

CMOS LSI

**SANYO**

No. 4988A

**LC74781, 74781M****On-Screen Display Controller LSI  
for VCR Products**

## Overview

The LC74781 and LC74781M are on-screen display CMOS LSIs that display characters and patterns on a TV screen under microprocessor control. The LC74781 and LC74781M display up to 12 lines of 24 characters, each in a 12 × 18 dot matrix.

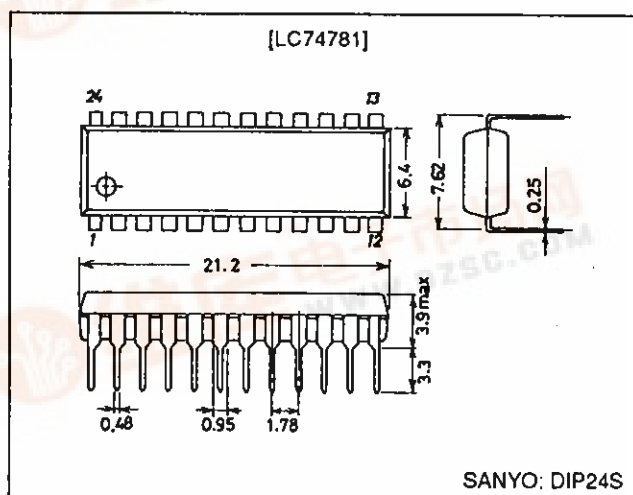
## Features

- Display structure: 12 lines × 24 characters (up to 288 characters)
- Character structure: 12 (horizontal) × 18 (vertical) dots
- Character sizes: Three size settings each in the vertical and horizontal directions
- Character set: 128 characters
- Display start position: 64 position settings each in the vertical and horizontal directions
- Blinking: In individual character units
- Blinking types: Two types with periods of about 0.5 and 1.0 second
- Blanking: Whole font area blanking (12 × 18 dots)
- Background colors: 8 colors (in internal synchronization mode): 4fSC (NTSC/PAL/PAL-M/PAL-N)
- Background colors: 4 colors (in internal synchronization mode): 2fSC (NTSC)
- Background colors: 1 color (blue) (in internal synchronization mode): 2fSC (PAL/PAL-M/PAL-N)
- External control input: 8-bit serial input format
- Built-in sync separator circuit
- Character blanked data output
- Video output: Compound NTSC, PAL, PAL-N and PAL-M output

## Package Dimensions

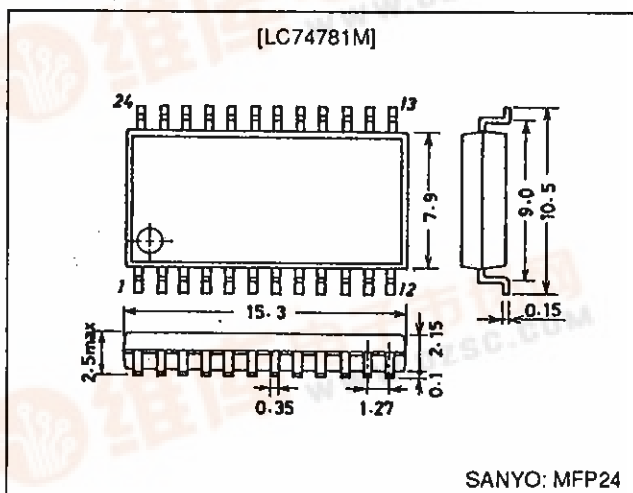
unit: mm

### 3067-DIP24S



unit: mm

### 3045B-MFP24



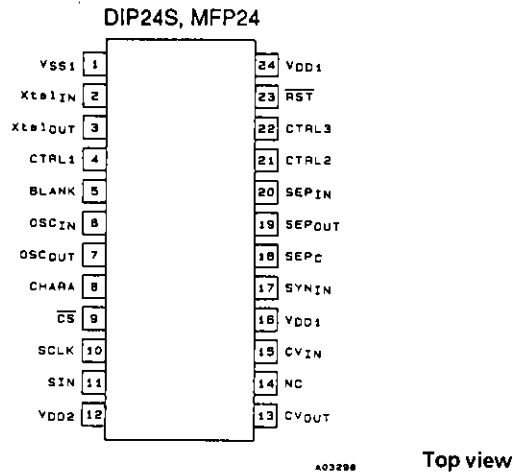
# LC74781, 74781M

## Pin Functions

| Pin No. | Symbol                 | Function                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------|------------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | V <sub>SS1</sub>       | Ground                                | Ground connection (digital system ground)                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2       | Xtal <sub>IN</sub>     | Crystal oscillator connection         | Used to connect the crystal oscillator and capacitor used to generate the internal synchronization signal, or to input an external clock (2fsc or 4fsc).                                                                                                                                                                                                                                                                                    |
| 3       | Xtal <sub>OUT</sub>    |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 4       | CTRL1                  | Crystal oscillator input switching    | Switches between external clock input mode and crystal oscillator mode.<br>Low = crystal oscillator mode, high = external clock mode                                                                                                                                                                                                                                                                                                        |
| 5       | BLANK                  | Blanking output                       | Outputs the blank signal (the OR of the character and border signals). (Outputs a composite sync signal when MOD0 is high.) Outputs the crystal oscillator clock during reset (when the RST pin is low), but can be set up to not output this signal by microprocessor command.                                                                                                                                                             |
| 6       | OSC <sub>IN</sub>      | LC oscillator connection              | Connections for the coil and capacitor that form the oscillator that generates the character output dot clock.                                                                                                                                                                                                                                                                                                                              |
| 7       | OSC <sub>OUT</sub>     |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 8       | CHARA                  | Character output                      | Outputs the character signal. (Functions as the external synchronization signal discrimination signal output pin when MOD0 is high, and outputs the state of the judgment as to whether the external synchronization signal is present or not. Outputs a high level when the synchronization signal is present.) Outputs the dot clock (LC oscillator) during reset, but can be set up to not output this signal by microprocessor command. |
| 9       | $\overline{\text{CS}}$ | Enable input                          | Serial data input enable input. Serial data input is enabled when low. A pull-up resistor is built in (hysteresis input).                                                                                                                                                                                                                                                                                                                   |
| 10      | SCLK                   | Clock input                           | Serial data input clock input.<br>A pull-up resistor is built in (hysteresis input).                                                                                                                                                                                                                                                                                                                                                        |
| 11      | SIN                    | Data input                            | Serial data input. A pull-up resistor is built in (hysteresis input).                                                                                                                                                                                                                                                                                                                                                                       |
| 12      | V <sub>DD2</sub>       | Power supply                          | Composite video signal level adjustment power supply pin (analog system power supply).                                                                                                                                                                                                                                                                                                                                                      |
| 13      | CV <sub>OUT</sub>      | Video signal output                   | Composite video signal output                                                                                                                                                                                                                                                                                                                                                                                                               |
| 14      | NC                     |                                       | Must be either connected to ground or left open.                                                                                                                                                                                                                                                                                                                                                                                            |
| 15      | CV <sub>IN</sub>       | Video signal input                    | Composite video signal input                                                                                                                                                                                                                                                                                                                                                                                                                |
| 16      | V <sub>DD1</sub>       | Power supply                          | Power supply (+5 V: digital system power supply)                                                                                                                                                                                                                                                                                                                                                                                            |
| 17      | SYN <sub>IN</sub>      | Sync separator circuit input          | Video signal input for the built-in sync separator circuit (Used for either horizontal synchronization signal or composite sync signal input when the built-in sync separator circuit is not used.)                                                                                                                                                                                                                                         |
| 18      | SEP <sub>C</sub>       | Sync separator circuit bias voltage   | Built-in sync separator circuit bias voltage monitor pin                                                                                                                                                                                                                                                                                                                                                                                    |
| 19      | SEP <sub>OUT</sub>     | Composite sync signal output          | Built-in sync separator circuit composite sync signal output. (When MOD1 is high, outputs a high level during internal synchronization and a low level during external synchronization.) (Outputs the SYN <sub>IN</sub> input signal when the internal sync separator circuit is not used.)                                                                                                                                                 |
| 20      | SEP <sub>IN</sub>      | Vertical synchronization signal input | Inputs a vertical synchronization signal created by integrating the SEP <sub>OUT</sub> pin output signal. An integrator must be attached at the SEP <sub>OUT</sub> pin. This pin must be tied to V <sub>DD1</sub> if unused.                                                                                                                                                                                                                |
| 21      | CTRL2                  | NTSC/PAL-M switching input            | The setting indicated by this pin takes priority in switching between the NTSC, PAL, PAL-M and PAL-N formats. A low level selects NTSC after a reset. The microprocessor command NTSC, PAL, PAL-M, or PAL-N setting is valid. High = PAL-M format.                                                                                                                                                                                          |
| 22      | CTRL3                  | SEP <sub>IN</sub> input control       | Controls whether or not the VSYNC signal is input to the SEP <sub>IN</sub> input. Low = VSYNC input, high = VSYNC not input.                                                                                                                                                                                                                                                                                                                |
| 23      | RST                    | Reset input                           | System reset input. A pull-up resistor is built in (hysteresis input).                                                                                                                                                                                                                                                                                                                                                                      |
| 24      | V <sub>DD1</sub>       | Power supply (+5 V)                   | Power supply (+5 V: digital system power supply)                                                                                                                                                                                                                                                                                                                                                                                            |

