CUSTOMER’S ACCEPTANCE SPECIFICATIONS

**SP14Q003-AZA**

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<td>7B64PS 2710-SP14Q003-AZA–2</td>
<td>10-1/3~3/3</td>
</tr>
<tr>
<td>11</td>
<td>PRECAUTION IN DESIGN</td>
<td>7B64PS 2711-SP14Q003-AZA–2</td>
<td>11-1/2~2/2</td>
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<td>12</td>
<td>DESIGNATION OF LOT MARK</td>
<td>7B64PS 2712-SP14Q003-AZA–2</td>
<td>12-1/1</td>
</tr>
<tr>
<td>13</td>
<td>PRECAUTION FOR USE</td>
<td>7B64PS 2713-SP14Q003-AZA–2</td>
<td>13-1/1</td>
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<td>7B64PS 2714-SP14Q003-AZA–2</td>
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</tr>
</tbody>
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ACCEPTED BY: ____________________  PROPOSED BY: [Signature]

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<th>SHEET No.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>May.01,’12</td>
<td>All pages</td>
<td>Company name changed:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KAOHSIUNG HITACHI ELECTRONICS CO., LTD.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KAOHSIUNG OPTO-ELECTRONICS INC.</td>
</tr>
</tbody>
</table>
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Added : Item 1) |
### 3. GENERAL SPECIFICATIONS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Part Name</td>
<td>SP14Q003-AZA</td>
</tr>
<tr>
<td>(2) Outer Dimensions</td>
<td>167.0(W)mm×109.0(H)mm×11.4(D)mm max.</td>
</tr>
<tr>
<td>(3) Effective Area</td>
<td>120(W)mm min. × 89(H)mm min.</td>
</tr>
<tr>
<td>(4) Dot Size</td>
<td>0.345(W)min. × 0.345(H)min.</td>
</tr>
<tr>
<td>(5) Dot Pitch</td>
<td>0.360(W)mm × 0.360(H)mm</td>
</tr>
<tr>
<td>(6) Dot Number (Resolution)</td>
<td>320 (W) × 240 (H) dots</td>
</tr>
<tr>
<td>(7) Duty Ratio</td>
<td>1/240</td>
</tr>
<tr>
<td>(8) LCD Type</td>
<td>Transmissive, Blue type (Negative type)</td>
</tr>
<tr>
<td>(9) Viewing Direction</td>
<td>6 O'clock</td>
</tr>
<tr>
<td>(10) Backlight Type</td>
<td>LED(Color: white)</td>
</tr>
<tr>
<td></td>
<td>Life time: 40Klh @ 25°C</td>
</tr>
<tr>
<td></td>
<td>Note: Life time for half of initial brightness</td>
</tr>
<tr>
<td>(11) Touch Panel</td>
<td>Analog resistive</td>
</tr>
<tr>
<td></td>
<td>Transparency: 76% min.</td>
</tr>
<tr>
<td></td>
<td>Surface type: anti glare</td>
</tr>
</tbody>
</table>
### 4. ABSOLUTE MAXIMUM RATINGS

#### 4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SYMBOL</th>
<th>MIN.</th>
<th>MAX.</th>
<th>UNIT</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply for Logic</td>
<td>VDD-VSS</td>
<td>0</td>
<td>6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Power Supply for LC Driving</td>
<td>VDD-VEE</td>
<td>0</td>
<td>27.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Input Signal Voltage</td>
<td>Vi</td>
<td>-0.3</td>
<td>VDD+0.3</td>
<td>V</td>
<td>Note1</td>
</tr>
<tr>
<td>Input Signal Current</td>
<td>1i</td>
<td>0</td>
<td>1</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Static Electricity</td>
<td>VESD0</td>
<td>-</td>
<td>±100</td>
<td>V</td>
<td>Note2,3,4</td>
</tr>
<tr>
<td></td>
<td>VESD1</td>
<td>-</td>
<td>±10</td>
<td>kV</td>
<td>Note2,3,5</td>
</tr>
</tbody>
</table>

**Note 1:** DOFF, FLM, CL1, CL2, D0-D3.
**Note 2:** Make certain you are grounded when handling LCM.
**Note 3:** Energy storage capacitance 200pF, discharge resistance 250Ω, Ta=25℃, 60%RH.
**Note 4:** Contact discharge to I/F connector pins.
**Note 5:** Contact discharge to front metal bezel.

