



# LC74735NW

## On-Screen Display Controller

### Overview

The LC74735NW is an on-screen display CMOS IC that displays characters and patterns on a TV screen.

For QVGA display, the LC74735NW supports the use of both a 12 × 18 dot character font and a 12 × 18 dot graphics font with 16 colors with a total of 512 characters and glyphs.

For WVGA display, the LC74735NW supports the use of both a 24 × 32 dot character font and a 12 × 16 dot graphics font with 16 colors with a total of 512 characters and glyphs.

The LC74735NW can also implement extremely varied displays by the use of an external ROM.

The LC74735NW supports both QVGA (480 × 234) and WVGA (800 × 480).

### Features

- Screen structure

- Main:

- QVGA mode: 40 characters × 13 lines (up to 520 characters) on a QVGA panel

- WVGA mode: 33 characters × 15 lines (up to 495 characters) on a WVGA panel

- Wallpaper display screen: Permanent repetition of a 2 × 2 (horizontal × vertical) character pattern

- Character structure

- QVGA mode:

- 12 dots (horizontal) × 18 dots (vertical): Character display

- 12 dots (horizontal) × 18 dots (vertical): Graphic glyph display

- WVGA mode:

- 24 dots (horizontal) × 32 dots (vertical): Character display

12 dots (horizontal) × 16 dots (vertical): Graphic glyph display (1 pixel: 2 × 2 dots)

- Character display clock:

About 9 MHz — QVGA with an LC oscillator

33.2 MHz (maximum: 40 MHz) WVGA with an external clock signal input

\*: The ROM image is known when QVGA or WVGA mode is specified.

- Number of characters: 512 (internal)

Up to 2048 characters when an external 16-bit 4M ROM is used.

- Character sizes: Four horizontal sizes (1×, 2×, 3×, and 4×)

Four vertical sizes (1×, 2×, 3×, and 4×)

(The character size is specified in line units.)

- Display start positions: 512 positions in the horizontal direction and 256 positions in the vertical direction.

|                            | QVGA mode | WVGA mode                |
|----------------------------|-----------|--------------------------|
| Setting units: Horizontal: | 1 dot     | 2 dots (In screen units) |
| Vertical:                  | 1 dot     | 2 dots (In screen units) |

- Display functions

- Blinking specification (in character units)

Period: 1/64, 1/32, and 1/16 of the vertical sync signal (in screen units)

Duty: Fixed at 50%

- Box (raised or recessed) display

Raised/recessed specification (in character units)

Left: Off/on specification (in character units)

Right: Off/on specification (in character units)

Top: Off/on specification (in character units)

Bottom: Off/on specification (in character units)

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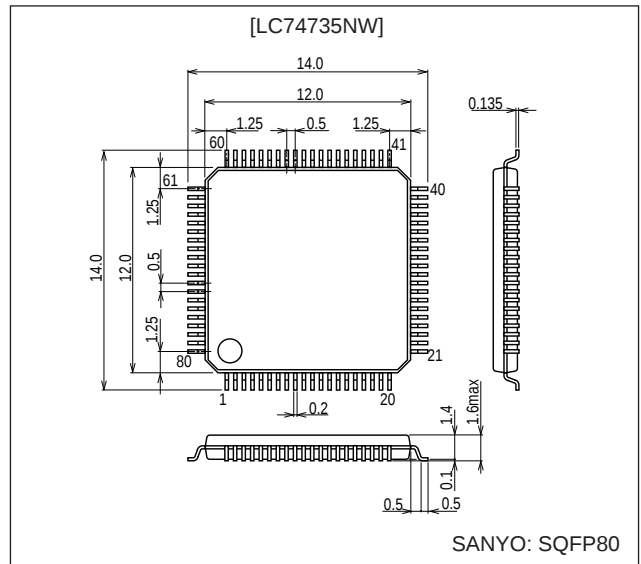
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

- Border specification (in line units): Only valid with glyphs from the character font.
- Color specification
  - Character
    - Character color (in character units): 1 of 16 colors can be specified.
    - Character background color (in character units): 1 of 16 colors can be specified.
    - Border color (in line units): 1 of 16 colors can be specified.
- Graphic
  - 16 types can be specified by ROM data
- Box color (line units) : 1/16 colors
- Background color (screen units) : 1/16 colors
- Color table (palette)
  - Sixteen colors can be selected from a set of 512 colors (One of which is specified to be transparent.)
  - Number of color tables: 2. This allows up to 32 colors to be displayed at the same time.
- Wallpaper screen (Graphics glyphs only)
  - Wallpaper display: Repeated display under the main screen (2 characters horizontally by 2 characters vertically).
  - Sprite character display: Displayed above the main screen (2 characters horizontally by 2 characters vertically)
- Output
  - QVGA
    - Analog RGB output
    - BLK (OSD display period signal)
  - WVGA
    - Digital RGB output (3 bits per color)
    - BLK (OSD display period signal)
- Package: SQFP80
- Voltage: 3.3 V

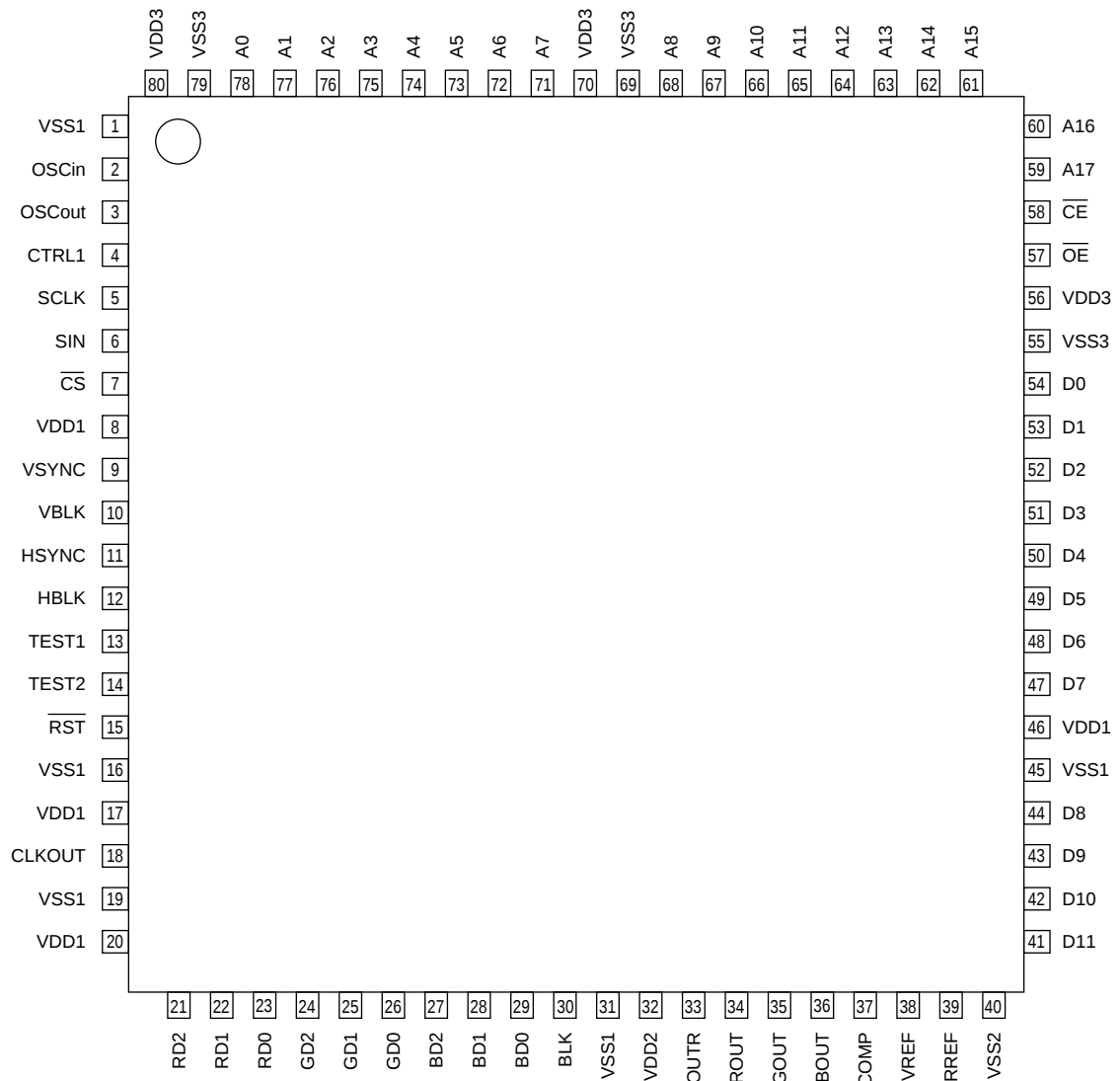
## Package Dimensions

unit: mm

### 3220-SQFP80



# Pin Assignments



Top view

## Pin Functions

| Pin No. | Symbol                  | Type                                  | Functional description                                                                                                                                      |
|---------|-------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | V <sub>SS1</sub>        | Ground                                | Connect a ground to this pin. (Digital system ground)                                                                                                       |
| 2       | OSCin                   | LC oscillator                         | Connect to the character output dot clock generator oscillator coil and capacitor.<br>May also be used for external clock input.                            |
| 3       | OSCOut                  |                                       |                                                                                                                                                             |
| 4       | CTRL1                   | OSCin oscillator input control        | Switches between external clock input mode and LC oscillator mode.<br>Low: LC oscillator, high: external clock input MORE+                                  |
| 5       | SCLK                    | Clock input                           | Clock input for the serial data input system<br>MORE+ (This input has hysteresis characteristics.)                                                          |
| 6       | SIN                     | Data input                            | Serial data input<br>MORE+ (This input has hysteresis characteristics.)                                                                                     |
| 7       | $\overline{\text{CS}}$  | Enable input                          | Enable input for the serial data input system. Serial data input is enabled when this pin is set low.<br>MORE+ (This input has hysteresis characteristics.) |
| 8       | V <sub>DD1</sub>        | Power supply (+3.3 V)                 | Digital system power supply: +3.3 V                                                                                                                         |
| 9       | VSYNC                   | Vertical sync signal input            | Vertical sync signal input<br>MORE+ (This input has hysteresis characteristics.)                                                                            |
| 10      | VBLK                    | Vertical blanking signal input        | Vertical blanking signal input<br>MORE+ (This input has hysteresis characteristics.)                                                                        |
| 11      | HSYNC                   | Horizontal sync signal input          | Horizontal sync signal input<br>MORE+ (This input has hysteresis characteristics.)                                                                          |
| 12      | HBLK                    | Horizontal blanking signal input      | Horizontal blanking signal input<br>MORE+ (This input has hysteresis characteristics.)                                                                      |
| 13      | TEST1                   | Test mode control 1                   | Test mode control 1<br>Low: normal operation, high: test mode MORE+                                                                                         |
| 14      | TEST2                   | Test mode control 2                   | Test mode control 2<br>Low: normal operation, high: test mode (scan mode) MORE+                                                                             |
| 15      | $\overline{\text{RST}}$ | Reset input                           | System reset input<br>MORE+ (This input has hysteresis characteristics.)                                                                                    |
| 16      | V <sub>SS1</sub>        | Ground                                | Connect a ground to this pin. (Digital system ground)                                                                                                       |
| 17      | V <sub>DD1</sub>        | Power supply (+3.3 V)                 | Power supply: (+3.3 V: Digital system)                                                                                                                      |
| 18      | CLKOUT                  | Clock output                          | Clock output                                                                                                                                                |
| 19      | V <sub>SS1</sub>        | Ground                                | Connect a ground to this pin. (Digital system ground)                                                                                                       |
| 20      | V <sub>DD1</sub>        | Power supply (+3.3 V)                 | Power supply: (+3.3 V: Digital system)                                                                                                                      |
| 21      | RD2                     | Rout output: bit 2                    | Rout output<br>This is a 3-bit digital output with values from 000 to 111.                                                                                  |
| 22      | RD1                     | Rout output: bit 1                    |                                                                                                                                                             |
| 23      | RD0                     | Rout output: bit 0                    |                                                                                                                                                             |
| 24      | GD2                     | Gout output: bit 2                    | Gout output<br>This is a 3-bit digital output with values from 000 to 111.                                                                                  |
| 25      | GD1                     | Gout output: bit 1                    |                                                                                                                                                             |
| 26      | GD0                     | Gout output: bit 0                    |                                                                                                                                                             |
| 27      | BD2                     | Bout output: bit 2                    | Bout output<br>This is a 3-bit digital output with values from 000 to 111.                                                                                  |
| 28      | BD1                     | Bout output: bit 1                    |                                                                                                                                                             |
| 29      | BD0                     | Bout output: bit 0                    |                                                                                                                                                             |
| 30      | BLK                     | Blanking signal output                | This signal indicates the OSD display period.                                                                                                               |
| 31      | V <sub>SS1</sub>        | Ground                                | Connect a ground to this pin. (Digital system ground)                                                                                                       |
| 32      | V <sub>DD2</sub>        | Power supply (+3.3 V)                 | Power supply: (+3.3 V: D/A converter)                                                                                                                       |
| 33      | OUTR                    | Outr output: analog                   | Output. Connect a resistor R <sub>o</sub> (68 Ω) to this pin.                                                                                               |
| 34      | Rout                    | Rout output: analog                   | D/A converter (3 bits) output. Connect a resistor R <sub>o</sub> to this pin.                                                                               |
| 35      | Gout                    | Gout output: analog                   | D/A converter (3 bits) output. Connect a resistor R <sub>o</sub> to this pin.                                                                               |
| 36      | Bout                    | Bout output: analog                   | D/A converter (3 bits) output. Connect a resistor R <sub>o</sub> to this pin.                                                                               |
| 37      | CCOMP                   | Phase correction capacitor connection | Capacitor connection: 1.5 μF                                                                                                                                |
| 38      | CVREF                   | Reference voltage output              | Capacitor connection: 0.1 μF                                                                                                                                |
| 39      | RREF                    | Reference resistor connection         | Connect a reference register to this pin.                                                                                                                   |
| 40      | V <sub>SS2</sub>        | Ground                                | Connect a ground to this pin. (D/A converter ground)                                                                                                        |

Continued on next page.

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Continued from preceding page.

| Pin No. | Symbol           | Type                          | Functional description                                            |
|---------|------------------|-------------------------------|-------------------------------------------------------------------|
| 41      | D11              | Data input 11                 | ROM data input 11. MORE+                                          |
| 42      | D10              | Data input 10                 | ROM data input 10. MORE+                                          |
| 43      | D9               | Data input 9                  | ROM data input 9. MORE+                                           |
| 44      | D8               | Data input 8                  | ROM data input 8. MORE+                                           |
| 45      | V <sub>SS1</sub> | Ground                        | Connect a ground to this pin. (Digital system ground)             |
| 46      | V <sub>DD1</sub> | Power supply (+3.3 V)         | Power supply: (+3.3 V: Digital system)                            |
| 47      | D7               | Data input 7                  | ROM data input 7. MORE+                                           |
| 48      | D6               | Data input 6                  | ROM data input 6. MORE+                                           |
| 49      | D5               | Data input 5                  | ROM data input 5. MORE+                                           |
| 50      | D4               | Data input 4                  | ROM data input 4. MORE+                                           |
| 51      | D3               | Data input 3                  | ROM data input 3. MORE+                                           |
| 52      | D2               | Data input 2                  | ROM data input 2. MORE+                                           |
| 53      | D1               | Data input 1                  | ROM data input 1. MORE+                                           |
| 54      | D0               | Data input 0                  | ROM data input 0. MORE+                                           |
| 55      | V <sub>SS3</sub> | Ground                        | Connect a ground to this pin. (External ROM output system ground) |
| 56      | V <sub>DD3</sub> | Power supply (+3.3 or +5.5 V) | Power supply (External ROM output system power supply)            |
| 57      | $\overline{OE}$  | Output enable                 | ROM output enable output. This is an active low output.           |
| 58      | $\overline{CE}$  | Chip enable                   | ROM chip enable output. This is an active low output.             |
| 59      | A17              | Address output 17             | ROM address output 17                                             |
| 60      | A16              | Address output 16             | ROM address output 16                                             |
| 61      | A15              | Address output 15             | ROM address output 15                                             |
| 62      | A14              | Address output 14             | ROM address output 14                                             |
| 63      | A13              | Address output 13             | ROM address output 13                                             |
| 64      | A12              | Address output 12             | ROM address output 12                                             |
| 65      | A11              | Address output 11             | ROM address output 11                                             |
| 66      | A10              | Address output 10             | ROM address output 10                                             |
| 67      | A9               | Address output 9              | ROM address output 9                                              |
| 68      | A8               | Address output 8              | ROM address output 8                                              |
| 69      | V <sub>SS3</sub> | Ground                        | Connect a ground to this pin. (External ROM output system ground) |
| 70      | V <sub>DD3</sub> | Power supply (+3.3 or +5.5 V) | Power supply (External ROM output system power supply)            |
| 71      | A7               | Address output 7              | ROM address output 7                                              |
| 72      | A6               | Address output 6              | ROM address output 6                                              |
| 73      | A5               | Address output 5              | ROM address output 5                                              |
| 74      | A4               | Address output 4              | ROM address output 4                                              |
| 75      | A3               | Address output 3              | ROM address output 3                                              |
| 76      | A2               | Address output 2              | ROM address output 2                                              |
| 77      | A1               | Address output 1              | ROM address output 1                                              |
| 78      | A0               | Address output 0              | ROM address output 0                                              |
| 79      | V <sub>SS3</sub> | Ground                        | Connect a ground to this pin. (External ROM output system ground) |
| 80      | V <sub>DD3</sub> | Power supply (+3.3 or +5.5 V) | Power supply (External ROM output system power supply)            |

## Specifications

### Absolute Maximum Ratings at Ta = 25°C

| Parameter                 | Symbol            | Conditions                                                         | Ratings                                         | Unit |
|---------------------------|-------------------|--------------------------------------------------------------------|-------------------------------------------------|------|
| Supply voltage            | V <sub>DD1</sub>  | V <sub>DD1</sub> , V <sub>DD2</sub>                                | V <sub>SS</sub> – 0.3 to V <sub>SS</sub> + 4.6  | V    |
|                           | V <sub>DD3</sub>  | V <sub>DD3</sub>                                                   | V <sub>SS</sub> – 0.3 to V <sub>SS</sub> + 6.0  | V    |
| Input voltage             | V <sub>IN</sub>   | All input pins                                                     | V <sub>SS</sub> – 0.3 to V <sub>DD1</sub> + 0.3 | V    |
| Output voltage            | V <sub>OUT1</sub> | RD2 to 0, GD2 to 0, BD2 to 0, and BLK outputs                      | V <sub>SS</sub> – 0.3 to V <sub>DD1</sub> + 0.3 | V    |
|                           | V <sub>OUT2</sub> | A0 to A17, $\overline{\text{CE}}$ , $\overline{\text{OE}}$ outputs | V <sub>SS</sub> – 0.3 to V <sub>DD1</sub> + 0.3 | V    |
| Maximum power dissipation | P <sub>dmax</sub> |                                                                    | 230                                             | mW   |
| Operating temperature     | T <sub>opg</sub>  |                                                                    | –30 to +70                                      | °C   |
| Storage temperature       | T <sub>stg</sub>  |                                                                    | –40 to +125                                     | °C   |

