For Messrs. Hitachi Europe Ltd.

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX06D57VM0AAA

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Please return 1 copy with your signature on this page for approval.

Accepted by: __________________________  Proposed by: __________________________

Date: __________________________

Hitachi Displays, Ltd.

Sh. No. 3284PS 2601 - TX06D57VM0AAA - 1A  Page 1-1/1
3. GENERAL DATA

(1) Product Name TX06D57VM0AAA

(2) Module Dimensions 39.8(W) mm x 56.1(H) mm x 2.7(t) mm
  Width: Excluding hooks of metal frame
  Thickness: Excluding electronic components

(3) Active Area Dimensions 33.84 (W) mm x 45.12 (H) mm

(4) Pixel Pitch 0.141 (W) mm x 0.141 (H) mm

(5) Resolution 240 x 3 (R,G,B) (W) x 320 (H) dots

(6) Color Pixel Arrangement BGR Vertical Stripe

(7) Display Mode Transmissive Type, Normally Black Mode

(8) Number of Colors
  65,536 Colors (SPI, 16-bit RGB - I/F)
  262,144 Colors (18-bit RGB - I/F)

(9) Viewing Direction -

(10) Backlight Light Emitting Diode (LED), Four LEDs connected in series

(11) Weight 12.6 g

(12) Power Supply Voltage $V_{CI} = 2.8$ V (typ) (for logic and analog circuits)

(13) Interface I/O power supply
    $V_{CCI}O = 1.8$ V to $V_{CI} (1.8 \leq V_{CCI}O \leq 2.8)$
    The same voltage as "H" level of a customer's interface signal must be supplied to $V_{CCI}O$.

(14) LCD Driver IC
    Source IC : BD663471 (with partial RAM (240xRGBx96 dots))
    Gate and Power IC : HD66786U

(15) Interface
    System interface : Clock synchronized Serial Interface (SPI)
    External display interface : 16-bit, 18-bit RGB Interface

Note (1) $V_{CCI}O$ is the reference voltage for adjusting the I/O signal level of BD663471. 
$V_{CCI}O$ voltage should be determined according to the customer's system.
4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply for Interface</td>
<td>VccIO</td>
<td>-0.3</td>
<td>4.0</td>
<td>V</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>Power Supply for Logic and Analog</td>
<td>Vci</td>
<td>-0.3</td>
<td>4.0</td>
<td>V</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>Vi</td>
<td>-0.3</td>
<td>VccIO+0.3</td>
<td>V</td>
<td>(1), (3)</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>Vo</td>
<td>-0.3</td>
<td>VccIO+0.3</td>
<td>V</td>
<td>(1), (4)</td>
</tr>
<tr>
<td>LED Reverse Voltage</td>
<td>VR</td>
<td>-</td>
<td>5</td>
<td>V</td>
<td>(1), (5)</td>
</tr>
<tr>
<td>LED Forward Current</td>
<td>ILED</td>
<td>-</td>
<td>35</td>
<td>mA</td>
<td>(5), (6)</td>
</tr>
<tr>
<td>Static Electricity</td>
<td></td>
<td>-</td>
<td>±2</td>
<td>kV</td>
<td>(7)</td>
</tr>
</tbody>
</table>

Notes
(1) All voltage values are referred to GND.
(2) VccIO ≤ Vci
VccIO is the reference voltage for adjusting the I/O signal level of BD663471.
The same voltage as "H" level of a customer's interface signal must be supplied to VccIO.
(3) Applies to the RESET, ID, SDI, SCL, CS*, VSYNC, HSYNC, DOTCLK and PD17 to PD0 pins.
(4) Applies to the SDO.
(5) Ta = 25°C, per piece of LED.
(6) Refer to Fig.1.
(7) 100 pF-1.5k ohm, 25°C-70%RH
Static electricity discharge point is the center of LCD's surface.

4.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Item</th>
<th>Operating</th>
<th>Storage</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>-20°C</td>
<td>70°C</td>
<td>-30°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>Note (1)</td>
<td>Note (1)</td>
<td>No condensation</td>
</tr>
<tr>
<td>Corrosive Gas</td>
<td>Not Acceptable</td>
<td>Not Acceptable</td>
<td></td>
</tr>
</tbody>
</table>

Notes
(1) Ta ≤ 40°C: 95%RH max.
Ta > 40°C: Absolute humidity must be lower than the humidity of 95%RH at 40°C.
(2) Background color slightly changes depending on ambient temperature and viewing angle.
The speed of response is slower at 0°C.
The temperature for operating in the table above apply to operation only.
Visual qualities, such as contrast and speed of response, to be evaluated at Ta = 25°C.
### 5. ELECTRICAL CHARACTERISTICS

#### 5.1 TFT-LCD MODULE

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage for Logic and Analog</td>
<td>VCI</td>
<td></td>
<td>2.72</td>
<td>2.8</td>
<td>2.88</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Input Voltage for Logic Circuits</td>
<td>Vi</td>
<td>&quot;H&quot; level</td>
<td>0.85</td>
<td>VCCIO</td>
<td>-</td>
<td>V</td>
<td>(1), (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;L&quot; level</td>
<td>-0.3</td>
<td>-</td>
<td>0.15xVCCIO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage for Logic Circuits</td>
<td>VO</td>
<td>&quot;H&quot; level</td>
<td>0.75</td>
<td>VCCIO</td>
<td>-</td>
<td>V</td>
<td>(1), (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;L&quot; level</td>
<td>-</td>
<td>-</td>
<td>0.2xVCCIO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input/Output Leak current</td>
<td>ILi</td>
<td></td>
<td>-1.0</td>
<td>-</td>
<td>1.0</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>Power Supply Current</td>
<td>ICC + ICI</td>
<td></td>
<td>All white</td>
<td>-</td>
<td>7.0</td>
<td>11.0</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partial</td>
<td>-</td>
<td>0.6</td>
<td>1.1</td>
<td>mA</td>
<td>(4)</td>
</tr>
<tr>
<td>Frame Frequency</td>
<td>fFLM</td>
<td>Normal display operation</td>
<td>-</td>
<td>(75)</td>
<td>-</td>
<td>Hz</td>
<td>(5)</td>
</tr>
<tr>
<td>RGB I/F mode</td>
<td>fFLM</td>
<td>Normal display operation</td>
<td>(75)</td>
<td>85</td>
<td>(95)</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>LED Forward Voltage</td>
<td>VLED</td>
<td></td>
<td>-</td>
<td>-</td>
<td>(3.2)</td>
<td>V</td>
<td>(6)</td>
</tr>
<tr>
<td>LED Forward Current</td>
<td>ILED</td>
<td></td>
<td>-</td>
<td>-</td>
<td>15.0</td>
<td>mA</td>
<td>(6), (7)</td>
</tr>
</tbody>
</table>

