

SPECIFICATION FOR APPROVAL

(•) Preliminary Specification

() Final Specification

| | |
|-------|--------------------|
| Title | 26.0" WXGA TFT LCD |
|-------|--------------------|

| | |
|-------|-------|
| BUYER | Sanyo |
| MODEL | |

| | |
|----------|--------------------------|
| SUPPLIER | LG.Philips LCD Co., Ltd. |
| *MODEL | LC260W01 |
| SUFFIX | A5K1 |

*When you obtain standard approval,
please use the above model name without suffix

| APPROVED BY | SIGNATURE DATE |
|-------------|-------------------|
| / | |
| / | |
| / | |

Please return 1 copy for your confirmation with
your signature and comments.

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TV Products Engineering Dept.
LG. Philips LCD Co., Ltd

Product Specification

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RECORD OF REVISIONS

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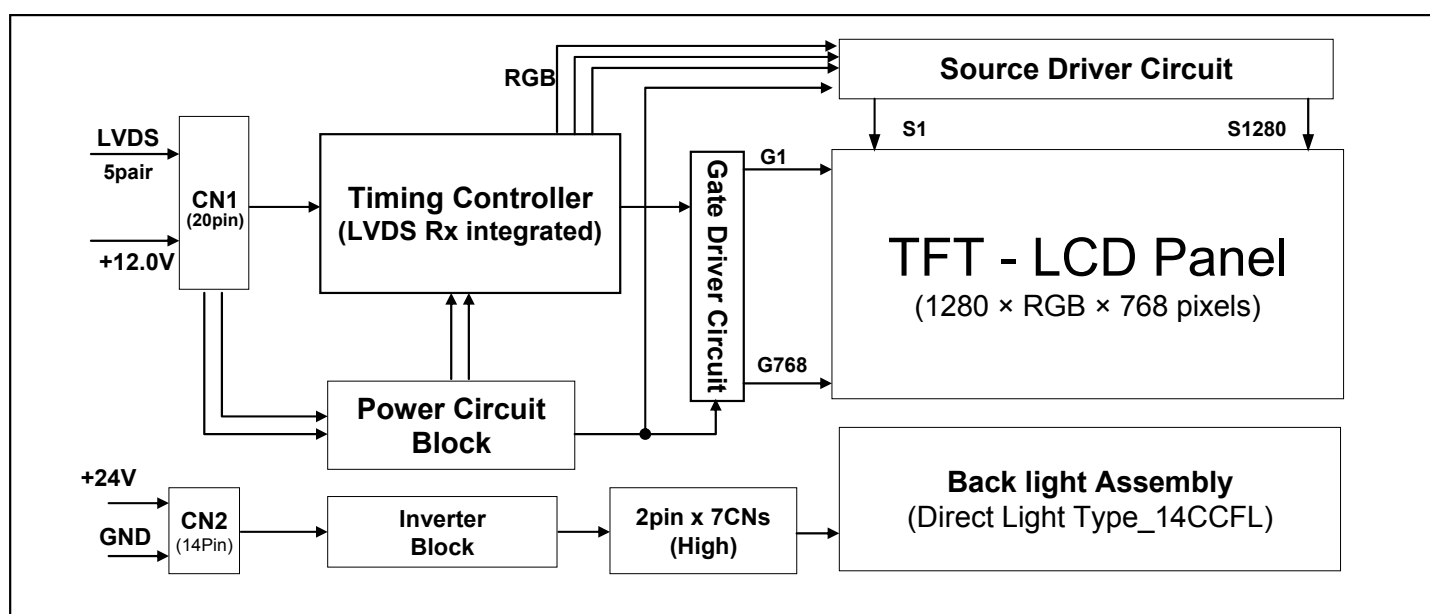
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1. General Description

The LC260W01 is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. This TFT-LCD has a 26.0 inch diagonally measured active display area with WXGA resolution (768 vertical by 1280 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 8-bit gray scale signal for each dot, thus, presenting a palette of more than 16.7M(true) colors with 8Bit.

The LC260W01 has been designed to apply the 8Bit LVDS interface.

It is intended to support LCD TV, PCTV where high brightness, wide viewing angle, high color saturation, and high color are important.



General Features

| | |
|------------------------|--|
| Active Screen Size | 26.0 inches(660.40mm) diagonal |
| Outline Dimension | 622.0(H) x 389.0(V) x 53.0(D) mm(Typ.) |
| Pixel Pitch | 0.1475mm x 0.4425mm x RGB |
| Pixel Format | 1280 horiz. By 768 vert. Pixels RGB strip arrangement |
| Color Depth | 16.7M colors |
| Luminance, White | 450 cd/m ² (Center 1 points typ.) |
| Viewing Angle(CR>10) | View Angle Free (R/L 176(Typ.), U/D 176(Typ.)) |
| Power Consumption | Total TBD Watt (Typ.) [LCM 4.14W / Inverter TBD W] |
| Weight | TBD g (Typ.) |
| Display Operating Mode | Transmissive mode, Normally Black |
| Surface Treatment | Hard coating(3H), Anti-glare treatment of the front polarizer, |

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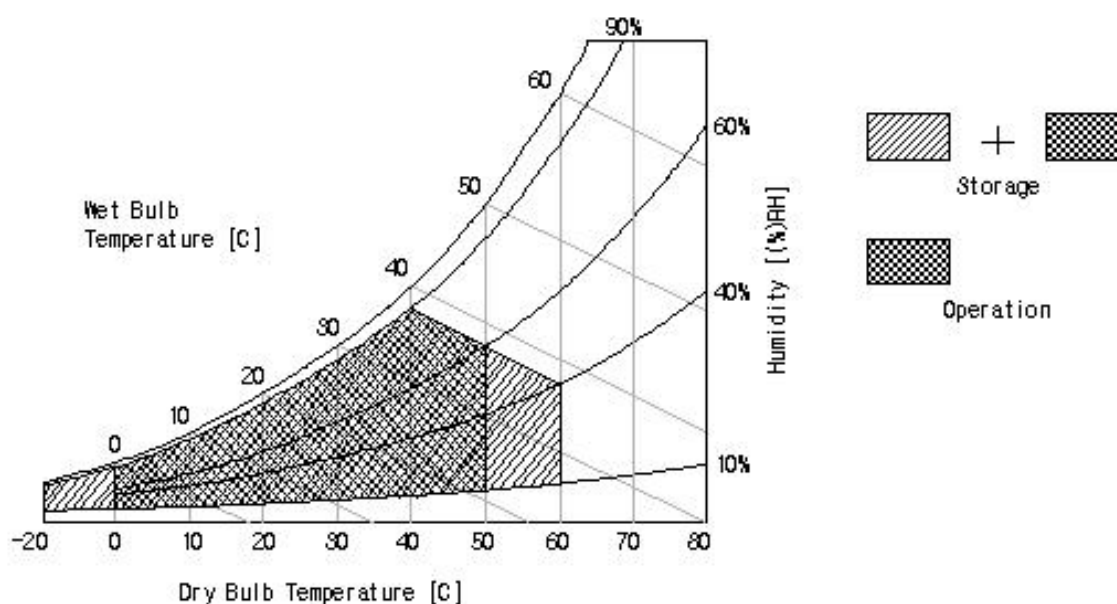
2. Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

Table 1. ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Values | | Units | Notes |
|----------------------------|-----------|--------|-------|--------------------|-------------------------------|
| | | Min | Max | | |
| Power Input Voltage | V_{LCD} | -0.3 | +14.0 | Vdc | at $25 \pm 5^{\circ}\text{C}$ |
| Operating Temperature | T_{OP} | 0 | +50 | $^{\circ}\text{C}$ | 1 |
| Storage Temperature | T_{ST} | -20 | +60 | $^{\circ}\text{C}$ | |
| Operating Ambient Humidity | H_{OP} | 10 | 90 | %RH | |
| Storage Humidity | H_{ST} | 10 | 90 | %RH | |

Notes : 1. Temperature and relative humidity range are shown in the figure below.
 Wet bulb temperature should be 39°C Max, and no condensation of water.



