

PRODUCT SPECIFICATION

Doc. Number :

- Tentative Specification
- Preliminary Specification
- Approval Specification

MODEL NO.: TECFDT156000001

| | |
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| Customer: | |
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| Name / Title _____ | _____ |
| Note | |
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PRODUCT SPECIFICATION

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REVISION HISTORY

| Version | Date | Page | Description |
|---------|---------------|------|---------------------------------|
| 1.0 | Jun. 15, 2018 | All | Spec Ver. 1.0 was first issued. |
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PRODUCT SPECIFICATION

1. GENERAL DESCRIPTION

1.1 OVERVIEW

TECFDT156000001 is a 15.6" TFT Liquid Crystal Display module with WLED Backlight unit and 30 pins 1ch-LVDS interface. This module supports 1366 x 768 WXGA mode and can display up to 16.7M colors. The converter module for Backlight is built in.

1.2 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|-------------------|---------------------------|-------|------|
| Screen Size | 15.6" real diagonal | | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1366 x R.G.B. x 768 | pixel | - |
| Pixel Pitch | 0.252 (H) x 0.252 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 262K/16.7M | color | - |
| Transmissive Mode | Normally white | - | - |
| Surface Treatment | AG type, 3H hard coating, | - | - |
| Luminance, White | 2000 | Cd/m2 | |
| Color Gamut | 65 % of NTSC(Typ.) | - | - |
| Power Consumption | 18.88(Max.) | W | |

2. MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|-------------|----------------|--------|---------|--------|------|------|
| Module Size | Horizontal (H) | 363.3 | 363.8 | 364.3 | mm | |
| | Vertical (V) | 215.42 | 215.92 | 216.42 | mm | |
| | Thickness (T) | 16.35 | 16.85 | 17.35 | mm | |
| Bezel Area | Horizontal | 347.03 | 347.53 | 348.03 | mm | |
| | Vertical | 196.34 | 196.84 | 197.34 | mm | |
| Active Area | Horizontal | - | 344.232 | - | mm | |
| | Vertical | - | 193.536 | - | mm | |
| Weight | | - | 1290 | 1350 | g | |

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3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|-------------------------------|--------|-------|------|------|----------|
| | | Min. | Max. | | |
| Storage Temperature | TST | -20 | 60 | °C | (1) |
| Operating Ambient Temperature | TOP | 0 | (60) | °C | (1), (2) |

Note (1)

(a) 90 %RH Max. ($T_a < 40$ °C).

(b) Wet-bulb temperature should be 39 °C Max. ($T_a < 40$ °C).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C min. and 60 °C max.

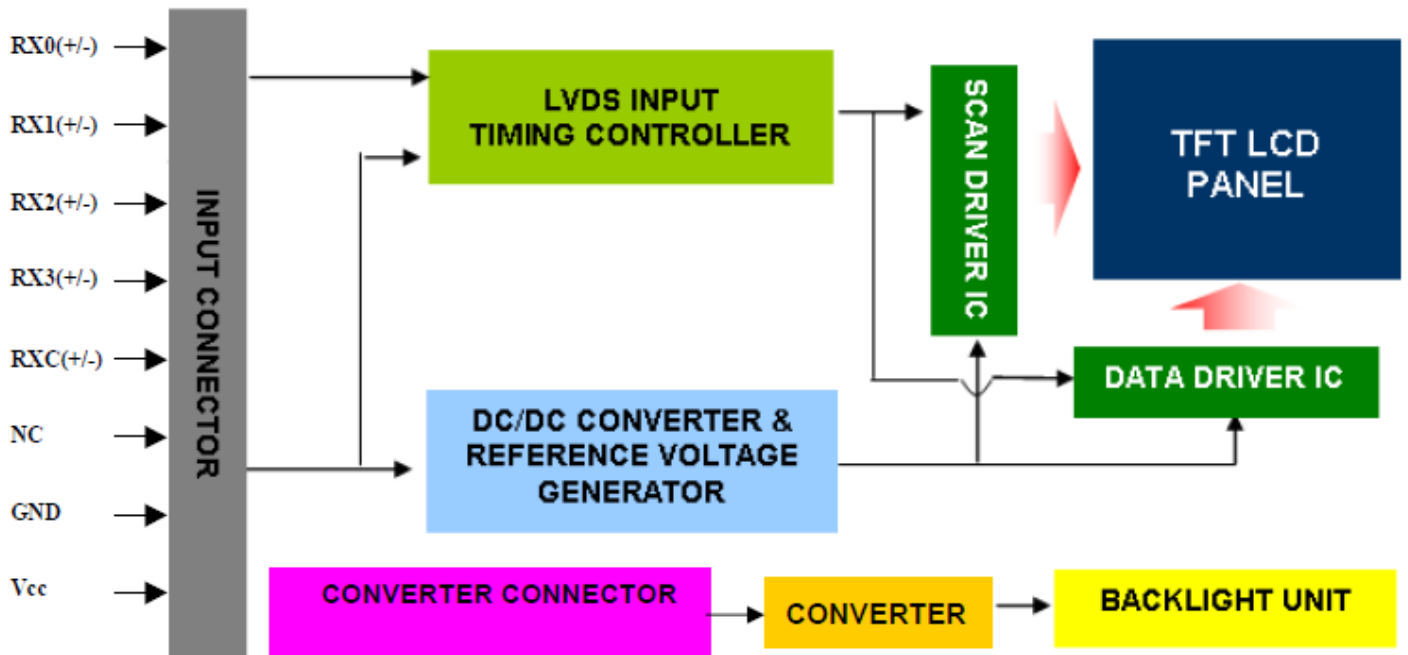
3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|----------------------|-----------------|-------|------|------|------|
| | | Min. | Max. | | |
| Power Supply Voltage | V _{CC} | -0.3 | 6.0 | V | (1) |
| Logic Input Voltage | V _{IN} | -0.3 | 6 | V | |

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



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4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

| Pin | Name | Description |
|-----|--------|--|
| 1 | GND | Ground |
| 2 | NC | Not connection, this pin should be open. |
| 3 | NC | Not connection, this pin should be open. |
| 4 | GND | Ground |
| 5 | RX0- | Negative LVDS differential data input. Channel 0 |
| 6 | RX0+ | Positive LVDS differential data input. Channel 0 |
| 7 | GND | Ground |
| 8 | RX1- | Negative LVDS differential data input. Channel 1 |
| 9 | RX1+ | Positive LVDS differential data input. Channel 1 |
| 10 | GND | Ground |
| 11 | RX2- | Negative LVDS differential data input. Channel 2 |
| 12 | RX2+ | Positive LVDS differential data input. Channel 2 |
| 13 | GND | Ground |
| 14 | RXCLK- | Negative LVDS differential clock input. |
| 15 | RXCLK+ | Positive LVDS differential clock input. |
| 16 | GND | Ground |
| 17 | RX3- | Negative LVDS differential data input. Channel 3 |
| 18 | RX3+ | Positive LVDS differential data input. Channel 3 |
| 19 | GND | Ground |
| 20 | NC | Not connection, this pin should be open. |
| 21 | NC | Not connection, this pin should be open. |
| 22 | NC | Not connection, this pin should be open. |
| 23 | GND | Ground |
| 24 | GND | Ground |
| 25 | GND | Ground |
| 26 | Vcc | +5V power supply |
| 27 | Vcc | +5V power supply |
| 28 | Vcc | +5V power supply |
| 29 | Vcc | +5V power supply |
| 30 | Vcc | +5V power supply |

Note (1) Connector Part No.: 187114-30091, P2

Note (2) The first pixel is odd.

