



# SOLUTIONS

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## TFT-Display Datasheet

# FG1001T0DSSWNG01 | DataImage

### Features

|                         |                       |
|-------------------------|-----------------------|
| ■ Active Screen Area    | 216.81x135.5 [mm]     |
| ■ Size   Format         | 10,1"   16:10         |
| ■ Resolution            | 1920x1200             |
| ■ Backlight             | LED                   |
| ■ Brightness            | 800 cd/m <sup>2</sup> |
| ■ LED Life Time         | 20K (h)               |
| ■ Interface             | MIPI                  |
| ■ Viewing Angle         | L/R 85/85 - U/D 85/85 |
| ■ Touchscreen           | no                    |
| ■ Power Supply          | 3.3V [Typ.]           |
| ■ Module Outline        | 229.4x150.0x2.9 [mm]  |
| ■ Operation Temperature | -10... + 60°C         |
| ■ Storage Temperature   | -20... + 70°C         |

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# DATA IMAGE CORPORATION

## TFT Module Specification

ITEM NO.: FG1001T0DSSWNG01

Prototype  Pre-prod.  Mass prod.

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|                    |               |              |               |               |
|--------------------|---------------|--------------|---------------|---------------|
| Customer Companies | QA Approval   | QA Check     | R&D Approval  | R&D Check     |
|                    | <i>pretty</i> | <i>Andy</i>  | Dragon        | <i>Andrew</i> |
| Approved by        | Version:      | Issued Date: | Total Pages:: | Prepared by   |
|                    | 1             | 08/MAR/19'   | 28            | Candy         |

**2. RECORD OF REVISION**

| Rev | Date       | Item | Page | Comment             | Source     |
|-----|------------|------|------|---------------------|------------|
| 1   | 08/MAR/19' |      |      | Initial PRELIMINARY | ESR0802035 |
|     |            |      |      |                     |            |

### 3. GENERAL SPECIFICATIONS

| Parameter   | Specifications              | Unit |
|---|-----------------------------|------|
| Screen Size   | 10.1 (diagonal)             | inch |
| Display resolution  | 1920(H) x (R,G,B) x 1200(V) | dot  |
| Active Area   | 216.81(H) x 135.5(V)        | mm   |
| Pixel Pitch   | 0.1129(H) x 0.1129(V)       | mm   |
| Pixel Arrangement   | R.G.B. Vertical Stripe      |      |
| Outline Dimension   | 229.4(H) x150(V) x2.9(D)    | mm   |
| Surface treatment   | Glare                       |      |
| Electrical Interface  | MIPI                        |      |
| Weight  | TBD                         | g    |
| Display mode  | AHVA, Normally Black        |      |
| our components and processes are compliant to RoHS standard |                             |      |

### 4. ABSOLUTE MAXIMUM RATINGS

An absolute maximum rating of the module is as following:

#### 4.1 Absolute Ratings of TFT LCD Module

| Parameter               | Symbol          | MIN. | MAX. | Unit   | Remark   |
|-------------------------|-----------------|------|------|--------|----------|
| Logic/LCD drive Voltage | V <sub>in</sub> | -0.3 | +4.5 | [Volt] | Note 1,2 |

#### 4.2 Absolute Ratings of Environment

| Parameter             | Symbol | MIN. | MAX. | Unit  | Remark |
|-----------------------|--------|------|------|-------|--------|
| Operating Temperature | TOP    | -10  | +60  | [°C]  |        |
| Operation Humidity    | HOP    | 5    | 90   | [%RH] |        |
| Storage Temperature   | TST    | -20  | +70  | [°C]  |        |
| Storage Humidity      | HST    | 5    | 90   | [%RH] |        |

Note 1: At Ta (25°C)

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: Maximum wet-bulb temperature is less than 39 °C and no condensation

Note 4: Operating temperature means “Front and rear surface” of panel

### 5. ELECTRICAL CHARACTERISTIC

#### 5.1 TFT LCD Module

##### 5.1.1 Power Specification

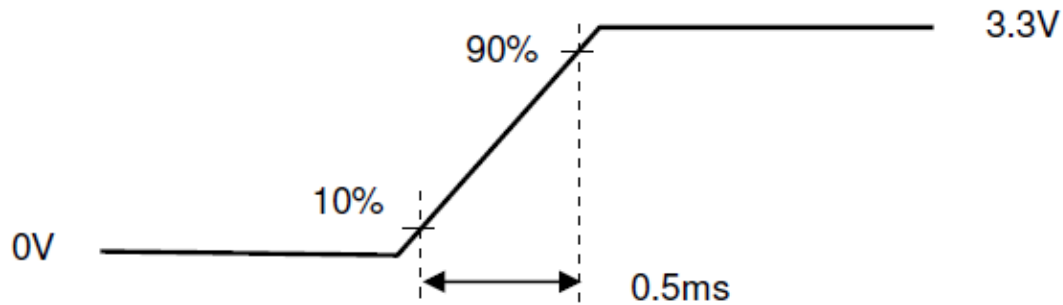
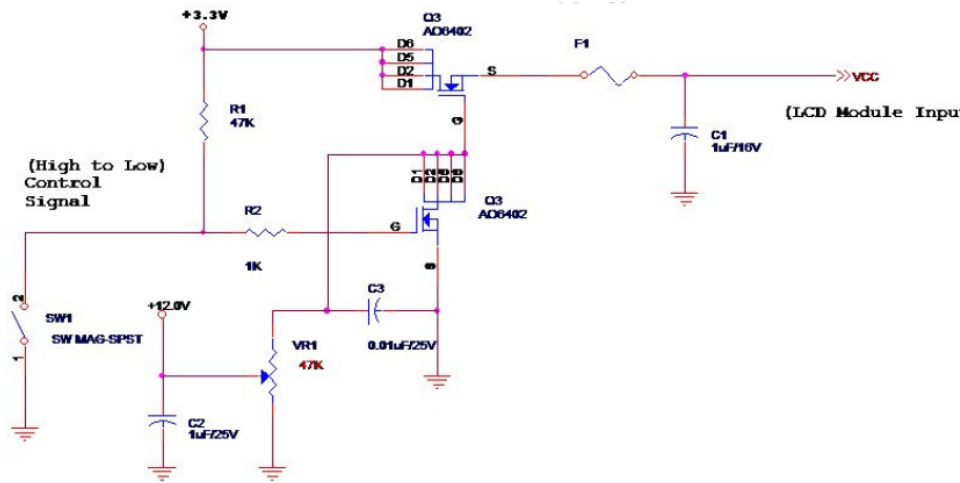
Input power specifications are as follows;

The power specification are measured under 25 and frame frequency under 60Hz

| Parameter                                | Symbol | MIN. | TYP. | MAX. | Unit        | Remark |
|--|--------|------|------|------|-------------|--------|
| Logic/LCD Drive Voltage                  | VDD    | 3.0  | 3.3  | 4.2  | [Volt]      |        |
| VDD Power                                | PDD    | -    | -    | 0.95 | [Watt]      | Note 1 |
| IDD Current                              | IDD    | -    | -    | 316  | [mA]        | Note 1 |
| Inrush Current                           | IRush  | -    | -    | 2000 | [mA]        | Note 2 |
| Allowable Logic/LCD Drive Ripple Voltage | VDDrp  | -    | -    | 100  | [mV]<br>p-p | Note 2 |

Note 1 : Maximum Measurement Condition: White Pattern at 3.3V driving voltage. ( $P_{max}=V_{3.3} \times I_{white}$ )

Note 2: Measure Condition

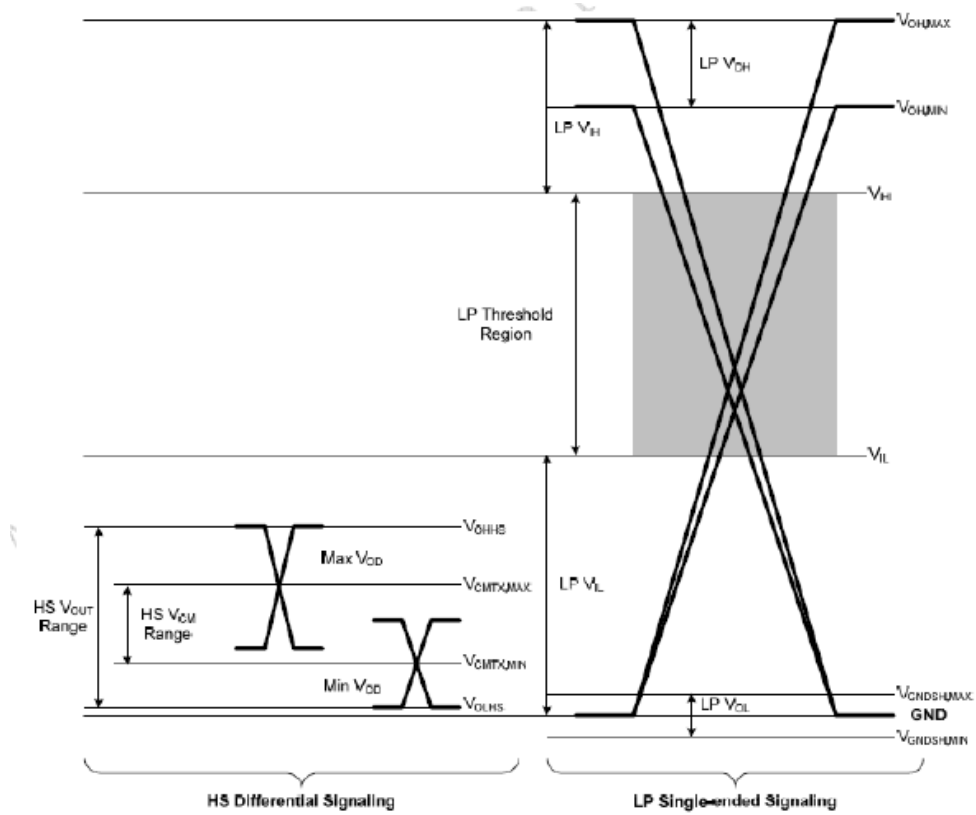

**VDD rising time**

### 5.1.2 Signal Electrical Characteristics

Input signals shall be low or High-impedance state when VDD is off.

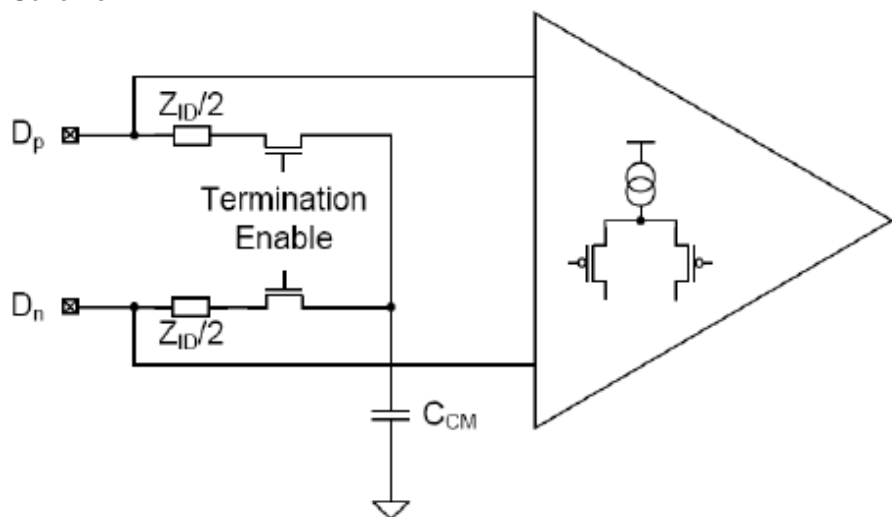
MIPI DC/AC Characteristics are as follows;

| Parameter                                      | Symbol             | MIN. | TYP. | MAX. | Unit |
|--|--------------------|------|------|------|------|
| Input data bit rate                            | BR <sub>MIPI</sub> | 200  | -    | 1000 | Mbps |
| Common-mode voltage(HS Rx mode)                | V <sub>CMRX</sub>  | 70   | -    | 330  | mV   |
| Differential input high threshold (HS Rx mode) | V <sub>IDTH</sub>  | -    | -    | 70   | mV   |
| Differential input low threshold (HS Rx mode)  | V <sub>IDTL</sub>  | -70  | -    | -    | mV   |
| Differential input voltage range (HS Rx mode)  | V <sub>IDM</sub>   | 70   | -    | 500  | mV   |
| Single-end input high voltage (HS Rx mode)     | V <sub>IHHS</sub>  | -    | -    | 460  | mV   |
| Single-end input low voltage (HS Rx mode)      | V <sub>ILHS</sub>  | -40  | -    | -    | mV   |
| Differential input impedance                   | Z <sub>ID</sub>    | 80   | 100  | 125  | Ω    |
| Logic 1 input voltage (LP Rx mode)             | V <sub>IHL</sub>   | 880  |      |      | mV   |
| Logic 0 input voltage (LP Rx mode)             | V <sub>ILL</sub>   |      |      | 550  | mV   |
| Output high level (LP Tx mode)                 | V <sub>OH</sub>    | 1.08 | 1.2  | 1.32 | V    |
| Output low level (LP Tx mode)                  | V <sub>OL</sub>    | -50  |      | 50   | mV   |



| Parameter                               | Symbol                | Conditions | MIN. | TYP. | MAX. | Unit |
|---|-----------------------|------------|------|------|------|------|
| Common-mode interference beyond 450MHz  | $\Delta V_{CMRX(HF)}$ |            | -    | -    | 100  | mV   |
| Common-mode interference 50MHz ~ 450MHz | $\Delta V_{CMRX(LF)}$ |            | -50  | -    | 50   | mV   |
| Common-mode termination                 | $C_{CM}$              |            | -    | -    | 60   | pF   |
| UI instantaneous                        | $UI_{INST}$           |            | 1    | -    | 12.5 | ns   |

## HS RX Scheme

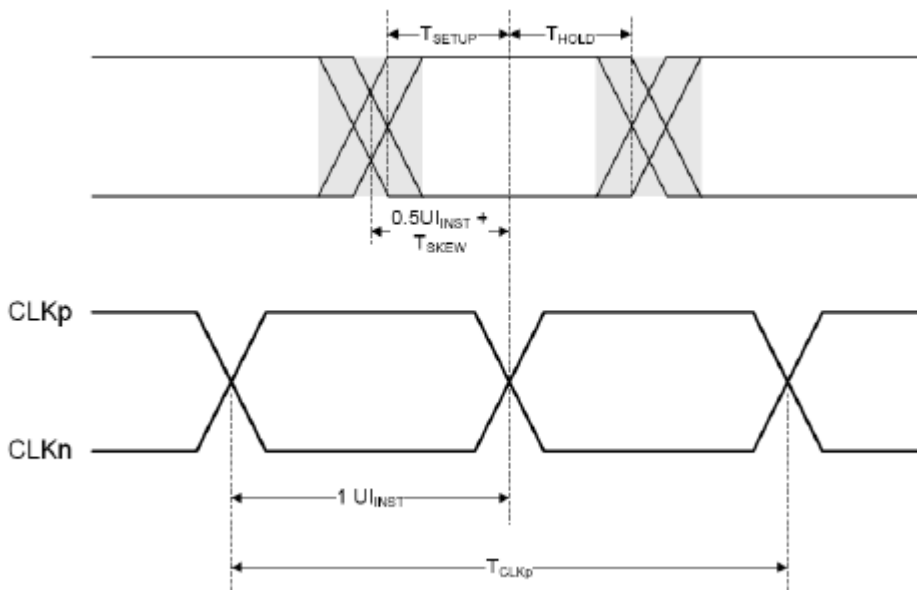


| Parameter                                    | Symbol          | MIN.  | TYP. | MAX. | Unit       | Notes |
|--|-----------------|-------|------|------|------------|-------|
| Data to Clock Skew (measured at transmitter) | $T_{SKEW[TX]}$  | -0.15 | -    | 0.15 | $U_{INST}$ | Note1 |
| Data to Clock Setup Time (receiver)          | $T_{SETUP[RX]}$ | 0.15  |      | -    | $U_{INST}$ | Note2 |
| Data to Clock Hold Time (receiver)           | $T_{HOLD[RX]}$  | 0.15  | -    | -    | $U_{INST}$ | Note2 |

Note:

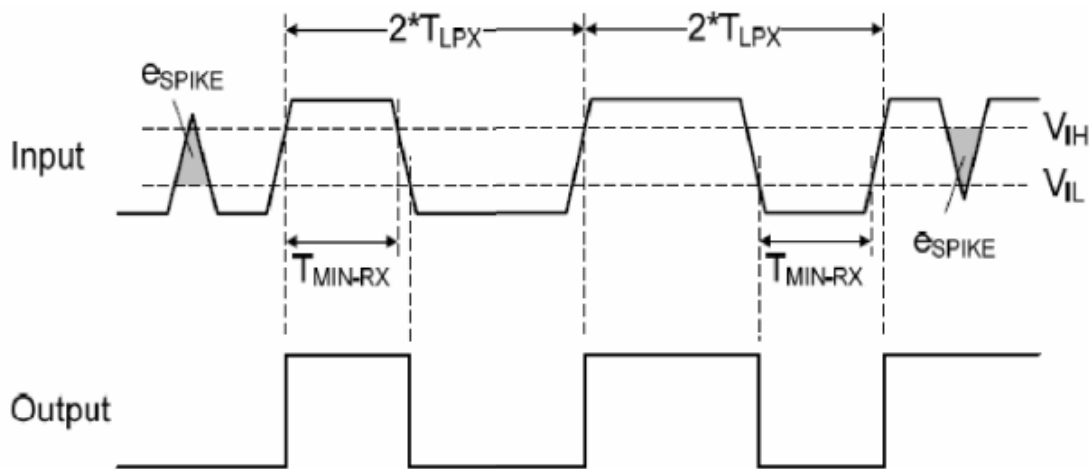
1. Total silicon and package delay budget of  $0.3 \cdot U_{INST}$
2. Total setup and hold window for receiver of  $0.3 \cdot U_{INST}$

### High Speed Data Transmission: Data to Clock Timing



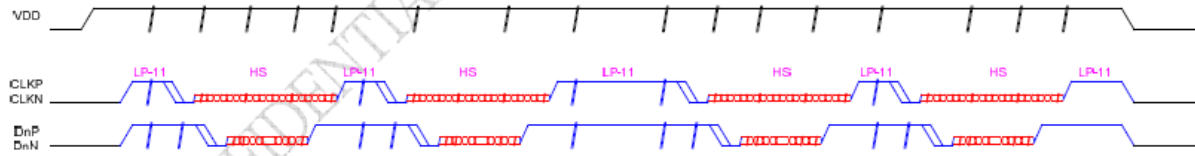
| Parameter                    | Symbol       | Conditions | MIN. | TYP. | MAX. | Unit |
|------------------------------|--------------|------------|------|------|------|------|
| Input pulse rejection        | $e_{SPIKE}$  |            | -    | -    | 300  | V.ps |
| Minimum pulse width response | $T_{MIN-RX}$ |            | 50   | -    | -    | ns   |
| Peak interference amplitude  | $V_{INT}$    |            | -    | -    | 200  | mV   |
| Interference frequency       | $f_{INT}$    |            | 450  | -    | -    | MHz  |

### Input Glitch Rejection of Low-Power Receivers



For MIPI data transmission from TX to TCON works properly in video mode, it is suggested that all of MIPI

lanes status follow the scheme showed in below. When power is turned on, all lanes (include clock lane) are into LP-11 status first. When TX wants to start transmitting data to TCON, the clock lane is into HS and start toggling. Then data lanes are into HS and data are transmitted. After data transmissions are finished (ex. H-blanking, V-blanking), the data lanes are returned to LP-11, then clock lane, too. The transmission start from LP-11 and stop in LP-11 on all lanes (include clock lane) are the recommended proper operation sequence for MIPI video mode.



