□ Tentative Specification
□ Preliminary Specification
■ Approval Specification

# MODEL NO.: V580DJ4

# SUFFIX: QE1

Revision : D2
Customer:

APPROVED BY SIGNATURE

Name / Title
Note

Please return 1 copy for your confirmation with your signature and

| Approved By | Checked By | Prepared By |
|---|---|---|
| Roger Huang | Vita Wu | Ching-Hung Lin |

**CONTENTS**

## REVISION HISTORY

| Version | Date | Page (New) | Section | Description |
|---|---|---|---|---|
| Ver. 2.0 | 1/16, 2018 | All | All | The Approval specification was firstly issued. |

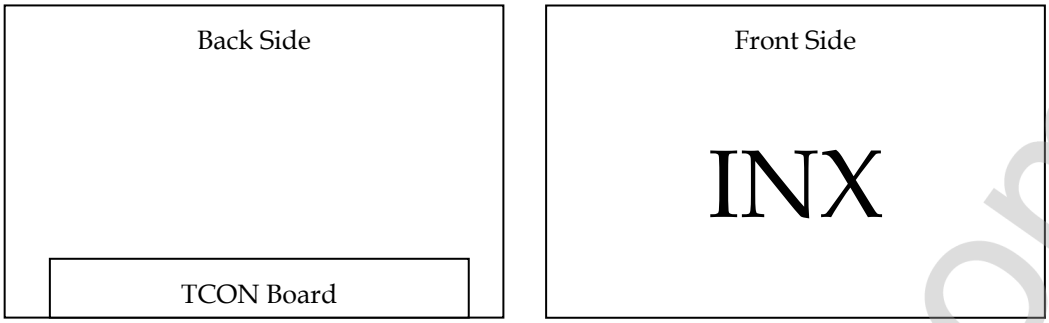
# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

V580DJ4-QE1 is a 58" TFT Liquid Crystal Display product with driver ICs and USIT interface. This product supports 3840 x 2160 QFHD TV format and can display true 16.7M colors (8-bit). The backlight unit is not built in.

## 1.2 FEATURES

| CHARACTERISTICS ITEMS | SPECIFICATIONS |
|---|---|
| Pixels [lines] | 3840 × 2160 |
| Active Area [mm] | 1270.08(H) x 721.44(V) |
| Pixel Pitch [mm] | 0.33075(H) x 0.334(V) |
| Pixel Arrangement | RGB vertical stripe |
| Weight [g] | 2790 g |
| Physical Size [mm] | 1282.88 (W) x 734.44 (H) x 1.324 (D) Typ |
| Display Mode | Transmissive mode / Normally black |
| Contrast Ratio | 5000:1 Typ.<br>(Typical value measured at INX's module) |
| Glass thickness (Array / CF) [mm] | 0.5 / 0.5 |
| Viewing Angle (CR>10)<br>(VA Model) | +89/-89(H),+89/-89(V) Typ.<br>(Typical value measured by INX's module) |
| Color Chromaticity | R=0.659, 0.325)<br>G=(0.274, 0.591)<br>B=(0.138, 0.100)<br>W=(0.301, 0.340)<br>* Please refer to "color chromaticity" in 6.2 |
| Cell Transparency [%] | 5.1% Typ. Please refer to "Transmittance" in 6.2 |
| Polarizer Surface Treatment | AG (Haze~1%), Hardness: 3H |
| Polarizer protection film peeling force | ≦0.2N/25mm<br>[1] Instrument : Tensile tester<br>[2] Measuring method :<br>Sample size : 25mm*15cm<br>Using tensile tester with constant velocity (0.3M/min) to measure peel strength. |
| Rotation Function | Unachievable |
| Display Orientation | Signal input with "INX" |
| Life Time (Black Fog Mura) | Cell lifetime 30,000Hrs is verified by Von margin test and meets the criteria as 5,000Hrs |
| RoHs Compliance | |

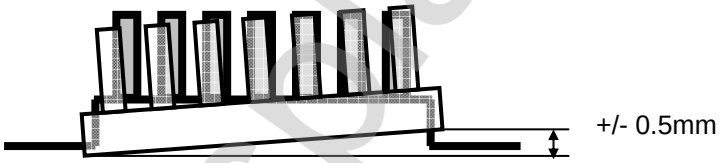



## 1.3 MECHANICAL SPECIFICATIONS

| Item | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Weight | 2650 | 2790 | 2930 | g | - |
| I/F connector mounting position | The mounting inclination of the connector makes the screen center within ± 0.5mm as the horizontal. | | | | (2) |

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

Note (2) Connector mounting position



## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Storage Temperature | $T_{ST}$ | -20 | +60 | ºC | (1), (3) |
| Operating Ambient Temperature | $T_{OP}$ | 0 | 50 | ºC | (1), (2), (3) |

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

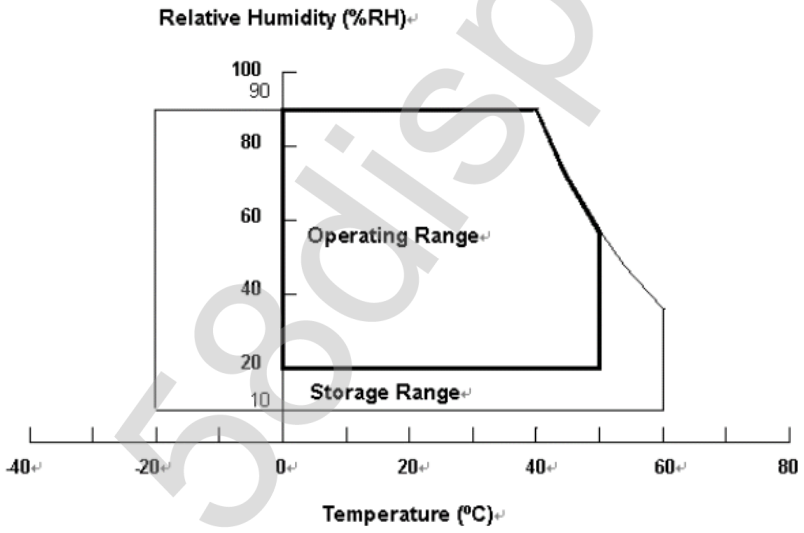
(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max.

(c) No condensation.

Note (2) Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 ºC. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) The rating of environment is base on LCD module. Leave LCD cell alone, this environment condition can't be guaranteed. Except LCD cell, the customer has to consider the ability of other parts of LCD module and LCD module process.



## 2.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)

When storing open cell units, following procedures are necessary.

(1) Temperature : 5~40 ℃

(2) Humidity : 35~75%RH

(3) Period : 6 months

(4) Control of ventilation and temperature is necessary.

(5) Please make sure to protect the product from strong light exposure, water or moisture. Be careful for condensation.

(6) If products delivered or kept in conditions of the recommended temperature or humidity, we recommend you leave them at a circumstance which is shown as below.

| Period | 1 month | 2 months | 3 months | 4 months | 5 months | 6 months |
|---|---|---|---|---|---|---|
| Baking condition | No baking | | 50℃, 10%, 24 hrs | 50℃, 10%, 48 hrs | | |

## 2.3 ELECTRICAL ABSOLUTE RATINGS

### 2.3.1 TFT OPEN CELL

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Voltage for gate driver | VGH | -0.3 | 40 | V | |
| Voltage for gate driver | VGL | -20 | 0.3 | V | |
| Voltage range for gate driver | VGH-VGL | -0.3 | 42 | V | |
| Voltage for data diver | VDDA | -0.3 | 20.4 | V | |
| Voltage for data diver | VDDA-VDDAML(R) | -0.3 | 11.3 | V | |
| Voltage for data diver | VDDAML(R) | GM10-0.2 | GM9+0.2 | V | |
| Logic input Voltage for data driver | VDD1V8 | -0.3 | 2.2 | V | |
| Logic input Voltage for data driver | VDD1V9 | -0.3 | 2.2 | V | |
| Logic input Voltage for gate driver | VDD | -0.3 | 5 | V | |
| Voltage for data diver | Input signals | -0.3 | VDD1V8+0.3 | V | (1) |

