# Product Specification

**(  ) Product Information**
**(  ) Preliminary Specification**
**( √ ) Approval Specification**

*Any modification of Spec is not allowed without SDC's permission.*

| | |
|---|---|
| CUSTOMER | R/A Customer |
| DATE OF ISSUE | 2022/06/19 |

| | |
|---|---|
| MODEL NO. | DV550QUB-R11-BL2K |
| EXTENSION CODE | -V(0) |

| **Customer Approval & Feedback** |
|---|
| |

| | |
|---|---|
| Approved by | 2022/06/19 |
| Prepared by | 2022/06/19 |
| | |

# DV550QUB-R11

# Product Specification

# Rev. 0

Customer : _____

| | |
|---|---|
| APPROVED BY | |
| DATE | |

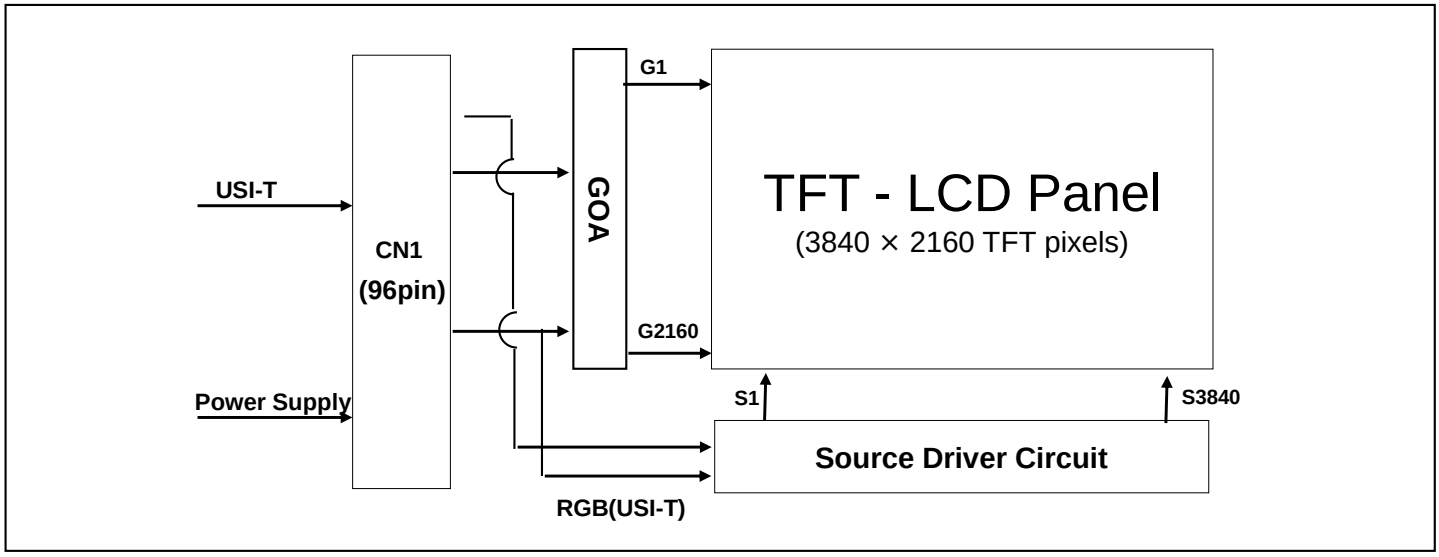
| | | |
|---|---|---|
| | | |
| CONFIRMED BY TV SBU | CONFIRMED BY QA | CONFIRMED BY R&D |

## FuZhou BOE Optoelectronics Technology Co., Ltd

# 1.0 GENERAL DESCRIPTION

## 1.1 Introduction

DV550QUB-R11 is a color active matrix TFT LCD open cell using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 55 inch diagonally measured active area with UHD resolutions (3840 horizontal by 2160 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 1.07G colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.




## 1.2 Features

- USIT interface with 12 pairs
- High-speed response
- Low color shift image quality
- 8-bit + FRC color depth, display 1.07G colors
- High luminance and contrast ratio, low reflection and wide viewing angle
- Gate driver use GOA mode
- ADS technology is applied for high display quality
- RoHS compliant

## 1.3 Application

- Commercial Digital Display
- Display Terminals for Control System
- Electronic Signage(Outdoor , Compatibility of direction H/V)
- High TNI 105℃

## 1.4 General Specification

< Table 1. General Specifications >

| Parameter | | Specification | Unit | Remark |
|---|---|---|---|---|
| Active area | | 1209.6(H) ×680.4(V) | mm | Array |
| Number of pixels | | 3840(H) ×2160(V) | pixels | |
| Pixel pitch | | 315(H) ×RGB×315(V) | μm | Array |
| Pixel arrangement | | Pixels RGB Vertical stripe | | Array |
| Display colors | | 16.7M(8bits-true) | colors | |
| Display mode | | Transmission mode, Normally Black | | |
| Outline Dimension | | 1247.8(H)x716.8V)× 58.5(B) | mm | Mech. |
| Weight | | 15.28 (Typ.) | Kg | Mech. |
| Power Consumption | | 360.5W(Typ.) | Watt | |
| Surface Treatment | | Haze 25%,3H (Front Polarizer) | | |
| Temperature | Operating | -30~70 | ℃ | High TNI 105℃ |
| | Storage | -30~70 | | |

Note 1 : Transmittance is measured by BOE BLU and By-pass mode T-con Board;
Light Source : Normal ;

## 2.0 ABSOLUTE MAXIMUM RATINGS

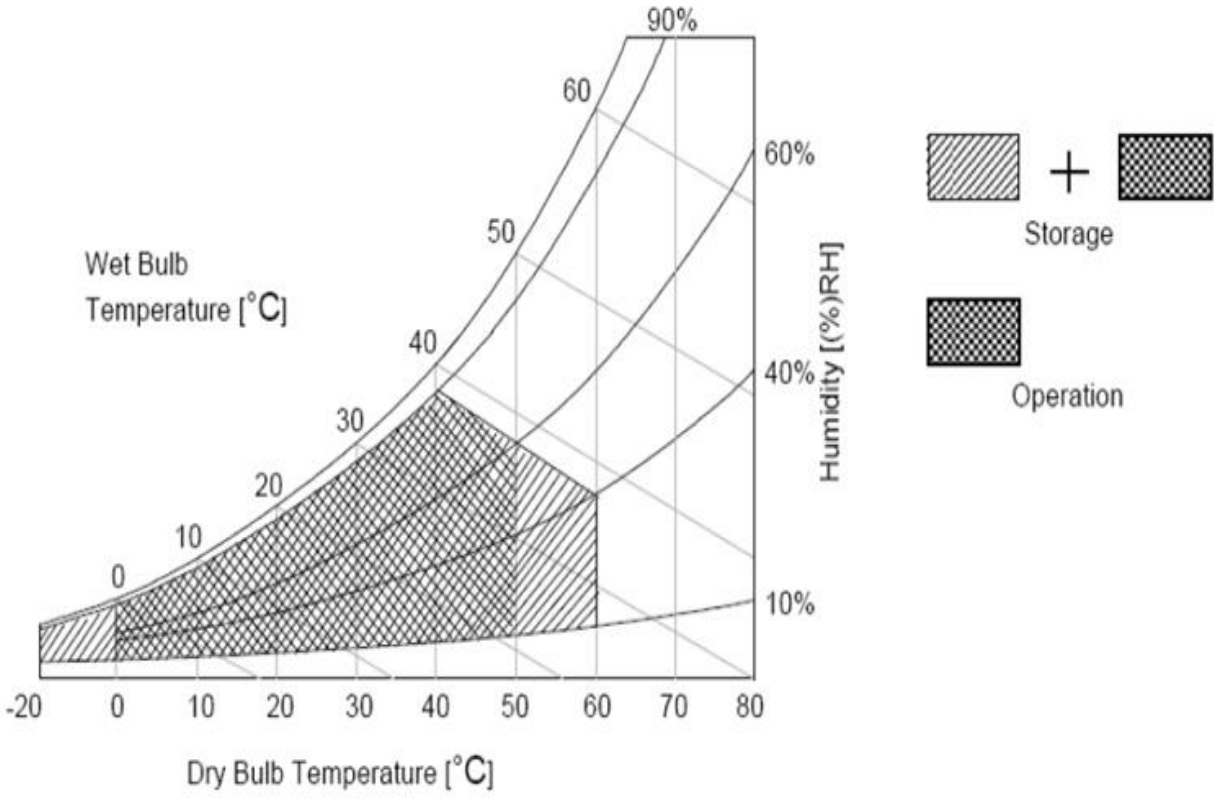
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Open Cell Absolute Maximum Ratings >

[VSS=GND=0V]

| Parameter | Symbol | Min. | Max. | Unit | Remark |
|---|---|---|---|---|---|
| Operating Temperature | $T_{OP}$ | -20 | +50 | ℃ | Note |
| | $T_{SUR}$ | -20 | +70 | ℃ | |
| Storage Temperature | $T_{ST}$ | -30 | +60 | ℃ | |
| Operating Ambient Humidity | Hop | 10 | 90 | %RH | |
| Storage Humidity | Hst | 10 | 90 | %RH | |

Note 1 : The operating test condition is based on BOE backlight.
Note 2 : Temperature and relative humidity range are shown in the figure below.
Note 3 : Wet bulb temperature should be 39 ℃ max. and no condensation of water.