The timing definitions are listed in below,

| Parameter                | Description   | MIN.          | TYP. | MAX.         | Unit |
|--------------------------|---|---------------|------|--------------|------|
| TCLK-MISS                | Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX.   |               |      | 60           | ns   |
| TCLK-POST                | Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of THS-TRAIL to the beginning of TCLK-TRAIL. | 60 ns + 52*UI |      |              | ns   |
| TCLK-PRE                 | Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.  | 8             |      |              | UI   |
| TCLK-PREPARE             | Time that the transmitter drives the Clock Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission.   | 38            |      | 95           | ns   |
| TCLK-SETTLE              | Time interval during which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of TCLK-PREPARE.   | 95            |      | 300          | ns   |
| TCLK-TERM-EN             | Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses VIL,MAX.   |               |      | 38           | ns   |
| TCLK-TRAIL               | Time that the transmitter drives the HS-0 state after the last payload clock bit of a HS transmission burst.  | 60            |      |              | ns   |
| TCLK-PREPARE + TCLK-ZERO | TCLK-PREPARE + time that the transmitter drives the HS-0 state prior to starting the Clock.   | 300           |      |              | ns   |
| TD-TERM-EN               | Time for the Data Lane receiver to enable the HS line termination, starting from the time   |               |      | 35 ns + 4*UI | ns   |

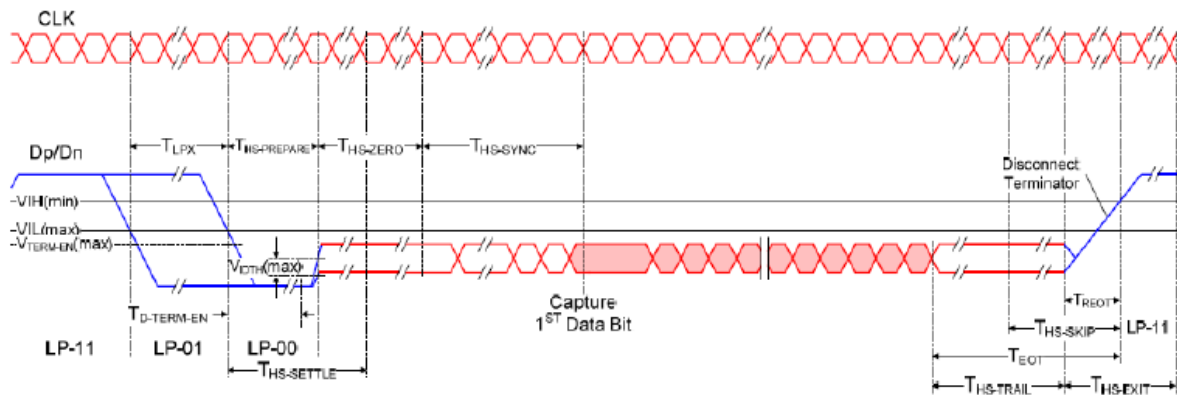


|                        |   |                |        |                |    |
|------------------------|---|----------------|--------|----------------|----|
|                        | point when Dn crosses VIL,MAX.  |                |        |                |    |
| TEOT                   | Transmitted time interval from the start of THS-TRAIL or TCLK-TRAIL, to the start of the LP-11 state following a HS burst.  |                |        | 105 ns + 12*UI | ns |
| THS-EXIT               | Time that the transmitter drives LP-11 following a HS burst.  | 100            |        |                | ns |
| THS-SYNC               | HS Sync-Sequence '00011101' period  |                | 8      |                | UI |
| THS-PREPARE            | Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission   | 40 ns + 4*UI   |        | 85 ns + 6*UI   | ns |
| THS-PREPARE + THS-ZERO | THS-PREPARE + time that the transmitter drives the HS-0 state prior to transmitting the Sync sequence.  | 145 ns + 10*UI |        |                | ns |
| THS-SETTLE             | Time interval during which the HS receiver shall ignore any Data Lane HS transitions, starting from the beginning of THS-PREPARE.   | 85 ns + 6*UI   |        | 145ns + 10*UI  | ns |
| THS-SKIP               | Time interval during which the HS-RX should ignore any transitions on the Data Lane, following a HS burst. The end point of the interval is defined as the beginning of the LP-11 state following the HS burst. | 40             |        | 55 ns + 4*UI   | ns |
| THS-TRAIL              | Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst  | 60 ns + 4*UI   |        |                | ns |
| TLPX                   | Transmitted length of any Low-Power state period  | 50             |        |                | ns |
| Ratio TLPX             | Ratio of TLPX(MASTER)/TLPX(SLAVE) between Master and Slave side   | 2/3            |        | 3/2            |    |
| TTA-GET                | Time that the new transmitter drives the Bridge state (LP-00) after accepting control during a Link Turnaround.   | 5*TLPX         |        |                | ns |
| TTA-GO                 | Time that the transmitter drives the Bridge state(LP-00) before releasing control during a Link Turnaround.   |                | 4*TLPX |                | ns |
| TTA-SURE               | Time that the new transmitter waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.  | TLPX           |        | 2*TLPX         | ns |

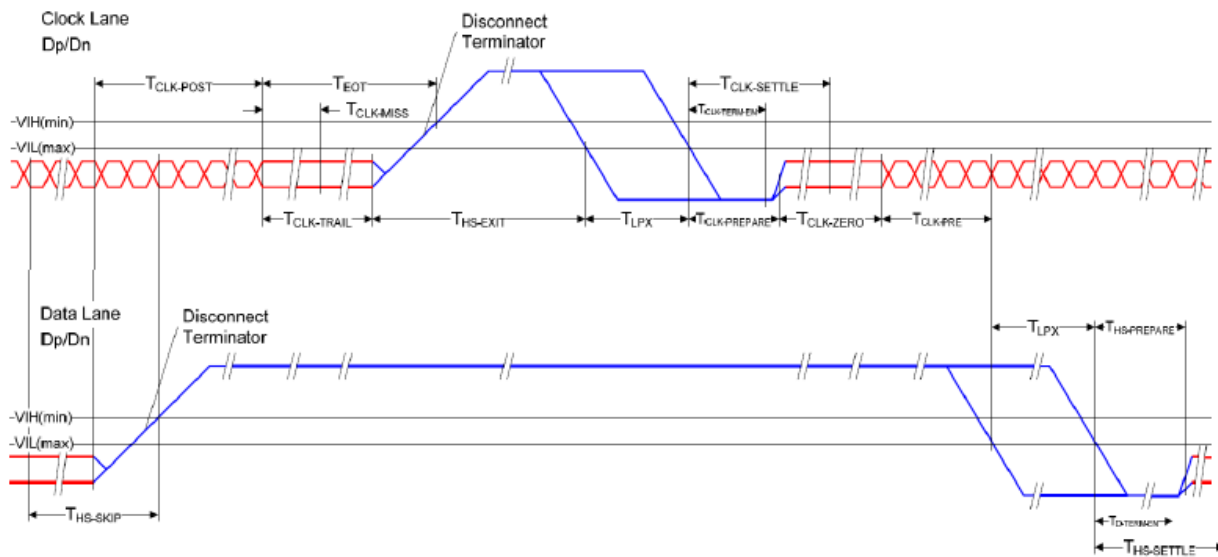
## Note:

1. The minimum value depends on the bit rate. Implementations should ensure proper operation for all the supported bit rates.
2. TLPX is an internal state machine timing reference. Externally measured values may differ slightly from the specified values due to asymmetrical rise and fall times.

## High-Speed Data Transmission in Bursts



### Switching the Clock Lane between Clock Transmission and Low-Power Mode



### Turnaround Procedure

## 5.2 Backlight Unit

### 5.2.1 LED characteristics

| Parameter                               | Symbol    | MIN.   | TYP.   | MAX. | Unit   | Condition                   |
|---|-----------|--------|--------|------|--------|-----------------------------|
| Backlight Power Consumption             | PLED      | -      | -      | 4.9  | [Watt] | (Ta=25°C @800nits)          |
| LED Life-Time                           | N/A       | 15,000 | 20,000 | -    | Hour   | (Ta=25°C @800nits)<br>Note1 |
| LED Forward Voltage                     | VF        | 5.5    | 5.65   | 5.8  | [Volt] | (Ta=25°C)                   |
| LED Forward Voltage of every LED string | VF-string | -      | -      | 34.8 | [Volt] | (Ta=25°C)<br>Note2          |
| LED Forward Current                     | IF        | -      | 20     | -    | [mA]   | (Ta=25°C)                   |

Note 1. The LED life-time define as the estimated time to 50% degradation of initial luminous.

Note2. LED Array 6 parallel \* 6 series

### 5.2.2 Backlight input signal characteristics

| Parameter                   | Symbol  | MIN. | TYP. | MAX. | Unit   | Remark   |
|-----------------------------|---------|------|------|------|--------|--|
| LED Power Supply            | VLED    | 3    |      | 12   | [Volt] | Define as Connector Interface (Ta=25°C)<br>Note1 |
| LED Enable Input High Level | VLED_EN | 1.7  | -    | 5.5  | [Volt] |  |
| LED Enable Input Low Level  |         | -    | -    | 0.8  | [Volt] |  |
| PWM Logic Input High Level  | VPWM_EN | 1.7  | -    | 5.5  | [Volt] |  |
| PWM Logic Input Low Level   |         | -    | -    | 0.8  | [Volt] |  |
| PWM Input Frequency         | FPWM    | 200  | -    | 10K  | Hz     |  |
| PWM Duty Ratio              | Duty    | 1    |      | 100  | %      |  |

Note 1: The input high level voltage conversion to 2.5V by level shift circuit.

Note 2: The LED PWM Logic Input Low Level Voltage must have an output impedance close to 0 ohm in front of input connector.

## 6. INPUT SIGNAL CHARACTERISTICS

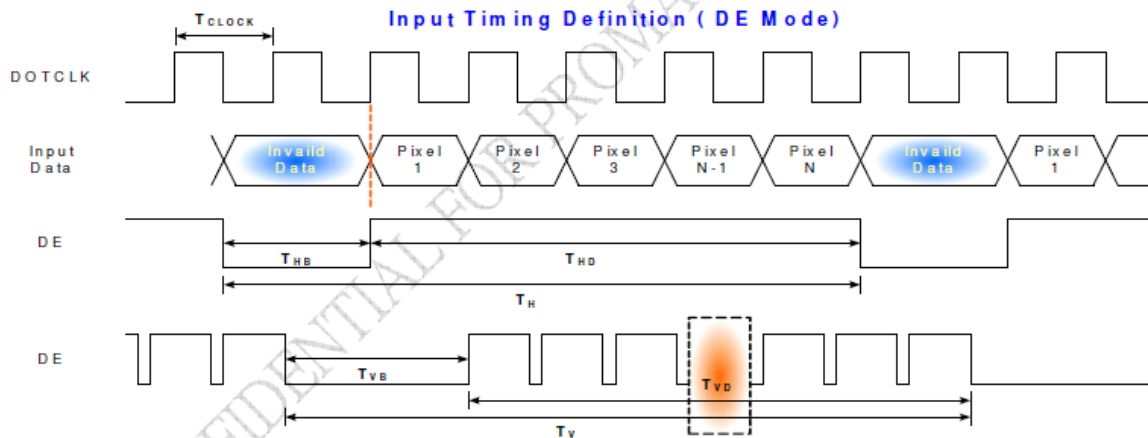
### 6.1 Timing Characteristics

Basically, interface timings should match the 1920x1200 /60Hz manufacturing guide line timing.

| Parameter          |          | Symbol                | MIN.   | TYP.  | MAX.   | Unit               |
|--------------------|----------|-----------------------|--------|-------|--------|--------------------|
| Frame Rate         |          | -                     | -      | 60    | -      | Hz                 |
| Clock frequency    |          | 1/ T <sub>clock</sub> | 148.04 | 149.9 | 151.27 | MHz                |
| Vertical Section   | Period   | T <sub>V</sub>        | 1206   | 1212  | 1218   | T <sub>Line</sub>  |
|                    | Active   | T <sub>VD</sub>       | 1200   |       |        |                    |
|                    | Blanking | T <sub>VB</sub>       | 6      | 12    | 18     |                    |
| Horizontal Section | Period   | T <sub>H</sub>        | 2046   | 2058  | 2070   | T <sub>clock</sub> |
|                    | Active   | T <sub>HD</sub>       | 1920   |       |        |                    |
|                    | Blanking | T <sub>HB</sub>       | 126    | 138   | 150    |                    |

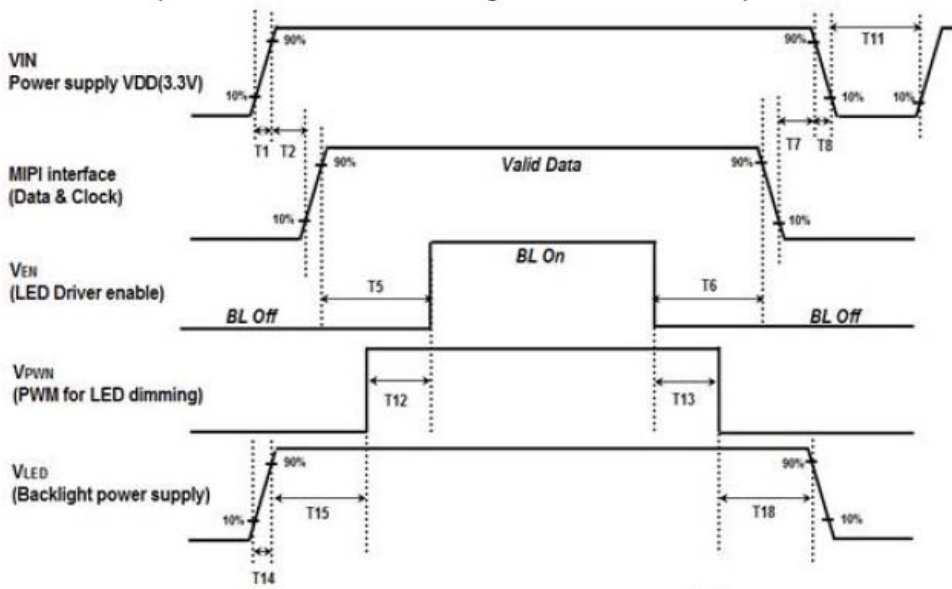
Note : DE mode only

### 6.1.2 Timing diagram



### 6.2 Power ON/OFF Sequence

Power on/off sequence is as follows. Interface signals and LED on/off sequence are also shown in the chart.



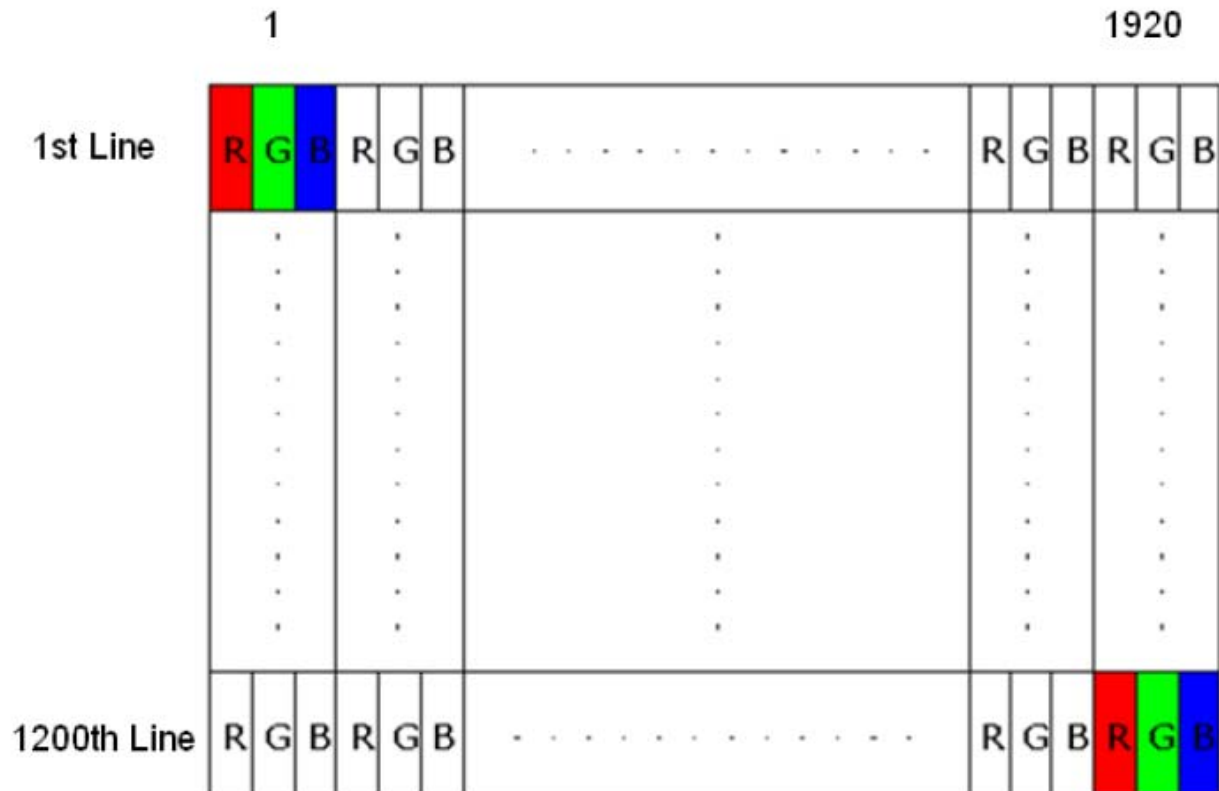
| Power Sequence Timing |       |      |       |
|-----------------------|-------|------|-------|
| Parameter             | Value |      | Units |
|                       | MIN.  | MAX. |       |
| T1                    | 0.5   | 10   | ms    |
| T2                    | 40    | -    |       |
| T5                    | 120   | -    |       |
| T6                    | 50    | -    |       |
| T7                    | 0     | -    |       |
| T8                    | 0     | 10   |       |
| T11                   | 500   | -    |       |
| T12                   | 10    | -    |       |
| T13                   | 10    | -    |       |
| T14                   | 0.5   | 10   |       |
| T15                   | 10    | -    |       |
| T18                   | 10    | -    |       |

Note: LED\_PWM must be pull low(GND) when it is not pull high.

### 6.3 Signal Interface Characteristic

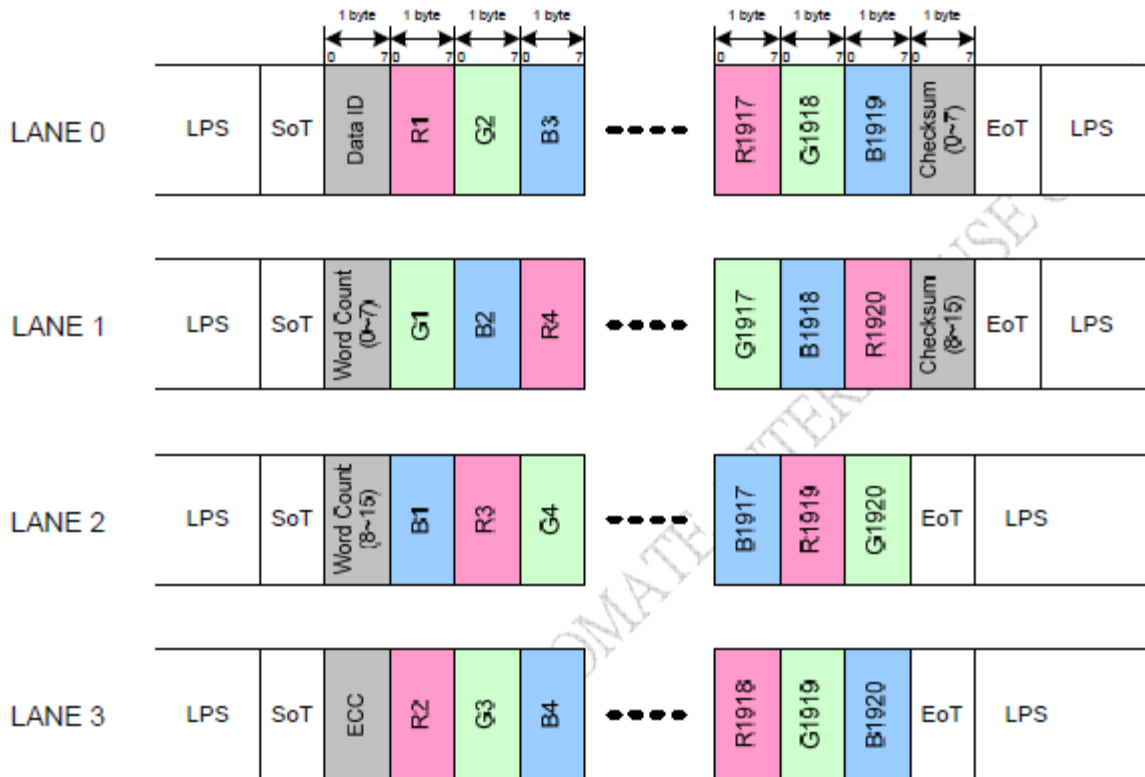
#### 6.3.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.



### 6.3.2 The Input Data Format

Input Pixel Stream Format (1920RGB in 4 Lanes with RGB 8-8-8 format)



LPS : Low Power State  
 SoT : Start of Transmission  
 EoT : End of Transmission  
 ECC : Error-Correcting Code

### 6.4 Integration Interface Requirement

#### 6.4.1 MIPI Connector Description

Physical interface is described as for the connector on module.

These connectors are capable of accommodating the following signals and will be following components.

