



## TFT LCD Preliminary Specification

# MODEL NO.: G070Y2-T02

Customer: \_\_\_\_\_

Approved by: \_\_\_\_\_

Note:

| Liquid Crystal Display Division |                   |
|---------------------------------|-------------------|
| QRA Division.                   | OA Head Division. |
| Approval                        | Approval          |
|                                 |                   |



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**REVISION HISTORY**

| Version | Date         | Section | Description                                            |
|---------|--------------|---------|--------------------------------------------------------|
| Ver 1.0 | Jun. 27, '09 | All     | G070Y2-T02 Preliminary specification was first issued. |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

G070Y2-T02 is a 7inch TFT Liquid Crystal Display module with a LED backlight unit and a-60-pin-and-1ch-TTL interface. TCON (timing controller) is included in driver IC. This module supports 800 (R.G.B )x 480 WVGA mode which main application is the automotive display and industrial field.

### 1.2 FEATURES

- Wide viewing angle.
- Fast response time
- High Color Gamut
- Wide operating temperature
- Reversible - scan function
- 6/8 bit convertible

### 1.3 APPLICATION

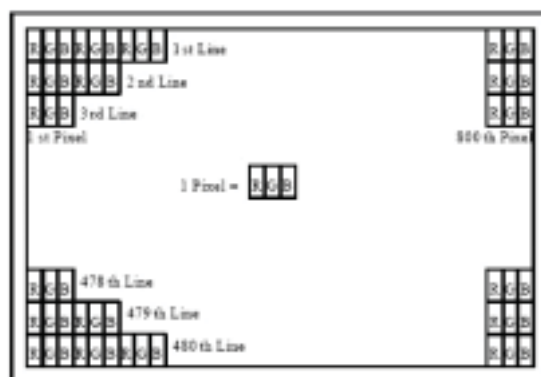
- Automotive Display
- Industry Application

### 1.4 GENERAL SPECIFICATIONS

| Item                     | Specification                   | Unit  | Note |
|--------------------------|---------------------------------|-------|------|
| Diagonal Size            | 7                               | inch  |      |
| Active Area              | 152.4x91.44                     | mm    | (1)  |
| Bezel Opening Area       | 154.6x93.64                     | mm    |      |
| Driver Element           | a-si TFT active matrix          | -     | -    |
| Pixel Number             | 800 x R.G.B. x 480              | pixel | -    |
| Pixel Pitch              | 0.1905 x 0.1905                 | mm    | -    |
| Pixel Arrangement        | RGB vertical stripe             | -     | (2)  |
| Display Colors           | 262k or 16.2M                   | color | -    |
| Display Mode             | Normal White                    | -     | -    |
| Surface Treatment        | Anti-glare, Hard Coating ( 3H ) | -     | -    |
| Module Power Consumption | 4.46                            | W     | Typ. |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2)





## 1.5 MECHANICAL SPECIFICATIONS

| Item        |                | Min.    | Typ.   | Max.    | Unit | Note |
|-------------|----------------|---------|--------|---------|------|------|
| Module Size | Horizontal (H) | (164.5) | (165)  | (165.5) | mm   | (1)  |
|             | Vertical (V)   | (103.5) | (104)  | (104.5) | mm   |      |
|             | Depth (D)      | (5.83)  | (6.33) | (6.83)  | mm   |      |
| Weight      |                | (118)   | (133)  | (148)   | g    |      |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.



## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

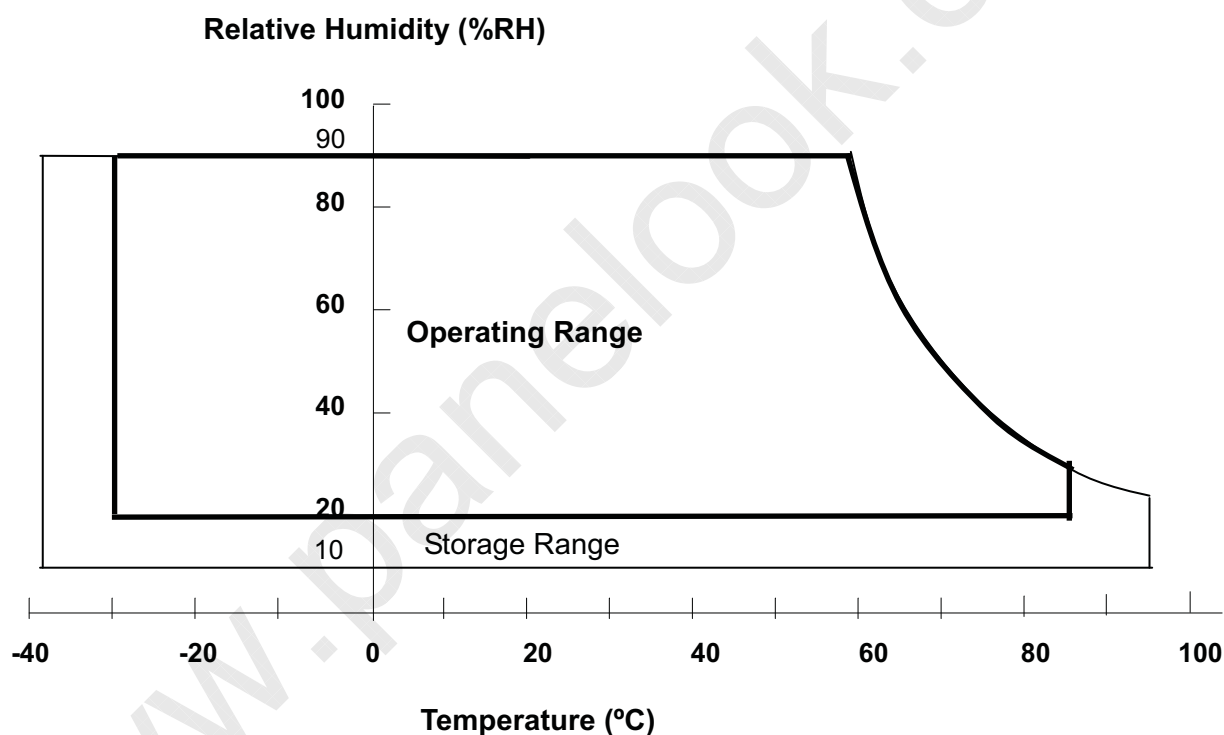
| Item                          | Symbol          | Value |      | Unit | Note |
|-------------------------------|-----------------|-------|------|------|------|
|                               |                 | Min.  | Max. |      |      |
| Operating Ambient Temperature | T <sub>OP</sub> | -30   | +85  | °C   |      |
| Storage Temperature           | T <sub>ST</sub> | -40   | +95  | °C   |      |

Note (1) Temperature and relative humidity range is shown in the figure below.

(2) 90 %RH Max. ( $T_a \leq 40\text{ }^{\circ}\text{C}$ ).

(3) Wet-bulb temperature should be 39 °C Max. ( $T_a > 40\text{ }^{\circ}\text{C}$ ).

(4) No condensation.





## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

Ta = 25 ± 2 °C

| Parameter             | Symbol | Value    |            | Unit | Note |
|-----------------------|--------|----------|------------|------|------|
|                       |        | Min.     | Max.       |      |      |
| Power Supply Voltage  | VCC    | (-0.3)   | (7)        | V    | -    |
|                       | VDDG   | (-0.3)   | (7)        | V    |      |
|                       | AVDD   | (-0.3)   | (13.5)     | V    | -    |
|                       | VGH    | (-0.3)   | (42)       | V    |      |
|                       | VGL    | (VGH-42) | (0.3)      | V    | -    |
| Digital Input Voltage | Vi     | (-0.3)   | (VCC +0.3) | V    | (1)  |
| Gamma Supply Voltage  | V1~V10 | (-0.3)   | (AVDD+0.3) | V    | -    |

Note (1) Vi means all input logic signal.