**Notes**

1. $1.8 \text{ V} \leq \text{VCCIO} \leq \text{VCI}$ ($\text{VCCIO} = 1.8 \text{ V} \text{ to } 2.8 \text{ V}$)
2. Input: RESET*, ID, SDI, SCL, CS*, VSYNC, HSYNC, DOTCLK, ENABLE, PD17 to PD0
3. VCI = VCCIO = 2.8 V, RGB I/F mode, fFLM = 85 Hz
   - Raster-row reversed AC drive
4. VCI = VCCIO = 2.8 V, 8-color mode, fFLM = 50 Hz
   - Frame reversed AC drive, No RGB I/F input signals
5. VCI = VCCIO = 2.8 V, Deep standby mode,
   - VCI, VCCIO: ON, Display: OFF
   - Internal oscillator: STOP, Power supply: OFF, No RGB I/F input signals.
6. It is the value for one LED.
7. The operating current of LED should be determined under the maximum rating of the temperature environmental condition.

![Fig. 1 Partial Pattern](image-url)
6. OPTICAL CHARACTERISTICS

6.1 OPTICAL CHARACTERISTICS OF LCD (BACKLIGHT ON)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brightness</td>
<td>B</td>
<td>ϕ=0°, θ=0°</td>
<td>150</td>
<td>220</td>
<td>-</td>
<td>cd/m²</td>
<td>(1)</td>
</tr>
<tr>
<td>Brightness Uniformity</td>
<td>-</td>
<td>ϕ=0°, θ=0°</td>
<td>70</td>
<td>80</td>
<td>-</td>
<td>%</td>
<td>(2), (4)</td>
</tr>
<tr>
<td>Viewing Angle</td>
<td>ϕ2+ϕ1</td>
<td>θ=0°, K≥10</td>
<td>-</td>
<td>160</td>
<td>-</td>
<td>deg</td>
<td>(3), (5), (6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>θ=90°, K≥10</td>
<td>-</td>
<td>160</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contrast Ratio</td>
<td>K</td>
<td>ϕ=0°, θ=0°</td>
<td>200</td>
<td>250</td>
<td>-</td>
<td>-</td>
<td>(5)</td>
</tr>
<tr>
<td>Response Time</td>
<td>tr+tf</td>
<td>ϕ=0°, θ=0°</td>
<td>-</td>
<td>60</td>
<td>120</td>
<td>ms</td>
<td>(7)</td>
</tr>
</tbody>
</table>

| Color Tone (Primary Color)    |        |           |         |         |         |          |      |
| Red                           | x      |           | 0.58    | 0.63    | 0.68    |          |      |
|                               | y      |           | 0.31    | 0.36    | 0.41    |          |      |
| Green                         | x      |           | 0.28    | 0.33    | 0.38    |          |      |
|                               | y      |           | 0.55    | 0.60    | 0.65    |          |      |
| Blue                          | x      | ϕ=0°, θ=0° | 0.09   | 0.14    | 0.19    |          |      |
|                               | y      |           | 0.05    | 0.10    | 0.15    |          |      |
| White                         | x      |           | 0.25    | 0.31    | 0.37    |          |      |
|                               | y      |           | 0.26    | 0.32    | 0.38    |          |      |

Measurement Conditions:
- Measurement environment: Dark room
- Ambient temperature: Ta = 25°C
- Sequence: Refer to Item 8.5.2, SEQUENCE.
- Power supply voltage: VCI = VCC.IO = 2.8 V
- Backlight current: ILED = 15 mA

Note (1) Definition of Brightness "B"

Sensor: TOPCON's BM-5A or equivalent
Measuring point: Center of LCD's active area
(4) Definition of Brightness Uniformity

Brightness Uniformity = Brightness (min) / Brightness (max) x 100 (%)  

(5) Definition of Contrast "K"

\[ K = \frac{\text{Brightness when displaying White raster}}{\text{Brightness when displaying Black raster}} \]

(6) Definition of Viewing Angle \( \phi_1 \) and \( \phi_2 \)

(7) Definition of Optical Response Time

Display data

<table>
<thead>
<tr>
<th>Black</th>
<th>White</th>
<th>Black</th>
</tr>
</thead>
</table>

Relative Brightness

\( \text{tr: Rise time} \)

\( \text{Optical response time} \)

\( \text{tr: Fall time} \)
7. BLOCK DIAGRAM

TFT-LCD
240 (H) x RGB x 320 (V)
(SS=1, GS=1, BGR=0)

Note (1)
R : Resistance for limiting current (R ≥ 100 ohm)
8. INTERFACE
8.1 INTERNAL PIN CONNECTION