### Recommended Operating Conditions

| Parameter                                                          | Symbol             | Conditions                                                                | Ratings               |     |                      | Unit |
|--------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------|-----------------------|-----|----------------------|------|
|                                                                    |                    |                                                                           | min                   | typ | max                  |      |
| Supply voltage                                                     | V <sub>DD1</sub>   | V <sub>DD1</sub> , V <sub>DD2</sub>                                       | 3.0                   | 3.3 | 3.6                  | V    |
|                                                                    | V <sub>DD3</sub>   | V <sub>DD3</sub>                                                          | 3.0                   | 3.3 | 5.5                  | V    |
| Input high-level voltage                                           | V <sub>IH1</sub>   | CTRL1, TEST1, TEST2                                                       | 0.7 V <sub>DD1</sub>  | —   | 5.5                  | V    |
|                                                                    | V <sub>IH2</sub>   | SCLK, SIN, $\overline{\text{CS}}$ , VSYNC, HSYNC, $\overline{\text{RST}}$ | 0.8 V <sub>DD1</sub>  | —   | 5.5                  | V    |
|                                                                    | V <sub>IH3</sub>   | D0 to D11                                                                 | 0.7 V <sub>DD1</sub>  | —   | 5.5                  | V    |
| Input low-level voltage                                            | V <sub>IL1</sub>   | CTRL1, TEST1, TEST2                                                       | V <sub>SS</sub> – 0.3 | —   | 0.3 V <sub>DD1</sub> | V    |
|                                                                    | V <sub>IL2</sub>   | SCLK, SIN, $\overline{\text{CS}}$ , VSYNC, HSYNC, $\overline{\text{RST}}$ | V <sub>SS</sub> – 0.3 | —   | 0.2 V <sub>DD1</sub> | V    |
|                                                                    | V <sub>IL3</sub>   | D0 to D11                                                                 | V <sub>SS</sub> – 0.3 | —   | 0.3 V <sub>DD1</sub> | V    |
| Oscillator frequency                                               | F <sub>OSC1</sub>  | OSCin and OSCout oscillator pins (LC oscillator)                          | —                     | 10  | —                    | MHz  |
| External clock input                                               | F <sub>OSC2</sub>  | OSCin, V <sub>DD1</sub> = 3.3 V                                           | —                     | 33  | 40                   | MHz  |
|                                                                    | V <sub>IN1</sub>   | V <sub>DD1</sub> = 3.3 V, CTRL1 = high                                    | 0.5                   | —   | 3.3                  | Vp-p |
| D/A converter (3 bit, 3 ch)<br>When maximum output voltage = 0.7 V | V <sub>refda</sub> | Reference voltage                                                         | —                     | 1.1 | —                    | V    |
|                                                                    | R <sub>fda</sub>   | Output load resistance ROUT, GOUT, and BOUT                               | 120                   | —   | 225                  | Ω    |
|                                                                    | R <sub>fbda</sub>  | Output load resistance OUTR                                               | 40                    | —   | 75                   | Ω    |
|                                                                    | R <sub>ref</sub>   | Reference load resistance, RREF                                           | 1232                  | —   | 2310                 | Ω    |

# LC74735NW

**Electrical Characteristics at Ta = –30 to +70°C, V<sub>DD</sub> = 3.3 V unless otherwise specified.**

| Parameter                 | Symbol           | Pin                                                                                            | Conditions                                           | Ratings                |     |     | Unit |
|---------------------------|------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------|-----|-----|------|
|                           |                  |                                                                                                |                                                      | min                    | typ | max |      |
| Output high-level voltage | V <sub>OH1</sub> | RD2 to 0, GD2 to 0, BD2 to 0, and BLK outputs                                                  | V <sub>DD1</sub> = 3.0 V<br>I <sub>OH1</sub> = –8 mA | V <sub>DD1</sub> – 0.8 | —   | —   | V    |
|                           | V <sub>OH2</sub> | A0 to 17, $\overline{\text{CE}}$ , and $\overline{\text{OE}}$                                  | V <sub>DD3</sub> = 3.0 V<br>I <sub>OH2</sub> = –8 mA | V <sub>DD3</sub> – 0.8 | —   | —   | V    |
|                           | V <sub>OH3</sub> | A0 to 17, $\overline{\text{CE}}$ , and $\overline{\text{OE}}$                                  | V <sub>DD3</sub> = 4.5 V<br>I <sub>OH3</sub> = –8 mA | V <sub>DD3</sub> – 0.8 | —   | —   | V    |
| Output low-level voltage  | V <sub>OL1</sub> | RD2 to 0, GD2 to 0, BD2 to 0, and BLK outputs                                                  | V <sub>DD1</sub> = 3.0 V<br>I <sub>OL1</sub> = 8 mA  | —                      | —   | 0.4 | V    |
|                           | V <sub>OL2</sub> | A0 to 17, $\overline{\text{CE}}$ , and $\overline{\text{OE}}$                                  | V <sub>DD3</sub> = 3.0 V<br>I <sub>OL2</sub> = 8 mA  | —                      | —   | 0.4 | V    |
|                           | V <sub>OL3</sub> | A0 to 17, $\overline{\text{CE}}$ , and $\overline{\text{OE}}$                                  | V <sub>DD3</sub> = 4.5 V<br>I <sub>OL3</sub> = 8 mA  | —                      | —   | 0.4 | V    |
| Input current             | I <sub>IH1</sub> | CTRL1, TEST1, TEST2, SCLK, SIN, $\overline{\text{CS}}$ , VSYNC, HSYNC, $\overline{\text{RST}}$ | V <sub>IN</sub> = V <sub>DD1</sub>                   | —                      | —   | 10  | μA   |
|                           | I <sub>IH2</sub> | D0 to 11                                                                                       | V <sub>IN</sub> = V <sub>DD3</sub>                   | —                      | —   | 10  | μA   |
|                           | I <sub>IL1</sub> | CTRL1, TEST1, TEST2, SCLK, SIN, $\overline{\text{CS}}$ , VSYNC, HSYNC                          | V <sub>IN</sub> = V <sub>SS</sub>                    | –10                    | —   | —   | μA   |
|                           | I <sub>IL2</sub> | D0 to 11                                                                                       | V <sub>IN</sub> = V <sub>SS</sub>                    | –10                    | —   | —   | μA   |
| Operating current drain   | I <sub>DD1</sub> | V <sub>DD1</sub>                                                                               | All outputs open<br>OSCin: 40 MHz                    | —                      | —   | 37  | mA   |
|                           | I <sub>DD2</sub> | V <sub>DD2</sub>                                                                               | D/A on                                               | —                      | —   | 22  | mA   |
|                           | I <sub>DD3</sub> | V <sub>DD3</sub>                                                                               |                                                      | —                      | —   | 20  | mA   |
| D/A converter             | CLK              | Clock frequency                                                                                |                                                      | —                      | —   | 20  | MHz  |
|                           | V <sub>max</sub> | Maximum output voltage                                                                         | V <sub>DD2</sub> = 3.3 V                             | 0.25                   | —   | 1.5 | V    |
|                           | V <sub>min</sub> | Minimum output voltage                                                                         | V <sub>DD2</sub> = 3.3 V                             | —                      | 0   | —   | V    |

## Timing Characteristics

OSD Write (See figure 1.) at  $T_a = -30$  to  $+70^\circ\text{C}$ ,  $V_{DD1} = 3.3 \pm 0.3 \text{ V}$ 

| Parameter                 | Symbol               | Conditions                                                         | Ratings |     |     | Unit          |
|---------------------------|----------------------|--------------------------------------------------------------------|---------|-----|-----|---------------|
|                           |                      |                                                                    | min     | typ | max |               |
| Minimum input pulse width | $t_w(\text{sclk})$   | SCLK                                                               | 200     | —   | —   | ns            |
|                           | $t_w(\text{cs})$     | $\overline{\text{CS}}$ (The period $\overline{\text{CS}}$ is high) | 1       | —   | —   | $\mu\text{s}$ |
| Data setup time           | $t_{su}(\text{cs})$  | $\overline{\text{CS}}$                                             | 200     | —   | —   | ns            |
|                           | $t_{su}(\text{sin})$ | SIN                                                                | 200     | —   | —   | ns            |
| Data hold time            | $t_h(\text{cs})$     | $\overline{\text{CS}}$                                             | 2       | —   | —   | $\mu\text{s}$ |
|                           | $t_h(\text{sin})$    | SIN                                                                | 200     | —   | —   | ns            |
| One word write time       | $t_{\text{word}}$    | The time to write 8 bits of data                                   | 4.2     | —   | —   | $\mu\text{s}$ |
|                           | $t_{wt}$             | RAM data write time                                                | 1       | —   | —   | $\mu\text{s}$ |

## Supplementary Materials

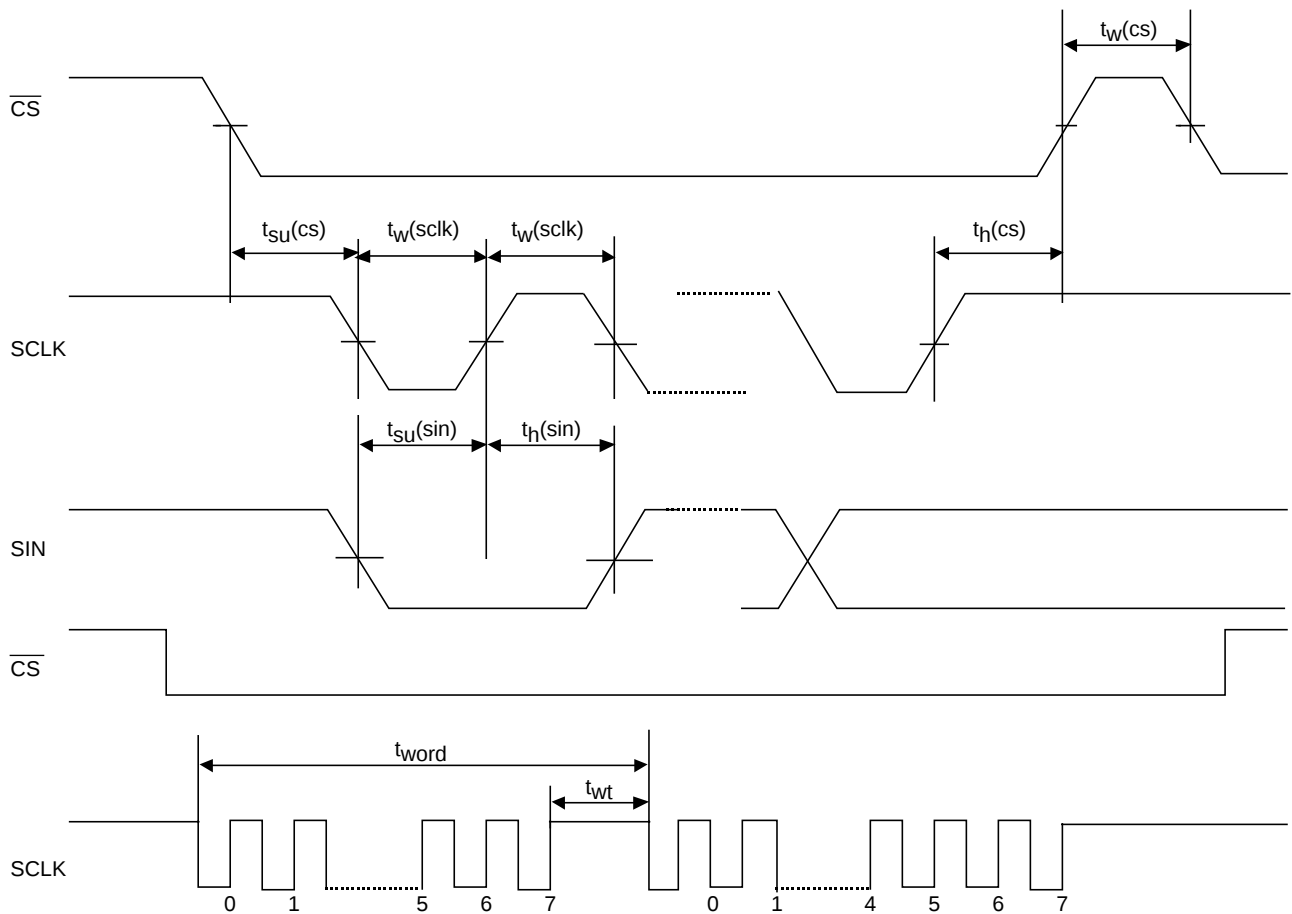
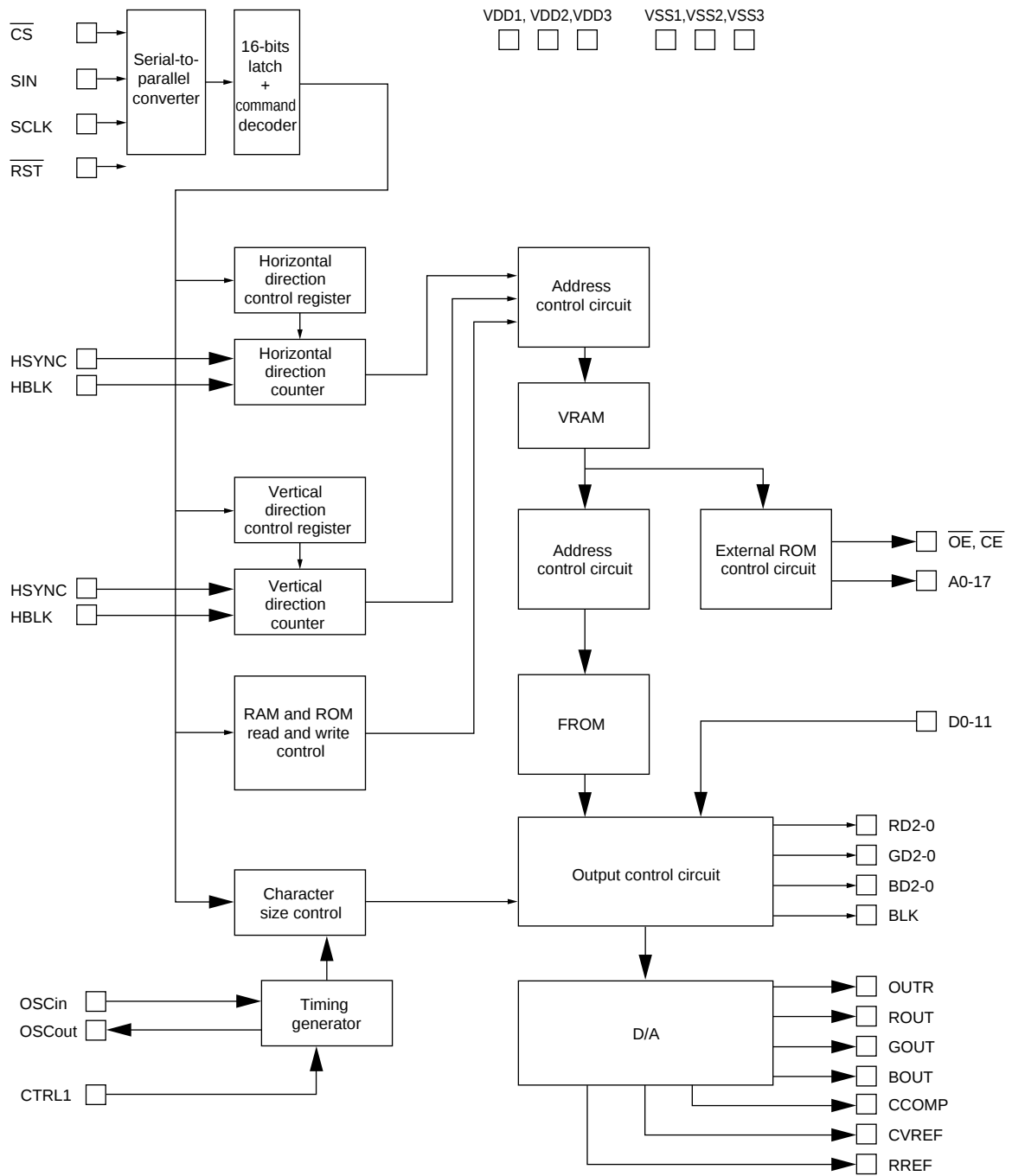


Figure 1 OSD Serial Data Input Timing

## System Block Diagram



## Display Control Commands

The display control commands have serial input format that consists of 8-bit units transmitted LSB first. A command consists of a command identification code in the first byte and data in the second and following bytes. Both a first byte and a second byte (16 bits) must be transmitted for each command. Commands 10, 11, and 71 set the IC to continuous write mode. (Continuous write mode is cleared by setting the  $\overline{\text{CS}}$  pin high.)