(2) Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

### 2.2.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

| Item                               | Symbol | Value  |       | Unit | Note |
|------------------------------------|--------|--------|-------|------|------|
|                                    |        | Min.   | Max.  |      |      |
| LED Light Bar Power Supply Voltage | VL     | (18.9) | (28)  | V    | (1)  |
| LED Light Bar Power Supply Current | IL     | -      | (180) | mA   | (1)  |

Note (1) Permanent damage to the device may occur if maximum or minimum values are exceeded.

Function operation should be restricted to the conditions described under Normal Operating Conditions.



### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 RECOMMENDED OPERATION CONDITION (GND = AVSS = 0V)

Ta = 25 ± 2 °C

| Parameter             |            | Symbol          | Value                 |        |                       | Unit | Note                   |
|-----------------------|------------|-----------------|-----------------------|--------|-----------------------|------|------------------------|
|                       |            |                 | Min.                  | Typ.   | Max.                  |      |                        |
| Power Supply Voltage  |            | VCC             | (3.0)                 | (3.3)  | (3.6)                 | V    |                        |
|                       |            | VDDG            | (3.0)                 | (3.3)  | (3.6)                 | V    |                        |
|                       |            | AVDD            | (9)                   | (10)   | (12)                  | V    |                        |
|                       |            | VGH             | (18)                  | (19)   | (20)                  | V    |                        |
|                       |            | VGL             | (-8)                  | (-6.8) | (-6)                  | V    |                        |
| Input Signal Voltage  |            | V1~V5           | (0.35AVDD)            |        | (AVDD-0.5)            | V    | (1)                    |
|                       |            | V6~V10          | (0.3)                 |        | (0.65AVDD)            | V    | (1)                    |
|                       |            | VCOM            |                       | (3.8)  |                       | V    |                        |
| Digital Input Voltage | High Level | V <sub>IH</sub> | (0.8V <sub>CC</sub> ) |        | (V <sub>CC</sub> )    | V    | I <sub>oL</sub> =400uA |
|                       | Low Level  | V <sub>IL</sub> | (0)                   |        | (0.2V <sub>CC</sub> ) | V    | I <sub>oH</sub> =400uA |

Note (1) Please refer to 11.1 application notes.

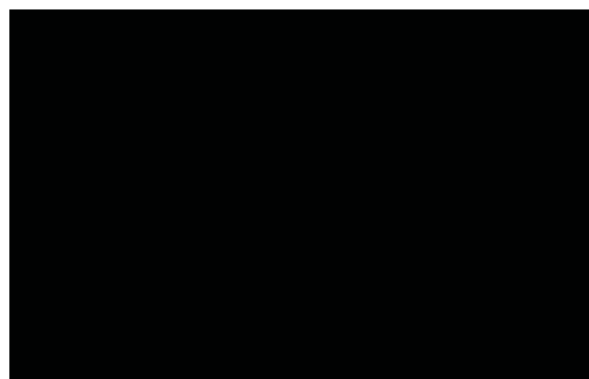
#### 3.2 CURRENT CONSUMPTION (GND = AVSS = 0V)

| Parameter                                       |  | Symbol          | Value |       |      | Unit | Note   |
|-------------------------------------------------|--|-----------------|-------|-------|------|------|--------|
|                                                 |  |                 | Min.  | Typ.  | Max. |      |        |
| Supply Current for Source/Gate Driver (Digital) |  | I <sub>CC</sub> | -     | (28)  | -    | mA   | (1)(2) |
| Supply Current for Source Driver (Analog)       |  | I <sub>DD</sub> | -     | (29)  | -    | mA   | (1)(3) |
| Supply Current for Gate Driver (High Level)     |  | I <sub>GG</sub> | -     | (0.8) | -    | mA   | (1)    |
| Supply Current for Gate Driver (Low Level)      |  | I <sub>EE</sub> | -     | (0.6) | -    | mA   | (1)    |

Note (1) The specified power supply current is under the conditions at VCC = 3.3 V, Ta = 25 ± 2 °C, f<sub>v</sub> = 60 Hz, whereas a power dissipation check pattern below is displayed.

(2) Fcph = 33MHz, F<sub>HS</sub> = 30.2KHz, black pattern, V<sub>cc</sub> = 3.3V.(3) Fcph = 33MHz, F<sub>HS</sub> = 30.2KHz, black pattern, AVDD = 10V, no loading.

Black Pattern



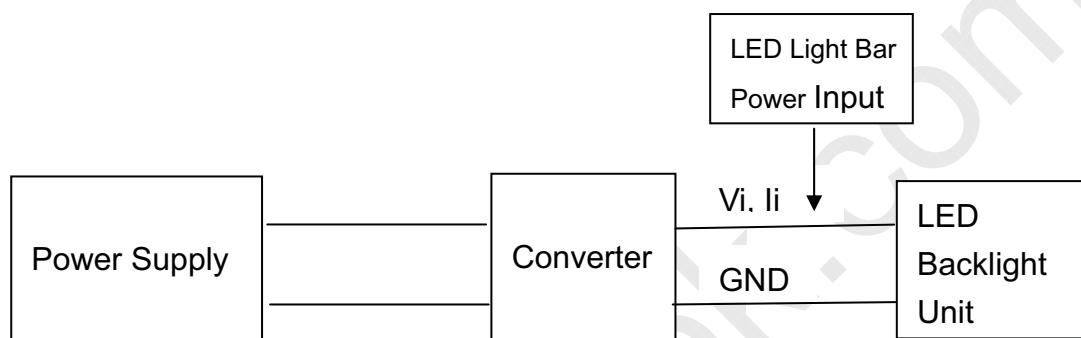
Active Area

## 3.3 BACKLIGHT UNIT

Ta = 25 ± 2 °C

| Parameter                          | Symbol          | Value   |        |      | Unit | Note                   |
|------------------------------------|-----------------|---------|--------|------|------|------------------------|
|                                    |                 | Min.    | Typ.   | Max. |      |                        |
| LED Light Bar Power Supply Voltage | V <sub>L</sub>  | (18.9)  | (25.2) | (28) | V    |                        |
| LED Light Bar Power Supply Current | I <sub>L</sub>  | --      | (160)  | --   | mA   | (1),(2)<br>(Duty 100%) |
| Power Consumption                  | P <sub>L</sub>  | --      | (3.92) | --   | W    | (3), (Duty 100%)       |
| LED Life Time                      | L <sub>BL</sub> | (50000) | ==     | ==   | hr   |                        |