# LC74781, 74781M

## Pin Assignment



## Specifications

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

| Parameter                   | Symbol               | Conditions                                 | Ratings                                        | Unit |
|-----------------------------|----------------------|--------------------------------------------|------------------------------------------------|------|
| Maximum supply voltage      | V <sub>DD</sub> max  | V <sub>DD1</sub> and V <sub>DD2</sub> pins | V <sub>SS</sub> - 0.3 to V <sub>SS</sub> + 7.0 | V    |
| Maximum input voltage       | V <sub>IN</sub> max  | All pins                                   | V <sub>SS</sub> - 0.3 to V <sub>DD</sub> + 0.3 | V    |
| Maximum output voltage      | V <sub>OUT</sub> max | BLANK, CHARA and SEPOUT pins               | V <sub>SS</sub> - 0.3 to V <sub>DD</sub> + 0.3 | V    |
| Allowable power dissipation | P <sub>d</sub> max   | Ta = 25°C                                  | 350                                            | mW   |
| Operating temperature       | T <sub>opr</sub>     |                                            | -30 to +70                                     | °C   |
| Storage temperature         | T <sub>stg</sub>     |                                            | -40 to +125                                    | °C   |

### Allowable Operating Ranges at Ta = -30 to +70°C

| Parameter                     | Symbol            | Conditions                                                                                        | min                   | typ    | max                    | Unit |
|-------------------------------|-------------------|---------------------------------------------------------------------------------------------------|-----------------------|--------|------------------------|------|
| Supply voltage                | V <sub>DD1</sub>  | V <sub>DD1</sub> pin                                                                              | 4.5                   | 5.0    | 5.5                    | V    |
|                               | V <sub>DD2</sub>  | V <sub>DD2</sub> pin                                                                              | 4.5                   | 5.0    | 1.27 V <sub>DD1</sub>  | V    |
| Input high level voltage      | V <sub>IH1</sub>  | RST, CS, SIN and SCLK pins                                                                        | 0.8 V <sub>DD1</sub>  |        | V <sub>DD1</sub> + 0.3 | V    |
|                               | V <sub>IH2</sub>  | CTRL1, CTRL2, CTRL3 and SEPIN pins                                                                | 0.7 V <sub>DD1</sub>  |        | V <sub>DD1</sub> + 0.3 | V    |
| Input low level voltage       | V <sub>IL1</sub>  | RST, CS, SIN and SCLK pins                                                                        | V <sub>SS</sub> - 0.3 |        | 0.2 V <sub>DD1</sub>   | V    |
|                               | V <sub>IL2</sub>  | CTRL1, CTRL2, CTRL3 and SEPIN pins                                                                | V <sub>SS</sub> - 0.3 |        | 0.3 V <sub>DD1</sub>   | V    |
| Pull-up resistance            | R <sub>PU</sub>   | RST, CS, SIN and SCLK pins, applies to pins set by options.                                       | 25                    | 50     | 90                     | kΩ   |
| Composite video input voltage | V <sub>IN1</sub>  | CVIN pin: V <sub>DD1</sub> = 5 V                                                                  |                       | 2.0    |                        | Vp-p |
|                               | V <sub>IN2</sub>  | SYNIN pin: V <sub>DD1</sub> = 5 V                                                                 |                       | 2.0    | 2.5                    | Vp-p |
| Input voltage                 | V <sub>IN3</sub>  | XtalIN pin (in external clock input mode), f <sub>in</sub> = 2fsc or 4fsc: V <sub>DD1</sub> = 5 V | 0.10                  |        | 5.0                    | Vp-p |
| Oscillator frequency          | F <sub>OSC1</sub> | XtalIN and XtalOUT oscillator pins (2fsc: NTSC)                                                   |                       | 7.159  |                        | MHz  |
|                               | F <sub>OSC1</sub> | XtalIN and XtalOUT oscillator pins (4fsc: NTSC)                                                   |                       | 14.318 |                        | MHz  |
|                               | F <sub>OSC1</sub> | XtalIN and XtalOUT oscillator pins (2fsc: PAL)                                                    |                       | 8.867  |                        | MHz  |
|                               | F <sub>OSC1</sub> | XtalIN and XtalOUT oscillator pins (4fsc: PAL)                                                    |                       | 17.734 |                        | MHz  |
|                               | F <sub>OSC1</sub> | XtalIN and XtalOUT oscillator pins (2fsc: PAL-M)                                                  |                       | 7.151  |                        | MHz  |
|                               | F <sub>OSC1</sub> | XtalIN and XtalOUT oscillator pins (4fsc: PAL-M)                                                  |                       | 14.302 |                        | MHz  |
|                               | F <sub>OSC1</sub> | XtalIN and XtalOUT oscillator pins (2fsc: PAL-N)                                                  |                       | 7.164  |                        | MHz  |
|                               | F <sub>OSC1</sub> | XtalIN and XtalOUT oscillator pins (4fsc: PAL-N)                                                  |                       | 14.328 |                        | MHz  |
|                               | F <sub>OSC2</sub> | OSCIN and OSCOUT oscillator pins (LC oscillator)                                                  | 5                     |        | 10                     | MHz  |

Note: If the XtalIN pin is used in clock input mode, be sure to prevent input noise from becoming a problem.