Note (1) USIT_DATA0P/N, USIT_DATA1P/N,SFC

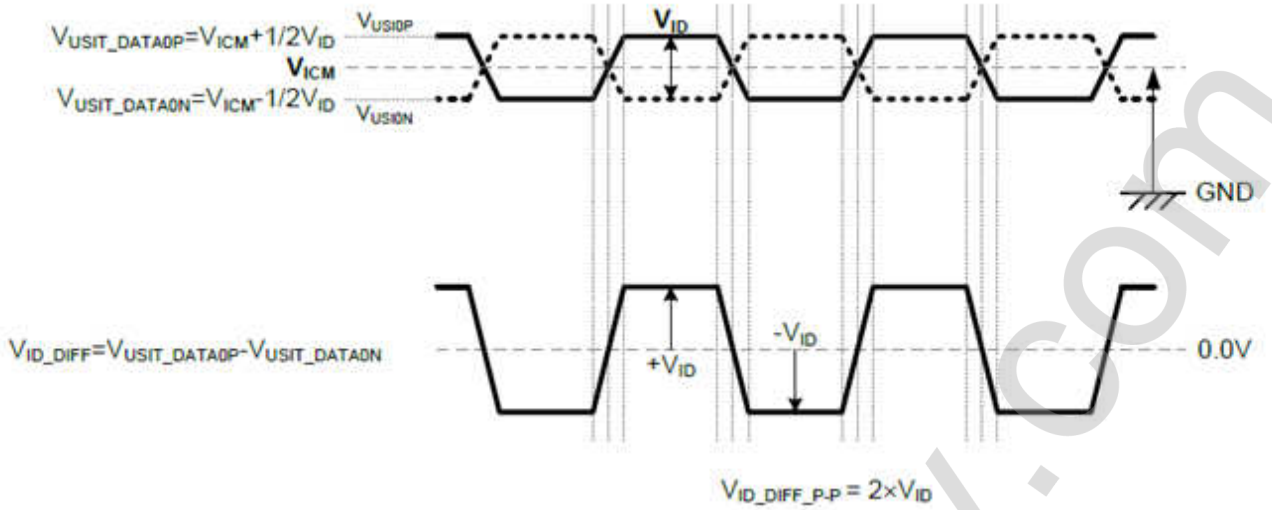
## 3. ELECTRICAL CHARACTERISTICS

### 3.1 TFT OPEN Cell

(Ta = 25 ± 2 ºC)

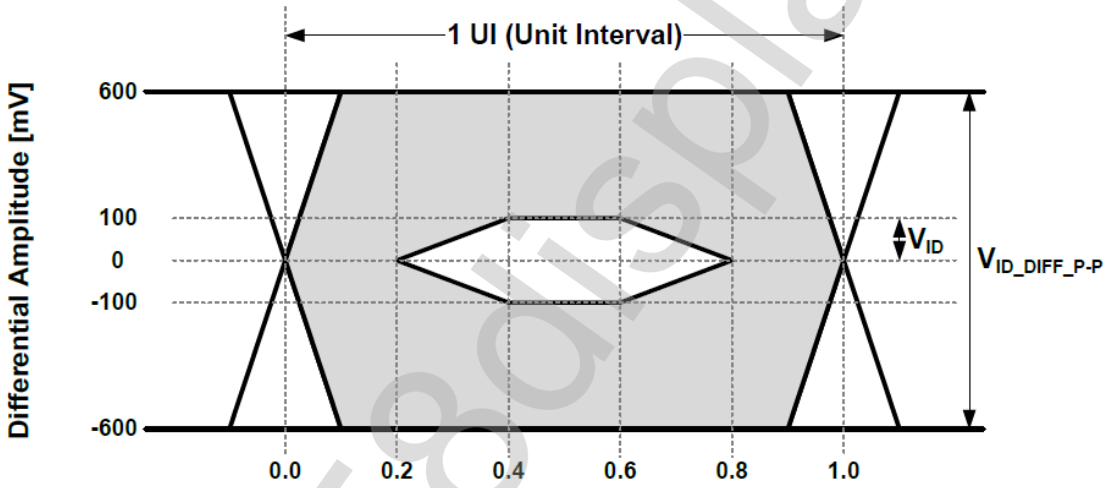
| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Voltage for gate driver | | VGH | 28.9 | 29.1 | 29.3 | V | |
| Voltage for gate driver | | VGL | -9.3 | -9.1 | -8.9 | V | |
| Voltage range for gate driver | | VGH -VGL | 12 | - | 40 | V | |
| Logic input Voltage for gate driver | | VDD | 3.25 | 3.3 | 3.35 | V | |
| Voltage for data diver | | VDDA | 17.6 | 17.7 | 17.8 | V | |
| Voltage for data diver | | VDDAML(R) | 7.526 | 8.369 | 9.362 | V | |
| Voltage for data diver | | GM1 | 16.417 | 16.423 | 16.429 | V | |
| Voltage for data diver | | GM9 | 9.225 | 9.231 | 9.237 | V | |
| Voltage for data diver | | GM10 | 7.784 | 7.79 | 7.796 | V | |
| Voltage for data diver | | GM18 | 0.464 | 0.46 | 0.466 | V | |
| Logic input Voltage for data driver | | VDD1V8 | 1.83 | 1.85 | 1.87 | V | |
| Logic input Voltage for data driver | | VDD1V9 | 1.83 | 1.85 | 1.87 | V | |
| USIT Interface | Input offset voltage | $V_{ICM}$ | 0.3 | 0.45 | 0.6 | V | (1) |
| | Differential input data voltage | $V_{ID}$ | 100 | - | 600 | mV | |
| | Differential input data peak to peak voltage | $V_{ID\_DIFF\_P-P}$ | 200 | - | 1200 | mV | (2) |
| | USI-T data frequency | $f_{USIDATA}$ | 330 | - | 900 | MHZ | |
| | | | 0.66 | - | 1.8 | Gbps | |
| | USI-T clock period | $t_{USICLK}$ | 5.56 | - | 15.15 | ns | |
| | USI-T SSCG | MR | -1.5 | - | +1.5 | % | |
| | | MF | 27 | - | 33 | kHz | |

Note (1) Single-Ended

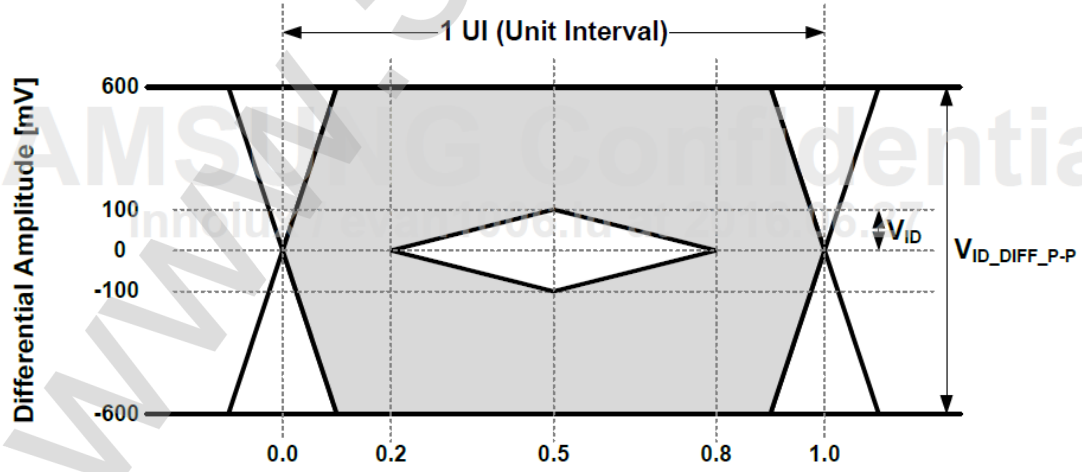



Note (2) USI-T Eye diagram

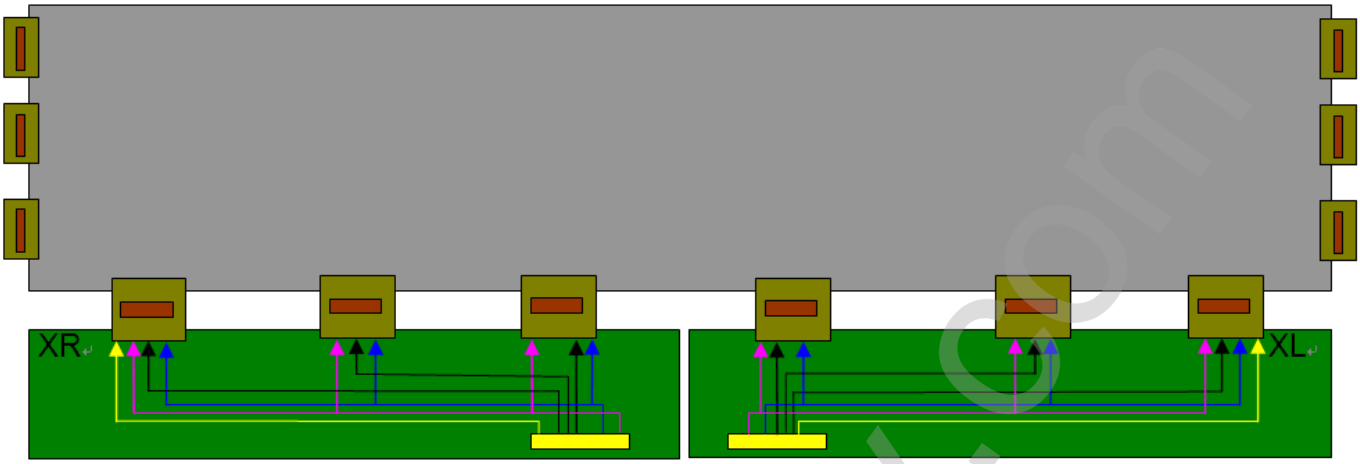
(a) Eye diagram without Driver ICs




(b) Eye diagram with Driver ICs



### 3.2 CIRCUIT AND WIRING DIAGRAM




USI-T signal

Control signals of data drivers.