Note (3) Input signal of even and odd clock should be the same timing.

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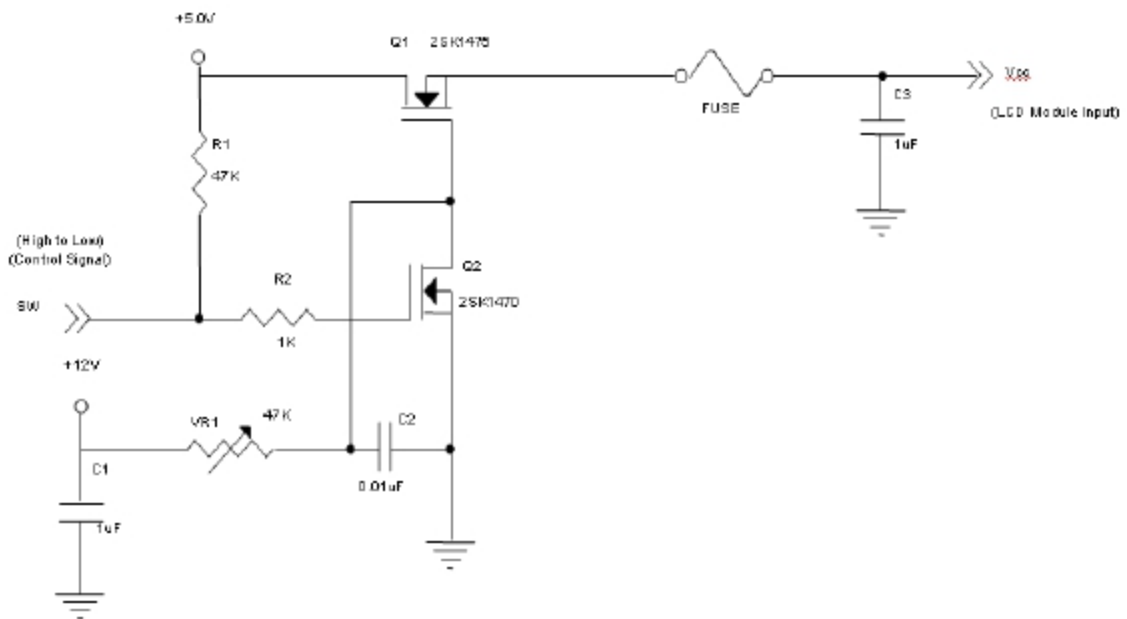
4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELECTRONICS SPECIFICATION

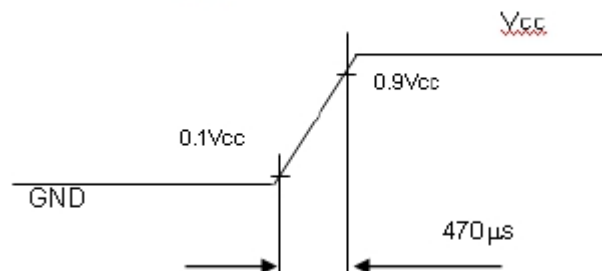
| Parameter | Symbol | Value | | | Unit | Note |
|---------------------------------|-------------------|-------|------|------|------|------|
| | | Min. | Typ. | Max. | | |
| Power Supply Voltage | V _{CC} | 4.5 | 5 | 5.5 | V | - |
| Ripple Voltage | V _{RP} | - | - | 150 | mV | - |
| Rush Current | I _{RUSH} | - | - | 3 | A | (2) |
| Power Supply Current | White | - | 0.16 | 0.21 | A | (3)a |
| | Black | - | 0.22 | 0.27 | A | (3)b |
| | Vertical Stripe | - | 0.27 | 0.32 | A | (3)c |
| Power Consumption | PLCD | - | 1.35 | 1.6 | Watt | (4) |
| LVDS differential input voltage | V _{id} | 200 | | 600 | mV | |
| LVDS common input voltage | V _{ic} | | 1.2 | | V | |
| Logic High Input Voltage | V _{IH} | 2.7 | | 3.3 | V | |
| Logic Low Input Voltage | V _{IL} | 0 | | 0.7 | V | |

Note (1) The ambient temperature is $T_a = 25 \pm 2 \text{ }^\circ\text{C}$.

Note (2) Measurement Conditions:

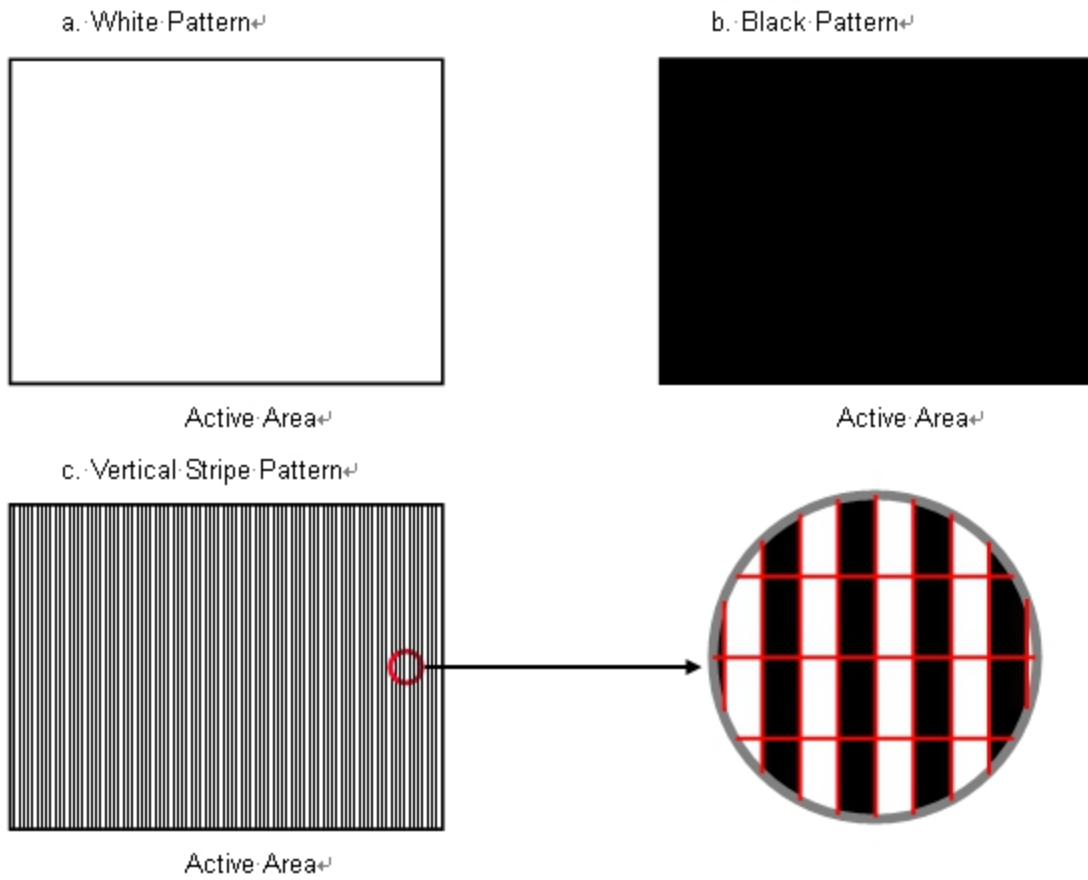


V_{CC} rising time is 470μs



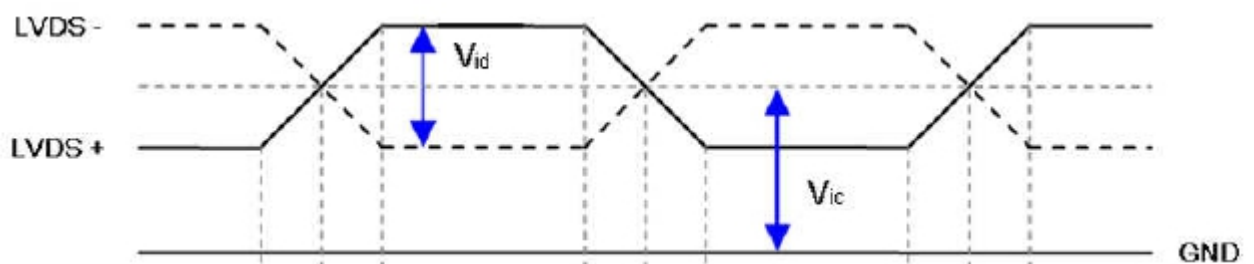
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Note (3) The specified power supply current is under the conditions at $V_{CC} = 5.0\text{ V}$, $T_a = 25 \pm 2\text{ }^\circ\text{C}$, $F_r = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.



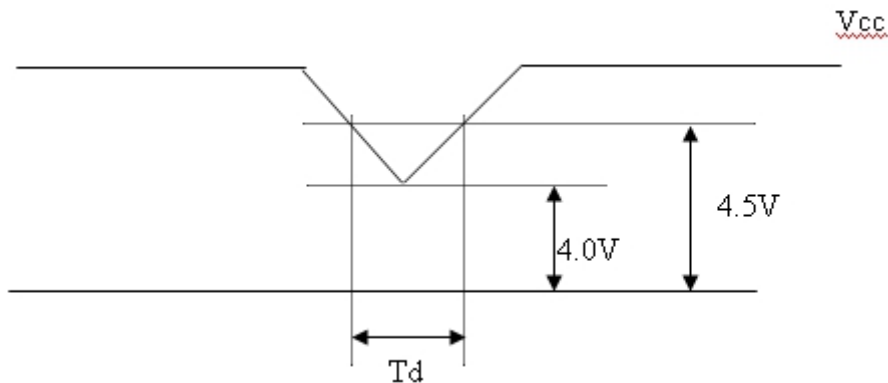
Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition



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4.3.2 Vcc Power Dip Condition



4.3.3 BACKLIGHT UNIT

| Symbol | Description | Min. | Typ. | Max. | Unit | Note |
|-----------|---------------------------------|--------|------|-------|--------|--------------------------------------|
| I_{RLB} | LED String Current | - | 450 | - | [mA] | Operating with fixed driving current |
| V_{LB} | LED String Voltage | - | - | 38.4 | [Volt] | |
| P_{BLU} | LED Light Bar Power Consumption | - | - | 17.28 | [Watt] | |
| LT_{LB} | L/B Life Time | 30,000 | - | - | [Hour] | |

Note 1: T_a means ambient temperature of TFT-LCD module,

Note 2: If module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 3: Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

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4.3.4 BACKLIGHT PIN ASSIGNMENT

| PIN # | Symbol | DESCRIPTION |
|-------|--------|--------------|
| 1 | VLED | High Voltage |
| 2 | GND | Low Voltage |

Note (1) Connector Part No.:
PHR-2P,JST

4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 LVDS DATA MAPPING TABLE

| | | | | | | | | |
|----------------|-------------|-----|-----|-----|-----|-----|-----|-----|
| LVDS Channel 0 | LVDS output | D7 | D6 | D4 | D3 | D2 | D1 | D0 |
| | Data order | G0 | R5 | R4 | R3 | R2 | R1 | R0 |
| LVDS Channel 1 | LVDS output | D18 | D15 | D14 | D13 | D12 | D9 | D8 |
| | Data order | B1 | B0 | G5 | G4 | G3 | G2 | G1 |
| LVDS Channel 2 | LVDS output | D26 | D25 | D24 | D22 | D21 | D20 | D19 |
| | Data order | DE | NA | NA | B5 | B4 | B3 | B2 |
| LVDS Channel 3 | LVDS output | D23 | D17 | D16 | D11 | D10 | D5 | D27 |
| | Data order | NA | B7 | B6 | G7 | G6 | R7 | R6 |

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4.4.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and 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 the assignment of color versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------|-----------------|-------------|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|
| | | Red | | | | | | | | Green | | | | | | | | Blue | | | | | | | |
| | | 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 Colors | 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 | 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 | 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 | 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 |
| Gray Scale Of Red | Red(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Red(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Red(2) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| | Red(253) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 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 | |
| | 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 | |
| Gray Scale Of Green | Green(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | | |
| | Green(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 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 | |
| | 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 | |
| Gray Scale Of Blue | Blue(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | | |
| | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | | |
| | Blue(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | |
| | Blue(254) | 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 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