# LC74781, 74781M

## Electrical Characteristics at Ta = -30 to +70°C, V<sub>DD1</sub> = 5 V unless otherwise specified

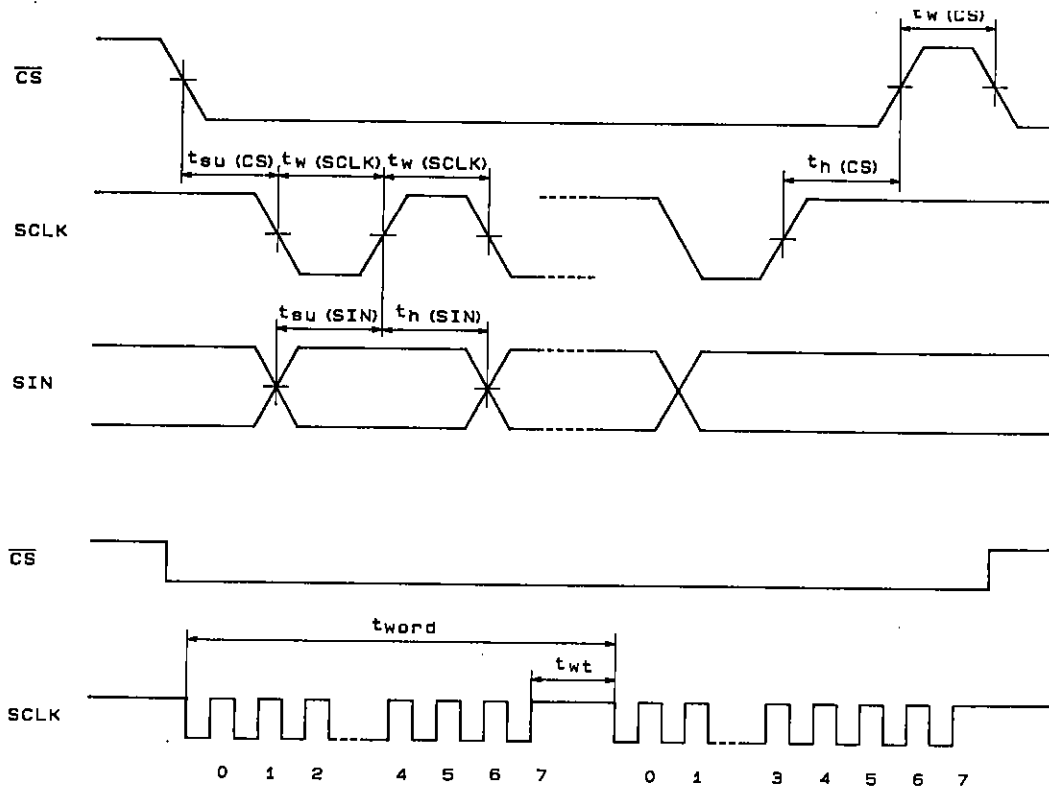
| Parameter                   | Symbol             | Conditions                                                                                      | min | typ  | max  | Unit   |
|-----------------------------|--------------------|-------------------------------------------------------------------------------------------------|-----|------|------|--------|
| Input off leakage current   | I <sub>leak1</sub> | CV <sub>IN</sub> pin                                                                            |     |      | 1    | μA     |
| Output off leakage current  | I <sub>leak2</sub> | CV <sub>OUT</sub> pin                                                                           |     |      | 1    | μA     |
| Output high level voltage   | V <sub>OH1</sub>   | BLANK, CHARA and SEP <sub>OUT</sub> pins: V <sub>DD1</sub> = 4.5 V, I <sub>OH</sub> = -1.0 mA   | 3.5 |      |      | V      |
| Output low level voltage    | V <sub>OL1</sub>   | BLANK, CHARA and SEP <sub>OUT</sub> pins: V <sub>DD1</sub> = 4.5 V, I <sub>OH</sub> = 1.0 mA    |     |      | 1.0  | V      |
| Input current               | I <sub>IH</sub>    | RST, CS, SIN, SCLK, CTRL1, CTRL3 and SEP <sub>IN</sub> pins: V <sub>IN</sub> = V <sub>DD1</sub> |     |      | 1    | μA     |
|                             | I <sub>IL</sub>    | CTRL1, CTRL2, CTRL3 and OSC <sub>IN</sub> pins: V <sub>IN</sub> = V <sub>SS1</sub>              | -1  |      |      | μA     |
| Operating current drain     | I <sub>DD1</sub>   | V <sub>DD1</sub> pin; all outputs: open, Xtal: 7.159 MHz, LC: 8 MHz                             |     |      | 15   | mA     |
|                             | I <sub>DD2</sub>   | V <sub>DD2</sub> pin: V <sub>DD2</sub> = 5 V                                                    |     |      | 20   | mA     |
| Sync level                  | V <sub>SN</sub>    | CV <sub>OUT</sub> pin<br>V <sub>DD1</sub> = 5.0 V, V <sub>DD2</sub> = 5.0 V                     | *1  | 0.70 | 0.82 | 0.94 V |
|                             |                    |                                                                                                 | *2  | 0.91 | 1.03 | 1.15 V |
| Pedestal level              | V <sub>PD</sub>    | CV <sub>OUT</sub> pin<br>V <sub>DD1</sub> = 5.0 V, V <sub>DD2</sub> = 5.0 V                     | *1  | 1.31 | 1.43 | 1.55 V |
|                             |                    |                                                                                                 | *2  | 1.53 | 1.65 | 1.77 V |
| Color burst low level       | V <sub>CBL</sub>   | CV <sub>OUT</sub> pin<br>V <sub>DD1</sub> = 5.0 V, V <sub>DD2</sub> = 5.0 V                     | *1  | 1.00 | 1.12 | 1.24 V |
|                             |                    |                                                                                                 | *2  | 1.21 | 1.33 | 1.45 V |
| Color burst high level      | V <sub>CBH</sub>   | CV <sub>OUT</sub> pin<br>V <sub>DD1</sub> = 5.0 V, V <sub>DD2</sub> = 5.0 V                     | *1  | 1.63 | 1.75 | 1.87 V |
|                             |                    |                                                                                                 | *2  | 1.84 | 1.96 | 2.08 V |
| Background color low level  | V <sub>RSL</sub>   | CV <sub>OUT</sub> pin<br>V <sub>DD1</sub> = 5.0 V, V <sub>DD2</sub> = 5.0 V                     | *1  | 1.47 | 1.59 | 1.71 V |
|                             |                    |                                                                                                 | *2  | 1.68 | 1.80 | 1.92 V |
| Background color high level | V <sub>RSH</sub>   | CV <sub>OUT</sub> pin<br>V <sub>DD1</sub> = 5.0 V, V <sub>DD2</sub> = 5.0 V                     | *1  | 1.99 | 2.11 | 2.23 V |
|                             |                    |                                                                                                 | *2  | 2.19 | 2.31 | 2.43 V |
| Border level 0              | V <sub>BK0</sub>   | CV <sub>OUT</sub> pin<br>V <sub>DD1</sub> = 5.0 V, V <sub>DD2</sub> = 5.0 V                     | *1  | 1.42 | 1.54 | 1.66 V |
|                             |                    |                                                                                                 | *2  | 1.63 | 1.75 | 1.87 V |
| Border level 1              | V <sub>BK1</sub>   | CV <sub>OUT</sub> pin<br>V <sub>DD1</sub> = 5.0 V, V <sub>DD2</sub> = 5.0 V                     | *1  | 1.99 | 2.11 | 2.23 V |
|                             |                    |                                                                                                 | *2  | 2.19 | 2.31 | 2.43 V |
| Character level             | V <sub>CHA</sub>   | CV <sub>OUT</sub> pin<br>V <sub>DD1</sub> = 5.0 V, V <sub>DD2</sub> = 5.0 V                     | *1  | 2.58 | 2.70 | 2.82 V |
|                             |                    |                                                                                                 | *2  | 2.78 | 2.90 | 3.02 V |

Note: 1. When the sync level is 0.8 V.  
2. When the sync level is 1.0 V.

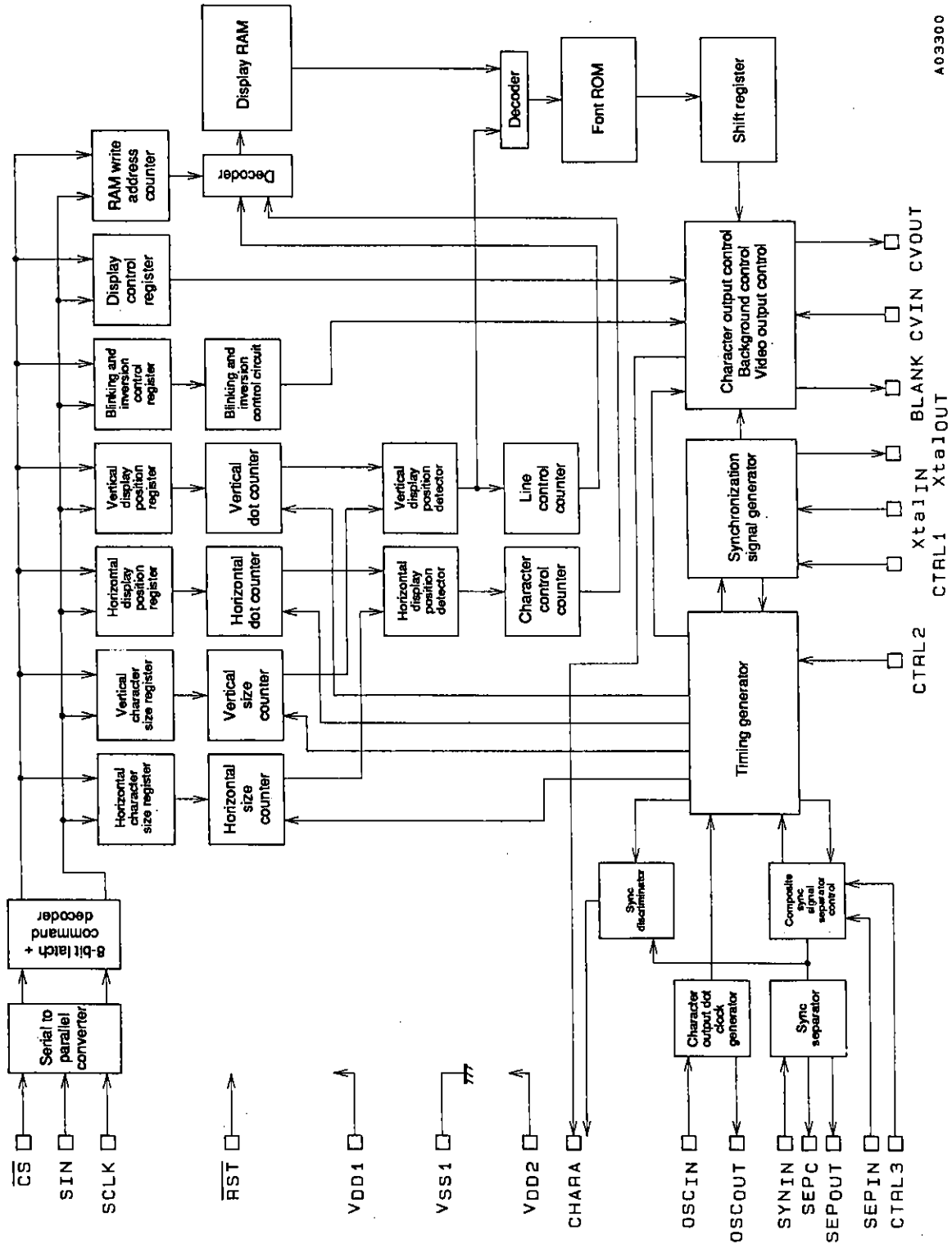
## Timing Characteristics at Ta = -30 to +70°C, V<sub>DD1</sub> = 5 ± 0.5 V