Note (1) LED light bar configuration is shown as below



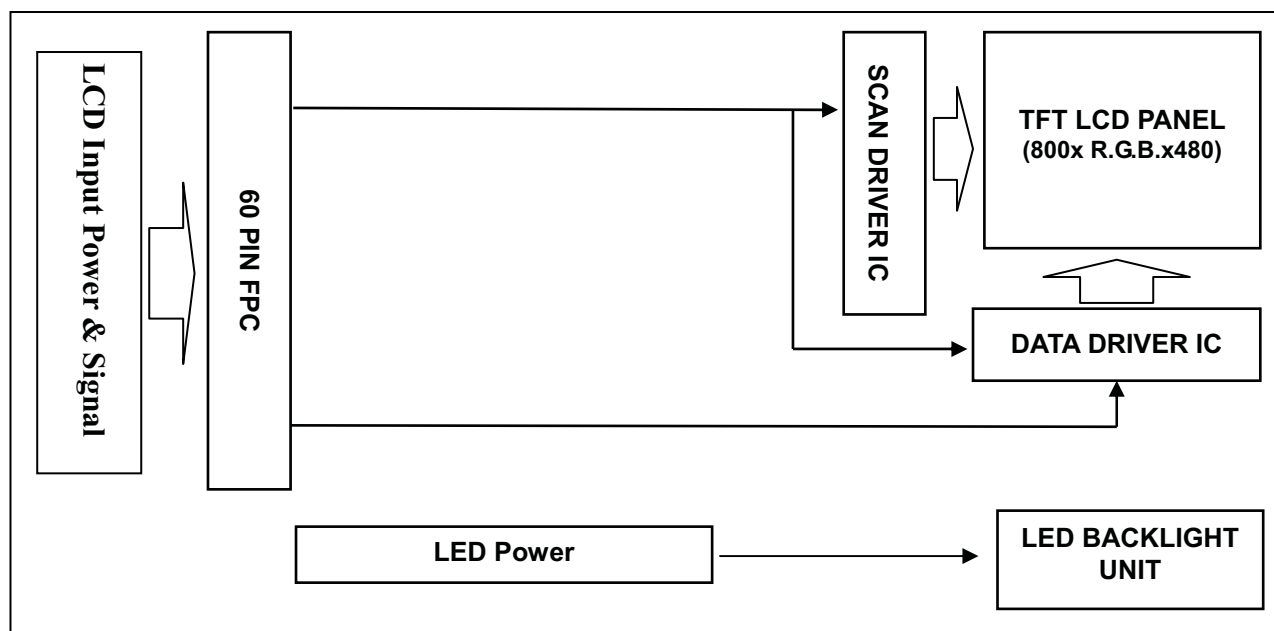
Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3)  $P_{Lmax} = I_{Lmax} \times V_{Lmax}$

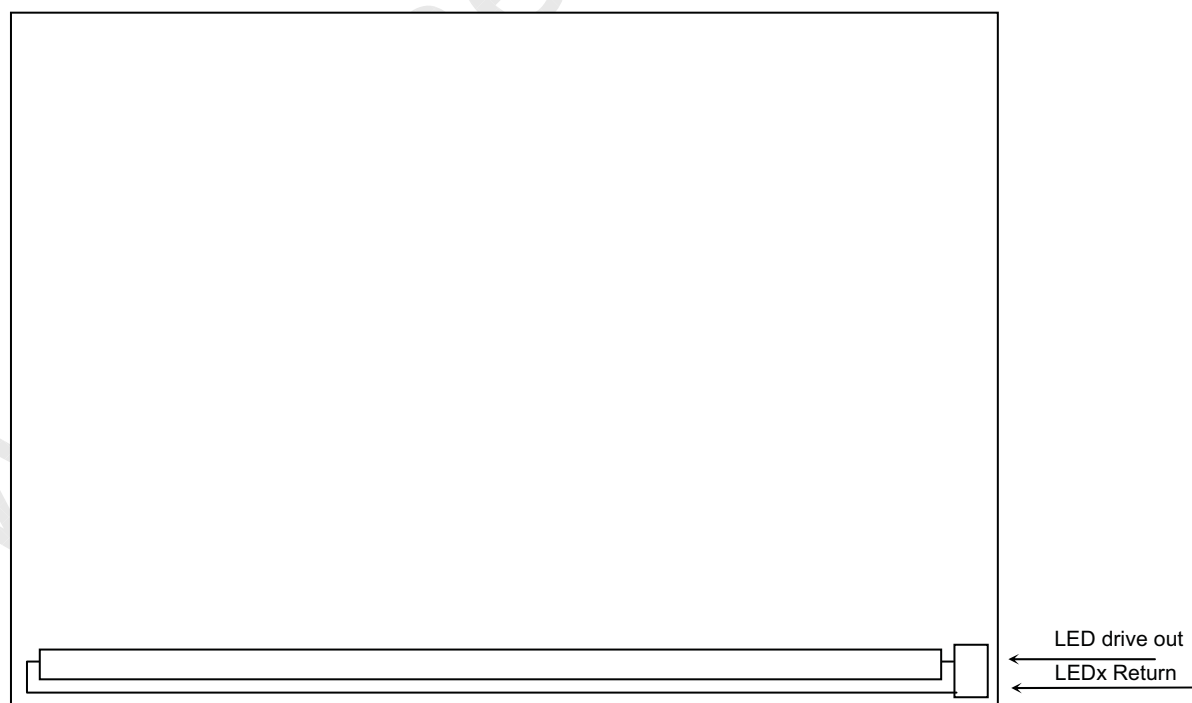
Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ± 2 °C and I<sub>L</sub> = 80 mA(Per EA) until the brightness becomes ≤ 50% of its original value.

## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE



### 4.2 BACKLIGHT UNIT





## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 FPC I/O PIN ASSIGNMENT

| Pin | Name | I/O | Description                                                                                                                                                                 |
|-----|------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | GND  | I   | Power Ground                                                                                                                                                                |
| 2   | VGL  | I   | Gate OFF Power Supply Voltage                                                                                                                                               |
| 3   | VGL  | I   | Gate OFF Power Supply Voltage                                                                                                                                               |
| 4   | /XAO | I   | Output all-on control<br>When /XAO is set to L, all outputs are fixed to VGH                                                                                                |
| 5   | VDDG | I   | Gate Driver Power supply (+3.3V)                                                                                                                                            |
| 6   | VDDG | I   | Gate Driver Power supply (+3.3V)                                                                                                                                            |
| 7   | GND  | I   | Power Ground                                                                                                                                                                |
| 8   | VGH  | I   | Gate ON Power Supply Voltage                                                                                                                                                |
| 9   | UD   | I   | Gate Driver Up/down scan setting<br>When UD=H, reverse scan<br>When UD=L, normal scan (Default pull low)                                                                    |
| 10  | DE   | I   | Input data enable control<br>When DE mode, active High to enable data input. (Default pull low)                                                                             |
| 11  | FRC  | I   | Dithering control setting<br>When FRC=H, the width of data input 8 bits<br>When FRC=L, the width of data input 6 bits and set Dx0 and Dx1 to logical low (Default pull low) |
| 12  | B07  | I   | Blue data (MSB)                                                                                                                                                             |
| 13  | B06  | I   | Blue data                                                                                                                                                                   |
| 14  | B05  | I   | Blue data                                                                                                                                                                   |
| 15  | B04  | I   | Blue data                                                                                                                                                                   |
| 16  | B03  | I   | Blue data                                                                                                                                                                   |
| 17  | B02  | I   | Blue data                                                                                                                                                                   |
| 18  | B01  | I   | Blue data                                                                                                                                                                   |
| 19  | B00  | I   | Blue data (LSB)                                                                                                                                                             |
| 20  | CLK  | I   | Clock signal<br>User can input different polarity CLK by EDGSL setting. (Default pull low)                                                                                  |
| 21  | GND  | I   | Power Ground                                                                                                                                                                |
| 22  | G07  | I   | Green data (MSB)                                                                                                                                                            |
| 23  | G06  | I   | Green data                                                                                                                                                                  |
| 24  | G05  | I   | Green data                                                                                                                                                                  |
| 25  | G04  | I   | Green data                                                                                                                                                                  |
| 26  | G03  | I   | Green data                                                                                                                                                                  |
| 27  | G02  | I   | Green data                                                                                                                                                                  |
| 28  | G01  | I   | Green data                                                                                                                                                                  |
| 29  | G00  | I   | Green data (LSB)                                                                                                                                                            |
| 30  | R07  | I   | Red data (MSB)                                                                                                                                                              |
| 31  | R06  | I   | Red data                                                                                                                                                                    |
| 32  | R05  | I   | Red data                                                                                                                                                                    |
| 33  | R04  | I   | Red data                                                                                                                                                                    |
| 34  | R03  | I   | Red data                                                                                                                                                                    |
| 35  | R02  | I   | Red data                                                                                                                                                                    |