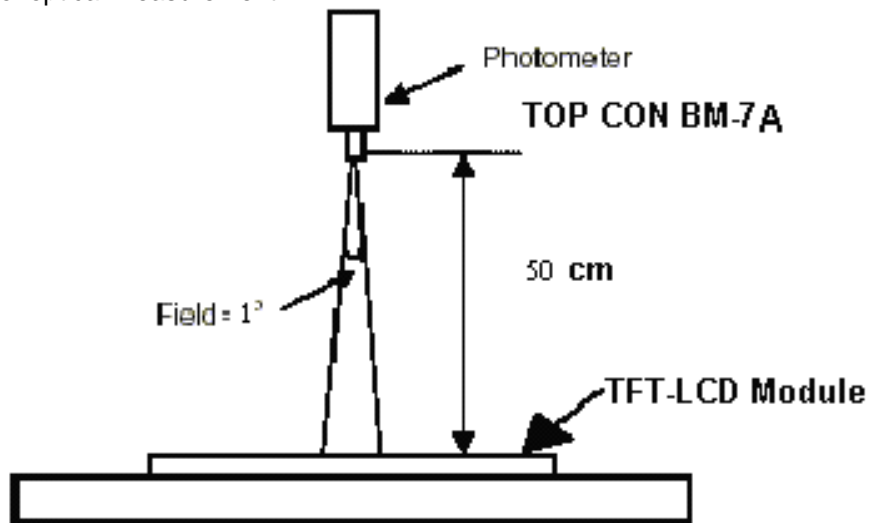
| Connector Name / Designation | For Signal Connector               |
|------------------------------|------------------------------------|
| Manufacturer                 | HIROSE                             |
| Type / Part Number           | FH34SJ-34S-0.5SH(50) or compatible |
| Mating Housing/Part Number   | FPC Cable                          |

### 7. OPTICAL CHARACTERISTIC

| Parameter                | Symbol          | Condition                            | MIN. | TYP. | MAX. | Unit              | Remarks  |
|--------------------------|-----------------|--------------------------------------|------|------|------|-------------------|----------|
| Viewing Angle<br>(CR≥10) | [degree]        | Horizontal (Right)<br>CR = 10 (Left) | 80   | 85   | -    | deg               | Note 1,4 |
|                          | [degree]        | Horizontal (Right)<br>CR = 10 (Left) | 80   | 85   | -    |                   |          |
|                          | [degree]        | Vertical (Upper)<br>CR = 10 (Lower)  | 80   | 85   | -    |                   |          |
|                          | [degree]        | Vertical (Upper)<br>CR = 10 (Lower)  | 80   | 85   | -    |                   |          |
| Contrast Ratio           | CR              | Normal<br>$\theta=\Phi=0^\circ$      | 600  | 800  | -    |                   | Note 1,3 |
| Response time            | T <sub>ON</sub> |                                      | -    | 25   | 35   | ms                | Note 1,6 |
| Color chromaticity       | Red x           |                                      | TBD  | TBD  | TBD  | -                 | Note 1,7 |
|                          | Red y           |                                      | TBD  | TBD  | TBD  | -                 |          |
|                          | Green x         |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | Green y         |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | Blue x          |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | Blue y          |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | White x         |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | White y         |                                      | TBD  | TBD  | TBD  |                   |          |
| Luminance                | L               |                                      | 600  | 800  | -    | Cd/m <sup>2</sup> | Note 1,2 |
| Luminance uniformity     | B-uni           | 5 points                             | 70   |      | -    | %                 | Note1,5  |
| Image sticking           |                 | tis                                  |      |      | 2    | Sec               | Note 8   |

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance ≤1 lux, and at room temperature). The operation temperature is 25°C±2°C. The measurement method is shown in Note1.

Note1: The method of optical measurement:

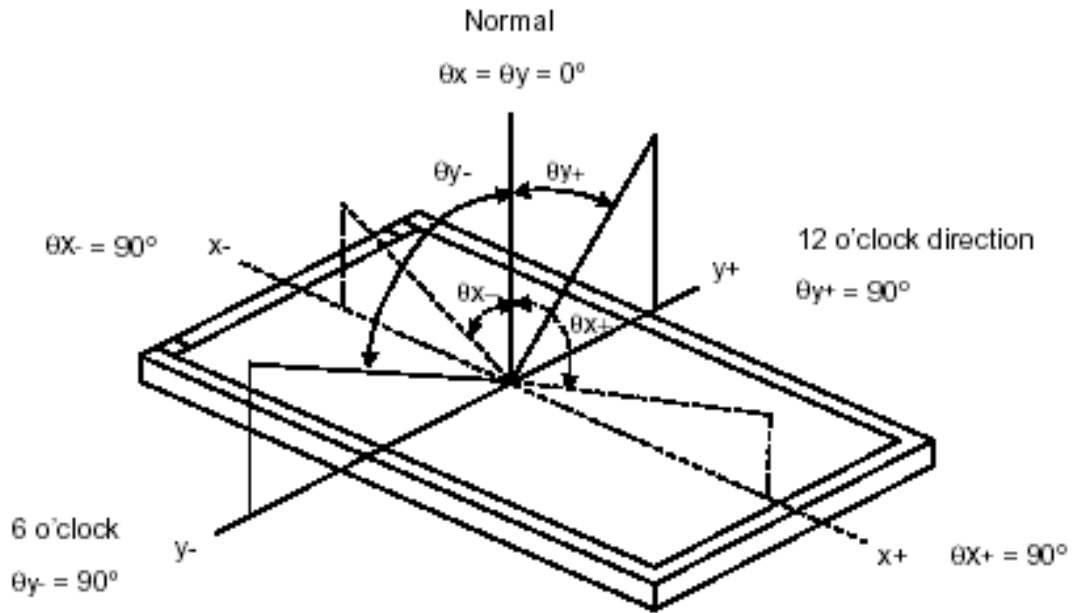


Note2: Measured at the center area of the panel and at the viewing angle of the  $\theta_x=\theta_y=0^\circ$

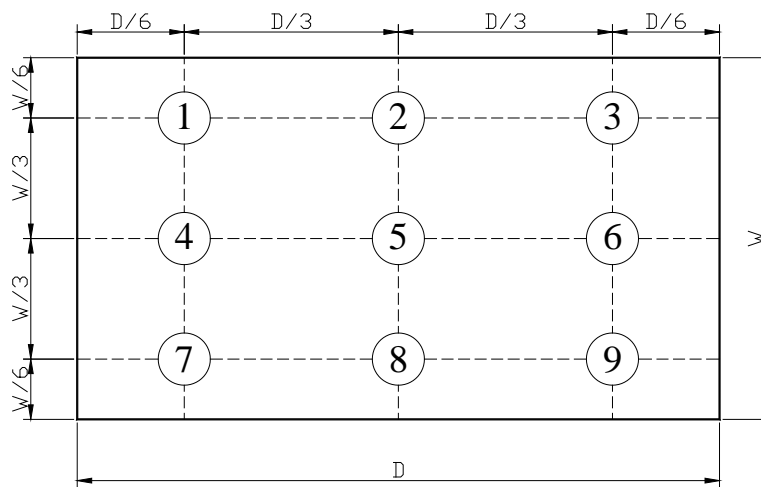
Note3: Definition of Contrast Ratio (CR):

$$CR = \frac{\text{Luminance with all pixels in white state}}{\text{Luminance with all pixels in Black state}}$$

Note4: Definition of Viewing Angle



Note 5: Definition of Brightness Uniformity (B-uni):

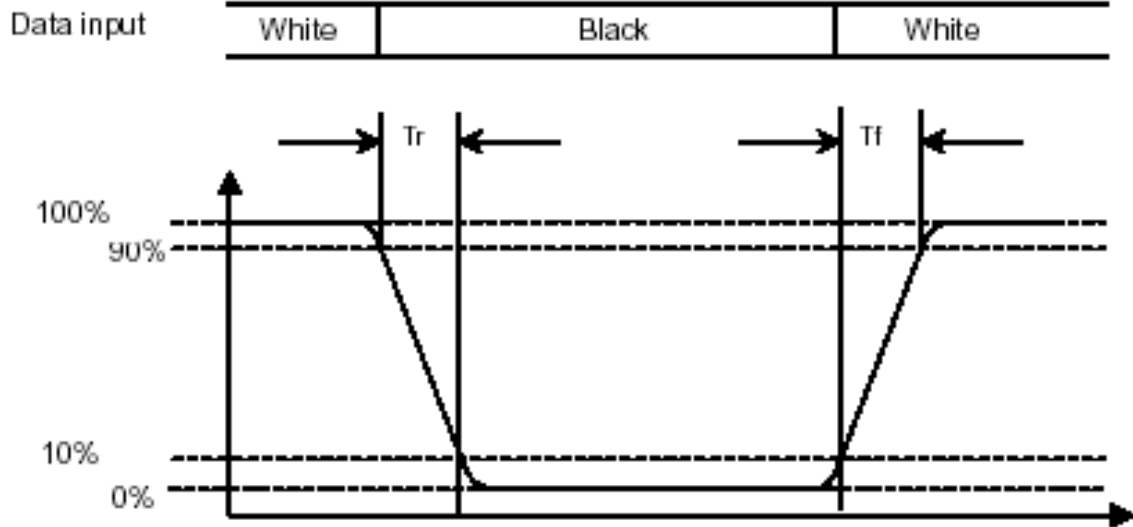


$$B\text{-uni} = \frac{\text{Minimum luminance of 9 points}}{\text{Maximum luminance of 9 points}} \quad (\text{Note 5}).$$

Note6: Definition of Response Time:

The Response Time is set initially by defining the "Rising Time ( $T_r$ )" and the "Falling Time ( $T_f$ )" respectively.  $T_r$  and  $T_f$  are defined as following figure.





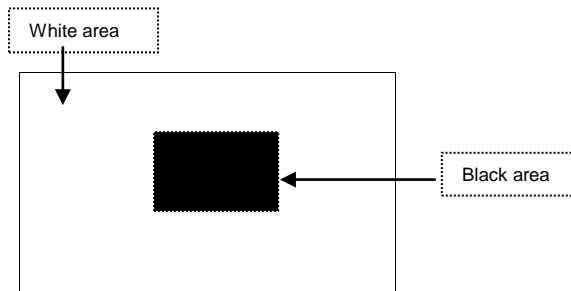
Note 7: Definition of Chromaticity:

The color coordinates  $(x_W, y_W)$ ,  $(x_R, y_R)$ ,  $(x_G, y_G)$ , and  $(x_B, y_B)$  are obtained with all pixels in the viewing field at white, red, green, and blue states, respectively.

Note 8: Definition of Image sticking (tis):

Continuously display the test pattern shown in the figure below for 2 hours. Then display a completely white screen. The previous image shall not persist more than 2 sec at 25 °C

**Image sticking pattern**

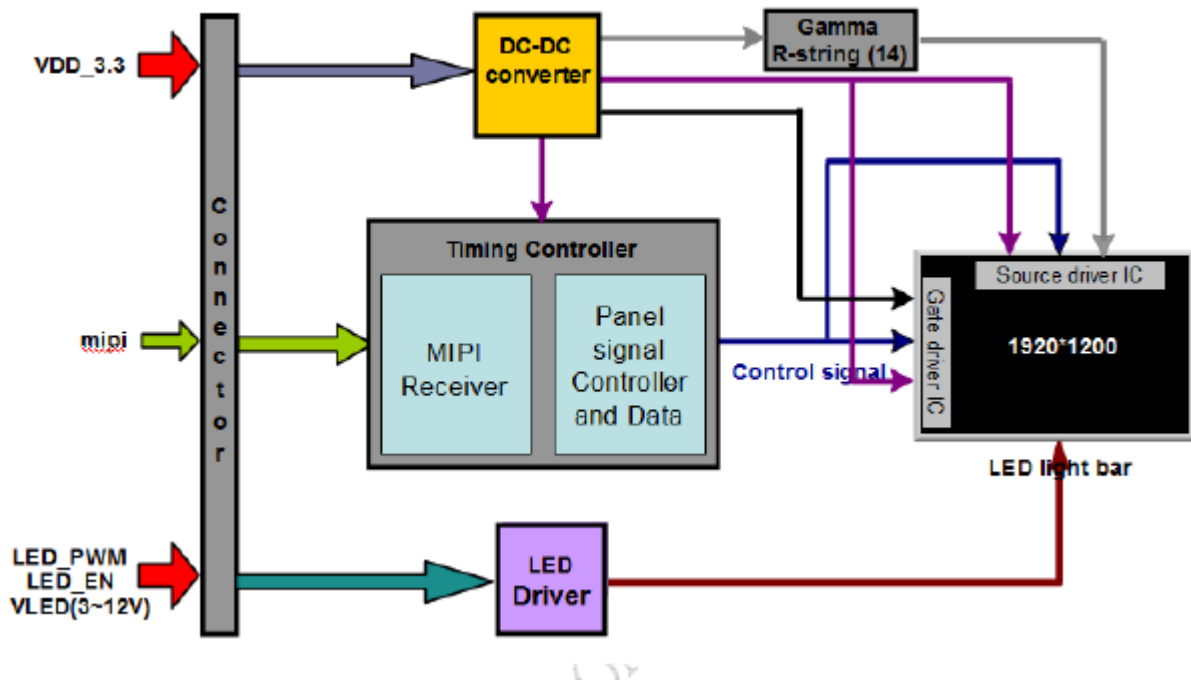


## 8. PIN CONNECTIONS

| Pin No | Symbol           | Function                           | Remark |
|--------|------------------|------------------------------------|--------|
| 1      | VDD              | DC-DC circuit supply voltage       |        |
| 2      | VDD              | DC-DC circuit supply voltage       |        |
| 3      | Hsync            | Yoe signal output to system        |        |
| 4      | LED_EN           | LED driver Enable Input            |        |
| 5      | LED_PWM          | Backlight LED driver PWM Input     |        |
| 6      | ID               | Pull high (10Kohm to 1.8V)         |        |
| 7      | ID               | Pull high (10Kohm to 1.8V)         |        |
| 8      | NC               | Not Connection                     |        |
| 9      | GND              | Ground                             |        |
| 10     | DSI_D2P/Rx-IN2P  | MIPI data pair 2 positive signal   |        |
| 11     | DSI_D2N/Rx-IN2N  | MIPI data pair 2 negative signal   |        |
| 12     | GND              | Ground                             |        |
| 13     | DSI_D1P/Rx-IN1P  | MIPI data pair 1 positive signal   |        |
| 14     | DSI_D1N/Rx-IN1N  | MIPI data pair 1 negative signal   |        |
| 15     | GND              | Ground                             |        |
| 16     | DSI_CLKP/Rx-CLKP | MIPI Clock positive signal         |        |
| 17     | DSI_CLKN/Rx-CLKN | MIPI Clock negative signal         |        |
| 18     | GND              | Ground                             |        |
| 19     | DSI_D0P/Rx-IN0P  | MIPI data pair 0 positive signal   |        |
| 20     | DSI_D0N/Rx-IN0N  | MIPI data pair 0 negative signal   |        |
| 21     | GND              | Ground                             |        |
| 22     | DSI_D3P/Rx-IN3P  | MIPI data pair 3 positive signal   |        |
| 23     | DSI_D3N/Rx-IN3N  | MIPI data pair 3 negative signal   |        |
| 24     | GND              | Ground                             |        |
| 25     | GND              | Ground                             |        |
| 26     | GND              | Ground                             |        |
| 27     | GND              | Ground                             |        |
| 28     | ID               | Pull low (4.7Kohm to Ground)       |        |
| 29     | Aging            | Aging Mode Power Supply (AUO only) |        |
| 30     | NC               | Not Connection                     |        |

|    |      |                  |  |
|----|------|------------------|--|
| 31 | LED+ | LED Power Supply |  |
| 32 | LED+ | LED Power Supply |  |
| 33 | LED+ | LED Power Supply |  |
| 34 | LED+ | LED Power Supply |  |

## 9. BLOCK DIAGRAM



## 10. QUALITY ASSURANCE

### 10.1 Test Condition

#### 10.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 25 ± 5°C

Humidity : 65 ± 5%

#### 10.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

#### 10.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

#### 10.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

#### 10.1.5 Test Method

| Reliability Test Item & Level |  |  | Remark        |
|-------------------------------|--|--|---------------|
| No.                           | Item                                     | Test Conditions  |               |
| 1                             | High Temperature Storage Test            | Ta = 70°C 300Hr  | IEC60068-2-2  |
| 2                             | Low Temperature Storage Test             | Ta = -20°C 300Hr   | IEC60068-2-1  |
| 3                             | High Temperature Operation Test          | Ts = 60°C 300Hr  | IEC60068-2-2  |
| 4                             | Low Temperature Operation Test           | Ta = -10°C 300Hr   | IEC60068-2-1  |
| 5                             | Operate at High Temperature and Humidity | 40 °C /90%,300Hr   | IEC60068-2-3  |
| 6                             | Thermal Shock                            | -10 °C /30 min , 60 °C /30 min , 20cycles  | IEC60068-2-14 |
| 7                             | Vibration Test                           | Acceleration: 1.5 G<br>Frequency: 10 - 500Hz Random<br>Sweep: 30 Minutes each Axis (X, Y, Z)<br>Test method: Non-Operation | IEC60068-2-6  |
| 8                             | Drop test (Package)                      | Height :60cm<br>1 conner,3edges,6surfaces  | IEC60068-2-32 |
| 9                             | ESD                                      | State: operating<br>Location: LCM/TP surface<br>Condition:150pf 330Ω<br>Contact +/- 8kV Air +/-15kV<br>Criteria: Class B   | IEC61000-4-2  |

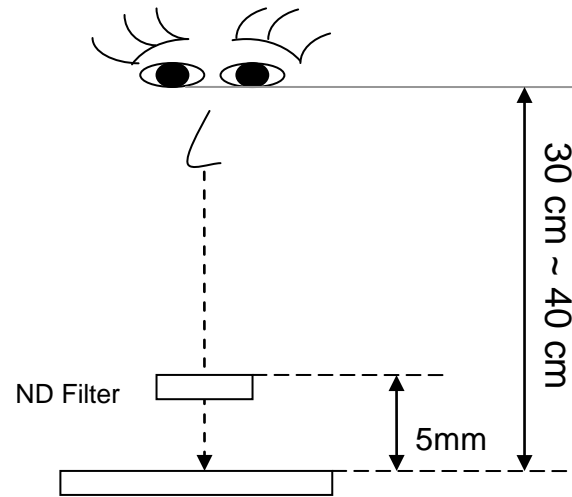
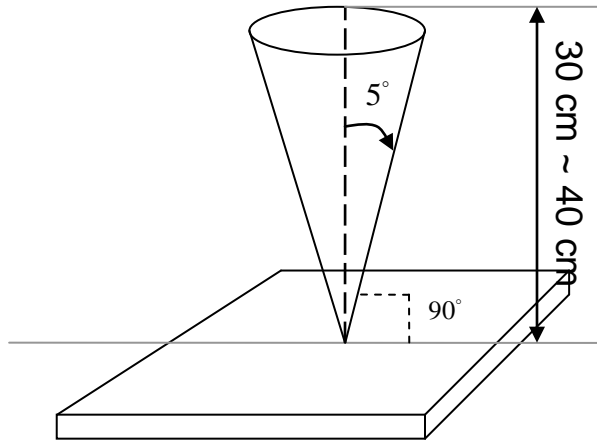
## 10.2 Inspection condition

### 10.2.1 Inspection conditions

10.2.1.1 Inspection Distance :  $35 \pm 5$  cm

10.2.1.2 View Angle :

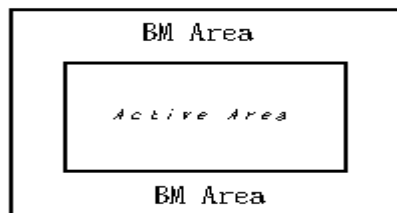
- (1) Inspection under operating condition :  $\pm 5^\circ$
- (2) Inspection under non-operating condition :  $\pm 45^\circ$



### 10.2.2 Environment conditions :

|                       |                       |                          |
|-----------------------|-----------------------|--------------------------|
| Ambient Temperature : |                       | $25 \pm 5^\circ\text{C}$ |
| Ambient Humidity :    |                       | $65 \pm 5\%$             |
| Ambient Illumination  | Cosmetic Inspection   | 400 ~ 600lux             |
|                       | Functional Inspection | 300 ~ 500lux             |