| Parameter                 | Symbol                | Conditions                          | min | typ | max | Unit |
|---------------------------|-----------------------|-------------------------------------|-----|-----|-----|------|
| Minimum input pulse width | t <sub>W</sub> (SCLK) | SCLK pin                            | 200 |     |     | ns   |
|                           | t <sub>W</sub> (CS)   | CS pin (the period when CS is high) | 1   |     |     | μs   |
| Data setup time           | t <sub>SU</sub> (CS)  | CS pin                              | 200 |     |     | ns   |
|                           | t <sub>SU</sub> (SIN) | SIN pin                             | 200 |     |     | ns   |
| Data hold time            | t <sub>H</sub> (CS)   | CS pin                              | 2   |     |     | μs   |
|                           | t <sub>H</sub> (SIN)  | SIN pin                             | 200 |     |     | ns   |
| One word write time       | t <sub>word</sub>     | 8-bit data write time               | 4.2 |     |     | μs   |
|                           | t <sub>wt</sub>       | RAM data write time                 | 1   |     |     | μs   |

Serial Data Input Timing



# System Block Diagram



## Display Control Commands

The display control commands have a serial input format with 8-bit units. A command consists of a command identifier code in the first byte and data in the second and subsequent bytes. There are eight commands as listed below.

- ① COMMAND0: Display memory (VRAM) write address setup command
- ② COMMAND1: Display character data write command
- ③ COMMAND2: Vertical display start position and vertical character size setup command
- ④ COMMAND3: Horizontal display start position and horizontal character size setup command
- ⑤ COMMAND4: Display control setup command
- ⑥ COMMAND5: Display control setup command
- ⑦ COMMAND6: Synchronization signal detection setup command
- ⑧ COMMAND7: Display control setup command

**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         |
| COMMAND0<br>(Set write address)                                                   | 1                           | 0 | 0 | 0 | V3         | V2         | V1         | V0         | 0           | 0        | 0        | H4         | H3         | H2         | H1         | H0        |
| COMMAND1<br>(Write character)                                                     | 1                           | 0 | 0 | 1 | 0          | 0          | 0          | at         | 0           | c6       | c5       | c4         | c3         | c2         | c1         | c0        |
| COMMAND2<br>(Set vertical display start position and vertical character size)     | 1                           | 0 | 1 | 0 | VS<br>21   | VS<br>20   | VS<br>11   | VS<br>10   | 0           | FS       | VP<br>5  | VP<br>4    | VP<br>3    | VP<br>2    | VP<br>1    | VP<br>0   |
| COMMAND3<br>(Set horizontal display start position and horizontal character size) | 1                           | 0 | 1 | 1 | HS<br>21   | HS<br>20   | HS<br>11   | HS<br>10   | 0           | LC       | HP<br>5  | HP<br>4    | HP<br>3    | HP<br>2    | HP<br>1    | HP<br>0   |
| COMMAND4<br>(Display control)                                                     | 1                           | 1 | 0 | 0 | TST<br>MOD | RAM<br>ERS | OSC<br>STP | SYS<br>RST | 0           | BLK<br>2 | BLK<br>1 | BLK<br>0   | BK<br>1    | BK<br>0    | RV         | DSP<br>ON |
| COMMAND5<br>(Display control)                                                     | 1                           | 1 | 0 | 1 | NP<br>1    | NP<br>0    | NON        | INT        | 0           | 0        | 0        | BCL        | CB         | PH<br>2    | PH<br>1    | PH<br>0   |
| COMMAND6<br>(Synchronization signal detection)                                    | 1                           | 1 | 1 | 0 | MOD<br>1   | MOD<br>0   | DIS<br>LIN | MUT        | 0           | RN<br>2  | RN<br>1  | RN<br>0    | SN<br>3    | SN<br>2    | SN<br>1    | SN<br>0   |
| COMMAND7<br>(Display control)                                                     | 1                           | 1 | 1 | 1 | EX<br>1    | PD<br>1    | EX<br>0    | PD<br>0    | 0           | 0        | 0        | VNP<br>SEL | VSP<br>SEL | MSK<br>ERS | MSK<br>SEL | EGL       |

Once written, the command identifier code in the first byte is stored until the next first byte is written. However, when the display character data write command (COMMAND1) is written, the LC74781/M locks into the display character data write mode, and another first byte cannot be written.

When a high level is input to the  $\overline{CS}$  pin, the LC74781/M is set to COMMAND0 (display memory write address setup mode).

## LC74781, 74781M

### ① COMMAND0 (Display memory write address setup command)

#### First byte

| DA0 to DA7 | Register name | Register content |                                                                        | Note |
|------------|---------------|------------------|------------------------------------------------------------------------|------|
|            |               | State            | Function                                                               |      |
| 7          | —             | 1                | Command 0 identification code<br>Set the display memory write address. |      |
| 6          | —             | 0                |                                                                        |      |
| 5          | —             | 0                |                                                                        |      |
| 4          | —             | 0                |                                                                        |      |
| 3          | V3            | 0                | Display memory address (0 to B hexadecimal)                            |      |
|            |               | 1                |                                                                        |      |
| 2          | V2            | 0                |                                                                        |      |
|            |               | 1                |                                                                        |      |
| 1          | V1            | 0                |                                                                        |      |
|            |               | 1                |                                                                        |      |
| 0          | V0            | 0                |                                                                        |      |
|            |               | 1                |                                                                        |      |

#### Second byte

| DA0 to DA7 | Register name | Register content |                                              | Note |
|------------|---------------|------------------|----------------------------------------------|------|
|            |               | State            | Function                                     |      |
| 7          | —             | 0                | Second byte identification bit               |      |
| 6          | —             | 0                |                                              |      |
| 5          | —             | 0                |                                              |      |
| 4          | H4            | 0                | Display memory address (0 to 17 hexadecimal) |      |
|            |               | 1                |                                              |      |
| 3          | H3            | 0                |                                              |      |
|            |               | 1                |                                              |      |
| 2          | H2            | 0                |                                              |      |
|            |               | 1                |                                              |      |
| 1          | H1            | 0                |                                              |      |
|            |               | 1                |                                              |      |
| 0          | H0            | 0                |                                              |      |
|            |               | 1                |                                              |      |

Note: The register states are all set to zero when the LC74781/M is reset with the  $\overline{\text{RST}}$  pin.

### ② COMMAND1 (Display character data write setup command)

#### First byte

| DA0 to DA7 | Register name | Register content |                                                                       | Note                                                                                                                                       |
|------------|---------------|------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|            |               | State            | Function                                                              |                                                                                                                                            |
| 7          | —             | 1                | Command 1 identification code<br>Set up display character data write. | When this command is input, the LC74781/M locks into the display character data write mode until the $\overline{\text{CS}}$ pin goes high. |
| 6          | —             | 0                |                                                                       |                                                                                                                                            |
| 5          | —             | 0                |                                                                       |                                                                                                                                            |
| 4          | —             | 1                |                                                                       |                                                                                                                                            |
| 3          | —             | 0                |                                                                       |                                                                                                                                            |
| 2          | —             | 0                |                                                                       |                                                                                                                                            |
| 1          | —             | 0                |                                                                       |                                                                                                                                            |
| 0          | at            | 0                | Character attribute off                                               |                                                                                                                                            |
|            |               | 1                | Character attribute on                                                |                                                                                                                                            |

# LC74781, 74781M

## Second byte

| DA0 to DA7 | Register name | Register content |                                       | Note |
|------------|---------------|------------------|---------------------------------------|------|
|            |               | State            | Function                              |      |
| 7          | —             | 0                | Character code (00 to 7F hexadecimal) |      |
| 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            | 0                |                                       |      |
|            |               | 1                |                                       |      |

Note: The register states are all set to zero when the LC74781/M is reset with the  $\overline{\text{RST}}$  pin.