|    |          |   |                                                                                                                                                                               |
|----|----------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 36 | R01      | I | Red data                                                                                                                                                                      |
| 37 | R00      | I | Red data (LSB)                                                                                                                                                                |
| 38 | RESETB   | I | Hardware global reset. Low active (Default pull high)                                                                                                                         |
| 39 | EDGSL    | I | Define input clock polarity<br>When EDGSL=L, Latch data by rising edge of CLK (Default Pull Low)<br>When EDGSL=H, CLK polarity is inverted, Latch data by falling edge of CLK |
| 40 | LR       | I | Shift direction of Source Driver IC internal shift register is controlled by this pin as show below:<br>LR=H SO1→ .....SO1200 (Default pull high)<br>LR=L SO1200→ .....SO1    |
| 41 | GND      | I | Power Ground                                                                                                                                                                  |
| 42 | VCOM     | I | Common voltage input                                                                                                                                                          |
| 43 | VCOM     | I | Common voltage input                                                                                                                                                          |
| 44 | VCOM_Cst | I | Power Ground                                                                                                                                                                  |
| 45 | VCC      | I | Digital power supply (+3.3V)                                                                                                                                                  |
| 46 | VCC      | I | Digital power supply (+3.3V)                                                                                                                                                  |
| 47 | AVDD     | I | Analog power supply (+12V)                                                                                                                                                    |
| 48 | AVDD     | I | Analog power supply (+12V)                                                                                                                                                    |
| 49 | GM1      | I | Gamma voltage level 1                                                                                                                                                         |
| 50 | GM2      | I | Gamma voltage level 2                                                                                                                                                         |
| 51 | GM3      | I | Gamma voltage level 3                                                                                                                                                         |
| 52 | GM4      | I | Gamma voltage level 4                                                                                                                                                         |
| 53 | GM5      | I | Gamma voltage level 5                                                                                                                                                         |
| 54 | GM6      | I | Gamma voltage level 6                                                                                                                                                         |
| 55 | GM7      | I | Gamma voltage level 7                                                                                                                                                         |
| 56 | GM8      | I | Gamma voltage level 8                                                                                                                                                         |
| 57 | GM9      | I | Gamma voltage level 9                                                                                                                                                         |
| 58 | GM10     | I | Gamma voltage level 10                                                                                                                                                        |
| 59 | VSSA     | I | Power Ground                                                                                                                                                                  |
| 60 | GND      | I | Power Ground                                                                                                                                                                  |

## 5.2 BACKLIGHT Driving Section

| No | Symbol | I/O | Description                                    |
|----|--------|-----|------------------------------------------------|
| 1  | HI     | I   | Power supply for backlight unit (High Voltage) |
| 2  | GND    | -   | GND for backlight unit                         |

Note (1) User's connector Part No: Aces 87210\_0236L

### 5.3 SCANNING DIRECTION

The following figures are seen from a front view and the arrow shows the direction of scan.

**Fig.1 Normal Scan**



**Fig.2 Reverse Scan**



**Fig.3 Reverse Scan**



**Fig.4 Reverse Scan**

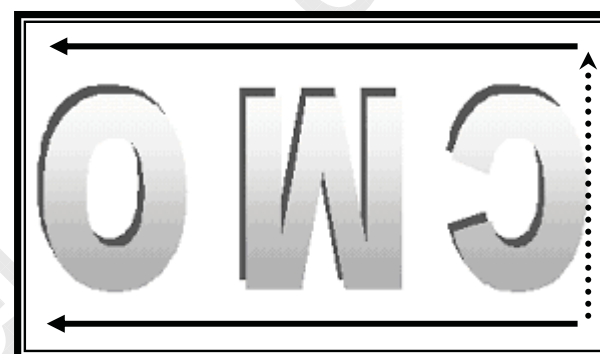


Fig. 1 Normal scan ( pin 40, LR = High ; pin 9, UD = Low )

Fig. 2 Reverse scan ( pin 40, LR = Low ; pin 9, UD = Low )

Fig. 3 Reverse scan ( pin 40, LR = High ; pin 9, UD = High )

Fig. 4 Reverse scan ( pin 40, LR = Low ; pin 9, UD = High )



## 5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-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. ( 0: Low Level Voltage, 1: High Level Voltage)

| Color               |                 | Data Signal |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|---------------------|-----------------|-------------|----|----|----|----|----|-------|----|----|----|----|----|------|----|----|----|----|----|
|                     |                 | Red         |    |    |    |    |    | Green |    |    |    |    |    | Blue |    |    |    |    |    |
|                     |                 | R5          | R4 | R3 | R2 | R1 | R0 | G5    | G4 | G3 | G2 | G1 | G0 | 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  |
|                     | Red             | 1           | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green           | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Blue            | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan            | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta         | 1           | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow          | 1           | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 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  |
| 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  |
|                     | Red(1)          | 0           | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(2)          | 0           | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :               | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :               | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Red(61)         | 1           | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(62)         | 1           | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(63)         | 1           | 1  | 1  | 1  | 1  | 1  | 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  |
|                     | Green(1)        | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(2)        | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :               | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :               | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Green(61)       | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(62)       | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(63)       | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 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  |
|                     | Blue(1)         | 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  | 1  | 0  |
|                     | :               | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :               | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Blue(61)        | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 0  | 1  |
|                     | Blue(62)        | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 0  |
|                     | Blue(63)        | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |



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

| 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  | 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  | 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  | 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  | 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  |
| 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  | 0  |
|                     | Green(1)       | 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(2)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 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  | 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  |
| 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  | 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  | 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  | 1  | 0  | 0  |
|                     | :              | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :              | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Blue(253)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 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  |