Voltages of data drivers.

Control signals and voltages of scan drivers.

## 4. INPUT TERMINAL PIN ASSIGNMENT

### 4.1 TFT LCD CELL INPUT

CNX01_1 Connector Pin Assignment (05002HR-H96VE)

| Pin | Name | Description | Note |
|---|---|---|---|
| 1 | FB_12 | TCON_READY | |
| 2 | NC | No Connection | |
| 3 | VDDA | VAA voltage | |
| 4 | VDDA | VAA voltage | |
| 5 | VDDA | VAA voltage | |
| 6 | VDDA | VAA voltage | |
| 7 | GM1 | Gamma voltage | |
| 8 | GM9 | Gamma voltage | |
| 9 | VDDAML | Half VAA Voltage | |
| 10 | GM10 | Gamma voltage | |
| 11 | GM18 | Gamma voltage | |
| 12 | VDD1V8 | Logic power | |
| 13 | VDD1V9 | Logic power | |
| 14 | NC | No Connection | |
| 15 | SRF_C | Source Driver Ready Feedback | |
| 16 | GND | Ground | |
| 17 | SFC1 | Shared Forward Channel Control | |
| 18 | GND | Ground | |
| 19 | US6O_N | USIT data signal - | |
| 20 | US6O_P | USIT data signal + | |
| 21 | GND | Ground | |
| 22 | NC | No Connection | |
| 23 | NC | No Connection | |
| 24 | GND | Ground | |
| 25 | US5O_N | USIT data signal - | |
| 26 | US5O_P | USIT data signal + | |
| 27 | GND | Ground | |
| 28 | NC | No Connection | |
| 29 | NC | No Connection | |
| 30 | GND | Ground | |
| 31 | US4O_N | USIT data signal - | |
| 32 | US4O_P | USIT data signal + | |
| 33 | GND | Ground | |

| | | | |
|---|---|---|---|
| 34 | NC | No Connection | |
| 35 | NC | No Connection | |
| 36 | GND | Ground | |
| 37 | US3O_N | USIT data signal - | |
| 38 | US3O_P | USIT data signal + | |
| 39 | GND | Ground | |
| 40 | NC | No Connection | |
| 41 | NC | No Connection | |
| 42 | GND | Ground | |
| 43 | US2O_N | USIT data signal - | |
| 44 | US2O_P | USIT data signal + | |
| 45 | GND | Ground | |
| 46 | NC | No Connection | |
| 47 | NC | No Connection | |
| 48 | GND | Ground | |
| 49 | US1O_N | USIT data signal - | |
| 50 | US1O_P | USIT data signal + | |
| 51 | GND | Ground | |
| 52 | NC | No Connection | |
| 53 | NC | No Connection | |
| 54 | GND | Ground | |
| 55 | NC | No Connection | |
| 56 | NC | No Connection | |
| 57 | GND | Ground | |
| 58 | NC | No Connection | |
| 59 | NC | No Connection | |
| 60 | GND | Ground | |
| 61 | NC | No Connection | |
| 62 | NC | No Connection | |
| 63 | GND | Ground | |
| 64 | NC | No Connection | |
| 65 | NC | No Connection | |
| 66 | GND | Ground | |
| 67 | SFC2 | Shared Forward Channel Control | |
| 68 | GND | Ground | |
| 69 | SPIF_MSI | Demura Flash IC DI(IO0) | |
| 70 | SO | Demura Flash IC DO(IO1) | |

| | | | |
|---|---|---|---|
| 71 | WP | Demura Flash IC /WP(IO2) | |
| 72 | HOLD | Demura Flash /HOLD(IO3) | |
| 73 | CLK | Demura Flash IC CLK | |
| 74 | SPIF_MCSN | Demura Flash IC /CS | |
| 75 | GND | Ground | |
| 76 | NC | No Connection | |
| 77 | NC | No Connection | |
| 78 | C_STV2 | Scan driver start pulse | |
| 79 | C_STV | Scan driver start pulse | |
| 80 | CKV | Scan driver clock | |
| 81 | OE1 | Scan driver output enable | |
| 82 | OE2 | Scan driver output enable | |
| 83 | NC | No Connection | |
| 84 | NC | No Connection | |
| 85 | VGH | Scan driver voltage | |
| 86 | NC | No Connection | |
| 87 | VGL | Scan driver voltage | |
| 88 | NC | No Connection | |
| 89 | NC | No Connection | |
| 90 | VCM_TFT | VCOM voltage | |
| 91 | VCM_CF_C | VCOM voltage | |
| 92 | VDDAML | Half VAA Voltage | |
| 93 | VDD | Logic power | |
| 94 | VDD | Logic power | |
| 95 | GND | Ground | |
| 96 | FB_12 | TCON_READY | |

CNX01_1 Connector Pin Assignment (05002HR-H96VE)

| Pin | Name | Description | Note |
|---|---|---|---|
| 1 | FB_23 | TCON_READY | |
| 2 | GND | Ground | |
| 3 | VDD | Logic power | |
| 4 | VDD | Logic power | |
| 5 | NC | No Connection | |
| 6 | VCM_CF_C | VCOM voltage | |
| 7 | VCM_TFT | VCOM voltage | |
| 8 | NC | No Connection | |

| | | | |
|---|---|---|---|
| 9 | NC | No Connection | |
| 10 | NC | No Connection | |
| 11 | NC | No Connection | |
| 12 | VGL | Scan driver voltage | |
| 13 | NC | No Connection | |
| 14 | VGH | Scan driver voltage | |
| 15 | NC | No Connection | |
| 16 | NC | No Connection | |
| 17 | OE2 | Scan driver output enable | |
| 18 | OE1 | Scan driver output enable | |
| 19 | CKV | Scan driver clock | |
| 20 | C_STV | Scan driver start pulse | |
| 21 | C_STV2 | Scan driver start pulse | |
| 22 | NC | No Connection | |
| 23 | NC | No Connection | |
| 24 | NC | No Connection | |
| 25 | GND | Ground | |
| 26 | SFC2 | Shared Forward Channel Control | |
| 27 | GND | Ground | |
| 28 | NC | No Connection | |
| 29 | NC | No Connection | |
| 30 | GND | Ground | |
| 31 | NC | No Connection | |
| 32 | NC | No Connection | |
| 33 | GND | Ground | |
| 34 | NC | No Connection | |
| 35 | NC | No Connection | |
| 36 | GND | Ground | |
| 37 | NC | No Connection | |
| 38 | NC | No Connection | |
| 39 | GND | Ground | |
| 40 | US12O_N | USIT data signal - | |
| 41 | US12O_P | USIT data signal + | |
| 42 | GND | Ground | |
| 43 | NC | No Connection | |
| 44 | NC | No Connection | |
| 45 | GND | Ground | |

| | | | |
|---|---|---|---|
| 46 | US11O_N | USIT data signal - | |
| 47 | US11O_P | USIT data signal + | |
| 48 | GND | Ground | |
| 49 | NC | No Connection | |
| 50 | NC | No Connection | |
| 51 | GND | Ground | |
| 52 | US10O_N | USIT data signal - | |
| 53 | US10O_P | USIT data signal + | |
| 54 | GND | Ground | |
| 55 | NC | No Connection | |
| 56 | NC | No Connection | |
| 57 | GND | Ground | |
| 58 | US9O_N | USIT data signal - | |
| 59 | US9O_P | USIT data signal + | |
| 60 | GND | Ground | |
| 61 | NC | No Connection | |
| 62 | NC | No Connection | |
| 63 | GND | Ground | |
| 64 | US8O_N | USIT data signal - | |
| 65 | US8O_P | USIT data signal + | |
| 66 | GND | Ground | |
| 67 | NC | No Connection | |
| 68 | NC | No Connection | |
| 69 | GND | Ground | |
| 70 | US7O_N | USIT data signal - | |
| 71 | US7O_P | USIT data signal + | |
| 72 | GND | Ground | |
| 73 | NC | No Connection | |
| 74 | NC | No Connection | |
| 75 | GND | Ground | |
| 76 | SFC1 | Shared Forward Channel Control | |
| 77 | GND | Ground | |
| 78 | NC | No Connection | |
| 79 | NC | No Connection | |
| 80 | NC | No Connection | |
| 81 | GND | Ground | |
| 82 | NC | No Connection | |

| | | | |
|---|---|---|---|
| 83 | SRF_C | Source Driver Ready Feedback | |
| 84 | VDD1V9 | Logic power | |
| 85 | VDD1V8 | Logic power | |
| 86 | GM18 | Gamma voltage | |
| 87 | GM10 | Gamma voltage | |
| 88 | VDDAMR | Half VAA voltage | |
| 89 | GM9 | Gamma voltage | |
| 90 | GM1 | Gamma voltage | |
| 91 | VDDA | VAA voltage | |
| 92 | VDDA | VAA voltage | |
| 93 | VDDA | VAA voltage | |
| 94 | VDDA | VAA voltage | |
| 95 | NC | No Connection | |
| 96 | FB_23 | TCON_READY | |