## 3.0 ELECTRICAL SPECIFICATIONS

### 3.1 Open Cell Electrical Specifications

< Table 3. Open Cell Electrical Specifications > [Ta =25±2 ℃]

| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| DC Supply Voltage | VGL | -4.0 | -4.2 | -4.4 | V |
| DC Supply Voltage | VGH | 34.6 | 35.8 | 37 | V |
| DC Supply Voltage | DVDD1V8 | 1.75 | 1.9 | 1.95 | V |
| DC Supply Voltage | DVDD1V9 | 1.75 | 1.9 | 1.95 | V |
| DC Supply Voltage | DVDD3V3 | 3.2 | 3.3 | 3.4 | V |
| DC Supply Voltage | VCOM | 7.2 | 7.3 | 7.4 | V |
| DC Supply Voltage | HAVDD | 7.5 | 7.6 | 7.7 | V |
| DC Supply Voltage | AVDD | 17.1 | 17.3 | 17.5 | V |
| DC Supply Voltage | VGMA_UH | 15.2 | 15.3 | 15.4 | V |
| DC Supply Voltage | VGMA_UL | 7.9 | 8.0 | 8.1 | V |
| DC Supply Voltage | VGMA_LH | 7.1 | 7.2 | 7.3 | V |
| DC Supply Voltage | VGMA_LL | 0.2 | 0.3 | 0.4 | V |

Notes:
1. VGH should be tested on SOC board. High voltage of STV/CLK/VDDODD/VDDEVEN is as same as VGH voltage.
2. Other test points are on source board. Use typical pattern to test.

## 3.1 Open Cell Electrical Specifications

< Table 4. Open Cell Current Setting Specifications >

[Ta =25±2 ℃]

| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| DC Supply Current | VGL | - | - | 128 | mA |
| DC Supply Current | LVGL | - | - | 185 | mA |
| DC Supply Current | VGH | - | - | 440 | mA |
| DC Supply Current | DVDD1V8 | - | - | 500 | mA |
| DC Supply Current | DVDD1V9 | - | - | 840 | mA |
| DC Supply Current | DVDD3V3 | - | - | 840 | mA |
| DC Supply Current | VCOM | - | - | 50 | mA |
| DC Supply Current | HAVDD | - | - | 350 | mA |
| DC Supply Current | AVDD | - | - | 2670 | mA |
| DC Supply Current | VGMA_UH | - | - | 20 | mA |
| DC Supply Current | VGMA_UL | - | - | 20 | mA |
| DC Supply Current | VGMA_LH | - | - | 20 | mA |
| DC Supply Current | VGMA_LL | - | - | 20 | mA |

Notes:

1. Current is RMS value test with TCON board; The input current drive capability must more than the Max value.
2. VCOM short-circuit current is 400mA.
3. VGH should be tested on SOC board.
4. Other test points are on SOC board. Use maximum pattern to test.

## 3.1 Open Cell Electrical Specifications

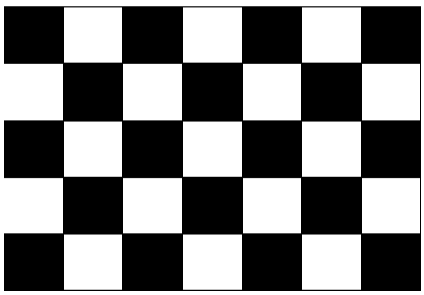
< Table 5. Open Cell Voltage Ripple Specifications > [Ta =25±2 ℃]

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| DC Supply Ripple | VGL | ±5% | mV |
| DC Supply Ripple | LVGL | ±5% | mV |
| DC Supply Ripple | VGH | ±5% | mV |
| DC Supply Ripple | DVDD1V8 | ±5% | mV |
| DC Supply Ripple | DVDD3V3 | ±5% | mV |
| DC Supply Ripple | VCOM | ±5% | mV |
| DC Supply Ripple | HAVDD | ±5% | mV |
| DC Supply Ripple | AVDD | ±5% | mV |
| DC Supply Ripple | VGMA_UH | 400 | mV |
| DC Supply Ripple | VGMA_UL | 300 | mV |
| DC Supply Ripple | VGMA_LH | 300 | mV |
| DC Supply Ripple | VGMA_LL | 50 | mV |

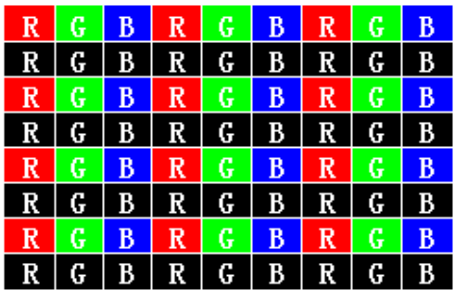
Notes:
1. Voltage ripple is Vpeak to Vpeak value. The ripple does not include V-blanking area ripple.
2. VGH should be tested on SOC board.
3. Other test points are on source board. Use maximum pattern to test.

## 3.2 Power Consumption and Flicker Pattern

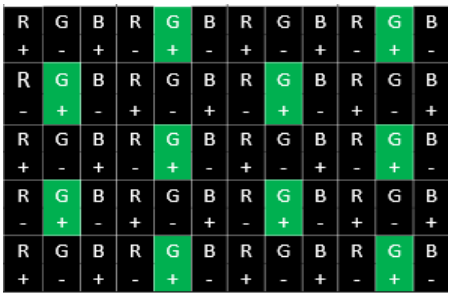
a) Typ : Mosaic 7X5 (L0/L255)



b) Max : Horizontal 1 Line(L0/L255)



c) Flicker Test Pattern



< Table 6. Power consumption>

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Power Consumption | PDD | - | 17 | 60 | W |
| Power Supply Current | IDD | - | 1416 | 5000 | mA |

## 3.3 Driver Characteristics

< Table 7. Driver Characteristics >

| Parameter | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Driver Surface Temperature | $T_{DS}$ | - | - | 125 | ℃ | Note |

Note 1: Any point on the driver surface must be less than 125 ℃ under any conditions.

2: This test condition is based on BOE module.

## 4.0 OPTICAL SPECIFICATION

The test of optical specifications shall be measured in a dark room (ambient luminance≤1 lux and temperature=25±2℃) with the equipment of Luminance meter system (Goniometer system and PR730) and test unit shall be located at an approximate distance 180cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to $\theta_{Ø=0}$ (=$\theta_3$ ) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (= $\theta_{12}$ ) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (= $\theta_9$ ) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$(= $\theta_6$ ) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 12.0V +/-10% at 25°C. Optimum viewing angle direction is 6 'clock.

< Table 5. Optical Table >

[VDD = 12.0V, Frame rate = 120Hz, Ta =25±2 ℃]

| Parameter | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle | Horizontal | $\Theta_3$ | CR > 10 | | 89 | | Deg. | Note 1 |
| | | $\Theta_9$ | | | 89 | | Deg. | |
| | Vertical | $\Theta_{12}$ | | | 89 | | Deg. | |
| | | $\Theta_6$ | | | 89 | | Deg. | |
| Color Temperature | | | | 9000 | 10,000 | 11500 | K | |
| Color Gamut | | | | 70 | 72 | - | % | |
| Contrast ratio | | CR | Θ = 0° (Center) Normal Viewing Angle | 1000:1 | 1200:1 | - | | Note 2 |
| Luminance of White | | $Y_w$ | | 2000 | 2500 | - | cd/m² | Note 3 |
| White luminance uniformity | | ΔY | | 70 | 75 | | % | Note 4 |
| Reproduction of color | White | $W_x$ | | TYP. - 0.03 | 0.280 | TYP. + 0.03 | | Note 5 |
| | | $W_y$ | | | 0.290 | | | |
| | Red | $R_x$ | | | - | | | |
| | | $R_y$ | | | - | | | |
| | Green | $G_x$ | | | - | | | |
| | | $G_y$ | | | - | | | |
| | Blue | $B_x$ | | | - | | | |
| | | $B_y$ | | | - | | | |
| Response Time | G to G | $T_g$ | | - | 8 | 10 | ms | Note 6 |
| Gamma Scale | | | | 2.0 | 2.2 | 2.4 | | |

Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface.
2. Contrast measurements shall be made at viewing angle of $\theta = 0°$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See Figure 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. The color chromaticity coordinates specified in Table 5.shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel. The BLU is used by BOE.
4. Response time Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate fV =120Hz to optimize.
   Each time in below table shall be measured by switching the input signal for "any level of gra y(bright)"and "any level of gray(dark)"

| Measured Response Time | | Target | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 15 | 31 | 47 | 63 | 79 | 95 | 111 | 127 | 143 | 159 | 175 | 191 | 207 | 223 | 239 | 255 |
| Start | 0 | | | | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | | | | |
| | 31 | | | | | | | | | | | | | | | | | |
| | 47 | | | | | | | | | | | | | | | | | |
| | 63 | | | | | | | | | | | | | | | | | |
| | 79 | | | | | | | | | | | | | | | | | |
| | 95 | | | | | | | | | | | | | | | | | |
| | 111 | | | | | | | | | | | | | | | | | |
| | 127 | | | | | | | | | | | | | | | | | |
| | 143 | | | | | | | | | | | | | | | | | |
| | 159 | | | | | | | | | | | | | | | | | |
| | 175 | | | | | | | | | | | | | | | | | |
| | 191 | | | | | | | | | | | | | | | | | |
| | 207 | | | | | | | | | | | | | | | | | |
| | 223 | | | | | | | | | | | | | | | | | |
| | 239 | | | | | | | | | | | | | | | | | |
| | 255 | | | | | | | | | | | | | | | | | |

5. Definition of Transmittance (T%) :
   Module is with white(L255) signal input

$$\text{Transmittance} = \frac{\text{Luminance of LCD Module}}{\text{Luminance of BLU}} \times 100\ \%$$

# 5.0 INTERFACE CONNECTION

## 5.1 Connector Pin Configuration

< Table 9. Open Cell Input Connector Pin Configuration >

| P/N | Name |
|---|---|
| 1 | AVDD |
| 2 | AVDD |
| 3 | AVDD |
| 4 | AVDD |
| 5 | AVDD |
| 6 | AVDD |
| 7 | AVDD |
| 8 | AVDD |
| 9 | GMA1 |
| 10 | GMA9 |
| 11 | HAVDD |
| 12 | HAVDD |
| 13 | GMA10 |
| 14 | GMA18 |
| 15 | FB_2 |
| 16 | GND |
| 17 | SFC1 |
| 18 | GND |
| 19 | USIT11N |
| 20 | USIT11P |
| 21 | GND |
| 22 | USIT10N |
| 23 | USIT10P |
| 24 | GND |
| 25 | USIT9N |
| 26 | USIT9P |
| 27 | GND |
| 28 | USIT8N |
| 29 | USIT8P |
| 30 | GND |
| 31 | USIT7N |
| 32 | USIT7P |
| 33 | GND |
| 34 | USIT6N |
| 35 | USIT6P |
| 36 | GND |
| 37 | USIT5N |
| 38 | USIT5P |
| 39 | GND |
| 40 | USIT4N |

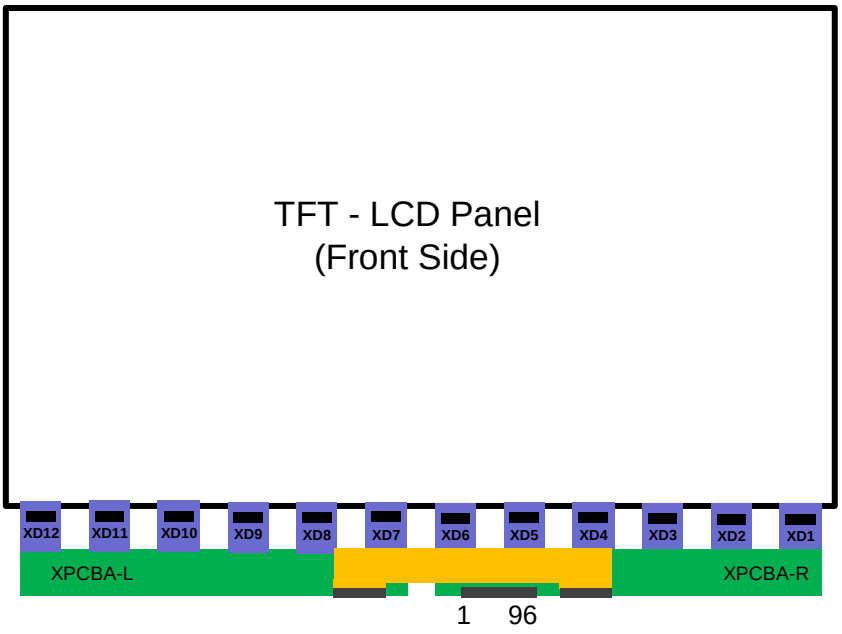
| P/N | Name |
|---|---|
| 41 | USIT4P |
| 42 | GND |
| 43 | USIT3N |
| 44 | USIT3P |
| 45 | GND |
| 46 | USIT2N |
| 47 | USIT2P |
| 48 | GND |
| 49 | USIT2N |
| 50 | USIT2P |
| 51 | GND |
| 52 | USIT1N |
| 53 | USIT1P |
| 54 | GND |
| 55 | SRF |
| 56 | SEL_EQ |
| 57 | 1.9V |
| 58 | 1.9V |
| 59 | 1.9V |
| 60 | 1.9V |
| 61 | HOLD |
| 62 | SCK |
| 63 | CS |
| 64 | DI |
| 65 | DO |
| 66 | WP |
| 67 | 3.3V |
| 68 | NC |
| 69 | VGL |
| 70 | VGLT |
| 71 | VGLT |
| 72 | VDDEVEN |
| 73 | VDDODD |
| 74 | NC |
| 75 | NC |
| 76 | NC |
| 77 | NC |
| 78 | NC |
| 79 | CLK6 |
| 80 | CLK5 |

| P/N | Name |
|---|---|
| 81 | CLK4 |
| 82 | NC |
| 83 | CLK3 |
| 84 | CLK2 |
| 85 | CLK1 |
| 86 | STV |
| 87 | STV_TRST |
| 88 | NC |
| 89 | VCOM2(NC) |
| 90 | VCOM2(NC) |
| 91 | VCOM0 |
| 92 | VCOM0 |
| 93 | FB_VCOMFBR(NC) |
| 94 | FB_VCOMFBL(NC) |
| 95 | GND |
| 96 | FB1 |

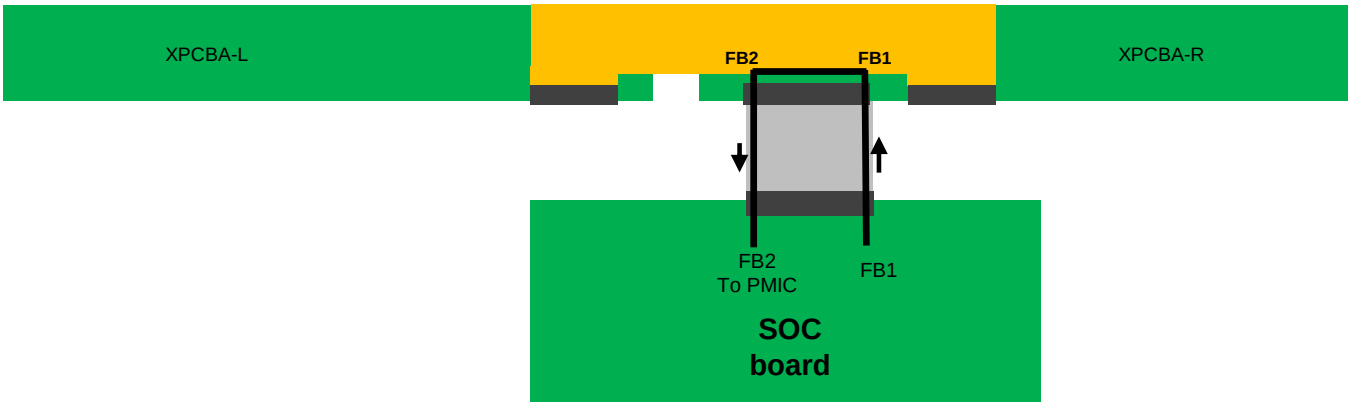
Note : NC(Not Connected) : This pins are only used for BOE internal operations.

Notes :

1. NC (Not Connected) : These pins show status of T/con board and are only used for BOE internal operations.
2. XPCBL and XPCBR Input pins assignments refer to the below diagram.




3. FB1/FB2 are used for FB function. Aim to avoid electrical damage when FFC skew plug happens. When using FB function, it requires customers to design circuit and power supply sequence which depends on power IC on SOC board. Otherwise, ignore FB function and keep these pins NC.