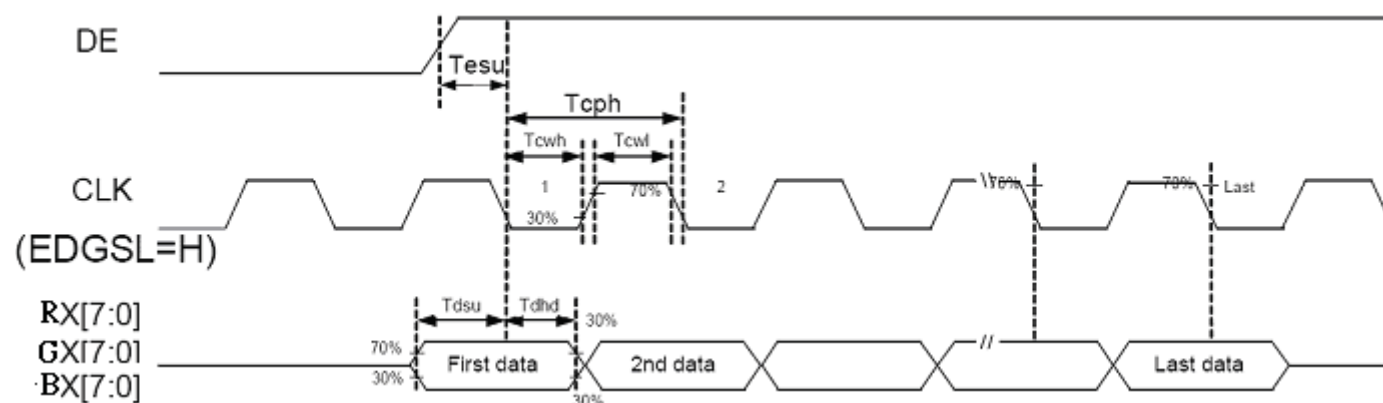
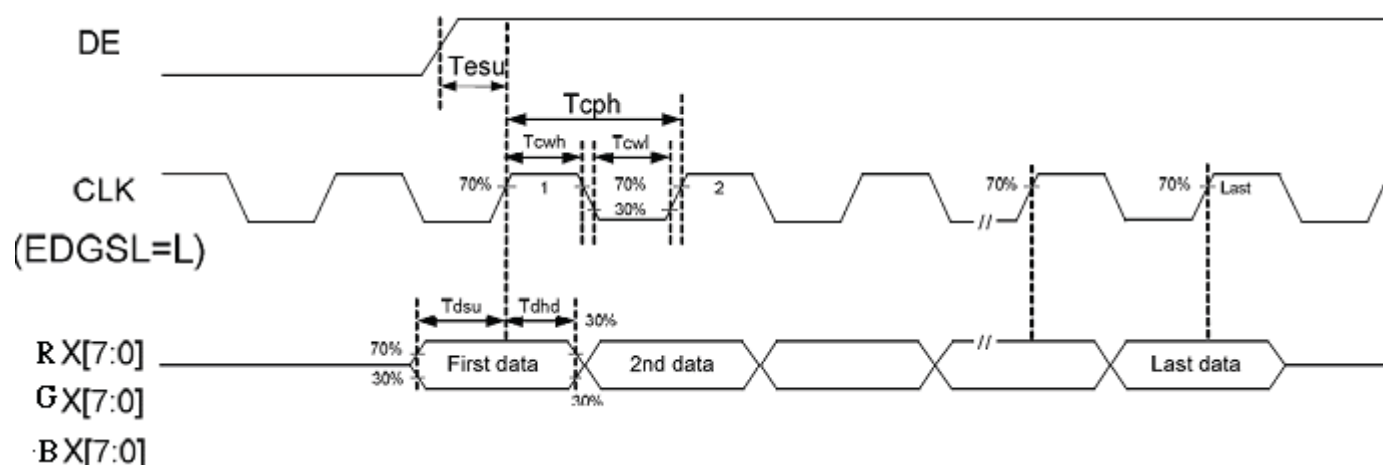
## 6. INTERFACE TIMING

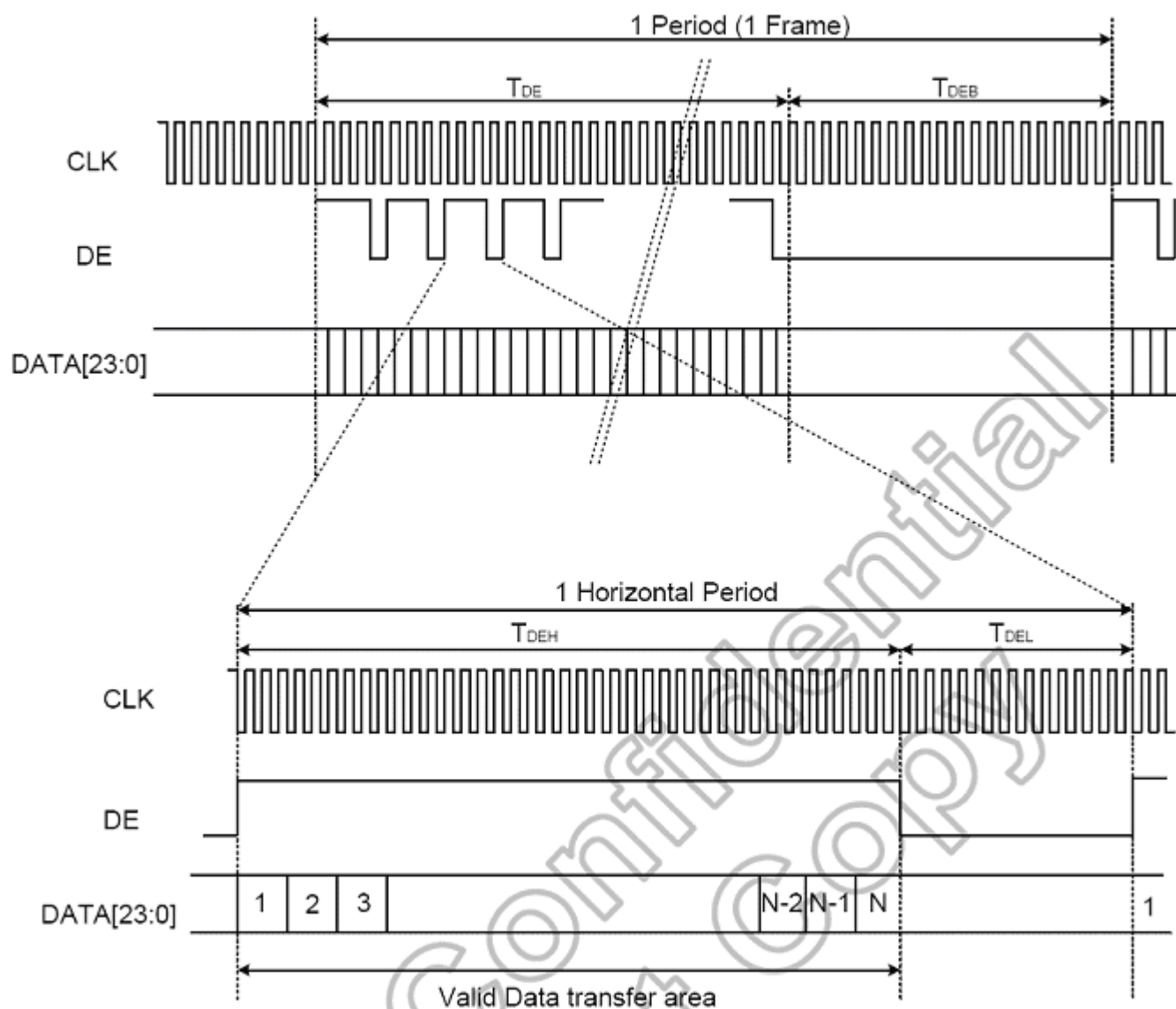
### 6.1 AC ELECTRICAL CHARACTERISTICS (VCC = V, AVDD = V, AVSS = GND = 0V, Ta = 25°C)

| Parameter         | Symbol            | Value  |         |         | Unit              | Condition |
|-------------------|-------------------|--------|---------|---------|-------------------|-----------|
|                   |                   | Min.   | Typ.    | Max.    |                   |           |
| Data setup time   | $T_{dsu}$         | (6)    |         |         | ns                |           |
| Data hold time    | $T_{dhd}$         | (6)    |         |         | ns                |           |
| DE setup time     | $T_{esu}$         | (6)    |         |         | ns                |           |
| CLK frequency     | $F_{CPH}$         | (29.4) | (33.26) | (42.48) | MHz               |           |
| CLK period        | $T_{CPH}$         |        | (30.06) |         | ns                |           |
| CLK pulse duty    | $T_{CWH}$         | (40)   | (50)    | (60)    | %                 |           |
| DE period         | $T_{DEH}+T_{DEL}$ | (1000) | (1056)  | (1200)  | $T_{CPH}$         |           |
| DE pulse width    | $T_{DEH}$         |        | (800)   |         | $T_{CPH}$         |           |
| DE frame blanking | $T_{DEB}$         | (10)   | (45)    | (110)   | $T_{DEH}+T_{DEL}$ |           |
| DE frame width    | $T_{DE}$          |        | (480)   |         | $T_{DEH}+T_{DEL}$ |           |