Suitable Connector: HIROSE FH26-39S-0.3SHW(05)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>ID</td>
<td>ID bit setting of device ID code</td>
</tr>
<tr>
<td>4</td>
<td>Vci</td>
<td>Power supply for logic and analog circuit</td>
</tr>
<tr>
<td>5</td>
<td>Vci</td>
<td>Power supply for logic and analog circuit</td>
</tr>
<tr>
<td>6</td>
<td>VcoIO</td>
<td>Power Supply for Interface signal</td>
</tr>
<tr>
<td>7</td>
<td>PD0</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>8</td>
<td>PD1</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>9</td>
<td>PD2</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>10</td>
<td>PD3</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>11</td>
<td>PD4</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>12</td>
<td>PD5</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>13</td>
<td>PD6</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>14</td>
<td>PD7</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>15</td>
<td>PD8</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>16</td>
<td>PD9</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>17</td>
<td>PD10</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>18</td>
<td>PD11</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>19</td>
<td>PD12</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>20</td>
<td>PD13</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>21</td>
<td>PD14</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>22</td>
<td>PD15</td>
<td>RGB data signal</td>
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<tr>
<td>23</td>
<td>PD16</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>24</td>
<td>PD17</td>
<td>RGB data signal</td>
</tr>
<tr>
<td>25</td>
<td>DOTCLK</td>
<td>Dot clock signal</td>
</tr>
<tr>
<td>26</td>
<td>HSYNC</td>
<td>Line synchronizing signal</td>
</tr>
<tr>
<td>27</td>
<td>VSYNC</td>
<td>Frame synchronizing signal</td>
</tr>
<tr>
<td>28</td>
<td>SC*</td>
<td>Chip select signal</td>
</tr>
<tr>
<td>29</td>
<td>SCL</td>
<td>Serial clock signal</td>
</tr>
<tr>
<td>30</td>
<td>SDI</td>
<td>Serial Instruction data input</td>
</tr>
<tr>
<td>31</td>
<td>SDO</td>
<td>Serial Instruction data output</td>
</tr>
<tr>
<td>32</td>
<td>REEST*</td>
<td>Reset signal</td>
</tr>
<tr>
<td>33</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>34</td>
<td>LED(AN)</td>
<td>VLED(+) (Anode)</td>
</tr>
<tr>
<td>35</td>
<td>LED(AN)</td>
<td>VLED(+) (Anode)</td>
</tr>
<tr>
<td>36</td>
<td>LED(CA)</td>
<td>VLED(-) (Cathode)</td>
</tr>
<tr>
<td>37</td>
<td>LED(CA)</td>
<td>VLED(-) (Cathode)</td>
</tr>
<tr>
<td>38</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>39</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Note (1) In serial interface mode, leave the SDO pin open when it is not used.
8.2 INTERFACE MODE SETTING

8.2.1 SPI INTERFACE MODE

<table>
<thead>
<tr>
<th>ID pin connection</th>
<th>ID bit</th>
<th>RS</th>
<th>R/W</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Set an index register</td>
</tr>
<tr>
<td>VCCIO</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Write an instruction or RAM data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>Read an instruction or RAM data</td>
</tr>
</tbody>
</table>

ID bit of the device ID code is determined by ID pin connection.
ID pin must be connected to GND or VCCIO according to the customer's system.

Basic data transferred through SPI

Note (1) When reading data from SDO, the start byte of a read command must be transferred.

8.2.2 RGB INTERFACE MODE

**RGB INTERFACE MODE & UNUSED PIN CONNECTION**

<table>
<thead>
<tr>
<th></th>
<th>16-bit</th>
<th>18-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGB Interface Mode</td>
<td>16-bit</td>
<td>18-bit</td>
</tr>
<tr>
<td>Number of display colors</td>
<td>65k</td>
<td>262k</td>
</tr>
<tr>
<td>RGB Data Bus Pins</td>
<td>PD17-0</td>
<td>PD17-13, PD11-1</td>
</tr>
<tr>
<td>Unused RGB Data Bus Pins</td>
<td></td>
<td>PD12, PD0</td>
</tr>
<tr>
<td>Pin No.</td>
<td>Signal</td>
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In 16-bit RGB-I/F, PD12 and PD0 pins must be fixed to GND level.

**INPUT DATA & RGB DATA**

18-bit RGB INTERFACE

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**RGB data**

16-bit RGB INTERFACE

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**RGB data**

Note (1) The data of PD17 is R5, and the data of PD5 is B5.
In 16-bit RGB-I/F, the input data are expanded into 18-bit by adding one bit (the same data as the MSB of RB) to the LSB of RB data within BD663471.
### 8.3 PARTIAL RAM ADDRESS MAP

Partial RAM: 240xRGBx96 dots

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- **Gn=1**
  - *0000"H*  *0001"H*  *0002"H*  *0003"H*  *00EC"H*  *00ED"H*  *00EE"H*  *00EF"H*
- **Gn=2**
  - *0100"H*  *0101"H*  *0102"H*  *0103"H*  *01EC"H*  *01ED"H*  *01EE"H*  *01EF"H*
- **Gn=3**
  - *0200"H*  *0201"H*  *0202"H*  *0203"H*  *02EC"H*  *02ED"H*  *02EE"H*  *02EF"H*
- **Gn=4**
  - *0300"H*  *0301"H*  *0302"H*  *0303"H*  *03EC"H*  *03ED"H*  *03EE"H*  *03EF"H*
- **Gn=5**
  - *0400"H*  *0401"H*  *0402"H*  *0403"H*  *04EC"H*  *04ED"H*  *04EE"H*  *04EF"H*

- **Gn=92**
  - *5B00"H*  *5B01"H*  *5B02"H*  *5B03"H*  *5BEC"H*  *5BED"H*  *5BEE"H*  *5BEF"H*
- **Gn=93**
  - *5C00"H*  *5C01"H*  *5C02"H*  *5C03"H*  *5CEC"H*  *5CED"H*  *5CEE"H*  *5CEF"H*
- **Gn=94**
  - *5D00"H*  *5D01"H*  *5D02"H*  *5D03"H*  *5DEC"H*  *5DED"H*  *5DEE"H*  *5DEF"H*
- **Gn=95**
  - *5E00"H*  *5E01"H*  *5E02"H*  *5E03"H*  *5ECC"H*  *5EED"H*  *5EEE"H*  *5EEF"H*
- **Gn=96**
  - *5F00"H*  *5F01"H*  *5F02"H*  *5F03"H*  *5FEC"H*  *5FED"H*  *5FEE"H*  *5FEF"H*
### 8.4 INTERFACE TIMING

#### 8.4.1 CLOCK SYNCHRONIZED SERIAL INTERFACE TIMING CHARACTERISTICS

[V_{cc} = 2.5 V to 3.3 V, VccIO = 1.65 V to 3.3 V]

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#### 8.4.2 RGB INTERFACE TIMING CHARACTERISTICS

[V_{cc} = 2.5 V to 3.3 V, VccIO = 1.65 V to 2.5 V]