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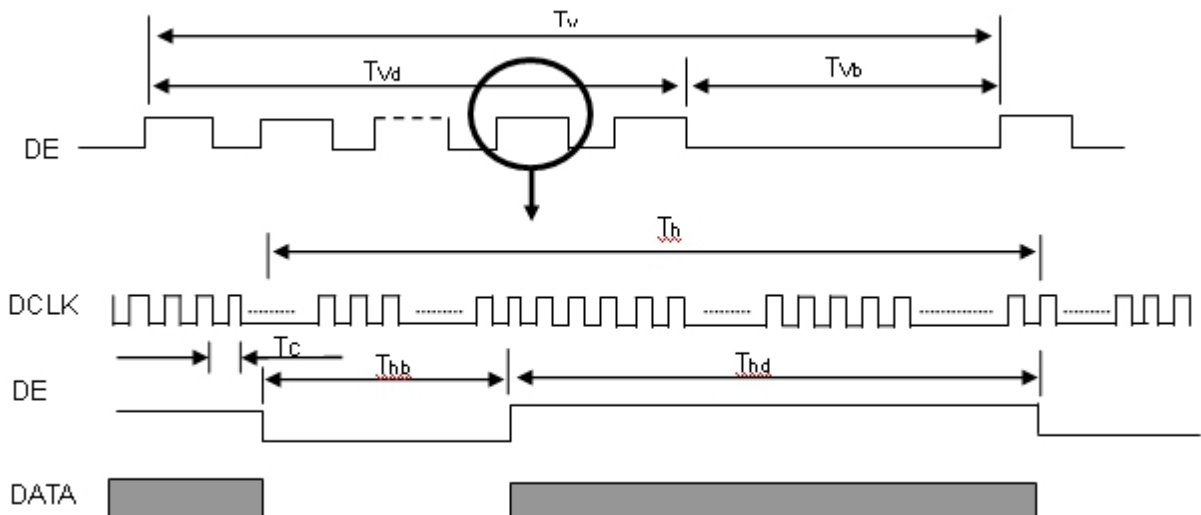
4.5 DISPLAY TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|-------------------------|--------------------------------------|----------------------------|---------|------|---------|----------------|--|
| LVDS Clock | Frequency | F _c | 63 | 76 | 96 | MHz | - |
| | Period | T _c | | 13 | | ns | |
| | Input cycle to cycle jitter | T _{rcj} | TC -200 | | TC +200 | ns | (1) |
| | Input Clock to data skew | TLVCCS | | | 400 | ps | (2) |
| | Spread spectrum modulation range | F _{clk_in_mod} | FC*97% | | FC*103% | MHz | (3) |
| | Spread spectrum modulation frequency | F _{SSM} | | | 200 | KHz | |
| Vertical Display Term | Frame Rate | Fr | 50 | 60 | 76 | Hz | T _v =T _{v_d} +T _{v_b} |
| | Total | T _v | 800 | 806 | 15 | Th | - |
| | Active Display | T _{v_d} | 768 | 768 | 768 | Th | - |
| | Blank | T _{v_b} | 32 | 38 | 47 | Th | - |
| Horizontal Display Term | Total | T _h | 1500 | 1560 | 1570 | T _c | T _h =T _{h_d} +T _{h_b} |
| | Active Display | T _{h_d} | 1366 | 1366 | 1366 | T _c | - |
| | Blank | T _{h_b} | 134 | 194 | 204 | T _c | - |

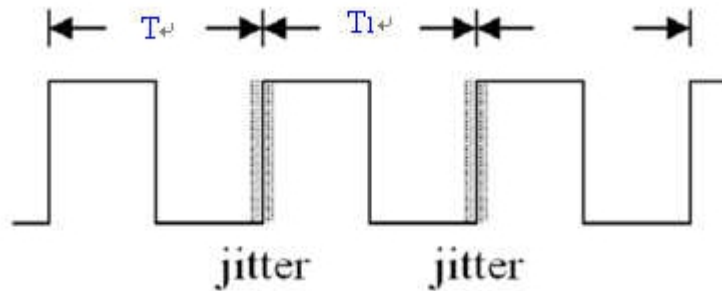
Note: Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

INPUT SIGNAL TIMING DIAGRAM

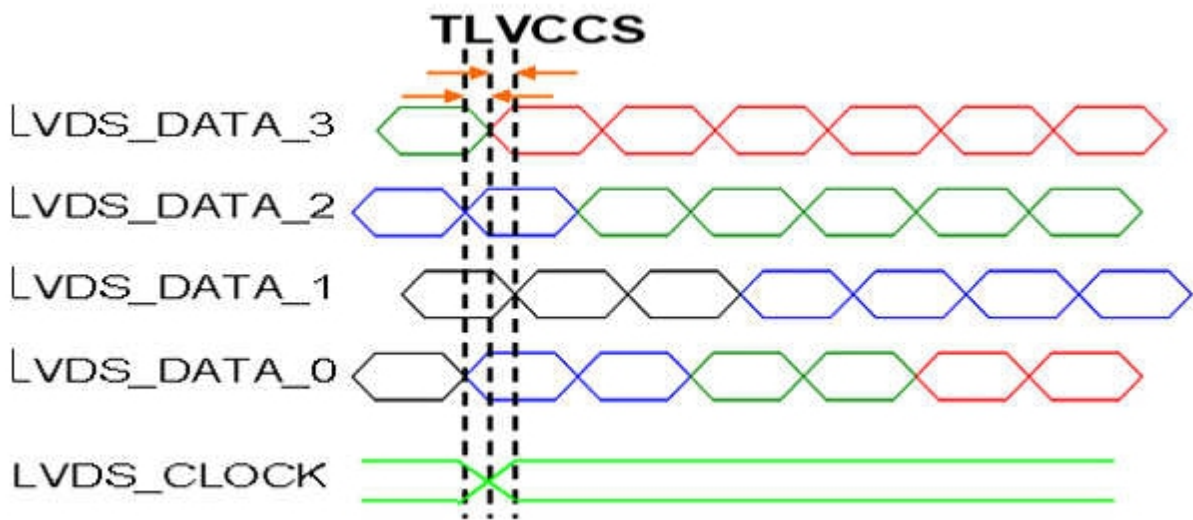


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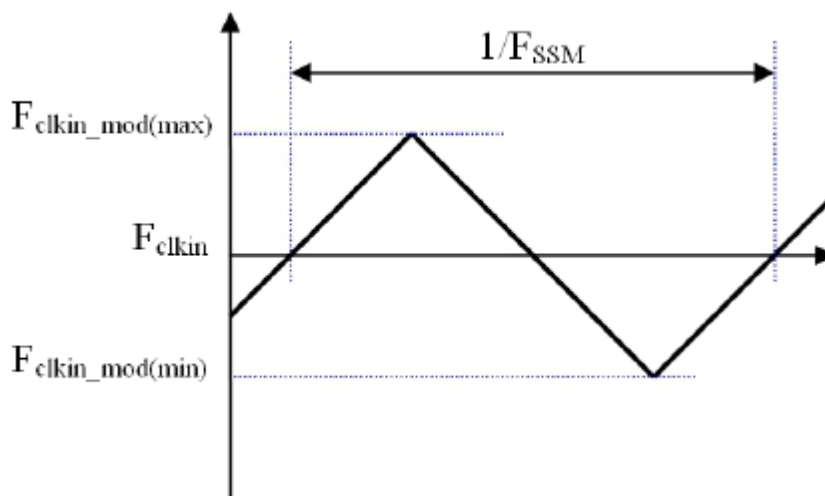
Note (1) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = |T_1 - T_1'|$



Note (2) Input Clock to data skew is defined as below figures.