#### 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℃</td>
<td>70℃</td>
<td>-30℃</td>
</tr>
<tr>
<td>Humidity</td>
<td>Note1</td>
<td>Note1</td>
<td>Without Condensation</td>
</tr>
<tr>
<td>Vibration</td>
<td>-</td>
<td>2.45m/s²</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.25G</td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>-</td>
<td>29.4m/s²</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 G</td>
<td></td>
</tr>
<tr>
<td>Corrosive Gas</td>
<td>Not Acceptable</td>
<td>Not Acceptable</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1:** Ta ≤ 40℃ : 85%RH max.
Ta > 40℃ : Absolute humidity must be lower than the humidity of 85%RH at 40℃
**Note 2:** Ta at -30℃ < 48h, at 80℃ < 168h.
**Note 3:** Background color changes slightly depending on ambient temperature.
This phenomenon is reversible.
**Note 4:** 5Hz~100Hz (Except resonance frequency)
**Note 5:** This module should be operated normally after finish the test.
**Note 6:** The response time will be slower under low temperature.
**Note 7:** Operation temp not include touch panel.
## 5. ELECTRICAL CHARACTERISTICS

### 5.1 ELECTRICAL CHARACTERISTICS

<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>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage for Logic</td>
<td>VDD-VSS</td>
<td>-</td>
<td>4.75</td>
<td>5.0</td>
<td>5.25</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Supply Voltage for LC Driving</td>
<td>VEE-VSS</td>
<td>-</td>
<td>-23.1</td>
<td>-22.0</td>
<td>-20.9</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Signal Voltage1</td>
<td>Vi</td>
<td>H LEVEL</td>
<td>0.8VDD</td>
<td>-</td>
<td>VDD</td>
<td>V</td>
<td>Note1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L LEVEL</td>
<td>0</td>
<td>-</td>
<td>0.2VDD</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Supply Current for Logic</td>
<td>IDD</td>
<td>VDD-VSS=5.0V</td>
<td>-</td>
<td>6.0</td>
<td>-</td>
<td>mA</td>
<td>Note2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VEE-VSS=-22.0V</td>
<td>-</td>
<td>6.0</td>
<td>-</td>
<td>mA</td>
<td>Note2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Supply Current for LC Driving</td>
<td>IEE</td>
<td>VDD-VSS=5.0V</td>
<td>-</td>
<td>5.0</td>
<td>-</td>
<td>mA</td>
<td>Note2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VEE-VSS=-22.0V</td>
<td>-</td>
<td>5.0</td>
<td>-</td>
<td>mA</td>
<td>Note2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended LC Driving Voltage</td>
<td>VDD-V0</td>
<td>Ta=0°C, φ=0º</td>
<td>23.0</td>
<td>24.0</td>
<td>25.0</td>
<td>V</td>
<td>Note3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta=25°C, φ=0º</td>
<td>22.0</td>
<td>23.0</td>
<td>24.0</td>
<td>V</td>
<td>Note3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta=50°C, φ=0º</td>
<td>21.0</td>
<td>22.0</td>
<td>23.0</td>
<td>V</td>
<td>Note3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame Frequency</td>
<td>fFLM</td>
<td></td>
<td>70</td>
<td>75</td>
<td>80</td>
<td>Hz</td>
<td>Note4</td>
</tr>
</tbody>
</table>

Note 1: DOFF, FLM, CL1, CL2, D0~D3.
Note 2: FLM=75Hz, test pattern is all “Q”.
VDD-V0=23.0V, Ta=25°C
Note 3: Recommended LC driving voltage may fluctuate about ±1.0V by each module.
Test pattern is all “Q”
Note 4: Please set the frame frequency so as to avoid flicker and rippling on the display.