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3. Electrical Specifications

3-1. Electrical Characteristics

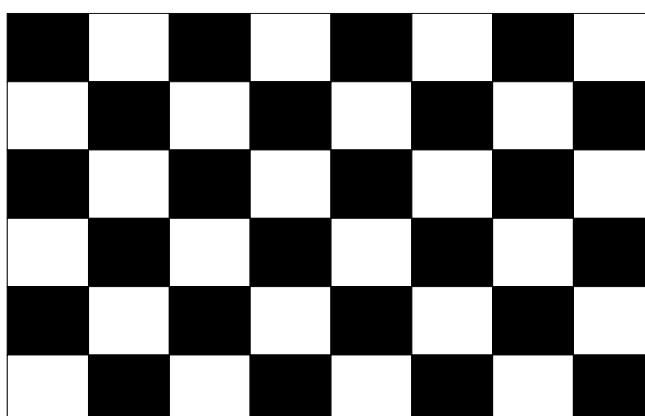
The LC260W01 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input power for the CCFL/Backlight, is to power the inverter.

Table 2_1. LCD PANEL ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Values | | | Unit | Notes |
|----------------------------|------------|--------|------|------|------|-------|
| | | Min | Typ | Max | | |
| Module : | | | | | | |
| Power Supply Input Voltage | V_{LCD} | 11.4 | 12.0 | 12.6 | Vdc | |
| Power Supply Input Current | I_{LCD} | - | 345 | 400 | mA | 1 |
| | | - | 400 | 520 | mA | 2 |
| Power Consumption | P_{LCD} | - | 4.14 | 4.8 | Watt | 1 |
| Rush current | I_{RUSH} | - | - | 3.0 | A | 3 |

- Notes: 1. The specified current and power consumption are under the $V_{LCD}=12.0V$, $25^{\circ}C$, $f_V=60Hz$ condition whereas mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.
2. The current is specified at the maximum current pattern.
3. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min).

White : 255 Gray
Black : 0 Gray



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Table 2_2. INVERTER ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Condition | Values | | | Unit | Notes |
|--------------------|-----------|-----------------|--------|------|------|------|-------|
| | | | Min. | Typ. | Max. | | |
| Inverter : | | | | | | | |
| Input Voltage | V_{DDB} | | 22.8 | 24.0 | 25.2 | V | 1 |
| Input Current | I_{DDB} | VBR(max) = 3.3V | TBD | TBD | TBD | A | 1 |
| | | VBR(min) = 0V | TBD | TBD | TBD | A | |
| Input Power | P_B | | TBD | TBD | TBD | Watt | |
| B/L on/off control | VON/OFF | Lamp ON = High | 2.0 | | 3.3 | V | |
| | | Lamp OFF =Low | 0.0 | | 1.0 | V | |
| Brightness Adj | VBR | | 0 | | 3.3 | V | |
| Lamp : | | | | | | | |
| Life Time | | | 50,000 | | | Hrs | 2 |

- Notes :
1. The specified current and power consumption are under the typical supply Input voltage, 16.5V.
 2. The life is determined as the time at which luminance of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at $25 \pm 2^\circ\text{C}$.
 3. Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 2Hrs in a dark environment at $25^\circ\text{C} \pm 2^\circ\text{C}$.

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3-2. Interface Connections

This LCD employs Two interface connections, a 20 pin connector is used for the module electronics and a 14Pin Connector is used for the integral backlight system.

3-2-1. LCD Module

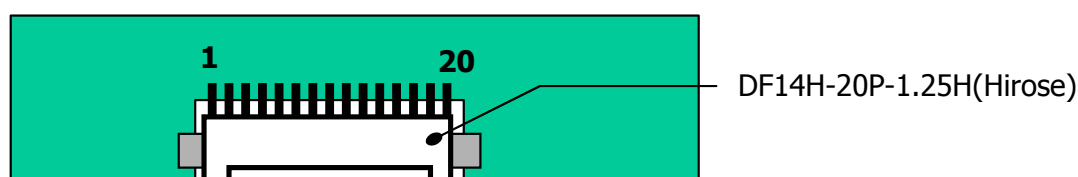
- LCD Connector : DF14H-20P-1.25H(Manufactured by Hirose) or Equivalent
- Mating connector : DF14-20S-1.25C(Manufactured by Hirose) or Equivalent

Table 3. MODULE CONNECTOR PIN CONFIGURATION

| Pin No | Symbol | Description | Output Pin # (LVDS Tx) |
|--------|------------------|-------------------------------|---------------------------|
| 1 | V _{LCD} | Power Supply +12.0V | |
| 2 | V _{LCD} | Power Supply +12.0V | |
| 3 | GND | Power Ground. | |
| 4 | GND | Power Ground | |
| 5 | RA- | LVDS Receiver Signal(-) | PIN#48 |
| 6 | RA+ | LVDS Receiver Signal(+) | PIN#47 |
| 7 | GND | Ground | |
| 8 | RB- | LVDS Receiver Signal(-) | PIN#46 |
| 9 | RB+ | LVDS Receiver Signal(+) | PIN#45 |
| 10 | GND | Ground | |
| 11 | RC- | LVDS Receiver Signal(-) | PIN#42 |
| 12 | RC+ | LVDS Receiver Signal(+) | PIN#41 |
| 13 | GND | Ground | |
| 14 | RCLK- | LVDS Receiver Clock Signal(-) | PIN#40 |
| 15 | RCLK+ | LVDS Receiver Clock Signal(+) | PIN#39 |
| 16 | GND | Ground | |
| 17 | RD- | LVDS Receiver Signal(-) | PIN#38 |
| 18 | RD+ | LVDS Receiver Signal(+) | PIN#37 |
| 19 | GND | Ground | |
| 20 | GND | Ground | |

- Notes :
1. The 20nd pin should be ground.
 2. All GND(ground) pins should be connected together and to Vss which should also be connected to the LCD's metal frame.
 3. All V_{LCD} (power input) pins should be connected together.
 4. Input Level of LVDS signal is based on the IEA 664 Standard.

