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# Specification For Approval

- ☐ Preliminary specification  
☒ Final specification

|              |                                                        |
|--------------|--------------------------------------------------------|
| <b>Title</b> | <b>AV101FHT-T10-28P0 (TLCM)</b><br>( COG-PVLSZT034-03) |
|--------------|--------------------------------------------------------|

|              |  |
|--------------|--|
| <b>Buyer</b> |  |
| <b>Model</b> |  |

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| <b>Supplier</b> | Cheng Du BOE Optoelectronics Technology CO., LTD |
| <b>Model</b>    | AV101FHT-T10-28P0<br>( COG-PVLSZT034-03)         |

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BOE CHENG DU  
Optoelectronics Technology CO., LTD



**BOECD Optoelectronics Technology CO., LTD**  
**AV101FHT-T10-28P0 Module Product Specification**

**CS3-SPM-S073**

Pre.3  
2019.07.02

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|                                 |            |                    |                |               |
|                                 |            |                    |                |               |
|                                 |            |                    |                |               |

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**Preliminary Specification  
Of  
LCD Module Type  
Model No.: AV101FHT-T10-28P0  
(COG-VLSZT034-03)**

**Note: The characteristics and performance index listed in this preliminary specification are subjected to final verification and validation. It's aimed for sample build and evaluation only, not yet for mass production. The ultimate design performance in final specification may change.**

## **1. General Description**

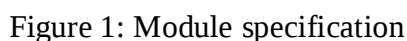
- 10.1" (diagonal) FHD, 16:9, Landscape, Transmissive, Normally black, ADS , with mutual Capacitive touch panel
- Display resolution: 1920 x RGB x 1080
- Viewing direction: All directions
- Display up to 16.7M colours
- Dual LVDS interface
- Driver IC: Source HX8290-A06 /Gate HX8691-A
- TFT-LCD logic voltage (VDD): 3.3V (TYP.)
- White LED backlight
- Connection HRS"FH28-60S-0.5SH"
- On-Cell Solution
- Mutual Type Projected Capacitive Touch Panel (with Synaptics S7882 controller)
- TP Logic voltage (TP\_VDD): 3.3V
- I2C interface for touch panel
- Chemical Strengthen Cover Glass with AGLRAF coating on Film
- Optically bonded touch panel to TFT

## 2. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1: Module mechanical detail

| Parameters                          |                          | Specifications                                                                           | Unit |
|-------------------------------------|--------------------------|------------------------------------------------------------------------------------------|------|
| Outline dimensions                  |                          | 244.85(W) x 159.25(H) x 7.14(D)<br>(Exclude FPC, cables & component and mounting screws) | mm   |
| Color TFT<br>1920 x RGB x 1080      | Ink printing opening     | 224.488(W) x 126.712(H)                                                                  | mm   |
|                                     | Active area              | 223.488(W) x 125.712(H)                                                                  | mm   |
|                                     | Display format           | 1920 x RGB x 1080                                                                        | -    |
|                                     | Color configuration      | RGB vertical stripes                                                                     | mm   |
|                                     | Dot pitch                | 0.1164 (W) x 0.1164(H)                                                                   | mm   |
| Projected capacitive<br>Touch Panel | Cover Lens dimension     | 244.85(W) x 159.25(H) x 1.1(D)                                                           | mm   |
|                                     | Cover Lens material      | Soda Lime Glass                                                                          | -    |
|                                     | Viewing area             | 225.488 (W)x 127.712(H)                                                                  | mm   |
|                                     | Black mask opening       | 224.488 (W)x 126.712(H)                                                                  | mm   |
|                                     | Active area              | 225.488 (W)x 127.712 (H)                                                                 | mm   |
| AGLRAF Film                         | Film dimension           | 243.85(W) x 158.25(H) x 0.09(D)                                                          | Mm   |
|                                     | Haze                     | 10                                                                                       | %    |
|                                     | Film surface reflectance | 2.2                                                                                      | %    |
|                                     | Surface hardness         | ≥3 (JIS-K-5600 (500g))                                                                   | H    |
| Backlight                           |                          | White LED                                                                                | -    |
| Weight                              |                          | 380±10%                                                                                  | gram |



### 3. Touch Panel Characteristics

Table 2: Touch panel features

| Item         | Contents                                              | Unit |
|--------------|-------------------------------------------------------|------|
| Type         | Mutual type projected capacitive touch panel          | -    |
| Interface    | I2C (Up to 400kbits/sec)                              | -    |
| Function     | Provide (X, Y) coordinates and number of touch points | -    |
| No. of touch | 10 touch                                              | -    |
| Sensing area | Ø8 (Typ.) finger touch                                | mm   |
| Resolution   | 1920 x 1080                                           | -    |
| Orientation  | (0,0) in the upper left corner                        |      |
| Input mode   | Finger or capacitive pen                              | -    |

### 4. Interface Signals

#### 4.1 TFT-LCD Panel and Backlight Driving

Recommended connector model: HRS: FH28-60S-0.5SH

Table 3: Connector Pin Assignments

| Pin No. | Symbol | I/O | Description                | Remarks |
|---------|--------|-----|----------------------------|---------|
| 1       | LED K1 | P   | Cathode1 of LED backlight. |         |
| 2       | LED K2 | P   | Cathode2 of LED backlight. |         |
| 3       | LED K3 | P   | Cathode3 of LED backlight. |         |
| 4       | NC     | -   | Dummy Pin                  |         |
| 5       | NC     | C   | Dummy Pin                  |         |
| 6       | NC     | C   | Dummy Pin                  |         |
| 7       | NC     | -   | Dummy Pin                  |         |
| 8       | LED A+ | P   | Anode of LED backlight.    |         |
| 9       | LED A+ | P   | Anode of LED backlight.    |         |
| 10      | NC     | -   | Dummy Pin                  |         |
| 11      | GND    | P   | Ground                     |         |
| 12      | OD0N   | I   | Odd Data channel 0 -       |         |
| 13      | OD0P   | I   | Odd Data channel 0 +       |         |
| 14      | GND    | P   | Ground                     |         |
| 15      | OD1N   | I   | Odd Data channel 1 -       |         |
| 16      | OD1P   | I   | Odd Data channel 1 +       |         |
| 17      | GND    | P   | Ground                     |         |
| 18      | OCLKN  | I   | Odd Clock channel -        |         |
| 19      | OCLKP  | I   | Odd Clock channel +        |         |
| 20      | GND    | P   | Ground                     |         |
| 21      | OD2N   | I   | Odd Data channel 2 -       |         |
| 22      | OD2P   | I   | Odd Data channel 2 +       |         |
| 23      | GND    | P   | Ground                     |         |
| 24      | OD3N   | I   | Odd Data channel 3 -       |         |

|    |           |     |                           |                         |
|----|-----------|-----|---------------------------|-------------------------|
| 25 | OD3P      | I   | Odd Data channel 3 +      |                         |
| 26 | GND       | P   | Ground                    |                         |
| 27 | ED0P      | I   | Even Data channel 0 +     |                         |
| 28 | ED0N      | I   | Even Data channel 0 -     |                         |
| 29 | GND       | P   | Ground                    |                         |
| 30 | ED1N      | I   | Even Data channel 1 -     |                         |
| 31 | ED1P      | I   | Even Data channel 1 +     |                         |
| 32 | GND       | P   | Ground                    |                         |
| 33 | ECLKN     | I   | Even Clock channel -      |                         |
| 34 | ECLKP     | I   | Even Clock channel +      |                         |
| 35 | GND       | P   | Ground                    |                         |
| 36 | ED2N      | I   | Even Data channel 2 -     |                         |
| 37 | ED2P      | I   | Even Data channel 2 +     |                         |
| 38 | GND       | P   | Ground                    |                         |
| 39 | ED3N      | I   | Even Data channel 3 -     |                         |
| 40 | ED3P      | I   | Even Data channel 3 +     |                         |
| 41 | GND       | P   | Ground                    |                         |
| 42 | VDD       | P   | Power pin                 | 3.3V typ.               |
| 43 | VDD       | P   | Power pin                 | 3.3V typ.               |
| 44 | ID1(GND)  | O   | ID1 Output pin            |                         |
| 45 | ID2(GND)  | O   | ID2 Output pin            |                         |
| 46 | RESET     | I   | Reset Pin                 | L: reset<br>H: Normal   |
| 47 | STB       | I   | Standby Pin               | L: Standby<br>H: Normal |
| 48 | CS        | I   | SPI chip select pin       | User set it to "1"      |
| 49 | SCL       | I   | SPI Clock pin             | User set it to "0"      |
| 50 | SDA       | I/O | SPI Data pin              | User set it to "0"      |
| 51 | TP_GND    | P   | GND for touch panel       |                         |
| 52 | TP_VDDBUS | P   | Voltage for touch panel   |                         |
| 53 | TP_/ATTN  | O   | Interrupt pin             |                         |
| 54 | TP_/XRESB | I   | Reset pin for touch panel |                         |
| 55 | TP_SDA    | I/O | I2C data pin              |                         |
| 56 | TP_GND    | P   | GND for touch panel       |                         |
| 57 | TP_SCL    | I   | I2C clock input pin       |                         |
| 58 | ID3(GND)  | O   | ID3 Output pin            |                         |
| 59 | TP_VDDH   | P   | Voltage for touch panel   |                         |
| 60 | TP_GND    | P   | GND for touch panel       |                         |

Remarks: For I/O, "I" is Input, "O" is Output. "P" is for Power, and "C" is for passive

## 5. Absolute Maximum Ratings

The absolute maximum ratings are list on table as follows. When used out of the absolute maximum ratings, the LSI may be permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the LSI will malfunction and cause poor reliability.