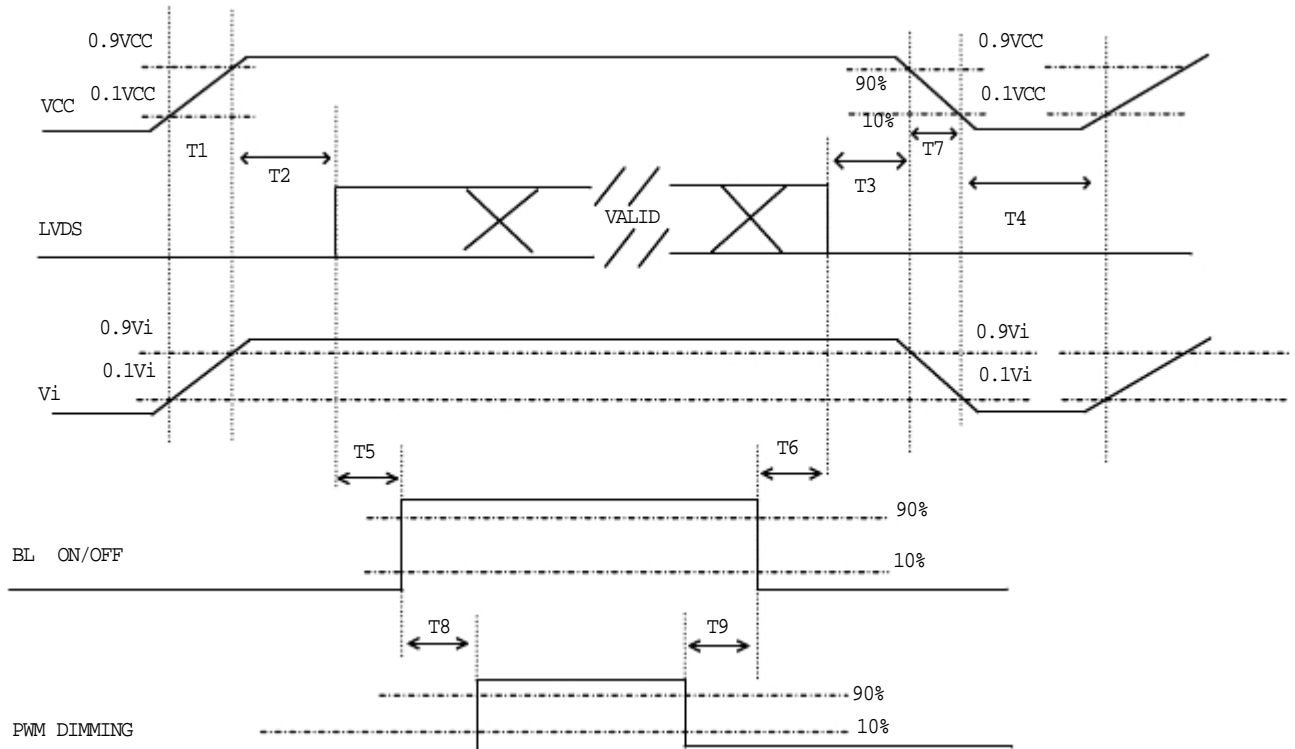
Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.



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4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram.



Timing Specifications:

| Parameter | Value | | | Units |
|-----------|-------|-----|-----|-------|
| | Min | Typ | Max | |
| T1 | 0.5 | - | 10 | ms |
| T2 | 0 | - | 50 | ms |
| T3 | 0 | - | 50 | ms |
| T4 | 500 | - | - | ms |
| T5 | 200 | - | - | ms |
| T6 | 20 | - | - | ms |
| T7 | 5 | - | 300 | ms |
| T8 | 10 | - | - | ms |
| T9 | 10 | - | - | ms |

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

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5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

| Item | Symbol | Value | Unit |
|---|---|-----------|------|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | VCC | 3.3 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| LED Light Bar Input Current Per Input Pin | IPIN | 450 ±1.95 | mADC |
| PWM Duty Ratio | D | 100 | % |
| LED Light Bar Test Converter | CMI 35-D065452 | | |

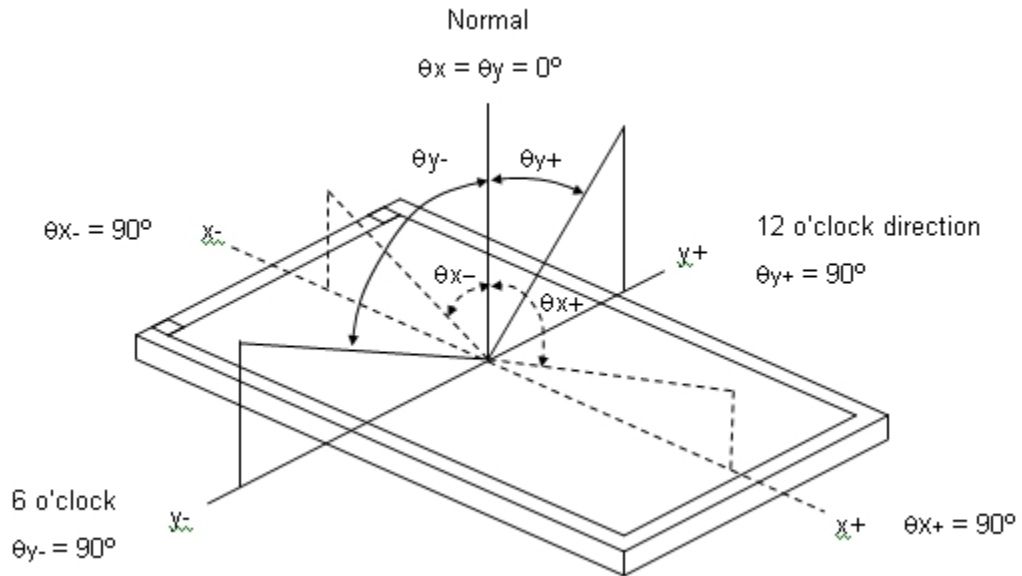
5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note | |
|--|----------------|--------------------------------------|--|----------------|-------|-------------------|----------|----------|
| Color Chromaticity (CIE 1931) | Red | Rx | $\theta_x=0^\circ, \theta_y=0^\circ$ CS-2000 R=G=B=255 Gray scale | Typ – 0.045 | 0.617 | Typ + 0.045 | - | (1), (5) |
| | | Ry | | | 0.340 | | | |
| | Green | Gx | | | 0.320 | | | |
| | | Gy | | | 0.598 | | | |
| | Blue | Bx | | | 0.160 | | | |
| | | By | | | 0.084 | | | |
| | White | Wx | | | 0.313 | | | |
| | | Wy | | | 0.329 | | | |
| Center Luminance of White (Center of Screen) | Lc | | 1800 | 2000 | - | cd/m ² | (4), (5) | |
| Contrast Ratio | CR | | 400 | 500 | - | - | (2), (5) | |
| Response Time | T _R | $\theta_x=0^\circ, \theta_y=0^\circ$ | - | 3 | 8 | ms | (3) | |
| | T _F | | - | 7 | 13 | | | |
| White Variation | W | $\theta_x=0^\circ, \theta_y=0^\circ$ | 65 | - | - | % | (5), (6) | |
| Viewing Angle | Horizontal | $\theta_x- + \theta_x+$ | CR ≥ 10 | 140 | 160 | --- | Deg. | (1), (5) |
| | Vertical | $\theta_y- + \theta_y+$ | | 140 | 160 | --- | | |