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<td>VSYNC Hold Time</td>
<td>TVH</td>
<td>μs</td>
<td>11</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HSYNC Setup Time</td>
<td>THS</td>
<td>ns</td>
<td>11</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HSYNC Hold Time</td>
<td>THH</td>
<td>ns</td>
<td>11</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DOTCLK &quot;Low&quot; Level Pulse Width</td>
<td>TLWD</td>
<td>ns</td>
<td>16</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DOTCLK &quot;High&quot; Level Pulse Width</td>
<td>THWD</td>
<td>ns</td>
<td>16</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DOTCLK Cycle Time</td>
<td>tCYCD</td>
<td>ns</td>
<td>105</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Data Setup Time</td>
<td>tDS</td>
<td>ns</td>
<td>11</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Data Hold Time</td>
<td>tDH</td>
<td>ns</td>
<td>11</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rise/Fall Time</td>
<td>Tr/Tf</td>
<td>ns</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

#### 8.4.3 RESET TIMING CHARACTERISTICS

[V_{cc} = 2.5 V to 3.3 V, VccIO = 1.65 V to 3.3 V]

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Unit</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reset &quot;Low&quot; Level Width</td>
<td>tRES</td>
<td>ns</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reset Rise Time</td>
<td>trRES</td>
<td>μs</td>
<td>-</td>
<td>-</td>
<td>10</td>
</tr>
</tbody>
</table>
### 8.4.4 16-bit/18-bit RGB INTERFACE TIMING

**Diagram:**
- **1 frame**
- **BPPv = 8H**
- **DP = 320H**
- **FPPv = 8H**
- **Notes (3), (4)**

**Notes:**
1. **BPPv** should be used with the high-speed write mode (HWM = "1").
2. Dot clock signal (DOTCLK) must be always supplied.
3. Front and back porch periods must be set before and after the display operation period (DP).
4. Front porch period continues until the next input of VSYNC signal.
5. Horizontal and vertical back porch periods (BPPH, BPPv) of interface signal must accord with R05h register setting value.

### Timing Table

<table>
<thead>
<tr>
<th>Item</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLW</td>
<td>1CLK</td>
<td>4CLK</td>
<td>-</td>
<td>HLW ≥ 1CLK</td>
</tr>
<tr>
<td>BPPH</td>
<td>10CLK</td>
<td>12CLK</td>
<td>20CLK</td>
<td>(5)</td>
</tr>
<tr>
<td>FPPH</td>
<td>10CLK</td>
<td>15CLK</td>
<td>100CLK</td>
<td></td>
</tr>
<tr>
<td>VLW</td>
<td>1H</td>
<td>4H</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>BPPv</td>
<td>3H</td>
<td>8H</td>
<td>15H</td>
<td>(3), (5)</td>
</tr>
<tr>
<td>FPPv</td>
<td>-</td>
<td>8H</td>
<td>-</td>
<td>(3), (4)</td>
</tr>
<tr>
<td>DP</td>
<td>-</td>
<td>-</td>
<td>320H</td>
<td></td>
</tr>
<tr>
<td>fDOTCLK</td>
<td>(75)</td>
<td>85</td>
<td>(95)</td>
<td></td>
</tr>
</tbody>
</table>

The number of raster-rows of 1 frame: BPPv + DP + FPPv
fDOTCLK = fFLM x (320 + BPPH + BPPv) x (240 + BPPH + FPPv)

**Notes:**
1. RGB-I/F mode should be used with the high-speed write mode (HWM = "1").
2. Dot clock signal (DOTCLK) must be always supplied.
3. Front and back porch periods must be set before and after the display operation period (DP).
4. Front porch period continues until the next input of VSYNC signal.
5. Horizontal and vertical back porch periods (BPPH, BPPv) of interface signal must accord with R05h register setting value.
8.5 REGISTER SETTING FLOW
8.5.1 STATE CHART

(a) 
Vcc, Vci: ON
Display: OFF
fosc: ON
Internal power supply: ON

(b) 
Vcc, Vci: ON
Display: ON
262k colors Full screen
OSD: OFF
fosc: ON
Internal power supply: ON

(c) 
Vcc, Vci: ON
Display: ON
262k colors Full screen
OSD: ON
fosc: ON
Internal power supply: ON

(d) Standby
Vcc, Vci: ON
Display: OFF
fosc: OFF
Internal power supply: OFF

(e) 
Vcc, Vci: ON
Display: ON
8 colors 96 lines
OSD: Partial
fosc: ON
Internal power supply: ON

RGB signals must be inputted.

Vcc=Vci=2.80V

It is displayed by the internal GRAM data. Since it is not necessary to input RGB signals, the display is in the state of a low power consumption.
### 8.5.2 SEQUENCE

#### Status (h) ---> (a)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power On reset</td>
</tr>
<tr>
<td>2</td>
<td>VccIO On</td>
</tr>
<tr>
<td>3</td>
<td>wait 1 ms</td>
</tr>
<tr>
<td>4</td>
<td>Reset* = &quot;H&quot;</td>
</tr>
<tr>
<td>5</td>
<td>wait 1 ms</td>
</tr>
<tr>
<td>6</td>
<td>Oscillation Start</td>
</tr>
<tr>
<td>7</td>
<td>R00h 0x01</td>
</tr>
<tr>
<td>8</td>
<td>wait 10 ms</td>
</tr>
</tbody>
</table>

#### Status (a) ---> (h)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Off</td>
</tr>
<tr>
<td>2</td>
<td>VccIO Off</td>
</tr>
</tbody>
</table>

#### Status (a) ---> (d)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>idx=000</td>
</tr>
<tr>
<td>2</td>
<td>0x1000</td>
</tr>
<tr>
<td>3</td>
<td>R40h 0x00</td>
</tr>
<tr>
<td>4</td>
<td>R41h 0x80</td>
</tr>
<tr>
<td>5</td>
<td>R42h 0x00</td>
</tr>
<tr>
<td>6</td>
<td>R40h 0x10</td>
</tr>
<tr>
<td>7</td>
<td>wait 100 us</td>
</tr>
<tr>
<td>8</td>
<td>R50h 0x01</td>
</tr>
</tbody>
</table>