### Display Control Command Table

| Command                                                  | First byte                  |   |   |   |      |   |      |        | Second byte |        |       |        |        |       |        |        |
|----------------------------------------------------------|-----------------------------|---|---|---|------|---|------|--------|-------------|--------|-------|--------|--------|-------|--------|--------|
|                                                          | Command identification code |   |   |   | Data |   |      |        | Data        |        |       |        |        |       |        |        |
|                                                          | 7                           | 6 | 5 | 4 | 3    | 2 | 1    | 0      | 7           | 6      | 5     | 4      | 3      | 2     | 1      | 0      |
| Command00 (Write address)<br>Main                        | 1                           | 0 | 0 | 0 | 0    | 0 | V3   | V2     | V1          | V0     | H5    | H4     | H3     | H2    | H1     | H0     |
| Command01 (Write address)<br>Sub (Wallpaper)             | 1                           | 0 | 0 | 0 | 0    | 1 | 0    | 0      | 0           | SV0    | 0     | 0      | 0      | 0     | 0      | SH0    |
| Command 10 (Character write)<br>Main                     | 1                           | 0 | 0 | 1 | 0    | 0 | RM2  | RM1(1) | 0           | 0      | at    | BXS    | BXL    | BXR   | BXU    | BXD    |
|                                                          |                             |   |   |   |      |   |      | (2)    | CB3         | CB2    | CB1   | CB0    | CC3    | CC2   | CC1    | CC0    |
|                                                          |                             |   |   |   |      |   |      | (3)    | 0           | 0      | CT0   | I/E    | M/G    | C10   | C9     | C8     |
|                                                          |                             |   |   |   |      |   |      | (4)    | C7          | C6     | C5    | C4     | C3     | C2    | C1     | C0     |
| Command 11 (Character write)<br>Sub (Wallpaper)          | 1                           | 0 | 0 | 1 | 0    | 1 | RM2  | RM1(1) | 0           | 0      | 0     | 0      | 0      | 0     | 0      | 0      |
|                                                          |                             |   |   |   |      |   |      | (2)    | 0           | 0      | 0     | 0      | 0      | 0     | 0      | 0      |
|                                                          |                             |   |   |   |      |   |      | (3)    | 0           | 0      | CT0   | I/E    | M/G    | C10   | C9     | C8     |
|                                                          |                             |   |   |   |      |   |      | (4)    | C7          | C6     | C5    | C4     | C3     | C2    | C1     | C0     |
| Command20 (System control)                               | 1                           | 0 | 1 | 0 | 0    | 0 | 0    | 0      | TSTMD2      | TSTMD1 | Q/W2  | Q/W1   | SYSRST | CTERS | SRMERS | MRMERS |
| Command21 (Display control)                              | 1                           | 0 | 1 | 0 | 0    | 0 | 0    | 1      | LCSOFF      | BK1    | BK0   | SBG1   | SBG0   | DSPBG | DSPGS  | DSPGM  |
| Command22 (I/O polarity control 1)                       | 1                           | 0 | 1 | 0 | 0    | 0 | 1    | 0      | BLD1        | BLO0   | BLOP  | BLO1   | BLO0   | CKP   | VIP    | HIP    |
| Command23 (Screen background color)                      | 1                           | 0 | 1 | 0 | 0    | 0 | 1    | 1      | 0           | 0      | BGCT1 | BGCT0  | BGC3   | BGC2  | BGC1   | BGC0   |
| Command24 (I/O polarity control 2)                       | 1                           | 0 | 1 | 0 | 0    | 1 | 0    | 0      | DSPMD1      | DSPMD0 | DASEL | VBLKON | HBLKON | CKOP  | VBP    | HBP    |
| Command25 (Output control)                               | 1                           | 0 | 1 | 0 | 0    | 1 | 0    | 1      | CEHSL       | TOKSL  | VIPSL | OTM2   | OTM1   | OTM0  | QRM1   | QRM0   |
| Command30<br>(Vertical display start position: main)     | 1                           | 0 | 1 | 1 | 0    | 0 | 0    | 0      | VPM7        | VPM6   | VPM5  | VPM4   | VPM3   | VPM2  | VPM1   | VPM0   |
| Command31<br>(Horizontal display start position: main)   | 1                           | 0 | 1 | 1 | 0    | 0 | 1    | HPM8   | HPM7        | HPM6   | HPM5  | HPM4   | HPM3   | HPM2  | HPM1   | HPM0   |
| Command32<br>(Vertical display start position: sub)      | 1                           | 0 | 1 | 1 | 0    | 1 | 0    | 0      | VPS7        | VPS6   | VPS5  | VPS4   | VPS3   | VPS2  | VPS1   | VPS0   |
| Command33<br>(Horizontal display start position: sub)    | 1                           | 0 | 1 | 1 | 0    | 1 | 1    | HPS8   | HPS7        | HPS6   | HPS5  | HPS4   | HPS3   | HPS2  | HPS1   | HPS0   |
| Command34<br>(Vertical display start position: screen)   | 1                           | 0 | 1 | 1 | 1    | 0 | 0    | 0      | VPG7        | VPG6   | VPG5  | VPG4   | VPG3   | VPG2  | VPG1   | VPG0   |
| Command35<br>(Horizontal display start position: screen) | 1                           | 0 | 1 | 1 | 1    | 0 | 1    | HPG8   | HPG7        | HPG6   | HPG5  | HPG4   | HPG3   | HPG2  | HPG1   | HPG0   |
| Command40<br>(Character size control)                    | 1                           | 1 | 0 | 0 | 0    | 0 | 0    | 0      | 0           | 0      | 0     | 0      | SZV1   | SZV0  | SZH1   | SZH0   |
| Command41<br>(Character size control: line setting U)    | 1                           | 1 | 0 | 0 | 0    | 1 | 0    | 0      | LSZ7        | LSZ6   | LSZ5  | LSZ4   | LSZ3   | LSZ2  | LSZ1   | LSZ0   |
| Command42<br>(Character size control: line setting D)    | 1                           | 1 | 0 | 0 | 1    | 0 | 0    | 0      | LSZ15       | LSZ14  | LSZ13 | LSZ12  | LSZ11  | LSZ10 | LSZ9   | LSZ8   |
| Command50<br>(Box control U)                             | 1                           | 1 | 0 | 1 | 0    | 0 | 0    | 0      | BXUW        | BXLW   | 0     | BXUCT0 | BXUC3  | BXUC2 | BXUC1  | BXUC0  |
| Command51<br>(Box control D)                             | 1                           | 1 | 0 | 1 | 0    | 1 | 0    | 0      | BXDW        | BXRW   | 0     | BXDCT0 | BXDC3  | BXDC2 | BXDC1  | BXDC0  |
| Command52<br>(Box control: line setting U)               | 1                           | 1 | 0 | 1 | 1    | 0 | 0    | 0      | LBX7        | LBX6   | LBX5  | LBX4   | LBX3   | LBX2  | LBX1   | LBX0   |
| Command53<br>(Box control: line setting D)               | 1                           | 1 | 0 | 1 | 1    | 1 | 0    | 0      | LBX15       | LBX14  | LBX13 | LBX12  | LBX11  | LBX10 | LBX9   | LBX8   |
| Command60<br>(Border control)                            | 1                           | 1 | 1 | 0 | 0    | 0 | BLK1 | BLK0   | 0           | 0      | 0     | EGCT0  | EGC3   | EGC2  | EGC1   | EGC0   |
| Command61<br>(Border control: line setting U)            | 1                           | 1 | 1 | 0 | 0    | 1 | 0    | 0      | LFC7        | LFC6   | LFC5  | LFC4   | LFC3   | LFC2  | LFC1   | LFC0   |
| Command62<br>(Border control: line setting D)            | 1                           | 1 | 1 | 0 | 1    | 0 | 0    | 0      | LFC15       | LFC14  | LFC13 | LFC12  | LFC11  | LFC10 | LFC9   | LFC8   |
| Command70 (Write address)<br>Color table                 | 1                           | 1 | 1 | 1 | 0    | 0 | 0    | 0      | 0           | 0      | 0     | CTN1   | CTA3   | CTA2  | CTA1   | CTA0   |
| Command71 (Data write)<br>Color table                    | 1                           | 1 | 1 | 1 | 0    | 1 | 0    | RMB(1) | 0           | 0      | 0     | 0      | TCK    | TB2   | TB1    | TB0    |
|                                                          |                             |   |   |   |      |   |      | (2)    | 0           | 0      | TG2   | TG1    | TG0    | TR2   | TR1    | TR0    |

**Command 00 (Main screen write address set command)**

## • First byte

| DA0 to 7 | Register    | Content |                                                                    | Notes |
|----------|-------------|---------|--------------------------------------------------------------------|-------|
|          |             | State   | Function                                                           |       |
| 7        | —           | 1       | Command 0 identification code<br>Main screen write address setting |       |
| 6        | —           | 0       |                                                                    |       |
| 5        | —           | 0       |                                                                    |       |
| 4        | —           | 0       |                                                                    |       |
| 3        | —           | 0       | Sub-identification code: 0                                         |       |
| 2        | —           | 0       |                                                                    |       |
| 1        | V3<br><MSB> | 0       |                                                                    |       |
|          |             | 1       |                                                                    |       |
| 0        | V2          | 0       |                                                                    |       |
|          |             | 1       |                                                                    |       |

## • Second byte

| DA0 to 7 | Register    | Content |                                                                                                                                  | Notes |
|----------|-------------|---------|----------------------------------------------------------------------------------------------------------------------------------|-------|
|          |             | State   | Function                                                                                                                         |       |
| 7        | V1          | 0       | Main screen memory line address<br>(0 to E, hexadecimal)                                                                         |       |
|          |             | 1       |                                                                                                                                  |       |
| 6        | V0<br><LSB> | 0       | QVGA mode: 13 lines                                                                                                              |       |
|          |             | 1       | WVGA mode: 15 lines                                                                                                              |       |
| 5        | H5<br><MSB> | 0       | Main screen memory character position address<br>(00 to 27, hexadecimal)<br>QVGA mode: 40 characters<br>WVGA mode: 33 characters |       |
|          |             | 1       |                                                                                                                                  |       |
| 4        | H4          | 0       |                                                                                                                                  |       |
|          |             | 1       |                                                                                                                                  |       |
| 3        | H3          | 0       |                                                                                                                                  |       |
|          |             | 1       |                                                                                                                                  |       |
| 2        | H2          | 0       |                                                                                                                                  |       |
|          |             | 1       |                                                                                                                                  |       |
| 1        | H1          | 0       |                                                                                                                                  |       |
|          |             | 1       |                                                                                                                                  |       |
| 0        | H0<br><LSB> | 0       |                                                                                                                                  |       |
|          |             | 1       |                                                                                                                                  |       |

**Command 01 (Subscreen write address set command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                         | Notes |
|----------|----------|---------|-------------------------------------------------------------------------|-------|
|          |          | State   | Function                                                                |       |
| 7        | —        | 1       | Command 0 identification code<br>Subscreen memory write address setting |       |
| 6        | —        | 0       |                                                                         |       |
| 5        | —        | 0       |                                                                         |       |
| 4        | —        | 0       |                                                                         |       |
| 3        | —        | 0       | Sub-identification code: 1                                              |       |
| 2        | —        | 1       |                                                                         |       |
| 1        | —        | 0       |                                                                         |       |
| 0        | —        | 0       |                                                                         |       |

## • Second byte

| DA0 to 7 | Register    | Content |                                    | Notes |
|----------|-------------|---------|------------------------------------|-------|
|          |             | State   | Function                           |       |
| 7        | —           | 0       |                                    |       |
| 6        | V0          | 0       | Subscreen memory line address      |       |
|          |             | 1       | (0 to 1, hexadecimal) 2 lines      |       |
| 5        | —           | 0       |                                    |       |
| 4        | —           | 0       |                                    |       |
| 3        | —           | 0       |                                    |       |
| 2        | —           | 0       |                                    |       |
| 1        | —           | 0       |                                    |       |
| 0        | H0<br><LSB> | 0       | Subscreen memory character address |       |
|          |             | 1       | (0 to 1, hexadecimal) 2 characters |       |

**Command 10 (Main screen display character data write setting command)**

## • First byte

| DA0 to 7 | Register | Content      |                                                                                                                                                                                                                                                                                                                                               |  |  | Notes                                                                                                                |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
|----------|----------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|----------------------------------------------------------------------------------------------------------------------|------|------|--|---|---|--------------|-----|---|---|--------------|------------|---|---|--------|------------|---|---|-----------|------------|---------------------------------|
|          |          | State        | Function                                                                                                                                                                                                                                                                                                                                      |  |  |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 7        | —        | 1            | Command 1 identification code<br>Display character data write setting                                                                                                                                                                                                                                                                         |  |  | When this command has been issued, the IC remains in display character data write mode until the CS pin is set high. |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 6        | —        | 0            |                                                                                                                                                                                                                                                                                                                                               |  |  |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 5        | —        | 0            |                                                                                                                                                                                                                                                                                                                                               |  |  |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 4        | —        | 1            |                                                                                                                                                                                                                                                                                                                                               |  |  |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 3        | —        | 0            | Sub-identification code 0                                                                                                                                                                                                                                                                                                                     |  |  |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 2        | —        | 0            |                                                                                                                                                                                                                                                                                                                                               |  |  |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 1        | RM2      | 0            | <table><tr><td>RM2</td><td>RM1</td><td colspan="2">Mode</td></tr><tr><td>0</td><td>0</td><td>(1)(2)(3)(4)</td><td>End</td></tr><tr><td>0</td><td>1</td><td>(1)(2)(3)(4)</td><td>Continuous</td></tr><tr><td>1</td><td>0</td><td>(3)(4)</td><td>Continuous</td></tr><tr><td>1</td><td>1</td><td>(2)(3)(4)</td><td>Continuous</td></tr></table> |  |  | RM2                                                                                                                  | RM1  | Mode |  | 0 | 0 | (1)(2)(3)(4) | End | 0 | 1 | (1)(2)(3)(4) | Continuous | 1 | 0 | (3)(4) | Continuous | 1 | 1 | (2)(3)(4) | Continuous | Continuous write mode selection |
|          |          | RM2          |                                                                                                                                                                                                                                                                                                                                               |  |  | RM1                                                                                                                  | Mode |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 0        | 0        | (1)(2)(3)(4) |                                                                                                                                                                                                                                                                                                                                               |  |  | End                                                                                                                  |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 0        | 1        | (1)(2)(3)(4) |                                                                                                                                                                                                                                                                                                                                               |  |  | Continuous                                                                                                           |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 1        | 0        | (3)(4)       |                                                                                                                                                                                                                                                                                                                                               |  |  | Continuous                                                                                                           |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 1        | 1        | (2)(3)(4)    |                                                                                                                                                                                                                                                                                                                                               |  |  | Continuous                                                                                                           |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 1        | 1        |              |                                                                                                                                                                                                                                                                                                                                               |  |  |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 0        | RM1      | 0            |                                                                                                                                                                                                                                                                                                                                               |  |  |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
|          |          | 1            |                                                                                                                                                                                                                                                                                                                                               |  |  |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |

## • Second byte (1)

| DA0 to 7 | Register | Content |               | Notes                              |
|----------|----------|---------|---------------|------------------------------------|
|          |          | State   | Function      |                                    |
| 7        | —        | 0       |               |                                    |
| 6        | —        | 0       |               |                                    |
| 5        | at       | 0       | Blinking off  | Blinking specification             |
|          |          | 1       | Blinking on   |                                    |
| 4        | BXS      | 0       | Raised        | Box specification: raised/recessed |
|          |          | 1       | Recessed      |                                    |
| 3        | BXL      | 0       | None          | Box specification: left side       |
|          |          | 1       | Box displayed |                                    |
| 2        | BXR      | 0       | None          | Box specification: right side      |
|          |          | 1       | Box displayed |                                    |
| 1        | BXU      | 0       | None          | Box specification: upper           |
|          |          | 1       | Box displayed |                                    |
| 0        | BXD      | 0       | None          | Box specification: lower           |
|          |          | 1       | Box displayed |                                    |

## • Second byte (2)

| DA0 to 7 | Register  | Content |                                                                                   | Notes                                                                                                            |
|----------|-----------|---------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
|          |           | State   | Function                                                                          |                                                                                                                  |
| 7        | CB3 [MSB] | 0       | Character background color specification<br>0000 to 1111, or 0 to F (hexadecimal) | Character background color specification<br>When a character glyph is specified, 1 of 16 colors may be selected. |
|          |           | 1       |                                                                                   |                                                                                                                  |
| 6        | CB2       | 0       |                                                                                   |                                                                                                                  |
|          |           | 1       |                                                                                   |                                                                                                                  |
| 5        | CB1       | 0       |                                                                                   |                                                                                                                  |
|          |           | 1       |                                                                                   |                                                                                                                  |
| 4        | CB0 [LSB] | 0       |                                                                                   |                                                                                                                  |
|          |           | 1       |                                                                                   |                                                                                                                  |
| 3        | CC3 [MSB] | 0       | Character color specification<br>0000 to 1111, or 0 to F (hexadecimal)            | Character color specification<br>When a character glyph is specified, 1 of 16 colors may be selected.            |
|          |           | 1       |                                                                                   |                                                                                                                  |
| 2        | CC2       | 0       |                                                                                   |                                                                                                                  |
|          |           | 1       |                                                                                   |                                                                                                                  |
| 1        | CC1       | 0       |                                                                                   |                                                                                                                  |
|          |           | 1       |                                                                                   |                                                                                                                  |
| 0        | CC0 <LSB> | 0       |                                                                                   |                                                                                                                  |
|          |           | 1       |                                                                                   |                                                                                                                  |

\*: This register is set to the all bits zero state when the IC is reset by the RST pin.

## • Second byte (3)

| DA0 to 7 | Register  | Content |                      | Notes                           |
|----------|-----------|---------|----------------------|---------------------------------|
|          |           | State   | Function             |                                 |
| 7        | —         | 0       |                      |                                 |
| 6        | —         | 0       |                      |                                 |
| 5        | CT0       | 0       | Color table number 1 | Color table selection           |
|          |           | 1       | Color table number 2 |                                 |
| 4        | I/E       | 0       | Internal ROM         | ROM selection                   |
|          |           | 1       | External ROM         |                                 |
| 3        | M/G       | 0       | Character            | Character/graphic specification |
|          |           | 1       | Graphic              |                                 |
| 2        | C10 [MSB] | 0       |                      | Character code specification    |
|          |           | 1       |                      |                                 |
| 1        | C9        | 0       |                      |                                 |
|          |           | 1       |                      |                                 |
| 0        | C8        | 0       |                      |                                 |
|          |           | 1       |                      |                                 |

## • Second byte (4)

| DA0 to 7 | Register | Content |                                                                                                                                                                                                                                                                                                | Notes                        |
|----------|----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
|          |          | State   | Function                                                                                                                                                                                                                                                                                       |                              |
| 7        | C7       | 0       | Character code<br>Internal ROM: 512 characters<br>000 to 1FF (hexadecimal)<br>0 to 511<br><br>External ROM: 2048 characters<br>000 to 7FF (hexadecimal)<br>0 to 2047<br><br>* Transparent character specification<br>I/E = 0 (Internal ROM)<br>M/G = 0 (Character)<br>Code = 1FF (hexadecimal) | Character code specification |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 6        | C6       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 5        | C5       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 4        | C4       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 3        | C3       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 2        | C2       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 1        | C1       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 0        | C0 [LSB] | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

**Command 11 (Subscreen display character data write setting command)**

## • First byte

| DA0 to 7 | Register | Content      |                                                                                                                                                                                                                                                                                                                                               |  |  | Notes |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
|----------|----------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|-------|----------------------------------------------------------------------------------------------------------------------|------|------|--|---|---|--------------|-----|---|---|--------------|------------|---|---|--------|------------|---|---|-----------|------------|---------------------------------|
|          |          | State        | Function                                                                                                                                                                                                                                                                                                                                      |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 7        | —        | 1            | Command 1 identification code<br>Display character data write setting                                                                                                                                                                                                                                                                         |  |  |       | When this command has been issued, the IC remains in display character data write mode until the CS pin is set high. |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 6        | —        | 0            |                                                                                                                                                                                                                                                                                                                                               |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 5        | —        | 0            |                                                                                                                                                                                                                                                                                                                                               |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 4        | —        | 1            |                                                                                                                                                                                                                                                                                                                                               |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 3        | —        | 0            | Sub-identification code 1                                                                                                                                                                                                                                                                                                                     |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 2        | —        | 1            |                                                                                                                                                                                                                                                                                                                                               |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 1        | RM2      | 0            | <table><tr><td>RM2</td><td>RM1</td><td colspan="2">Mode</td></tr><tr><td>0</td><td>0</td><td>[1][2][3][4]</td><td>End</td></tr><tr><td>0</td><td>1</td><td>[1][2][3][4]</td><td>Continuous</td></tr><tr><td>1</td><td>0</td><td>[3][4]</td><td>Continuous</td></tr><tr><td>1</td><td>1</td><td>[2][3][4]</td><td>Continuous</td></tr></table> |  |  |       | RM2                                                                                                                  | RM1  | Mode |  | 0 | 0 | [1][2][3][4] | End | 0 | 1 | [1][2][3][4] | Continuous | 1 | 0 | [3][4] | Continuous | 1 | 1 | [2][3][4] | Continuous | Continuous write mode selection |
|          |          | RM2          |                                                                                                                                                                                                                                                                                                                                               |  |  |       | RM1                                                                                                                  | Mode |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 0        | 0        | [1][2][3][4] |                                                                                                                                                                                                                                                                                                                                               |  |  |       | End                                                                                                                  |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 0        | 1        | [1][2][3][4] |                                                                                                                                                                                                                                                                                                                                               |  |  |       | Continuous                                                                                                           |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 1        | 0        | [3][4]       |                                                                                                                                                                                                                                                                                                                                               |  |  |       | Continuous                                                                                                           |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 1        | 1        | [2][3][4]    |                                                                                                                                                                                                                                                                                                                                               |  |  |       | Continuous                                                                                                           |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 1        | 1        |              |                                                                                                                                                                                                                                                                                                                                               |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
| 0        | RM1      | 0            |                                                                                                                                                                                                                                                                                                                                               |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
|          |          | 1            |                                                                                                                                                                                                                                                                                                                                               |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
|          |          | 0            |                                                                                                                                                                                                                                                                                                                                               |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |
|          |          | 1            |                                                                                                                                                                                                                                                                                                                                               |  |  |       |                                                                                                                      |      |      |  |   |   |              |     |   |   |              |            |   |   |        |            |   |   |           |            |                                 |