#### Timing Controller Timing Chart

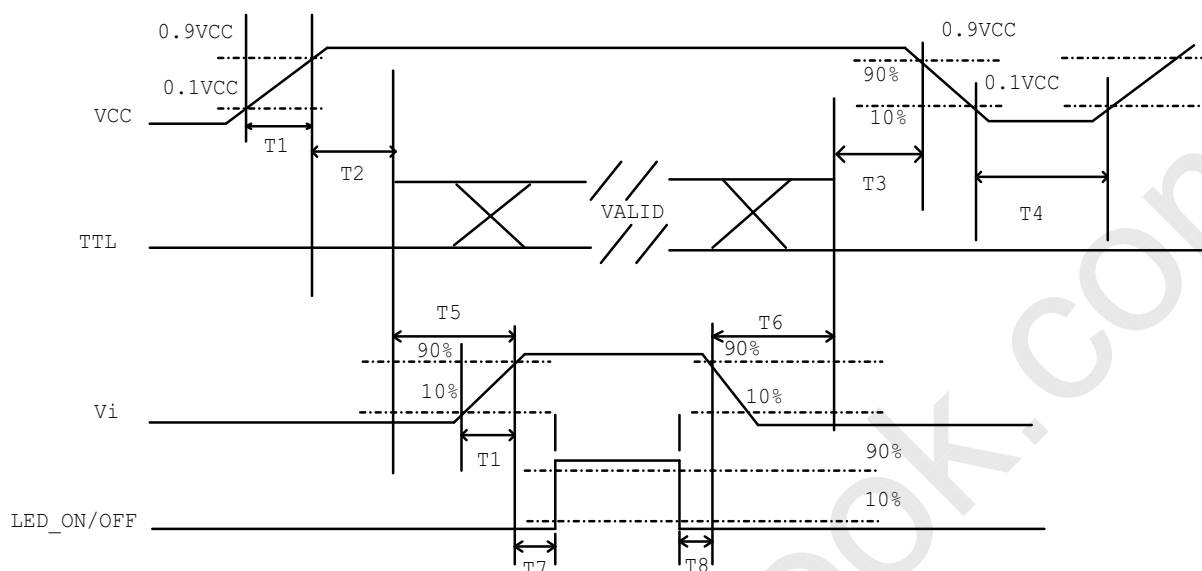
##### ■ Clock and Data input waveform



**■Data input format**

## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



### Power ON/OFF sequence

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.

| 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        | 200   | -   | -   | ms    |
| T7        | 10    | -   | -   | ms    |
| T8        | 10    | -   | -   | ms    |



## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item                | Symbol                                                        | Value | Unit |
|---------------------|---------------------------------------------------------------|-------|------|
| Ambient Temperature | Ta                                                            | 25±2  | °C   |
| Ambient Humidity    | Ha                                                            | 50±10 | %RH  |
| Supply Voltage      | V <sub>CC</sub>                                               | 3.3   | V    |
| Input Signal        | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |       |      |
| Current             | I <sub>f</sub>                                                | (80)  | mA   |
| Converter Duty      |                                                               | 100   | %    |

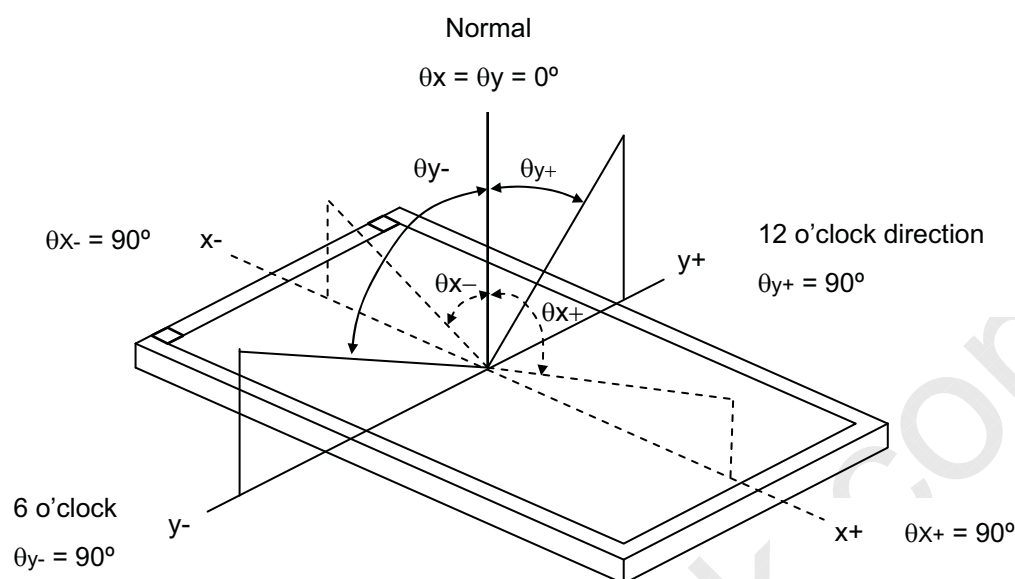
Note (1) I<sub>f</sub> means the forward current of each channel

### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

| Item                      |            | Symbol          | Condition                                                    | Min.       | Typ.    | Max.              | Unit     | Note     |
|---------------------------|------------|-----------------|--------------------------------------------------------------|------------|---------|-------------------|----------|----------|
| Color Chromaticity        | Red        | R <sub>x</sub>  | $\theta_x=0^\circ, \theta_y=0^\circ$<br>Viewing Normal Angle | Typ – 0.03 | (0.645) | Typ + 0.03        |          | (1), (6) |
|                           |            | R <sub>y</sub>  |                                                              |            | (0.341) |                   |          |          |
|                           | Green      | G <sub>x</sub>  |                                                              |            | (0.312) |                   |          |          |
|                           |            | G <sub>y</sub>  |                                                              |            | (0.625) |                   |          |          |
|                           | Blue       | B <sub>x</sub>  |                                                              |            | (0.153) |                   |          |          |
|                           |            | B <sub>y</sub>  |                                                              |            | (0.053) |                   |          |          |
|                           | White      | W <sub>x</sub>  |                                                              |            | (0.313) |                   |          |          |
|                           |            | W <sub>y</sub>  |                                                              |            | (0.329) |                   |          |          |
| Center Luminance of White |            | L <sub>C</sub>  | (400)                                                        | (500)      |         | cd/m <sup>2</sup> | (4), (6) |          |
| Contrast Ratio            |            | CR              | (500)                                                        | (600)      |         | -                 | (2), (6) |          |
| Response Time             |            | T <sub>R</sub>  |                                                              | (5)        | (10)    | Ms                | (3)      |          |
|                           |            | T <sub>F</sub>  |                                                              | (11)       | (16)    | Ms                |          |          |
| White Variation           |            | ΔW              |                                                              |            | (1.25)  | (1.4)             | -        | (5), (6) |
| Viewing Angle             | Horizontal | θ <sub>x+</sub> | CR ≥ 10                                                      | (60)       | (70)    |                   | Deg.     | (1), (6) |
|                           |            | θ <sub>x-</sub> |                                                              | (60)       | (70)    |                   |          |          |
|                           | Vertical   | θ <sub>y+</sub> |                                                              | (50)       | (60)    |                   |          |          |
|                           |            | θ <sub>y-</sub> |                                                              | (50)       | (60)    |                   |          |          |

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):



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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