Rear view of LCM



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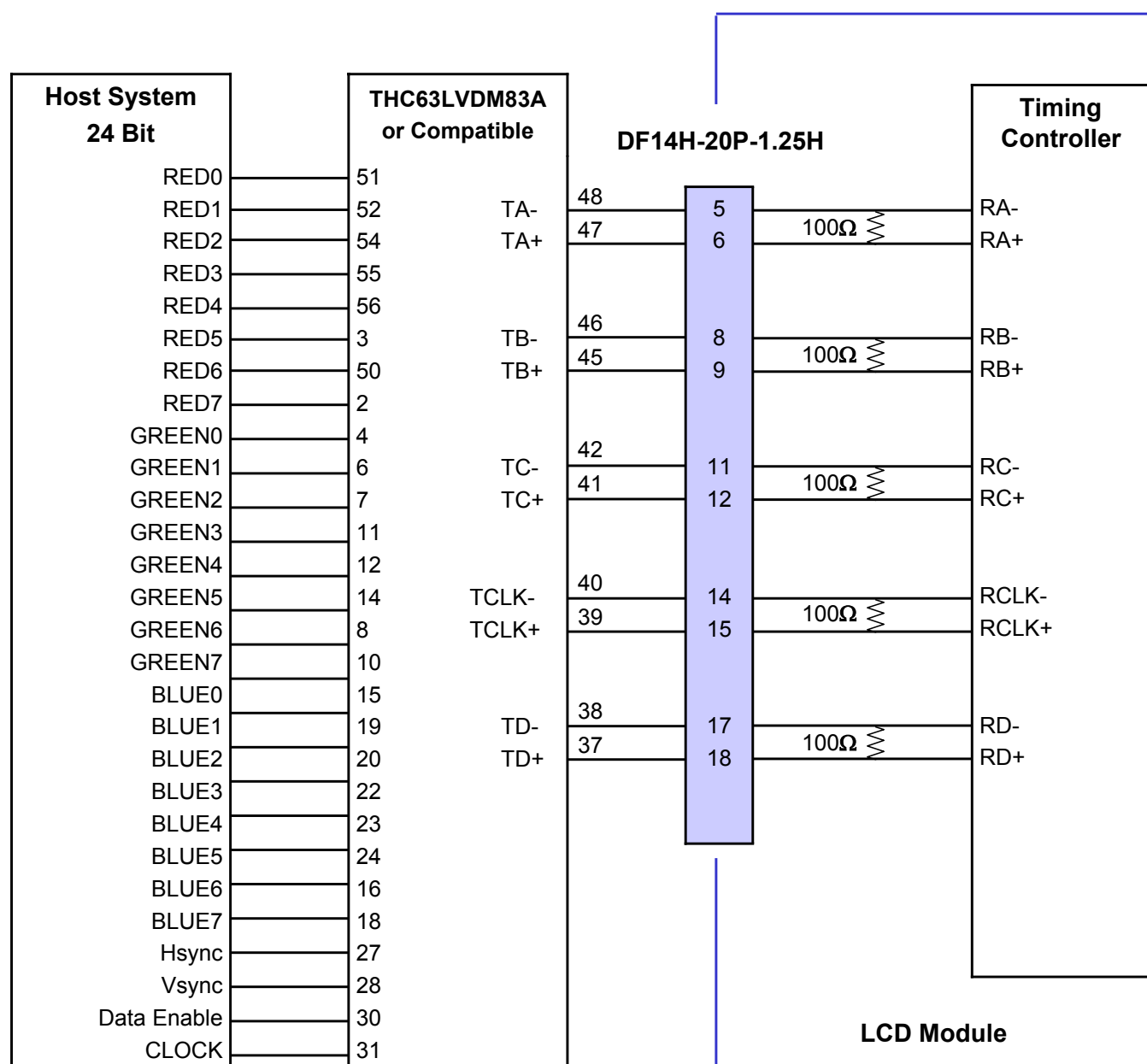
Table 4. REQUIRED SIGNAL ASSIGNMENT FOR FLATLINK'S Transmitter(THC63LVDM83A/LVDF83A)

| Pin # | Pin Name | Symbol | Description | Output |
|-------|----------|--------------|-------------------------------|------------|
| 51 | TA0 | Red0 [LSB] | Red Pixel Data | RA- RA+ |
| 52 | TA1 | Red1 | Red Pixel Data | |
| 54 | TA2 | Red2 | Red Pixel Data | |
| 55 | TA3 | Red3 | Red Pixel Data | |
| 56 | TA4 | Red4 | Red Pixel Data | |
| 2 | TD1 | Red7 [MSB] | Red Pixel Data | RD- RD+ |
| 3 | TA5 | Red5 | Red Pixel Data | RA- RA+ |
| 4 | TA6 | Green0 [LSB] | Green Pixel Data | |
| 6 | TB0 | Green1 | Green Pixel Data | RB- RB+ |
| 7 | TB1 | Green2 | Green Pixel Data | |
| 8 | TD2 | Green6 | Green Pixel Data | RD- RD+ |
| 10 | TD3 | Green7 [MSB] | Green Pixel Data | |
| 11 | TB2 | Green3 | Green Pixel Data | RB- RB+ |
| 12 | TB3 | Green4 | Green Pixel Data | |
| 14 | TB4 | Green5 | Green Pixel Data | |
| 15 | TB5 | Blue0 [LSB] | Blue Pixel Data | RD- RD+ |
| 16 | TD4 | Blue6 | Blue Pixel Data | |
| 18 | TD5 | Blue7 [MSB] | Blue Pixel Data | RB- RB+ |
| 19 | TB6 | Blue1 | Blue Pixel Data | |
| 20 | TC0 | Blue2 | Blue Pixel Data | RC- RC+ |
| 22 | TC1 | Blue3 | Blue Pixel Data | |
| 23 | TC2 | Blue4 | Blue Pixel Data | |
| 24 | TC3 | Blue5 | Blue Pixel Data | |
| 25 | TD6 | RES | | RD- RD+ |
| 27 | TC4 | Hsync. | No connection, If unnecessary | RC- RC+ |
| 28 | TC5 | Vsync. | No connection, If unnecessary | |
| 30 | TC6 | EN | Data Enable | |
| 50 | TD0 | Red6 | Red Pixel Data | RD- RD+ |

Notes: 1. Refer to LVDS Transmitter Data Sheet for detail descriptions.
2. 7 means MSB and 0 means LSB at R,G,B pixel data.

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Table 5. REQUIRED SIGNAL ASSIGNMENT FOR LVDS Transmitter (THC63LVDM83A / LVDF83A)
Compatible : NS DS90C383/384



Notes : The LCD Module uses a 100Ohm resistor between positive and negative lines of each receiver input.

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3-2-2. Backlight Inverter

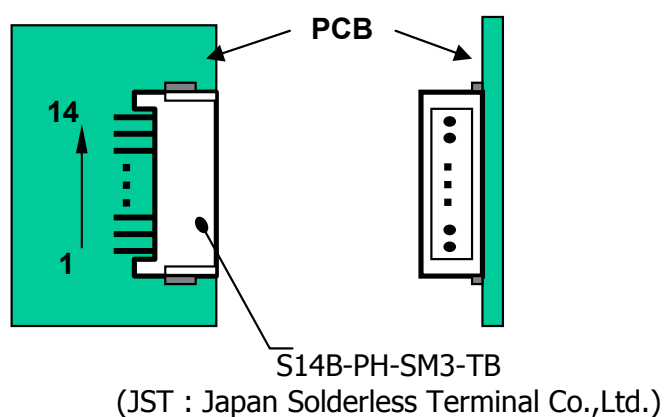
- Inverter Connector : S14B-PH-SM3 Side entry type (Manufactured by JST) or Equivalent
- Mating Connector : PHR-14(Manufactured by JST) or Equivalent

Table 6. INVERTER CONNECTOR PIN CONFIGURATION

| Pin No | Symbol | Description | Remarks |
|--------|--------------|-------------------------------|-------------------------------|
| 1 | VBL | Power Supply +24V | |
| 2 | VBL | Power Supply +24V | |
| 3 | VBL | Power Supply +24V | |
| 4 | VBL | Power Supply +24V | |
| 5 | VBL | Power Supply +24V | |
| 6 | GND | Backlight Ground | Note 1 |
| 7 | GND | Backlight Ground | |
| 8 | GND | Backlight Ground | |
| 9 | GND | Backlight Ground | |
| 10 | GND | Backlight Ground | |
| 11 | Panel Detect | Not Define | |
| 12 | VON/OFF | Backlight On/off Signal | (On :2.0V~3.3V/Off :0.0~0.8V) |
| 13 | VBR | Brightness Adjustable Voltage | (Max :3.3V / Min :0.0V) |
| 14 | GND | Signal Ground | |

Notes : 1. GND is connected to the LCD's metal frame.