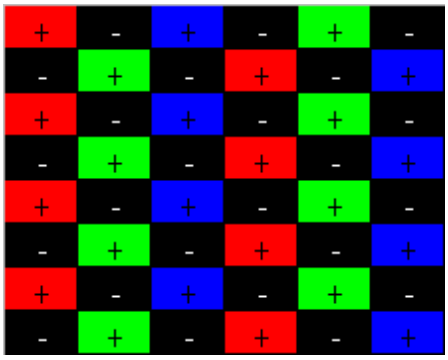
Note (1) The screw hole which is distant from the connector is merged with Ground

## 4.2 FLICKER (Vcom) ADJUSTMENT

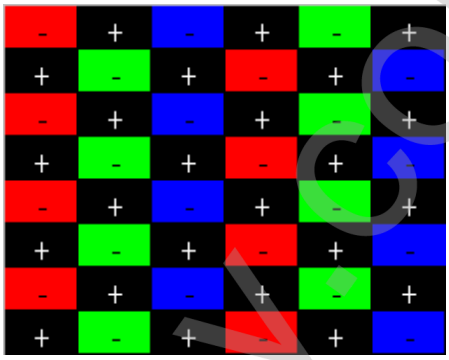
(1) Adjustment Pattern :

Column-inversion pattern was shown as below. If customer need below pattern, please directly contact with Account FAE.

Frame N



Frame N+1



(2) Adjustment method: (Digital V-com)

Programmable memory IC is used for Digital V-com adjustment in this model. INX provide Auto Vcom tools to adjust Digital V-com.The detail connection and setting instruction, please directly contact with Account FAE or refer INX Auto V-com adjustment OI. Below items is suggested to be ready before Digital V-com adjustment in customer LCM line.

a. USB Sensor Board.

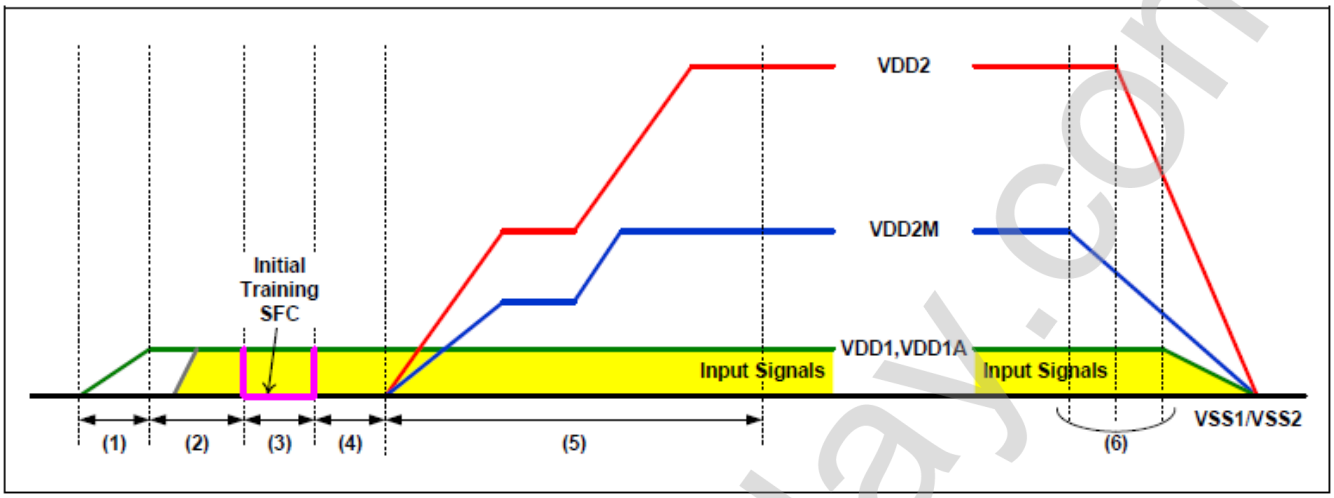
b. Programmable software

## 5. INTERFACE TIMING

### 5.1 DATA DRIVER POWER ON/OFF SEQUENCE

(Ta = 25 ± 2 ºC)

To prevent the device from damage due to latch up, the power on/off sequence show below must be followed.




Note (1) VDD1 & VDD1A settling time (max. 5ms). All input signals set to GND level.

Note (2) VDD1 and VDD1A should be settled down before the falling edge of SFC input in this period.
There is no time limit in this period.

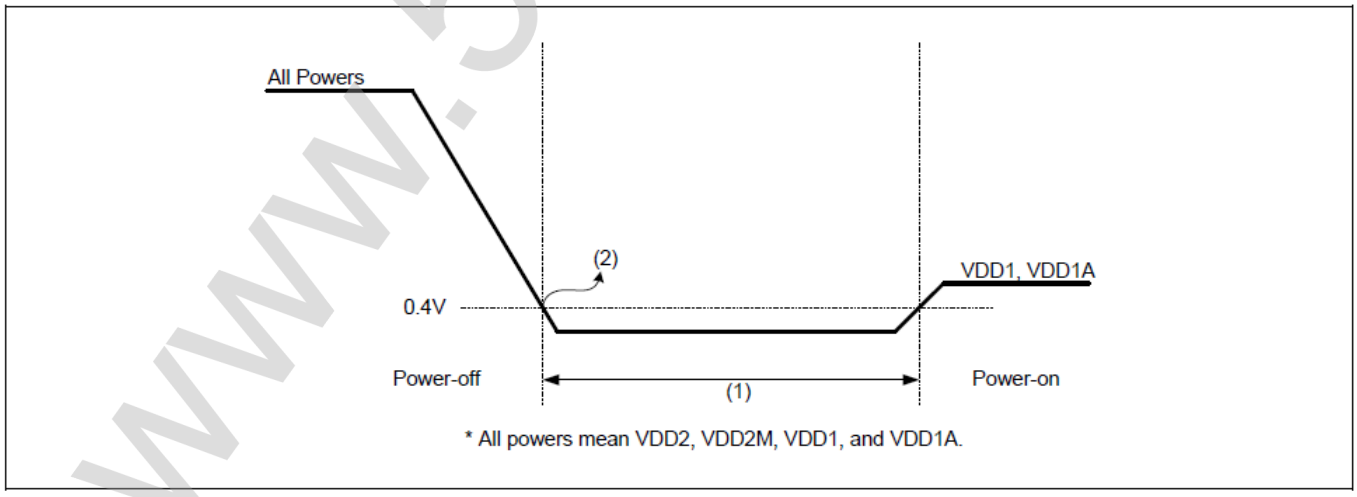
Note (3) USI-T initialization period (min. 4500T to max. 40ms). Input signals must be stable.

Note (4) Delay time from the end of USI-T initialization period to the start of VDD2 (min. 8ms).
Rx logic is initialized in this period.

Note (5) VDD2 & VDD2M settling time (max. 0.5s)

Note (6) Power-off sequence begins at these points.
Power-off points of VDD1 and VDD1A are defined as minimum voltage of the recommended operation conditions.

#### 5.1.1 Interval between Power-Off and Power-On Sequence




Note (1) Min, 0.8s.

Note (2) At this point, all powers must be less than or equal to 0.4V.