PRODUCT SPECIFICATION

Note (1) Definition of Viewing Angle (θ_x, θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

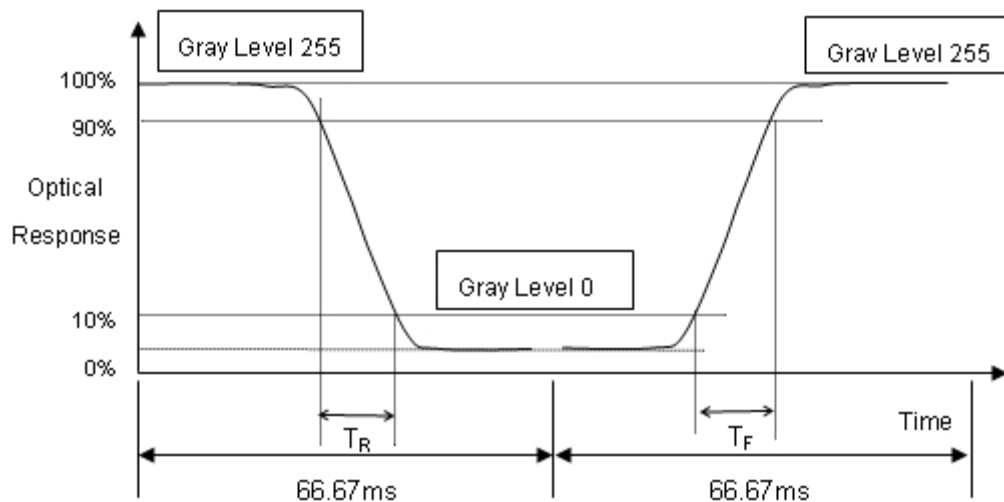
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):



PRODUCT SPECIFICATION

Note (4) Definition of Luminance of White (L_c):

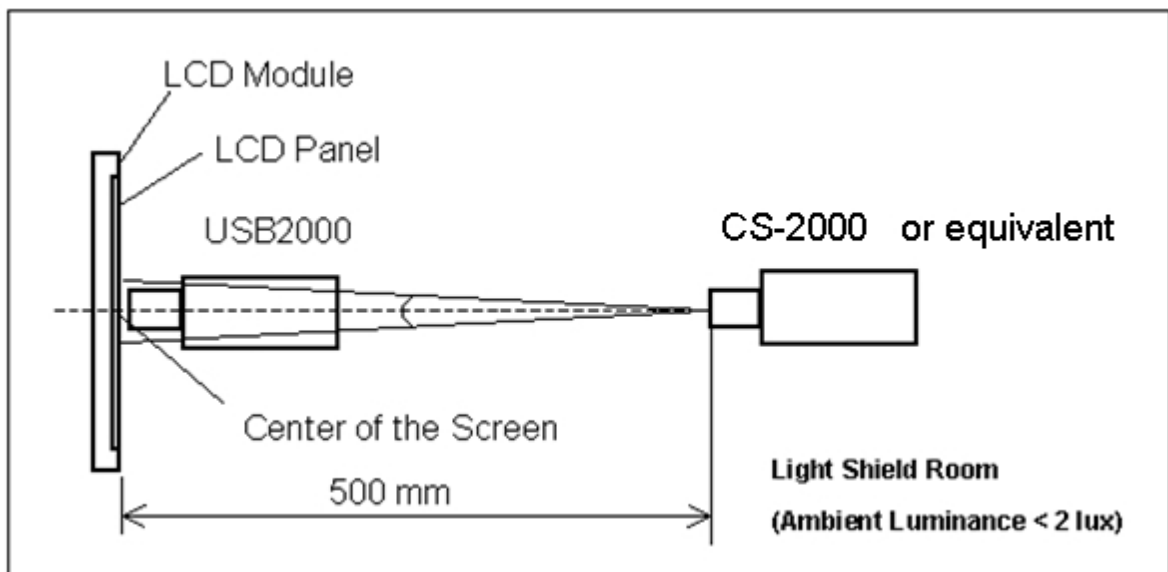
Measure the luminance of gray level 255 at center point

$$L_c = L(5)$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

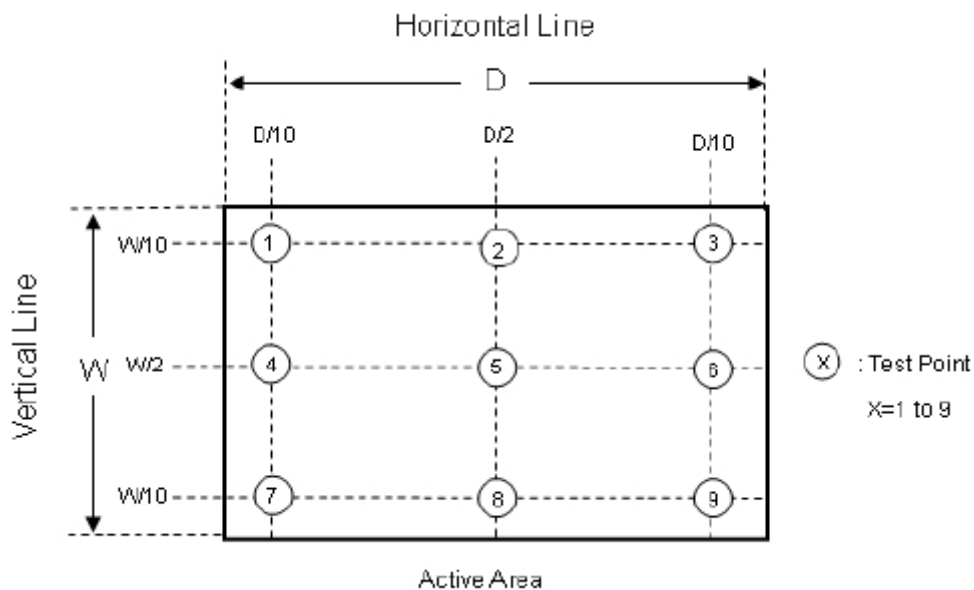
The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

$$\delta W = (\text{Minimum} [L(1) \sim L(9)] / \text{Maximum} [L(1) \sim L(9)]) * 100\%$$