## • Second byte (1)

| DA0 to 7 | Register | Content |          | Notes |
|----------|----------|---------|----------|-------|
|          |          | State   | Function |       |
| 7        | —        | 0       |          |       |
| 6        | —        | 0       |          |       |
| 5        |          | 0       |          |       |
| 4        |          | 0       |          |       |
| 3        |          | 0       |          |       |
| 2        |          | 0       |          |       |
| 1        |          | 0       |          |       |
| 0        |          | 0       |          |       |

## • Second byte (2)

| DA0 to 7 | Register | Content |          | Notes |
|----------|----------|---------|----------|-------|
|          |          | State   | Function |       |
| 7        |          | 0       |          |       |
| 6        |          | 0       |          |       |
| 5        |          | 0       |          |       |
| 4        |          | 0       |          |       |
| 3        |          | 0       |          |       |
| 2        |          | 0       |          |       |
| 1        |          | 0       |          |       |
| 0        |          | 0       |          |       |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

## • Second byte (3)

| DA0 to 7 | Register  | Content |                                   | Notes                        |
|----------|-----------|---------|-----------------------------------|------------------------------|
|          |           | State   | Function                          |                              |
| 7        | —         | 0       |                                   |                              |
| 6        | —         | 0       |                                   |                              |
| 5        | CT0       | 0       | Color table number 1              | Color table selection        |
|          |           | 1       | Color table number 2              |                              |
| 4        | I/E       | 0       | Internal ROM                      | ROM selection                |
|          |           | 1       | External ROM                      |                              |
| 3        | M/G       | 0       | Only when transparent is selected | Graphic only                 |
|          |           | 1       | Graphic only                      |                              |
| 2        | C10 [MSB] | 0       |                                   | Character code specification |
|          |           | 1       |                                   |                              |
| 1        | C9        | 0       |                                   |                              |
|          |           | 1       |                                   |                              |
| 0        | C8        | 0       |                                   |                              |
|          |           | 1       |                                   |                              |

## • Second byte (4)

| DA0 to 7 | Register | Content |                                                                                                                                                                                                                                                                                                | Notes                        |
|----------|----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
|          |          | State   | Function                                                                                                                                                                                                                                                                                       |                              |
| 7        | C7       | 0       | Character code<br>Internal ROM: 512 characters<br>000 to 1FF (hexadecimal)<br>0 to 511<br><br>External ROM: 2048 characters<br>000 to 7FF (hexadecimal)<br>0 to 2047<br><br>* Transparent character specification<br>I/E = 0 (Internal ROM)<br>M/G = 0 (Character)<br>Code = 1FF (hexadecimal) | Character code specification |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 6        | C6       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 5        | C5       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 4        | C4       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 3        | C3       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 2        | C2       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 1        | C1       | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |
| 0        | C0 [LSB] | 0       |                                                                                                                                                                                                                                                                                                |                              |
|          |          | 1       |                                                                                                                                                                                                                                                                                                |                              |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

**Command 20 (System control setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                          | Notes |
|----------|----------|---------|----------------------------------------------------------|-------|
|          |          | State   | Function                                                 |       |
| 7        | —        | 1       | Command 2 identification code<br>System control settings |       |
| 6        | —        | 0       |                                                          |       |
| 5        |          | 1       |                                                          |       |
| 4        |          | 0       |                                                          |       |
| 3        |          | 0       | Sub-identification code 0                                |       |
| 2        |          | 0       |                                                          |       |
| 1        |          | 0       |                                                          |       |
| 0        |          | 0       |                                                          |       |

## • Second byte

| DA0 to 7 | Register | Content |                                                          | Notes                                                                                                                              |
|----------|----------|---------|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
|          |          | State   | Function                                                 |                                                                                                                                    |
| 7        | TSTMD2   | 0       | Normal operation                                         | Do not use test mode. This bit must always be set to 0.                                                                            |
|          |          | 1       | Test mode 2                                              |                                                                                                                                    |
| 6        | TSTMD1   | 0       | Normal operation                                         | Do not use test mode. This bit must always be set to 0.                                                                            |
|          |          | 1       | Test mode 1                                              |                                                                                                                                    |
| 5        | Q/W2     | 0       | Normal mode                                              | Normal / Independent                                                                                                               |
|          |          | 1       | Independent mode    Specified by COM24.                  |                                                                                                                                    |
| 4        | Q/W1     | 0       | QVGA mode    D/A converter on, 40 characters × 13 lines  | QVGA / WVGA                                                                                                                        |
|          |          | 1       | WVGA mode    D/A converter off, 33 characters × 15 lines |                                                                                                                                    |
| 3        | SYSRST   | 0       |                                                          | The registers are reset when the $\overline{CS}$ pin is low.<br>The reset state is cleared when the $\overline{CS}$ pin goes high. |
|          |          | 1       | Reset all registers (All bits set to 0.)                 |                                                                                                                                    |
| 2        | CTERS    | 0       |                                                          | Applications must provide a wait time of about 1ms.<br>Use DSPOFF to execute this operation.                                       |
|          |          | 1       | Erase the color table. (Sets all values to 00.)          |                                                                                                                                    |
| 1        | SRMERS   | 0       |                                                          | Applications must provide a wait time of about 1ms.<br>Use DSPOFF to execute this operation.                                       |
|          |          | 1       | Erase main RAM. (Sets all values to 00.)<br>Wallpaper    |                                                                                                                                    |
| 0        | MRMERS   | 0       |                                                          | Applications must provide a wait time of about 1ms.<br>Use DSPOFF to execute this operation.                                       |
|          |          | 1       | Erase sub-RAM. (Sets all values to 00.)<br>Main screen   |                                                                                                                                    |

**Command 21 (Display control setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                  | Notes |
|----------|----------|---------|--------------------------------------------------|-------|
|          |          | State   | Function                                         |       |
| 7        | —        | 1       | Command 2 identification code<br>Display control |       |
| 6        | —        | 0       |                                                  |       |
| 5        | —        | 1       |                                                  |       |
| 4        | —        | 0       |                                                  |       |
| 3        | —        | 0       | Extended command 1 identification code           |       |
| 2        | —        | 0       |                                                  |       |
| 1        | —        | 0       |                                                  |       |
| 0        | —        | 1       |                                                  |       |

## • Second byte

| DA0 to 7 | Register | Content |                                                                                                                                                                                                        |  |  | Notes                           |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
|----------|----------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|---------------------------------|-----------------|-----------------|---|---|------|---|---|------|---|---|------|------------------------------------------------|--|
|          |          | State   | Function                                                                                                                                                                                               |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 7        | LCSOFF   | 0       | Enables stopping the LC oscillator                                                                                                                                                                     |  |  | LC oscillator on/off control    |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
|          |          | 1       | Disables stopping the LC oscillator                                                                                                                                                                    |  |  | Valid when the display is off.  |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 6        | BK1      | 0       | <table><tr><th>BK1</th><th>BK0</th><th>Blinking period</th></tr><tr><td>0</td><td>0</td><td>1/16</td></tr><tr><td>0</td><td>1</td><td>1/32</td></tr><tr><td>1</td><td>0</td><td>1/64</td></tr></table> |  |  | BK1                             | BK0             | Blinking period | 0 | 0 | 1/16 | 0 | 1 | 1/32 | 1 | 0 | 1/64 | Blinking period<br>Specified for screen units. |  |
|          |          | BK1     |                                                                                                                                                                                                        |  |  | BK0                             | Blinking period |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 0        | 0        | 1/16    |                                                                                                                                                                                                        |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 0        | 1        | 1/32    |                                                                                                                                                                                                        |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 1        | 0        | 1/64    |                                                                                                                                                                                                        |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 1        |          |         |                                                                                                                                                                                                        |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 5        | BK0      | 0       |                                                                                                                                                                                                        |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
|          |          | 1       |                                                                                                                                                                                                        |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 4        | SBG1     | 0       | Display after the main screen                                                                                                                                                                          |  |  | Subscreen display specification |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
|          |          | 1       | Display before the main screen                                                                                                                                                                         |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 3        | SBG0     | 0       | Iterated display (wallpaper)                                                                                                                                                                           |  |  | Subscreen display specification |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
|          |          | 1       | Horizontal 2-character x vertical 2-character display (sprite)                                                                                                                                         |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 2        | DSPBG    | 0       | Display off                                                                                                                                                                                            |  |  | Screen background color         |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
|          |          | 1       | Display on                                                                                                                                                                                             |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 1        | DSPGS    | 0       | Display off                                                                                                                                                                                            |  |  | Subscreen (wallpaper)           |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
|          |          | 1       | Display on                                                                                                                                                                                             |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
| 0        | DSPGM    | 0       | Display off                                                                                                                                                                                            |  |  | Main screen                     |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |
|          |          | 1       | Display on                                                                                                                                                                                             |  |  |                                 |                 |                 |   |   |      |   |   |      |   |   |      |                                                |  |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

**Command 22 (I/O polarity control setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                         | Notes |
|----------|----------|---------|---------------------------------------------------------|-------|
|          |          | State   | Function                                                |       |
| 7        | —        | 1       | Command 2 identification code<br>I/O polarity control 1 |       |
| 6        | —        | 0       |                                                         |       |
| 5        | —        | 1       |                                                         |       |
| 4        | —        | 0       |                                                         |       |
| 3        | —        | 0       | Extended command 2 identification code                  |       |
| 2        | —        | 0       |                                                         |       |
| 1        | —        | 1       |                                                         |       |
| 0        | —        | 0       |                                                         |       |

## • Second byte

| DA0 to 7 | Register                                                                                                           | Content                                                     |                                                                                                                                                                                                                                                     |                             | Notes                          |      |                             |   |   |                                                             |   |   |                                         |                                                |
|----------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------|------|-----------------------------|---|---|-------------------------------------------------------------|---|---|-----------------------------------------|------------------------------------------------|
|          |                                                                                                                    | State                                                       | Function                                                                                                                                                                                                                                            |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 7        | BLD1                                                                                                               | 0                                                           | <table><tr><th>BLD1</th><th>BLD0</th><th>BLY output delay</th></tr><tr><td>0</td><td>0</td><td>±0</td></tr><tr><td>0</td><td>1</td><td>+1</td></tr></table>                                                                                         |                             | BLD1                           | BLD0 | BLY output delay            | 0 | 0 | ±0                                                          | 0 | 1 | +1                                      | BLK output delay setting<br>In dot clock units |
| BLD1     | BLD0                                                                                                               | BLY output delay                                            |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 0        | 0                                                                                                                  | ±0                                                          |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 0        | 1                                                                                                                  | +1                                                          |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 6        | BLD0                                                                                                               | 0                                                           | <table><tr><td>1</td><td>0</td><td>+2</td></tr><tr><td>1</td><td>1</td><td>+3</td></tr></table>                                                                                                                                                     |                             | 1                              | 0    | +2                          | 1 | 1 | +3                                                          |   |   |                                         |                                                |
|          |                                                                                                                    | 1                                                           | 0                                                                                                                                                                                                                                                   | +2                          |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
|          |                                                                                                                    | 1                                                           | 1                                                                                                                                                                                                                                                   | +3                          |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 1        |                                                                                                                    |                                                             |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 5        | BLOP                                                                                                               | 0                                                           | BLK output: positive polarity                                                                                                                                     |                             | BLK output polarity selection  |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 1        | BLK output: negative polarity   |                                                             |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 4        | BLO1                                                                                                               | 0                                                           | <table><tr><th>BLO1</th><th>BLO0</th><th>BLK output</th></tr><tr><td>0</td><td>0</td><td>Text + character background + wallpaper + screen background</td></tr><tr><td>0</td><td>1</td><td>Text + character background + wallpaper</td></tr></table> |                             | BLO1                           | BLO0 | BLK output                  | 0 | 0 | Text + character background + wallpaper + screen background | 0 | 1 | Text + character background + wallpaper | BLK output control                             |
| BLO1     | BLO0                                                                                                               | BLK output                                                  |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 0        | 0                                                                                                                  | Text + character background + wallpaper + screen background |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 0        | 1                                                                                                                  | Text + character background + wallpaper                     |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 3        | BLO0                                                                                                               | 0                                                           | <table><tr><td>1</td><td>0</td><td>Text + character background</td></tr><tr><td>1</td><td>1</td><td>Text</td></tr></table>                                                                                                                          |                             | 1                              | 0    | Text + character background | 1 | 1 | Text                                                        |   |   |                                         |                                                |
|          |                                                                                                                    | 1                                                           | 0                                                                                                                                                                                                                                                   | Text + character background |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
|          |                                                                                                                    | 1                                                           | 1                                                                                                                                                                                                                                                   | Text                        |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 1        |                                                                                                                    |                                                             |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 2        | CKP                                                                                                                | 0                                                           | Clock input: positive polarity                                                                                                                                                                                                                      |                             | Clock input polarity selection |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 1        | Clock input: negative polarity  |                                                             |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 1        | VIP                                                                                                                | 0                                                           | VSYNC input: negative polarity                                                                                                                                   |                             | VSYNC input polarity selection |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 1        | VSYNC input: positive polarity  |                                                             |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 0        | HIP                                                                                                                | 0                                                           | HSYNC input: negative polarity                                                                                                                                   |                             | HSYNC input polarity selection |      |                             |   |   |                                                             |   |   |                                         |                                                |
| 1        | HSYNC input: positive polarity  |                                                             |                                                                                                                                                                                                                                                     |                             |                                |      |                             |   |   |                                                             |   |   |                                         |                                                |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

**Command 23 (Screen background color setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                        | Notes |
|----------|----------|---------|----------------------------------------|-------|
|          |          | State   | Function                               |       |
| 7        | —        | 1       | Command 2 identification code          |       |
| 6        | —        | 0       |                                        |       |
| 5        | —        | 1       |                                        |       |
| 4        | —        | 0       | Screen background color                |       |
| 3        | —        | 0       |                                        |       |
| 2        | —        | 0       | Extended command 3 identification code |       |
| 1        |          | 1       |                                        |       |
| 0        |          | 1       |                                        |       |

## • Second byte

| DA0 to 7 | Register | Content           |                                                                                                                                                                                                                                               |  |  | Notes |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
|----------|----------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|-------|---------------------|---------------------|---|---|-------------------|---|---|-----------------|---|---|-------------------|------------------------------------------------|--|
|          |          | State             | Function                                                                                                                                                                                                                                      |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 7        | —        | 0                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 6        | —        | 0                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 5        | BGCT1    | 0                 | <table><tr><td>T1</td><td>T0</td><td>Color table setting</td></tr><tr><td>0</td><td>0</td><td>Color table No. 2</td></tr><tr><td>0</td><td>1</td><td>Invalid setting</td></tr><tr><td>1</td><td>X</td><td>Color table No. 1</td></tr></table> |  |  | T1    | T0                  | Color table setting | 0 | 0 | Color table No. 2 | 0 | 1 | Invalid setting | 1 | X | Color table No. 1 | Screen background color<br>Color table setting |  |
|          |          | T1                |                                                                                                                                                                                                                                               |  |  | T0    | Color table setting |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 0        | 0        | Color table No. 2 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 0        | 1        | Invalid setting   |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 1        | X        | Color table No. 1 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 1        |          |                   |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 4        | BGCT0    | 0                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
|          |          | 1                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 3        | BGC3     | 0                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
|          |          | 1                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 2        | BGC2     | 0                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
|          |          | 1                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 1        | BGC1     | 0                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
|          |          | 1                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
| 0        | BGC0     | 0                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |
|          |          | 1                 |                                                                                                                                                                                                                                               |  |  |       |                     |                     |   |   |                   |   |   |                 |   |   |                   |                                                |  |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

**Command 24 (I/O polarity control setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                         | Notes |
|----------|----------|---------|---------------------------------------------------------|-------|
|          |          | State   | Function                                                |       |
| 7        | —        | 1       | Command 2 identification code<br>I/O polarity control 2 |       |
| 6        | —        | 0       |                                                         |       |
| 5        | —        | 1       |                                                         |       |
| 4        | —        | 0       |                                                         |       |
| 3        | —        | 0       | Extended command 4 identification code                  |       |
| 2        | —        | 1       |                                                         |       |
| 1        | —        | 0       |                                                         |       |
| 0        | —        | 0       |                                                         |       |

## • Second byte

| DAO to 7 | Register | Content                  |                                                                                                                                                                                                                                                                             |  |  | Notes                                                                                |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
|----------|----------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--------------------------------------------------------------------------------------|--------------------------|--------------------------|---|---|--------------------------|---|---|--------------------------|---|---|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
|          |          | State                    | Function                                                                                                                                                                                                                                                                    |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 7        | DSPMD1   | 0                        | <table><tr><th>MD1</th><th>MD0</th><th>Main screen display area</th></tr><tr><td>0</td><td>0</td><td>40 characters × 13 lines</td></tr><tr><td>0</td><td>1</td><td>33 characters × 15 lines</td></tr><tr><td>1</td><td>0</td><td>40 characters × 16 lines</td></tr></table> |  |  | MD1                                                                                  | MD0                      | Main screen display area | 0 | 0 | 40 characters × 13 lines | 0 | 1 | 33 characters × 15 lines | 1 | 0 | 40 characters × 16 lines | Main screen display area selection<br>Only valid in independent mode.<br>COM20 to COM2<br>*: In WVGA mode: fixed 33-character × 15-line display |  |  |
|          |          | MD1                      |                                                                                                                                                                                                                                                                             |  |  | MD0                                                                                  | Main screen display area |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 0        | 0        | 40 characters × 13 lines |                                                                                                                                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 0        | 1        | 33 characters × 15 lines |                                                                                                                                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 1        | 0        | 40 characters × 16 lines |                                                                                                                                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 1        |          |                          |                                                                                                                                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 6        | DSPMD0   | 0                        | <table><tr><th>MD1</th><th>MD0</th><th>Main screen display area</th></tr><tr><td>0</td><td>0</td><td>40 characters × 13 lines</td></tr><tr><td>0</td><td>1</td><td>33 characters × 15 lines</td></tr><tr><td>1</td><td>0</td><td>40 characters × 16 lines</td></tr></table> |  |  | MD1                                                                                  | MD0                      | Main screen display area | 0 | 0 | 40 characters × 13 lines | 0 | 1 | 33 characters × 15 lines | 1 | 0 | 40 characters × 16 lines | Main screen display area selection<br>Only valid in independent mode.<br>COM20 to COM2<br>*: In WVGA mode: fixed 33-character × 15-line display |  |  |
|          |          | MD1                      |                                                                                                                                                                                                                                                                             |  |  | MD0                                                                                  | Main screen display area |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 0        | 0        | 40 characters × 13 lines |                                                                                                                                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 0        | 1        | 33 characters × 15 lines |                                                                                                                                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 1        | 0        | 40 characters × 16 lines |                                                                                                                                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 1        |          |                          |                                                                                                                                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 5        | D/ASEL   | 0                        | On                                                                                                                                                                                                                                                                          |  |  | D/A converter used/unused selection<br>Only valid in independent mode. COM20 to COM2 |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
|          |          | 1                        | Off                                                                                                                                                                                                                                                                         |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 4        | VBLKON   | 0                        | Disabled                                                                                                                                                                                                                                                                    |  |  | VBLK input selection                                                                 |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
|          |          | 1                        | Enabled                                                                                                                                                                                                                                                                     |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 3        | HBLKON   | 0                        | Disabled                                                                                                                                                                                                                                                                    |  |  | HBLK input selection                                                                 |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
|          |          | 1                        | Enabled                                                                                                                                                                                                                                                                     |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 2        | CKOP     | 0                        | Clock output positive polarity                                                                                                                                                                                                                                              |  |  | Clock output polarity selection                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
|          |          | 1                        | Clock output negative polarity                                                                                                                                                                                                                                              |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 1        | VBP      | 0                        | VBLK input negative polarity                                                                                                                                                             |  |  | VBLK input polarity selection                                                        |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
|          |          | 1                        | VBLK input positive polarity                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
| 0        | HBP      | 0                        | HBLK input negative polarity                                                                                                                                                             |  |  | HBLK input polarity selection                                                        |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |
|          |          | 1                        | HBLK input positive polarity                                                                                                                                                             |  |  |                                                                                      |                          |                          |   |   |                          |   |   |                          |   |   |                          |                                                                                                                                                 |  |  |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