### 10.2.3 Definition of applicable Zones



**10.3 Inspection Parameters**

| No.   | Parameter                              | Criteria  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|---|--|---|-------------------|-------------------|-------------------------------------|------------------|-------------------------------------|--------|--|-----|--|-----|---|---|-----------------|---|---------------|---|
| 1   | Operating                              | Display function: No Display malfunction (Major)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Contrast ratio (Black, White):<br>Does not meet specified range in the spec. (Major) (Note:3)   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Line Defect: No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major) (Note:1)   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Point Defect (Red, green, blue, dark): Active area $\leq 8$ dots (Minor)(Note:1)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | <table border="1"> <thead> <tr> <th>Item</th> <th>Acceptable number</th> <th>Total</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td>Bright</td> <td>3</td> <td rowspan="4">6</td> <td rowspan="4">Minor</td> <td rowspan="4">1.5</td> </tr> <tr> <td>Dark</td> <td>5</td> </tr> <tr> <td>Adjacent Bright</td> <td>1</td> </tr> <tr> <td>Adjacent Dark</td> <td>2</td> </tr> </tbody> </table>  | Item              | Acceptable number | Total                               | Class Of Defects | AQL Level                           | Bright | 3  | 6   | Minor  | 1.5 | Dark                                      | 5 | Adjacent Bright | 1 | Adjacent Dark | 2 |
|   |  | Item  | Acceptable number | Total             | Class Of Defects                    | AQL Level        |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Bright  | 3                 | 6                 | Minor                               | 1.5              |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Dark  | 5                 |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Adjacent Bright   | 1                 |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Adjacent Dark   | 2                 |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| Non-uniformity:<br>Visible through 2%ND filter white, R, G, B and gray 50%pattern. (Minor)  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| Foreign material in Black or White spots shape ( $W > 1/4L$ ) (Note: 5)   |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| <table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td><math>D \leq 0.5</math></td> <td>*</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td><math>0.5 &lt; D \leq 1.0</math></td> <td>4</td> </tr> <tr> <td><math>D &gt; 1.0</math></td> <td>0</td> </tr> </tbody> </table>   | Dimension                              | Acceptable number   | Class Of Defects  | AQL Level         | $D \leq 0.5$                        | *                | Minor                               | 1.5    | $0.5 < D \leq 1.0$                                       | 4   | $D > 1.0$  | 0   |   |   |                 |   |               |   |
| Dimension   | Acceptable number                      | Class Of Defects  | AQL Level         |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D \leq 0.5$  | *                                      | Minor   | 1.5               |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $0.5 < D \leq 1.0$  | 4                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D > 1.0$   | 0                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D = (\text{Long} + \text{Short}) / 2$ * : Disregard  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| Foreign Material in Line or spiral shape ( $W \leq 1/4L$ ) (Note: 4)  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| <table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td><math>W &gt; 0.3\text{mm}, L &gt; 10\text{mm}</math></td> <td>0</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td><math>L \leq 10\text{mm}, 0.2\text{mm} &lt; W \leq 0.3\text{mm}</math></td> <td>4</td> </tr> <tr> <td><math>L \leq 10\text{mm}, W \leq 0.2\text{mm}</math></td> <td>*</td> </tr> </tbody> </table> | Dimension                              | Acceptable number   | Class Of Defects  | AQL Level         | $W > 0.3\text{mm}, L > 10\text{mm}$ | 0                | Minor                               | 1.5    | $L \leq 10\text{mm}, 0.2\text{mm} < W \leq 0.3\text{mm}$ | 4   | $L \leq 10\text{mm}, W \leq 0.2\text{mm}$                | *   |   |   |                 |   |               |   |
| Dimension   | Acceptable number                      | Class Of Defects  | AQL Level         |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $W > 0.3\text{mm}, L > 10\text{mm}$   | 0                                      | Minor   | 1.5               |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $L \leq 10\text{mm}, 0.2\text{mm} < W \leq 0.3\text{mm}$  | 4                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $L \leq 10\text{mm}, W \leq 0.2\text{mm}$   | *                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| L : Length W : Width * : Disregard  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| 2   | External Inspection<br>(non-operating) | Dimension: Outline (Major)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Bezel appearance: uneven (Minor)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Scratch on the Polarize & Touch Panel : (Note:2)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | <table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td><math>W &gt; 0.3\text{mm}, L &gt; 10\text{mm}</math></td> <td>0</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td><math>L \leq 10\text{mm}, 0.2\text{mm} &lt; W \leq 0.3\text{mm}</math></td> <td>4</td> </tr> <tr> <td><math>L \leq 10\text{mm}, W \leq 0.2\text{mm}</math></td> <td>*</td> </tr> </tbody> </table> | Dimension         | Acceptable number | Class Of Defects                    | AQL Level        | $W > 0.3\text{mm}, L > 10\text{mm}$ | 0      | Minor  | 1.5 | $L \leq 10\text{mm}, 0.2\text{mm} < W \leq 0.3\text{mm}$ | 4   | $L \leq 10\text{mm}, W \leq 0.2\text{mm}$ | * |                 |   |               |   |
|   |  | Dimension   | Acceptable number | Class Of Defects  | AQL Level                           |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | $W > 0.3\text{mm}, L > 10\text{mm}$   | 0                 | Minor             | 1.5                                 |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | $L \leq 10\text{mm}, 0.2\text{mm} < W \leq 0.3\text{mm}$  | 4                 |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $L \leq 10\text{mm}, W \leq 0.2\text{mm}$   | *                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| L : Length W : Width * : Disregard  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| Dent and spots shape on the polarize (Note:2): (Note: 5)  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| <table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td><math>D \leq 0.5</math></td> <td>*</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td><math>0.5 &lt; D \leq 1.0</math></td> <td>4</td> </tr> <tr> <td><math>D &gt; 1.0</math></td> <td>0</td> </tr> </tbody> </table>   | Dimension                              | Acceptable number   | Class Of Defects  | AQL Level         | $D \leq 0.5$                        | *                | Minor                               | 1.5    | $0.5 < D \leq 1.0$                                       | 4   | $D > 1.0$  | 0   |   |   |                 |   |               |   |
| Dimension   | Acceptable number                      | Class Of Defects  | AQL Level         |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D \leq 0.5$  | *                                      | Minor   | 1.5               |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $0.5 < D \leq 1.0$  | 4                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D > 1.0$   | 0                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |

|  |  |  |
|--|--|--|
|  |  | $D = (Long + Short) / 2$ * : Disregard |
|--|--|--|

| Class of defects | Definition |  |
|------------------|------------|--|
|                  | AQL 0.65   | It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function. |
|                  | AQL 1.5    | It is a defect that will not result in functioning problem with deviation classified.  |

Note:1.(a)Bright point defect is defined as point defect of R,G,B with area >1/2 pixel respectively

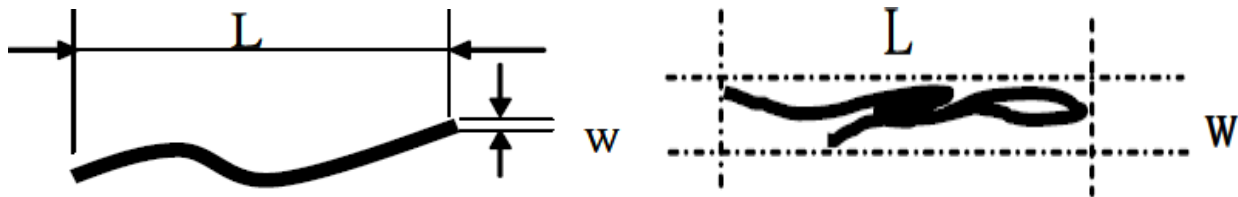
(b)Dark point defect is defined as visible in full white pattern.

(c)The point defect must under 2% ND Filter visible .

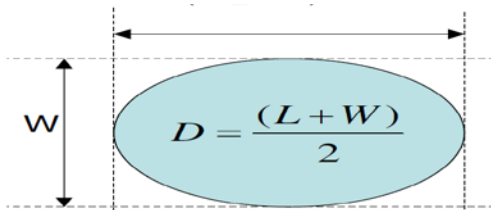
Note:2 The external inspection should be conducted at the distance  $30 \pm 5$ cm between the eyes of inspector and the panel .

Note:3 Luminance measurement for contrast ratio is at the distance  $50 \pm 5$ cm between the detective head and the panel with ambient luminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

Note:4 W-Width in mm , L-length of Max.(L1,L2) in mm.



Note:5 Spot Foreign Material ( $W \geq L/4$ )



#### 10.4 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

Lot size: Quantity of shipment lot per model.

Sampling type: normal inspection, single sampling

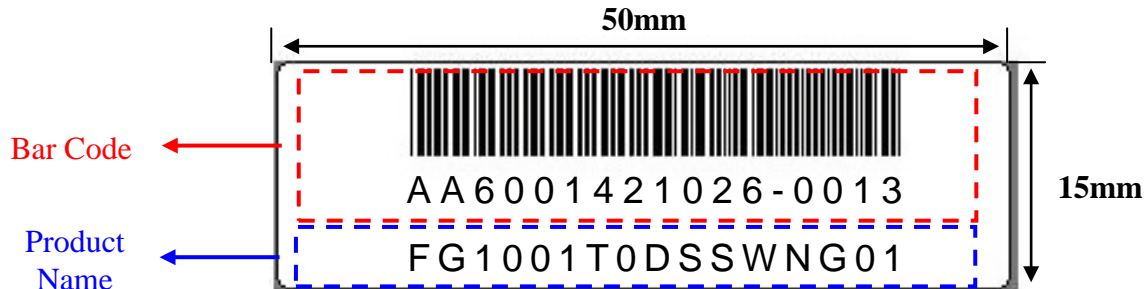
Sampling table: ISO 2859

Inspection level: Level II



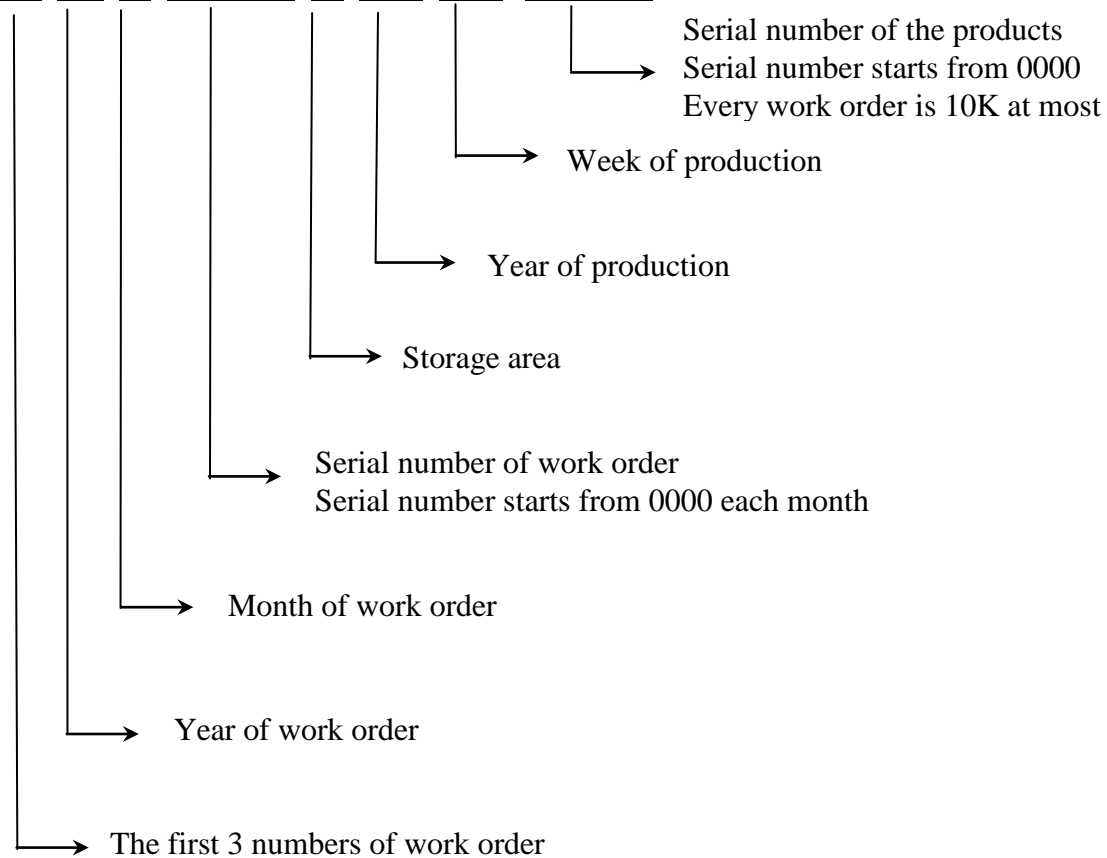
## 11. LCM PRODUCT LABEL DEFINE

Product Label style:

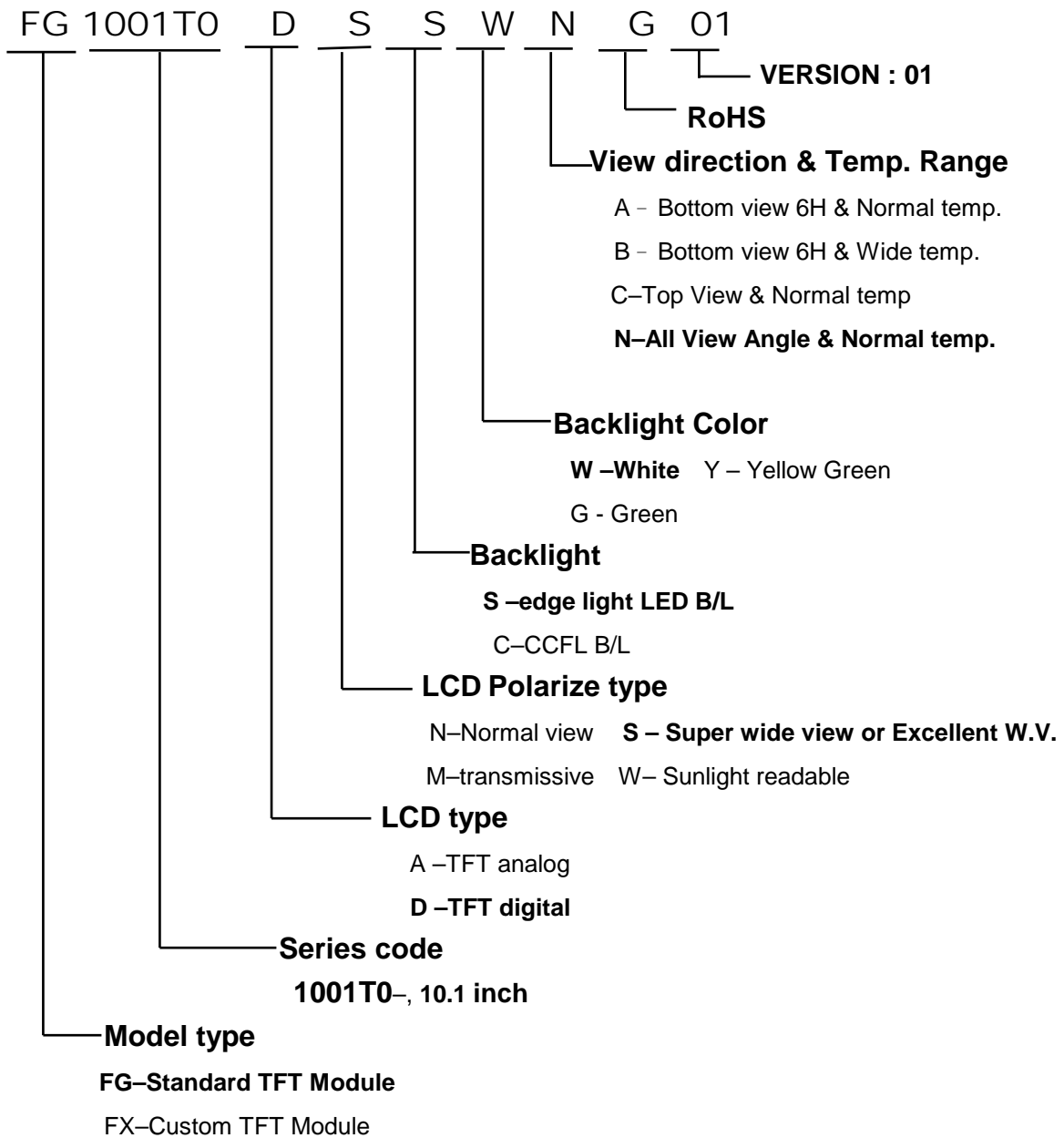


BarCode Define:

**A A 6 0014 2 10 26-0013**



**Product Name Define:**



## 12. PRECAUTIONS IN USE LCM

### 1. ASSEMBLY PRECAUTIONS

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) 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.
- (4) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (5) Do not open the case because inside circuits do not have sufficient strength.
- (6) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
- (7) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
- (8) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

### 2. OPERATING PRECAUTIONS

- (1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
- (2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification
- (3) 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.
- (4) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (5) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (6) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.

### 3. ELECTROSTATIC DISCHARGE CONTROL

- (1) The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such the copper leads on the PCB and the interface terminals with any parts of the human body.

- (2) The modules should be kept in antistatic bags or other containers resistant to static for storage.
- (3) Only properly grounded soldering irons should be used.
- (4) If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
- (5) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended
- (6) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

### 4. STORAGE PRECAUTIONS

- (1) When you store LCDs for a long time, it is recommended to keep the temperature between 0°C-40°C without the exposure of sunlight and to keep the humidity less than 90%RH.
- (2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C 90%RH
- (3) Please do not leave the LCDs in the environment of low temperature; below -20°C.

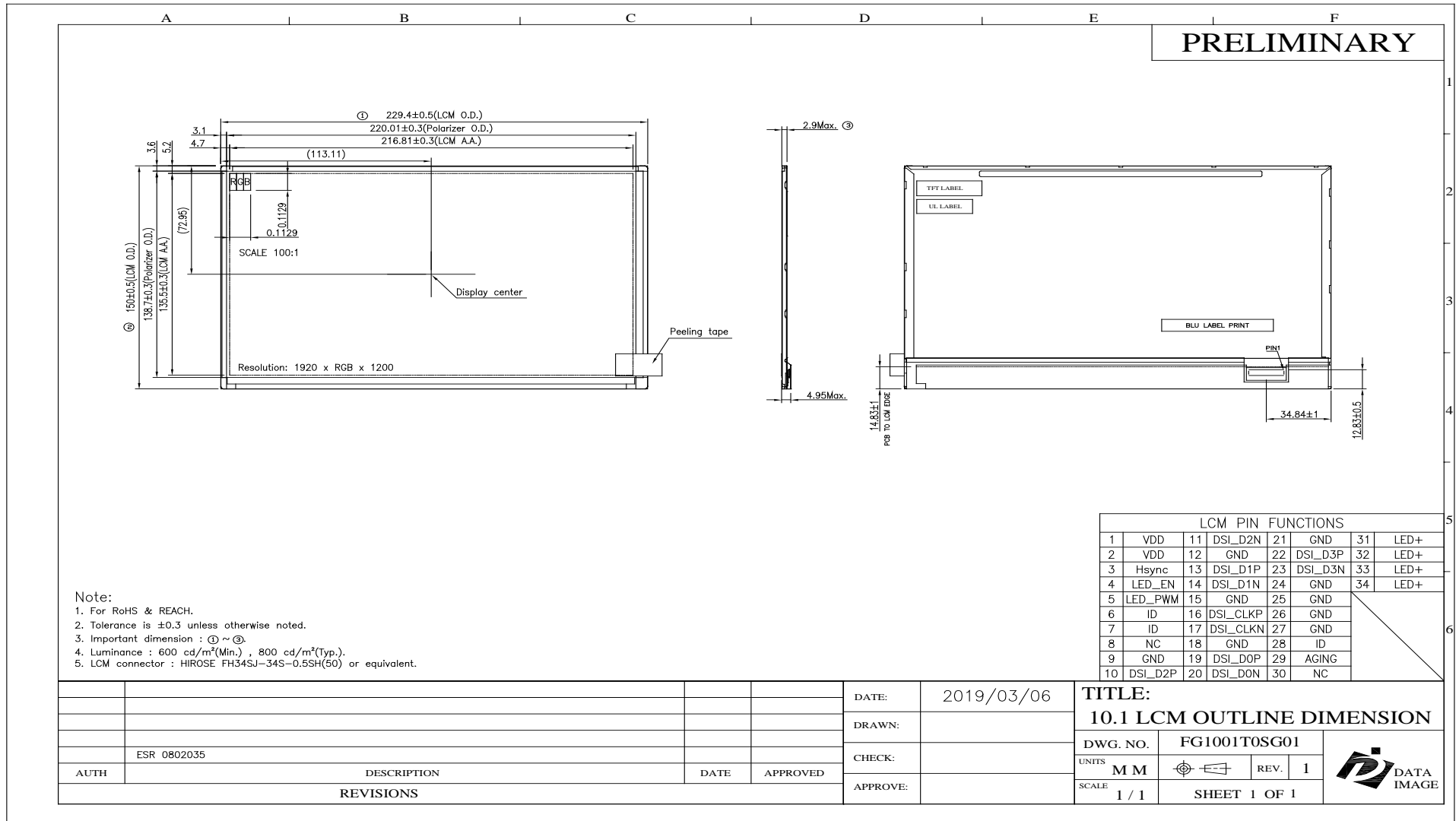
### 5. OTHERS

- (1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight and strong UV rays
- (2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
- (3) For the packaging box, please pay attention to the followings:
  - a. Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
  - b. Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
  - c. Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)
- (4) Waste  
Liquid crystal module products shall not be arbitrarily discarded, the water and soil have a negative impact on the environment, the need to be handled by a qualified unit.