PRODUCT SPECIFICATION

6. RELIABILITY TEST ITEM

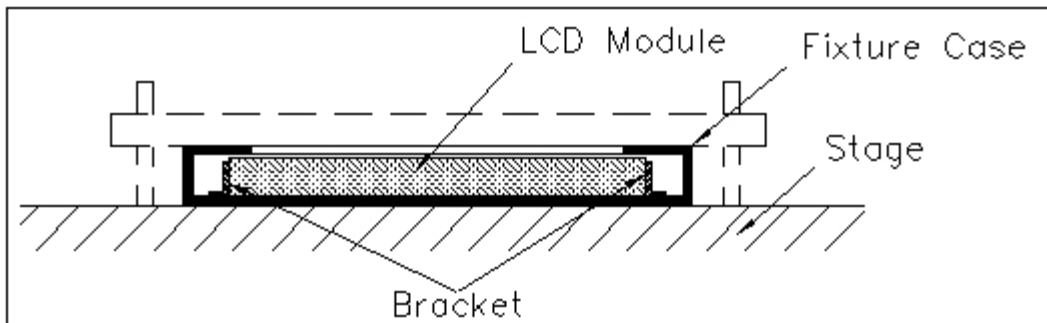
| Items | Required Condition | Note |
|-----------------------------------|---|------|
| Temperature Humidity Bias (THB) | Ta= 50°C , 80%RH, 240hours | |
| High Temperature Operation (HTO) | Ta= 60°C , 50%RH , 240hours | |
| Low Temperature Operation (LTO) | Ta= 0°C , 240hours | |
| High Temperature Storage (HTS) | Ta= 60°C , 240hours | |
| Low Temperature Storage (LTS) | Ta= -20°C , 240hours | |
| Vibration Test (Non-operation) | Acceleration: 1.5 Grms Wave: Half-sine Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z) | |
| Shock Test (Non-operation) | Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis) | |
| Thermal Shock Test (TST) | -20°C/30min , 60°C / 30min , 100 cycles | |
| On/Off Test | 25°C , On/10sec , Off /10sec , 30,000 cycles | |
| ESD (Electro Static Discharge) | Contact Discharge: ± 8KV, 150pF(330) Air Discharge: ± 15KV, 150pF(330) | |
| Altitude Test | Operation:10,000 ft / 24hours Non-Operation:30,000 ft / 24hours | |

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



PRODUCT SPECIFICATION

7. PACKING

7.1 PACKING SPECIFICATIONS

- (1) 10 pcs LCD modules / 1 Box
- (2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm
- (3) Weight: approximately 17Kg (10 modules per box)

7.2 PACKING METHOD

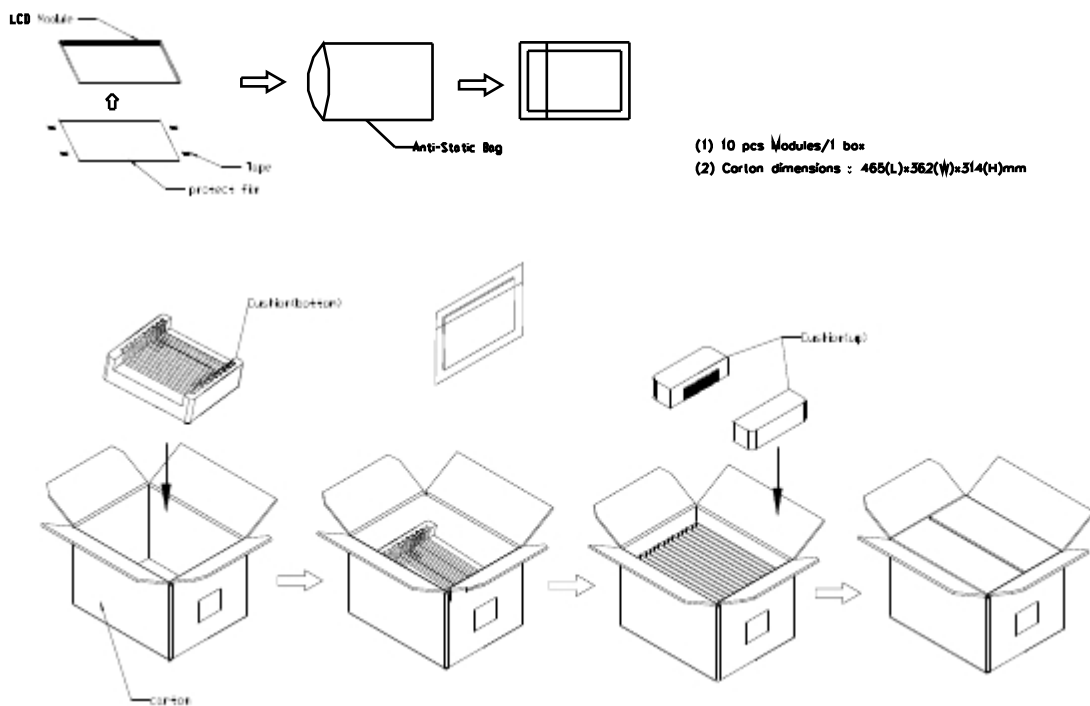
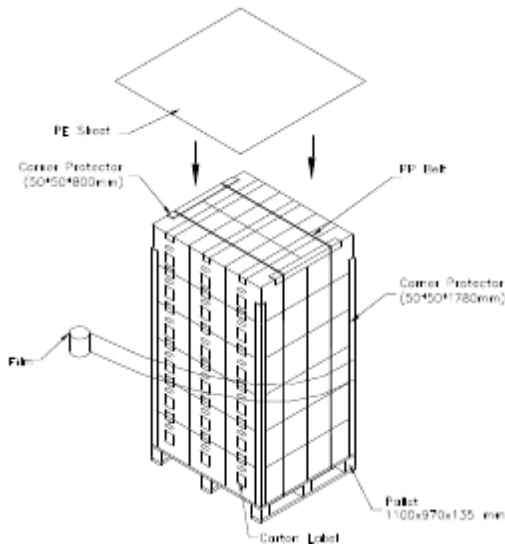


Figure. 7-1 Packing

PRODUCT SPECIFICATION

Sea / Land Transportation (40ft Container)