Table 4: Absolute Maximum Ratings & Environmental Conditions

| Item                                   | Symbol                 | Min. | Max.  | Unit |
|----------------------------------------|------------------------|------|-------|------|
| Power Supply voltage                   | VDD3.3V                | -0.3 | +3.96 | V    |
| Single LED forward current             | I <sub>F</sub>         | -    | 150   | mA   |
| Total LED forward current              | I <sub>F</sub> (Total) | -    | 450   | mA   |
| Relative Humidity (at 60°C,)           | RH                     |      | 90    | %    |
| Operating Temperature (Note 2, Note 3) | Topr                   | -30  | +85   | °C   |
| Storage Temperature                    | Tstg                   | -40  | +90   | °C   |

Note 1: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

Note 2: No optical performance guarantee under -30°C

Note 3: Panel surface temperature should not exceed 85°C.

Note 4: No condensation allowed under any condition.

Note 5: GND = 0V.

### **[Caution]**

Do not display fixed pattern for prolonged hours because it may develop image sticking on the display.

## 6. Electrical Specifications

### 6.1 Block Diagram

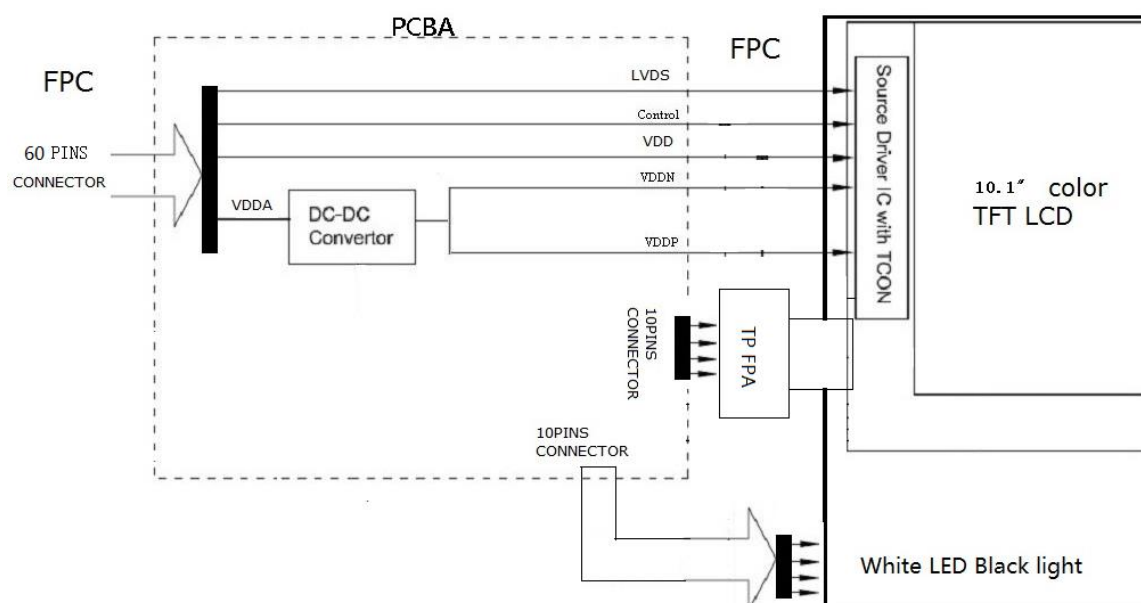


Figure 2: Block diagram

## 6.2 TFT LCD Module DC Characteristics

Table 5: DC characteristic

| Parameter                                    | Symbol      | Min.    | Typ. | Max.    | Unit |
|----------------------------------------------|-------------|---------|------|---------|------|
| Power supply voltage                         | VCC         | 3.15    | 3.3  | 3.45    | V    |
| Power supply current                         | ICC(Note 2) | -       | 220  | 330     | mA   |
| Driver input high signal voltage<br>(Note 3) | VIH         | 0.7*VCC | -    | VCC     | V    |
| Driver input low signal voltage<br>(Note 3)  | VIL         | GND     |      | 0.3*VCC |      |

Note 1: The supply voltage is measured and specified at the interface connector of LCM..

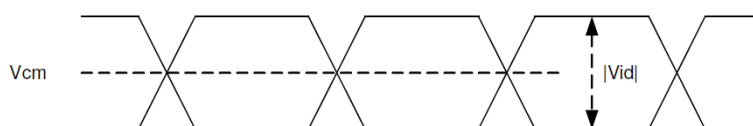
Note 2: column inversion, Frame rate =60Hz. Tested value is RMS value.

Note 3: For SDA, SCL, CS, STBYB, RESET signal.

Table 6: LVDS DC Characteristics

| Parameter                                    | Symbol             | Min. | Typ. | Max.                     | Unit |
|----------------------------------------------|--------------------|------|------|--------------------------|------|
| Differential input high<br>Threshold voltage | R <sub>TH</sub>    | -    | -    | +0.1                     | V    |
| Differential input low<br>threshold voltage  | R <sub>TL</sub>    | -0.1 | -    | -                        | V    |
| Differential input common<br>Mode voltage    | R <sub>CM</sub>    | 1    | 1.2  | 1.7- V <sub>ID</sub>  /2 | V    |
| LVDS input voltage                           | V <sub>INLV</sub>  | 0.7  |      | 1.7                      | V    |
| Differential input voltage                   | V <sub>ID</sub>    | 0.1  |      | 0.6                      | V    |
| Differential input leakage<br>Current        | R <sub>VXliz</sub> | -10  | -    | +10                      | uA   |

**Single-ended:**  
LVCLKP(R),  
LVCLKN(R),  
LVD[3:0]P(R),  
LVD[3:0]N(R)



**Differential:**  
LVCLKP(R)-LVCLKN(R),  
LVD[3:0]P(R)-  
LVD[3:0]N(R)

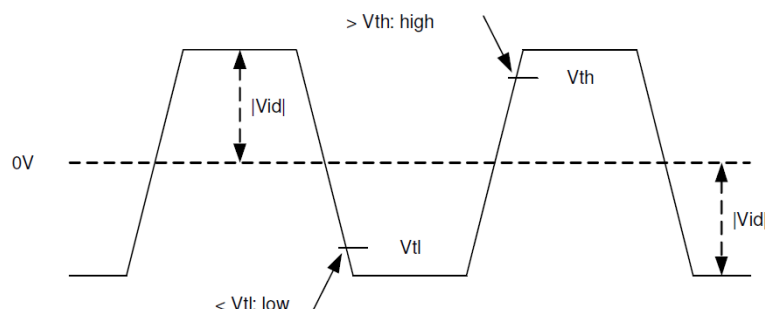


Figure 3: LVDS DC character

### 6.3 Typical Electrical Characteristics for Touch Panel

At Ta = 25°C, TP\_VDD(TP\_VDDH & TP\_VDDBUS)=3.3V, TP\_GND=0V.

Table 7: DC characteristics of touch panel

| Parameter                  | Symbol    | Min. | Typ. | Max. | Unit |
|----------------------------|-----------|------|------|------|------|
| Touch panel supply voltage | AVDD/DVDD | 3.2  | 3.3  | 3.4  | V    |
| Touch panel supply current | TP_HIDD1  | -    | -    | 40   | mA   |
| Touch panel supply current | TP_BIDD2  | -    | -    | 2    | mA   |
|                            |           |      |      |      |      |
|                            |           |      |      |      |      |

### 6.4 Recommended Driving Condition for LED Backlight

Table 8: DC characteristics of LED backlight

| Parameter                             | Symbol                | Condition                                                 | Min.  | Typ. | Max. | Unit | Remark |
|---------------------------------------|-----------------------|-----------------------------------------------------------|-------|------|------|------|--------|
| Supply voltage of LED backlight       | V <sub>LED</sub>      | Backlight current = 240 mA<br>Number of LED = 30 pcs      |       | 30   |      | V    | Note 1 |
| Supply current of LED backlight       | I <sub>LED1/3</sub>   | Per LED string                                            | -     | 80   | -    | mA   | Note 2 |
| Total Supply current of LED backlight | I <sub>LEDTotal</sub> | I <sub>LED1</sub> + I <sub>LED2</sub> + I <sub>LED3</sub> | -     | 240  | -    | mA   | Note 2 |
| Backlight Power Consumption           | P <sub>LED</sub>      | -                                                         | -     | 7.2  | -    | W    | Note 3 |
| LED Life time                         | LIFE                  | Ta=25 °C, I <sub>LED</sub> =80mA                          | 30000 |      |      | Hrs  | Note 4 |

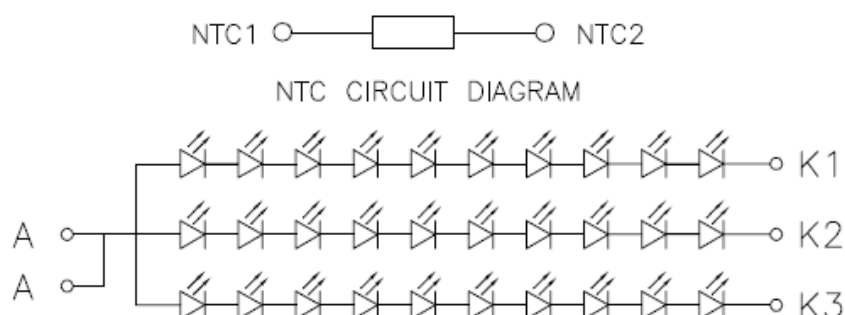
Note 1: Backlight Circuit Diagram

Note 2: The LED driving condition is defined for each LED module.