# 6.0 INTERFACE SIGNAL TIMING SPECIFICATION

## 6.1 Signal Timing Parameters

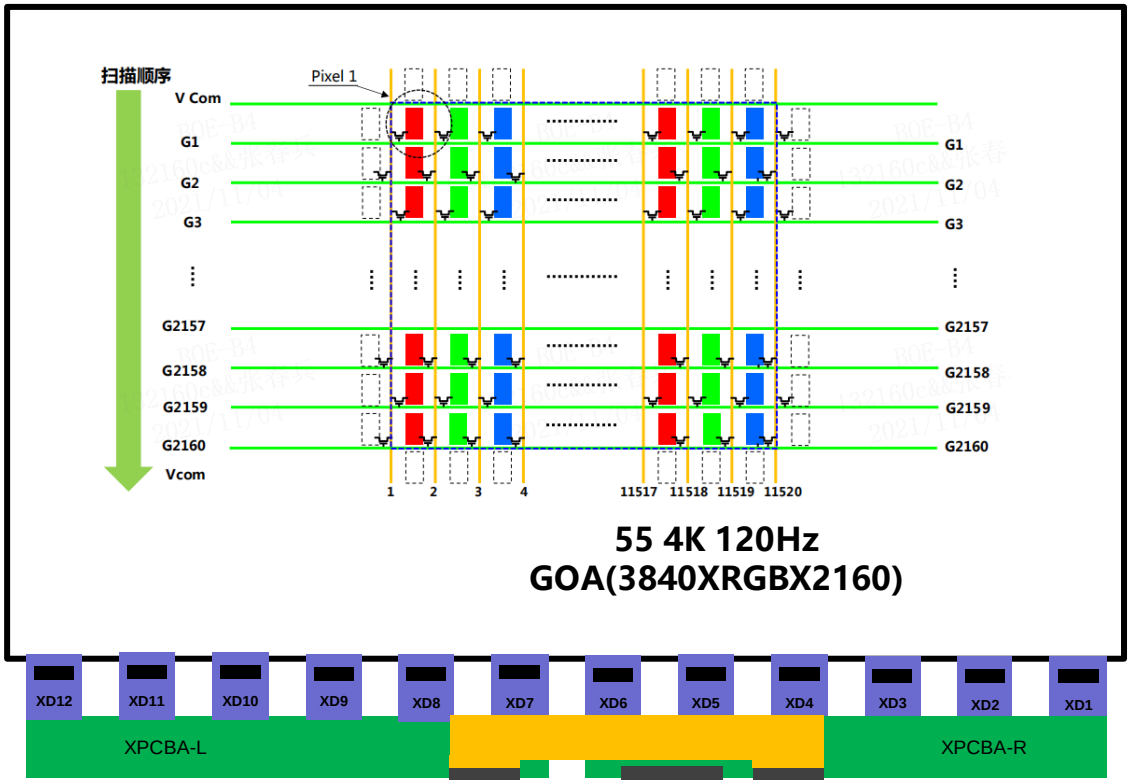
< Table 11. Timing Table >

| Item | | Symbols | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Frequency | | 1/Tc | 69 | 74.5 | 77 | MHz |
| Vertical | Frame Rate | F | 114 | 120 | 126 | Hz |
| | Total | $T_V$ | 2200 | 2250 | 2450 | $T_H$ |
| | Display | $T_{VD}$ | 2160 | | | $T_H$ |
| | Blank | $T_{VB}$ | 40 | 90 | 290 | $T_H$ |
| Horizontal | Total | $T_H$ | 270 | 275 | 280 | $T_{CLK}$ |
| | Display | $T_{HD}$ | - | 240 | - | $T_{CLK}$ |
| | Blank | $T_{HB}$ | 30 | 35 | 40 | $T_{CLK}$ |

Notes:

1. This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.
2. This product should keep data frequency and Horizontal value fixed when adjusting frame rate.
3. This product supports frequency 120Hz and Vertical & Horizontal values must follow the table.

## 6.2 Pixel Structure



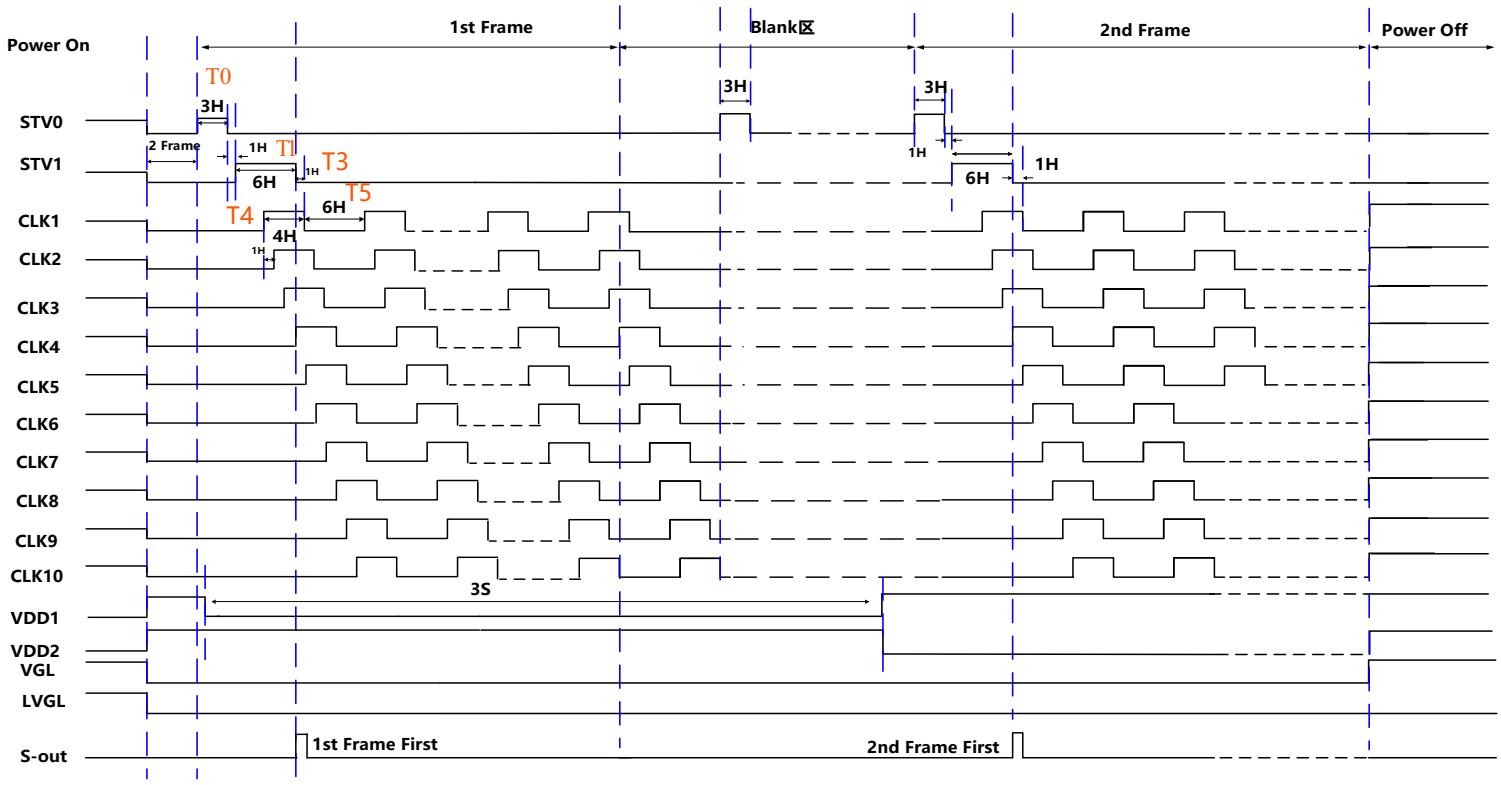

Notes:

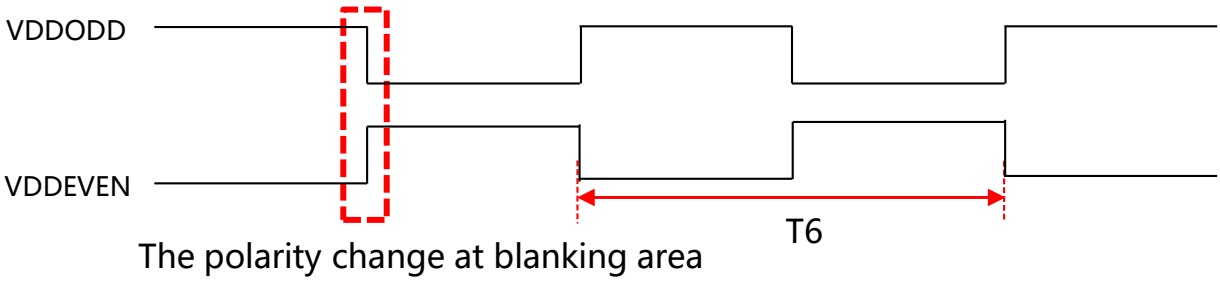
1. Panel is progressive scan from top to bottom.
2. Source driver data latch direction is from right to left.