Rear view of LCM



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3-3. Signal Timing Specifications

This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for it's proper operation.

Table 7. TIMING TABLE

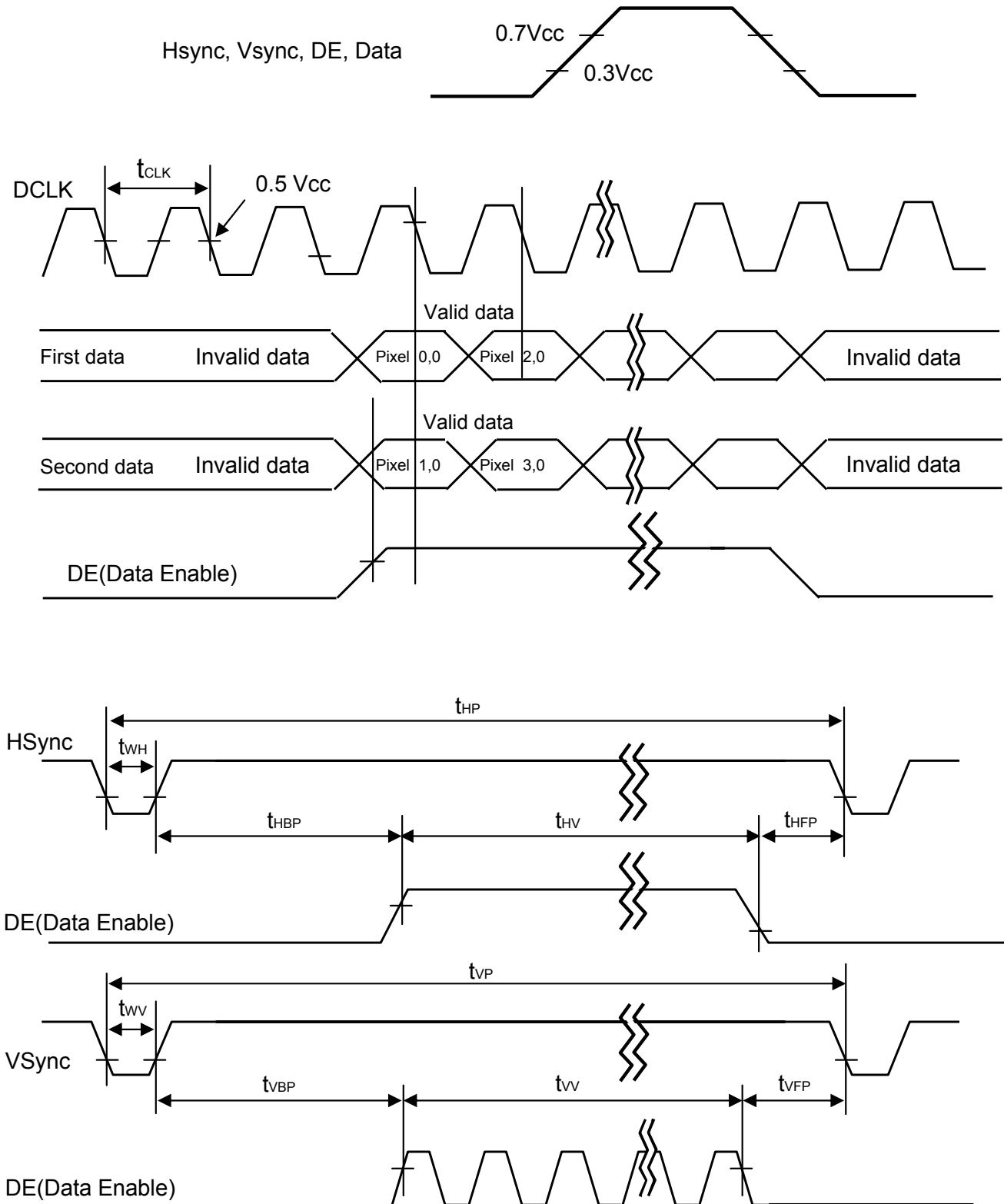
| ITEM | Symbol | | Min | Typ | Max | Unit | Note |
|---------------------|------------------------|------|------|-------|------|------|---|
| DCLK | Period | tCLK | 12.2 | 12.5 | - | ns | |
| | Frequency | - | - | 80 | 82 | MHz | |
| Hsync | Period | tHP | 1328 | 1648 | - | tCLK | |
| | Frequency | fH | 44.0 | 48.54 | - | kHz | |
| | Width | tWH | 8 | 16 | - | tCLK | |
| Vsync | Period | tVP | 775 | 810 | - | tHP | Note 1) PAL : 47~53Hz NTSC: 57~63Hz |
| | Frequency | fV | 47 | 60 | 63 | Hz | |
| | Width | tWV | 2 | 6 | - | tHP | |
| DE (Data Enable) | Horizontal Valid | tHV | 1280 | 1280 | 1280 | tCLK | |
| | Horizontal Back Porch | tHBP | 16 | 80 | - | | |
| | Horizontal Front Porch | tHFP | 24 | 272 | - | | |
| | Horizontal Blank | - | 48 | 368 | - | | |
| | Vertical Valid | tVV | 768 | 768 | 768 | tHP | |
| | Vertical Back Porch | tVBP | 3 | 20 | - | | |
| | Vertical Front Porch | tVFP | 2 | 16 | - | | |
| | Vertical Blank | - | 7 | 42 | - | | |

Notes : Hsync period and Hsync width-active should be even number times of tCLK. If the value is odd number times of tCLK, display control signal can be asynchronous. In order to operate this LCM a Hsync., Vsync and DE(data enable) signals should be used.

1. The performance of the electro-optical characteristics are may be influenced by variance of the vertical refresh rates.
2. Vsync, Hsync should be keep the above specification.
3. Hsync Period, Hsync Width, and Horizontal Back Porch should be any times of character number (8).