### 5.2 ELECTRICAL CHARACTERISTICS OF LED BACKLIGHT

<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>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage for LED</td>
<td>VLED</td>
<td>-</td>
<td>-</td>
<td>5.0</td>
<td>5.2</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Supply Current for LED</td>
<td>ILED</td>
<td>VLED=5.0V</td>
<td>160</td>
<td>170</td>
<td>mA</td>
<td></td>
<td>Note1</td>
</tr>
</tbody>
</table>

Note 1: The ILED changes depending on ambient temperature.

![Allowable forward current vs. Ambient Temperature graph]

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### 6. OPTICAL CHARACTERISTICS

**6.1 OPTICAL CHARACTERISTICS OF LCD**  \( Ta=25^\circ C \) (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>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing Area</td>
<td>( \phi_2-\phi_1 )</td>
<td>( K \geq 2.0 )</td>
<td>- 40</td>
<td>-</td>
<td>-</td>
<td>deg</td>
<td>Note1,2</td>
</tr>
<tr>
<td></td>
<td>( K )</td>
<td>( \phi=0^\circ, \theta=0^\circ )</td>
<td>- 6</td>
<td>-</td>
<td>-</td>
<td></td>
<td>Note3</td>
</tr>
<tr>
<td>Response Time (Rise)</td>
<td>( tr )</td>
<td>( \phi=0^\circ, \theta=0^\circ )</td>
<td>- 250</td>
<td>-</td>
<td>ms</td>
<td></td>
<td>Note4</td>
</tr>
<tr>
<td>Response Time (Fall)</td>
<td>( tf )</td>
<td>( \phi=0^\circ, \theta=0^\circ )</td>
<td>- 190</td>
<td>-</td>
<td>ms</td>
<td></td>
<td>Note4</td>
</tr>
</tbody>
</table>

(Measure condition by KOE)

**Note 1:** Definition of \( \theta \) and \( \phi \)

(Normal)

Viewing direction

[Diagram of viewing direction]

**Note 2:** Definition of viewing angle \( \phi_1 \) and \( \phi_2 \)

Contrast ratio \( K \) vs viewing angle \( \phi \)

**Note 3:** Definition of contrast "K"

\[
K = \frac{\text{Brightness on selected dot (B1)}}{\text{Brightness on non-selected dot (B2)}}
\]

**Note 4:** Definition of optical response

[Diagram of optical response]

\( \phi=0^\circ \)

Sensor BM7 Distance=0.4m

Backlight

LCD

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6.2 OPTICAL CHARACTERISTICS OF BACKLIGHT

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brightness</td>
<td>120</td>
<td>160</td>
<td>-</td>
<td>cd/m²</td>
<td>ILED=160mA</td>
</tr>
<tr>
<td>Brightness Uniformity</td>
<td>-</td>
<td>-</td>
<td>±30</td>
<td>%</td>
<td>Note1</td>
</tr>
</tbody>
</table>

Ta=25°C, Display data should be all “ON”.
The LCD driving voltage should be adjusted at the voltage where the peak contrast is obtained.

Note 1: Measure of the following 9 places on the display.

![Diagram of brightness measurement](image)

Definition of the brightness tolerance.

\[
\left( \frac{\text{Max. or Min. Brightness - Average Brightness}}{\text{Average Brightness}} \right) \times 100\% 
\]
8. INTERFACE TIMING CHART
8.1 INTERFACE TIMING CHART

52.1μs \( \leq T \leq 59.5\mu s \)

- CL1
- CL2
- D3
- D2
- D1
- D0
- FLM
- CL1
- FLM
- D0~D3

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PAGE 8-1/3
### 8.2 TIMING CHARACTERISTICS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SYMBOL</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL2 frequency</td>
<td>fCP</td>
<td>-</td>
<td>-</td>
<td>6.5</td>
<td>MHz</td>
</tr>
<tr>
<td>CL2 pulse width</td>
<td>tw</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>CL2 rise, fall time</td>
<td>tr, tf</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>ns</td>
</tr>
<tr>
<td>Data set up time</td>
<td>tDSU</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Data hold time</td>
<td>tDHD</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>CL1 set up time</td>
<td>tLSU</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>CL1 clock time</td>
<td>tLC</td>
<td>120</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>“FLM” set up time</td>
<td>tSETUP</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>“FLM” hold time</td>
<td>tHOLD</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>“CL1” pulse width</td>
<td>twc</td>
<td>125</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
</tbody>
</table>