#### Status (d) ---> (a)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R00h 0x01</td>
</tr>
<tr>
<td>2</td>
<td>wait 10 ms</td>
</tr>
<tr>
<td>3</td>
<td>R50h 0x00</td>
</tr>
<tr>
<td>4</td>
<td>wait 100 us</td>
</tr>
</tbody>
</table>

#### Status (b) ---> (c)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R04h 0x02</td>
</tr>
<tr>
<td>2</td>
<td>wait 40 ms</td>
</tr>
<tr>
<td>3</td>
<td>R0Ah 0x1B</td>
</tr>
<tr>
<td>4</td>
<td>OSD area 1 Line setting</td>
</tr>
<tr>
<td>5</td>
<td>Start line (1)</td>
</tr>
<tr>
<td>6</td>
<td>OSD area 2 Line setting</td>
</tr>
<tr>
<td>7</td>
<td>Start line (279)</td>
</tr>
<tr>
<td>8</td>
<td>R0Ah 0x06</td>
</tr>
<tr>
<td>9</td>
<td>R30h 0x00</td>
</tr>
<tr>
<td>10</td>
<td>R31h 0xEF</td>
</tr>
<tr>
<td>11</td>
<td>R32h 0x00</td>
</tr>
<tr>
<td>12</td>
<td>R33h 0x5F</td>
</tr>
<tr>
<td>13</td>
<td>OSD area 1 RAM setting</td>
</tr>
<tr>
<td>14</td>
<td>54 lines from 00h to 36h</td>
</tr>
<tr>
<td>15</td>
<td>OSD area 2 RAM setting</td>
</tr>
<tr>
<td>16</td>
<td>42 lines from 36h to 5Fh</td>
</tr>
<tr>
<td>17</td>
<td>Serial I/F writing</td>
</tr>
<tr>
<td>18</td>
<td>R20h 0x00</td>
</tr>
<tr>
<td>19</td>
<td>R21h 0x00</td>
</tr>
<tr>
<td>20</td>
<td>R23h 0x36</td>
</tr>
<tr>
<td>21</td>
<td>Image write (240x96)</td>
</tr>
<tr>
<td>22</td>
<td>R04h 0x03</td>
</tr>
</tbody>
</table>

#### Status (c) ---> (b)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R0Ah 0x00</td>
</tr>
</tbody>
</table>
### Status (e) ---> (c)

<table>
<thead>
<tr>
<th></th>
<th>Action</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RGB input ON</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>R04h 0x02</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>wait 40 ms</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>idx=001, 0x1223</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>R40h 0x01</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>R41h 0x91</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>R42h 0x03</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>R40h 0x11</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>wait 100 us</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>idx=011, 0x0CCF</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>R40h 0x03</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>R41h 0x66</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>R42h 0x0F</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>R40h 0x13</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>wait 100 us</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>R03h 0x00</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>idx=010, 0x0A04</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>R40h 0x02</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>R41h 0x50</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>R42h 0x04</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>R40h 0x12</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>wait 100 us</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>idx=000, 0x1174</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>R40h 0x00</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>R41h 0x8B</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>R42h 0x14</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>R40h 0x10</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>wait 100 us</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>R0Ah 0x1B</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>R04h 0x03</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>wait 40 ms</td>
<td></td>
</tr>
</tbody>
</table>

### Status (c) ---> (e)

<table>
<thead>
<tr>
<th></th>
<th>Action</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R04h 0x82</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>wait 40 ms</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>R0Ah 0x5B</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>idx=001, 0x0046</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>R40h 0x01</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>R41h 0x02</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>R42h 0x06</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>R40h 0x11</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>wait 100 us</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>idx=011, 0x0DC0</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>R40h 0x03</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>R41h 0x8E</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>R42h 0x00</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>R40h 0x13</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>wait 100 us</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>R40h 0x02</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>idx=010, 0x0F04</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>R40h 0x12</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>R41h 0x78</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>R42h 0x04</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>R40h 0x10</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>wait 100 us</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>idx=000, 0x1072</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>R40h 0x10</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>R41h 0x83</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>R42h 0x12</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>R40h 0x10</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>wait 100 us</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>R03h 0x00</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>R07h 0x80</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>R50h 0x24</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>wait 40 ms</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>RGB input OFF</td>
<td></td>
</tr>
</tbody>
</table>

---

**Note:** The table above illustrates a sequence of actions and values for transitioning between two states (e) and (c) in a display system, with specific memory addresses and wait times indicated.
<table>
<thead>
<tr>
<th>No.</th>
<th>Command</th>
<th>Address</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RGB input ON</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>R05h</td>
<td>0x00</td>
<td></td>
<td>**** Follow LCDC settings.</td>
</tr>
<tr>
<td>3</td>
<td>R50h</td>
<td>0x00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>R51h</td>
<td>0x00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>idx=000</td>
<td>0x000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>R40h</td>
<td>0x00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>R41h</td>
<td>0x00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>R42h</td>
<td>0x00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>R40h</td>
<td>0x10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>idx=010</td>
<td>0x0A04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>R40h</td>
<td>0x02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>R41h</td>
<td>0x50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>R42h</td>
<td>0x04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>R40h</td>
<td>0x12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>idx=011</td>
<td>0x0CCF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>R40h</td>
<td>0x03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>R41h</td>
<td>0x66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>R42h</td>
<td>0x0F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>R40h</td>
<td>0x13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>idx=001</td>
<td>0x1223</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>R40h</td>
<td>0x01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>R41h</td>
<td>0x91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>R42h</td>
<td>0x03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>R40h</td>
<td>0x11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>idx=110</td>
<td>0x19C0</td>
<td></td>
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<td>R41h</td>
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<td>R42h</td>
<td>0x14</td>
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<td>41</td>
<td>R40h</td>
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Follow LCDC settings.