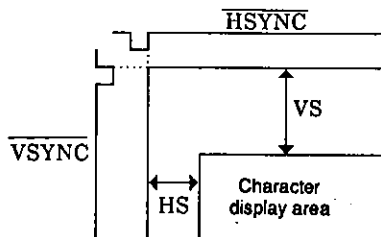
## ③ COMMAND2 (Vertical display start position and vertical character size setup command)

### First byte

| DA0 to DA7 | Register name | Register content |                                                                                                                                                                                    | Note        |   |   |   |            |            |   |            |            |                                     |
|------------|---------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---|---|---|------------|------------|---|------------|------------|-------------------------------------|
|            |               | State            | Function                                                                                                                                                                           |             |   |   |   |            |            |   |            |            |                                     |
| 7          | —             | 1                | Command 2 identification code<br>Set the vertical display start position and vertical character size.                                                                              |             |   |   |   |            |            |   |            |            |                                     |
| 6          | —             | 0                |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 5          | —             | 1                |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 4          | —             | 0                |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 3          | VS21          | 0                | <table><tr><td>VS21 \ VS20</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1H per dot</td><td>2H per dot</td></tr><tr><td>1</td><td>3H per dot</td><td>1H per dot</td></tr></table> | VS21 \ VS20 | 0 | 1 | 0 | 1H per dot | 2H per dot | 1 | 3H per dot | 1H per dot | Second line vertical character size |
|            |               | VS21 \ VS20      |                                                                                                                                                                                    | 0           | 1 |   |   |            |            |   |            |            |                                     |
| 0          | 1H per dot    | 2H per dot       |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 1          | 3H per dot    | 1H per dot       |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 1          |               |                  |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 2          | VS20          | 0                |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
|            |               | 1                |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 1          | VS11          | 0                | <table><tr><td>VS11 \ VS10</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1H per dot</td><td>2H per dot</td></tr><tr><td>1</td><td>3H per dot</td><td>1H per dot</td></tr></table> | VS11 \ VS10 | 0 | 1 | 0 | 1H per dot | 2H per dot | 1 | 3H per dot | 1H per dot | First line vertical character size  |
|            |               | VS11 \ VS10      |                                                                                                                                                                                    | 0           | 1 |   |   |            |            |   |            |            |                                     |
| 0          | 1H per dot    | 2H per dot       |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 1          | 3H per dot    | 1H per dot       |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 1          |               |                  |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
| 0          | VS10          | 0                |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |
|            |               | 1                |                                                                                                                                                                                    |             |   |   |   |            |            |   |            |            |                                     |

### Second byte

| DA0 to DA7 | Register name | Register content |                                                                                                                                                                | Note |
|------------|---------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|            |               | State            | Function                                                                                                                                                       |      |
| 7          | —             | 0                | Second byte identification bit                                                                                                                                 |      |
| 6          | FS            | 0                | Crystal oscillator frequency: 2fsc                                                                                                                             |      |
|            |               | 1                | Crystal oscillator frequency: 4fsc                                                                                                                             |      |
| 5          | VP5 (MSB)     | 0                | If VS is the vertical display start position then:<br>$VS = H \times \left( 2 \sum_{n=0}^5 2^n VP_n \right)$<br>H: the horizontal synchronization pulse period |      |
|            |               | 1                |                                                                                                                                                                |      |
| 4          | VP4           | 0                |                                                                                                                                                                |      |
|            |               | 1                |                                                                                                                                                                |      |
| 3          | VP3           | 0                |                                                                                                                                                                |      |
|            |               | 1                |                                                                                                                                                                |      |
| 2          | VP2           | 0                |                                                                                                                                                                |      |
|            |               | 1                |                                                                                                                                                                |      |
| 1          | VP1           | 0                |                                                                                                                                                                |      |
|            |               | 1                |                                                                                                                                                                |      |
| 0          | VP0 (LSB)     | 0                |                                                                                                                                                                |      |
|            |               | 1                |                                                                                                                                                                |      |



The vertical display start position is set by the 6 bits VP0 to VP5. The weight of bit 1 is 2H.

Note: The register states are all set to zero when the LC74781/M is reset with the  $\overline{\text{RST}}$  pin.

# LC74781, 74781M

## ④ COMMAND3 (Horizontal display start position and horizontal character size setup command)

First byte

| DA0 to DA7 | Register name | Register content |                                                                                                                                                                                            | Note        |   |   |   |              |              |   |              |              |                                       |
|------------|---------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---|---|---|--------------|--------------|---|--------------|--------------|---------------------------------------|
|            |               | State            | Function                                                                                                                                                                                   |             |   |   |   |              |              |   |              |              |                                       |
| 7          | —             | 1                | Command 3 identification code<br>Set the horizontal display start position and horizontal character size.                                                                                  |             |   |   |   |              |              |   |              |              |                                       |
| 6          | —             | 0                |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 5          | —             | 1                |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 4          | —             | 1                |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 3          | HS21          | 0                | <table><tr><td>HS21 \ HS20</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1 Tc per dot</td><td>2 Tc per dot</td></tr><tr><td>1</td><td>3 Tc per dot</td><td>1 Tc per dot</td></tr></table> | HS21 \ HS20 | 0 | 1 | 0 | 1 Tc per dot | 2 Tc per dot | 1 | 3 Tc per dot | 1 Tc per dot | Second line horizontal character size |
|            |               | HS21 \ HS20      |                                                                                                                                                                                            | 0           | 1 |   |   |              |              |   |              |              |                                       |
| 0          | 1 Tc per dot  | 2 Tc per dot     |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 1          | 3 Tc per dot  | 1 Tc per dot     |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 1          |               |                  |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 2          | HS20          | 0                |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
|            |               | 1                |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 1          | HS11          | 0                | <table><tr><td>HS11 \ HS10</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1 Tc per dot</td><td>2 Tc per dot</td></tr><tr><td>1</td><td>3 Tc per dot</td><td>1 Tc per dot</td></tr></table> | HS11 \ HS10 | 0 | 1 | 0 | 1 Tc per dot | 2 Tc per dot | 1 | 3 Tc per dot | 1 Tc per dot | First line horizontal character size  |
|            |               | HS11 \ HS10      |                                                                                                                                                                                            | 0           | 1 |   |   |              |              |   |              |              |                                       |
| 0          | 1 Tc per dot  | 2 Tc per dot     |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 1          | 3 Tc per dot  | 1 Tc per dot     |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 1          |               |                  |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
| 0          | HS10          | 0                |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |
|            |               | 1                |                                                                                                                                                                                            |             |   |   |   |              |              |   |              |              |                                       |

Second byte

| DA0 to DA7 | Register name | Register content |                                                                                                                                                                         | Note                                                                                                 |
|------------|---------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
|            |               | State            | Function                                                                                                                                                                |                                                                                                      |
| 7          | —             | 0                | Second byte identification bit                                                                                                                                          |                                                                                                      |
| 6          | LC            | 0                | An LC oscillator is used for the dot clock.                                                                                                                             | Selects the dot clock used in horizontal character display.                                          |
|            |               | 1                | A crystal oscillator is used for the dot clock.                                                                                                                         |                                                                                                      |
| 5          | HP5 (MSB)     | 0                | If HS is the horizontal start position then:<br>$HS = Tc \times (2 \sum_{n=0}^5 2^n HP_n)$<br>Tc: Period of the oscillator connected to OSCIN/OSCOUT in operating mode. | The horizontal display start position is set by the six bits HP5 to HP0. The weight of bit 1 is 2Tc. |
|            |               | 1                |                                                                                                                                                                         |                                                                                                      |
| 4          | HP4           | 0                |                                                                                                                                                                         |                                                                                                      |
|            |               | 1                |                                                                                                                                                                         |                                                                                                      |
| 3          | HP3           | 0                |                                                                                                                                                                         |                                                                                                      |
|            |               | 1                |                                                                                                                                                                         |                                                                                                      |
| 2          | HP2           | 0                |                                                                                                                                                                         |                                                                                                      |
|            |               | 1                |                                                                                                                                                                         |                                                                                                      |
| 1          | HP1           | 0                |                                                                                                                                                                         |                                                                                                      |
|            |               | 1                |                                                                                                                                                                         |                                                                                                      |
| 0          | HP0 (LSB)     | 0                |                                                                                                                                                                         |                                                                                                      |
|            |               | 1                |                                                                                                                                                                         |                                                                                                      |

Note: The register states are all set to zero when the LC74781/M is reset with the  $\overline{RST}$  pin.