**Command 25 (Output control 3 setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                 | Notes |
|----------|----------|---------|-------------------------------------------------|-------|
|          |          | State   | Function                                        |       |
| 7        | —        | 1       | Command 2 identification code<br>Output control |       |
| 6        | —        | 0       |                                                 |       |
| 5        | —        | 1       |                                                 |       |
| 4        | —        | 0       |                                                 |       |
| 3        | —        | 0       | Extended command 5 identification code          |       |
| 2        | —        | 1       |                                                 |       |
| 1        | —        | 0       |                                                 |       |
| 0        | —        | 1       |                                                 |       |

## • Second byte

| DA0 to 7 | Register | Content |                                                                                                                                                                                                                                                                                                                                                                           |      |                      | Notes                                                |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|----------|----------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------------|------------------------------------------------------|-------|---------------|---------------|-----------|---|------|---|-----------|---------------------------|------|---|------|----------------------|-----------------------------------------------------------------------------------------------------|--|--|--|---|---|------|---|---|------|---|
|          |          | State   | Function                                                                                                                                                                                                                                                                                                                                                                  |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 7        | CEHSL    | 0       | Normal operation                                                                                                                                                                                                                                                                                                                                                          |      |                      | $\overline{\text{CE}}$ pin                           |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | 1       | $\overline{\text{CE}}$ pin held fixed at the high level                                                                                                                                                                                                                                                                                                                   |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 6        | TOKSL    | 0       | Normal mode                                                                                                                                                                                                                                                                                                                                                               |      |                      | Transmissive mode specification                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | 1       | Transmissive mode<br>The color specified at address 0 in color table No. 1 is displayed in the transmissive state.                                                                                                                                                                                                                                                        |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 5        | VIPSL    | 0       | Falling edge detection                                                                                                                                                                                                                                                                                                                                                    |      |                      | Selects the detection polarity for the VSYNC signal. |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | 1       | Rising edge detection                                                                                                                                                                                                                                                                                                                                                     |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 4        | OTMD2    | 0       | Output off state (always low)                                                                                                                                                                                                                                                                                                                                             |      |                      | CLKOUT pin (pin 18)<br>Output control                |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | 1       | Normal output                                                                                                                                                                                                                                                                                                                                                             |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 3        | OTMD1    | 0       | <table><tr><th>OTMD2</th><th>OTMD1</th><th>OTMD0</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td><td>Normal</td></tr></table>                                                                                                                                                                                                                                   |      |                      |                                                      | OTMD2 | OTMD1         | OTMD0         | Output    | 0 | 0    | 0 | Normal    | A0 to 17 output selection |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | OTMD2   |                                                                                                                                                                                                                                                                                                                                                                           |      |                      |                                                      | OTMD1 | OTMD0         | Output        |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 0        | 0        | 0       | Normal                                                                                                                                                                                                                                                                                                                                                                    |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 1        |          |         |                                                                                                                                                                                                                                                                                                                                                                           |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 2        | OTMD0    | 0       | <table><tr><td>0</td><td>0</td><td>1</td><td>RGB No. 1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>RGB No. 2</td></tr><tr><td>0</td><td>1</td><td>1</td><td>High-impedance state</td></tr></table>                                                                                                                                                                     |      |                      |                                                      | 0     | 0             | 1             | RGB No. 1 | 0 | 1    | 0 | RGB No. 2 |                           | 0    | 1 | 1    | High-impedance state |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | 0       | 0                                                                                                                                                                                                                                                                                                                                                                         | 1    | RGB No. 1            |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | 0       | 1                                                                                                                                                                                                                                                                                                                                                                         | 0    | RGB No. 2            |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | 0       | 1                                                                                                                                                                                                                                                                                                                                                                         | 1    | High-impedance state |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 1        | QRM1     | 0       | <table><tr><th>QRM1</th><th>QRM0</th><th>ROM selection</th></tr><tr><td>0</td><td>0</td><td>ROM1</td></tr><tr><td>0</td><td>1</td><td>ROM2</td></tr><tr><td rowspan="2">0</td><td rowspan="2">QRM0</td><td>0</td><td colspan="4"><table><tr><td>1</td><td>0</td><td>ROM3</td></tr><tr><td>1</td><td>1</td><td>ROM4</td></tr></table></td></tr><tr><td>1</td></tr></table> |      |                      |                                                      | QRM1  | QRM0          | ROM selection | 0         | 0 | ROM1 | 0 | 1         |                           | ROM2 | 0 | QRM0 | 0                    | <table><tr><td>1</td><td>0</td><td>ROM3</td></tr><tr><td>1</td><td>1</td><td>ROM4</td></tr></table> |  |  |  | 1 | 0 | ROM3 | 1 | 1 | ROM4 | 1 |
|          |          | QRM1    |                                                                                                                                                                                                                                                                                                                                                                           |      |                      |                                                      | QRM0  | ROM selection |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | 0       |                                                                                                                                                                                                                                                                                                                                                                           |      |                      |                                                      | 0     | ROM1          |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 0        | 1        | ROM2    |                                                                                                                                                                                                                                                                                                                                                                           |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 0        | QRM0     | 0       | <table><tr><td>1</td><td>0</td><td>ROM3</td></tr><tr><td>1</td><td>1</td><td>ROM4</td></tr></table>                                                                                                                                                                                                                                                                       |      |                      |                                                      | 1     | 0             | ROM3          | 1         | 1 | ROM4 |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
|          |          | 1       | 0                                                                                                                                                                                                                                                                                                                                                                         | ROM3 |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 1        | 1        | ROM4    |                                                                                                                                                                                                                                                                                                                                                                           |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |
| 1        |          |         |                                                                                                                                                                                                                                                                                                                                                                           |      |                      |                                                      |       |               |               |           |   |      |   |           |                           |      |   |      |                      |                                                                                                     |  |  |  |   |   |      |   |   |      |   |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

## • When RGB No. 1 or RGB No. 2 is selected:

The A17 to 9 output is set to the RD2 to BD0 three-value output. (Supported by connecting external resistors.)

\* It will not be possible to use external ROM in this case. (Only internal ROM can be used.)

No. 1: RGB = 000 = Black only. Here the output will go to the high-impedance state giving the middle level due to the external resistor.

For areas other than the display area, the output will be at the low level.

No. 2: When any individual color is zero, the output will go to the high-impedance state giving the middle level due to the external resistor.

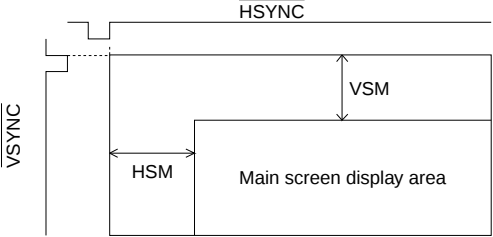
For areas other than the display area, the output will be at the low level.

**Command 30 (Main screen: vertical display start position setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                                       | Notes |
|----------|----------|---------|---------------------------------------------------------------------------------------|-------|
|          |          | State   | Function                                                                              |       |
| 7        | —        | 1       | Command 3 identification code<br>Main screen: vertical display start position setting |       |
| 6        | —        | 0       |                                                                                       |       |
| 5        | —        | 1       |                                                                                       |       |
| 4        | —        | 1       |                                                                                       |       |
| 3        | —        | 0       | Extended command 0 identification code                                                |       |
| 2        | —        | 0       |                                                                                       |       |
| 1        | —        | 0       |                                                                                       |       |
| 0        | —        | 0       |                                                                                       |       |

## • Second byte

| DA0 to 7 | Register   | Content |                                                                                                                                                                                                         | Notes                                                                                                                                                                                                                                          |
|----------|------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |            | State   | Function                                                                                                                                                                                                |                                                                                                                                                                                                                                                |
| 7        | VPM7 (MSB) | 0       | <p>The vertical display start position, VSM, is given by:</p> $VSM = 1H \times \left( \sum_{n=0}^7 2^n VPMn \right)$  | <p>Main screen</p> <p>The vertical display start position is specified by the 8 bits VPM7 to 0.</p> <p>The weight of the LSB is 1H in QVGA mode, and the weight of the LSB is 2H in WVGA mode</p> <p>This setting applies in screen units.</p> |
| 6        | VPM6       | 1       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 5        | VPM5       | 0       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 5        | VPM5       | 1       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 4        | VPM4       | 0       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 4        | VPM4       | 1       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 3        | VPM3       | 0       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 3        | VPM3       | 1       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 2        | VPM2       | 0       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 2        | VPM2       | 1       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 1        | VPM1       | 0       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 1        | VPM1       | 1       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 0        | VPM0 (LSB) | 0       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |
| 0        | VPM0 (LSB) | 1       |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                |

**Command 31 (Main screen: horizontal display start position setting command)**

## • First byte

| DA0 to 7 | Register   | Content |                                                                                         | Notes |
|----------|------------|---------|-----------------------------------------------------------------------------------------|-------|
|          |            | State   | Function                                                                                |       |
| 7        | —          | 1       | Command 3 identification code<br>Main screen: horizontal display start position setting |       |
| 6        | —          | 0       |                                                                                         |       |
| 5        | —          | 1       |                                                                                         |       |
| 4        | —          | 1       |                                                                                         |       |
| 3        | —          | 0       | Extended command 1 identification code                                                  |       |
| 2        | —          | 0       |                                                                                         |       |
| 1        | —          | 1       |                                                                                         |       |
| 0        | HPM8 (MSB) | 0       |                                                                                         |       |
|          |            | 1       |                                                                                         |       |

## • Second byte

| DA0 to 7 | Register   | Content |                                                                                                                                                                                                                                                                                                          | Notes                                                                                                                                                                                                                            |
|----------|------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |            | State   | Function                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                  |
| 7        | HPM7       | 0       | The horizontal display start position, HSM, is given by:<br>$\text{HSM} = 1\text{Tc} \times \left( \sum_{n=0}^8 2^n \text{HPM}n \right) + \alpha$ $\alpha = 57 \text{ Tc}$ Tc: The input clock frequency in operating mode.<br><br>• Setting disable range<br>QVGA : 00 to 07 HEX<br>WVGA : 00 to 07 HEX | Main screen<br>The horizontal display start position is specified by the 9 bits HPM8:0.<br>The weight of the LSB is 1TC in QVGA mode, and the weight of the LSB is 2TC in WVGA mode<br><br>This setting applies in screen units. |
|          |            | 1       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
| 6        | HPM6       | 0       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
|          |            | 1       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
| 5        | HPM5       | 0       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
|          |            | 1       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
| 4        | HPM4       | 0       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
|          |            | 1       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
| 3        | HPM3       | 0       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
|          |            | 1       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
| 2        | HPM2       | 0       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
|          |            | 1       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
| 1        | HPM1       | 0       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
|          |            | 1       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
| 0        | HPM0 (LSB) | 0       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |
|          |            | 1       |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |

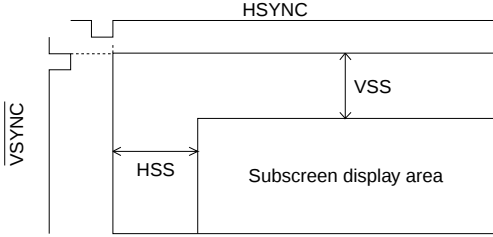
\*: This register is set to the all bits zero state when the IC is reset by the RST pin.

**Command 32 (Subscreen: vertical display start position setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                                     | Notes |
|----------|----------|---------|-------------------------------------------------------------------------------------|-------|
|          |          | State   | Function                                                                            |       |
| 7        | —        | 1       | Command 3 identification code<br>Subscreen: vertical display start position setting |       |
| 6        | —        | 0       |                                                                                     |       |
| 5        | —        | 1       |                                                                                     |       |
| 4        | —        | 1       |                                                                                     |       |
| 3        | —        | 0       | Extended command 2 identification code                                              |       |
| 2        | —        | 1       |                                                                                     |       |
| 1        | —        | 0       |                                                                                     |       |
| 0        | —        | 0       |                                                                                     |       |

## • Second byte

| DA0 to 7 | Register   | Content |                                                                                                                                                                                                          | Notes                                                                                                                                                                                                                                                    |
|----------|------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |            | State   | Function                                                                                                                                                                                                 |                                                                                                                                                                                                                                                          |
| 7        | VPS7 (MSB) | 0       | <p>The vertical display start position, VSS, is given by:</p> $VSS = 1H \times \left( \sum_{n=0}^7 2^n VPS_n \right)$  | <p>Subscreen (wallpaper)</p> <p>The vertical display start position is specified by the 8 bits VPS7 to 0.</p> <p>The weight of the LSB is 1H in QVGA mode, and the weight of the LSB is 2H in WVGA mode</p> <p>This setting applies in screen units.</p> |
| 6        | VPS6       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
|          |            | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
| 5        | VPS5       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
|          |            | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
| 4        | VPS4       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
|          |            | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
| 3        | VPS3       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
|          |            | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
| 2        | VPS2       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
|          |            | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
| 1        | VPS1       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
|          |            | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
| 0        | VPS0 (LSB) | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |
|          |            | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |

**Command 33 (Subscreen: horizontal display start position setting command)**

## • First byte

| DA0 to 7 | Register   | Content |                                                                                       | Notes |
|----------|------------|---------|---------------------------------------------------------------------------------------|-------|
|          |            | State   | Function                                                                              |       |
| 7        | —          | 1       | Command 3 identification code<br>Subscreen: horizontal display start position setting |       |
| 6        | —          | 0       |                                                                                       |       |
| 5        | —          | 1       |                                                                                       |       |
| 4        | —          | 1       |                                                                                       |       |
| 3        | —          | 0       | Extended command 3 identification code                                                |       |
| 2        | —          | 1       |                                                                                       |       |
| 1        | —          | 1       |                                                                                       |       |
| 0        | HPS8 (MSB) | 0       |                                                                                       |       |
|          |            | 1       |                                                                                       |       |

## • Second byte

| DA0 to 7 | Register   | Content |                                                                                                                                                                                                                                                                             | Notes                                                                                                                                                                                                                                         |
|----------|------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |            | State   | Function                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                               |
| 7        | HPS7       | 0       | The horizontal display start position, HSS, is given by:<br>$HSS = 1Tc \times \left( \sum_{n=0}^8 2^n HPSn \right) + \alpha$ $\alpha = 14 Tc$ Tc: The input clock frequency in operating mode.<br><br>• Setting disable range<br>QVGA : 00 to 2F HEX<br>WVGA : 00 to 17 HEX | Subscreen (wallpaper)<br>The horizontal display start position is specified by the 9 bits HPS8 to 0.<br>The weight of the LSB is 1TC in QVGA mode, and the weight of the LSB is 2TC in WVGA mode<br><br>This setting applies in screen units. |
|          |            | 1       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
| 6        | HPS6       | 0       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
|          |            | 1       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
| 5        | HPS5       | 0       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
|          |            | 1       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
| 4        | HPS4       | 0       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
|          |            | 1       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
| 3        | HPS3       | 0       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
|          |            | 1       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
| 2        | HPS2       | 0       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
|          |            | 1       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
| 1        | HPS1       | 0       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
|          |            | 1       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
| 0        | HPS0 (LSB) | 0       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |
|          |            | 1       |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                               |

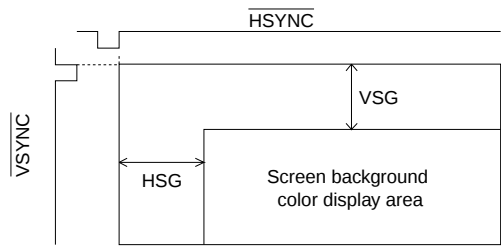
\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{RST}$  pin.

**Command 34 (Screen background color: vertical display start position setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                                                   | Notes |
|----------|----------|---------|---------------------------------------------------------------------------------------------------|-------|
|          |          | State   | Function                                                                                          |       |
| 7        | —        | 1       | Command 3 identification code<br>Screen background color: vertical display start position setting |       |
| 6        | —        | 0       |                                                                                                   |       |
| 5        | —        | 1       |                                                                                                   |       |
| 4        | —        | 1       |                                                                                                   |       |
| 3        | —        | 1       | Extended command 4 identification code                                                            |       |
| 2        | —        | 0       |                                                                                                   |       |
| 1        | —        | 0       |                                                                                                   |       |
| 0        | —        | 0       |                                                                                                   |       |

## • Second byte

| DA0 to 7 | Register   | Content |                                                                                                                                                                                                          | Notes                                                                                                                                                                                                                                                      |
|----------|------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |            | State   | Function                                                                                                                                                                                                 |                                                                                                                                                                                                                                                            |
| 7        | VPG7 (MSB) | 0       | <p>The vertical display start position, VSG, is given by:</p> $VSG = 1H \times \left( \sum_{n=0}^7 2^n VPG_n \right)$  | <p>Screen background color</p> <p>The vertical display start position is specified by the 8 bits VPG7 to 0.</p> <p>The weight of the LSB is 1H in QVGA mode, and the weight of the LSB is 2H in WVGA mode</p> <p>This setting applies in screen units.</p> |
| 6        | VPG6       | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 5        | VPG5       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 5        | VPG5       | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 4        | VPG4       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 4        | VPG4       | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 3        | VPG3       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 3        | VPG3       | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 2        | VPG2       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 2        | VPG2       | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 1        | VPG1       | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 1        | VPG1       | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 0        | VPG0 (LSB) | 0       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |
| 0        | VPG0 (LSB) | 1       |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |

**Command 35 (Screen background color: horizontal display start position setting command)**

## • First byte

| DA0 to 7 | Register   | Content |                                                                                                     | Notes |
|----------|------------|---------|-----------------------------------------------------------------------------------------------------|-------|
|          |            | State   | Function                                                                                            |       |
| 7        | —          | 1       | Command 3 identification code<br>Screen background color: horizontal display start position setting |       |
| 6        | —          | 0       |                                                                                                     |       |
| 5        | —          | 1       |                                                                                                     |       |
| 4        | —          | 1       |                                                                                                     |       |
| 3        | —          | 1       | Extended command 5 identification code                                                              |       |
| 2        | —          | 0       |                                                                                                     |       |
| 1        | —          | 1       |                                                                                                     |       |
| 0        | HPS8 (MSB) | 0       |                                                                                                     |       |
|          |            | 1       |                                                                                                     |       |

## • Second byte

| DA0 to 7 | Register   | Content |                                                                                                                                                                   | Notes                                                                                                                                                                                                                                       |
|----------|------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |            | State   | Function                                                                                                                                                          |                                                                                                                                                                                                                                             |
| 7        | HPG7       | 0       | The horizontal display start position, HSG, is given by:<br>$HSG = 1Tc \times \left( \sum_{n=0}^8 HPG_n \right)$ Tc: The input clock frequency in operating mode. | Screen background color<br>The horizontal display start position is specified by the 9 bits HPG8 to 0.<br>The weight of the LSB is 1TC in QVGA mode, and the weight of the LSB is 2TC in WVGA mode<br>This setting applies in screen units. |
|          |            | 1       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
| 6        | HPG6       | 0       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
|          |            | 1       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
| 5        | HPG5       | 0       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
|          |            | 1       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
| 4        | HPG4       | 0       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
|          |            | 1       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
| 3        | HPG3       | 0       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
|          |            | 1       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
| 2        | HPG2       | 0       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
|          |            | 1       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
| 1        | HPG1       | 0       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
|          |            | 1       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
| 0        | HPG0 (LSB) | 0       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |
|          |            | 1       |                                                                                                                                                                   |                                                                                                                                                                                                                                             |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{RST}$  pin.