Gamma setting

Status (a) ---> (b)

to Sequence No.42
### Status (b) ---&gt; (a)

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<tr>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>wait 40 ms</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>R06h 0x00</td>
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</tr>
<tr>
<td>4</td>
<td>wait 40 ms</td>
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</tr>
<tr>
<td>5</td>
<td>idx=000 0x0174</td>
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</tr>
<tr>
<td>6</td>
<td>R40h 0x00</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>R41h 0x0B</td>
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</tr>
<tr>
<td>8</td>
<td>R42h 0x14</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>R40h 0x10</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>wait 100 us</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>R04h 0x00</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>R06h 0x00</td>
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<tr>
<td>13</td>
<td>idx=000 0x0010</td>
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<tr>
<td>14</td>
<td>R40h 0x00</td>
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</tr>
<tr>
<td>15</td>
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<td>R40h 0x10</td>
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<td>17</td>
<td>wait 10 ms</td>
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</tr>
<tr>
<td>18</td>
<td>idx=000 0x0000</td>
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<tr>
<td>19</td>
<td>R40h 0x00</td>
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</tr>
<tr>
<td>20</td>
<td>R42h 0x00</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>R40h 0x10</td>
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<td>22</td>
<td>wait 10 ms</td>
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</tr>
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<td>23</td>
<td>RGB input OFF</td>
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### Status (e) ---&gt; (b)

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<td>wait 40 ms</td>
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</tr>
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<td>R0Ah 0x5B</td>
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</tr>
<tr>
<td>4</td>
<td>idx=001 0x0046</td>
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</tr>
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<td>5</td>
<td>R40h 0x01</td>
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<td>R41h 0x02</td>
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<td>8</td>
<td>R40h 0x11</td>
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</tr>
<tr>
<td>9</td>
<td>wait 100 us</td>
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</tr>
<tr>
<td>10</td>
<td>idx=011 0x0CC0</td>
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</tr>
<tr>
<td>11</td>
<td>R40h 0x03</td>
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</tr>
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<td>12</td>
<td>R42h 0x66</td>
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<td>R40h 0x00</td>
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<td>R42h 0x12</td>
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<td>R40h 0x10</td>
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</tr>
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<td>23</td>
<td>wait 100 us</td>
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</tr>
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<td>24</td>
<td>R03h 0x00</td>
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</tr>
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<td>25</td>
<td>R07h 0x80</td>
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<td>27</td>
<td>R51h 0x30</td>
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</tr>
<tr>
<td>28</td>
<td>OSD area 1 Line setting</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Start line (1)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>R0Bh 0x00</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>R0Ch 0x00</td>
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</tr>
<tr>
<td>32</td>
<td>OSD area 2 Line setting</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Start line (279)</td>
<td></td>
</tr>
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<td>34</td>
<td>R0Dh 0x11</td>
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</tr>
<tr>
<td>35</td>
<td>R0Eh 0x06</td>
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</tr>
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<td>36</td>
<td>R30h 0x00</td>
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<td>37</td>
<td>R31h 0xEF</td>
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<td>R32h 0x00</td>
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</tr>
<tr>
<td>39</td>
<td>R33h 0x5F</td>
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<td>OSD area 1 RAM setting</td>
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</tr>
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<td>41</td>
<td>54 lines from 00h to 35h</td>
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</tr>
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<td>42</td>
<td>R34h 0x00</td>
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</tr>
<tr>
<td>43</td>
<td>R35h 0x35</td>
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</tr>
<tr>
<td>44</td>
<td>R0Ah 0x00</td>
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<td>45</td>
<td>R0Bh 0x00</td>
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<td>R21h 0x00</td>
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<td>47</td>
<td>R23h 0x36</td>
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<td>48</td>
<td>R22h -</td>
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</tr>
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<td>49</td>
<td>Image write (240x96)</td>
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</tr>
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<td>50</td>
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<td>52</td>
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</tr>
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<td>53</td>
<td>wait 40 ms</td>
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</tr>
<tr>
<td>54</td>
<td>RGB input OFF</td>
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</tr>
</tbody>
</table>

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**Hitachi Displays, Ltd.**

**Date:** June 8, 2006  
**Sh. No.:** 3284PS 2608 - TX06D57VM0AAA - 1A  
**Page:** 8-11/11
10. VISUAL INSPECTION

10.1 INSPECTION CONDITION

(1) Ambient illumination: 1000 - 1500 [lx]
(2) Distance between inspector’s eyes and LCD Module: Approximately 30 [cm]
(3) Viewing angle: ≤ 30°
(4) Refer to the Measurement Conditions described in Item 6.1 for the conditions other than specified here.

10.2 DEFINITION OF ZONE

The visual inspection zones of LCD Module is divided into three as follows:

A zone: Active Area (For dimensions, see Item 9, DIMENSIONAL OUTLINE.)
B zone: Viewing Area but Active Area (For dimensions, see Item 9, DIMENSIONAL OUTLINE.)
C zone: Whole LCD Module except the Viewing Area (Including FPC and frame)
<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Maximum Acceptable Number</th>
<th>Unit</th>
<th>Applied Zone</th>
<th>LCD module</th>
<th>Back light</th>
<th>Note</th>
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<tr>
<td>1</td>
<td>Dot Defect</td>
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<td></td>
<td>A</td>
<td>On</td>
<td>(1), (2), (3), (4), (8)</td>
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</tr>
<tr>
<td></td>
<td>Bright dot</td>
<td>1 dot</td>
<td>pc</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Adjacent dots</td>
<td>0</td>
<td>set</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Dark dot</td>
<td>1 dot</td>
<td>pc</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>Adjacent dots</td>
<td>0</td>
<td>set</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Number</td>
<td>2</td>
<td>pc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>2</td>
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<td></td>
<td></td>
<td>A</td>
<td>On</td>
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<td>3</td>
<td>Uneven Brightness (Linear)</td>
<td>Serious one is not allow ed.</td>
<td>-</td>
<td>A</td>
<td>On</td>
<td></td>
<td>(6)</td>
</tr>
<tr>
<td>4</td>
<td>Uneven Brightness (Circular)</td>
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<td>5</td>
<td>Foreign Particles, Stain (Linear)</td>
<td></td>
<td></td>
<td>A, B</td>
<td>On</td>
<td>(5), (6), (7), (8)</td>
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</tr>
<tr>
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<td>W: Width</td>
<td>0.01&lt; W ≤ 0.05</td>
<td>pc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L: Length</td>
<td>≤ 2.0</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>&gt;2.0</td>
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<tr>
<td></td>
<td>0.05&lt; W</td>
<td>-</td>
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<tr>
<td></td>
<td></td>
<td>Refer to No.6. (Judge with D.)</td>
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<td>6</td>
<td>Foreign Particles, Stain (Circular)</td>
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<td></td>
<td>A, B</td>
<td>On</td>
<td>(5), (6), (7), (8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D: Average diameter</td>
<td>≤ 0.1</td>
<td>pc</td>
<td></td>
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<tr>
<td></td>
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<td>0.1&lt; D ≤ 0.15</td>
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<tr>
<td></td>
<td></td>
<td>0.15&lt; D ≤ 0.2</td>
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<td></td>
<td>0.2&lt; D</td>
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<td>W: Width, L: Length</td>
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<tr>
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<td>≤ 0.04</td>
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<td>8</td>
<td>Scratch of Polarizer (Circular)</td>
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<td>A, B</td>
<td>Off</td>
<td>(5), (6), (7)</td>
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</tr>
<tr>
<td></td>
<td>D: Average diameter</td>
<td>≤ 0.2</td>
<td>pc</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ 0.4</td>
<td>2</td>
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</tr>
<tr>
<td></td>
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<td>&gt;0.4</td>
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<td>9</td>
<td>Polarizer Bubble [mm]</td>
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<td>A, B</td>
<td>Off</td>
<td>(5), (6), (7)</td>
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<tr>
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<td>D: Average diameter</td>
<td>≤ 0.15</td>
<td>pc</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15&lt; D ≤ 0.2</td>
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</tr>
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<td></td>
<td>0.2&lt; D ≤ 0.4</td>
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<td>10</td>
<td>Scratch, Dent in Frame</td>
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<td></td>
<td>C</td>
<td>Off</td>
<td>(6)</td>
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<tr>
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<td>Scratch of FPC</td>
<td>Serious one is not allow ed.</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>(6)</td>
</tr>
</tbody>
</table>
Notes

(1) A defect whose area is more than 50% of the dot is regarded as a Dot Defect.

(2) A dot whose brightness at all black screen is more than 30% of a normal white dot is defined as a Bright Dot Defect.

(3) A defect whose brightness in all white screen is less than 60% of a normal white dot is defined as a Dark Dot Defect.

(4) Defective dots which are not adjacent are taken as a single Dot Defect each.

(5) Something which can be easily wiped off is disregarded as a defect.

(6) In case a problem arises, both parties should discuss needed items such as limit samples.

(7) Definitions for D, W and L are as follows.

**Definition of D**

\[
D = \frac{a + b}{2} \text{ (mm)}
\]

**Definitions of W and L**

(8) Distance between two defective dots is 10 mm minimum.
11. PRECAUTIONS IN DESIGN

11.1 GENERAL ATTENTION

(1) The LCD module covered by this specification is designed as the display for mobile phone. When it is used for other purposes, we do not guarantee these specifications at all about the contents including quality and safety. Moreover, this module has not been particularly developed as an object for equipment in connection with a human life such as medical apparatus of life support relation.

(2) Never attempt to disassemble this LCD module. There is danger such as a burn, an electric shock, and an injury. Moreover, when module is disassembled, we do not guarantee these specifications including quality and safety.

11.2 PRECAUTIONS AGAINST ELECTROSTATIC DISCHARGE

As this module contains C-MOS LSIs, it is not strong against electrostatic discharge. Make certain that the operator is grounded with suitable gear such as a wrist band. Pay attention not to touch terminal pins directly.

11.3 HANDLING PRECAUTIONS

(1) Do not leave the LCD module in a humid environment for a long time. When the ambient temperature is over 35 degrees C in storage, please avoid high humidity. The polarizer can be deteriorated in high temperatures and high humidity. Moreover, it is also the cause of bubble and peeling of polarizer. Please store/operate the LCD module within the specified temperatures and normal humidity.

(2) Since the polarizer tends to be easily scratched, the LCD module should be handled with full care so as not to get them touched, pushed or rubbed by a piece of glass, tweezers and anything else which is harder than a pencil lead 3H.

(3) Maximum pressure to the surface must be 1.96 Pa. If the area to be given pressure is less than 1 cm², the pressure must be 1.96 N or less.

(4) As the adhesives used for adhering upper and lower polarizers is an organic matter, it can be deteriorated by chemical reaction with such chemicals as acetone, toluene, ethanol and isopropyl alcohol. The following solvent is recommended for use: Normal hexane. Please contact us when it is necessary for you to use other chemicals than the above.

(5) Lightly wipe a dirty surface with a clean soft material such as a cotton swab and a cloth for glasses, dampened with recommended chemicals without scrubbing it hardly. Always wipe the surface horizontally or vertically. Never give a wipe in a circle. To prevent the display surface from damage and to keep the appearance in good state, it is sufficient, in general, to wipe it with a cotton swab.

(6) If spittle or a water drop comes in contact with the display area, immediately wipe it off. They can damage the display in some way including deformation and faded color.
(7) Condensation on the LCD module may cause a damage, stain or dirt to the polarizer. When you need to take out the LCD module from some place at low temperature for test, etc., it is required to let them stand at room temperature before taking them out.

(8) Touching the display area or the terminal pins with bare hands or contaminating them is prohibited because the stain on the display area and poor insulation between terminals are often caused by being touched with bare hands. (Some cosmetics are detrimental to polarizers.)

(9) As the display is made of glass, it is possible to be broken by a shock, especially its periphery can be easily cracked or chipped in handling. Please handle it with care and prevent it from being dropped.

(10) Never bend nor scratch the interface part. Those actions can cause poor contacting.

(11) Since the top and bottom areas of bent FPC tend to be easily damaged, be fully careful not to push or hold those areas.

(12) Please do not apply local stress to the LCD module's back side. It has potential to add a scratch to the backlight guide, or to become a non-uniformity issue. Pay extra attention to the interface connector portion at the time of connector insertion.

11.4 OPERATION PRECAUTIONS

(1) Spike noise can cause malfunction of the circuit. Recommended condition of spike noise level is as follows: Vcc = ±200 mV (over and under shoot voltage).

(2) Response time depends on a temperature. (At a lower temperature, it becomes longer.) And also brightness and color vary depending on a temperature.