## 5.2 GATE DRIVER AC CHARACTERISTICS

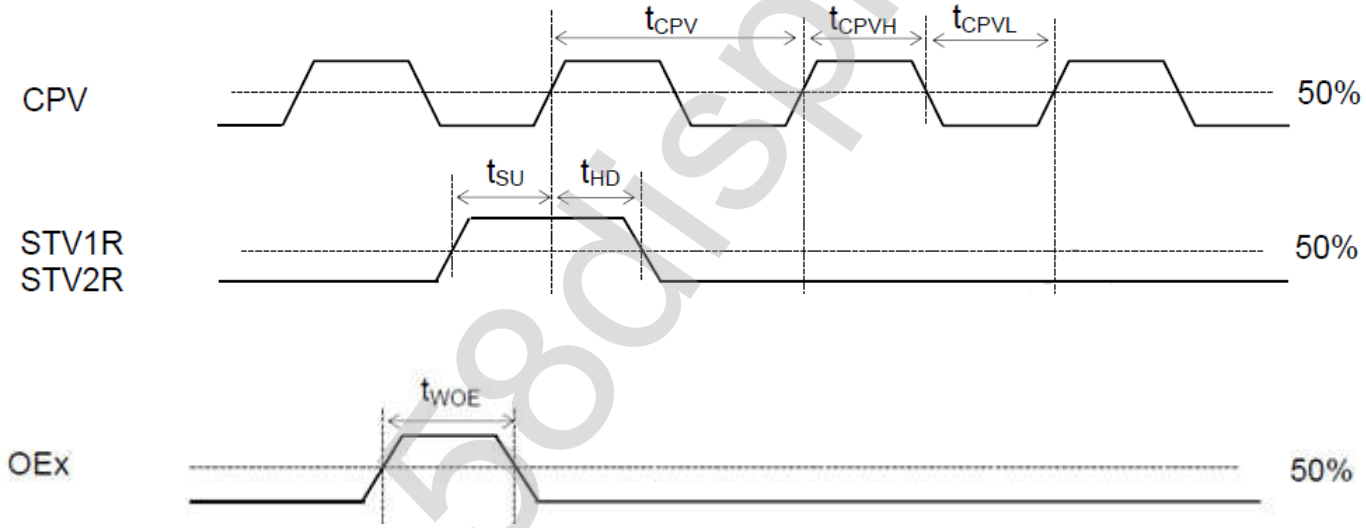
| Parameter | Symbol | Condition | Spec. | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| CPV period | $t_{CPV}$ | -- | 5 | - | - | us |
| CPV pulse width | $t_{CPVH}$,$t_{CPVL}$ | 50% duty cycle | 2.5 | - | - | |
| OE1 & OE2 pulse width | $t_{WOE}$ | - | 0.5 | - | - | |
| Data setup time | $t_{SU}$ | - | 0.5 | - | - | |
| Data hold time | $t_{HD}$ | - | 0.5 | - | - | |

Note (1) $T_A$= 40 ° C to +85 ° C,VGH-VGL=12V to 40V,VDD=2.3V to 3.6V

Note (2) For pre-scan mode.

Note (3) Start pulse falling edge should not fall between OE rising edge and CPV rising edge

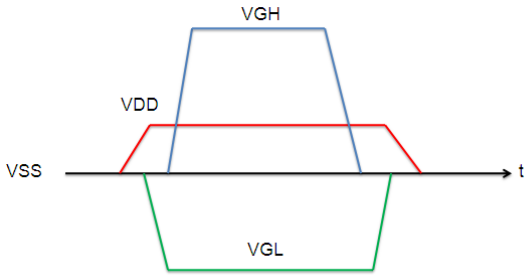
### 5.2.1 Waveform




### 5.2.2 Gate Driver Power On/Off Sequence

When power on : VDD → VGL → VGH

When power off : VGH → VGL → VDD

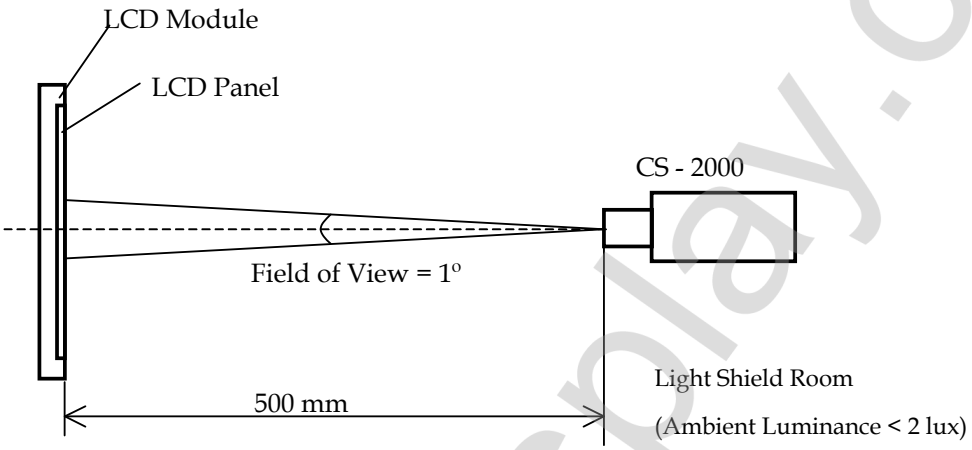


## 6. OPTICAL CHARACTERISTICS

### 6.1 TEST CONDITIONS

| Item | Symbol | Value | Unit |
|---|---|---|---|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | $V_{CC}$ | 12V±1.2 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring in a windless room.



## 6.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown as below. The following items should be measured under the test conditions described in 6.1 and stable environment shown in 6.1.

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color Chromaticity | Red | Rcx | $\theta_x$=0°, $\theta_Y$ =0° Viewing Angle at Normal Direction Standard light source "C" | Typ. -0.03 | 0.659 | Typ. +0.03 | - | (0) |
| | | Rcy | | | 0.325 | | - | |
| | Green | Gcx | | | 0.274 | | - | |
| | | Gcy | | | 0.591 | | - | |
| | Blue | Bcx | | | 0.138 | | - | |
| | | Bcy | | | 0.100 | | - | |
| | White | Wcx | | | 0.301 | | - | |
| | | Wcy | | | 0.340 | | - | |
| Color Gamut | | CG | | | 72 | | % | |
| Transmittance | | T% | $\theta_x$=0°, $\theta_Y$ =0° with INX module | 4.6 | 5.1 | | % | (5) |
| Transmittance Variation | | δT | | | | 1.3 | | (6) |
| Contrast Ratio | | CR | | 3500 | 5000 | - | - | (1),(3) |
| Response Time | | Gray to gray | $\theta_x$=0°, $\theta_Y$ =0° with INX Module | - | 9.5 | 19 | ms | (1),(4) |
| Gamma | | | 50~128 gray level | 1.9 | 2.2 | 2.5 | | (1)(7) |
| ACC Linearity | | ACC | | -0.030 | | +0.030 | | (1)(8) |
| Viewing Angle | Horizontal | $\theta_x$+ | CR≥10 With INX module | 80 | 89 | - | Deg. | (1),(2) |
| | | $\theta_x$- | | 80 | 89 | - | | |
| | Vertical | $\theta_Y$+ | | 80 | 89 | - | | |
| | | $\theta_Y$- | | 80 | 89 | - | | |
| Transmission direction of the up polarizer | | $\Phi_{up-P}$ | - | - | 90 | - | Deg. | (9) |

Note (0) Light source is the standard light source "C" which is defined by CIE and driving voltage are based on suitable gamma voltages. The calculating method is as following:

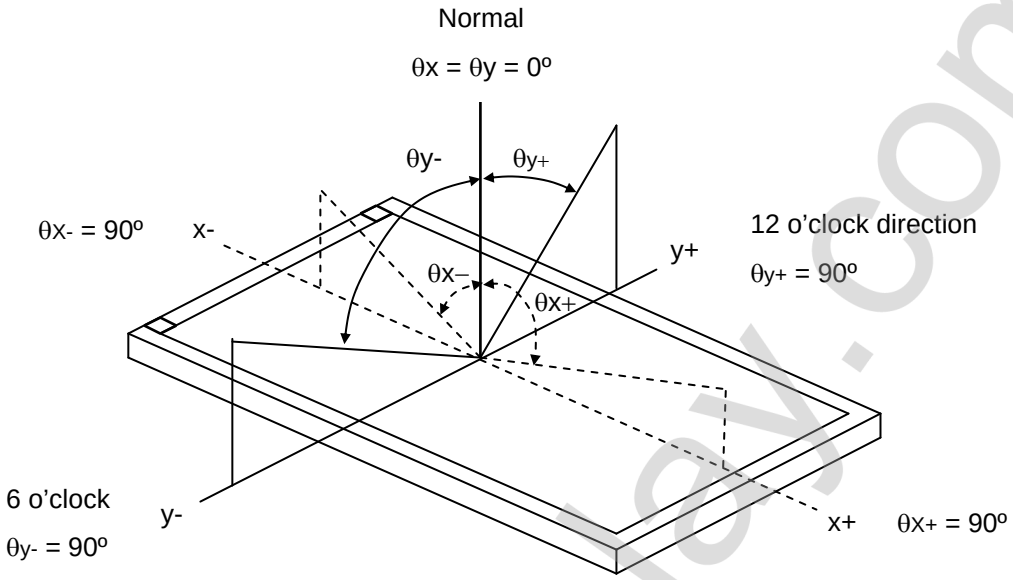
1. Measure Module's and BLU's spectrum at center point. White and R,G,B are with signal input. BLU (for V580DJ4-QE1) is supplied by INX.
2. Calculate cell's spectrum.
3. Calculate cell's chromaticity by using the spectrum of standard light source "C".