Total input current = 80 x 3= 240 mA

Note 3: Backlight power consumption is calculated by I<sub>LED</sub> (Total) x V<sub>LED</sub>

Note 4: The LED Life-time define as the estimated time to 50% of initial luminous



### AMBIENT TEMPERATURE VS. FORWARD CURRENT

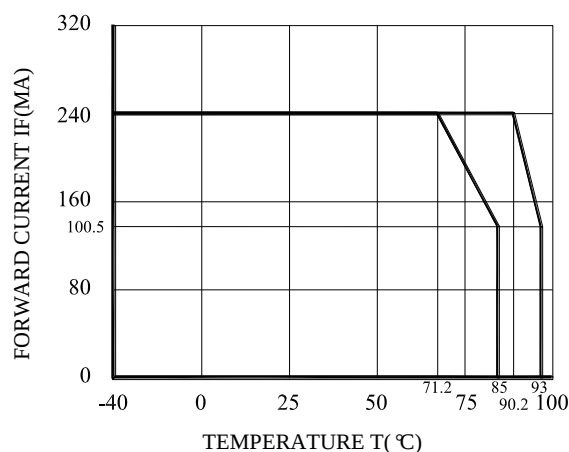


Figure 4. Recommended derating curve

## 6.5 Signal Specification

### 6.5.1 LVDS AC electrical characteristics

Table 9: AC characteristics of LVDS

| Parameter         | Symbol  | Min.  | Typ. | Max. | Unit   |
|-------------------|---------|-------|------|------|--------|
| Clock frequency   | FLVCYC  | 20    | -    | 85   | MHz    |
| Clock period      | TLVCYC  | 11.76 | -    | -    | ns     |
| 1 data bit time   | UI      | -     | 1/7  | -    | TLVCYC |
| Clock high time   | TLVCH   | 2.8   | 4    | 4.2  | UI     |
| Clock low time    | TLVCL   | 2.8   | 3    | 4.2  | UI     |
| Position 1        | TPOS1   | -0.2  | 0    | 0.2  | UI     |
| Position 0        | TPOS0   | 0.8   | 1    | 1.2  | UI     |
| Position 6        | TPOS6   | 1.8   | 2    | 2.2  | UI     |
| Position 5        | TPOS5   | 2.8   | 3    | 3.2  | UI     |
| Position 4        | TPOS4   | 3.8   | 4    | 4.2  | UI     |
| Position 3        | TPOS3   | 4.8   | 5    | 5.2  | UI     |
| Position 2        | TPOS2   | 5.8   | 6    | 6.2  | UI     |
| Input eye width   | TEYEW   | 0.6   | -    | -    | UI     |
| Input eye border  | TEX     | -     | -    | 0.2  | UI     |
| LVDS wake up time | TENLVDS | -     | -    | 150  | us     |

LVCLKP (R)-LVCLKN (R)

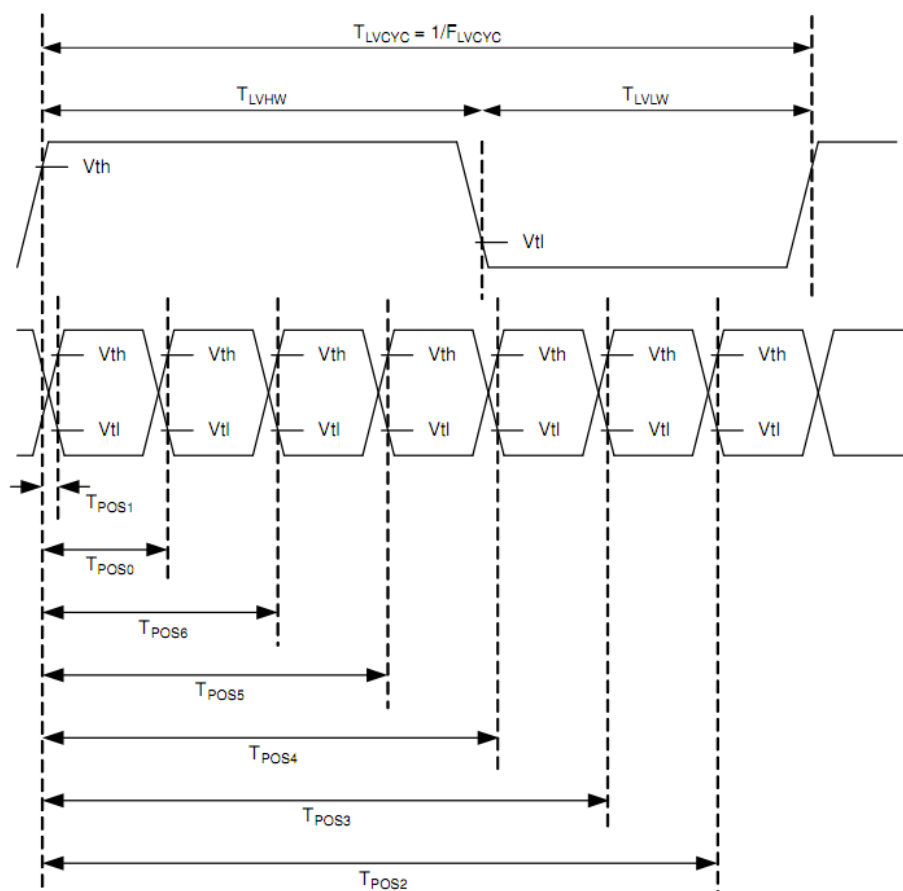
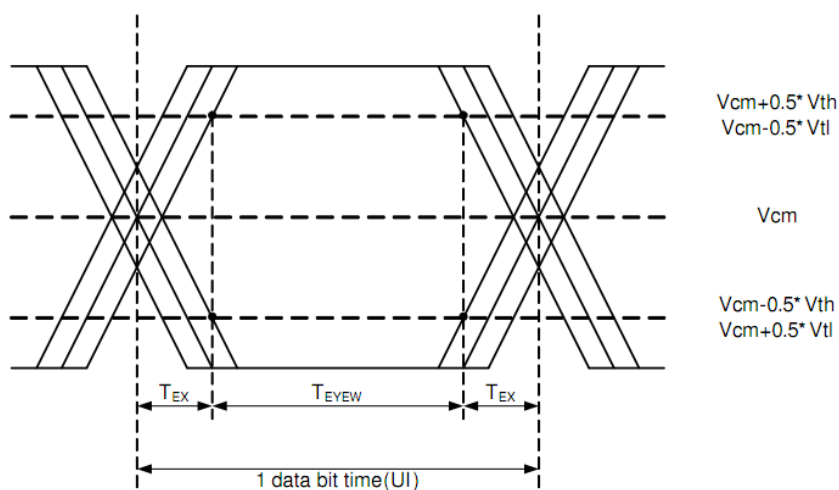
LVD [3:0]P(R)-  
LVD [3:0]N(R)