### 6. LIMITED WARRANTY

Unless otherwise agreed between DATA IMAGE and customer, DATA IMAGE will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with DATA IMAGE acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DATA IMAGE is limited to repair and/or replacement on the terms set forth above. DATA IMAGE will not responsible for any subsequent or consequential events.

Confidential Document  
**13. OUTLINE DRAWING**



## 14. PACKAGE INFORMATION

TBD

# DATA IMAGE CORPORATION

## TFT Module Specification

ITEM NO.: FG1001T0DSSWNG01

Prototype  Pre-prod.  Mass prod.

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|                    |               |              |               |               |
|--------------------|---------------|--------------|---------------|---------------|
| Customer Companies | QA Approval   | QA Check     | R&D Approval  | R&D Check     |
|                    | <i>pretty</i> | <i>Andy</i>  | Dragon        | <i>Andrew</i> |
| Approved by        | Version:      | Issued Date: | Total Pages:: | Prepared by   |
|                    | 1             | 08/MAR/19'   | 28            | Candy         |

**2. RECORD OF REVISION**

| Rev | Date       | Item | Page | Comment             | Source     |
|-----|------------|------|------|---------------------|------------|
| 1   | 08/MAR/19' |      |      | Initial PRELIMINARY | ESR0802035 |
|     |            |      |      |                     |            |

### 3. GENERAL SPECIFICATIONS

| Parameter   | Specifications              | Unit |
|---|-----------------------------|------|
| Screen Size   | 10.1 (diagonal)             | inch |
| Display resolution  | 1920(H) x (R,G,B) x 1200(V) | dot  |
| Active Area   | 216.81(H) x 135.5(V)        | mm   |
| Pixel Pitch   | 0.1129(H) x 0.1129(V)       | mm   |
| Pixel Arrangement   | R.G.B. Vertical Stripe      |      |
| Outline Dimension   | 229.4(H) x 150(V) x 2.9(D)  | mm   |
| Surface treatment   | Glare                       |      |
| Electrical Interface  | MIPI                        |      |
| Weight  | TBD                         | g    |
| Display mode  | AHVA, Normally Black        |      |
| our components and processes are compliant to RoHS standard |                             |      |

### 4. ABSOLUTE MAXIMUM RATINGS

An absolute maximum rating of the module is as following:

#### 4.1 Absolute Ratings of TFT LCD Module

| Parameter               | Symbol          | MIN. | MAX. | Unit   | Remark   |
|-------------------------|-----------------|------|------|--------|----------|
| Logic/LCD drive Voltage | V <sub>in</sub> | -0.3 | +4.5 | [Volt] | Note 1,2 |

#### 4.2 Absolute Ratings of Environment

| Parameter             | Symbol | MIN. | MAX. | Unit  | Remark |
|-----------------------|--------|------|------|-------|--------|
| Operating Temperature | TOP    | -10  | +60  | [°C]  |        |
| Operation Humidity    | HOP    | 5    | 90   | [%RH] |        |
| Storage Temperature   | TST    | -20  | +70  | [°C]  |        |
| Storage Humidity      | HST    | 5    | 90   | [%RH] |        |

Note 1: At T<sub>a</sub> (25°C)

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: Maximum wet-bulb temperature is less than 39 °C and no condensation

Note 4: Operating temperature means “Front and rear surface” of panel

### 5. ELECTRICAL CHARACTERISTIC

#### 5.1 TFT LCD Module

##### 5.1.1 Power Specification

Input power specifications are as follows;

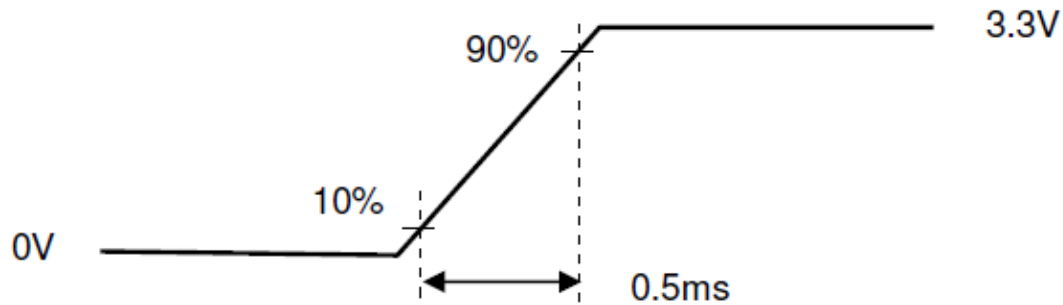
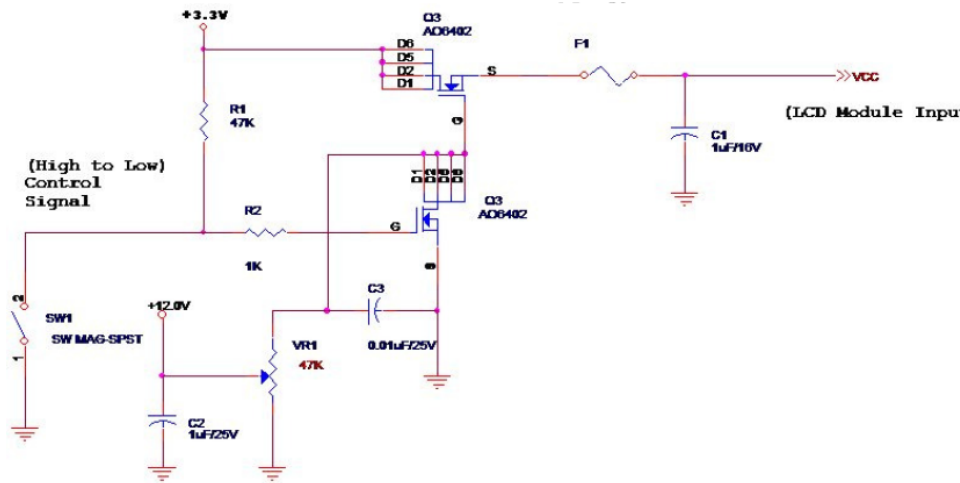
The power specification are measured under 25 and frame frequency under 60Hz

| Parameter                                | Symbol            | MIN. | TYP. | MAX. | Unit        | Remark |
|--|-------------------|------|------|------|-------------|--------|
| Logic/LCD Drive Voltage                  | VDD               | 3.0  | 3.3  | 4.2  | [Volt]      |        |
| VDD Power                                | PDD               | -    | -    | 0.95 | [Watt]      | Note 1 |
| IDD Current                              | IDD               | -    | -    | 316  | [mA]        | Note 1 |
| Inrush Current                           | IRush             | -    | -    | 2000 | [mA]        | Note 2 |
| Allowable Logic/LCD Drive Ripple Voltage | VDD <sub>rp</sub> | -    | -    | 100  | [mV]<br>p-p | Note 2 |

Note 1 : Maximum Measurement Condition: White Pattern at 3.3V driving voltage. (P<sub>max</sub>=V<sub>3.3</sub> x I<sub>white</sub>)

Note 2: Measure Condition



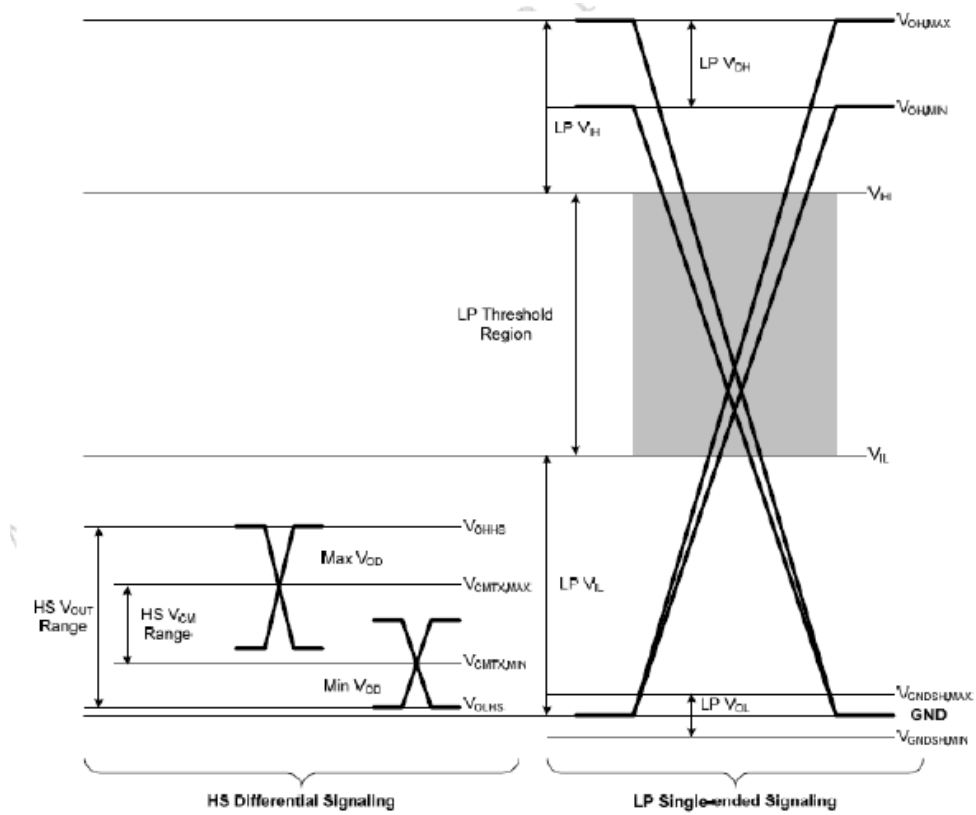

**VDD rising time**

### 5.1.2 Signal Electrical Characteristics

Input signals shall be low or High-impedance state when VDD is off.

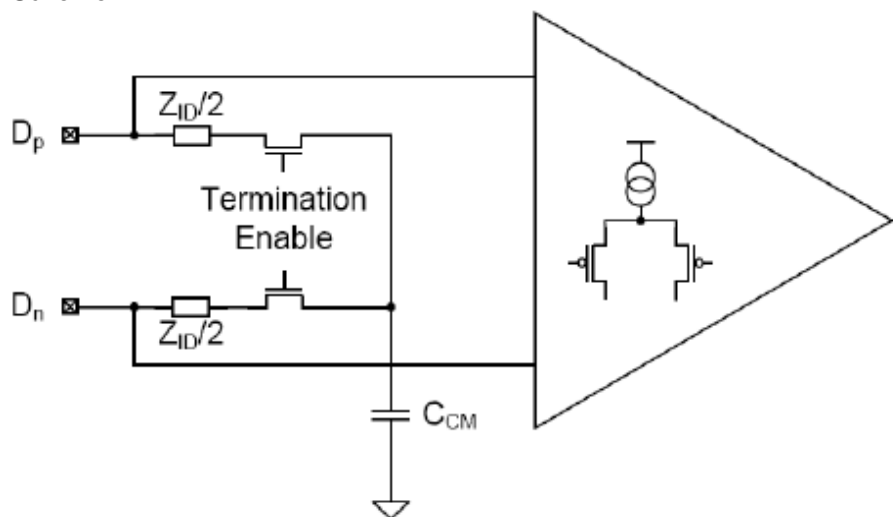
MIPI DC/AC Characteristics are as follows;

| Parameter                                      | Symbol             | MIN. | TYP. | MAX. | Unit |
|--|--------------------|------|------|------|------|
| Input data bit rate                            | BR <sub>MIPI</sub> | 200  | -    | 1000 | Mbps |
| Common-mode voltage(HS Rx mode)                | V <sub>CMRX</sub>  | 70   | -    | 330  | mV   |
| Differential input high threshold (HS Rx mode) | V <sub>IDTH</sub>  | -    | -    | 70   | mV   |
| Differential input low threshold (HS Rx mode)  | V <sub>IDTL</sub>  | -70  | -    | -    | mV   |
| Differential input voltage range (HS Rx mode)  | V <sub>IDM</sub>   | 70   | -    | 500  | mV   |
| Single-end input high voltage (HS Rx mode)     | V <sub>IHHS</sub>  | -    | -    | 460  | mV   |
| Single-end input low voltage (HS Rx mode)      | V <sub>ILHS</sub>  | -40  | -    | -    | mV   |
| Differential input impedance                   | Z <sub>ID</sub>    | 80   | 100  | 125  | Ω    |
| Logic 1 input voltage (LP Rx mode)             | V <sub>IHL</sub>   | 880  |      |      | mV   |
| Logic 0 input voltage (LP Rx mode)             | V <sub>ILL</sub>   |      |      | 550  | mV   |
| Output high level (LP Tx mode)                 | V <sub>OH</sub>    | 1.08 | 1.2  | 1.32 | V    |
| Output low level (LP Tx mode)                  | V <sub>OL</sub>    | -50  |      | 50   | mV   |



| Parameter                               | Symbol                | Conditions | MIN. | TYP. | MAX. | Unit |
|---|-----------------------|------------|------|------|------|------|
| Common-mode interference beyond 450MHz  | $\Delta V_{CMRX(HF)}$ |            | -    | -    | 100  | mV   |
| Common-mode interference 50MHz ~ 450MHz | $\Delta V_{CMRX(LF)}$ |            | -50  | -    | 50   | mV   |
| Common-mode termination                 | $C_{CM}$              |            | -    | -    | 60   | pF   |
| UI instantaneous                        | $UI_{INST}$           |            | 1    | -    | 12.5 | ns   |

## HS RX Scheme

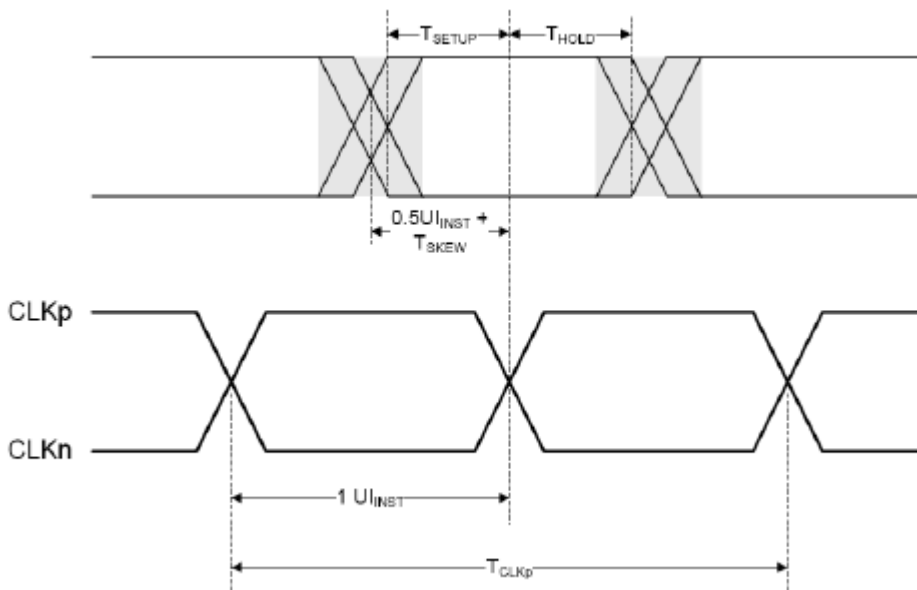


| Parameter                                    | Symbol                        | MIN.  | TYP. | MAX. | Unit              | Notes |
|--|-------------------------------|-------|------|------|-------------------|-------|
| Data to Clock Skew (measured at transmitter) | $T_{\text{SKEW}[\text{TX}]}$  | -0.15 | -    | 0.15 | $U_{\text{INST}}$ | Note1 |
| Data to Clock Setup Time (receiver)          | $T_{\text{SETUP}[\text{RX}]}$ | 0.15  |      | -    | $U_{\text{INST}}$ | Note2 |
| Data to Clock Hold Time (receiver)           | $T_{\text{HOLD}[\text{RX}]}$  | 0.15  | -    | -    | $U_{\text{INST}}$ | Note2 |

Note:

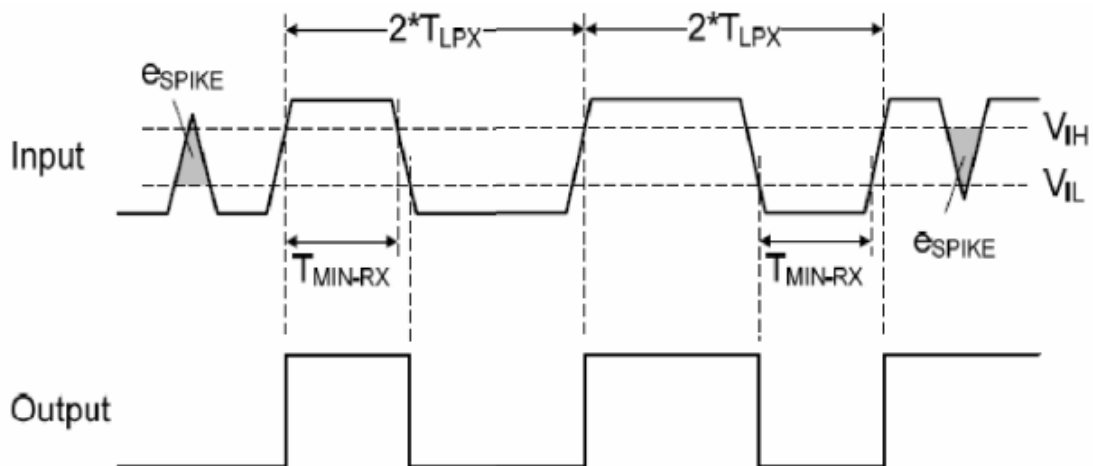
1. Total silicon and package delay budget of  $0.3 \cdot U_{\text{INST}}$
2. Total setup and hold window for receiver of  $0.3 \cdot U_{\text{INST}}$

### High Speed Data Transmission: Data to Clock Timing



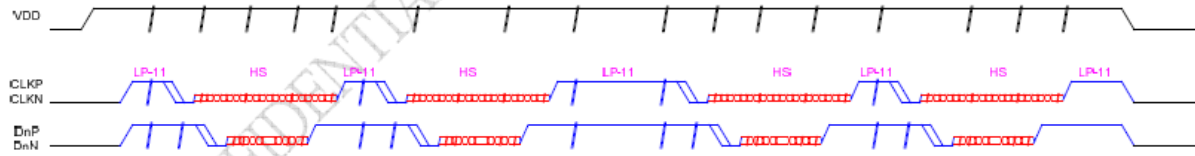
| Parameter                    | Symbol              | Conditions | MIN. | TYP. | MAX. | Unit |
|------------------------------|---------------------|------------|------|------|------|------|
| Input pulse rejection        | $e_{\text{SPIKE}}$  |            | -    | -    | 300  | V.ps |
| Minimum pulse width response | $T_{\text{MIN-RX}}$ |            | 50   | -    | -    | ns   |
| Peak interference amplitude  | $V_{\text{INT}}$    |            | -    | -    | 200  | mV   |
| Interference frequency       | $f_{\text{INT}}$    |            | 450  | -    | -    | MHz  |

### Input Glitch Rejection of Low-Power Receivers



For MIPI data transmission from TX to TCON works properly in video mode, it is suggested that all of MIPI

lanes status follow the scheme showed in below. When power is turned on, all lanes (include clock lane) are into LP-11 status first. When TX wants to start transmitting data to TCON, the clock lane is into HS and start toggling. Then data lanes are into HS and data are transmitted. After data transmissions are finished (ex. H-blanking, V-blanking), the data lanes are returned to LP-11, then clock lane, too. The transmission start from LP-11 and stop in LP-11 on all lanes (include clock lane) are the recommended proper operation sequence for MIPI video mode.