## ⑤ COMMAND4 (Display control setup command)

First byte

| DA0 to DA7 | Register name | Register content |                                                                | Note                                                                                                       |
|------------|---------------|------------------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
|            |               | State            | Function                                                       |                                                                                                            |
| 7          | —             | 1                | Command 4 identification code<br>Display control               |                                                                                                            |
| 6          | —             | 1                |                                                                |                                                                                                            |
| 5          | —             | 0                |                                                                |                                                                                                            |
| 4          | —             | 0                |                                                                |                                                                                                            |
| 3          | TSTMOD        | 0                | Normal operating mode                                          | This bit must be zero.                                                                                     |
|            |               | 1                | Test mode                                                      |                                                                                                            |
| 2          | RAMERS        | 0                |                                                                | The RAM erase operation requires about 500 $\mu$ s (It is executed in the DSPOFF state.)                   |
|            |               | 1                | Erase display RAM (set to 7F hexadecimal)                      |                                                                                                            |
| 1          | OSCSTP        | 0                | Do not stop the crystal oscillator and LC oscillator circuits. | Valid when character display is off in external synchronization mode.                                      |
|            |               | 1                | Stop the crystal oscillator and LC oscillator circuits.        |                                                                                                            |
| 0          | SYSRST        | 0                |                                                                | Reset occurs when the $\overline{CS}$ pin is low, and the reset is cleared when $\overline{CS}$ goes high. |
|            |               | 1                | Reset all registers and turn the display off.                  |                                                                                                            |

# LC74781, 74781M

## Second byte

| DA0 to DA7 | Register name | Register content    |                                                                                                                                                                                                    |  | Note                                                                                                                              |             |   |   |   |              |                |   |             |                     |                            |
|------------|---------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------|-------------|---|---|---|--------------|----------------|---|-------------|---------------------|----------------------------|
|            |               | State               | Function                                                                                                                                                                                           |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
| 7          | —             | 0                   | Second byte identification bit                                                                                                                                                                     |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
| 6          | BLK2          | 0                   | Character display block                                                                                                                                                                            |  | Full character size specification                                                                                                 |             |   |   |   |              |                |   |             |                     |                            |
|            |               | 1                   | Video display block                                                                                                                                                                                |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
| 5          | BLK1          | 0                   | <table><tr><td>BLK1 \ BLK0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>Blanking off</td><td>Character size</td></tr><tr><td>1</td><td>Border size</td><td>Full character size</td></tr></table> |  |                                                                                                                                   | BLK1 \ BLK0 | 0 | 1 | 0 | Blanking off | Character size | 1 | Border size | Full character size | Changes the blanking size. |
|            |               | BLK1 \ BLK0         |                                                                                                                                                                                                    |  |                                                                                                                                   | 0           | 1 |   |   |              |                |   |             |                     |                            |
| 0          | Blanking off  | Character size      |                                                                                                                                                                                                    |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
| 1          | Border size   | Full character size |                                                                                                                                                                                                    |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
| 4          | BLK0          | 0                   |                                                                                                                                                                                                    |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
|            |               | 1                   |                                                                                                                                                                                                    |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
| 3          | BK1           | 0                   | Blinking period: about 0.5 s                                                                                                                                                                       |  | Switches the blinking period.                                                                                                     |             |   |   |   |              |                |   |             |                     |                            |
|            |               | 1                   | Blinking period: about 1.0 s                                                                                                                                                                       |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
| 2          | BK0           | 0                   | Blinking off                                                                                                                                                                                       |  | When blinking is specified for reversed characters, the blinking will be between normal character and reversed character display. |             |   |   |   |              |                |   |             |                     |                            |
|            |               | 1                   | Blinking on                                                                                                                                                                                        |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
| 1          | RV            | 0                   | Reverse (character reversing) off                                                                                                                                                                  |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
|            |               | 1                   | Reverse (character reversing) on                                                                                                                                                                   |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
| 0          | DSPON         | 0                   | Character display off                                                                                                                                                                              |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |
|            |               | 1                   | Character display on                                                                                                                                                                               |  |                                                                                                                                   |             |   |   |   |              |                |   |             |                     |                            |

Note: The register states are all set to zero when the LC74781/M is reset with the RST pin.

## ⑥ COMMAND5 (Display control setup command)

### First byte

| DA0 to DA7 | Register name | Register content |                                                                                                                                                           |  | Note                                                    |   |   |   |      |       |   |     |       |                                             |
|------------|---------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------|---|---|---|------|-------|---|-----|-------|---------------------------------------------|
|            |               | State            | Function                                                                                                                                                  |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 7          | —             | 1                | Command 5 identification code<br>Display control                                                                                                          |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 6          | —             | 1                |                                                                                                                                                           |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 5          | —             | 0                |                                                                                                                                                           |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 4          | —             | 1                |                                                                                                                                                           |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 3          | NP1           | 0                | <table><tr><td>NP1 \ NP0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>NTSC</td><td>PAL-M</td></tr><tr><td>1</td><td>PAL</td><td>PAL-N</td></tr></table> |  | NP1 \ NP0                                               | 0 | 1 | 0 | NTSC | PAL-M | 1 | PAL | PAL-N | Switches between NTSC, PAL, PAL-M and PAL-N |
|            |               | NP1 \ NP0        |                                                                                                                                                           |  | 0                                                       | 1 |   |   |      |       |   |     |       |                                             |
| 0          | NTSC          | PAL-M            |                                                                                                                                                           |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 1          | PAL           | PAL-N            |                                                                                                                                                           |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 1          |               |                  |                                                                                                                                                           |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 2          | NP0           | 0                |                                                                                                                                                           |  |                                                         |   |   |   |      |       |   |     |       |                                             |
|            |               | 1                |                                                                                                                                                           |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 1          | NON           | 0                | Interlaced                                                                                                                                                |  | Switches between interlaced and non-interlaced displays |   |   |   |      |       |   |     |       |                                             |
|            |               | 1                | Non-interlaced                                                                                                                                            |  |                                                         |   |   |   |      |       |   |     |       |                                             |
| 0          | INT           | 0                | External synchronization                                                                                                                                  |  | Switches between external and internal synchronization  |   |   |   |      |       |   |     |       |                                             |
|            |               | 1                | Internal synchronization                                                                                                                                  |  |                                                         |   |   |   |      |       |   |     |       |                                             |

# LC74781, 74781M

## Second byte

| DA0 to DA7 | Register name | Register content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                               |              |                          |           |          | Note                                      |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
|------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------------------|-----------|----------|-------------------------------------------|---------|---------|--------------------------|------------|------|-----|---|---------|----------|-----------|------------|--------------------------------------------------------------------|----------|--------------|---|---|---|---------|------------|---|---|---|----------|------------|---|---|---|----------|--------------|
|            |               | State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Function                                                                                                                                                                                                                                                                                      |              |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 7          | —             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Second byte identification bit                                                                                                                                                                                                                                                                |              |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 6          | —             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                               |              |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 5          | —             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                               |              |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 4          | BCL           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Background color present                                                                                                                                                                                                                                                                      |              |                          |           |          | Only valid with internal synchronization. |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
|            |               | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | No background color (only the background level is set)                                                                                                                                                                                                                                        |              |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 3          | CB            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Outputs a color burst signal.                                                                                                                                                                                                                                                                 |              |                          |           |          | Only valid when BCL is high.              |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
|            |               | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Stops color burst signal output.                                                                                                                                                                                                                                                              |              |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 2          | PH2           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <table><tr><th rowspan="2">Phase 2</th><th rowspan="2">Phase 1</th><th rowspan="2">Phase 0</th><th colspan="2">Background color (phase)</th></tr><tr><th>NTSC</th><th>PAL</th></tr><tr><td>0</td><td>0</td><td>0</td><td><math>\pi/2^*</math></td><td><math>\pm\pi/2</math></td></tr></table> |              |                          |           |          | Phase 2                                   | Phase 1 | Phase 0 | Background color (phase) |            | NTSC | PAL | 0 | 0       | 0        | $\pi/2^*$ | $\pm\pi/2$ | Sample background color phase diagram for PAL mode color burst<br> |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
|            |               | Phase 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Phase 1                                                                                                                                                                                                                                                                                       | Phase 0      | Background color (phase) |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| NTSC       | PAL           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                               |              |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 0          | 0             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $\pi/2^*$                                                                                                                                                                                                                                                                                     | $\pm\pi/2$   |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 1          | 1             | <table><tr><td>0</td><td>0</td><td>1</td><td>In phase*</td><td>In phase</td></tr><tr><td>0</td><td>1</td><td>0</td><td><math>3\pi/2^*</math></td><td><math>\mp\pi/2</math></td></tr><tr><td>0</td><td>1</td><td>1</td><td><math>\pi^*</math></td><td><math>\pm\pi</math></td></tr><tr><td>1</td><td>0</td><td>0</td><td><math>3\pi/4</math></td><td><math>\pm 3\pi/4</math></td></tr><tr><td>1</td><td>0</td><td>1</td><td><math>\pi/4</math></td><td><math>\pm\pi/4</math></td></tr><tr><td>1</td><td>1</td><td>0</td><td><math>7\pi/4</math></td><td><math>\mp\pi/4</math></td></tr><tr><td>1</td><td>1</td><td>1</td><td><math>5\pi/4</math></td><td><math>\mp 3\pi/4</math></td></tr></table> | 0                                                                                                                                                                                                                                                                                             | 0            | 1                        | In phase* | In phase | 0                                         | 1       | 0       | $3\pi/2^*$               | $\mp\pi/2$ | 0    | 1   | 1 | $\pi^*$ | $\pm\pi$ | 1         | 0          | 0                                                                  | $3\pi/4$ | $\pm 3\pi/4$ | 1 | 0 | 1 | $\pi/4$ | $\pm\pi/4$ | 1 | 1 | 0 | $7\pi/4$ | $\mp\pi/4$ | 1 | 1 | 1 | $5\pi/4$ | $\mp 3\pi/4$ |
| 0          | 0             | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | In phase*                                                                                                                                                                                                                                                                                     | In phase     |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 0          | 1             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $3\pi/2^*$                                                                                                                                                                                                                                                                                    | $\mp\pi/2$   |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 0          | 1             | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $\pi^*$                                                                                                                                                                                                                                                                                       | $\pm\pi$     |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 1          | 0             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $3\pi/4$                                                                                                                                                                                                                                                                                      | $\pm 3\pi/4$ |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 1          | 0             | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $\pi/4$                                                                                                                                                                                                                                                                                       | $\pm\pi/4$   |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 1          | 1             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $7\pi/4$                                                                                                                                                                                                                                                                                      | $\mp\pi/4$   |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 1          | 1             | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $5\pi/4$                                                                                                                                                                                                                                                                                      | $\mp 3\pi/4$ |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
| 0          | PH0           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                               |              |                          |           |          | *: When 2fsc NTSC is used                 |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |
|            |               | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                               |              |                          |           |          |                                           |         |         |                          |            |      |     |   |         |          |           |            |                                                                    |          |              |   |   |   |         |            |   |   |   |          |            |   |   |   |          |              |