Figure 5

Single-ended:  
LVD [3:0]P,  
LVD [3:0]N

**Differential:  
LVD[3:0]P-LVD[3:0]N**

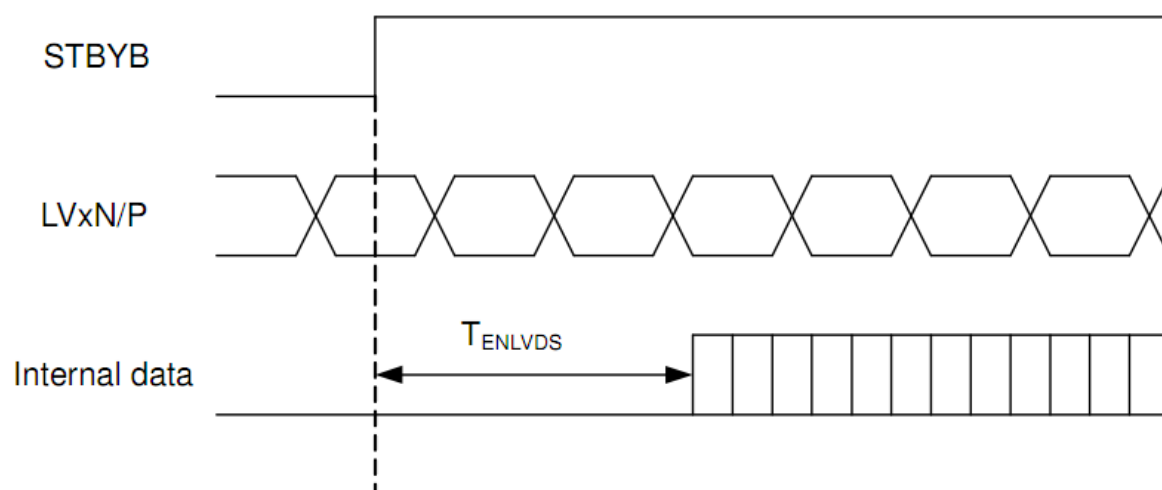
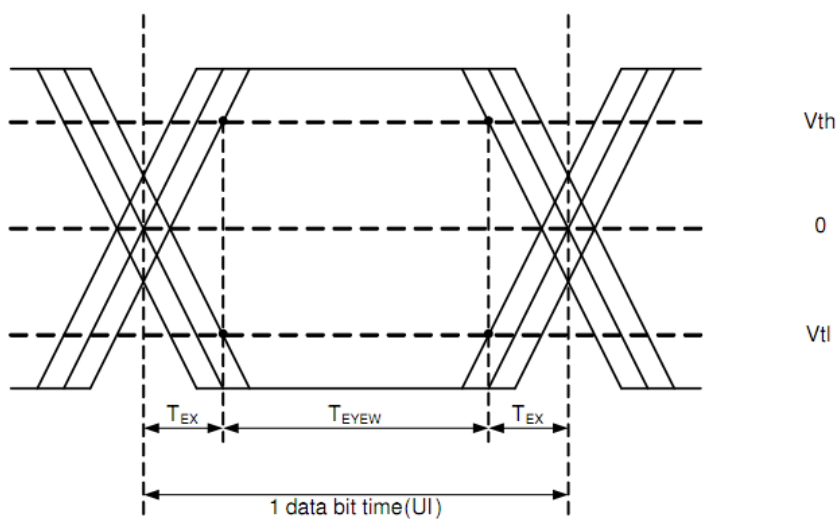


Figure 6

### 6.5.2 LVDS Input Format (VESA 8bit)

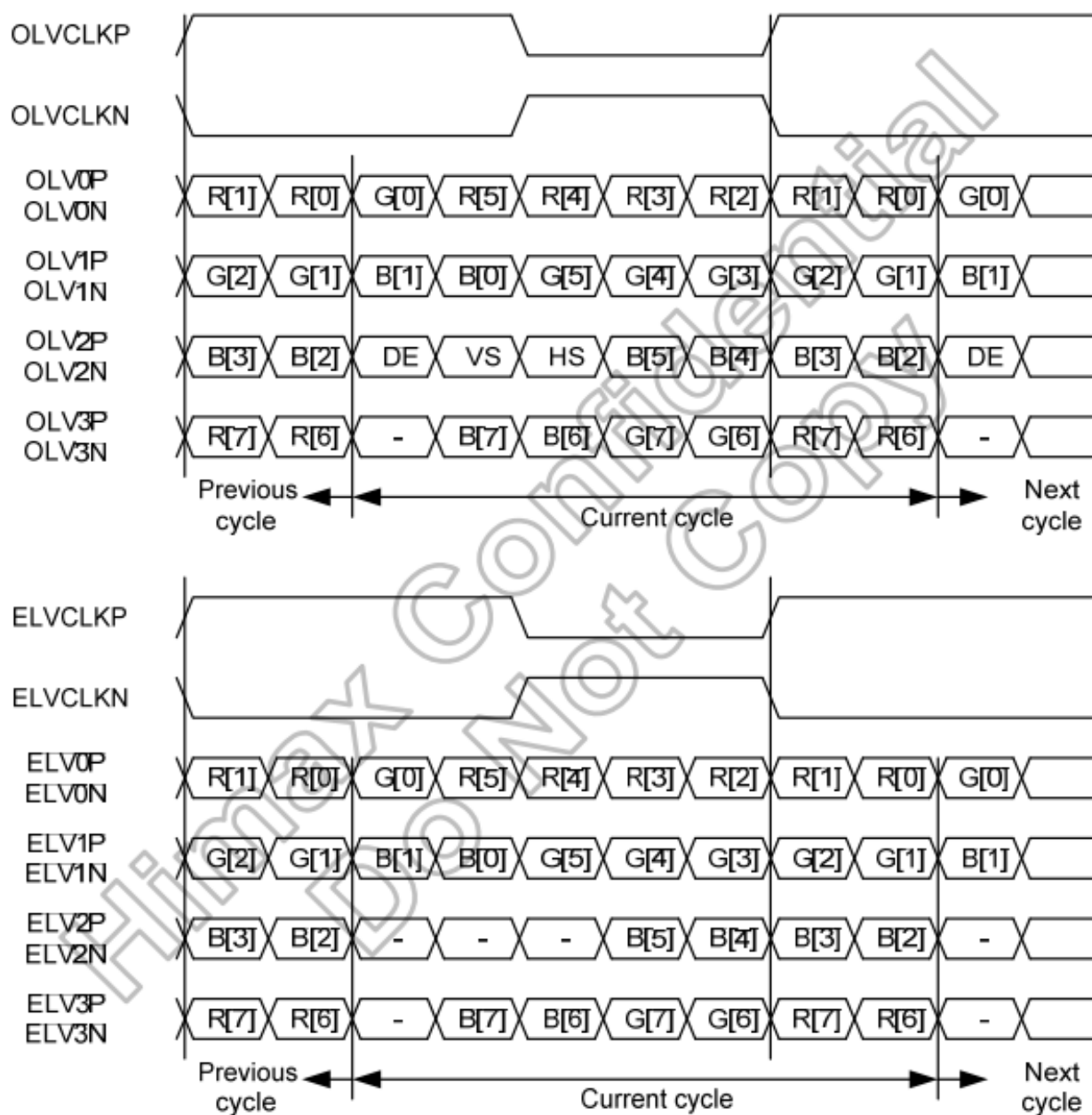


Figure 7: LVDS input data format (VESA format)

### 6.5.3 Video Signal Timing

Table 10: Video signal timing

| Symbol             | Parameter              | Conditions | Related Pins | Min. | Typ. | Max. | Unit |
|--------------------|------------------------|------------|--------------|------|------|------|------|
| VP                 | Vertical Total         | -          | VSYNC        | 1087 | 1118 | 1404 | Line |
| VS                 | VSYNC Low Pulse Width  | -          | VSYNC        | 1    | 3    | 20   | Line |
| VBP                | Vertical Back Porch    | -          | VSYNC        | 2    | 30   | 255  | Line |
| VFP                | Vertical Front Porch   | -          | VSYNC        | 5    | 8    | 260  | Line |
| VDISP              | Vertical Active Area   | -          | VSYNC        | -    | 1080 | -    | Line |
| HP                 | Horizontal Total       | -          | HSYNC        | 989  | 1002 | 1248 | DCK  |
| HS                 | HSYNC Low Pulse Width  | -          | HSYNC        | 10   | 12   | 255  | DCK  |
| HBP                | Horizontal Back Porch  | -          | HSYNC        | 5    | 16   | 255  | DCK  |
| HFP                | Horizontal Front Porch | -          | HSYNC        | 24   | 26   | 260  | DCK  |
| HDISP              | Horizontal Active Area | -          | HSYNC        | -    | 960  | -    | DCK  |
| F <sub>frame</sub> | Frame Frequency        | -          | CLK          | -    | 60   | -    | Hz   |
| f <sub>CLK</sub>   | CLK frequency          | -          | CLK          | 64.5 | 67.2 | 85   | MHz  |