Color Gamut can be calculated by RGB Color Chromaticity coverage of the sRGB color space.

Note (1) Light source is the BLU which supplied by INX (?) and the cell driving voltage are based on suitable gamma voltages.

Note (2) Definition of Viewing Angle (θx, θy) :

Viewing angles are measured by Autronic Conoscope Cono-80 (or Eldim EZ-Contrast 160R)




Note (3) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

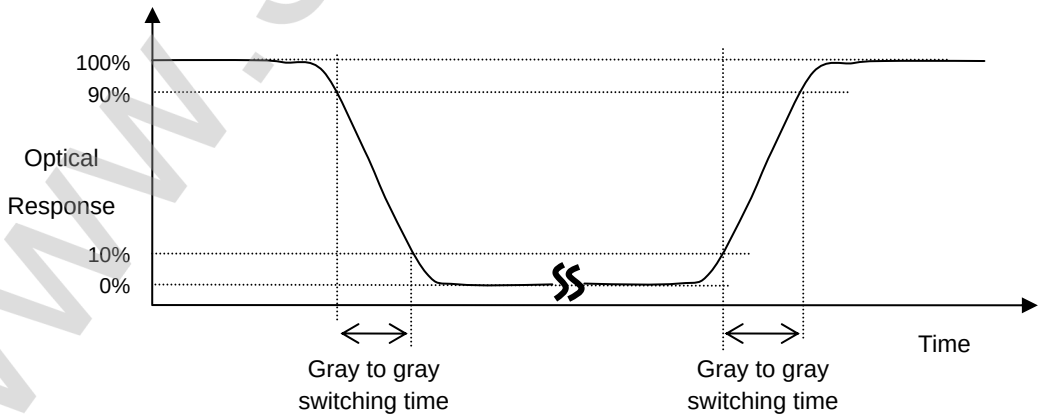
$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance of L1023}}{\text{Surface Luminance of L0}}$$

L1023 : Luminance of gray level 1023

L0 : Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (5).

Note (4) Definition of Gray-to-Gray Switching Time:




The driving signal means the signal of gray level 0, 124, 252, 380, 508, 636, 764, 892 and 1023 at the center point X5 in Note (6) .

Gray to gray average time means the average switching time of gray level 0, 124, 252, 380, 508, 636, 764, 892 and 1023 to each other.

Note (5) Definition of Transmittance (T%) :

Measure the transmittance at 5 points.

Light source is the BLU which contains three diffuser sheets and the cell driving voltage are based on suitable gamma voltages.

Transmittance (T%) = Average $\left[T(1), T(2), T(3), T(4), T(5)\right]$

The transmittance of each point can be calculated by the following expression.

$$T(X) = \frac{L255\,(X)\ \text{of LCD module}}{\text{Luminance}\ (X)\ \text{of BLU}} \times 100\%$$

L255: Luminance of gray level 255

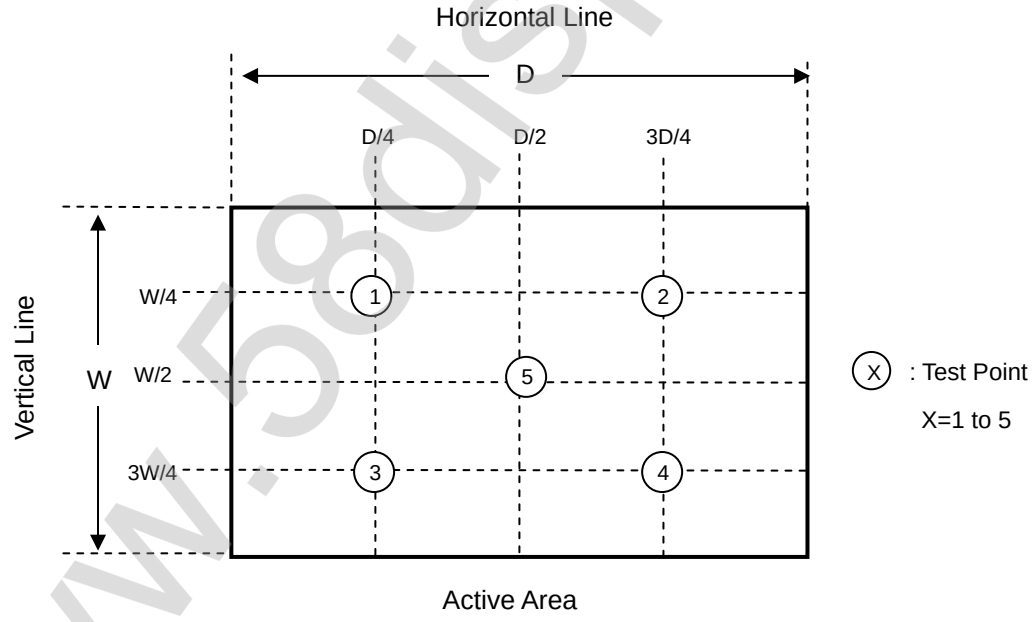
T(X) is corresponding to the point X1~X5 at the figure in Note (6).

Note (6) Definition of Transmittance Variation (δT) :

Measure the transmittance at 5 points.

$$\text{Transmittance Variation } (\delta T) = \frac{\text{Maximum}\ [\,T(1), T(2), T(3), T(4), T(5)\,]}{\text{Minimum}\ [\,T(1), T(2), T(3), T(4), T(5)\,]}$$

T(X) is calculated as Note(5).




Note (7) Definition of Gamma (GV) :

Gamma is the value of gray level 200~512 at the center point X5 in Note (6).

Note (8) Definition of ACC linearity (ACC) :

Measure the Chromaticity of White of gray level 512~1023 at the center point X5 in Note (6).

# 7. PRECAUTIONS

## 7.1 ASSEMBLY AND HANDLING PRECAUTIONS

[ 1 ] Do not apply improper or unbalanced force such as bending or twisting to open cells during assembly.

[ 2 ] It is recommended to assemble or to install an open cell into a customer's product in clean working areas. The dust and oil may cause electrical short to an open cell or worsen polarizers on an open cell.

[ 3 ] Do not apply pressure or impulse to an open cell to prevent the damage.

[ 4 ] Always follow the correct power-on sequence when an open cell is assembled and turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

[ 5 ] Do not design sharp-pointed structure / parting line / tooling gate on the plastic part of a COF (Chip on film), because the burr will scrape the COF.

[ 6 ] If COF would be bended in assemble process, do not place IC on the bending corner.

[ 7 ] The gap between COF IC and any structure of BLU must be bigger than 2 mm. This can prevent the damage of COF IC.

[ 8 ] The bezel opening must have no burr and be smooth to prevent the surface of an open cell scraped.

[ 9 ] The bezel of a module or a TV set can not contact with force on the surface of an open cell. It might cause light leakage or scrape.

[ 10 ] In the case of no FFC or FPC attached with open cells, customers can refer the FFC / FPC drawing and buy them by self.

[ 11 ] It is important to keep enough clearance between customers' front bezel/backlight and an open cell. Without enough clearance, the unexpected force during module assembly procedure may damage an open cell.

[ 12 ] Do not plug in or unplug an I/F (interface) connector while an assembled open cell is in operation.

[ 13 ] Use a soft dry cloth without chemicals for cleaning, because the surface of the polarizer is very soft and easily scratched.

[ 14 ] Moisture can easily penetrate into an open cell and may cause the damage during operation.

[ 15 ] When storing open cells as spares for a long time, the following precaution is necessary.

[ 15.1 ] Do not leave open cells in high temperature and high humidity for a long time. It is highly recommended to store open cells in the temperature range from 0 to 35℃ at normal humidity without condensation.

[ 15.2 ] Open cells shall be stored in dark place. Do not store open cells in direct sunlight or fluorescent light environment.

[ 16 ] When ambient temperature is lower than 10ºC, the display quality might be reduced.

[ 17 ] Unpacking (EPS Box) in order to prevent open cells broken:

[ 17.1 ] Moving EPS boxes by one operator may cause EPS boxes fell down and open cells broken by abnormal methods. Two operators carry one EPS box with their two hands. Do handle EPS boxes carefully, such as avoiding impact, putting down, and piling up gently.

[ 17.2 ] To prevent EPS boxes sliding from carts and falling down, EPS boxes should be placed on a surface with resistance.

[ 17.3 ] To prevent an open cell broken or a COF damaged in a EPS box, please follow the instructions below:

[17.3.1] Do not peel a polarizer protection film of an open cell off in a EPS box.

[17.3.2] Do not install FFC or LVDS cables of an open cell in a EPS box.