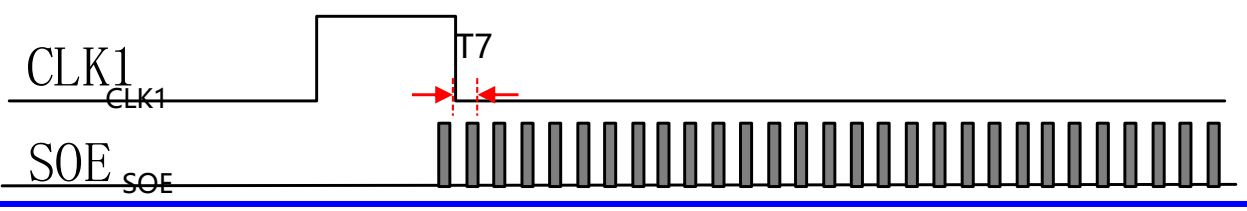
## 6.0 SIGNAL TIMING SPECIFICATION

H total :4400
V total :2250
Frame Rate:120Hz

### 6.1 Signal Timing Waveform



## 6.3 Signal Timing Waveform

H total :4400
V total :2250
Frame Rate:120Hz

### 6.3.2 Signal Timing Waveform Remark

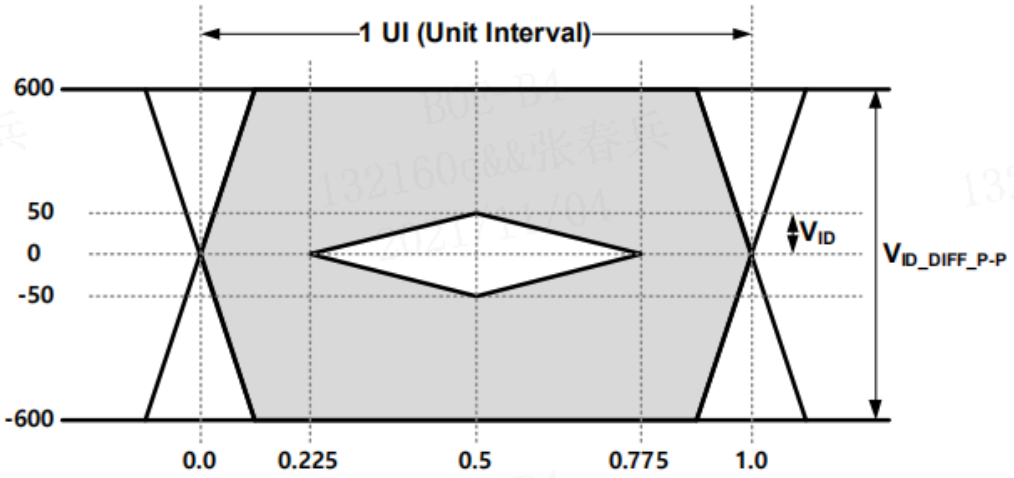
| | Min. | Typ. | Max. | | |
|---|---|---|---|---|---|
| T0 | - | 7.4us | - | STV0 Width | |
| T1 | - | 22.2us | - | STV1 Width(6H) | |
| T2 | - | 3.7us | - | CLK1 Falling to STV Falling（1H） | |
| T3 | - | 3.7us | - | CLK1 Falling to CLK2 Falling(1H) | |
| T4 | - | 14.8us | - | CLK High Width(4H) | |
| T5 | - | 22.2us | - | CLK Low Width(6H) | |
| T6 | 3s | 4s | 5s | VDDODD/VDDEVEN Period | Changed in blanking area |
| T7 | - | 1.9us | - | GOE | |

**Notes :**

1. 1H=1/（Frame Rate*V total).
2.When power on, STV and CLK1~CLK6 should keep low before the first STV.
3.VDDODD and VDDEVEN must reverse in vertical blanking time.

## 6.4 Signal Eye Diagram

< Table 12. USIT Eye Diagram >




(a) Eye Diagram with a Driver IC @ TP3

< Table 13. Eye Diagram information >

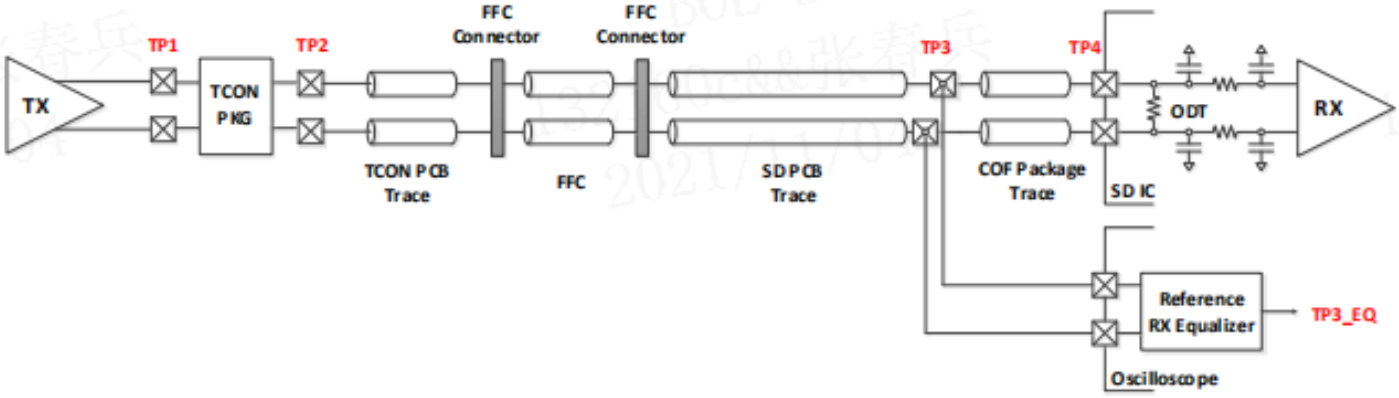
(VSS1 = VSS2 = 0V)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input offset voltage | $V_{ICM}$ (1) | VDD1A = 1.62V to 1.98V | 0.3 | 0.45 | 0.6 | V |
| Differential input data voltage | $V_{ID}$ (2) (3) | | 50 | – | 600 | mV |
| Differential input data peak-to-peak voltage | $V_{ID\_DIFF\_P-P}$ (2) (3) | | 100 | – | 1200 | |
| Differential input data voltage with EQ | $V_{ID\_EQ}$ (4) (5) | | 50 | – | 600 | |
| Differential input data peak-to-peak voltage with EQ | $V_{ID\_DIFF\_P-P\_EQ}$ (4) (5) | | 100 | – | 1200 | |
| Internal termination resistor | $R_T$ (6) | $T_C$(6) | Typ-20% | 100 | Typ+20% | Ω |

**NOTE:**

1. $V_{ICM}$ voltage is the common mode voltage of the differential input data.
2. The min/max level of $V_{ID}$ includes all the AC fluctuation upon DC level. Differential input voltage is measured at TP3 in case of low-lossy channel so that satisfied eye diagram can be obtained at TP3 without any receiver equalizer options.
3. The condition of measurement for eye diagram with bonding a Driver IC on the source PCB is illustrated *Figure 3*(a).
4. The min level of $V_{ID\_EQ}$ means internal min value of USI-T data and the max level of $V_{ID\_EQ}$ means external max value of the USI-T data in eye diagram at TP3_EQ when RX equalizer is enabled, respectively. The condition of measurement for eye diagram is to bond a Driver IC on the source PCB (*Figure 3*(b)) and measured at TP3_EQ.
5. The differential input data voltage with EQ includes all the AC fluctuation upon DC level. Differential input voltage is measured at TP3_EQ, the reference EQ output. Allowable channel characteristics including TCON board, FFC, Source PCB, and FPCB are defined by eye mask specification at TP3_EQ after application of corresponding reference equalizer, with a response curve as defined in *5.1 TP3_EQ Reference Equalizers*. Configurable reference EQ with 7 steps is provided for TP3_EQ eye measurement. As described in *5.1 TP3_EQ Reference Equalizers*, because the reference receiver equalizer does not define the downstream device receiver equalizer implementation, the implemented equalizer characteristics will be provided as a supplement.

Notes:
- Please use the measurement results just for your reference.
- Eye measurement results using the Oscilloscope PLL are inaccurate because EPI uses the DLL..