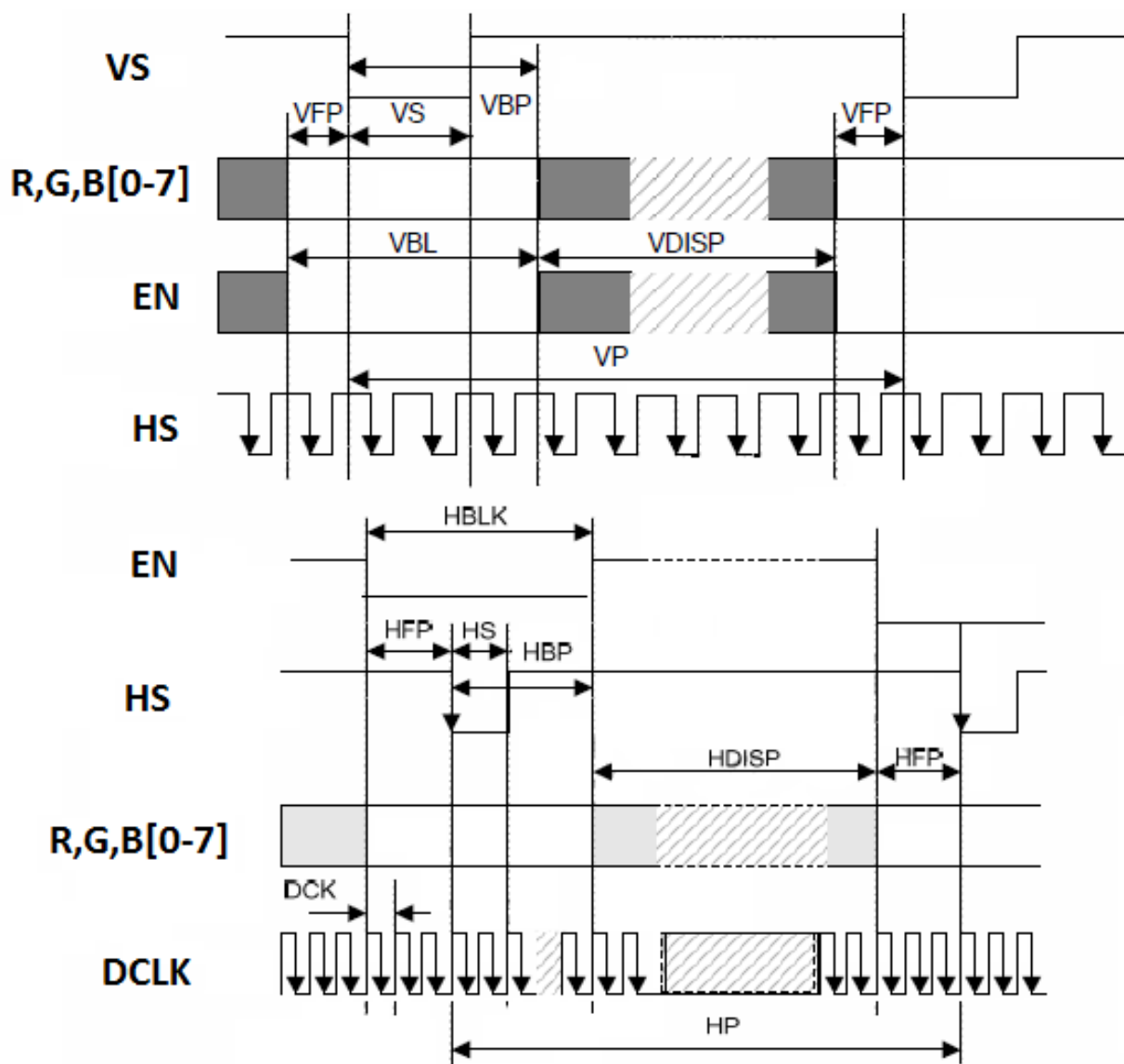


Figure 8

#### 6.5.4 SPI interface (3 wires)

SPI interface is used to read and write the setting registers of the TFT module.

All registers setting have been OTP in driver IC.

So no need to using the SPI to initialize module, just pull high SPI pins at customer's system side.

When write register, customer should write the same data to all source driver ICs .

ID[1:0]=0, correspond to Master IC

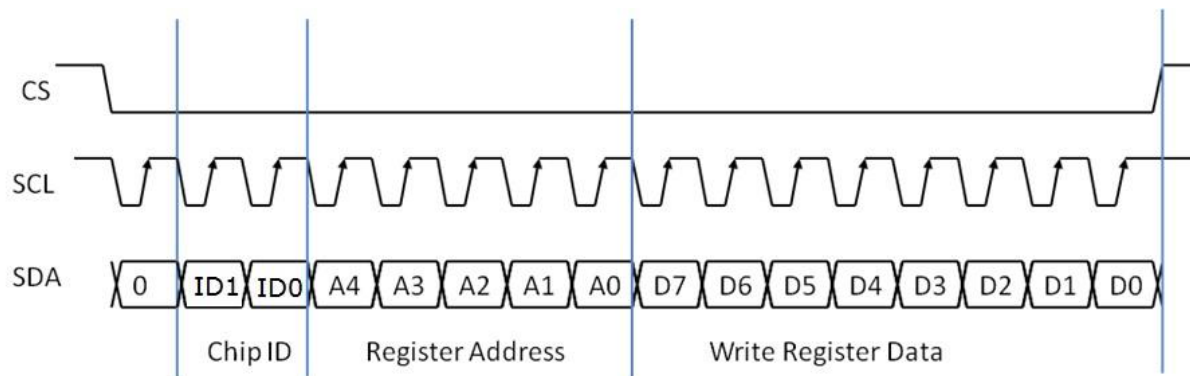


Figure 9: SPI write data format

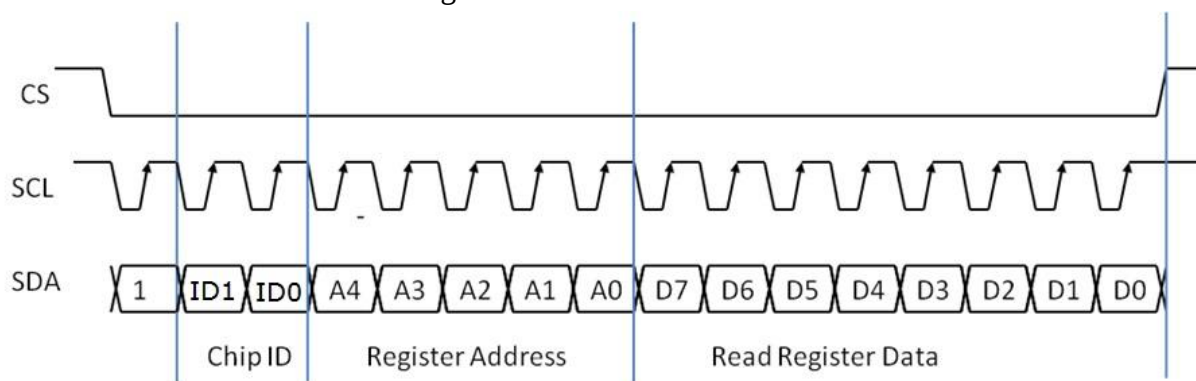


Figure 10: SPI read data format

### 6.5.5 SPI interface timing chart

Table 11: AC Characteristic of SPI interface

| Parameter   | Symbol | Condition          | Min. | Typ. | Max. | Unit |
|-------------|--------|--------------------|------|------|------|------|
| Setup Time  | tS0    | CS to SCL          | 60   | -    | -    | ns   |
|             | tS1    | SDA to SCL         | 60   | -    | -    | ns   |
| Hold Time   | tH0    | CS to SCL          | 60   | -    | -    | ns   |
|             | tH1    | SDA to SCL         | 60   | -    | -    | ns   |
| Pulse Width | tW1L   | SCL Negative cycle | 75   | -    | -    | ns   |
|             | tW1H   | SCL Positive cycle | 75   | -    | -    | ns   |
|             | tW2    | CS pulse width     | 1    | -    | -    | us   |
| Clock duty  | -      | SCL                | 40   | 50   | 60   | %    |

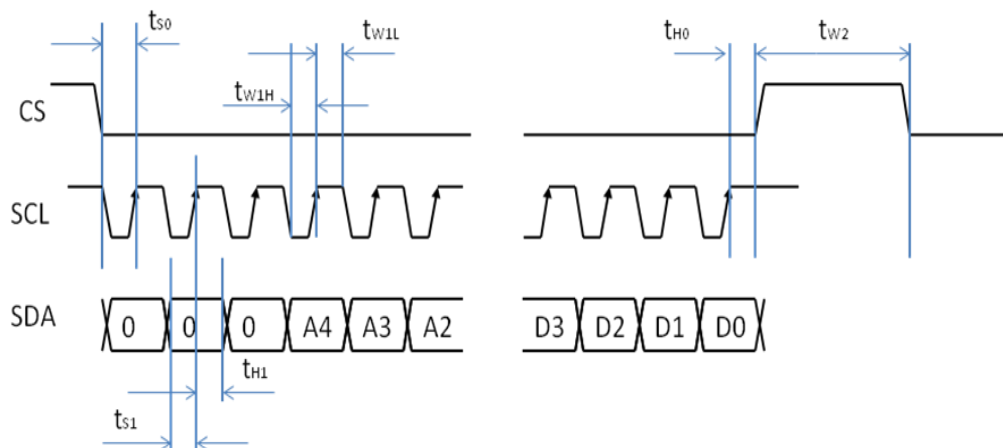


Figure 11: SPI timing

## 6.5.6 Reset Timing

Table 12

| Symbol | Parameter                  | Min.      | Typ. | Max. | Unit |
|--------|----------------------------|-----------|------|------|------|
| tRW    | Reset pulse width          | 10(note1) | -    | -    | us   |
| tRT    | Reset complete time        | -         | -    | 5    | us   |
| tNNS   | Negative spike noise width | -         | -    | 100  | ns   |

Note1: There is a RC filter on STB and RESET signal line. R=10K ohm , C=0.1uF.