[17.3.3] Do not press the surface of an open cell in a EPS box.

[17.3.4] Do not pull X-board when an open cell placed in a EPS box.

[ 18 ] Handling – In order to prevent open cells, COFs , and components damaged:

[ 18.1 ] The forced displacement between open cells and X-board may cause a COF damaged. Use a fixture tool for handling an open cell to avoid X-board vibrating and interfering with other components on a PCBA & a COF.

[ 18.2 ] To prevent open cells and COFs damaged by taking out from EPS boxes, using vacuum jigs to take out open cells horizontally is recommended.

[ 18.3 ] Improper installation procedure may cause COFs of an open cell over bent which causes damages. As installing an open cell on a backlight or a test jig, place the bottom side of the open cell first on the backlight or the test jig and make sure no interference before fitting the open cell into the backlight/the test jig.

[ 18.4 ] Handle open cells one by one.

[ 19 ] Avoid any metal or conductive material to contact PCB components, because it could cause electrical damage or defect.

[ 20 ] The suggestion of removing polarizer-protection film is illustrated as following

[ 20.1 ] Scan COF on the left side (Figure 1)

Remove slowly and follow the direction : from left-up to right-down

[ 20.2 ] Scan COF on the right side (Figure 2)

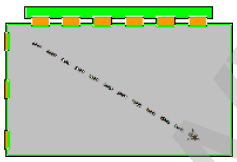
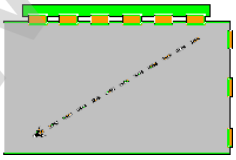
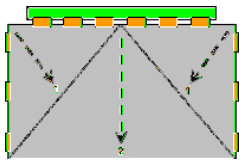
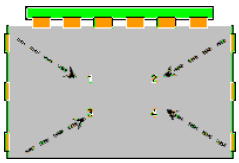
Remove slowly and follow the direction : from right-up to left-down

[ 20.3 ] Scan COF on the left and right side (Figure 3)

Remove slowly and follow the direction as marked by 1 and 2.

[ 20.4 ] Scan COF on the left and right side (Figure 4)

Remove slowly and follow the direction as marked by 1, 2, 3 and 4.

| Figure 1 | Figure 2 | Figure 3 | Figure 4 |
|---|---|---|---|
|  |  |  |  |

[ 21 ] Surface resistance of packaging material is listed as below :

| Parts | Surface resistance | Unit |
|---|---|---|
| EPS Box | $10^6$~$10^9$ | ohm/sq |
| Spacer | $10^6$~$10^9$ | ohm/sq |
| Polarizer Protection Film | $\leqq 10^{10}$ | ohm/sq |

## 7.2 SAFETY PRECAUTIONS

[ 1 ] If the liquid crystal material leaks from the open cell, 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 end of life, open cells are not harmful in case of normal operation and storage.

## 8. DEFINITION OF LABELS

### 8.1 OPEN CELL LABEL

The barcode nameplate is pasted on each open cell as illustration for INX internal control.

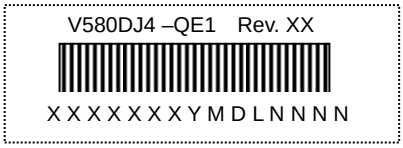
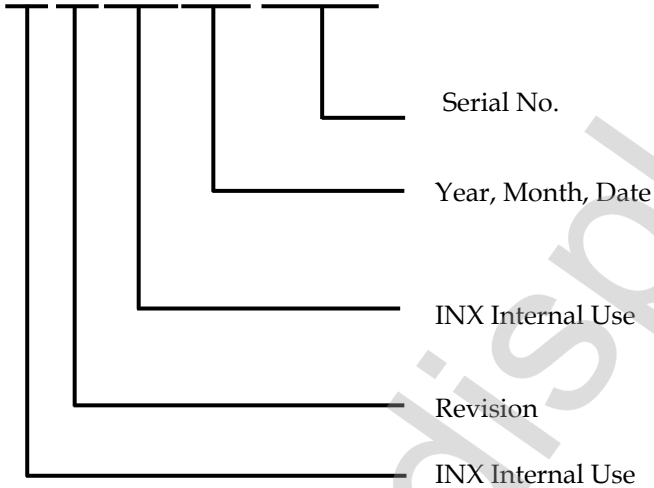



Figure.8-1 Serial No. Label on SPWB

Model Name : V580DJ4-QE1

Revision : Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

Serial ID : X X X X X X X Y M D L N N N N




Serial ID includes the information as below:

Manufactured Date :

Year: 2010=0, 2011=1, 2012=2…etc.

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I ,O, and U.

Revision Code : Cover all the change

Serial No.: Manufacturing sequence of product

## 9. PACKAGING

### 9.1 PACKAGING SPECIFICATIONS

(1) 16 pcs LCD Panels / 1 Box

(2) Box dimensions : 1442 (L) X 1030 (W) X145 (H) mm

(3) Weight : approximately 52.8 Kg / 1 Box

(4) 128 pcs LCD TV Panels / 1 Group

(5) Group dimensions : 1460 (L) X 1050 (W) X1268 (H) mm

(6) Weight : approximately 441 Kg / 1 Group

(7) Please fill up the container to avoid any cargo be damaged.

(8) INX recommend to follow the packing method as described in 9.2.

(9) When transferring in warehouse or factory, the arm length of electric forklift or hand pallet truck must be longer than the pallet length.

(10)After un-packing, one box is needed to be carried by two persons which is to prevent box bent or fell down.

(11)The surface area of the worktable or carts should be greater than box size.

### 9.2 PACKAGING METHOD

Packaging method is shown in following figures.

Figures 9-1 ~ 9-3 are the packaging method

(1) Packing Method (EPS Box)

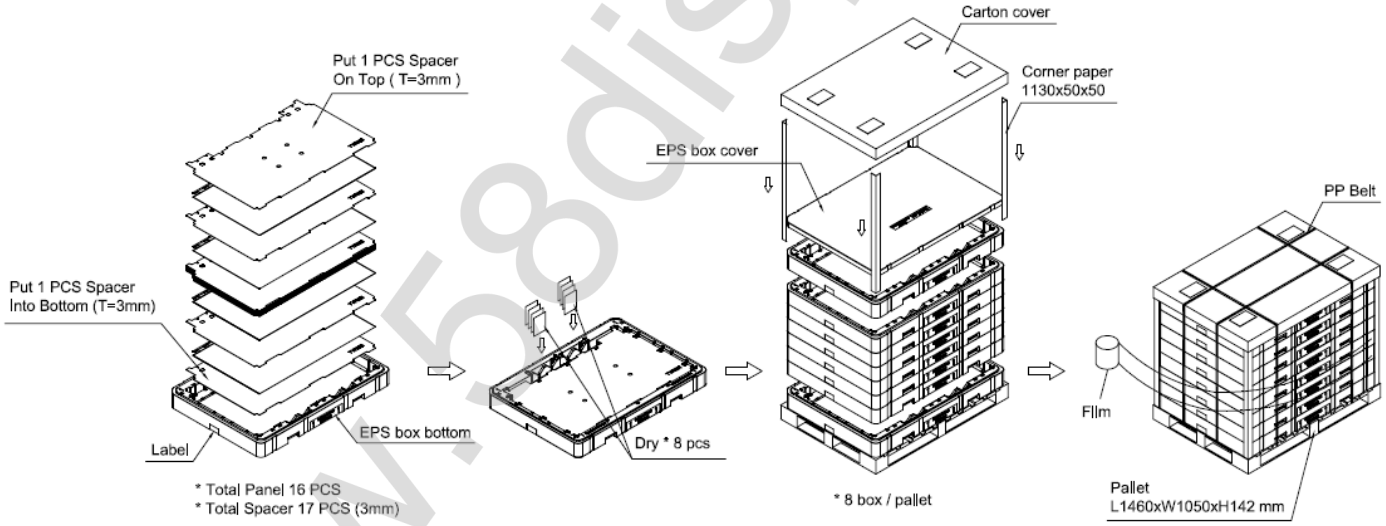
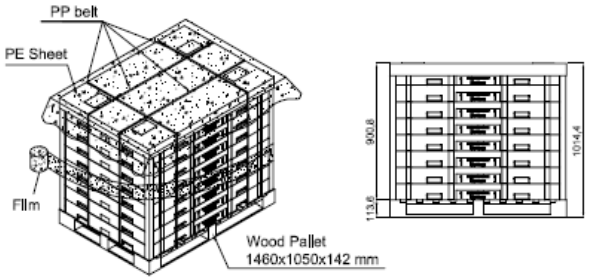