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3-4. Signal Timing Waveforms



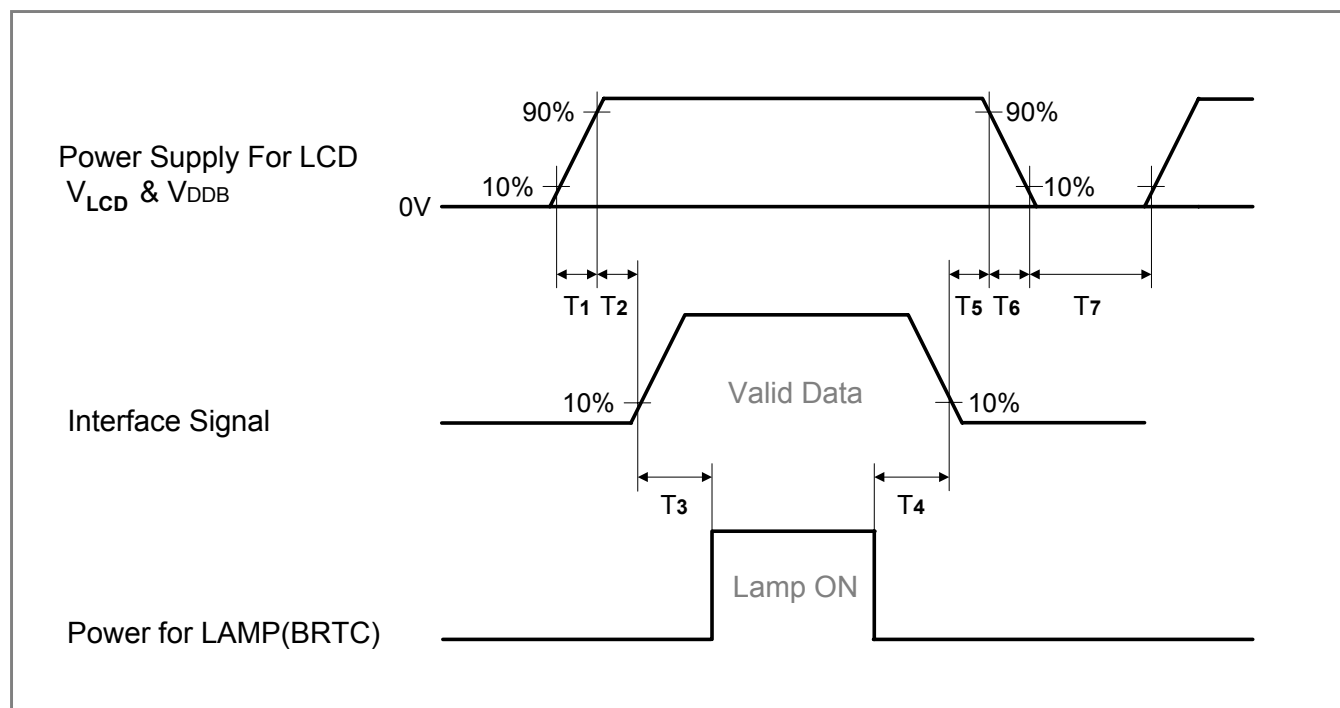
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3-5. Color Input Data Reference

The Brightness of each primary color(red,green,blue) is based on the 8-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Table 8. COLOR DATA REFERENCE

| Color | | Input Color Data | | | | | | | | | | | | | | | | | | | | | | | |
|-------------|------------------|------------------|----|----|----|----|----|-----|----|-------|----|----|----|----|----|-----|----|------|----|----|----|----|----|----|-----|
| | | RED | | | | | | | | GREEN | | | | | | | | BLUE | | | | | | | |
| | | MSB | | | | | | LSB | | MSB | | | | | | LSB | | MSB | | | | | | | LSB |
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue (255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| RED | RED (000) Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED (001) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ... | ... | | | | | | | | ... | | | | | | | | ... | | | | | | | |
| | RED (254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED (255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GREEN | GREEN (000) Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | GREEN (001) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ... | ... | | | | | | | | ... | | | | | | | | ... | | | | | | | |
| | GREEN (254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | GREEN (255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BLUE | BLUE (000) Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | BLUE (001) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | ... | ... | | | | | | | | ... | | | | | | | | ... | | | | | | | |
| | BLUE (254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | BLUE (255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

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3-6. Power Sequence

Table 9. POWER SEQUENCE

| Parameter | Values | | | Units |
|-----------|--------|-----|-----|-------|
| | Min | Typ | Max | |
| T1 | 1 | - | 10 | ms |
| T2 | 0.5 | - | 50 | ms |
| T3 | 200 | - | - | ms |
| T4 | 200 | - | - | ms |
| T5 | 0.5 | - | 50 | ms |
| T6 | - | - | 10 | ms |
| T7 | 1 | - | - | s |

- Notes :
1. Please avoid floating state of interface signal at invalid period.
 2. When the interface signal is invalid, be sure to pull down the power supply for LCD V_{LCD} to 0V.
 3. Lamp power must be turn on after power supply for LCD an interface signal are valid.

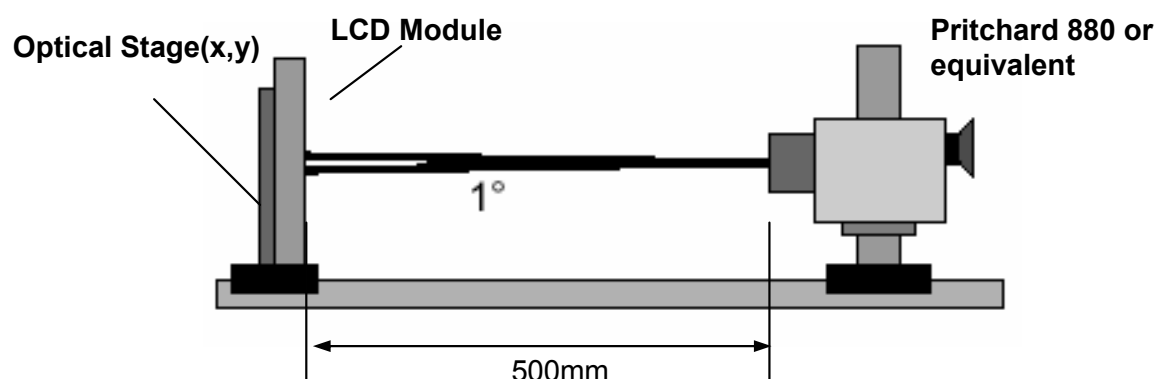
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4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately **30min** in a dark environment at $25\pm 2^{\circ}\text{C}$. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0° .

FIG. 1 presents additional information concerning the measurement equipment and method.

FIG. 1 Optical Characteristic Measurement Equipment and Method



$T_a: 25\pm 2^{\circ}\text{C}$, $V_{\text{LCD}}: 12.0\text{V}$, $f_v: 60\text{Hz}$,
 $D_{\text{clk}}: 80\text{MHz}$, $V_{\text{BR}} = \text{High}$

Table 10. OPTICAL CHARACTERISTICS

| Parameter | | Symbol | Values | | | Units | Notes |
|--------------------------|-------------------------------------|------------------------------|-----------|-------|-----------|-----------------|-------|
| | | | Min | Typ | Max | | |
| Contrast Ratio | | CR | 350 | 500 | | | 1 |
| Surface Luminance, white | | L_{WH} | 300 | 450 | | cd/m^2 | 2 |
| Luminance Variation | | δ_{WHITE} 5P | | - | TBD | | 3 |
| Response Time | Rise Time | TrR | | 7.5 | TBD | ms | 4 |
| | Decay Time | TrD | | 8.5 | TBD | | |
| Color Coordinates | | | | | | | |
| | RED | RX | Typ -0.03 | TBD | Typ +0.03 | | |
| | | RY | | TBD | | | |
| | GREEN | GX | | TBD | | | |
| | | GY | | TBD | | | |
| | BLUE | BX | | TBD | | | |
| | | BY | | TBD | | | |
| | WHITE | WX | | 0.285 | | | |
| | | WY | | 0.293 | | | |
| Viewing Angle (CR>10) | | | | | | | |
| | x axis, right($\phi=0^{\circ}$) | θ_r | 85 | 88 | - | degree | 5 |
| | x axis, left ($\phi=180^{\circ}$) | θ_l | 85 | 88 | - | | |
| | y axis, up ($\phi=90^{\circ}$) | θ_u | 85 | 88 | - | | |
| | y axis, down ($\phi=270^{\circ}$) | θ_d | 85 | 88 | - | | |
| Gray Scale | | | | TBD | | | 6 |

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Notes : 1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

Surface luminance is the center point(1).