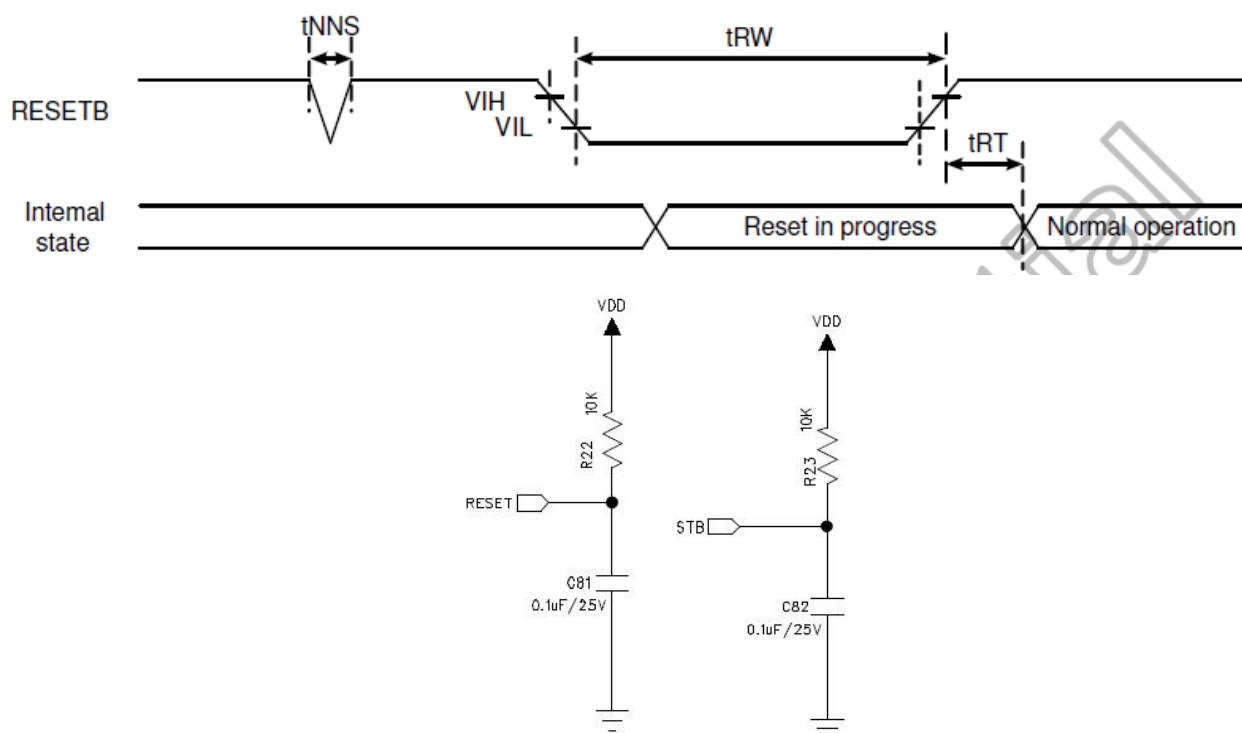


Figure 12

## 6.5.7 Power On/ Off Sequence

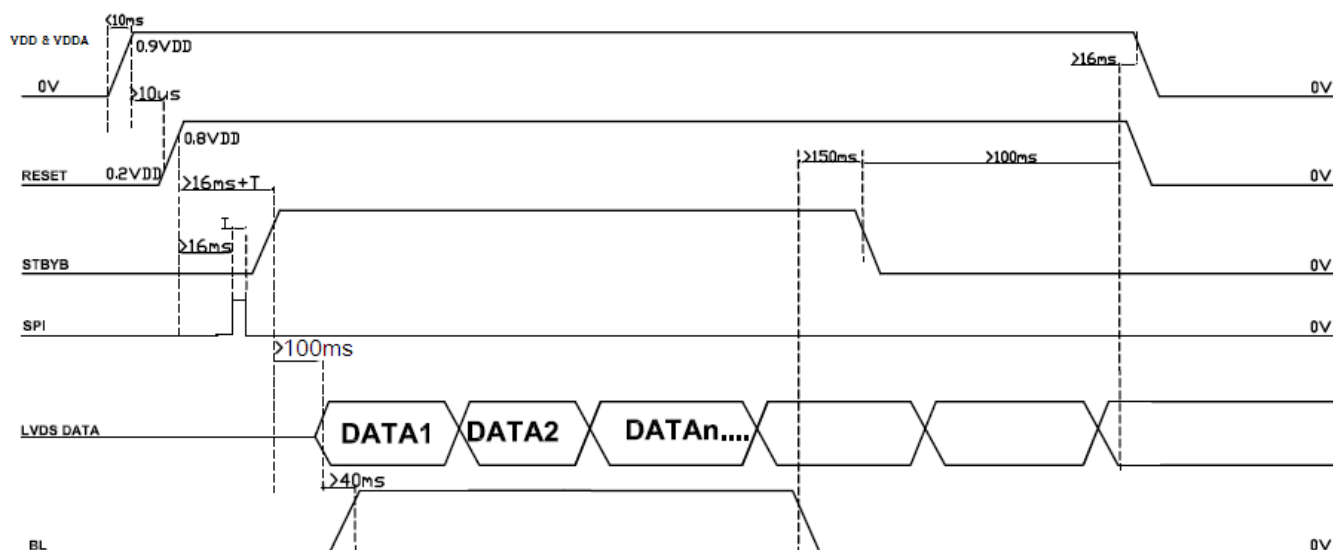


Figure 13: Power on/off sequence

### 6.5.8 Pixel Arrangement

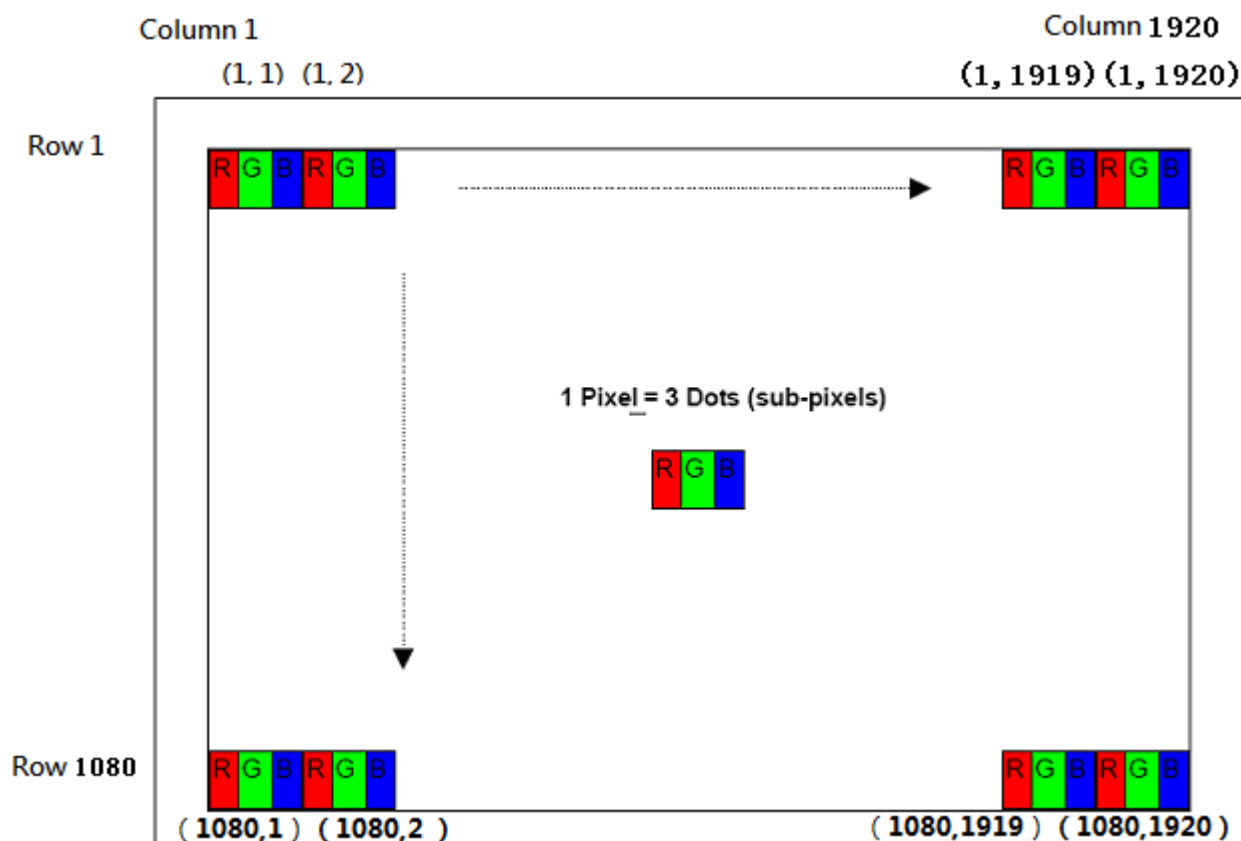


Figure 14:

## 6.6 Touch Panel Timing Characteristics

### 6.6.1 Power Up/Reset

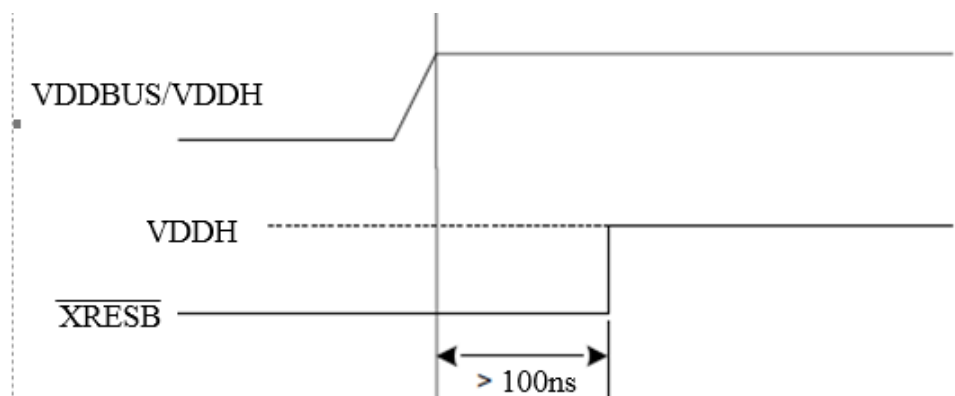


Figure 15: Power sequencing on the S7882

Note: VDDBUS/VDDH can be powered up in any order.