Air Transportation

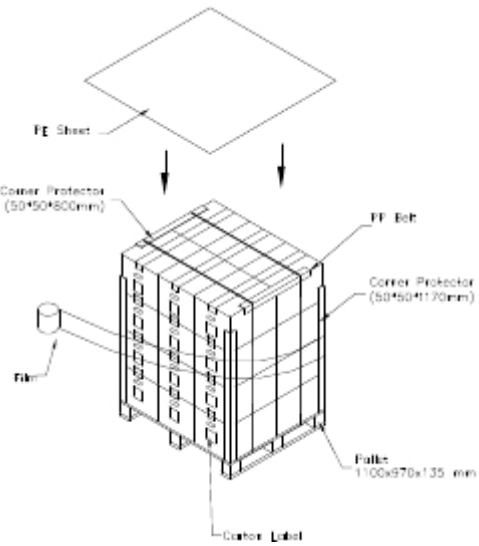


Figure. 7-2 Packing

7.3 UN-PACKING METHOD

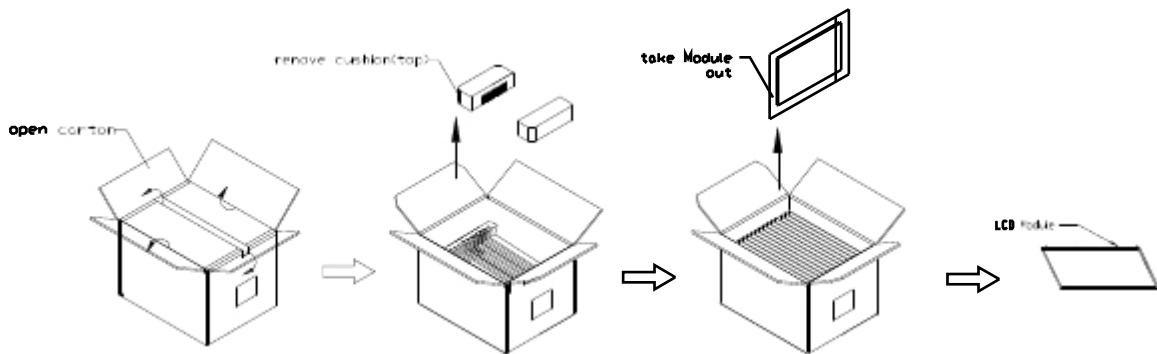


Figure. 7-3 UN-Packing

8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly.

8.2 STORAGE PRECAUTIONS

- (1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0°C to 35°C and relative humidity of less than 70%
- (2) Do not store the TFT – LCD module in direct sunlight
- (3) The module should be stored in dark place. It is prohibited to apply sunlight or fluorescent light in storing

8.3 OPERATION PRECAUTIONS

- (1) The LCD product should be operated under normal condition.
Normal condition is defined as below :
Temperature : 20±15°C
Humidity: 65±20%
Display pattern : continually changing pattern(Not stationary)
- (2) If the product will be used in extreme conditions such as high temperature, high humidity, high altitude, display pattern or operation time etc... It is strongly recommended to contact CMI for application engineering advice. Otherwise, its reliability and function may not be guaranteed.

8.4 SAFETY PRECAUTIONS

- (1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

8.5 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

- (1) UL60950-1 or updated standard.
- (2) IEC60950-1 or updated standard.

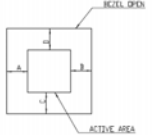
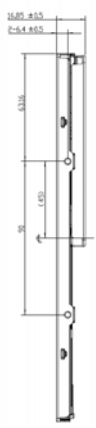
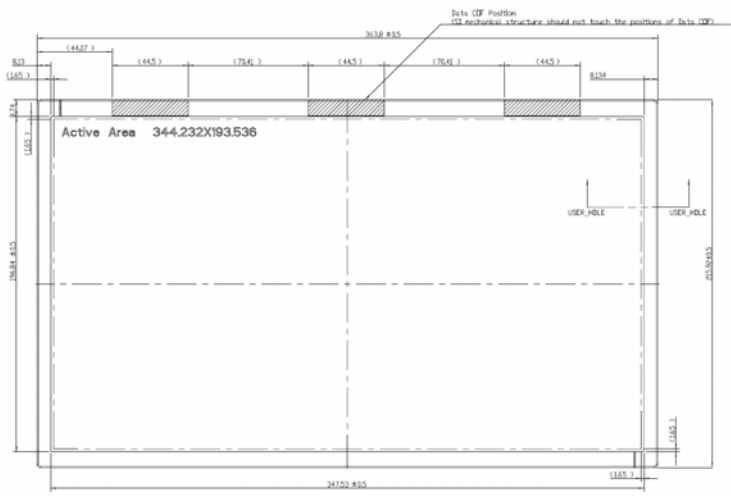
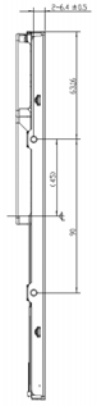
8.6 OTHER

When fixed patterns are displayed for a long time, remnant image is likely to occur

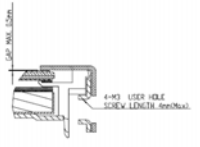
| REV | BY | DATE | DESCRIPTION | SCALE |
|-----|----|------|-----------------------|-------|
| 1 | | | ISSUE FOR MANUFACTURE | 1:1 |



Bits (DP) Position
 (1) mechanical structure should not touch the positions of Bits (DP)

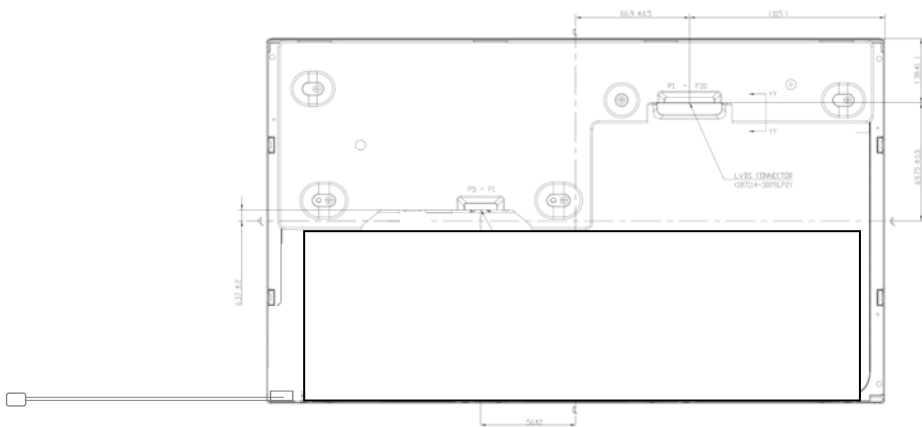


NOTE:
 1. DISPLAY AREA POSITION TOLERANCE: M-Bottom & E-Bottom
 2. SHOW/FREE TOLERANCE: BOM
 3. SIZE POINT HOLE ROTATIONAL TONGUE MAX. IS 3kgf-cm



SECTION USER_HOLE-USER_HOLE
 SCALE: 4X

| REV | BY | DATE | DESCRIPTION |
|-----|-----|------|-------------|
| 1 | ... | ... | ... |
| 2 | ... | ... | ... |



NOTE:
 1. DISPLAY AREA POSITION TOLERANCE: M-Bottom & C-Bottom.
 2. UNSPECIFIED TOLERANCE: ±0.1mm.
 3. SIDE MOUNT HOLE ROTATIONAL TOLERANCE: MAX. IS 36°/mm.