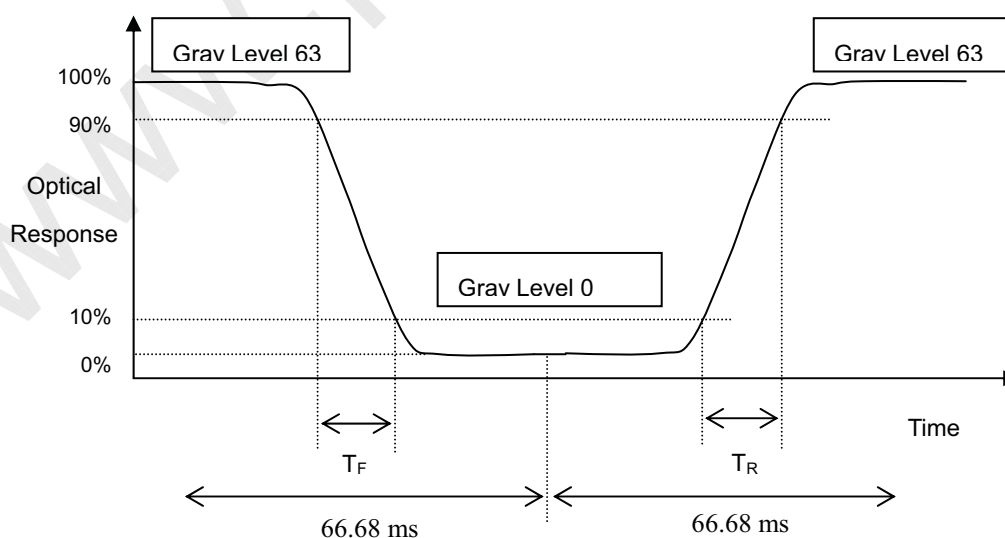
$L_{63}$ : Luminance of gray level 63

$L_0$ : Luminance of gray level 0

$$CR = CR(5)$$

$CR(X)$  is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

Note (3) Definition of Response Time ( $T_R$ ,  $T_F$ ) and measurement method:



Note (4) Definition of Luminance of White ( $L_C$ ):

Measure the luminance of gray level 63 at center point

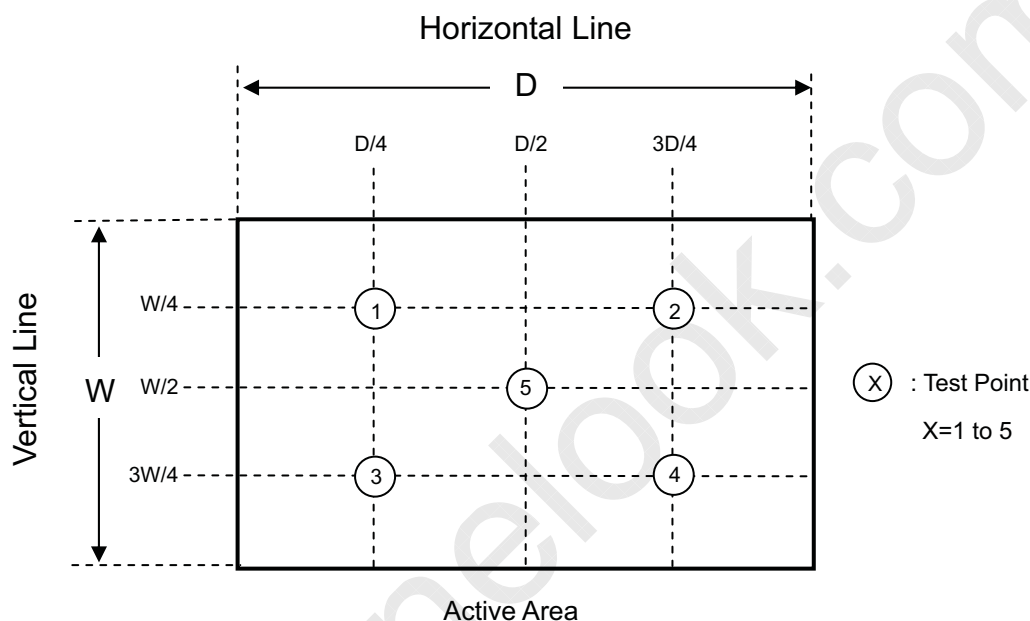
$$L_C = L(5)$$

$L(x)$  is corresponding to the luminance of the point X at Figure in Note (5).

Note (5) Definition of White Variation ( $\delta W$ ):

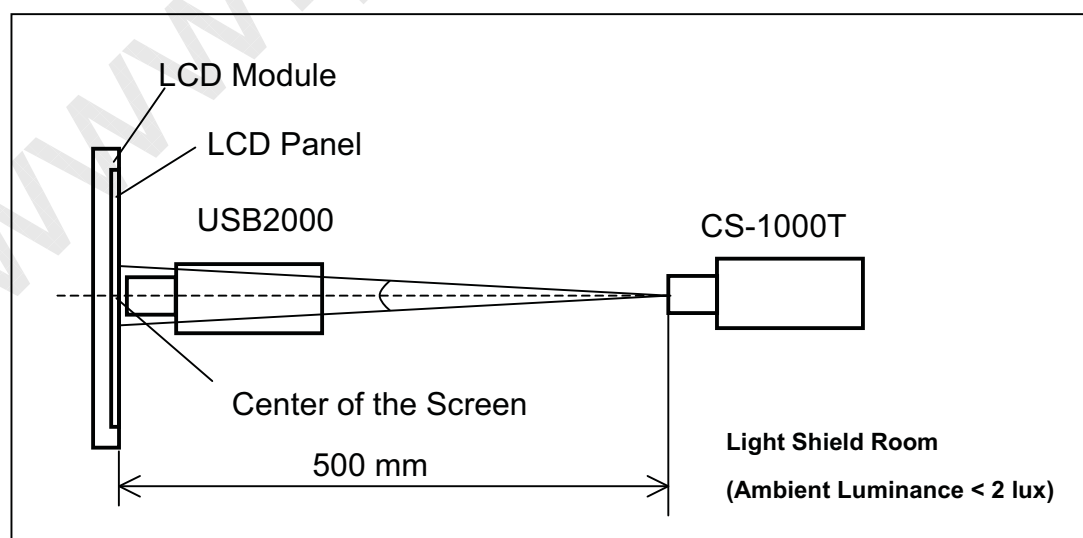
Measure the luminance of gray level 63 at 5 points

$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$$



Note (6) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.





## 8. Reliability Test

| No. | Test Item                                  | Test Condition                                   | Note    |
|-----|--------------------------------------------|--------------------------------------------------|---------|
| 1   | High Temperature Storage                   | 95℃, 240 hours                                   | (1) (2) |
| 2   | Low Temperature Storage                    | -40℃, 240 hours                                  |         |
| 3   | Thermal Shock Storage                      | {{(-40℃, 0.5 hour) (85℃, 0.5 hour)}}, 100 cycles |         |
| 4   | High Temperature Operating                 | 85℃, 240 hours                                   |         |
| 5   | Low Temperature Operating                  | -30℃, 240 hours                                  |         |
| 6   | High Temperature & High Humidity Operating | 60℃, 90% RH, 240hours                            |         |
| 7   | Shock (Non-Operating)                      | 100G, 6ms, +/-XYZ 3 times                        | (3)(5)  |
| 8   | Vibration (Non-Operating)                  | 3G, 10 to 200 Hz, sine wave                      | (4)(5)  |

Note (1) There should be no condensation on the surface of panel during test.

Note (2) The temperature of panel display surface area should be 95℃ Max.