The XRESB pin can be used to reset the device whenever necessary. The XRESB pin must be asserted low for at least 100ns to cause a reset. After releasing the XRESB pin the device takes 45ms before it is

ready to start communications. It is recommended to connect the XRESB pin to a host controller to allow it to initiate a full hardness reset without requiring a power-down.

### 6.6.2 I2C Device Address for the Touch IC

Table 13: Format of SLA+W and SLA+R

| Bit 7                       | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0      |
|-----------------------------|-------|-------|-------|-------|-------|-------|------------|
| Device Address: <b>0x30</b> |       |       |       |       |       |       | Read/Write |

### 6.6.3 I2C Compatible Specification

Table 14

| Parameter                      | Operation   |
|--------------------------------|-------------|
| Addresses                      | <b>0x30</b> |
| Maximum bus speed (SCL)        | 400kHz      |
| I <sup>2</sup> C specification | Version 2.1 |

### 6.6.4 I2C host interface

To ensure software compatibility, full details of the Synaptics register-mapped interface protocol can be found in the Synaptics RMI4 Specification (PN: 511-000405-01 and 511-000405-02).

## 7. Optical Characteristics

Conditions unless specified otherwise:

- Ta = 25 °C, dark room
- TFT-LCD supply voltage = 3.3 volts
- Elapsed time from switch on is greater than 30 minutes
- RGB, white and black test patterns only
- Factory settings
- Luminance = 100% unless specified
- Measurements are conducted at ambient temperature and perpendicular unless specified

**Table 15: Optical Specifications**

| Parameter                            | Symbol     | Condition | Min.  | Typ.  | Max.  | Unit              | Remark             |
|--------------------------------------|------------|-----------|-------|-------|-------|-------------------|--------------------|
| Viewing Angle                        | Horizontal | Θ3        | 70    | 85    |       | °                 |                    |
|                                      |            | Θ9        | 70    | 85    |       | °                 |                    |
|                                      | Vertical   | Θ12       | 70    | 85    |       | °                 |                    |
|                                      |            | Θ6        | 70    | 85    |       | °                 |                    |
| Contrast Ratio                       | CR         | Θ= 0°     | 800   | 1000  |       |                   | Note 1             |
| Luminance(on the cover lens surface) | L          | Θ= 0°     | 600   | 700   |       | cd/m <sup>2</sup> | Note 2             |
| Uniformity                           | %          | Θ= 0°     | 75    | 80    |       |                   | Note 3             |
| NTSC                                 | %          | Θ= 0°     | 65    | 70    |       |                   |                    |
| Reproduction Of color                | Red        | Rx        | -0.03 | 0.634 | +0.03 |                   | Note 4<br>* Module |
|                                      |            | Ry        | -0.03 | 0.322 | +0.03 |                   |                    |
|                                      | Green      | Gx        | -0.03 | 0.332 | +0.03 |                   |                    |
|                                      |            | Gy        | -0.03 | 0.623 | +0.03 |                   |                    |
|                                      | Blue       | Bx        | -0.03 | 0.149 | +0.03 |                   |                    |
|                                      |            | By        | -0.03 | 0.076 | +0.03 |                   |                    |
| White                                |            | Wx        | -0.03 | 0.290 | +0.03 |                   |                    |
|                                      |            | Wy        | -0.03 | 0.317 | +0.03 |                   |                    |
| Response Time                        | Tr +Tf     | Ta=25 °   |       | 30    | 40    | ms                | Note 5             |
|                                      |            | Ta=-30 °  |       | 600   | 700   | ms                |                    |
| Gamma                                |            |           | 1.9   | 2.2   | 2.5   |                   | Ta=25 °            |
| Cross talk                           |            |           |       |       | 3.0%  |                   |                    |
| Image sticking                       | Level      |           |       |       | 2     |                   | Note 6             |

Note:

1. Contrast measurements shall be made at viewing angle of Θ= 0, and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. Luminance Contrast Ratio (CR) is defined mathematically.

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

2. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. This measurement shall be taken at the locations shown in FIG. 16.

3. Uniformity measurement shall be taken at the locations shown in FIG. 17, for a total of the measurements per display, measure surface luminance of these nine points across the LCD surface 50cm from the surface with all pixels displaying white.

$$\text{Uniformity} = \frac{\text{Min Luminance of 9 points}}{\text{Max Luminance of 9 points}} \times 100\%$$

4. The color chromaticity coordinates specified in Table15 shall be calculated from The spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the Module.

5. The electro-optical response time measurements shall be made as FIG.18 by switching the “data” input signal ON and OFF.

The times needed for the luminance to change from 10% to 90% is  $T_r$  and 90% to 10% is  $T_f$ .

6. Image Sticking<LEVEL 2

60degC,1hr,<Level2. Test pattern: Chess, Inspection pattern: 50% grey. (FIG.19)