Figure.9-1 packing method

(2) Shipping Mode

A TYPE

Air transportation / film for single pallet

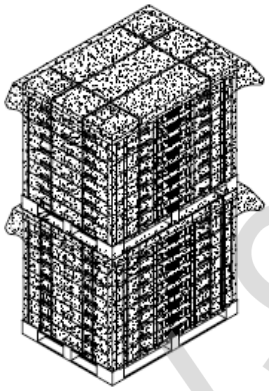



8 Box / Pallet

B TYPE (Stack of pallet)

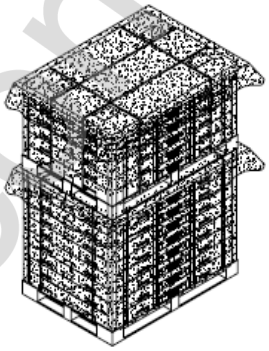
Sea&Land Transportation

40ft HQ Container



8 Box / Pallet + 8 Box / Pallet

40ft Container

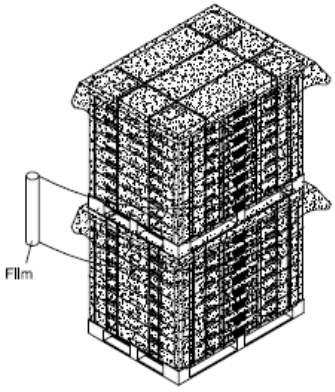


8 Box / Pallet + 5 Box / Pallet

C TYPE ( Film for stack of pallet )

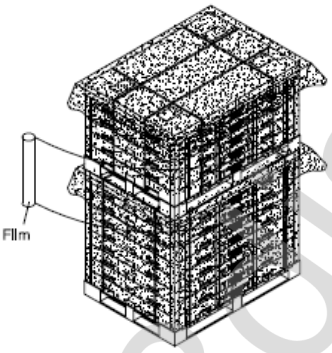
Sea&Land Transportation

40ft HQ Container




8 Box / Pallet + 8 Box / Pallet

40ft Container




8 Box / Pallet + 5 Box / Pallet

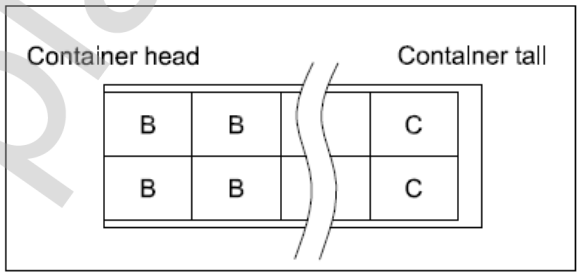



Figure.9-2 packing method

(3) The Fixed Way of Block and Plank in the Container Tail

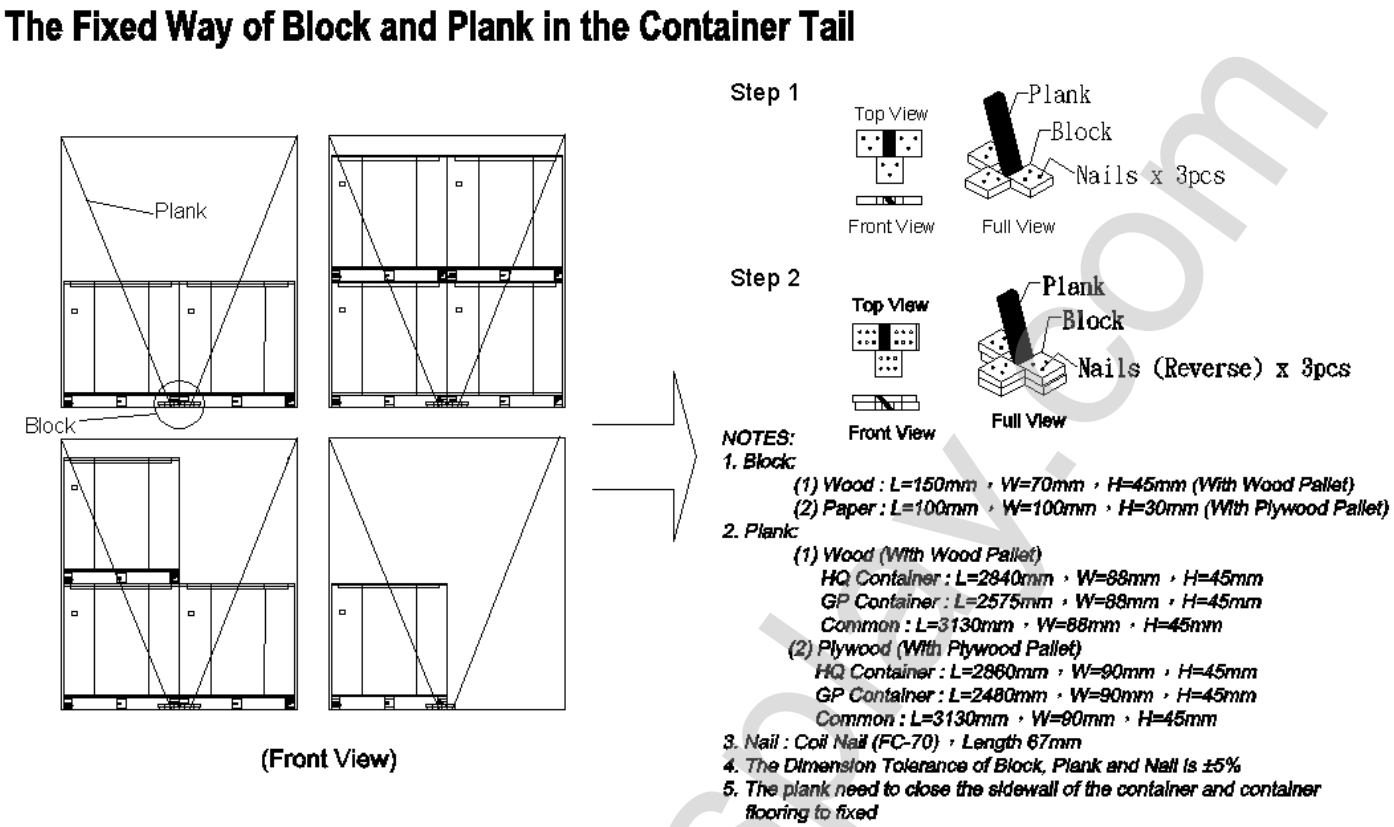



Figure.9-3 packing method

### 9.3 UN-PACKAGING METHOD

Un-packaging method is shown as following figures.

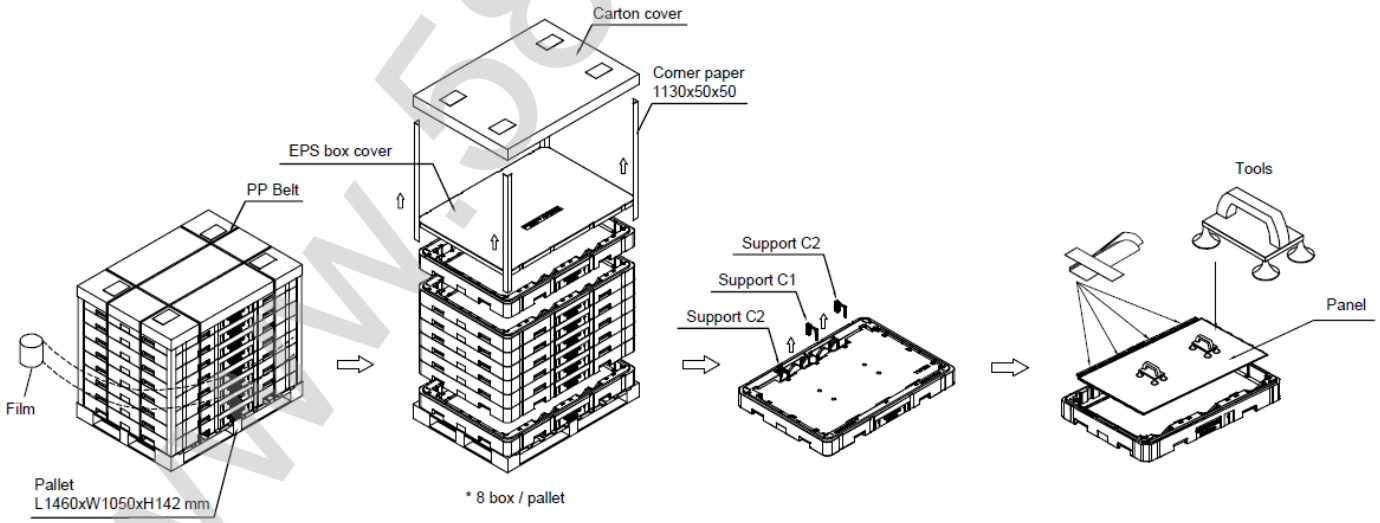



Figure.9-4 Un-packing method

## 10. MECHANICAL CHARACTERISTIC