The timing definitions are listed in below,

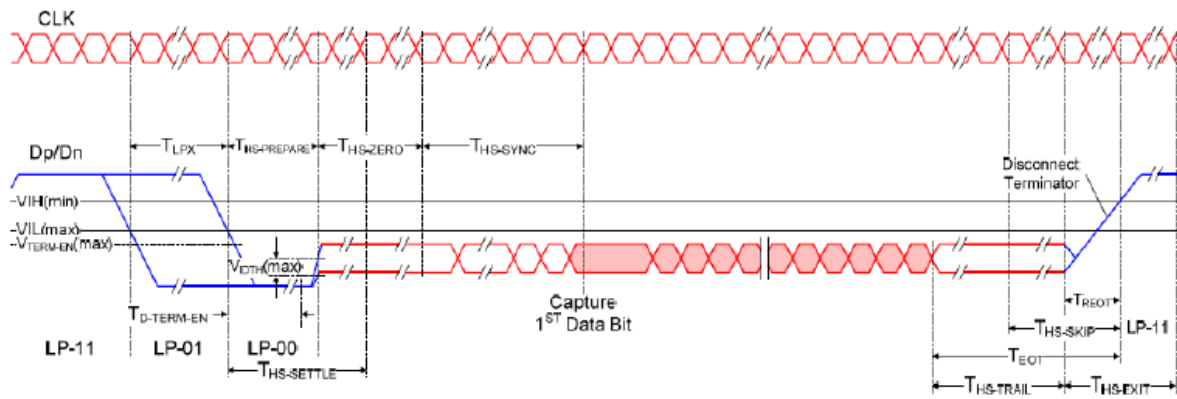
| Parameter                | Description   | MIN.          | TYP. | MAX.         | Unit |
|--------------------------|---|---------------|------|--------------|------|
| TCLK-MISS                | Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX.   |               |      | 60           | ns   |
| TCLK-POST                | Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of THS-TRAIL to the beginning of TCLK-TRAIL. | 60 ns + 52*UI |      |              | ns   |
| TCLK-PRE                 | Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.  | 8             |      |              | UI   |
| TCLK-PREPARE             | Time that the transmitter drives the Clock Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission.   | 38            |      | 95           | ns   |
| TCLK-SETTLE              | Time interval during which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of TCLK-PREPARE.   | 95            |      | 300          | ns   |
| TCLK-TERM-EN             | Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses VIL,MAX.   |               |      | 38           | ns   |
| TCLK-TRAIL               | Time that the transmitter drives the HS-0 state after the last payload clock bit of a HS transmission burst.  | 60            |      |              | ns   |
| TCLK-PREPARE + TCLK-ZERO | TCLK-PREPARE + time that the transmitter drives the HS-0 state prior to starting the Clock.   | 300           |      |              | ns   |
| TD-TERM-EN               | Time for the Data Lane receiver to enable the HS line termination, starting from the time   |               |      | 35 ns + 4*UI | ns   |

|                        |   |                |        |                |    |
|------------------------|---|----------------|--------|----------------|----|
|                        | point when Dn crosses VIL,MAX.  |                |        |                |    |
| TEOT                   | Transmitted time interval from the start of THS-TRAIL or TCLK-TRAIL, to the start of the LP-11 state following a HS burst.  |                |        | 105 ns + 12*UI | ns |
| THS-EXIT               | Time that the transmitter drives LP-11 following a HS burst.  | 100            |        |                | ns |
| THS-SYNC               | HS Sync-Sequence '00011101' period  |                | 8      |                | UI |
| THS-PREPARE            | Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the HS transmission   | 40 ns + 4*UI   |        | 85 ns + 6*UI   | ns |
| THS-PREPARE + THS-ZERO | THS-PREPARE + time that the transmitter drives the HS-0 state prior to transmitting the Sync sequence.  | 145 ns + 10*UI |        |                | ns |
| THS-SETTLE             | Time interval during which the HS receiver shall ignore any Data Lane HS transitions, starting from the beginning of THS-PREPARE.   | 85 ns + 6*UI   |        | 145ns + 10*UI  | ns |
| THS-SKIP               | Time interval during which the HS-RX should ignore any transitions on the Data Lane, following a HS burst. The end point of the interval is defined as the beginning of the LP-11 state following the HS burst. | 40             |        | 55 ns + 4*UI   | ns |
| THS-TRAIL              | Time that the transmitter drives the flipped differential state after last payload data bit of a HS transmission burst  | 60 ns + 4*UI   |        |                | ns |
| TLPX                   | Transmitted length of any Low-Power state period  | 50             |        |                | ns |
| Ratio TLPX             | Ratio of TLPX(MASTER)/TLPX(SLAVE) between Master and Slave side   | 2/3            |        | 3/2            |    |
| TTA-GET                | Time that the new transmitter drives the Bridge state (LP-00) after accepting control during a Link Turnaround.   | 5*TLPX         |        |                | ns |
| TTA-GO                 | Time that the transmitter drives the Bridge state(LP-00) before releasing control during a Link Turnaround.   |                | 4*TLPX |                | ns |
| TTA-SURE               | Time that the new transmitter waits after the LP-10 state before transmitting the Bridge state (LP-00) during a Link Turnaround.  | TLPX           |        | 2*TLPX         | ns |

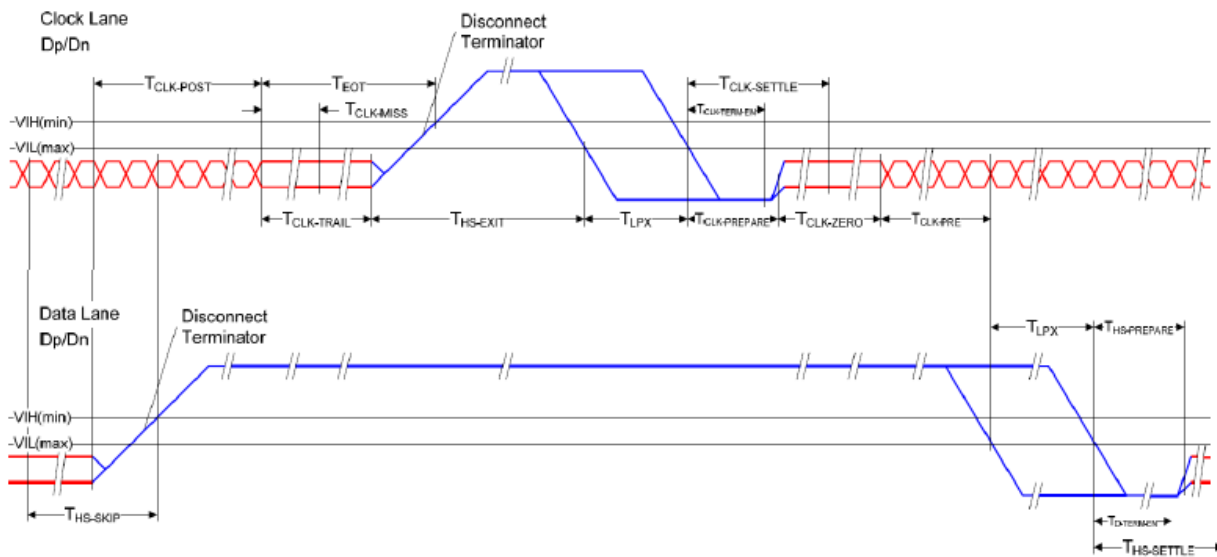
Note:

1. The minimum value depends on the bit rate. Implementations should ensure proper operation for all the supported bit rates.
2. TLPX is an internal state machine timing reference. Externally measured values may differ slightly from the specified values due to asymmetrical rise and fall times.

High-Speed Data Transmission in Bursts



### Switching the Clock Lane between Clock Transmission and Low-Power Mode



### Turnaround Procedure

## 5.2 Backlight Unit

### 5.2.1 LED characteristics

| Parameter                               | Symbol    | MIN.   | TYP.   | MAX. | Unit   | Condition                   |
|---|-----------|--------|--------|------|--------|-----------------------------|
| Backlight Power Consumption             | PLED      | -      | -      | 4.9  | [Watt] | (Ta=25°C @800nits)          |
| LED Life-Time                           | N/A       | 15,000 | 20,000 | -    | Hour   | (Ta=25°C @800nits)<br>Note1 |
| LED Forward Voltage                     | VF        | 5.5    | 5.65   | 5.8  | [Volt] | (Ta=25°C)                   |
| LED Forward Voltage of every LED string | VF-string | -      | -      | 34.8 | [Volt] | (Ta=25°C)<br>Note2          |
| LED Forward Current                     | IF        | -      | 20     | -    | [mA]   | (Ta=25°C)                   |

Note 1. The LED life-time define as the estimated time to 50% degradation of initial luminous.

Note2. LED Array 6 parallel \* 6 series

### 5.2.2 Backlight input signal characteristics

| Parameter                   | Symbol  | MIN. | TYP. | MAX. | Unit   | Remark   |
|-----------------------------|---------|------|------|------|--------|--|
| LED Power Supply            | VLED    | 3    |      | 12   | [Volt] | Define as Connector Interface (Ta=25°C)<br>Note1 |
| LED Enable Input High Level | VLED_EN | 1.7  | -    | 5.5  | [Volt] |  |
| LED Enable Input Low Level  |         | -    | -    | 0.8  | [Volt] |  |
| PWM Logic Input High Level  | VPWM_EN | 1.7  | -    | 5.5  | [Volt] |  |
| PWM Logic Input Low Level   |         | -    | -    | 0.8  | [Volt] |  |
| PWM Input Frequency         | FPWM    | 200  | -    | 10K  | Hz     |  |
| PWM Duty Ratio              | Duty    | 1    |      | 100  | %      |  |

Note 1: The input high level voltage conversion to 2.5V by level shift circuit.

Note 2: The LED PWM Logic Input Low Level Voltage must have an output impedance close to 0 ohm in front of input connector.

## 6. INPUT SIGNAL CHARACTERISTICS

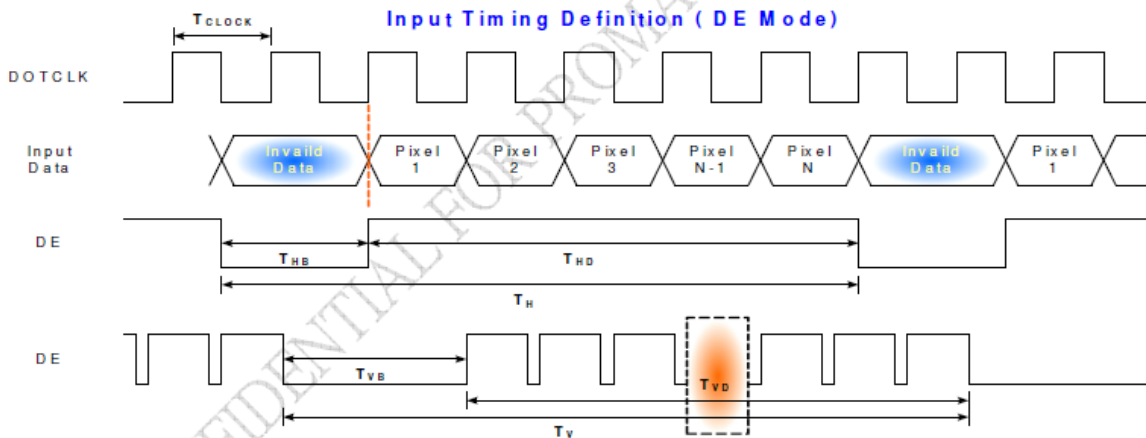
### 6.1 Timing Characteristics

Basically, interface timings should match the 1920x1200 /60Hz manufacturing guide line timing.

| Parameter          |          | Symbol                | MIN.   | TYP.  | MAX.   | Unit               |
|--------------------|----------|-----------------------|--------|-------|--------|--------------------|
| Frame Rate         |          | -                     | -      | 60    | -      | Hz                 |
| Clock frequency    |          | 1/ T <sub>clock</sub> | 148.04 | 149.9 | 151.27 | MHz                |
| Vertical Section   | Period   | T <sub>V</sub>        | 1206   | 1212  | 1218   | T <sub>Line</sub>  |
|                    | Active   | T <sub>VD</sub>       | 1200   |       |        |                    |
|                    | Blanking | T <sub>VB</sub>       | 6      | 12    | 18     |                    |
| Horizontal Section | Period   | T <sub>H</sub>        | 2046   | 2058  | 2070   | T <sub>clock</sub> |
|                    | Active   | T <sub>HD</sub>       | 1920   |       |        |                    |
|                    | Blanking | T <sub>HB</sub>       | 126    | 138   | 150    |                    |

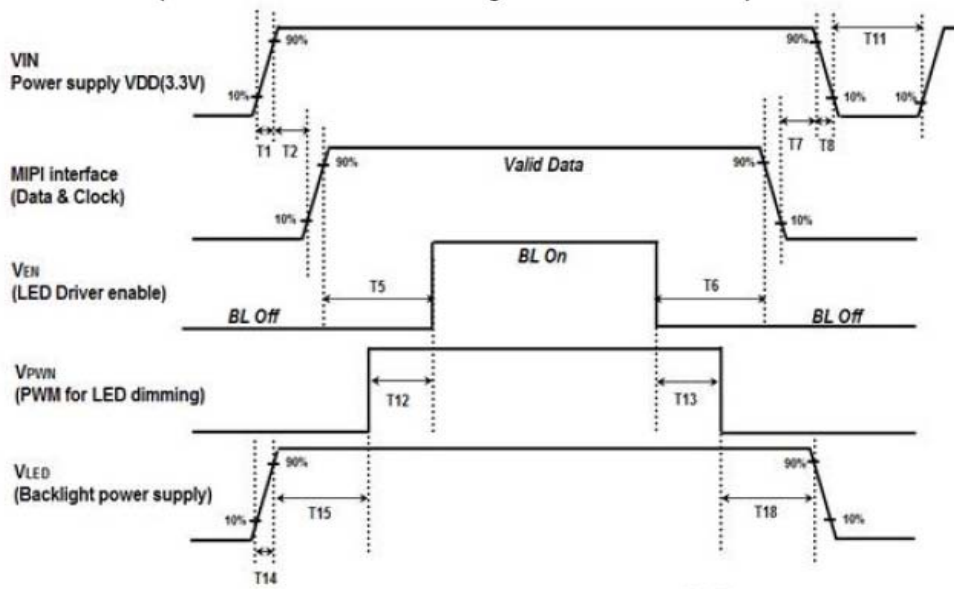
Note : DE mode only

### 6.1.2 Timing diagram



### 6.2 Power ON/OFF Sequence

Power on/off sequence is as follows. Interface signals and LED on/off sequence are also shown in the chart.





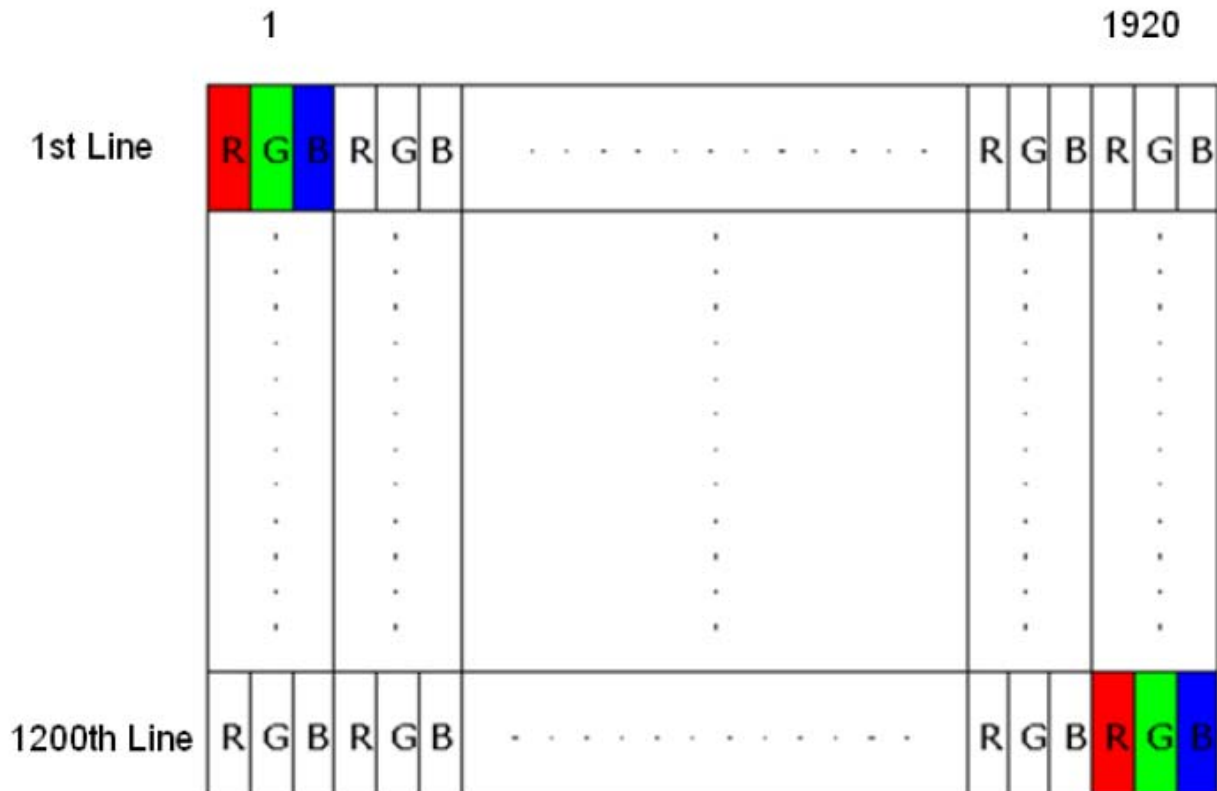
| Power Sequence Timing |       |      |       |
|-----------------------|-------|------|-------|
| Parameter             | Value |      | Units |
|                       | MIN.  | MAX. |       |
| T1                    | 0.5   | 10   | ms    |
| T2                    | 40    | -    |       |
| T5                    | 120   | -    |       |
| T6                    | 50    | -    |       |
| T7                    | 0     | -    |       |
| T8                    | 0     | 10   |       |
| T11                   | 500   | -    |       |
| T12                   | 10    | -    |       |
| T13                   | 10    | -    |       |
| T14                   | 0.5   | 10   |       |
| T15                   | 10    | -    |       |
| T18                   | 10    | -    |       |

Note: LED\_PWM must be pull low(GND) when it is not pull high.

### 6.3 Signal Interface Characteristic

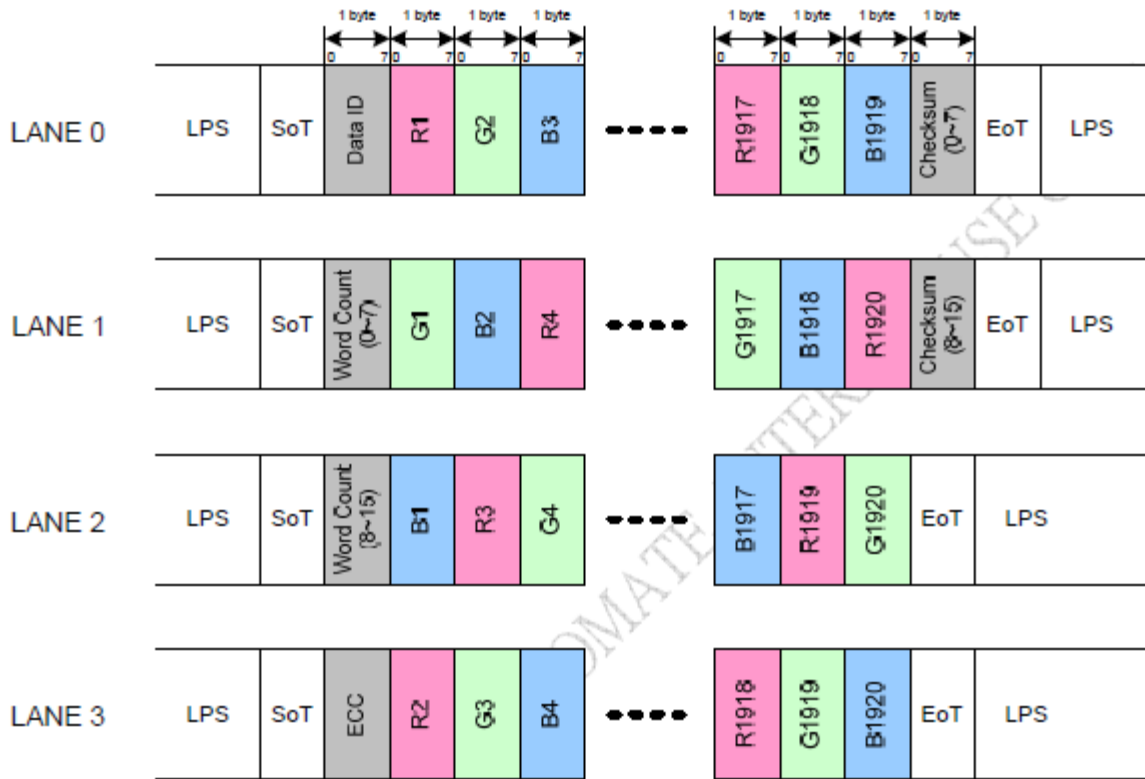
#### 6.3.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.



### 6.3.2 The Input Data Format

Input Pixel Stream Format (1920RGB in 4 Lanes with RGB 8-8-8 format)



LPS : Low Power State  
 SoT : Start of Transmission  
 EoT : End of Transmission  
 ECC : Error-Correcting Code

### 6.4 Integration Interface Requirement

#### 6.4.1 MIPI Connector Description

Physical interface is described as for the connector on module.

These connectors are capable of accommodating the following signals and will be following components.