A03301

Note: The register states are all set to zero when the LC74781/M is reset with the RST pin.

## ⑦ COMMAND6 (Synchronization signal detection setup command)

### First byte

| DA0 to DA7 | Register name | Register content |                                                                                                                | Note                                                 |
|------------|---------------|------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
|            |               | State            | Function                                                                                                       |                                                      |
| 7          | —             | 1                | Command 6 identification code<br>Synchronization signal control settings                                       |                                                      |
| 6          | —             | 1                |                                                                                                                |                                                      |
| 5          | —             | 1                |                                                                                                                |                                                      |
| 4          | —             | 0                |                                                                                                                |                                                      |
| 3          | MOD1          | 0                | Sync separator circuit signal                                                                                  | Switches the SEP <sub>OUT</sub> (pin 19) output      |
|            |               | 1                | High level output during internal synchronization                                                              |                                                      |
| 2          | MOD0          | 0                | Pin 5: Blank signal<br>Pin 8: Character signal                                                                 | Switches the BLANK (pin 5) and CHARA (pin 8) outputs |
|            |               | 1                | Pin 5: Composite synchronization signal<br>Pin 8: External synchronization signal discrimination output signal |                                                      |
| 1          | DISLIN        | 0                | 12 lines                                                                                                       | Switches the number of display lines.                |
|            |               | 1                | 10 lines                                                                                                       |                                                      |
| 0          | MUT           | 0                | Normal output                                                                                                  | Switches CV <sub>OUT</sub>                           |
|            |               | 1                | CV <sub>IN</sub> is cut and CV <sub>OUT</sub> is fixed at the pedestal level.                                  |                                                      |

# LC74781, 74781M

## Second byte

| DA0 to DA7 | Register name | Register content |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  | Note |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
|------------|---------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--|--|------|-----|--------------------------------|--------------------------------|--------------------------------|---|---|---------|---|--------------|---|----------|---|---|----------|---------|---|---|---|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------|---|---|---|---|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            |               | State            | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 7          | —             | 0                | Second byte identification bit                                                                                                                                                                                                                                                                                                                                                                                                                                  |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 6          | RN2           | 0                | <table><tr><td>RN2</td><td>RN1</td><td>RN0</td><td>Number of times HSYNC detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0 times</td></tr><tr><td>0</td><td>0</td><td>1</td><td>4 times</td></tr><tr><td>0</td><td>1</td><td>0</td><td>8 times</td></tr><tr><td>1</td><td>0</td><td>0</td><td>16 times</td></tr></table>                                                                                                                                |              |  |  | RN2  | RN1 | RN0                            | Number of times HSYNC detected | 0                              | 0 | 0 | 0 times | 0 | 0            | 1 | 4 times  | 0 | 1 | 0        | 8 times | 1 | 0 | 0 | 16 times | External synchronization signal detection control<br>Signal absent to present transition recognition<br>Setting for the sampling period when SYNC can be detected consecutively in the horizontal synchronization signal period (1H). |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
|            |               | RN2              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  | RN1  | RN0 | Number of times HSYNC detected |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 0 times                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 1                | 4 times                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 1             | 0                | 8 times                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          | 0             | 0                | 16 times                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          |               |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 5          | RN1           | 0                | <table><tr><td>RN2</td><td>RN1</td><td>RN0</td><td>Number of times HSYNC detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0 times</td></tr><tr><td>0</td><td>0</td><td>1</td><td>4 times</td></tr><tr><td>0</td><td>1</td><td>0</td><td>8 times</td></tr><tr><td>1</td><td>0</td><td>0</td><td>16 times</td></tr></table>                                                                                                                                |              |  |  | RN2  | RN1 | RN0                            | Number of times HSYNC detected | 0                              | 0 | 0 | 0 times | 0 | 0            | 1 | 4 times  | 0 | 1 | 0        | 8 times | 1 | 0 | 0 | 16 times |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
|            |               | RN2              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  | RN1  | RN0 | Number of times HSYNC detected |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 0 times                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 1                | 4 times                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 1             | 0                | 8 times                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          | 0             | 0                | 16 times                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          |               |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 4          | RN0           | 0                | <table><tr><td>RN2</td><td>RN1</td><td>RN0</td><td>Number of times HSYNC detected</td></tr><tr><td>0</td><td>1</td><td>0</td><td>8 times</td></tr><tr><td>1</td><td>0</td><td>0</td><td>16 times</td></tr></table>                                                                                                                                                                                                                                              |              |  |  | RN2  | RN1 | RN0                            | Number of times HSYNC detected | 0                              | 1 | 0 | 8 times | 1 | 0            | 0 | 16 times |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
|            |               | RN2              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  | RN1  | RN0 | Number of times HSYNC detected |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 1             | 0                | 8 times                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          | 0             | 0                | 16 times                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          |               |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 3          | SN3           | 0                | <table><tr><td>SN3</td><td>SN2</td><td>SN1</td><td>SN0</td><td>Number of times HSYNC detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>Not detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>32 times</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>64 times</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>128 times</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>256 times</td></tr></table> |              |  |  | SN3  | SN2 | SN1                            | SN0                            | Number of times HSYNC detected | 0 | 0 | 0       | 0 | Not detected | 0 | 0        | 0 | 1 | 32 times | 0       | 0 | 1 | 0 | 64 times | 0                                                                                                                                                                                                                                     | 1 | 0 | 0 | 128 times | 1 | 0 | 0 | 0 | 256 times | External synchronization signal detection control<br>Signal present to absent transition recognition<br>Setting for the sampling period when SYNC can not be detected consecutively in the horizontal synchronization signal period (1H). |
|            |               | SN3              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  | SN2  | SN1 | SN0                            | Number of times HSYNC detected |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Not detected |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 32 times     |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 1                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 64 times     |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 1             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 128 times    |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          | 0             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 256 times    |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          |               |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 2          | SN2           | 0                | <table><tr><td>SN3</td><td>SN2</td><td>SN1</td><td>SN0</td><td>Number of times HSYNC detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>Not detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>32 times</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>64 times</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>128 times</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>256 times</td></tr></table> |              |  |  | SN3  | SN2 | SN1                            | SN0                            | Number of times HSYNC detected | 0 | 0 | 0       | 0 | Not detected | 0 | 0        | 0 | 1 | 32 times | 0       | 0 | 1 | 0 | 64 times | 0                                                                                                                                                                                                                                     | 1 | 0 | 0 | 128 times | 1 | 0 | 0 | 0 | 256 times |                                                                                                                                                                                                                                           |
|            |               | SN3              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  | SN2  | SN1 | SN0                            | Number of times HSYNC detected |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Not detected |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 32 times     |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 1                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 64 times     |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 1             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 128 times    |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          | 0             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 256 times    |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          |               |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          | SN1           | 0                | <table><tr><td>SN3</td><td>SN2</td><td>SN1</td><td>SN0</td><td>Number of times HSYNC detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>Not detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>32 times</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>64 times</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>128 times</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>256 times</td></tr></table> |              |  |  | SN3  | SN2 | SN1                            | SN0                            | Number of times HSYNC detected | 0 | 0 | 0       | 0 | Not detected | 0 | 0        | 0 | 1 | 32 times | 0       | 0 | 1 | 0 | 64 times | 0                                                                                                                                                                                                                                     | 1 | 0 | 0 | 128 times | 1 | 0 | 0 | 0 | 256 times |                                                                                                                                                                                                                                           |
|            |               | SN3              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  | SN2  | SN1 | SN0                            | Number of times HSYNC detected |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Not detected |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 32 times     |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 1                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 64 times     |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 1             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 128 times    |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          | 0             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 256 times    |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          |               |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | SN0           | 0                | <table><tr><td>SN3</td><td>SN2</td><td>SN1</td><td>SN0</td><td>Number of times HSYNC detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>Not detected</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>32 times</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>64 times</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>128 times</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>256 times</td></tr></table> |              |  |  | SN3  | SN2 | SN1                            | SN0                            | Number of times HSYNC detected | 0 | 0 | 0       | 0 | Not detected | 0 | 0        | 0 | 1 | 32 times | 0       | 0 | 1 | 0 | 64 times | 0                                                                                                                                                                                                                                     | 1 | 0 | 0 | 128 times | 1 | 0 | 0 | 0 | 256 times |                                                                                                                                                                                                                                           |
|            |               | SN3              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  | SN2  | SN1 | SN0                            | Number of times HSYNC detected |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Not detected |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 0                | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 32 times     |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 0             | 1                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 64 times     |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 0          | 1             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 128 times    |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          | 0             | 0                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 256 times    |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |
| 1          |               |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |  |      |     |                                |                                |                                |   |   |         |   |              |   |          |   |   |          |         |   |   |   |          |                                                                                                                                                                                                                                       |   |   |   |           |   |   |   |   |           |                                                                                                                                                                                                                                           |