Note 1: \( \text{tr}, \text{tf} < \frac{1}{fCP-2tw} \) and \( \text{tr}, \text{tf} \leq 50\text{ns} \)

Diagram:

- **CL2**: Pulse width \( tw \), rise time \( tr \), fall time \( tf \)
- **D0-D3**: Data setup time \( tDSU \), data hold time \( tDHD \)
- **CL1**: Clock setup time \( tLSU \), clock time \( tLC \), pulse width \( twc \)
- **FLM**: Setup time \( tSETUP \), hold time \( tHOLD \)
8.3 POWER ON/OFF TIMING SEQUENCE

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>MIN.</th>
<th>MAX.</th>
<th>UNIT</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>tDLD</td>
<td>50</td>
<td>-</td>
<td>ms</td>
<td>Note1</td>
</tr>
<tr>
<td>tCH</td>
<td>0</td>
<td>30</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>tLDH</td>
<td>0</td>
<td>-</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>tDOr</td>
<td>-</td>
<td>100</td>
<td>ns</td>
<td>Note2</td>
</tr>
<tr>
<td>tDOf</td>
<td>-</td>
<td>100</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>tDLCr</td>
<td>0</td>
<td>-</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>tDLCf</td>
<td>0</td>
<td>-</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>tDLCs</td>
<td>20</td>
<td>-</td>
<td>ms</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Please keep the specified sequence because wrong sequence may cause permanent damage to the LCD panel.

Note 2: KOE recommends you to use DOFF function. Display quality may deteriorate if you don't use DOFF function.

8.4 POWER SUPPLY FOR LCM (EXAMPLE)

Note 1: VR : 10kΩ
9. OUTLINE DIMENSIONS

9.1 OUTLINE DIMENSIONS

Note 1: Measurement when adding $9.8 \times 10^4$ Pa at the measuring point.
### 9.2 Display Pattern

![Display Pattern Diagram]

- Scale: NTS
- Unit: mm
- Measurement Tolerance: ±0.1

### 9.3 Interface Pin Connection

**FPC**: pitch 1.25mm 14 pins

<table>
<thead>
<tr>
<th>INTERFACE</th>
<th>PIN No.</th>
<th>SIGNAL</th>
<th>LEVEL</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCM CN1</td>
<td>1</td>
<td>D0</td>
<td>H/L</td>
<td>Display Data</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>D1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>D2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>D3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>DOFF</td>
<td>H/L</td>
<td>H: ON / L: OFF</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>FLM</td>
<td>H</td>
<td>First Line Marker</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>N.C</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>CL1</td>
<td>H→L</td>
<td>Data Latch</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>CL2</td>
<td>H→L</td>
<td>Data Shift</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>VDD</td>
<td>-</td>
<td>Power Supply for Logic</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>VSS</td>
<td>-</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>VEE</td>
<td>-</td>
<td>Power Supply for LC</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>V0</td>
<td>-</td>
<td>Operating Voltage LC Driving</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>VSS</td>
<td>-</td>
<td>GND</td>
</tr>
</tbody>
</table>

**LCM CN2**

<table>
<thead>
<tr>
<th>INTERFACE</th>
<th>PIN No.</th>
<th>SIGNAL</th>
<th>LEVEL</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCM CN2</td>
<td>1</td>
<td>VLED(+)</td>
<td>-</td>
<td>Power Supply for LED</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>N.C</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>N.C</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>VLED(-)</td>
<td>-</td>
<td>LED GND</td>
</tr>
</tbody>
</table>

**LED I/F**: J.A.E / IL-G-4S-S3C2-SA

**T/P CN3**

<table>
<thead>
<tr>
<th>INTERFACE</th>
<th>PIN No.</th>
<th>SIGNAL</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/P CN3</td>
<td>1</td>
<td>XR</td>
<td>Analog Signal from Digitizer Right</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>YU</td>
<td>Analog Signal from Digitizer Up</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>XL</td>
<td>Analog Signal from Digitizer Left</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>YB</td>
<td>Analog Signal from Digitizer Bottom</td>
</tr>
</tbody>
</table>