2. Surface luminance is the center point(1) across the LCD surface 50cm from the surface with all pixels displaying white under the condition of $I_{BL}=6mArms$. For more information see FIG 1.

3. The variation in surface luminance , δ WHITE is defined by measuring L_{ON} at watch test position 1 through 5, and then dividing maximum L_{ON} of 5 points luminance by minimum L_{ON} of each 5points luminance. For more information see FIG 2.

$$\delta \text{ WHITE} = \text{Maximum (LON1, LON2,, LON5) / Minimum (LON1, LON2,, LON5)}$$

4. Response time is the time required for the display to transition from black to white (Rise Time, TrR) and from white to black (Decay Time, TrD). For additional information see FIG 3.

5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Gray scale specification

Gamma Value is approximately 2.2. For more information see Table 11.

Table 11. Gray Scale Specification

| Gray Level | Luminance [%] (Typ) |
|------------|---------------------|
| L0 | 0.30 |
| L15 | 0.65 |
| L31 | 1.20 |
| L47 | 2.50 |
| L63 | 4.68 |
| L79 | 7.80 |
| L95 | 11.7 |
| L111 | 16.0 |
| L127 | 21.2 |
| L143 | 27.7 |
| L159 | 35.2 |
| L175 | 43.5 |
| L191 | 53.0 |
| L207 | 63.7 |
| L223 | 75.4 |
| L239 | 86.4 |
| L255 | 100 |

Product Specification

FIG. 2 Luminance

<measuring point for surface luminance & measuring point for luminance variation>

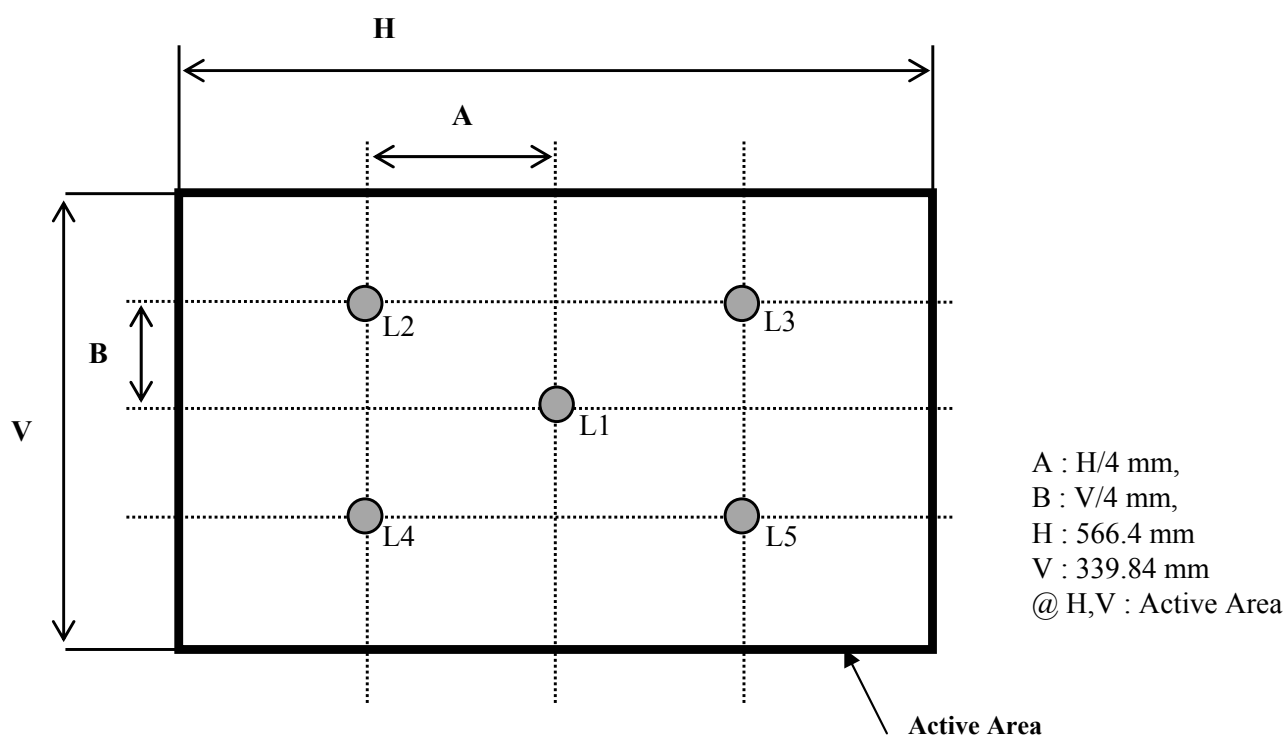
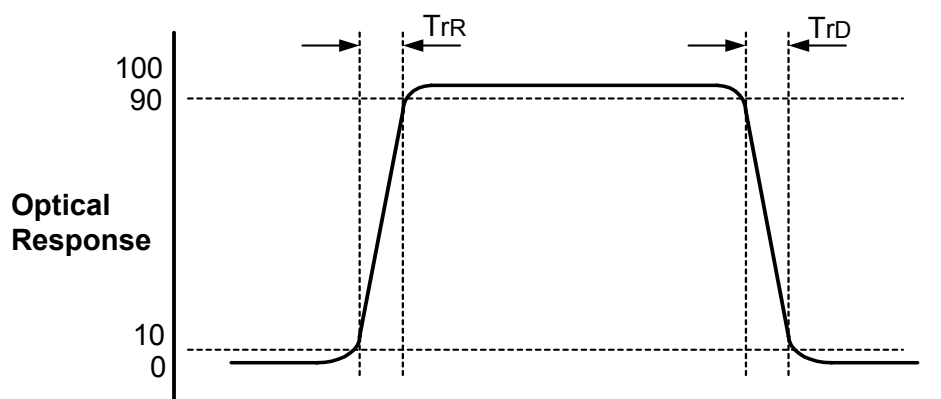