(3) Be careful for condensation at a sudden temperature change. Condensation can make damage to polarizers or electrical contacts. And after fading condensation, smear or a spot may occur.

(4) When a fixed pattern is displayed at long times, afterimage is likely to occur.

(5) As the LCD module has a high frequency circuit, take sufficient measures against electromagnetic noise, such as shielding your system.

(6) Do not connect nor disconnect the module to or from main system with power applied.

(7) Strong light exposure may cause malfunction of the driver.
11.5 STORAGE

When storing the LCD modules as spare parts for a long time, the following precautions are necessary.

(1) Store the LCD modules in a dark place; do not expose them to sunlight or fluorescent light. Keep the temperature between 10 and 30 degrees C, and the humidity from 55% to 75%.

(2) The polarizer surface should not come in contact with any other object. It is recommended that the LCD modules are stored in the container in which they were shipped.

11.6 SAFETY

This LCD module is a glass product. When it got damaged, be sure to wear a pair of protective gloves to deal it. Moreover, when any liquid leaked out of a damaged glass cell comes in contact with your skin, immediately wash it off well with soap and water.

11.7 MECHANICAL DESIGN

(1) The design of the mobile phone case for this LCD module should be well studied so that any shock will not be added to the LCD module. When the case is dropped and the shock is not enough absorbed by the case, the LCD module may be broken.

(2) To prevent foreign substances from entering, please apply a piece of polyurethane foam cushion, such as PORON, around the LCD. Providing a cushion material such as PORON in the case will help LCD driver get less shock.

11.8 ENVIRONMENTAL PROTECTION

(1) Abide by the national law, legislation and local regulation when disposing of this LCD module.

(2) This LCD module complies with RoHS Directive.
12. DESIGNATION OF LOT MARK

LOT MARK
Lot mark is consisted of 11 digits x 2 line

Production control
Revision
Product name

Serial number
Day
Month
Year

Production base
S: assembly in China
H: assembly in Japan

<table>
<thead>
<tr>
<th>Revision</th>
<th>Contents of change</th>
<th>Year</th>
<th>Figure in lot mark</th>
</tr>
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<td>7</td>
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<td>4</td>
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<tbody>
<tr>
<td>Fig. in lot mark</td>
<td>W</td>
<td>X</td>
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</table>

Print example
TX0657AAAA0
001S6470001
13. PACKING SPECIFICATIONS

13.1 PLASTIC TRAY

*Products should not run around on the tray.
*Number of LCD module per tray: 15 pcs (5x3)

Tape: 4 places

Tray: 11 trays are alternately turned and stacked.
Top tray: No LCD Module, for top cover purpose

Eleven stacked trays are put in the antistatic bag.
*Folded part of the bag is inserted under the tray.
*Be careful not to damage a bag.
13.2 INNER BOX SPECIFICATIONS

Specification of packing in the inner box

(1) Polyurethane foam cushion is put in a corrugated cardboard box.

(2) Two antistatic bags holding 11 stacked trays each are placed in the box side by side.

(3) A corrugated cardboard sheet is put on the trays.

(4) Two more antistatic bags with trays are placed on the cardboard sheet.

(5) Another polyurethane foam cushion is put on them.

(6) The box is sealed with tape (in "I" shape).

(7) In the case of a fraction, the space is filled up with a buffer material.

Unit: mm
Size (L, W, H) | Approx. 610 x 330 x 335 mm
---|---
Quantity | 1 to 600 pcs
13.3 OUTER BOX SPECIFICATIONS

An outer box is used only when the number of products is less than the minimum quantity for pallet.

<table>
<thead>
<tr>
<th>Weight (full load)</th>
<th>Approx. 13.4 kg</th>
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<tbody>
<tr>
<td>Size (L, W, H)</td>
<td>730 x 450 x 470 mm</td>
</tr>
<tr>
<td>Quantity</td>
<td>1 to 600 pcs</td>
</tr>
</tbody>
</table>

Two outer boxes are used if the quantity is between 601 and 1200.
Marking of Outer Box

Markings are in red, except for a case mark.

<table>
<thead>
<tr>
<th>Mark</th>
<th>Position</th>
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</thead>
<tbody>
<tr>
<td>&quot;FRAGILE HANDLE WITH CARE&quot;</td>
<td>Top panel and both side panels</td>
</tr>
<tr>
<td>&quot;GLASS&quot;</td>
<td>Top panel</td>
</tr>
<tr>
<td>Case mark</td>
<td>One side panel</td>
</tr>
<tr>
<td>(4) [icons]</td>
<td>Both end panels</td>
</tr>
</tbody>
</table>
13.4 Pallet Specifications

Weight (full load) | Approx. 99 kg
Size (L, W, H) | Approx. 1100 (typ) x 800 (typ) x 880 (max) mm
Quantity | 1201 to 3600 pcs
Marking on Pallet Load

Markings are in red, except for a case mark.

<table>
<thead>
<tr>
<th>Mark</th>
<th>Position</th>
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<tbody>
<tr>
<td>(1) &quot;FRAGILE HANDLE WITH CARE&quot;</td>
<td>Top panel and both end panels</td>
</tr>
<tr>
<td>(2) &quot;GLASS&quot;</td>
<td>Top panel and both side panels</td>
</tr>
<tr>
<td>(3) Case mark</td>
<td>One side panel</td>
</tr>
<tr>
<td>(4)</td>
<td>Both end panels</td>
</tr>
<tr>
<td>(5) &quot;HANDLE WITH FORKLIFT TRUCK ONLY&quot;</td>
<td>Both side panels</td>
</tr>
</tbody>
</table>
14. PRECAUTIONS FOR USE

(1) A limit sample should be provided by the both parities on an occasion when the both parties agree to its necessity.
Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

(2) On the following occasions, the handling of the problem should be decided through discussion and agreement between responsible people of the both parties.

a) When a question arises in the specifications.
b) When a new problem which is not mentioned in the specifications occurs.
c) When the customer changes any item of inspection specification or operating condition and reports it to Hitachi, and a problem in the specification arises because of the change.
d) When a new problem is found with the customer's operating set for sample evaluation.