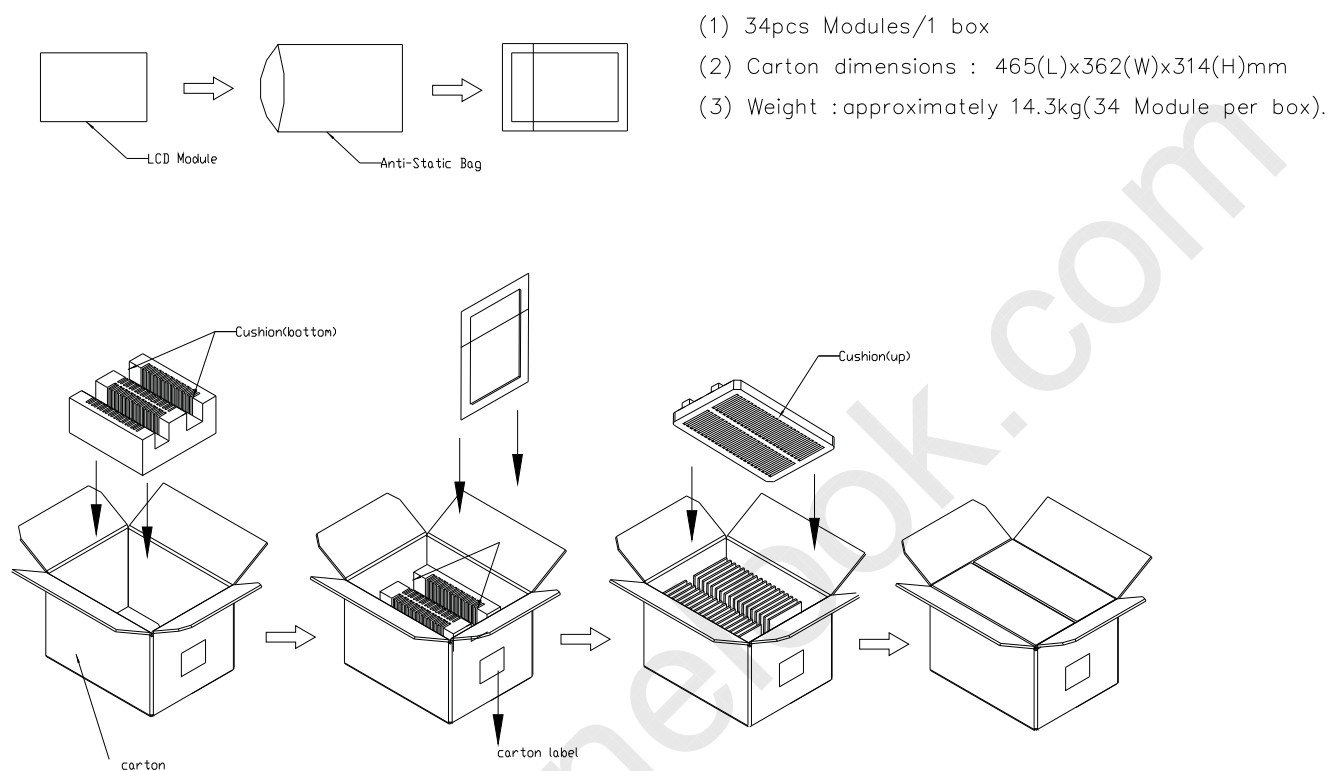
Note (3) 6ms, half sine wave, 3 times for +/-X, +/-Y, +/-Z.

Note (4) 3 directions: X, Y and Z axes, 60min per each direction; 6 cycles; sweep time = 5 minutes; peak acceleration = 3G; frequency = 10 to 200 Hz; sine wave.

Note (5) 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.

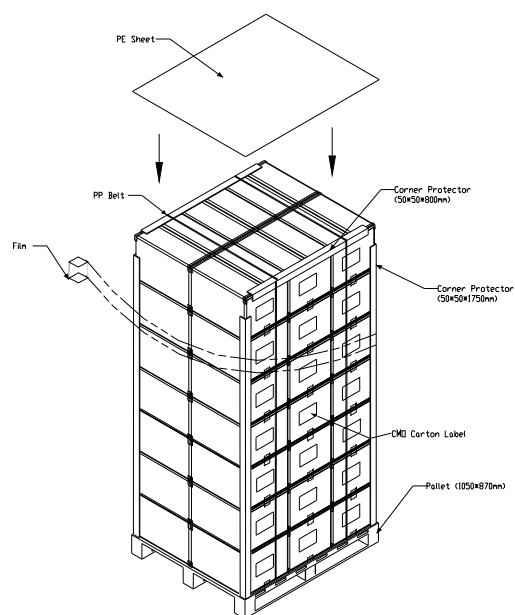
Note (6) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before the reliability test.

## 9. PACKAGING

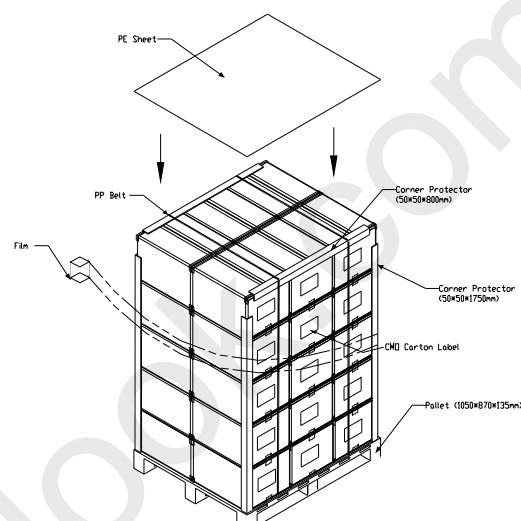




## Sea and Land Transportation



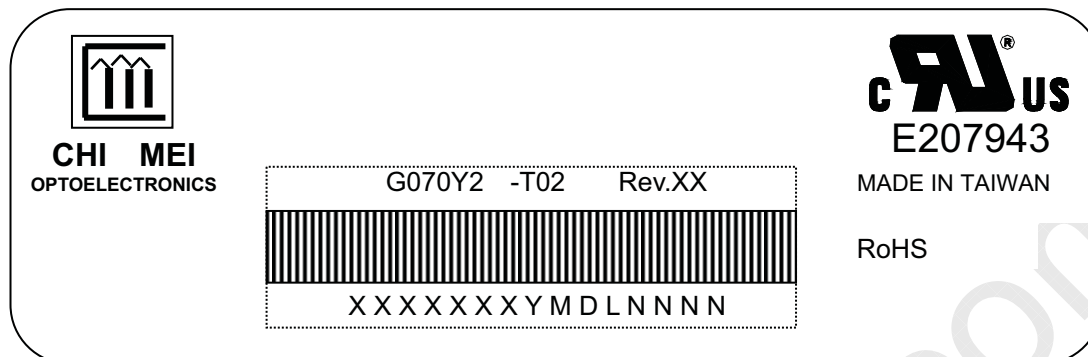
## Air Transportation



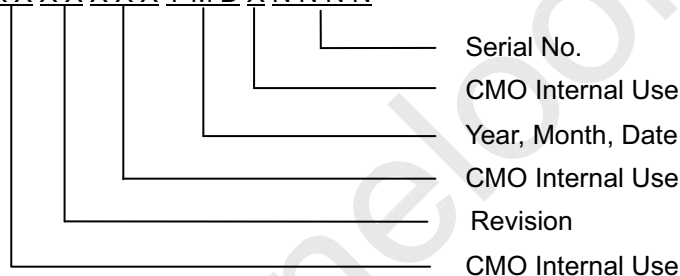
## 10. DEFINITION OF LABELS

### 10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: G070Y2 - T02
- (b) Revision: Rev. XX, for example: A1, ..., C1, C2 ...etc.
- (c) Serial ID: XXXXXXXXYMDXNNNN



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2001~2009  
 Month: 1~9, A~C, for Jan. ~ Dec.  
 Day: 1~9, A~Y, for 1<sup>st</sup> to 31<sup>st</sup>, exclude I, O and U
- (b) Revision Code: cover all the change  
 Serial No.: Manufacturing sequence of product

## 11. PRECAUTIONS

### 11.1 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, and the starting voltage of CCFL will be higher than room temperature.
- (11) Do not keep same pattern in a long period of time. It may cause image sticking on LCD

### 11.2 SAFETY PRECAUTIONS

- (1) Do not disassemble the module or insert anything into the Backlight unit to prevent electrical shock.
- (2) 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.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