FIG. 3 Response Time

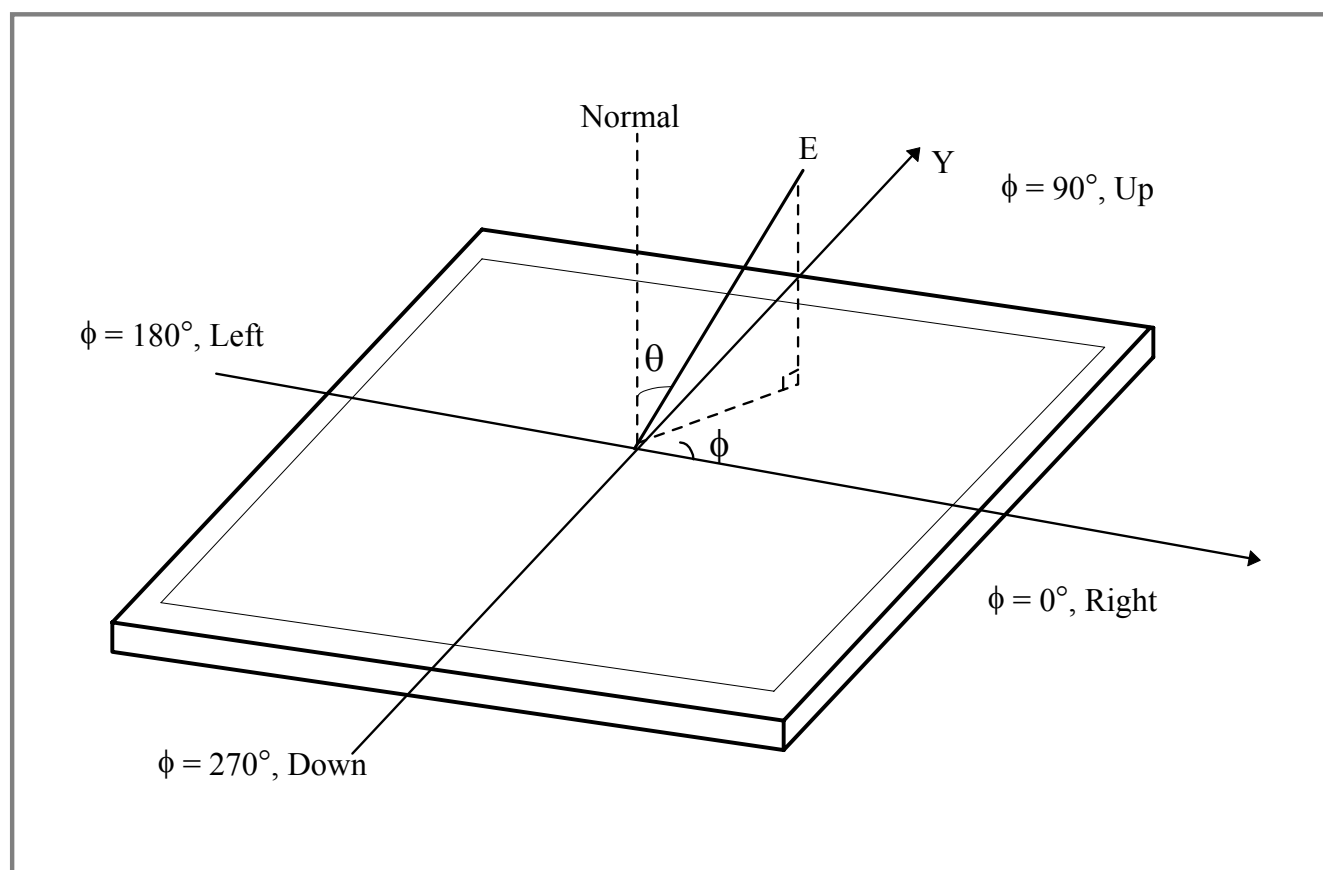
The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.



Product Specification

FIG. 4 Viewing angle

<Dimension of viewing angle range>



Product Specification

5. Mechanical Characteristics

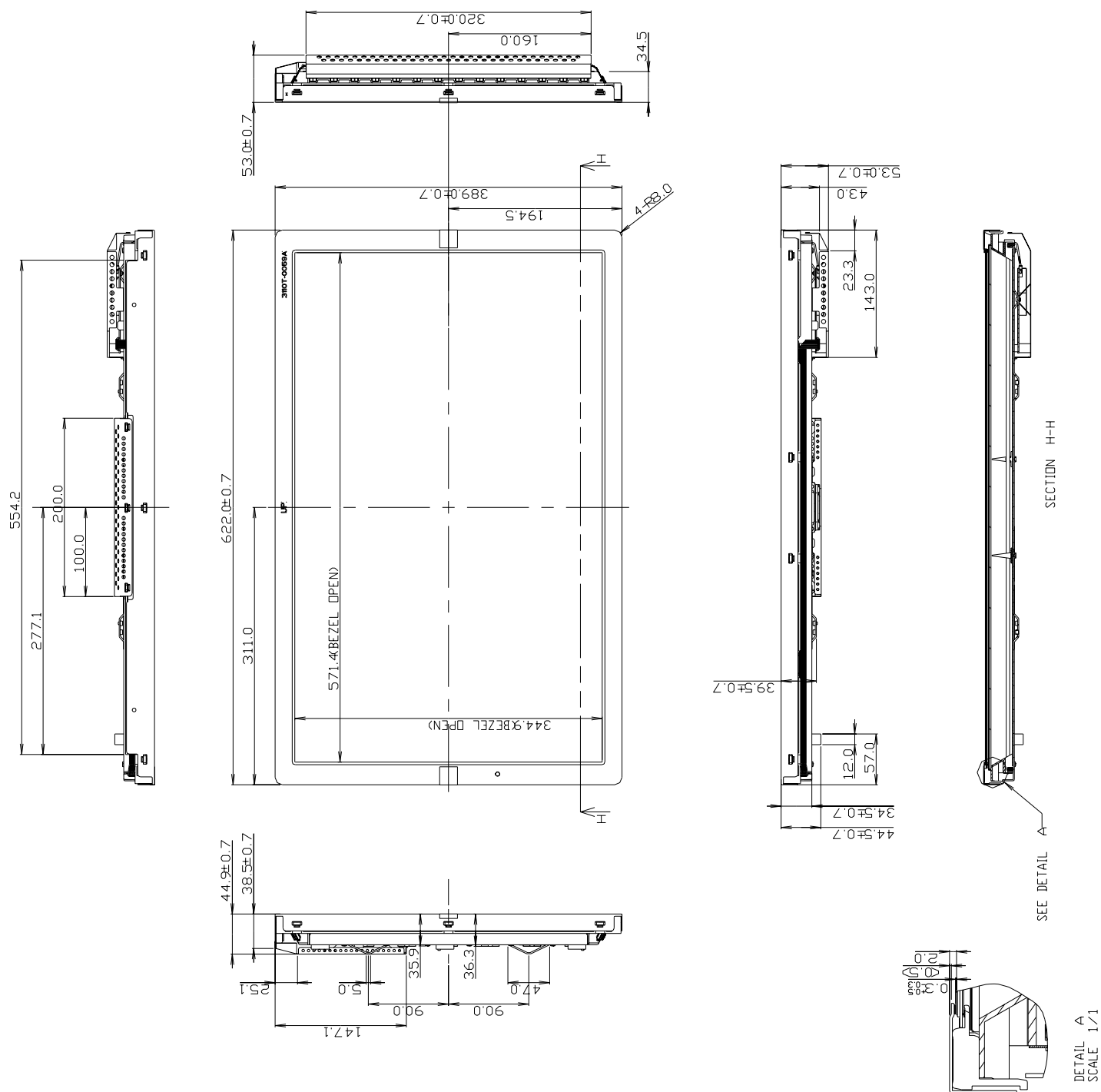
The contents provide general mechanical characteristics. In addition the figures in the next page are detailed mechanical drawing of the LCD.

| | | |
|---------------------|---|----------|
| Outline Dimension | Horizontal | 622.0mm |
| | Vertical | 389.0mm |
| | Depth | 53.0mm |
| Bezel Area | Horizontal | 571.4mm |
| | Vertical | 344.9mm |
| Active Display Area | Horizontal | 566.4mm |
| | Vertical | 339.84mm |
| Weight | TBD | |
| Surface Treatment | Hard coating(3H) Anti-glare treatment of the front polarizer | |