**Command 40 (Character size control setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                        | Notes |
|----------|----------|---------|------------------------------------------------------------------------|-------|
|          |          | State   | Function                                                               |       |
| 7        | —        | 1       | Command 4 identification code<br>Display character data write settings |       |
| 6        | —        | 1       |                                                                        |       |
| 5        | —        | 0       |                                                                        |       |
| 4        | —        | 0       |                                                                        |       |
| 3        | —        | 0       | Extended command 0 identification code                                 |       |
| 2        | —        | 0       |                                                                        |       |
| 1        | —        | 0       |                                                                        |       |
| 0        | —        | 0       |                                                                        |       |

## • Second byte

| DA0 to 7 | Register | Content |                                                                                                                                                                                                                                           |    |  | Notes |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
|----------|----------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--|-------|----------------|----------------|---|---|----|---|---|----|---|---|----|---|---|----|--------------------------------------------------------------------------------------------------|
|          |          | State   | Function                                                                                                                                                                                                                                  |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 7        | —        | 0       |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 6        | —        | 0       |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 5        | —        | 0       |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 4        | —        | 0       |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 3        | SZV1     | 0       | <table><tr><th>SZV1</th><th>SZV0</th><th>Character size</th></tr><tr><td>0</td><td>0</td><td>1×</td></tr><tr><td>0</td><td>1</td><td>2×</td></tr><tr><td>1</td><td>0</td><td>3×</td></tr><tr><td>1</td><td>1</td><td>4×</td></tr></table> |    |  | SZV1  | SZV0           | Character size | 0 | 0 | 1× | 0 | 1 | 2× | 1 | 0 | 3× | 1 | 1 | 4× | Specifies the character size in the vertical direction.<br>This setting applies in line units.   |
|          |          | SZV1    |                                                                                                                                                                                                                                           |    |  | SZV0  | Character size |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 0        | 0        | 1×      |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 0        | 1        | 2×      |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 1        | 0        | 3×      |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 1        | 1        | 4×      |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 1        |          |         |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 2        | SZV0     | 0       |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
|          |          | 0       | 1                                                                                                                                                                                                                                         | 2× |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
|          |          | 1       | 0                                                                                                                                                                                                                                         | 3× |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
|          |          | 1       | 1                                                                                                                                                                                                                                         | 4× |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 1        | SZH1     | 0       | <table><tr><th>SZH1</th><th>SZH0</th><th>Character size</th></tr><tr><td>0</td><td>0</td><td>1×</td></tr><tr><td>0</td><td>1</td><td>2×</td></tr><tr><td>1</td><td>0</td><td>3×</td></tr><tr><td>1</td><td>1</td><td>4×</td></tr></table> |    |  | SZH1  | SZH0           | Character size | 0 | 0 | 1× | 0 | 1 | 2× | 1 | 0 | 3× | 1 | 1 | 4× | Specifies the character size in the horizontal direction.<br>This setting applies in line units. |
|          |          | SZH1    |                                                                                                                                                                                                                                           |    |  | SZH0  | Character size |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 0        | 0        | 1×      |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 0        | 1        | 2×      |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 1        | 0        | 3×      |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 1        | 1        | 4×      |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 1        |          |         |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
| 0        | SZH0     | 0       |                                                                                                                                                                                                                                           |    |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
|          |          | 0       | 1                                                                                                                                                                                                                                         | 2× |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
|          |          | 1       | 0                                                                                                                                                                                                                                         | 3× |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |
|          |          | 1       | 1                                                                                                                                                                                                                                         | 4× |  |       |                |                |   |   |    |   |   |    |   |   |    |   |   |    |                                                                                                  |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

**Command 41 (Character size line U control setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                | Notes |
|----------|----------|---------|----------------------------------------------------------------|-------|
|          |          | State   | Function                                                       |       |
| 7        | —        | 1       | Command 4 identification code<br>Character size line U control |       |
| 6        | —        | 1       |                                                                |       |
| 5        | —        | 0       |                                                                |       |
| 4        | —        | 0       |                                                                |       |
| 3        | —        | 0       | Extended command 1 identification code                         |       |
| 2        | —        | 1       |                                                                |       |
| 1        | —        | 0       |                                                                |       |
| 0        | —        | 0       |                                                                |       |

## • Second byte

| DA0 to 7 | Register | Content |                        | Notes                                              |
|----------|----------|---------|------------------------|----------------------------------------------------|
|          |          | State   | Function               |                                                    |
| 7        | LSZ7     | 0       | Do not set for line 8. | Character size line setting control<br>Upper lines |
|          |          | 1       | Set for line 8.        |                                                    |
| 6        | LSZ6     | 0       | Do not set for line 7. |                                                    |
|          |          | 1       | Set for line 7.        |                                                    |
| 5        | LSZ5     | 0       | Do not set for line 6. |                                                    |
|          |          | 1       | Set for line 6.        |                                                    |
| 4        | LSZ4     | 0       | Do not set for line 5. |                                                    |
|          |          | 1       | Set for line 5.        |                                                    |
| 3        | LSZ3     | 0       | Do not set for line 4. |                                                    |
|          |          | 1       | Set for line 4.        |                                                    |
| 2        | LSZ2     | 0       | Do not set for line 3. |                                                    |
|          |          | 1       | Set for line 3.        |                                                    |
| 1        | LSZ1     | 0       | Do not set for line 2. |                                                    |
|          |          | 1       | Set for line 2.        |                                                    |
| 0        | LSZ0     | 0       | Do not set for line 1. |                                                    |
|          |          | 1       | Set for line 1.        |                                                    |

**Command 42 (Character size line D control setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                | Notes |
|----------|----------|---------|----------------------------------------------------------------|-------|
|          |          | State   | Function                                                       |       |
| 7        | —        | 1       | Command 4 identification code<br>Character size line D control |       |
| 6        | —        | 1       |                                                                |       |
| 5        | —        | 0       |                                                                |       |
| 4        | —        | 0       |                                                                |       |
| 3        | —        | 1       | Extended command 2 identification code                         |       |
| 2        | —        | 0       |                                                                |       |
| 1        | —        | 0       |                                                                |       |
| 0        | —        | 0       |                                                                |       |

## • Second byte

| DA0 to 7 | Register | Content |                         | Notes                                              |
|----------|----------|---------|-------------------------|----------------------------------------------------|
|          |          | State   | Function                |                                                    |
| 7        | LSZ15    | 0       | Do not set for line 16. | Character size line setting control<br>Lower lines |
|          |          | 1       | Set for line 16.        |                                                    |
| 6        | LSZ14    | 0       | Do not set for line 15. |                                                    |
|          |          | 1       | Set for line 15.        |                                                    |
| 5        | LSZ13    | 0       | Do not set for line 14. |                                                    |
|          |          | 1       | Set for line 14.        |                                                    |
| 4        | LSZ12    | 0       | Do not set for line 13. |                                                    |
|          |          | 1       | Set for line 13.        |                                                    |
| 3        | LSZ11    | 0       | Do not set for line 12. |                                                    |
|          |          | 1       | Set for line 12.        |                                                    |
| 2        | LSZ10    | 0       | Do not set for line 11. |                                                    |
|          |          | 1       | Set for line 11.        |                                                    |
| 1        | LSZ9     | 0       | Do not set for line 10. |                                                    |
|          |          | 1       | Set for line 10.        |                                                    |
| 0        | LSZ8     | 0       | Do not set for line 9.  |                                                    |
|          |          | 1       | Set for line 9.         |                                                    |

**Command 50 (Box control: U setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                         | Notes |
|----------|----------|---------|---------------------------------------------------------|-------|
|          |          | State   | Function                                                |       |
| 7        | —        | 1       | Command 5 identification code<br>Box control U settings |       |
| 6        | —        | 1       |                                                         |       |
| 5        | —        | 0       |                                                         |       |
| 4        | —        | 1       |                                                         |       |
| 3        | —        | 0       | Extended command 0 identification code                  |       |
| 2        | —        | 0       |                                                         |       |
| 1        | —        | 0       |                                                         |       |
| 0        | —        | 0       |                                                         |       |

## • Second byte

| DA0 to 7 | Register | Content |                                                                                     | Notes                                                                                       |
|----------|----------|---------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
|          |          | State   | Function                                                                            |                                                                                             |
| 7        | BXUW     | 0       | Box display: upper side is 1 dot.                                                   | Box display: upper side<br>Dot width. This setting applies in line units.                   |
|          |          | 1       | Box display: upper side is 2 dots.                                                  |                                                                                             |
| 6        | BXLW     | 0       | Box display: left side is 1 dot.                                                    | Box display: left side<br>Dot width. This setting applies in line units.                    |
|          |          | 1       | Box display: left side is 2 dots.                                                   |                                                                                             |
| 5        | —        | 0       |                                                                                     |                                                                                             |
| 4        | BXUCT0   | 0       | Color table No. 1                                                                   | Box display: upper side<br>Color table specification<br>This setting applies in line units. |
|          |          | 1       | Color table No. 2                                                                   |                                                                                             |
| 3        | BXUC3    | 0       | Box display: upper side color specification<br>0000 to 1111<br>0 to F (hexadecimal) | Box display: upper side<br>Color specification<br>This setting applies in line units.       |
|          |          | 1       |                                                                                     |                                                                                             |
| 2        | BXUC2    | 0       |                                                                                     |                                                                                             |
|          |          | 1       |                                                                                     |                                                                                             |
| 1        | BXUC1    | 0       |                                                                                     |                                                                                             |
|          |          | 1       |                                                                                     |                                                                                             |
| 0        | BXUC0    | 0       |                                                                                     |                                                                                             |
|          |          | 1       |                                                                                     |                                                                                             |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

**Command 51 (Box control: D setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                         | Notes |
|----------|----------|---------|---------------------------------------------------------|-------|
|          |          | State   | Function                                                |       |
| 7        | —        | 1       | Command 5 identification code<br>Box control D settings |       |
| 6        | —        | 1       |                                                         |       |
| 5        | —        | 0       |                                                         |       |
| 4        | —        | 1       |                                                         |       |
| 3        | —        | 0       | Extended command 1 identification code                  |       |
| 2        | —        | 1       |                                                         |       |
| 1        | —        | 0       |                                                         |       |
| 0        | —        | 0       |                                                         |       |

## • Second byte

| DA0 to 7 | Register | Content |                                                                                     | Notes                                                                                       |
|----------|----------|---------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
|          |          | State   | Function                                                                            |                                                                                             |
| 7        | BXDW     | 0       | Box display: lower side is 1 dot.                                                   | Box display: lower side<br>Dot width. This setting applies in line units.                   |
|          |          | 1       | Box display: lower side is 2 dots.                                                  |                                                                                             |
| 6        | BXRW     | 0       | Box display: right side is 1 dot.                                                   | Box display: right side<br>Dot width. This setting applies in line units.                   |
|          |          | 1       | Box display: right side is 2 dots.                                                  |                                                                                             |
| 5        | —        | 0       |                                                                                     |                                                                                             |
| 4        | BXDCT0   | 0       | Color table No. 1                                                                   | Box display: lower side<br>Color table specification<br>This setting applies in line units. |
|          |          | 1       | Color table No. 2                                                                   |                                                                                             |
| 3        | BXDC3    | 0       | Box display: lower side color specification<br>0000 to 1111<br>0 to F (hexadecimal) | Box display: lower side<br>Color specification<br>This setting applies in line units.       |
|          |          | 1       |                                                                                     |                                                                                             |
| 2        | BXDC2    | 0       |                                                                                     |                                                                                             |
|          |          | 1       |                                                                                     |                                                                                             |
| 1        | BXDC1    | 0       |                                                                                     |                                                                                             |
|          |          | 1       |                                                                                     |                                                                                             |
| 0        | BXDC0    | 0       |                                                                                     |                                                                                             |
|          |          | 1       |                                                                                     |                                                                                             |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

**Command 52 (Box control: U line setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                             | Notes |
|----------|----------|---------|-------------------------------------------------------------|-------|
|          |          | State   | Function                                                    |       |
| 7        | —        | 1       | Command 5 identification code<br>Box control U line setting |       |
| 6        | —        | 1       |                                                             |       |
| 5        | —        | 0       |                                                             |       |
| 4        | —        | 1       | Extended command 2 identification code                      |       |
| 3        | —        | 1       |                                                             |       |
| 2        | —        | 0       |                                                             |       |
| 1        | —        | 0       |                                                             |       |
| 0        | —        | 0       |                                                             |       |

## • Second byte

| DA0 to 7 | Register | Content |                        | Notes                                           |
|----------|----------|---------|------------------------|-------------------------------------------------|
|          |          | State   | Function               |                                                 |
| 7        | LBX7     | 0       | Do not set for line 8. | Box control line setting control<br>Upper lines |
|          |          | 1       | Set for line 8.        |                                                 |
| 6        | LBX6     | 0       | Do not set for line 7. |                                                 |
|          |          | 1       | Set for line 7.        |                                                 |
| 5        | LBX5     | 0       | Do not set for line 6. |                                                 |
|          |          | 1       | Set for line 6.        |                                                 |
| 4        | LBX4     | 0       | Do not set for line 5. |                                                 |
|          |          | 1       | Set for line 5.        |                                                 |
| 3        | LBX3     | 0       | Do not set for line 4. |                                                 |
|          |          | 1       | Set for line 4.        |                                                 |
| 2        | LBX2     | 0       | Do not set for line 3. |                                                 |
|          |          | 1       | Set for line 3.        |                                                 |
| 1        | LBX1     | 0       | Do not set for line 2. |                                                 |
|          |          | 1       | Set for line 2.        |                                                 |
| 0        | LBX0     | 0       | Do not set for line 1. |                                                 |
|          |          | 1       | Set for line 1.        |                                                 |

**Command 53 (Box control: D line control setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                             | Notes |
|----------|----------|---------|-------------------------------------------------------------|-------|
|          |          | State   | Function                                                    |       |
| 7        | —        | 1       | Command 4 identification code<br>Box control D line setting |       |
| 6        | —        | 1       |                                                             |       |
| 5        | —        | 0       |                                                             |       |
| 4        | —        | 0       |                                                             |       |
| 3        | —        | 1       | Extended command 3 identification code                      |       |
| 2        | —        | 1       |                                                             |       |
| 1        | —        | 0       |                                                             |       |
| 0        | —        | 0       |                                                             |       |

## • Second byte

| DA0 to 7 | Register | Content |                         | Notes                                           |
|----------|----------|---------|-------------------------|-------------------------------------------------|
|          |          | State   | Function                |                                                 |
| 7        | LBX15    | 0       | Do not set for line 16. | Box control line setting control<br>Lower lines |
|          |          | 1       | Set for line 16.        |                                                 |
| 6        | LBX14    | 0       | Do not set for line 15. |                                                 |
|          |          | 1       | Set for line 15.        |                                                 |
| 5        | LBX13    | 0       | Do not set for line 14. |                                                 |
|          |          | 1       | Set for line 14.        |                                                 |
| 4        | LBX12    | 0       | Do not set for line 13. |                                                 |
|          |          | 1       | Set for line 13.        |                                                 |
| 3        | LBX11    | 0       | Do not set for line 12. |                                                 |
|          |          | 1       | Set for line 12.        |                                                 |
| 2        | LBX10    | 0       | Do not set for line 11. |                                                 |
|          |          | 1       | Set for line 11.        |                                                 |
| 1        | LBX9     | 0       | Do not set for line 10. |                                                 |
|          |          | 1       | Set for line 10.        |                                                 |
| 0        | LBX8     | 0       | Do not set for line 9.  |                                                 |
|          |          | 1       | Set for line 9.         |                                                 |

**Command 60 (Border control setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                         |      |                                  | Notes                                                            |
|----------|----------|---------|---------------------------------------------------------|------|----------------------------------|------------------------------------------------------------------|
|          |          | State   | Function                                                |      |                                  |                                                                  |
| 7        | —        | 1       | Command 6 identification code<br>Border control setting |      |                                  |                                                                  |
| 6        | —        | 1       |                                                         |      |                                  |                                                                  |
| 5        | —        | 1       |                                                         |      |                                  |                                                                  |
| 4        | —        | 0       |                                                         |      |                                  |                                                                  |
| 3        | —        | 0       | Extended command 0 identification code                  |      |                                  |                                                                  |
| 2        | —        | 0       |                                                         |      |                                  |                                                                  |
| 1        | BLK1     | 0       | BLK1                                                    | BLK0 | Border mode specification        | Border mode specification<br>This setting applies in line units. |
|          |          | 1       | 0                                                       | 0    | Normal display                   |                                                                  |
| 0        | BLK0     | 0       | 0                                                       | 1    | Border                           |                                                                  |
|          |          | 1       | 1                                                       | 0    | Shadow 1 (lower side)            |                                                                  |
|          |          | 1       | 1                                                       | 1    | Shadow 2 (lower and right sides) |                                                                  |
|          |          |         |                                                         |      |                                  |                                                                  |

## • Second byte

| DA0 to 7 | Register | Content |                                                                             | Notes                                                                              |
|----------|----------|---------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|          |          | State   | Function                                                                    |                                                                                    |
| 7        | —        | 0       |                                                                             |                                                                                    |
| 6        | —        | 0       |                                                                             |                                                                                    |
| 5        | —        | 0       |                                                                             |                                                                                    |
| 4        | EGCT0    | 0       | Color table No. 1                                                           | Border display<br>Color table specification<br>This setting applies in line units. |
|          |          | 1       | Color table No. 2                                                           |                                                                                    |
| 3        | EGC3     | 0       | Border display: color specification<br>0000 to 1111<br>0 to F (hexadecimal) | Border display<br>color specification<br>This setting applies in line units.       |
|          |          | 1       |                                                                             |                                                                                    |
| 2        | EGC2     | 0       |                                                                             |                                                                                    |
|          |          | 1       |                                                                             |                                                                                    |
| 1        | EGC1     | 0       |                                                                             |                                                                                    |
|          |          | 1       |                                                                             |                                                                                    |
| 0        | EGC0     | 0       |                                                                             |                                                                                    |
|          |          | 1       |                                                                             |                                                                                    |

\*: This register is set to the all bits zero state when the IC is reset by the RST pin.