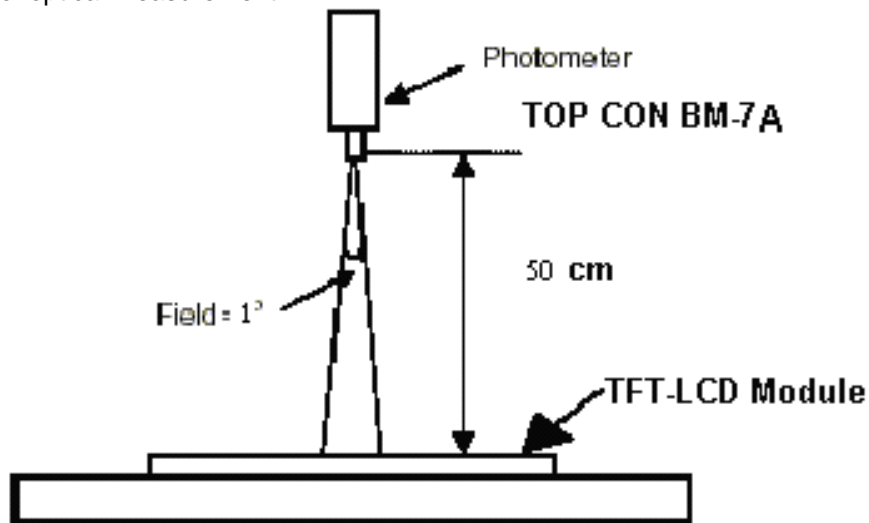
| Connector Name / Designation | For Signal Connector               |
|------------------------------|------------------------------------|
| Manufacturer                 | HIROSE                             |
| Type / Part Number           | FH34SJ-34S-0.5SH(50) or compatible |
| Mating Housing/Part Number   | FPC Cable                          |

### 7. OPTICAL CHARACTERISTIC

| Parameter                | Symbol          | Condition                            | MIN. | TYP. | MAX. | Unit              | Remarks  |
|--------------------------|-----------------|--------------------------------------|------|------|------|-------------------|----------|
| Viewing Angle<br>(CR≥10) | [degree]        | Horizontal (Right)<br>CR = 10 (Left) | 80   | 85   | -    | deg               | Note 1,4 |
|                          | [degree]        | Horizontal (Right)<br>CR = 10 (Left) | 80   | 85   | -    |                   |          |
|                          | [degree]        | Vertical (Upper)<br>CR = 10 (Lower)  | 80   | 85   | -    |                   |          |
|                          | [degree]        | Vertical (Upper)<br>CR = 10 (Lower)  | 80   | 85   | -    |                   |          |
| Contrast Ratio           | CR              | Normal<br>$\theta=\Phi=0^\circ$      | 600  | 800  | -    |                   | Note 1,3 |
| Response time            | T <sub>ON</sub> |                                      | -    | 25   | 35   | ms                | Note 1,6 |
| Color chromaticity       | Red x           |                                      | TBD  | TBD  | TBD  | -                 | Note 1,7 |
|                          | Red y           |                                      | TBD  | TBD  | TBD  | -                 |          |
|                          | Green x         |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | Green y         |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | Blue x          |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | Blue y          |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | White x         |                                      | TBD  | TBD  | TBD  |                   |          |
|                          | White y         |                                      | TBD  | TBD  | TBD  |                   |          |
| Luminance                | L               |                                      | 600  | 800  | -    | Cd/m <sup>2</sup> | Note 1,2 |
| Luminance uniformity     | B-uni           | 5 points                             | 70   |      | -    | %                 | Note1,5  |
| Image sticking           |                 | tis                                  |      |      | 2    | Sec               | Note 8   |

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance ≤1 lux, and at room temperature). The operation temperature is 25°C±2°C. The measurement method is shown in Note1.

Note1: The method of optical measurement:

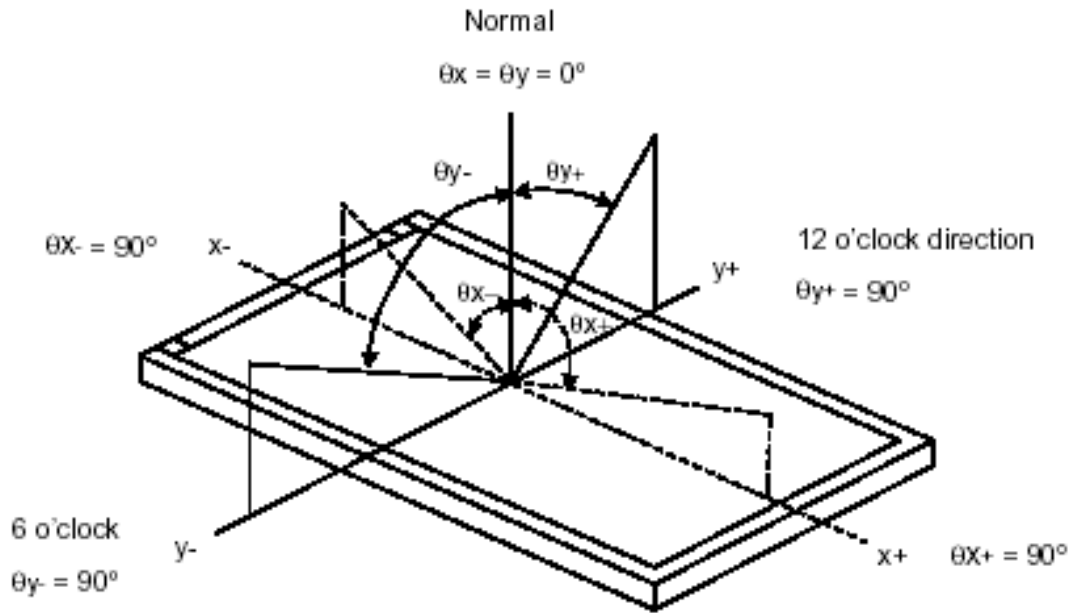


Note2: Measured at the center area of the panel and at the viewing angle of the  $\theta_x=\theta_y =0^\circ$

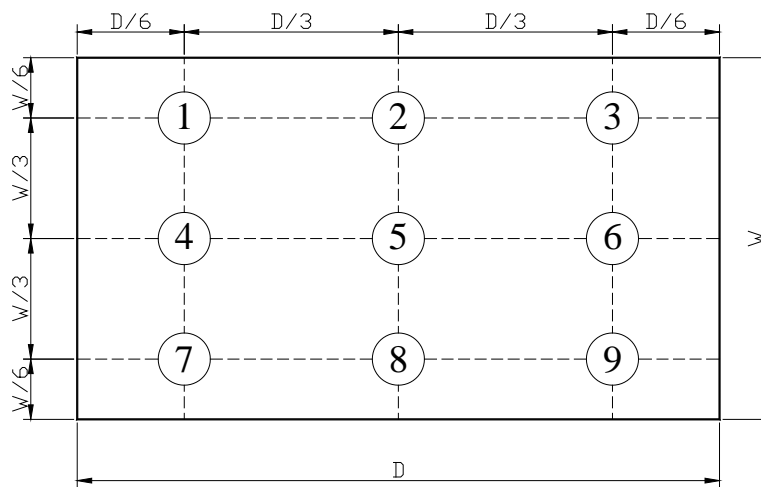
Note3: Definition of Contrast Ratio (CR):

$$CR = \frac{\text{Luminance with all pixels in white state}}{\text{Luminance with all pixels in Black state}}$$

Note4: Definition of Viewing Angle



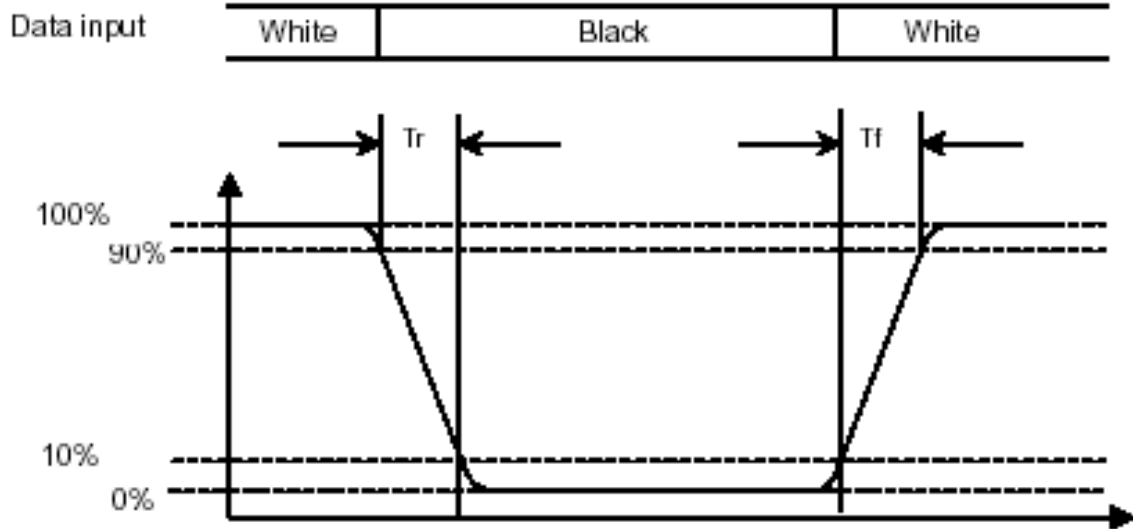
Note 5: Definition of Brightness Uniformity (B-uni):



$$B\text{-uni} = \frac{\text{Minimum luminance of 9 points}}{\text{Maximum luminance of 9 points}} \quad (\text{Note 5}).$$

Note6: Definition of Response Time:

The Response Time is set initially by defining the "Rising Time ( $T_r$ )" and the "Falling Time ( $T_f$ )" respectively.  $T_r$  and  $T_f$  are defined as following figure.



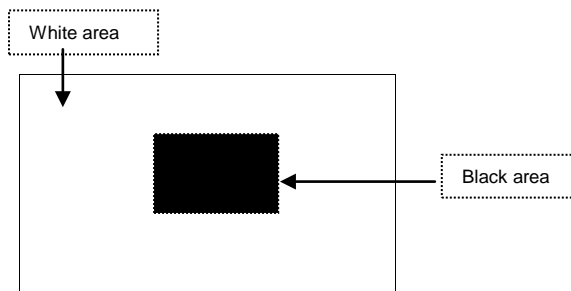
Note 7: Definition of Chromaticity:

The color coordinates  $(x_W, y_W)$ ,  $(x_R, y_R)$ ,  $(x_G, y_G)$ , and  $(x_B, y_B)$  are obtained with all pixels in the viewing field at white, red, green, and blue states, respectively.

Note 8: Definition of Image sticking (tis):

Continuously display the test pattern shown in the figure below for 2 hours. Then display a completely white screen. The previous image shall not persist more than 2 sec at 25 °C

#### Image sticking pattern

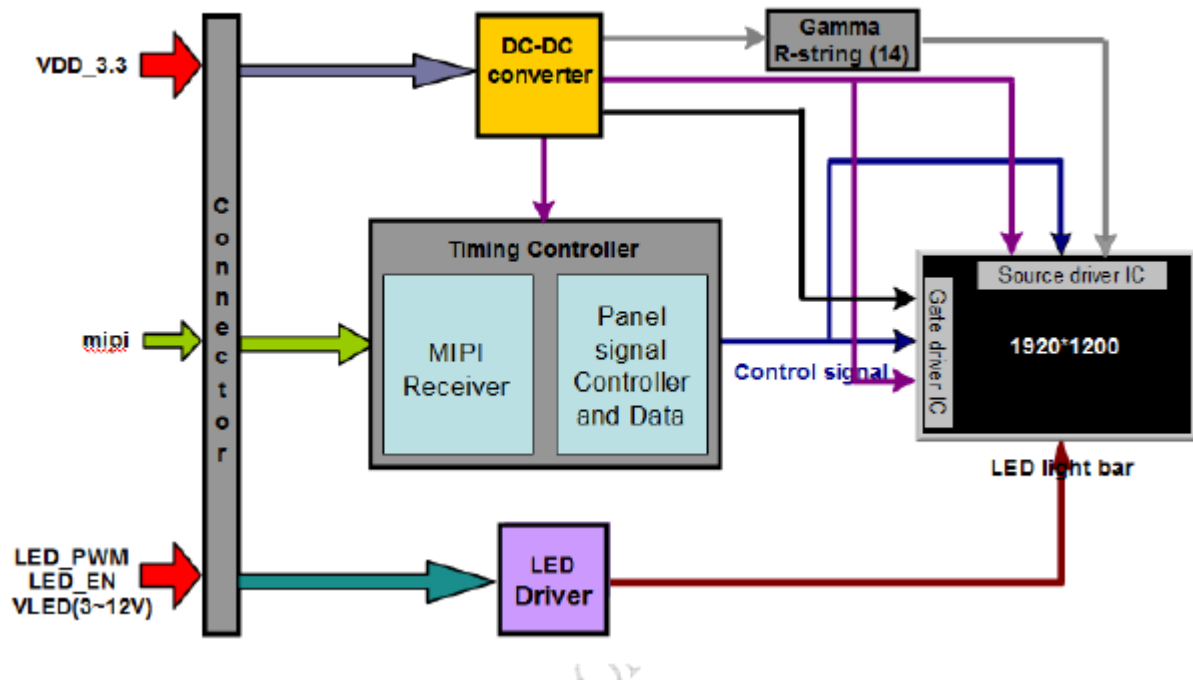


## 8. PIN CONNECTIONS

| Pin No | Symbol           | Function                           | Remark |
|--------|------------------|------------------------------------|--------|
| 1      | VDD              | DC-DC circuit supply voltage       |        |
| 2      | VDD              | DC-DC circuit supply voltage       |        |
| 3      | Hsync            | Yoe signal output to system        |        |
| 4      | LED_EN           | LED driver Enable Input            |        |
| 5      | LED_PWM          | Backlight LED driver PWM Input     |        |
| 6      | ID               | Pull high (10Kohm to 1.8V)         |        |
| 7      | ID               | Pull high (10Kohm to 1.8V)         |        |
| 8      | NC               | Not Connection                     |        |
| 9      | GND              | Ground                             |        |
| 10     | DSI_D2P/Rx-IN2P  | MIPI data pair 2 positive signal   |        |
| 11     | DSI_D2N/Rx-IN2N  | MIPI data pair 2 negative signal   |        |
| 12     | GND              | Ground                             |        |
| 13     | DSI_D1P/Rx-IN1P  | MIPI data pair 1 positive signal   |        |
| 14     | DSI_D1N/Rx-IN1N  | MIPI data pair 1 negative signal   |        |
| 15     | GND              | Ground                             |        |
| 16     | DSI_CLKP/Rx-CLKP | MIPI Clock positive signal         |        |
| 17     | DSI_CLKN/Rx-CLKN | MIPI Clock negative signal         |        |
| 18     | GND              | Ground                             |        |
| 19     | DSI_D0P/Rx-IN0P  | MIPI data pair 0 positive signal   |        |
| 20     | DSI_D0N/Rx-IN0N  | MIPI data pair 0 negative signal   |        |
| 21     | GND              | Ground                             |        |
| 22     | DSI_D3P/Rx-IN3P  | MIPI data pair 3 positive signal   |        |
| 23     | DSI_D3N/Rx-IN3N  | MIPI data pair 3 negative signal   |        |
| 24     | GND              | Ground                             |        |
| 25     | GND              | Ground                             |        |
| 26     | GND              | Ground                             |        |
| 27     | GND              | Ground                             |        |
| 28     | ID               | Pull low (4.7Kohm to Ground)       |        |
| 29     | Aging            | Aging Mode Power Supply (AUO only) |        |
| 30     | NC               | Not Connection                     |        |

|    |      |                  |  |
|----|------|------------------|--|
| 31 | LED+ | LED Power Supply |  |
| 32 | LED+ | LED Power Supply |  |
| 33 | LED+ | LED Power Supply |  |
| 34 | LED+ | LED Power Supply |  |

## 9. BLOCK DIAGRAM





## 10. QUALITY ASSURANCE

### 10.1 Test Condition

#### 10.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 25 ± 5°C

Humidity : 65 ± 5%

#### 10.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

#### 10.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

#### 10.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

#### 10.1.5 Test Method

| Reliability Test Item & Level |  |  | Remark        |
|-------------------------------|--|--|---------------|
| No.                           | Item                                     | Test Conditions  |               |
| 1                             | High Temperature Storage Test            | Ta = 70°C 300Hr  | IEC60068-2-2  |
| 2                             | Low Temperature Storage Test             | Ta = -20°C 300Hr   | IEC60068-2-1  |
| 3                             | High Temperature Operation Test          | Ts = 60°C 300Hr  | IEC60068-2-2  |
| 4                             | Low Temperature Operation Test           | Ta = -10°C 300Hr   | IEC60068-2-1  |
| 5                             | Operate at High Temperature and Humidity | 40 °C /90%,300Hr   | IEC60068-2-3  |
| 6                             | Thermal Shock                            | -10 °C /30 min , 60 °C /30 min , 20cycles  | IEC60068-2-14 |
| 7                             | Vibration Test                           | Acceleration: 1.5 G<br>Frequency: 10 - 500Hz Random<br>Sweep: 30 Minutes each Axis (X, Y, Z)<br>Test method: Non-Operation | IEC60068-2-6  |
| 8                             | Drop test (Package)                      | Height :60cm<br>1 conner,3edges,6surfaces  | IEC60068-2-32 |
| 9                             | ESD                                      | State: operating<br>Location: LCM/TP surface<br>Condition:150pf 330Ω<br>Contact +/- 8kV Air +/-15kV<br>Criteria: Class B   | IEC61000-4-2  |

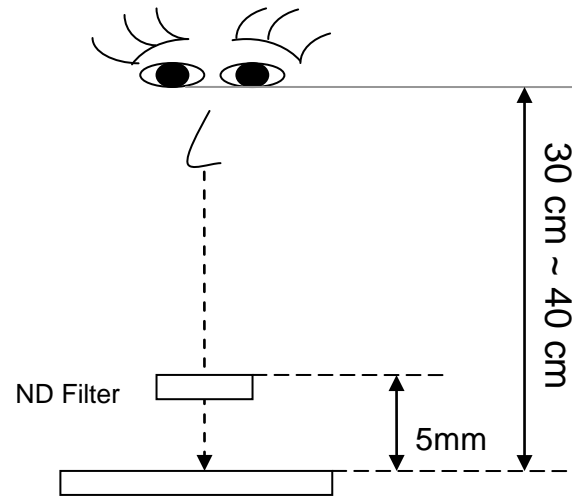
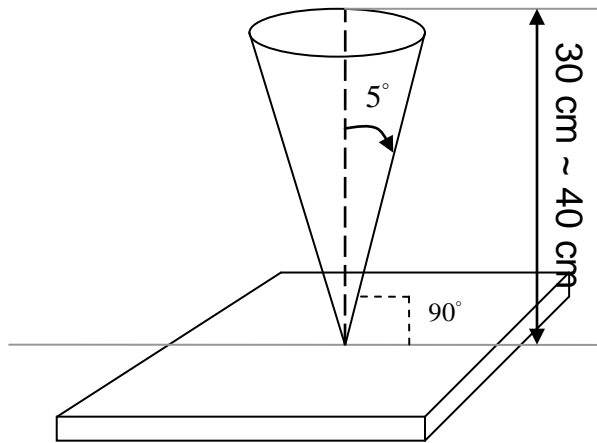
## 10.2 Inspection condition

### 10.2.1 Inspection conditions

10.2.1.1 Inspection Distance :  $35 \pm 5$  cm

10.2.1.2 View Angle :

- (1) Inspection under operating condition :  $\pm 5^\circ$
- (2) Inspection under non-operating condition :  $\pm 45^\circ$



### 10.2.2 Environment conditions :

|                       |                       |                          |
|-----------------------|-----------------------|--------------------------|
| Ambient Temperature : |                       | $25 \pm 5^\circ\text{C}$ |
| Ambient Humidity :    |                       | $65 \pm 5\%$             |
| Ambient Illumination  | Cosmetic Inspection   | 400 ~ 600lux             |
|                       | Functional Inspection | 300 ~ 500lux             |