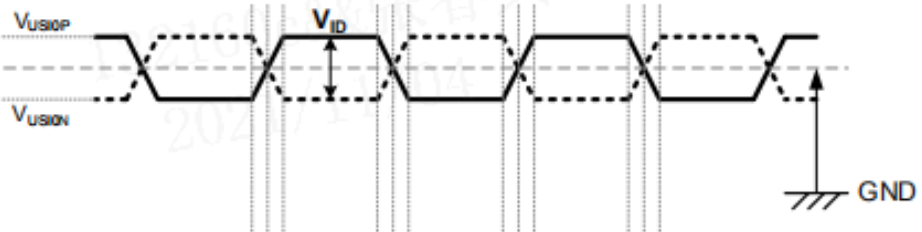



6. $R_T$ is an internal termination resistor (On-Die Termination). Condition is $T_{C,typ}$ (52.5°C).
7. Signal parameter

*** Single-ended**

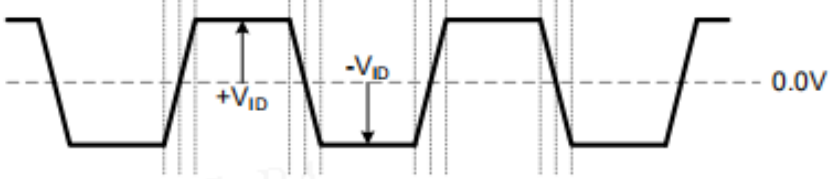
$V_{USIT\_DATA0P}=V_{ICM}+1/2V_{ID}$

$V_{USIT\_DATA0N}=V_{ICM}-1/2V_{ID}$



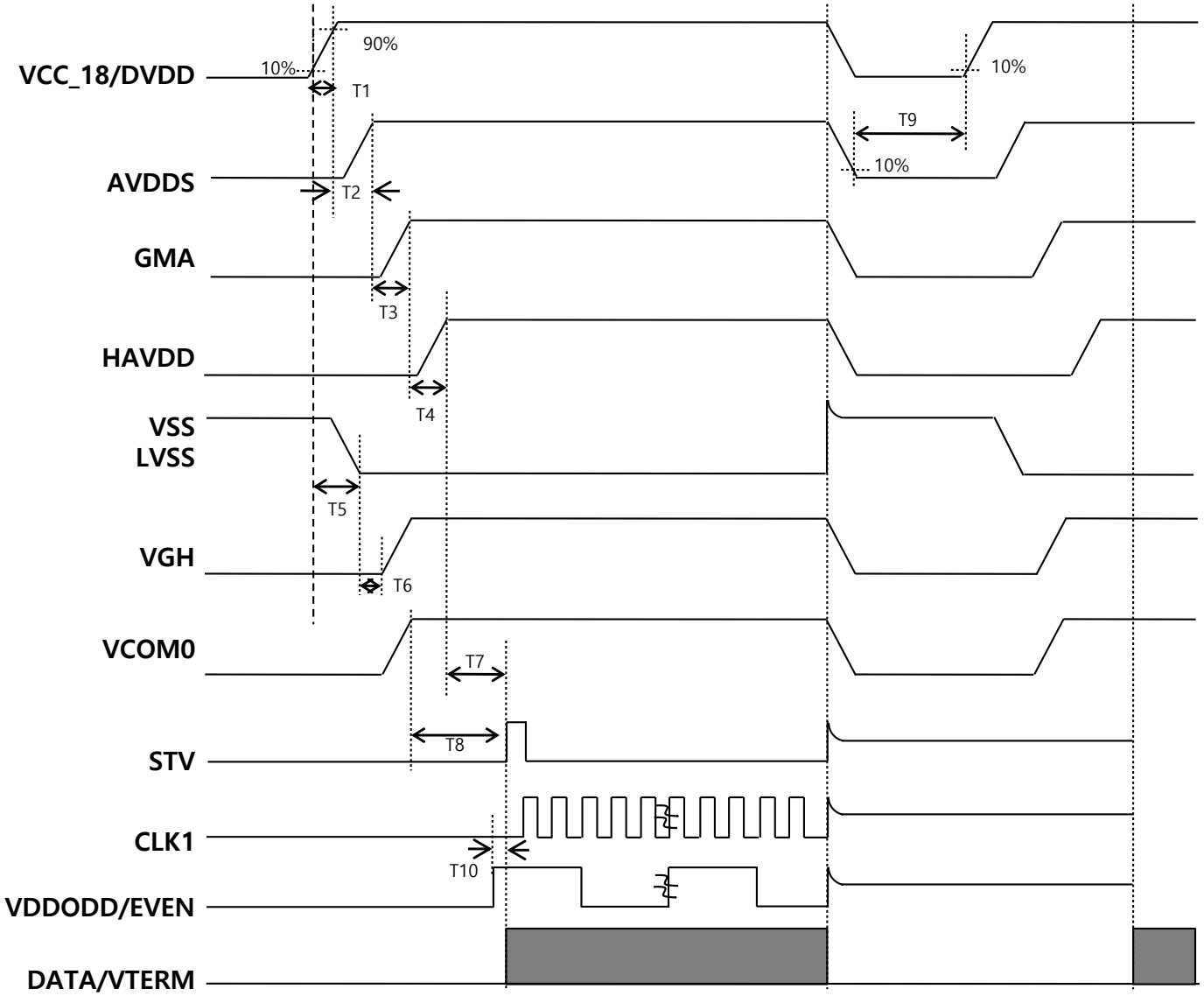

*** Differential**

$V_{ID\_DIFF}=V_{USIT\_DATA0P}-V_{USIT\_DATA0N}$




$V_{ID\_DIFF\_P-P} = 2\times V_{ID}$

## 7.0 POWER SEQUENCE




Notes :
1. When power off, VGL(VSS),STV,CLK,VDDODD/VDDEVEN timing should follow VGH falling.
2. VGH is on SOC board only, so T6 time is tested on SOC board.

## 7.0 POWER SEQUENCE

| T | Min | Type | Max | Unit | Note |
|---|---|---|---|---|---|
| T1 | 0 | - | 10 | ms | |
| T2 | 0 | - | - | ms | |
| T3 | 0 | - | - | ms | AVDDS must be higher than HAVDD and GMA all the time |
| T4 | -200 | - | 1000 | ms | AVDDS must be higher than HAVDD and GMA all the time |
| T5 | 0 | - | - | ms | |
| T6 | 0 | - | - | ms | |
| T7 | 0 | - | - | ms | |
| T8 | 0 | - | - | ms | |
| T9 | 1 | - | - | s | |
| T10 | 2 | - | - | Frame | VDD should pull high before 1st STV rising |

## 8.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

< Table 10. Input Signal and Display Color Table >

| Color | | Input Color Data | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MSB RED LSB | | | | | | | | MSB GREEN LSB | | | | | | | | MSB BLUE LSB | | | | | | | |
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| R | RED(000) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED(001) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ---- | | | | | | | | | | | | | | | | | | | | | | | | |
| | RED(254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED(255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| G | Green (000) | 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 (0001) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ---- | | | | | | | | | | | | | | | | | | | | | | | | |
| | Green (254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | Blue(000) | 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(0001) | 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(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 |

# 9.0 MECHANICAL CHARACTERISTICS

## 9.1 Dimensional Requirements

Figure 3(located in Appendix) shows mechanical outlines for the model DV550QUB-R11. Other parameters are shown in Table 12.

< Table 12. Dimensional Parameters >

| Parameter | Specification | Unit |
|---|---|---|
| Dimensional outline | 1247.8(H)x716.8V)× 58.5(B) | mm |
| Weight | 15.28 | Kg |
| Active area | 1209.6(H) ×680.4(V) | mm |
| Pixel pitch | 315(H) ×315(V) | μm |
| Number of pixels | 3840(H) × 2160(V) | pixels |
| Back-light | D-LED Backlight | |

## 9.2 Surface Treatment and Polarizer Hardness

The surface of the LCD has a Low haze coating and a coating to Reduce scratching.
The front and bottom polarizer hardness is 3H(Min 2H).

## 10.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

< Table 13. Reliability Test Parameters >

| No | Test Items | Conditions |
|---|---|---|
| 1 | High temperature storage test | Ta = 60 ℃, 240 hrs |
| 2 | Low temperature storage test | Ta = -20 ℃, 240 hrs |
| 3 | High temperature & high humidity operation test | Ta = 50 ℃, 80%RH, 240hrs |
| 4 | High temperature operation test | Ta = 50 ℃, 240hrs |
| 5 | Low temperature operation test | Ta = -5 ℃, 240hrs |
| 6 | Thermal shock | Ta = -20 ℃ ↔ 60 ℃ (0.5 hr), 100 cycle |

Note 1: This test condition is based on BOE module.

Under 24 hours a day is available for black fog mura（In ordinary temperature）.
Life time 45,000 hours is available for black fog mura（In ordinary temperature）

## 11.0 PRECAUTIONS

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

### 11.1 Mounting Precautions

- Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- You must mount a module using specified mounting holes (Details refer to the drawings)
- You should consider the mounting structure so that uneven force (ex. Twisted stress, Concentrated stress)is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- Do not apply mechanical stress or static pressure on module; Abnormal display cause by pressing some parts of module during assembly process , do not belong to product failure, the press should be agreed by two sides.
- Determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Do not apply mechanical stress or static pressure on module , and avoid impact, vibration and falling.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Protection film for polarizer on the module should be slowly peeled off before display.
- Be careful to prevent water & chemicals contact the module surface.
- You should adopt radiation structure to satisfy the temperature specification.
- Long side LED Bar design is recommended when using E-LED type Back Light
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane & alcohol is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene , because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading..