**Command 61 (Border control U line setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                | Notes |
|----------|----------|---------|----------------------------------------------------------------|-------|
|          |          | State   | Function                                                       |       |
| 7        | —        | 1       | Command 6 identification code<br>Border control U line setting |       |
| 6        | —        | 1       |                                                                |       |
| 5        | —        | 1       |                                                                |       |
| 4        | —        | 0       | Extended command 1 identification code                         |       |
| 3        | —        | 0       |                                                                |       |
| 2        | —        | 1       |                                                                |       |
| 1        | —        | 0       |                                                                |       |
| 0        | —        | 0       |                                                                |       |

## • Second byte

| DA0 to 7 | Register | Content |                        | Notes                                               |
|----------|----------|---------|------------------------|-----------------------------------------------------|
|          |          | State   | Function               |                                                     |
| 7        | LFC7     | 0       | Do not set for line 8. | Border control line settings control<br>Upper lines |
|          |          | 1       | Set for line 8.        |                                                     |
| 6        | LFC6     | 0       | Do not set for line 7. |                                                     |
|          |          | 1       | Set for line 7.        |                                                     |
| 5        | LFC5     | 0       | Do not set for line 6. |                                                     |
|          |          | 1       | Set for line 6.        |                                                     |
| 4        | LFC4     | 0       | Do not set for line 5. |                                                     |
|          |          | 1       | Set for line 5.        |                                                     |
| 3        | LFC3     | 0       | Do not set for line 4. |                                                     |
|          |          | 1       | Set for line 4.        |                                                     |
| 2        | LFC2     | 0       | Do not set for line 3. |                                                     |
|          |          | 1       | Set for line 3.        |                                                     |
| 1        | LFC1     | 0       | Do not set for line 2. |                                                     |
|          |          | 1       | Set for line 2.        |                                                     |
| 0        | LFC0     | 0       | Do not set for line 1. |                                                     |
|          |          | 1       | Set for line 1.        |                                                     |

**Command 62 (Border control D line setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                | Notes |
|----------|----------|---------|----------------------------------------------------------------|-------|
|          |          | State   | Function                                                       |       |
| 7        | —        | 1       | Command 6 identification code<br>Border control D line setting |       |
| 6        | —        | 1       |                                                                |       |
| 5        | —        | 1       |                                                                |       |
| 4        | —        | 0       |                                                                |       |
| 3        | —        | 1       | Extended command 2 identification code                         |       |
| 2        | —        | 0       |                                                                |       |
| 1        | —        | 0       |                                                                |       |
| 0        | —        | 0       |                                                                |       |

## • Second byte

| DA0 to 7 | Register | Content |                         | Notes                                               |
|----------|----------|---------|-------------------------|-----------------------------------------------------|
|          |          | State   | Function                |                                                     |
| 7        | LFC15    | 0       | Do not set for line 16. | Border control line settings control<br>Lower lines |
|          |          | 1       | Set for line 16.        |                                                     |
| 6        | LFC14    | 0       | Do not set for line 15. |                                                     |
|          |          | 1       | Set for line 15.        |                                                     |
| 5        | LFC13    | 0       | Do not set for line 14. |                                                     |
|          |          | 1       | Set for line 14.        |                                                     |
| 4        | LFC12    | 0       | Do not set for line 13. |                                                     |
|          |          | 1       | Set for line 13.        |                                                     |
| 3        | LFC11    | 0       | Do not set for line 12. |                                                     |
|          |          | 1       | Set for line 12.        |                                                     |
| 2        | LFC10    | 0       | Do not set for line 11. |                                                     |
|          |          | 1       | Set for line 11.        |                                                     |
| 1        | LFC9     | 0       | Do not set for line 10. |                                                     |
|          |          | 1       | Set for line 10.        |                                                     |
| 0        | LFC8     | 0       | Do not set for line 9.  |                                                     |
|          |          | 1       | Set for line 9.         |                                                     |

**Command 70 (Color table write address setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                    | Notes |
|----------|----------|---------|--------------------------------------------------------------------|-------|
|          |          | State   | Function                                                           |       |
| 7        | —        | 1       | Command 7 identification code<br>Color table write address setting |       |
| 6        | —        | 1       |                                                                    |       |
| 5        | —        | 1       |                                                                    |       |
| 4        | —        | 1       |                                                                    |       |
| 3        | —        | 0       | Sub-identifier code 0                                              |       |
| 2        | —        | 0       |                                                                    |       |
| 1        | —        | 0       |                                                                    |       |
| 0        | —        | 0       |                                                                    |       |

## • Second byte

| DA0 to 7 | Register      | Content |                                                                  | Notes                                   |
|----------|---------------|---------|------------------------------------------------------------------|-----------------------------------------|
|          |               | State   | Function                                                         |                                         |
| 7        | —             |         |                                                                  |                                         |
| 6        | —             |         |                                                                  |                                         |
| 5        | —             |         |                                                                  |                                         |
| 4        | CTN1          | 0       | Color table No. 1 selected                                       | Color table selection<br>No. 1 or No. 2 |
|          |               | 1       | Color table No. 2 selected                                       |                                         |
| 3        | CTA3<br><MSB> | 0       | Color table address<br>0 to 15<br>0 to F (hexadecimal) 16 values | Addresses of the color tables           |
|          |               | 1       |                                                                  |                                         |
| 2        | CTA2          | 0       |                                                                  |                                         |
|          |               | 1       |                                                                  |                                         |
| 1        | CTA1          | 0       |                                                                  |                                         |
|          |               | 1       |                                                                  |                                         |
| 0        | CTA0<br><LSB> | 0       |                                                                  |                                         |
|          |               | 1       |                                                                  |                                         |

**Command 71 (Color table data write setting command)**

## • First byte

| DA0 to 7 | Register | Content |                                                                       |        | Notes                                                                                                                                    |                                 |
|----------|----------|---------|-----------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
|          |          | State   | Function                                                              |        |                                                                                                                                          |                                 |
| 7        | —        | 1       | Command 7 identification code<br>Display character data write setting |        | When this command has been issued, the IC remains in display character data write mode until the $\overline{\text{CS}}$ pin is set high. |                                 |
| 6        | —        | 1       |                                                                       |        |                                                                                                                                          |                                 |
| 5        | —        | 1       |                                                                       |        |                                                                                                                                          |                                 |
| 4        | —        | 1       |                                                                       |        |                                                                                                                                          |                                 |
| 3        | —        | 0       | Sub-identifier code 1                                                 |        |                                                                                                                                          |                                 |
| 2        | —        | 1       |                                                                       |        |                                                                                                                                          |                                 |
| 1        | —        | 0       |                                                                       |        |                                                                                                                                          |                                 |
| 0        | RM3      | 0       | RM3                                                                   | Mode   |                                                                                                                                          | Continuous write mode selection |
|          |          |         | 0                                                                     | [1][2] | End                                                                                                                                      |                                 |
|          |          | 1       | 1                                                                     | [1][2] | Continuous                                                                                                                               |                                 |

## • Second byte (1)

| DA0 to 7 | Register | Content |                                                               | Notes                 |
|----------|----------|---------|---------------------------------------------------------------|-----------------------|
|          |          | State   | Function                                                      |                       |
| 7        | —        | 0       |                                                               |                       |
| 6        | —        | 0       |                                                               |                       |
| 5        | —        | 0       |                                                               |                       |
| 4        | —        | 0       |                                                               |                       |
| 3        | TOK      | 0       | Color                                                         |                       |
|          |          | 1       | Transparent (BLK output: low)                                 |                       |
| 2        | TB2      | 0       | Color table<br>B output<br>000 to 111<br>0 to 7 (hexadecimal) | Color table setting B |
|          |          | 1       |                                                               |                       |
| 1        | TB1      | 0       |                                                               |                       |
|          |          | 1       |                                                               |                       |
| 0        | TB0      | 0       |                                                               |                       |
|          |          | 1       |                                                               |                       |

## • Second byte (2)

| DA0 to 7 | Register | Content |                                                               | Notes                 |
|----------|----------|---------|---------------------------------------------------------------|-----------------------|
|          |          | State   | Function                                                      |                       |
| 7        | —        | 0       |                                                               |                       |
| 6        | —        | 0       |                                                               |                       |
| 5        | TG2      | 0       | Color table<br>G output<br>000 to 111<br>0 to 7 (hexadecimal) | Color table setting G |
|          |          | 1       |                                                               |                       |
| 4        | TG1      | 0       |                                                               |                       |
|          |          | 1       |                                                               |                       |
| 3        | TG0      | 0       | Color table<br>R output<br>000 to 111<br>0 to 7 (hexadecimal) | Color table setting R |
|          |          | 1       |                                                               |                       |
| 2        | TR2      | 0       |                                                               |                       |
|          |          | 1       |                                                               |                       |
| 1        | TR1      | 0       |                                                               |                       |
|          |          | 1       |                                                               |                       |
| 0        | TR0      | 0       |                                                               |                       |
|          |          | 1       |                                                               |                       |

\*: This register is set to the all bits zero state when the IC is reset by the  $\overline{\text{RST}}$  pin.

When transparent is selected, the BLK output is set to the low level. (Transparent state)

The RGB outputs are values from the color table.

The transparent specification is best for color table 1, address 0000.

Since the data is set to all zeros by a RAM clear operation,  
the RGB output will be 000 (black) and the BLK output will be 1.

Transparent is specified by setting the TOK bit to 1. (The BLK output will go to the low level.)

## Display Structure

The display screen consists of a 40-character × 15-line grid.

QVGA mode (12 × 18 dot characters)

40-character × 13-line QVGA panel (480 × 234)

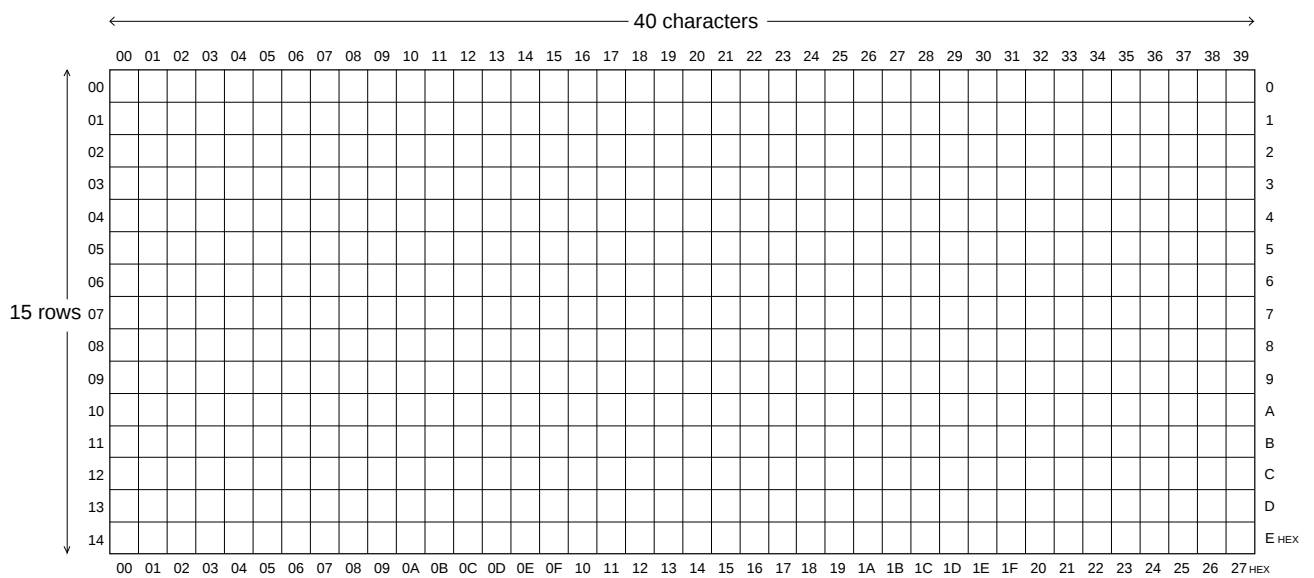
WVGA mode (12 × 16 dot characters)

33-character × 15-line WVGA panel (800 × 480)

Up to a maximum of 600 characters can be displayed.

If the character size is increased, the number of characters that can be displayed will decrease to be fewer than 600 characters.

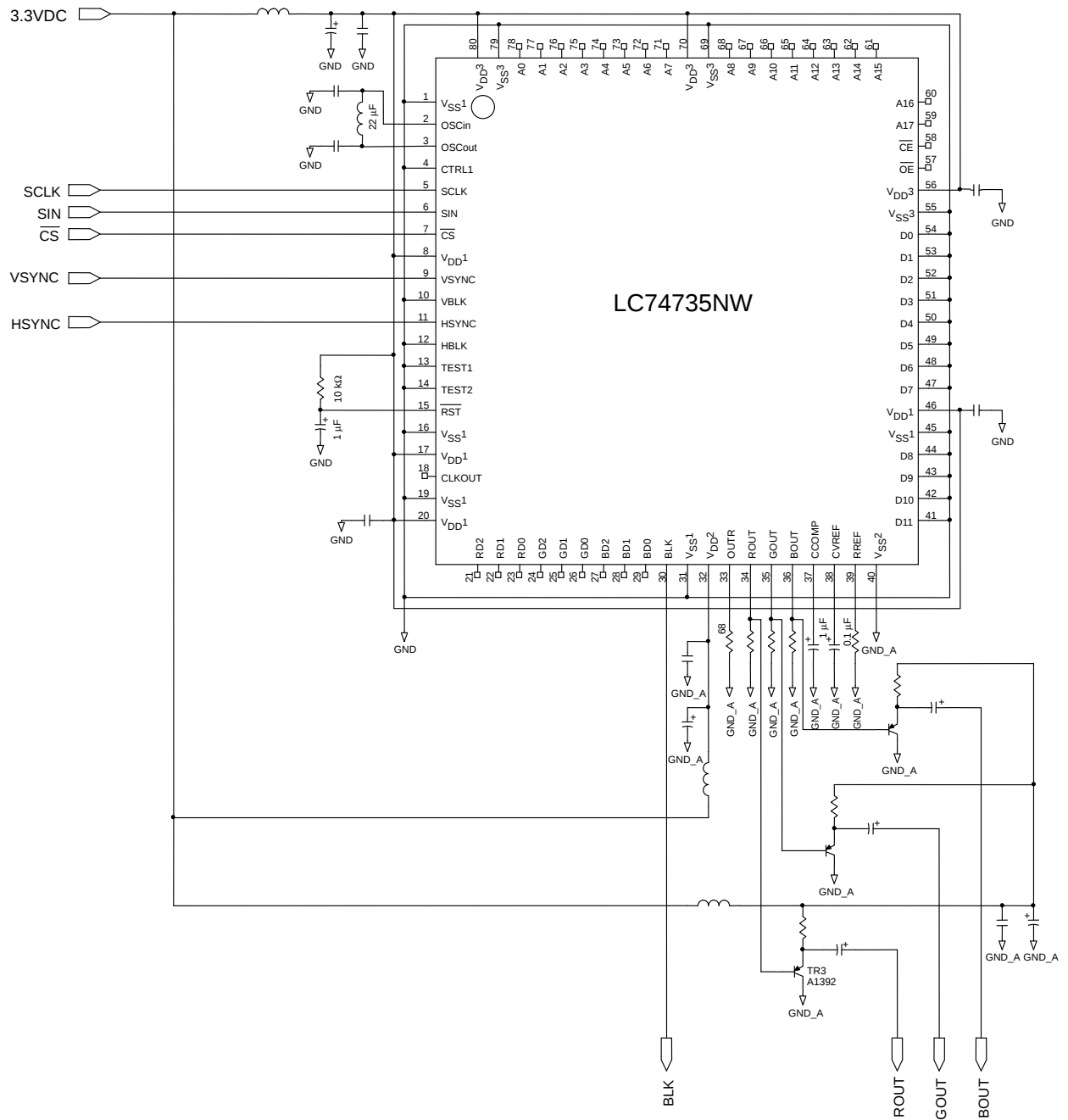
Display memory is addressed by specifying a line address (0 to 14 (decimal) and a character position address (0 to 39 (decimal)).



Display Structure (Display memory address)

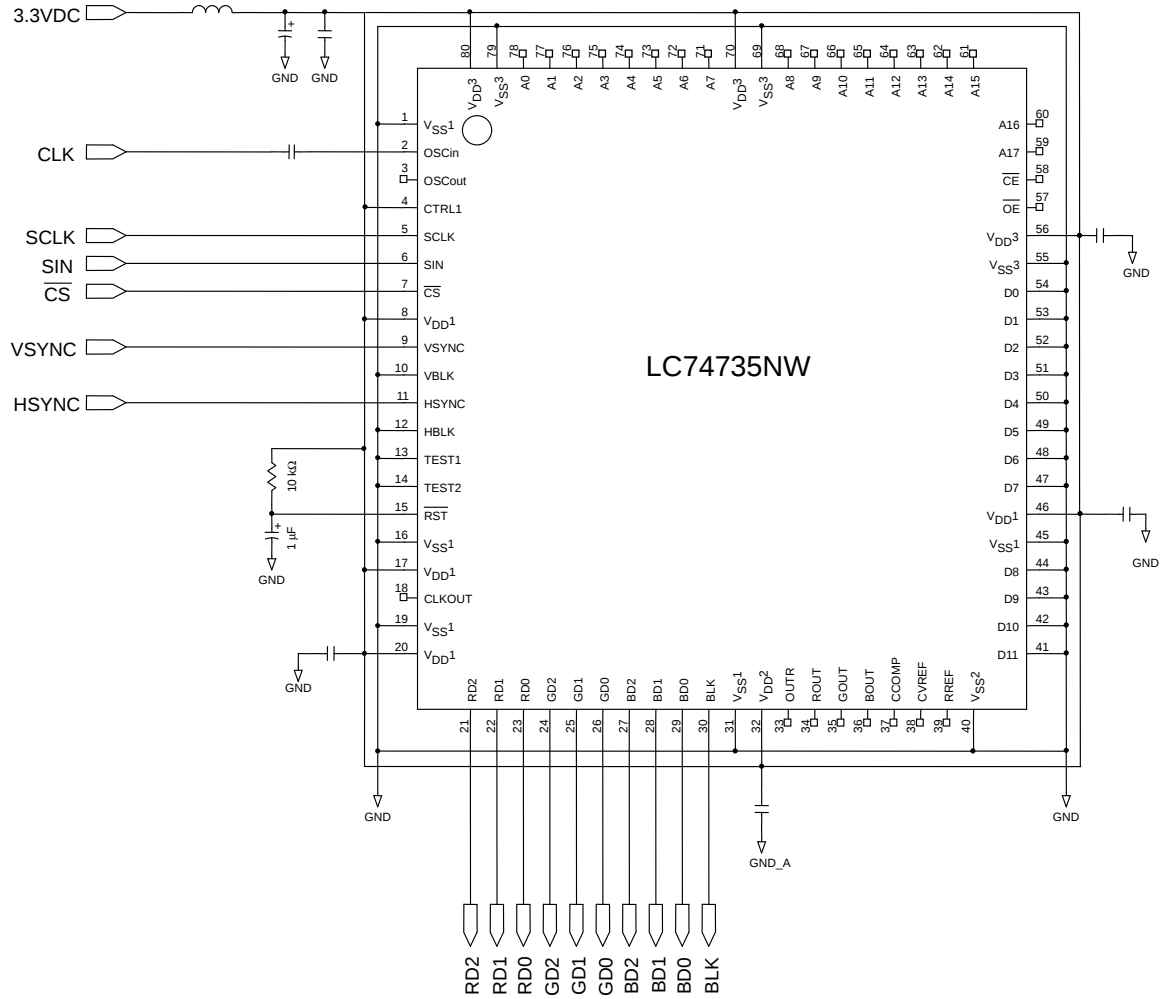
# Sample Application Circuits

- QVGA mode (analog output)



## LC74735NW

- WVGA mode (digital output)



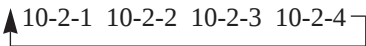
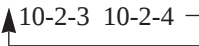
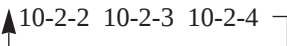
## Operational Description

### Command transfer method

#### Overview

- Commands are transferred in 8-bit units, LSB first.  
Always send a first byte and a second byte (16 bits).
- Command 10 (Main RAM write)  
Command 11 (Wallpaper write)  
Command 71 (Color table write)  
When these commands specify continuous mode (RM2, 1 RM3), the IC is locked in continuous write mode.  
(Continuous write mode is cleared by setting the CS  $\overline{\text{pin}}$  high.)