Note : See Attached Drawing(Front / Rear View)

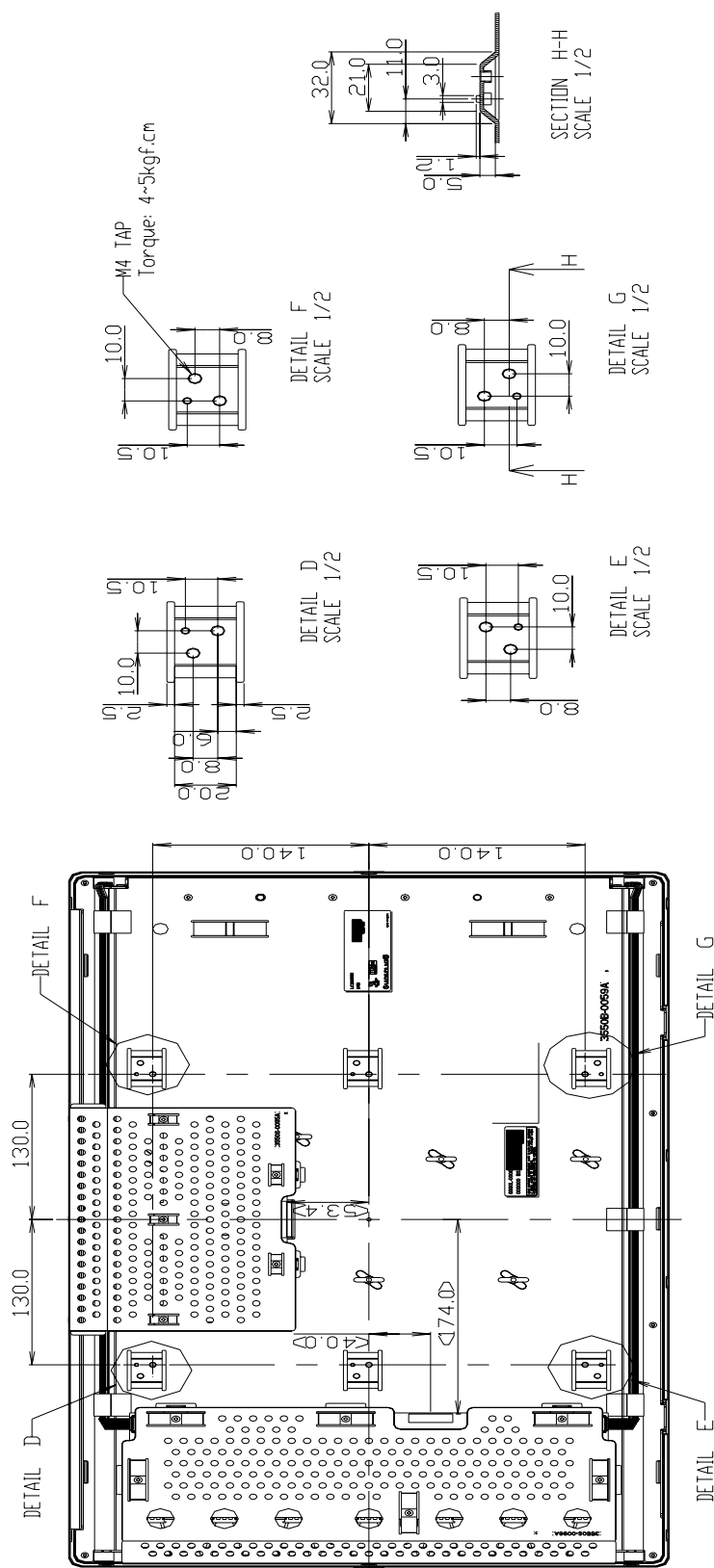
Product Specification

<FRONT VIEW>



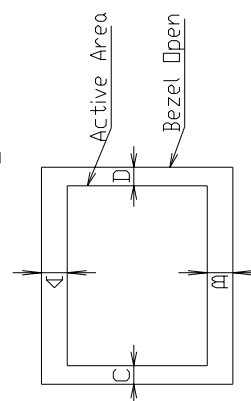
Product Specification

<REAR VIEW>



NOTES

1. UNSPECIFIED TOLERANCES ARE $\pm 0.5\text{mm}$
2. TILT AND A PARTIAL DISPOSITION TOLERANCE OF DISPLAY AREA ARE AS FOLLOW
 - 1) X-DIRECTION : $IA-BI < 1.7\text{mm}$
 - 2) Y-DIRECTION : $IC-DI < 1.7\text{mm}$



Product Specification

6. Reliability

Environment test condition

| No | Test Item | Condition |
|----|---|--|
| 1 | High temperature storage test | Ta= 60°C 240h |
| 2 | Low temperature storage test | Ta= -20°C 240h |
| 3 | High temperature operation test | Ta= 50°C 50%RH 240h |
| 4 | Low temperature operation test | Ta= 0°C 240h |
| 5 | Vibration test (non-operating) | Wave form : random Vibration level : 1.0Grms Bandwidth : 10-500Hz Duration : X,Y,Z, 10 min One time each direction |
| 6 | Shock test (non-operating) | Shock level : 100Grms Waveform : half sine wave, 2ms Direction : $\pm X$, $\pm Y$, $\pm Z$ One time each direction |
| 7 | Humidity condition Operation | Ta= 40 °C ,90%RH |
| 8 | Altitude operating storage / shipment | 0 - 14,000 feet(4267.2m) 0 - 40,000 feet(12192m) |

7. International Standards

7-1. Safety

- a) UL 60950 Third Edition, Underwriters Laboratories, Inc. Dated Dec. 11, 2000.
Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
- b) CAN/CSA C22.2 No. 60950, Third Edition, Canadian Standards Association, Dec. 1, 2000.
Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
- c) EN 60950 : 2000, Third Edition
IEC 60950 : 1999, Third Edition
European Committee for Electrotechnical Standardization(CENELEC)
EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

7-2. EMC

- a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. "American National Standards Institute(ANSI), 1992
- b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
- c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization.(CENELEC), 1998 (Including A1:2000)

Product Specification

8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

A,B,C : SIZE

D : YEAR

E : MONTH

F,G : PANEL CODE

H : ASSEMBLY CODE

I,J,K,L,M : SERIAL NO.

Note

1. YEAR

| | | | | | | | | | | | |
|------|----|----|----|------|------|------|------|------|------|------|------|
| Year | 97 | 98 | 99 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Mark | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

2. MONTH

| | | | | | | | | | | | | |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Mark | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C |

3. Serial No.

| | | |
|------|---------------|------------------------------|
| Year | 1 ~ 99999 | 100000 ~ |
| Mark | 00001 ~ 99999 | A0001 ~ A9999, , Z9999 |

b) Location of Lot Mark

Serial NO. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one box : 4pcs

b) Box Size : 853X497X555

9. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD module.

9-1. MOUNTING PRECAUTIONS

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

9-2. OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
 $V = \pm 200\text{mV}$ (Over and under shoot voltage)
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can not be operated its full characteristics perfectly.
- (8) A screw which is fastened up the steels should be a machine screw (if not, it causes metal foreign material and deal LCM a fatal blow)
- (9) Please do not set LCD on its edge.

9-3. ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9-5. STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

9-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) The protection film is attached to the bezel with a small masking tape.
When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal -hexane.