### 10.2.3 Definition of applicable Zones



**10.3 Inspection Parameters**

| No.   | Parameter                              | Criteria  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|---|--|---|-------------------|-------------------|-------------------------------------|------------------|-------------------------------------|--------|--|-----|--|-----|---|---|-----------------|---|---------------|---|
| 1   | Operating                              | Display function: No Display malfunction (Major)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Contrast ratio (Black, White):<br>Does not meet specified range in the spec. (Major) (Note:3)   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Line Defect: No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major) (Note:1)   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Point Defect (Red, green, blue, dark): Active area $\leq 8$ dots (Minor)(Note:1)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | <table border="1"> <thead> <tr> <th>Item</th> <th>Acceptable number</th> <th>Total</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td>Bright</td> <td>3</td> <td rowspan="4">6</td> <td rowspan="4">Minor</td> <td rowspan="4">1.5</td> </tr> <tr> <td>Dark</td> <td>5</td> </tr> <tr> <td>Adjacent Bright</td> <td>1</td> </tr> <tr> <td>Adjacent Dark</td> <td>2</td> </tr> </tbody> </table>  | Item              | Acceptable number | Total                               | Class Of Defects | AQL Level                           | Bright | 3  | 6   | Minor  | 1.5 | Dark                                      | 5 | Adjacent Bright | 1 | Adjacent Dark | 2 |
|   |  | Item  | Acceptable number | Total             | Class Of Defects                    | AQL Level        |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Bright  | 3                 | 6                 | Minor                               | 1.5              |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Dark  | 5                 |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Adjacent Bright   | 1                 |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Adjacent Dark   | 2                 |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| Non-uniformity:<br>Visible through 2%ND filter white, R, G, B and gray 50%pattern. (Minor)  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| Foreign material in Black or White spots shape ( $W > 1/4L$ ) (Note: 5)   |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| <table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td><math>D \leq 0.5</math></td> <td>*</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td><math>0.5 &lt; D \leq 1.0</math></td> <td>4</td> </tr> <tr> <td><math>D &gt; 1.0</math></td> <td>0</td> </tr> </tbody> </table>   | Dimension                              | Acceptable number   | Class Of Defects  | AQL Level         | $D \leq 0.5$                        | *                | Minor                               | 1.5    | $0.5 < D \leq 1.0$                                       | 4   | $D > 1.0$  | 0   |   |   |                 |   |               |   |
| Dimension   | Acceptable number                      | Class Of Defects  | AQL Level         |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D \leq 0.5$  | *                                      | Minor   | 1.5               |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $0.5 < D \leq 1.0$  | 4                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D > 1.0$   | 0                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D = (\text{Long} + \text{Short}) / 2$ * : Disregard  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| Foreign Material in Line or spiral shape ( $W \leq 1/4L$ ) (Note: 4)  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| <table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td><math>W &gt; 0.3\text{mm}, L &gt; 10\text{mm}</math></td> <td>0</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td><math>L \leq 10\text{mm}, 0.2\text{mm} &lt; W \leq 0.3\text{mm}</math></td> <td>4</td> </tr> <tr> <td><math>L \leq 10\text{mm}, W \leq 0.2\text{mm}</math></td> <td>*</td> </tr> </tbody> </table> | Dimension                              | Acceptable number   | Class Of Defects  | AQL Level         | $W > 0.3\text{mm}, L > 10\text{mm}$ | 0                | Minor                               | 1.5    | $L \leq 10\text{mm}, 0.2\text{mm} < W \leq 0.3\text{mm}$ | 4   | $L \leq 10\text{mm}, W \leq 0.2\text{mm}$                | *   |   |   |                 |   |               |   |
| Dimension   | Acceptable number                      | Class Of Defects  | AQL Level         |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $W > 0.3\text{mm}, L > 10\text{mm}$   | 0                                      | Minor   | 1.5               |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $L \leq 10\text{mm}, 0.2\text{mm} < W \leq 0.3\text{mm}$  | 4                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $L \leq 10\text{mm}, W \leq 0.2\text{mm}$   | *                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| L : Length W : Width * : Disregard  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| 2   | External Inspection<br>(non-operating) | Dimension: Outline (Major)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Bezel appearance: uneven (Minor)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | Scratch on the Polarize & Touch Panel : (Note:2)  |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | <table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td><math>W &gt; 0.3\text{mm}, L &gt; 10\text{mm}</math></td> <td>0</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td><math>L \leq 10\text{mm}, 0.2\text{mm} &lt; W \leq 0.3\text{mm}</math></td> <td>4</td> </tr> <tr> <td><math>L \leq 10\text{mm}, W \leq 0.2\text{mm}</math></td> <td>*</td> </tr> </tbody> </table> | Dimension         | Acceptable number | Class Of Defects                    | AQL Level        | $W > 0.3\text{mm}, L > 10\text{mm}$ | 0      | Minor  | 1.5 | $L \leq 10\text{mm}, 0.2\text{mm} < W \leq 0.3\text{mm}$ | 4   | $L \leq 10\text{mm}, W \leq 0.2\text{mm}$ | * |                 |   |               |   |
|   |  | Dimension   | Acceptable number | Class Of Defects  | AQL Level                           |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | $W > 0.3\text{mm}, L > 10\text{mm}$   | 0                 | Minor             | 1.5                                 |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
|   |  | $L \leq 10\text{mm}, 0.2\text{mm} < W \leq 0.3\text{mm}$  | 4                 |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $L \leq 10\text{mm}, W \leq 0.2\text{mm}$   | *                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| L : Length W : Width * : Disregard  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| Dent and spots shape on the polarize (Note:2): (Note: 5)  |  |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| <table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td><math>D \leq 0.5</math></td> <td>*</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td><math>0.5 &lt; D \leq 1.0</math></td> <td>4</td> </tr> <tr> <td><math>D &gt; 1.0</math></td> <td>0</td> </tr> </tbody> </table>   | Dimension                              | Acceptable number   | Class Of Defects  | AQL Level         | $D \leq 0.5$                        | *                | Minor                               | 1.5    | $0.5 < D \leq 1.0$                                       | 4   | $D > 1.0$  | 0   |   |   |                 |   |               |   |
| Dimension   | Acceptable number                      | Class Of Defects  | AQL Level         |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D \leq 0.5$  | *                                      | Minor   | 1.5               |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $0.5 < D \leq 1.0$  | 4                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |
| $D > 1.0$   | 0                                      |   |                   |                   |                                     |                  |                                     |        |  |     |  |     |   |   |                 |   |               |   |

|  |  |  |
|--|--|--|
|  |  | $D = (Long + Short) / 2$ * : Disregard |
|--|--|--|

| Class of defects | Definition |  |
|------------------|------------|--|
|                  | AQL 0.65   | It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function. |
|                  | AQL 1.5    | It is a defect that will not result in functioning problem with deviation classified.  |

Note:1.(a)Bright point defect is defined as point defect of R,G,B with area >1/2 pixel respectively

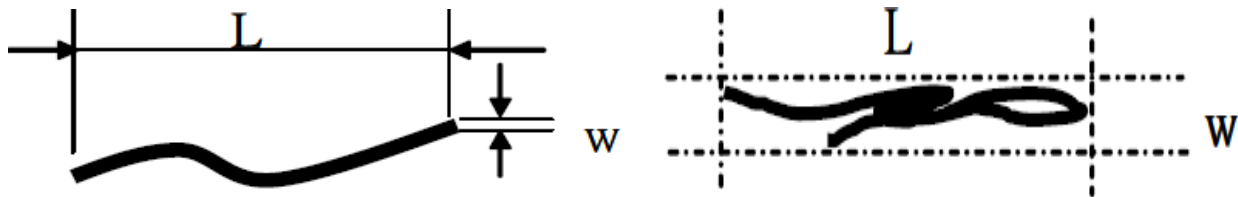
(b)Dark point defect is defined as visible in full white pattern.

(c)The point defect must under 2% ND Filter visible .

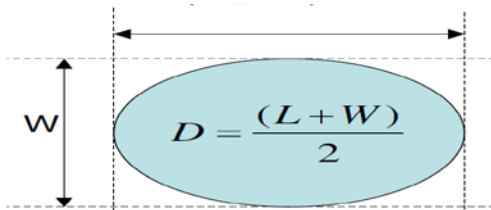
Note:2 The external inspection should be conducted at the distance  $30 \pm 5$ cm between the eyes of inspector and the panel .

Note:3 Luminance measurement for contrast ratio is at the distance  $50 \pm 5$ cm between the detective head and the panel with ambient luminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

Note:4 W-Width in mm , L-length of Max.(L1,L2) in mm.



Note:5 Spot Foreign Material ( $W \geq L/4$ )



#### 10.4 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

Lot size: Quantity of shipment lot per model.

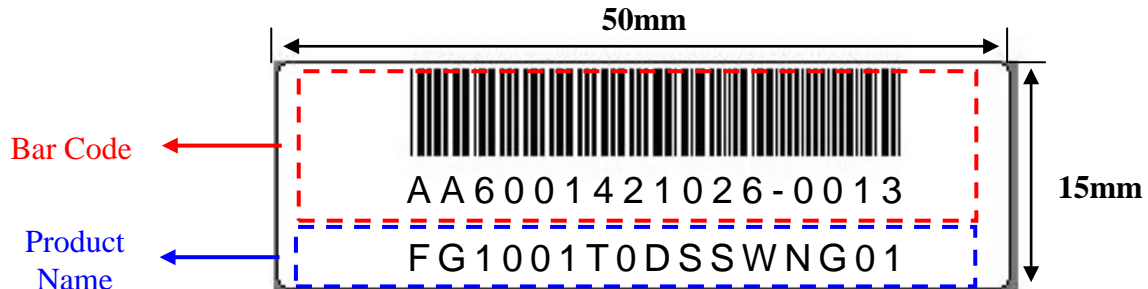
Sampling type: normal inspection, single sampling

Sampling table: ISO 2859

Inspection level: Level II

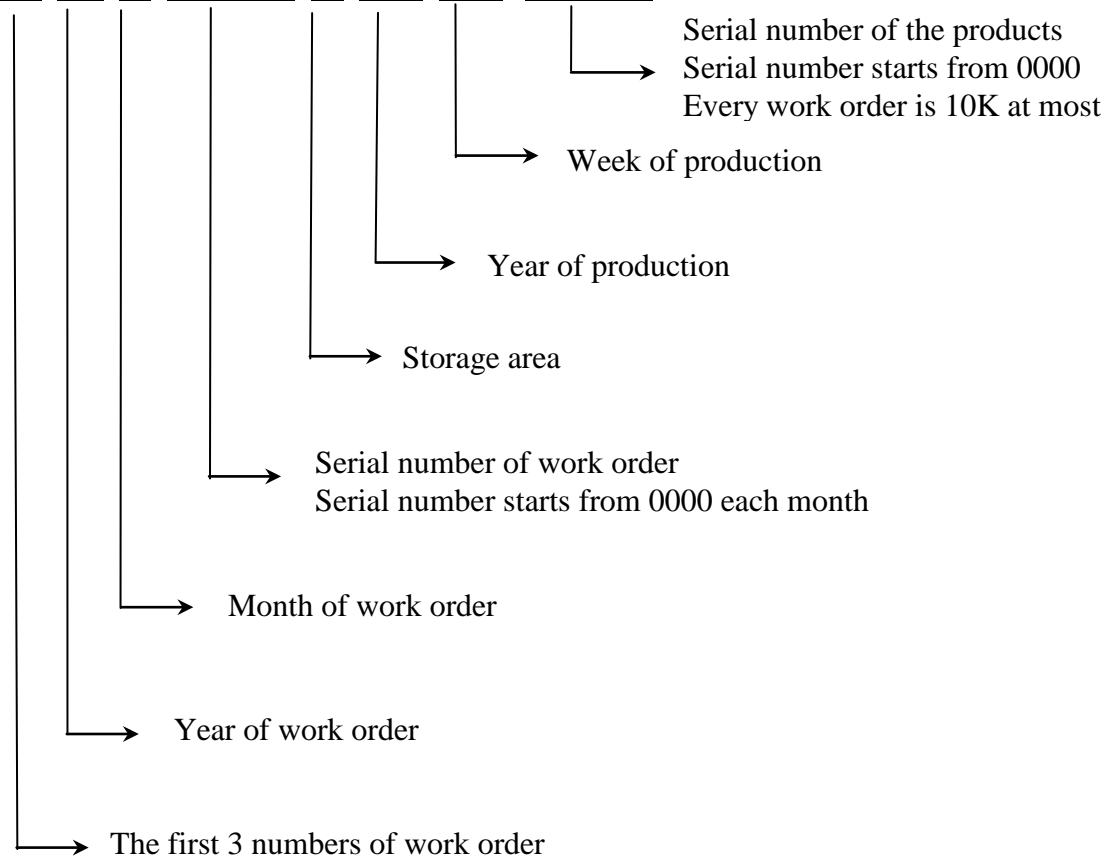
## 11. LCM PRODUCT LABEL DEFINE

Product Label style:

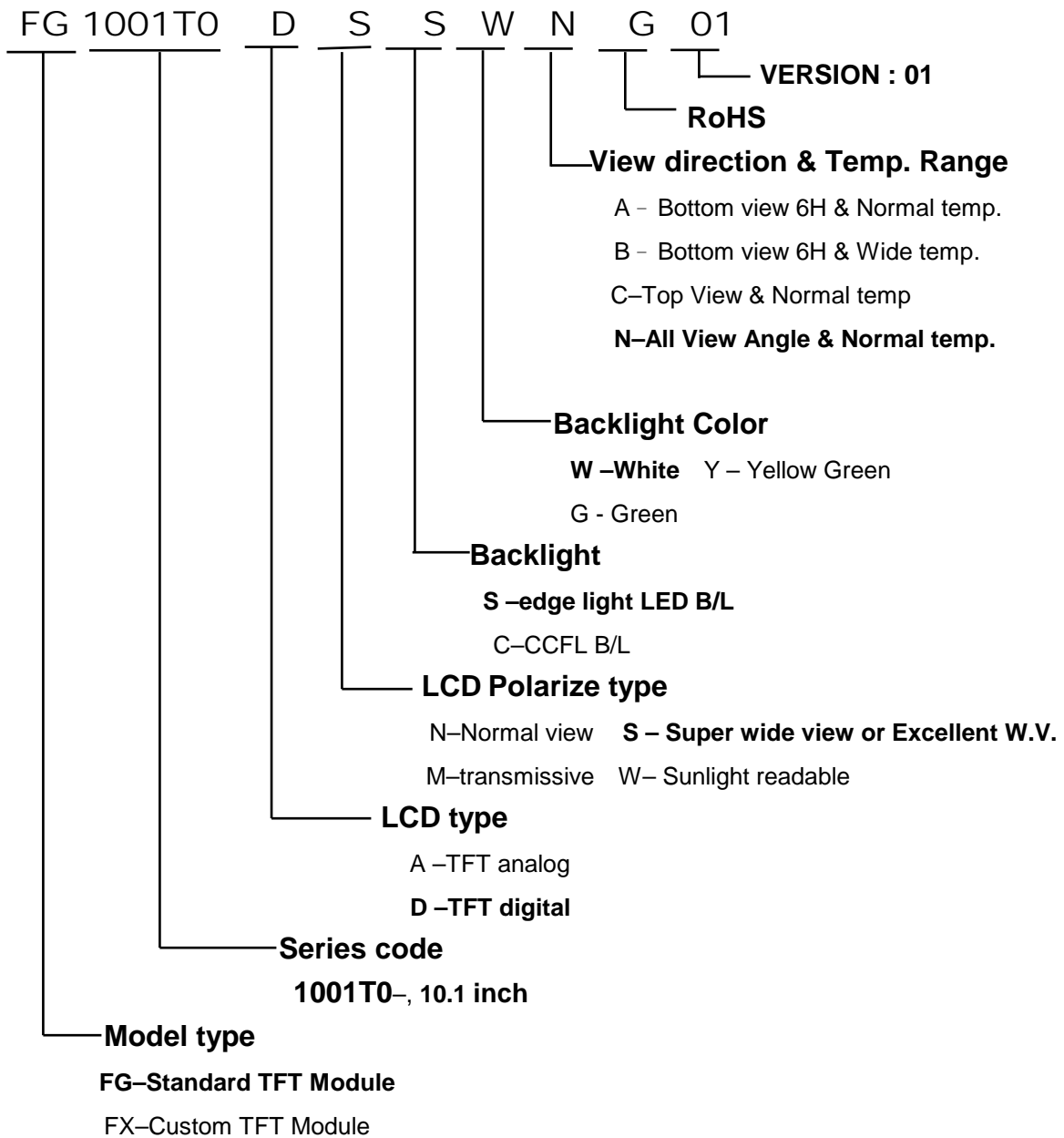


BarCode Define:

**A A 6 0014 2 10 26-0013**



**Product Name Define:**



## 12. PRECAUTIONS IN USE LCM

### 1. ASSEMBLY PRECAUTIONS

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) 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.
- (4) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (5) Do not open the case because inside circuits do not have sufficient strength.
- (6) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
- (7) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
- (8) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

### 2. OPERATING PRECAUTIONS

- (1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
- (2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification
- (3) 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.
- (4) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (5) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (6) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.

### 3. ELECTROSTATIC DISCHARGE CONTROL

- (1) The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such the copper leads on the PCB and the interface terminals with any parts of the human body.

- (2) The modules should be kept in antistatic bags or other containers resistant to static for storage.
- (3) Only properly grounded soldering irons should be used.
- (4) If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
- (5) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended
- (6) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

### 4. STORAGE PRECAUTIONS

- (1) When you store LCDs for a long time, it is recommended to keep the temperature between 0°C-40°C without the exposure of sunlight and to keep the humidity less than 90%RH.
- (2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C 90%RH
- (3) Please do not leave the LCDs in the environment of low temperature; below -20°C.

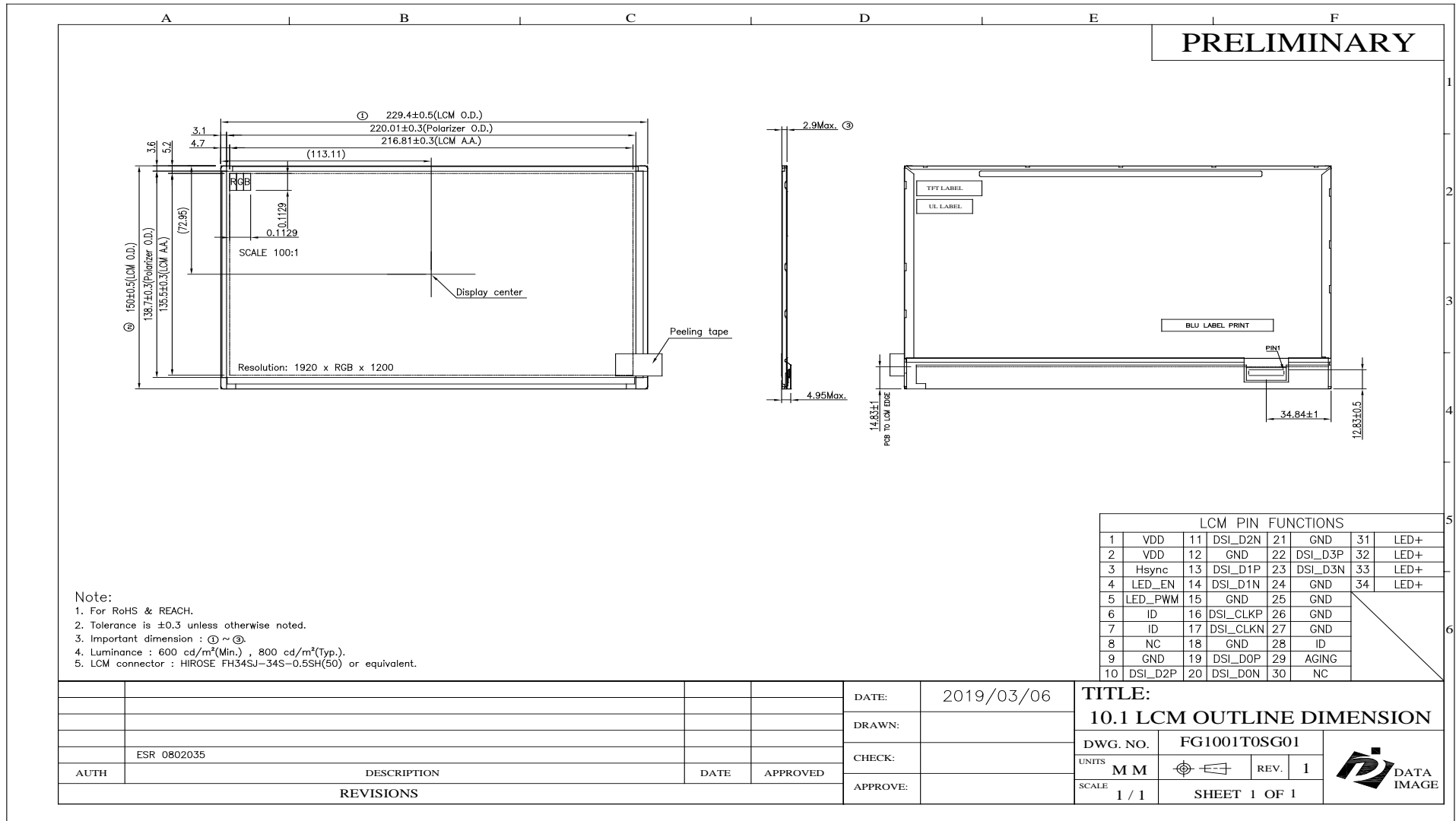
### 5. OTHERS

- (1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight and strong UV rays
- (2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
- (3) For the packaging box, please pay attention to the followings:
  - a. Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
  - b. Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
  - c. Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)
- (4) Waste  
Liquid crystal module products shall not be arbitrarily discarded, the water and soil have a negative impact on the environment, the need to be handled by a qualified unit.

### 6. LIMITED WARRANTY

Unless otherwise agreed between DATA IMAGE and customer, DATA IMAGE will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with DATA IMAGE acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DATA IMAGE is limited to repair and/or replacement on the terms set forth above. DATA IMAGE will not responsible for any subsequent or consequential events.

Confidential Document  
**13. OUTLINE DRAWING**





## 14. PACKAGE INFORMATION

TBD