#### Writing Data to VRAM

- Write start address specification  
Use command 00 to set the write start address.  
V3:0: Vertical direction, H5:0: Horizontal direction
- Data write  
Continuous write mode differs depending on the write mode specification. (RM1, RM2)
  - 1 Normal (RM2 = 0, RM1 = 0: initial state) \*Continuous mode not used\*  
-- COM10-1 10-2-1 10-2-2 10-2-3 10-2-4 command wait state --
  - 2 Write continuous (RM2 = 0, RM1 = 1): Mode 2  
COM10-1 
  - 3 Write continuous (RM2 = 1, RM1 = 0): Mode 3  
COM10-1 10-2-1 10-2-2 10-2-3 10-2-4 
  - 4 Write continuous (RM2 = 1, RM1 = 1): Mode 4  
COM10-1 10-2-1 10-2-2 10-2-3 10-2-4 

\*: In modes 2, 3, and 4, the IC remains locked in continuous write mode until the  $\overline{\text{CS}}$  pin is set high.

- The write address is automatically incremented.
- The write address is retained unless the IC is reset or a new write address is issued.

## Color Table write

- Write start address specification

Use command 70 to set the color table write start address.

CTN1: Color table specification (No.1, No.2), CTA3 to 0: Address specification

| No.1    |      |     |     | No.2 |      |     |     |     |   |
|---------|------|-----|-----|------|------|-----|-----|-----|---|
|         |      | R   | G   | B    |      |     | R   | G   | B |
| Address | 0000 | XXX | XXX | XXX  | 0000 | XXX | XXX | XXX |   |
|         | 0001 |     |     |      | 0001 |     |     |     |   |
|         | 0010 |     |     |      | 0010 |     |     |     |   |
|         |      |     |     |      |      |     |     |     |   |
|         |      |     |     |      |      |     |     |     |   |
|         |      |     |     |      |      |     |     |     |   |
|         |      |     |     |      |      |     |     |     |   |
|         |      |     |     |      |      |     |     |     |   |
|         | 1110 |     |     |      | 1110 |     |     |     |   |
|         | 1111 |     |     |      | 1111 |     |     |     |   |

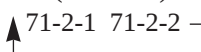
- Data write

Continuous write mode differs depending on the write mode specification. (RM3)

- 1 Normal (RM3 = 0: initial state) \*Continuous mode not used\*

-- COM71-1 71-2-1 71-2-2 command wait state ---

- 2 Write continuous (RM3 = 1) mode

COM71-1 

\*: In mode 2, the IC remains locked in continuous write mode until the  $\overline{\text{CS}}$  pin is set high.

- The write address is automatically incremented.
- The write address is retained unless the IC is reset or a new write address is issued.

**Display format**

## Color Specification Related Items

- When a character is specified

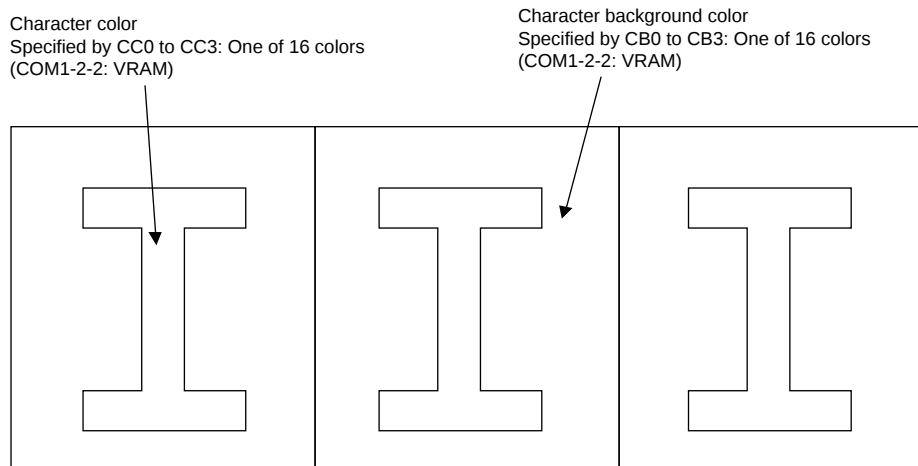
Specify color with the character color (character area) and character background color (outside the character area)

Character color: One of 16 colors

Character background color: One of 16 colors

Color tables: Table No. 1 or No. 2 specified by CT1 to CT0. (COM1-2-3: VRAM)

→ One of 32 types



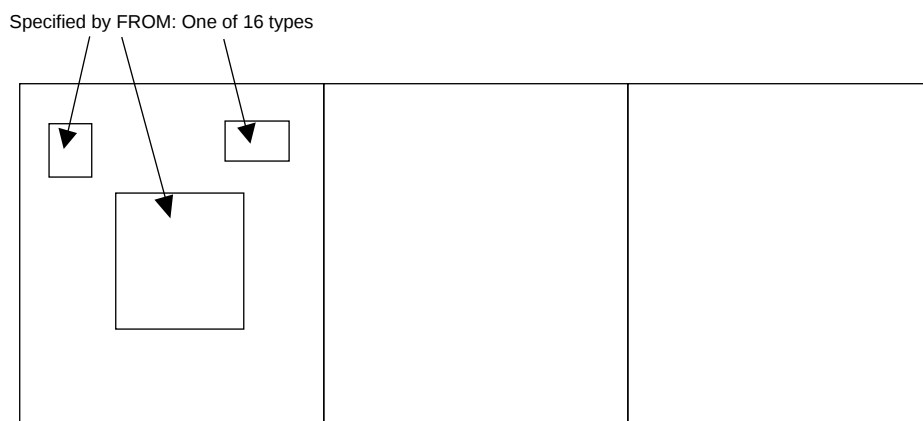
- When a graphic is specified

Specify color is in dot units ( $12 \times 18$  or  $12 \times 16$ )

One of 16 colors (FROM)

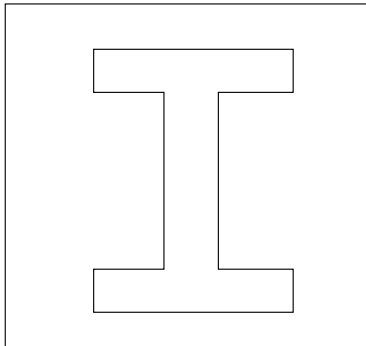
Color tables: Table No. 1 or No. 2 specified by CT1 to CT0. (COM1-2-3: VRAM)

→ One of 32 types



## Display Control Related Items

- Blinking: In character units  
Normal at1 = 0 (COM1-2-1: VRAM)

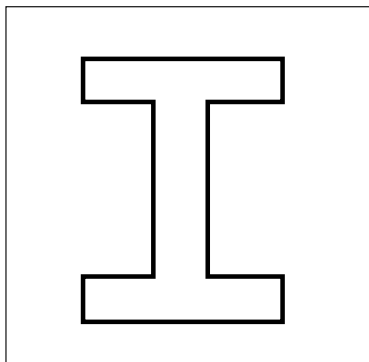


Blinking at1 = 1

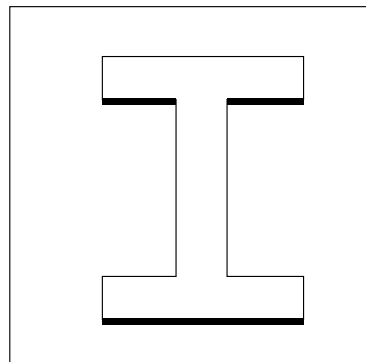
Display alternates between normal and transparent with the blinking period. (COM21-2: BK1, 0)

- Border display: Only valid for font specified characters  
Border color: One of 16 colors (COM60-2 EGC3 to 0)  
Color table specification (COM60-2 EGCT0)  
→ One of 32 types  
Border mode control (COM60-1 BLK1, 0)

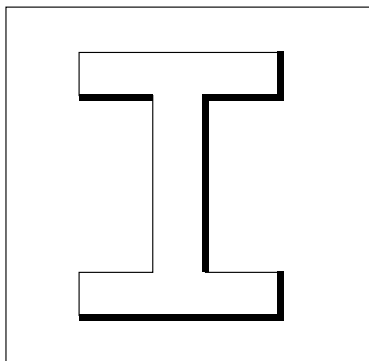
Border



Shadow 1: lower

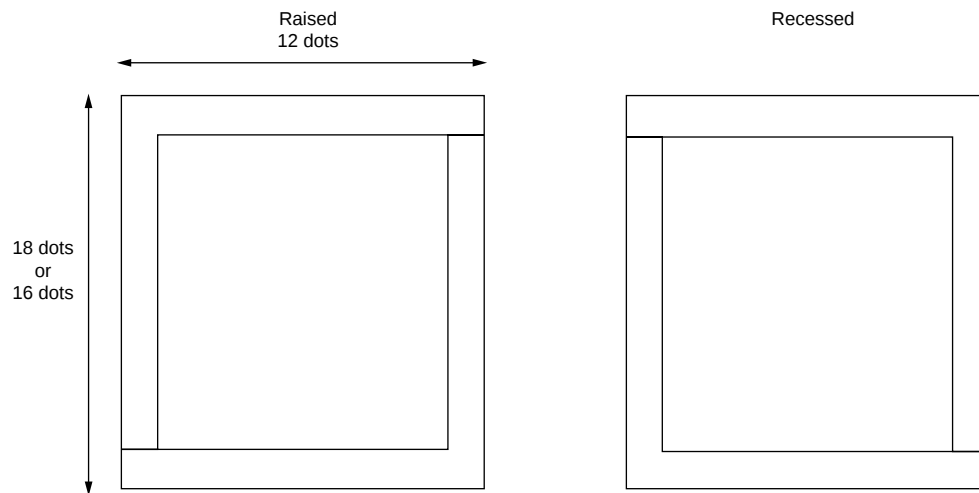


Shadow 2: lower + right



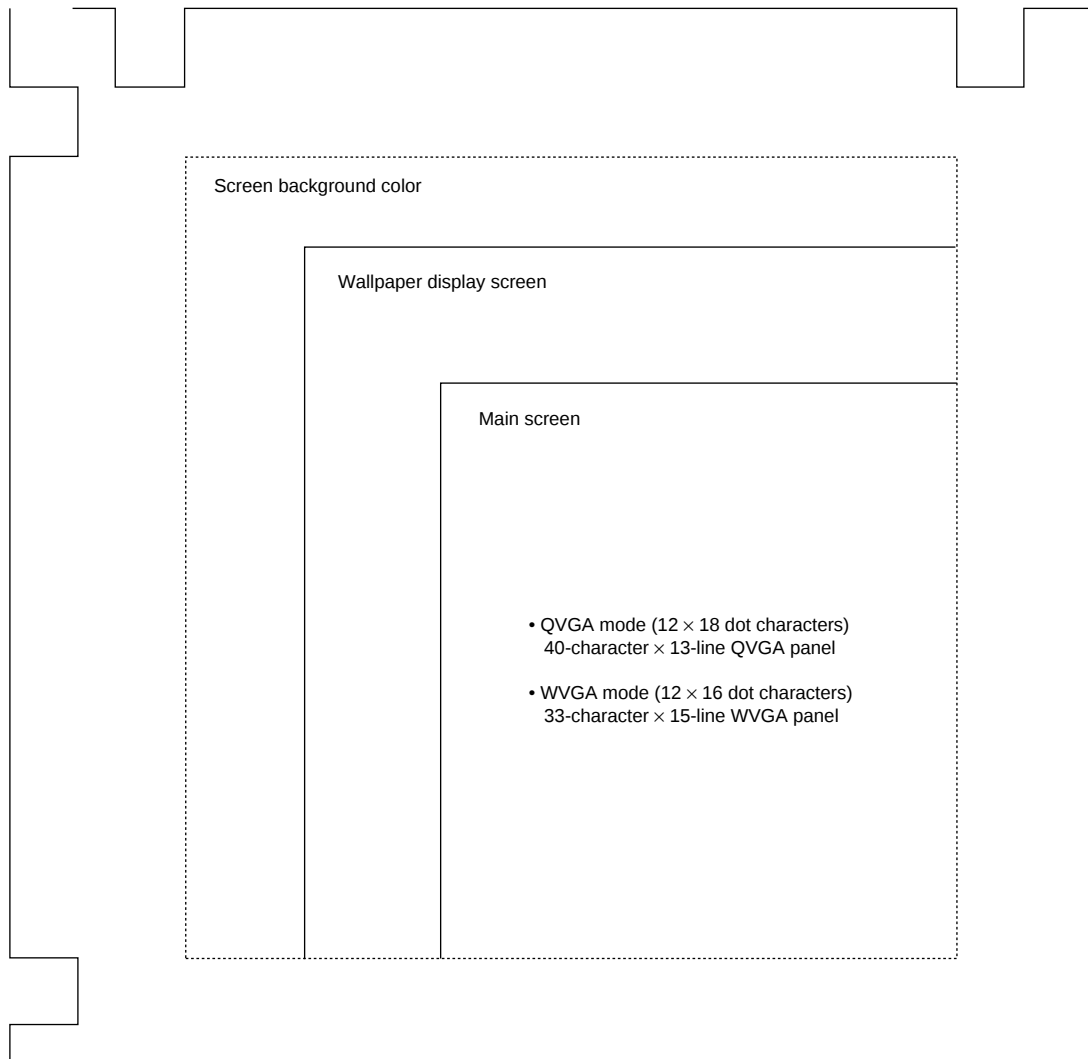
- Character size: Specified in line units  
The character size is specified as 1x to 4x independently for the vertical and horizontal directions.  
(COM40-2)

## Box Display (raised/recessed)



- Raised/recessed specification: In character units (COM10-2-1 BXS)
- Left side - displayed/undisplayed specification: in character units (COM10-2-1 BXL)
- Right side - displayed/undisplayed specification: in character units (COM10-2-1 BXR)
- Upper side - displayed/undisplayed specification: in character units (COM10-2-1 BXU)
- Lower side - displayed/undisplayed specification: in character units (COM10-2-1 BXD)
- Color specification: In line units
  - COM50 (Upper side)
  - COM51 (Lower side)
    - BXUC3:0: One of 16 colors
    - BXDC3:0: One of 16 colors
- Color table specification
  - BXUCT0
  - BXDCT0
  - ' One of 32 types
- Dot width specification: 1 or 2 dots
  - Each of left, right, upper, and lower can be specified independently. (BXLW BXRW BXUW BXDW)

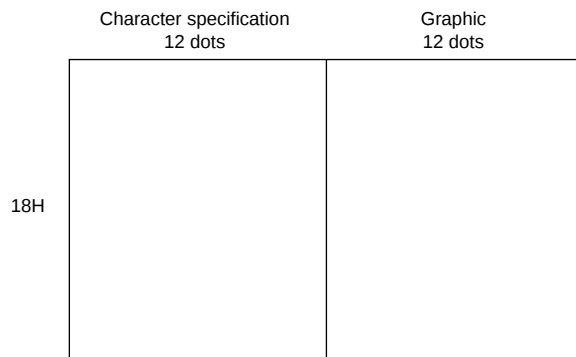
## Screen Structure



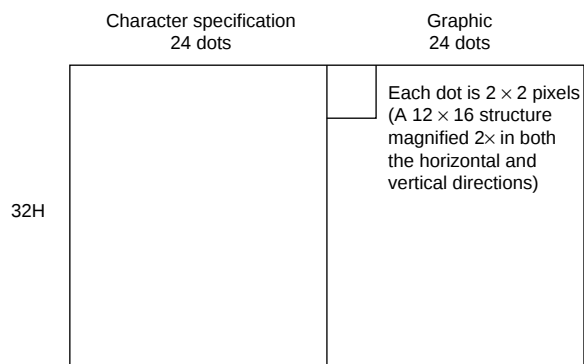
- For each screen: Display on/off (transparent) can be specified independently.
  - For each screen: The display start position can be specified independently.
- The wallpaper display screen and the main screen require xxxx clocks before the horizontal start position is reached.

## Display Format

## • QVGA



## • WVGA

**ROM structure**

Internal ROM (512 characters)

## • Character font

QVGA: 12 × 18-dot structure

WVGA: 24 × 32-dot structure, i.e. 12 × 16 times 4

## • Graphics

CQVGA: 12 × 18-dot structure

WVGA: 12 × 16-dot structure, i.e. displayed magnified 2× in both the horizontal and vertical directions.

Note that the contents of ROM differ for QVGA and WVGA.

(That is, different ROMs for QVGA and WVGA must be created.)

External ROM (2048 characters)

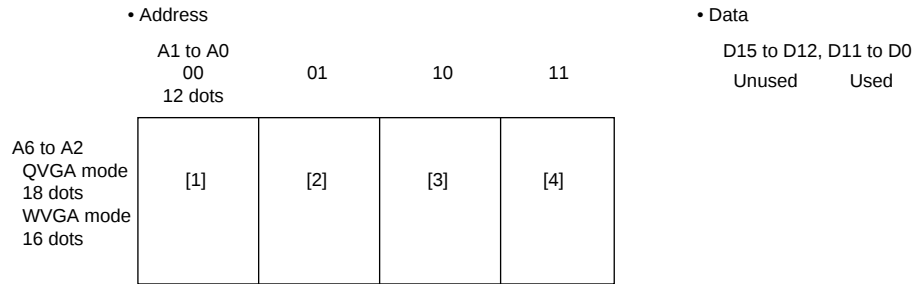
• Conditions

Use a 16-bit 4M ROM with an access time less than 3 times the dot clock period

Example: DCLK = 50 MHz = 20 ns period  $\times$  3 = under 60 ns

DCLK = 10 MHz = 100 ns period  $\times$  3 = under 300 ns

• ROM map



A17 to A7 (10 bits) = 2048 characters = character codes

• Display appearance

QVGA: 1 character =  $12 \times 18$  dots

Character font: [1]

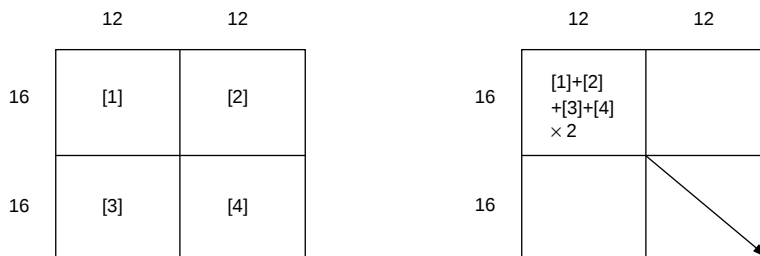
Graphics: [1] + [2] + [3] + [4]

WVGA: 1 character =  $12 \times 16$  dots

Character font: [1] [2]

[3] [4]

Graphics: ([1] + [2] + [3] + [4]) displayed magnified  $2\times$  in both the horizontal and vertical directions.



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