**FPC**: Pitch 1.0mm 4pins

Recommend Suitable connector: (HIROSE) FH12-10(4)SA-ISH
10. APPEARANCE STANDARD
10.1 APPEARANCE INSPECTION CONDITION

Visual inspection should be done under the following condition.
(1) The inspection should be done under in the dark room.
(2) The CFL should be lighted with the prescribed inverter.
(3) The distance between eyes of an inspector and the LCD module is 25cm.
(4) The viewing zone is shown the figure.
Viewing angle ≤ 25°

10.2 DEFINITION OF EACH ZONE
A zone: Within the effective area specified at page 9-1/2 of this document.
B zone: Area between the window of metal frame and the effective area line
specified at page 9-1/2 of this document.
10.3 APPEARANCE SPECIFICATION

*) If a problem occurs in respect to any of these items, both parties (Customer and KOE) will discuss in more detail.

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM</th>
<th>CRITERIA</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scratches</td>
<td>Serious one is not allowed</td>
<td>*</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Dent</td>
<td>Serious one is not allowed</td>
<td>*</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Wrinkles in Polarizer</td>
<td>Serious one is not allowed</td>
<td>*</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bubbles</td>
<td>Average Diameter D(mm)</td>
<td>Maximum Number Acceptable</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D≤0.2</td>
<td>Ignore</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2&lt;D≤0.3</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3&lt;D≤0.5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5&lt;D</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stains, Foreign Materials,</td>
<td>Filamentous Length L(mm)</td>
<td>Width W(mm)</td>
<td>Maximum Number Acceptable</td>
</tr>
<tr>
<td></td>
<td>Dark Spot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td></td>
<td>L≤2.0</td>
<td>W≤0.03</td>
<td>Ignore</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>L≤3.0</td>
<td>0.03&lt;W≤0.05</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>L≤2.5</td>
<td>0.05&lt;W≤0.1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Round Round Average Diameter D(mm)</td>
<td>Maximum Number Acceptable</td>
<td>Minimum Space</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>D&lt;0.2</td>
<td>Ignore</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2≤D&lt;0.33</td>
<td>8</td>
<td>10mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.33≤D</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total Filamentous + Round = 10</td>
<td>Those wiped out easily are acceptable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pinhole</td>
<td>Average Diameter D(mm)</td>
<td>Maximum Number Acceptable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D≤0.15</td>
<td>Ignore</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.15&lt;D≤0.3</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C≤0.015</td>
<td>Ignore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contrast Irregularity (Spot)</td>
<td>Average Diameter D(mm)</td>
<td>Maximum Number Acceptable</td>
<td>Minimum Space</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D≤0.25</td>
<td>Ignore</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.25&lt;D≤0.35</td>
<td>10</td>
<td>20mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.35&lt;D≤0.5</td>
<td>4</td>
<td>20mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5&lt;D</td>
<td>None</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>ITEM</td>
<td>CRITERIA</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------</td>
<td>---------------------------------</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Contrast Irregularity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCD</td>
<td>(Line) (Filamentous)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Width D(mm)</td>
<td>Length L(mm)</td>
<td>Maximum Number Acceptable</td>
<td>Minimum Space</td>
</tr>
<tr>
<td></td>
<td>( W \leq 0.25 )</td>
<td>( L \leq 1.2 )</td>
<td>2</td>
<td>20mm</td>
</tr>
<tr>
<td></td>
<td>( W \leq 0.2 )</td>
<td>( L \leq 1.5 )</td>
<td>3</td>
<td>20mm</td>
</tr>
<tr>
<td></td>
<td>( W \leq 0.15 )</td>
<td>( L \leq 2.0 )</td>
<td>3</td>
<td>20mm</td>
</tr>
<tr>
<td></td>
<td>( W \leq 0.1 )</td>
<td>( L \leq 3.0 )</td>
<td>4</td>
<td>20mm</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM</th>
<th>CRITERIA</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Dark Spots, White Spots</td>
<td>( D \leq 0.4 )</td>
<td>Ignore</td>
<td></td>
</tr>
<tr>
<td>L.E.D</td>
<td>Foreign Materials (Spot)</td>
<td>( D &gt; 0.4 )</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>B/L</td>
<td>Foreign Materials (Line)</td>
<td>( W \leq 0.2 ) ( \leq L &lt; 2.5 ) ( \leq 1 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/L</td>
<td></td>
<td>( W \leq 0.2 ) ( &gt; L &gt; 2.5 ) None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/L</td>
<td>Scratches</td>
<td>( W \leq 0.1 )</td>
<td>Ignore</td>
<td></td>
</tr>
<tr>
<td>B/L</td>
<td></td>
<td>( 0.1 &lt; W \leq 0.2 ) ( \leq L \leq 11.0 ) ( \leq 1 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/L</td>
<td></td>
<td>( 0.1 &lt; W \leq 0.2 ) ( \leq L \leq 11.0 ) None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/L</td>
<td></td>
<td>( W \leq 0.2 )</td>
<td>Ignore</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Definition of average diameter \( D \)