- This module has its circuitry PCB's on the rear side and Driver IC, should be handled carefully in order not to be stressed.
- Avoid impose stress on PCB and Driver IC during assembly process ,Do not drawing, bending, COF package & wire
- Do not disassemble the module.

## 11.2 Operating Precautions

- Do not connector or disconnect the cable to/from the Module at the "Power On" Condition.
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the module would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- Do not allow to adjust the adjustable resistance or switch
- The electrochemical reaction caused by DC voltage will lead to LCD module degradation, so DC drive should be avoided.
- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipment to protect against static electricity.
- Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- Design the length of cable to connect between the connector for back-light and the converter as shorter as possible and the shorter cable shall be connected directly , The long cable between back-light and Converter may cause the Luminance of LED to lower and need a higher startup voltage
- The cables should be as short as possible between System Board and PCB interface.
- Connectors are precision devices to transmit electrical signals, and operators should plug in parallel
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.

## 11.3 Electrostatic Discharge Precautions

- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc.
- Do not close to static electricity to avoid product damage.
- Do not touch interface pin directly.

## 11.4 Precautions for Strong Light Exposure

- Do not leave the module operation or storage in Strong light . Strong light exposure causes degradation of polarizer and color filter.

## 11.5 Precautions for Storage

A. Atmosphere Requirement

| ITEM | UNIT | MIN | MAX |
|---|---|---|---|
| Storage Temperature | (℃) | 5 | 40 |
| Storage Humidity | (%rH) | 40 | 75 |
| Storage Life | 6 months | | |
| Storage Condition | • The storage room should be equipped with a dark and good ventilation facility.<br>• Prevent products from being exposed to the direct sunlight, moisture and water.<br>• The product need to keep away from organic solvent and corrosive gas.<br>• Be careful for condensation at sudden temperature change.<br>• Storage condition is guaranteed under packing conditions. | | |

B. Package Requirement

- The product should be placed in a sealed polythene bag.
- Product Should be placed on the pallet, Which is away from the floor, Be cautions not to pile the product up.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.
- As the original protective film, do not use the adhesive protective film to avoid change of Pol color and characteristic.

## 11.6 Precautions for protection film

- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertic al from panel surface, If possible, under ESD control device like ion blower, and the humidity of wor king room should be kept over 50%RH to reduce the risk of static charge.
- People who peeled off the protection film should wear anti-static strap and grounded well.

## 11.7 Appropriate Condition for Commercial Display

-Generally large-sized LCD modules are designed for consumer applications . Accordingly, long-term display like in Commercial Display application, can cause uneven display including image sticking. To optimize module's lifetime and function, several operating usages are required.

1. Normal operating condition
   - Temperature: 20±15°C
   - Operating Ambient Humidity : 55±20%
   - Display pattern: dynamic pattern (Real display)
   - Well-ventilated place is recommended to set up Commercial Display system
2. Special operating condition

   a. Ambient condition

   - Well-ventilated place is recommended to set up Commercial Display system.

   b. Power and screen save

   - Periodical power-off or screen save is needed after long-term display.

   c. As the low temperature, the response time is greatly delayed. As the high temperatures (higher than the operating temperature) the LCD module may turn black screen. The above phenomenon cannot explain the failure of the display. When the temperature returns to the normal operating temperature, the LCD module will return to normal display.

   d. When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD module may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD module 's surface which may affect the operation of the polarizer and LCD module

   e. Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.

   f. Products should be protected from high and low temperature, water vapor and ultraviolet radiation,in order to avolid direct exposure to the extreme environment for a long time.

   g. Long time and large angle forword use or unconventional use , It is strongly recommended to contact BOE for filed application engineering advice

3. Operating usages to protect against image sticking due to long-term static display.
   a. Suitable operating time: under 20 hours a day.
   b. Static information display recommended to use with moving image.
   - Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.
   c. Background and character (image) color change
   - Use different colors for background and character, respectively.
   - Change colors themselves periodically.
   d. Avoid combination of background and character with large different luminance.
   1) Abnormal condition just means conditions except normal condition.
   2) Black image or moving image is strongly recommended as a screen save
4. Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.

## 11.8 Other Precautions

A. LC Leak

- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- 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.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

B. Rework

- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

C. In order to prevent potential problems, flicker should be adjusted by optimizing the Vcom value in customer LCM Line through the I2C Interface.

## 12.0 PRODUCT SERIAL NUMBER

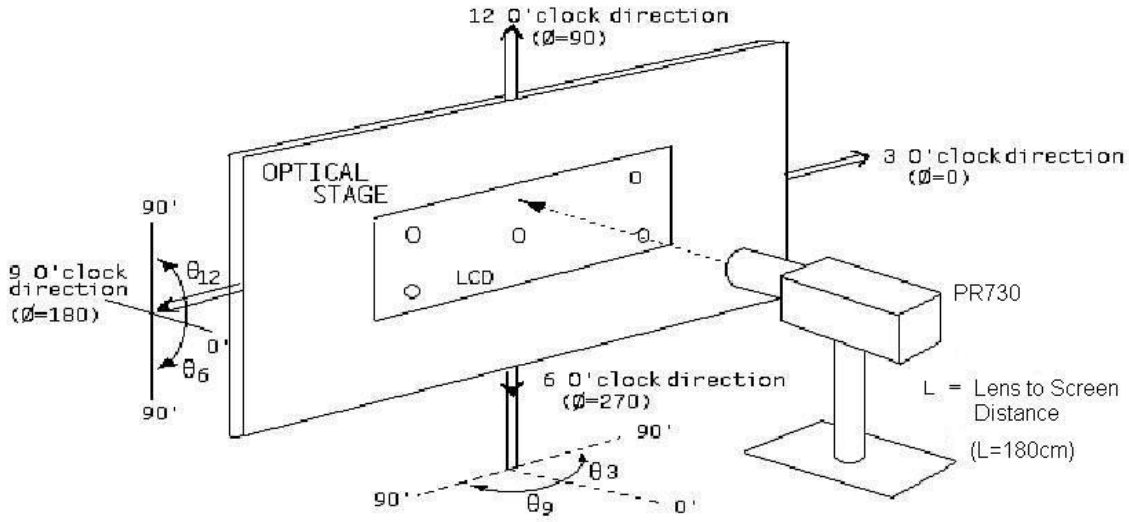

① QR Code ② MDL ID
③ FG Code ④ P/N
⑤ Bar Code

MDL ID Naming Rule:

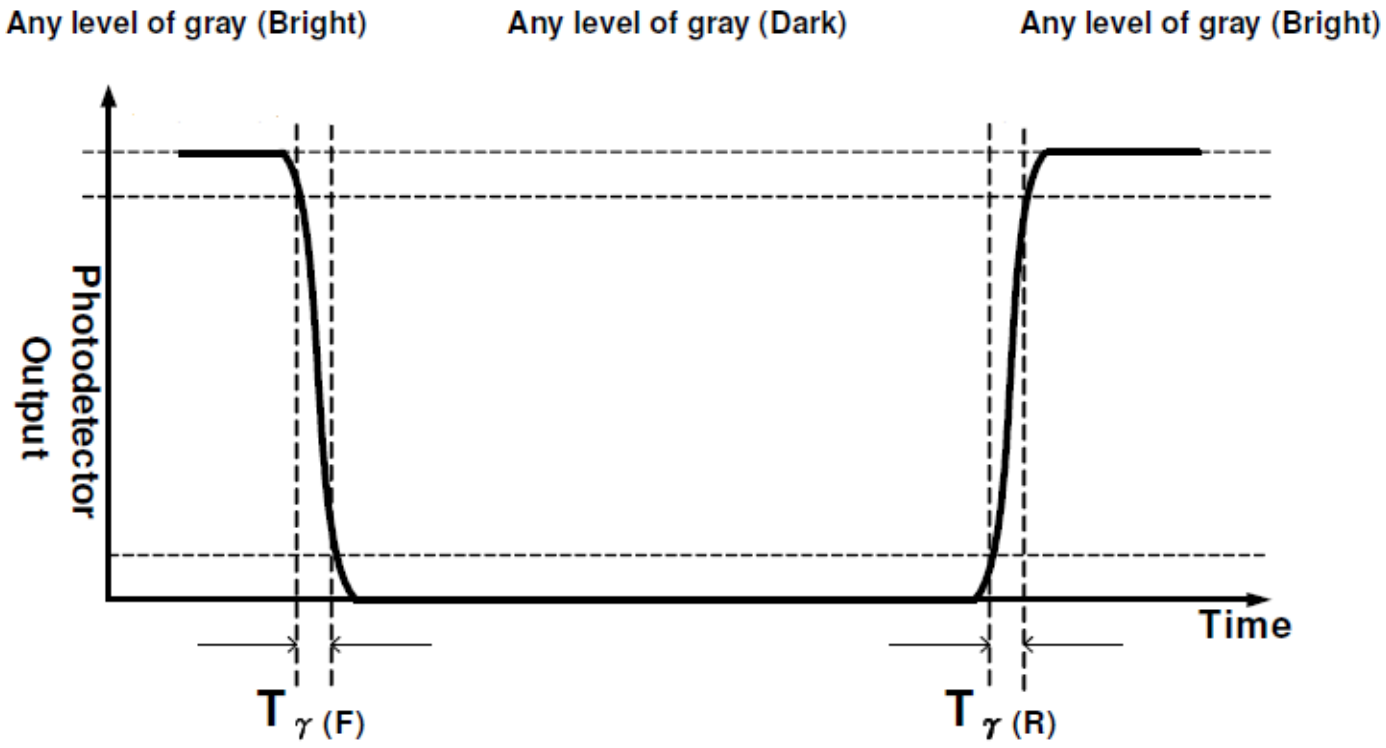
| Code \ Digit | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Model Code GBN | | Grade | Line | Year | | Month | Model Extension Code | | | |
| Code \ Digit | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | | | |
| Description | Serial No | | | | | | 扫码不显示，BOE厂内用 | | | | |