Note: The register states are all set to zero when the LC74781/M is reset with the  $\overline{\text{RST}}$  pin.

## ⑧ COMMAND7 (Display control setup command)

### First byte

| DA0 to DA7 | Register name | Register content |                                                        | Note                                            |
|------------|---------------|------------------|--------------------------------------------------------|-------------------------------------------------|
|            |               | State            | Function                                               |                                                 |
| 7          | —             | 1                | Command 7 identification code<br>Display control setup |                                                 |
| 6          | —             | 1                |                                                        |                                                 |
| 5          | —             | 1                |                                                        |                                                 |
| 4          | —             | 1                |                                                        |                                                 |
| 3          | EX1           | 0                | MODE1 setting output                                   | Switches the SEP <sub>OUT</sub> (pin 19) output |
|            |               | 1                | PORT DATA1 setting output                              |                                                 |
| 2          | PD1           | 0                | The output is set low.                                 |                                                 |
|            |               | 1                | The output is set high.                                |                                                 |
| 1          | EX0           | 0                | MODE0 setting output                                   | Switches the BLANK (pin 5) output               |
|            |               | 1                | PORT DATA0 setting output                              |                                                 |
| 0          | PD0           | 0                | The output is set low.                                 |                                                 |
|            |               | 1                | The output is set high.                                |                                                 |

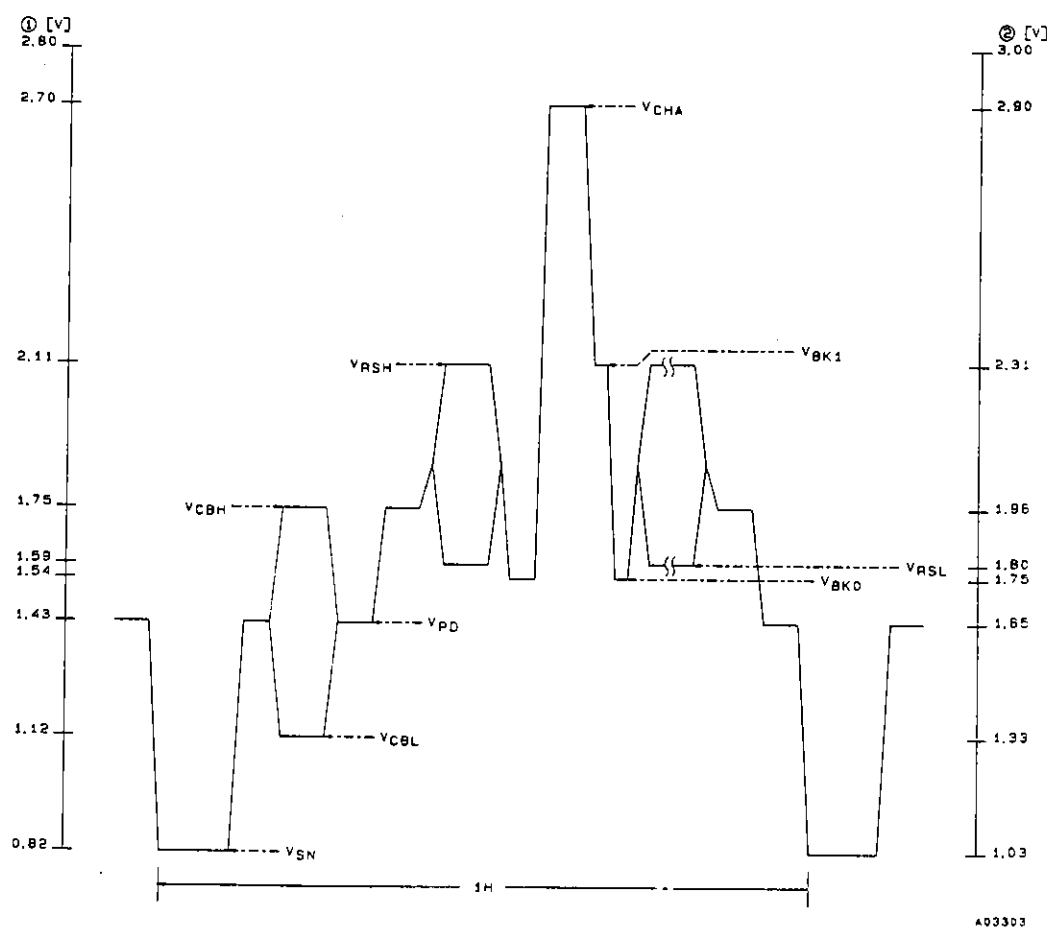
### Second byte

| DA0 to DA7 | Register name | Register content |                                           | Note                                                                                 |
|------------|---------------|------------------|-------------------------------------------|--------------------------------------------------------------------------------------|
|            |               | State            | Function                                  |                                                                                      |
| 7          | —             | 0                | Second byte identification bit            |                                                                                      |
| 6          | —             | 0                |                                           |                                                                                      |
| 5          | —             | 0                |                                           |                                                                                      |
| 4          | VNPSEL        | 0                | V falling edge detection                  | Switches V acquisition polarity when internal V separation is used in external mode. |
|            |               | 1                | V rising edge detection                   |                                                                                      |
| 3          | VSPSEL        | 0                | VSEP: about 8.9 $\mu\text{s}$ (for NTSC)  | Switches the internal V separation time.                                             |
|            |               | 1                | VSEP: about 17.8 $\mu\text{s}$ (for NTSC) |                                                                                      |
| 2          | MSKERS        | 0                | Mask valid                                | HSYNC and VSYNC mask release                                                         |
|            |               | 1                | Mask invalid                              |                                                                                      |
| 1          | MSKSEL        | 0                | 3H (for NTSC)                             | Switches the VSYNC mask.                                                             |
|            |               | 1                | 20H (for NTSC)                            |                                                                                      |
| 0          | EGL           | 0                | Border level 0 only (VBK0)                | Switches the border level<br>(Only valid for BLK0 = 0 and BLK1 = 1)                  |
|            |               | 1                | Border level has two stages (VBK0, VBK1)  |                                                                                      |

Note: The register states are all set to zero when the LC74781/M is reset with the  $\overline{\text{RST}}$  pin.



## Composite Video Signal Output Level (internally generated level)

CV<sub>OUT</sub> output level waveform ( $V_{DD2} = 5.00$  V)

| Output level                      | Output voltage ① [V] | Output voltage ② [V] |
|-----------------------------------|----------------------|----------------------|
| $V_{CHA}$ : Character             | 2.70                 | 2.90                 |
| $V_{BK1}$ : Border                | 2.11                 | 2.31                 |
| $V_{RSH}$ : Background color high | 2.11                 | 2.31                 |
| $V_{CBH}$ : Color burst high      | 1.75                 | 1.96                 |
| $V_{RSL}$ : Background color low  | 1.59                 | 1.80                 |
| $V_{BK0}$ : Border                | 1.54                 | 1.75                 |
| $V_{PD}$ : Pedestal               | 1.43                 | 1.65                 |
| $V_{CBL}$ : Color burst low       | 1.12                 | 1.33                 |
| $V_{SN}$ : Sync                   | 0.82                 | 1.03                 |

 $V_{DD2} = 5.00$  V

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