\[
D = \frac{a+b}{2}
\]

Note 2: Definition of length \( L \) and width \( W \)

Note 3: Definition of pinhole

\[
c : \text{Salience}
\]
11. PRECAUTION IN DESIGN

11.1 LC DRIVING VOLTAGE (VEE) AND VIEWING ANGLE RANGE
Setting VEE out of the recommended condition will be a cause for a change of viewing angle range.

11.2 PRECAUTIONS AGAINST STATIC CHARGE
As this module contains C-MOS LSIs, it is not strong against electrostatic discharge. Make certain that the operator’s body is connected to the ground through a list band etc. And don’t touch I/F pins directly.

11.3 POWER ON SEQUENCE
Input signals should not be applied to LCD module before power supply voltage is applied and reaches to specified voltage (VDD). If above sequence is not kept, C-MOS LSIs of LCD modules may be damaged due to latch up problem.

11.4 PACKAGING
(1) No leaving product is preferable in the place of high humidity for a long period of time. For their storage in the place where temperature is 35°C or higher, special care to prevent them from high humidity is required. A combination of high temperature and high humidity may cause them polarization degradation as well as bubble generation and polarizer peel-off. Please keep the temperature and humidity within the specified range for use and storage.

(2) Since polarizers tend to be easily damaged, They should be handled full with care so as not to get them touched, pushed or rubbed.

(3) As the adhesives used for adhering polarizers are made of organic substances which will be deteriorated by a chemical reaction with such chemicals as acetone, toluene, ethanol and isopropyl alcohol. The following solvents are recommended for use: normal hexane

Please contact us when it is necessary for you to use chemicals.

(4) Lightly wipe to clean the dirty surface with absorbent cotton waste or other soft material like chamois, soaked in the chemicals recommended without scrubbing it hardly. To prevent the display surface from damage and keep the appearance in good state, it is sufficient, in general, to wipe it with absorbent cotton.

(5) Immediately wipe off saliva or water drop attached on the display area because its long period adherence may cause deformation or faded color on the spot.

(6) Foggy dew deposited on the surface due to coldness will be caused for polarizer damage, stain and dirt on product. When necessary to take out the products from some place at low temperature for test, etc. It is required for them to be warmed up in a container once at the temperature higher than that of room.

(7) Touching the display area and contact terminals with bare hands and contaminating them are prohibited, because the stain on the display area and poor insulation between terminals are often caused by being touched by bare hands. (Some cosmetics are detrimental to polarizers.)
(8) In general the quality of glass is fragile so that it tends to be cracked or chipped in handling, specially on its periphery. Be careful not to give it sharp shock caused by dropping down, etc.

11.5 CAUTION FOR OPERATION
(1) It is an indispensable condition to drive LCDs within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. An electrochemical reaction due to direct current causes LCDs undesirable deterioration, so that the use of direct current driver should be avoided.

(2) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCDs show dark blue color in them. However those phenomena do not mean malfunction or out of order with LCDs which will come back in the specified operating temperature range.

