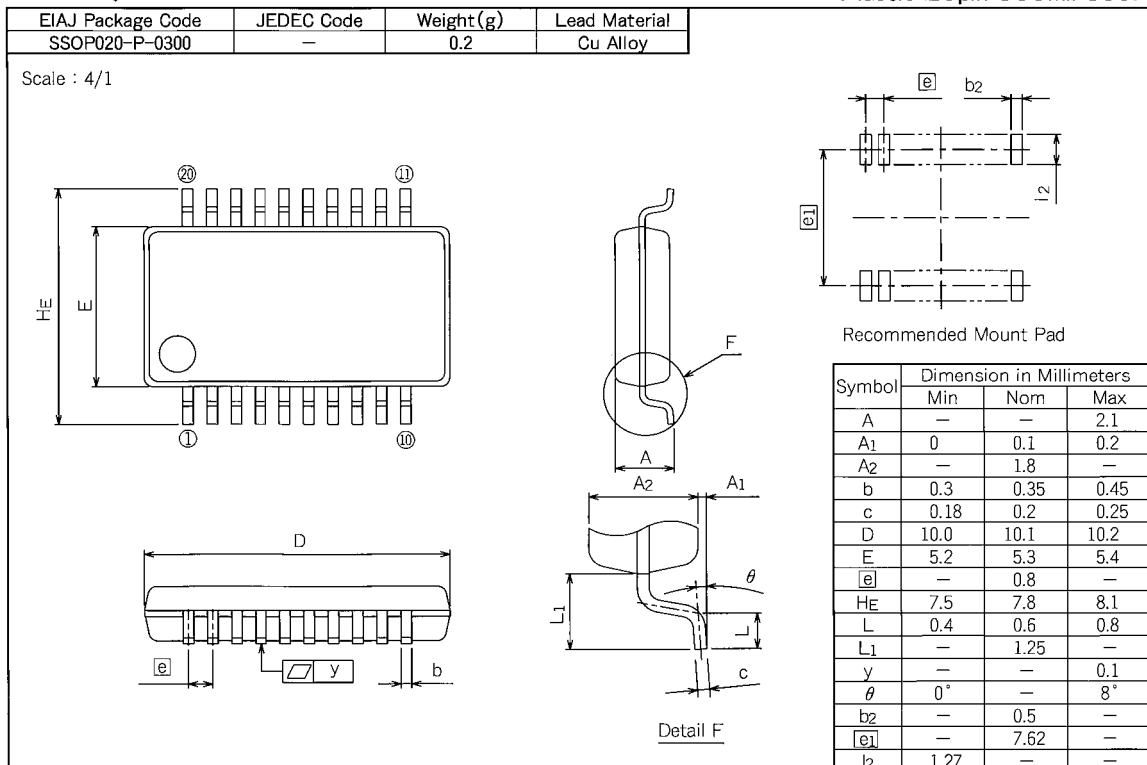
20P4B

Plastic 20pin 300mil SDIP



20P2Q-A

Plastic 20pin 300mil SSOP





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REVISION DESCRIPTION LIST

M35070-XXXSP/FP DATA SHEET

| Rev. No. | Revision Description   | Rev. date |
|----------|--|-----------|
| 1.0      | First Edition  | 980402    |
| 1.1      | P50 20P2Q-A (20-PIN SSOP) MARK SPECIFICATION FORM<br>B: Note 4 added | 000707    |
|          |  |           |