## 14.0 APPENDIX 1

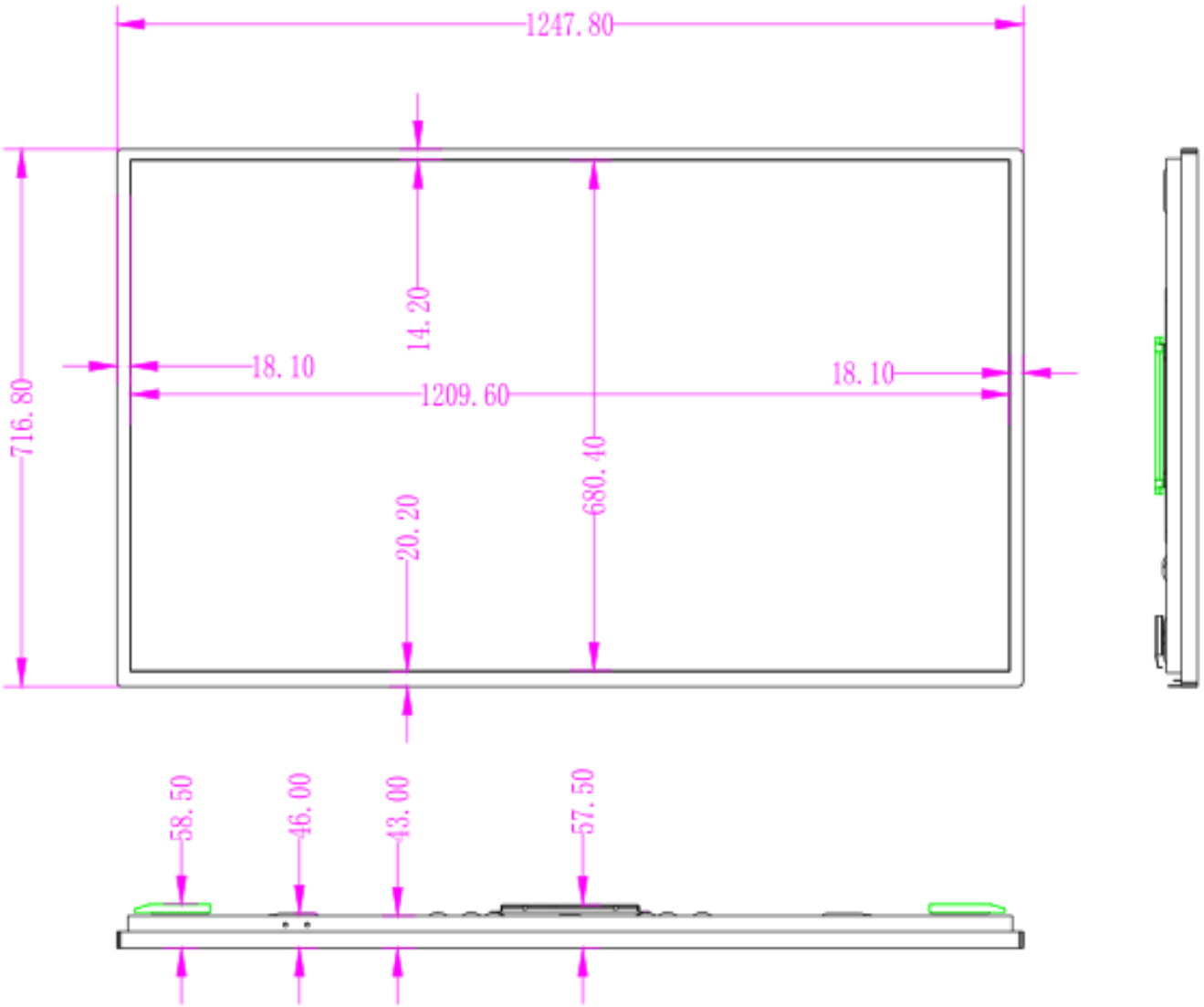
< Figure 6. Measurement Set Up >

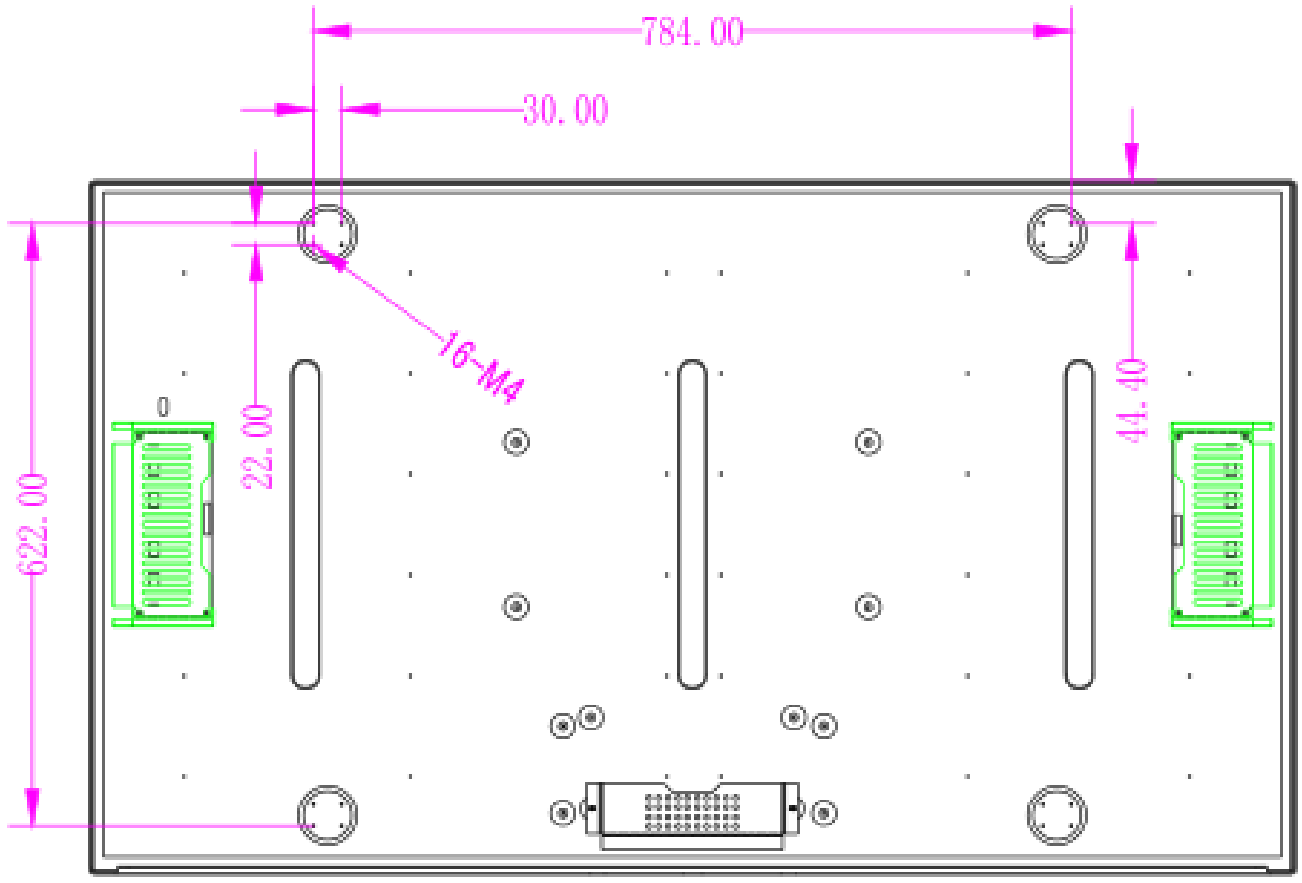



< Figure 7. Response Time Testing >



## 14.0 APPENDIX 2

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