(3) If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

(4) A slight dew depositing on terminals is a cause for electrochemical reaction resulting in terminal open circuit. Please operate the LCD module under the relative condition of 40°C 85%RH.

11.6 STORAGE
In case of storing for a long period of time (for instance, for years) for the purpose of replacement use, the following ways are recommended.

(1) Storage in a polyethylene bag with the opening sealed, so the fresh air will not be entered from outside.

(2) Placing in a dark place where neither exposure to direct sunlight nor light is, keeping temperature in the range from 0°C to 35°C.

(3) Storing with no touch on polarizer surface by anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery from us.)

11.7 SAFETY
(1) It is recommendable to crash damaged or unnecessary LCDs into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

(2) When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.
12. DESIGNATION OF LOT MARK

12.1 LOT MARK
Lot mark is consisted of 4 digital number.

```
8 0 4 1 T
```

Made in Taiwan
Week
Month
Year

Note 1. Some products have alphabet at the end or the first.

<table>
<thead>
<tr>
<th>MONTH</th>
<th>FIGURE IN LOT MARK</th>
<th>MONTH</th>
<th>FIGURE IN LOT MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan.</td>
<td>01</td>
<td>Jul.</td>
<td>07</td>
</tr>
<tr>
<td>Feb.</td>
<td>02</td>
<td>Aug.</td>
<td>08</td>
</tr>
<tr>
<td>Mar.</td>
<td>03</td>
<td>Sep.</td>
<td>09</td>
</tr>
<tr>
<td>Apr.</td>
<td>04</td>
<td>Oct.</td>
<td>10</td>
</tr>
<tr>
<td>May</td>
<td>05</td>
<td>Nov.</td>
<td>11</td>
</tr>
<tr>
<td>Jun.</td>
<td>06</td>
<td>Dec.</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WEEK (DAY IN CALENDAR)</th>
<th>FIGURE IN LOT MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>01~07</td>
<td>1</td>
</tr>
<tr>
<td>08~14</td>
<td>2</td>
</tr>
<tr>
<td>15~21</td>
<td>3</td>
</tr>
<tr>
<td>22~28</td>
<td>4</td>
</tr>
<tr>
<td>29~31</td>
<td>5</td>
</tr>
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</table>

12.2 REVISION

<table>
<thead>
<tr>
<th>REV No.</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

12.3 LOCATION OF LOT MARK
on the back side of LCM

```
8 0 4 1 T
```
13. PRECAUTION FOR USE

13.1 A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

13.2 On the following occasions, the handling of the problem should be decided through discussion and agreement between responsible persons of the both parties.

(1) When a question is arisen in the specifications.

(2) When a new problem is arisen which is not specified in this specifications.

(3) When an inspection specifications change or operating condition change in customer is reported to KOE, and some problem is arisen in this specification due to the change.

(4) When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

The precaution that should be observed when handling LCM have been explained above. If any points are unclear or if you have any request, please contact KOE.
14. TOUCH PANEL SPECIFICATION

14.1 RATINGS

14.1.1 ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SPECIFICATION</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>7V</td>
<td>Without Condensation</td>
</tr>
<tr>
<td>Contact Current</td>
<td>20mA</td>
<td></td>
</tr>
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</table>

14.1.2 OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>5.0 / 3.3 VDC</td>
</tr>
<tr>
<td>Contact Current</td>
<td>10 ~ 20 mA</td>
</tr>
<tr>
<td>Actuation Force</td>
<td>80g max. (R8, Silicone rubber)</td>
</tr>
</tbody>
</table>

14.2 SURFACE HARDNESS

2H

14.3 OPTICAL CHARACTERISTICS

14.3.1 TRANSPARENCY: 76%.min. (WAVE LENGTH: 450 ~ 700nm)

14.4 ELECTRICAL CHARACTERISTICS

14.4.1 CONDUCTIVE RESISTANCE

<table>
<thead>
<tr>
<th>TERMINAL</th>
<th>CONDUCTIVE RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>XR-XL</td>
<td>150~1300Ω</td>
</tr>
<tr>
<td>YU-YB</td>
<td>150~1300Ω</td>
</tr>
</tbody>
</table>

14.4.2 INSULATION RESISTANCE

<table>
<thead>
<tr>
<th>TERMINAL</th>
<th>INSULATION RESISTANCE</th>
<th>TESTING VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-Y</td>
<td>20MΩ</td>
<td>25VDC</td>
</tr>
</tbody>
</table>

14.4.3 BOUNCE CHATTERING

10ms max.
14.4.4 LINEARITY

(1) LINEARITY
Linearity Deviation : 2% max.

(2) TESTING CIRCUIT
(a) X axis linearity testing method, 100g, VXR-VXL=5V, VOUT=VYU.

(b) Y axis linearity method, 100g VYU-VYB=5V, VOUT=VXR

(3) CALCULATION
(a) X axis linearity
\[
\text{LINEARITY} = \frac{\triangle E_{\text{max.}}}{E_{A1} - E_{An}} \times 100(\%)
\]
14.5 ENVIRONMENTAL TESTING

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CONDITIONS</th>
<th>CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Temperature Storage</td>
<td>60°C : 120h &amp; 25°C : 24h</td>
<td>After testing must to meet the specifications of the Electrical,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mechanical &amp; Optical Characteristics.</td>
</tr>
<tr>
<td>Low Temperature Storage</td>
<td>-20°C : 120h &amp; 25°C : 24h</td>
<td></td>
</tr>
<tr>
<td>Temperature Cycle</td>
<td>-20°C ↔ 70°C : 10 Cycles within (30) (60) (30) : minutes &amp; 25°C : 24h (Without Condensation)</td>
<td></td>
</tr>
<tr>
<td>Humidity Storage</td>
<td>60°C , 90%RH. 120h</td>
<td></td>
</tr>
<tr>
<td>Durability for Keystroke</td>
<td>150g , R8, HS40 Silicon Rubber (Speed : 330mm/sec) : 1000000 Activations</td>
<td></td>
</tr>
</tbody>
</table>

14.6 APPEARANCE SPECIFICATION

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM</th>
<th>CRITERIA</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hair Flaws</td>
<td>FILAMENTOUS</td>
<td>O</td>
<td>-</td>
</tr>
<tr>
<td>T/P</td>
<td>Length (L(mm))</td>
<td>Width (W(mm))</td>
<td>Maximum Number Acceptable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L ≤ 12</td>
<td>W ≤ 0.05</td>
<td>Ignore</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L ≤ 5</td>
<td>0.05 &lt; W ≤ 0.1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L &gt; 2</td>
<td>0.1 &lt; W</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dot-shaped Impurities</td>
<td>Average Diameter (D(mm))</td>
<td>Maximum Number Acceptable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D ≤ 0.1</td>
<td>Ignore</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.1 &lt; D ≤ 0.3</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.3 &lt; D</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scratch</td>
<td>FILAMENTOUS</td>
<td>O</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Length (L(mm))</td>
<td>Width (W(mm))</td>
<td>Maximum Number Acceptable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L ≤ 12</td>
<td>W ≤ 0.05</td>
<td>Ignore</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L ≤ 12</td>
<td>0.05 &lt; W ≤ 0.1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L &gt; 12</td>
<td>0.1 &lt; W</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
14.6.3 GLASS INDENTATION

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Indentation</td>
<td>X ≤ 5.0, Y ≤ 3.0, Z ≤ t</td>
</tr>
<tr>
<td></td>
<td>But, indentation can not including seal area.</td>
</tr>
<tr>
<td></td>
<td>t: Glass thickness.</td>
</tr>
</tbody>
</table>

| Corner Broken               | X ≤ 2.0, Y ≤ 5.0, Z ≤ t |
|                             | But, indentation can not including seal area. |

| Indentation Within Pattern  | Y ≤ 1 is ignore |
|                             | But, Must to meet the specification of conducting pattern indentation. |

| Proceeding Crack            | None |

14.6.4 BLISTERING (PUFFINESS): 0.4 mm max.

14.7 SAFETY AND ATTENTIONS
1) UV protection is recommended to avoid the possibility of performance degrading when touch panel is likely applied under UV environment for a long period of time.