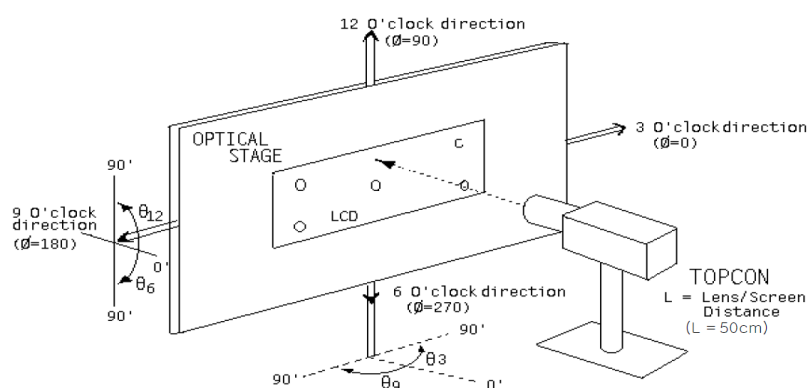


Figure 16: Measurement Set Up

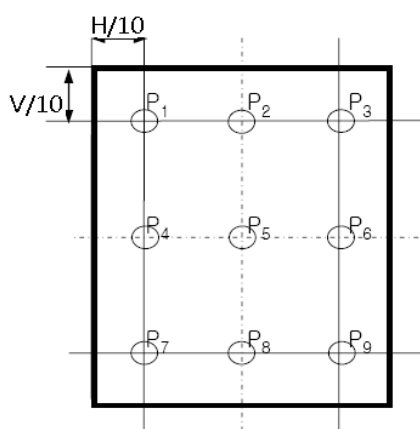


Figure 17: Uniformity Measurement Locations

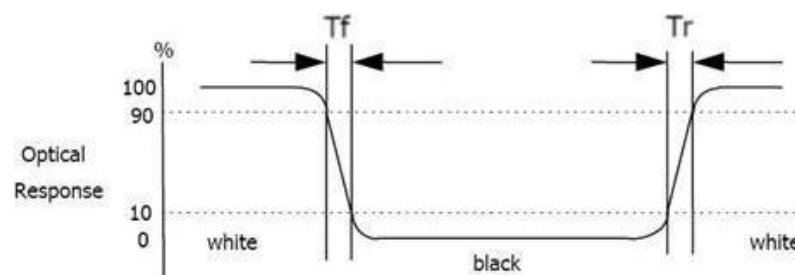


Figure 18: Response Time Testing

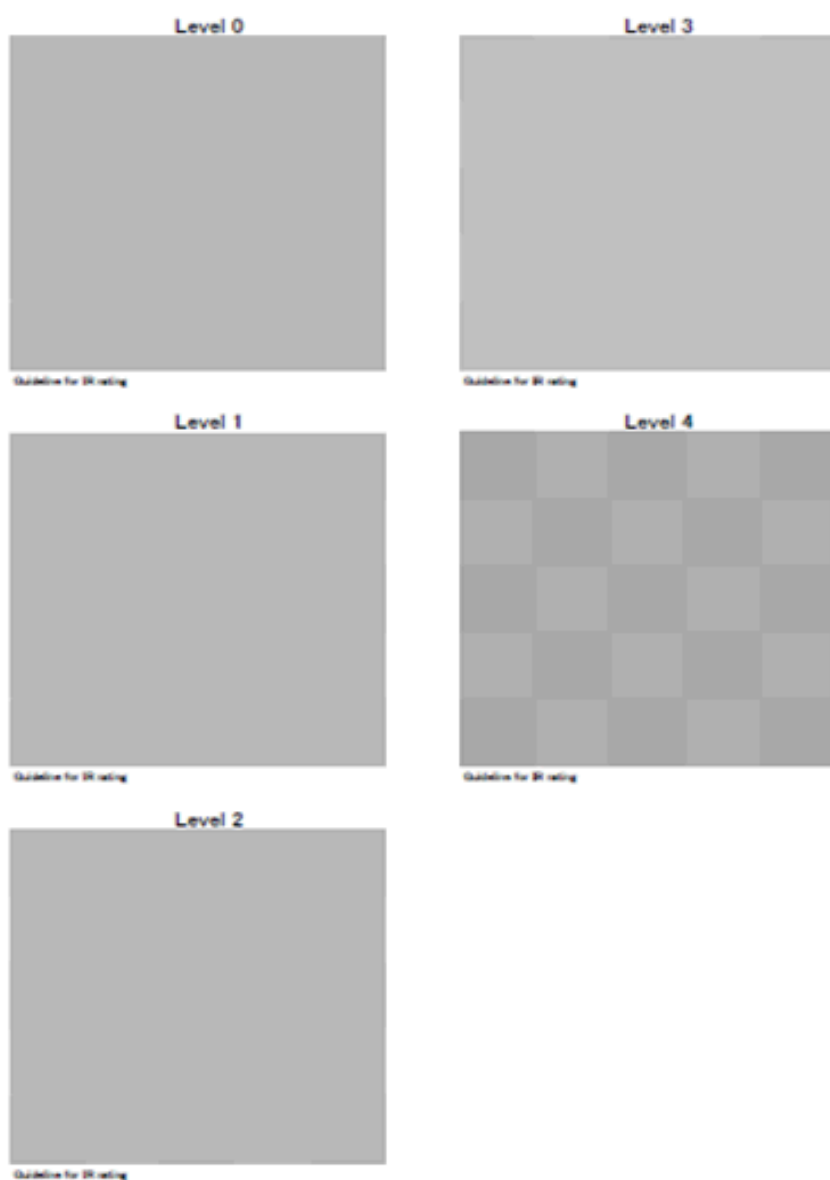


Figure 19: Image Sticking

## 8. Reliability Tests / Environmental

### 8.1 Reliability Test Conditions

Table 16: List of reliability tests

| NO. | Test Item                                           | Test Condition                                                                                                                                                                                              | Duration |
|-----|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1   | High temperature, high humidity operation test(THO) | 60℃, 90%RH 240hrs                                                                                                                                                                                           | 4PCS     |
| 2   | Low temperature operation test(LTO) Note 2          | -30℃, 240hrs                                                                                                                                                                                                | 4PCS     |
| 3   | High temperature operation test(HTO) Note 1         | 85℃ 240hrs                                                                                                                                                                                                  | 4PCS     |
| 4   | High temperature storage test(HTS)                  | 90℃ 240hrs                                                                                                                                                                                                  | 4PCS     |
| 5   | Low temperature storage test(LTS)                   | -40℃ 240hrs                                                                                                                                                                                                 | 4PCS     |
| 6   | Mechanical Shock                                    | 3 directions: X,Y,Z axes<br>Repeats:6<br>Peak acc.:100 G<br>Pulse duration: 6 ms (half sine wave)<br>Non-Operating                                                                                          | 4PCS     |
| 7   | Mechanical Vibration                                | 3 directions: X,Y,Z axes<br>Sweep time: 10 (1Oct/ min)<br>Frequency: 10 -> 150->10 Hz<br>10-58 Hz: constant amplitude 0.75mm peak.<br>58-150Hz: constant acceleration 10g peak<br>Sinusoidal, Non-Operating | 4PCS     |
| 8   | Temperature shock                                   | -30℃(15mins)~85℃(15mins) , 100cycles                                                                                                                                                                        | 4PCS     |
| 9   | ESD                                                 | R = 330ohm, C = 330pF,<br>· Air discharge: ±15 KV to display surface<br>· Contact discharge: ±8 KV to side BZ<br>class B                                                                                    | 2PCS     |
| 10  | Package Drop                                        | Height 0.8m, 1corner, 3edges, 6surface                                                                                                                                                                      | 2PCS     |

Note 1: Panel surface temperature should not exceed 85 ℃.

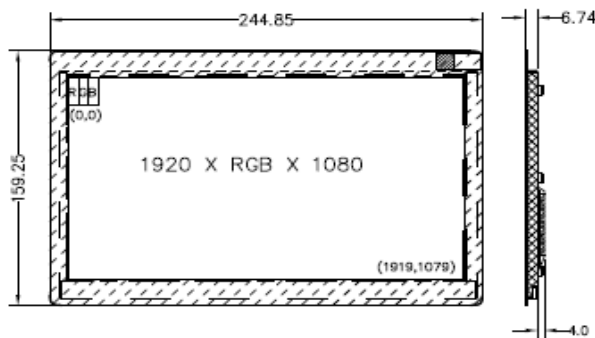
Note 2: No optical performance guarantee below -30℃.

Note 3: For module internal structure robustness test purpose only. Customer application design should take care of overall mounting robustness with module

## 9. Packing Specification

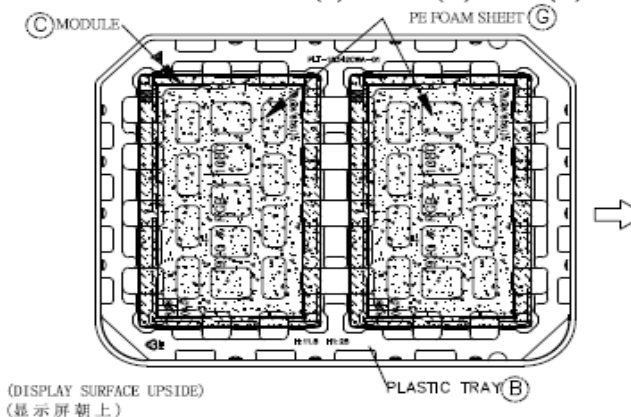
PD DRAWING IS BASED ON PD-AV101FHT-T10-28P0, ONLY THE MODULE IS DIFFERENT.

CONFIGURATION:  
MS: AV101FHT-T10-28P0

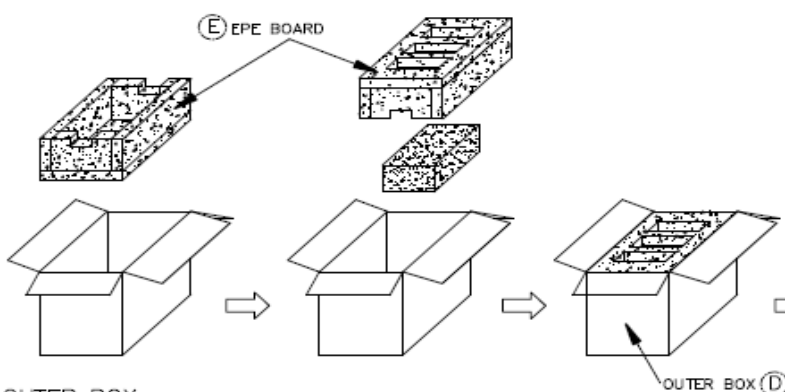
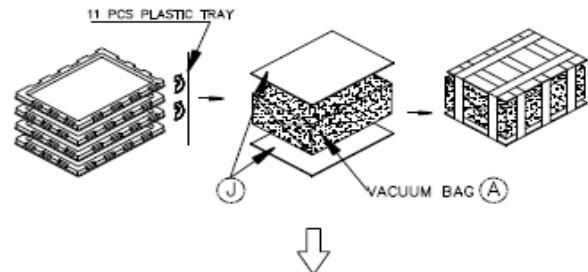


| REV | AMENDMENT                                    |                 |                 |              |               | DATE               |  |
|-----|----------------------------------------------|-----------------|-----------------|--------------|---------------|--------------------|--|
| 1   | Change the F-Label size,Add the material No. |                 |                 |              |               | 2019.06.04         |  |
|     |                                              |                 |                 |              |               |                    |  |
| L   | 44-9241054                                   | OUTER BOX LABEL | 16              | PCS          | 0.0500        | 102X36             |  |
| K   | 44-9241053                                   | OUTER BOX LABEL | 16              | PCS          | 0.0500        | 102X36             |  |
| J   | 44-9312132                                   | PLASTIC SHEET   | 32              | PCS          | 0.1000        | 380X290X4.0        |  |
| I   | 44-9441220                                   | PALLET          | 1               | PCS          | 0.0032        | 1100X900           |  |
| H   | 44-9451019                                   | HARD EDGES      | 8               | PCS          | 0.0250        | 700X60X60          |  |
| G   | 44-9312303                                   | PE FOAM SHEET   | 320             | PCS          | 1.0000        | 242X157X2.0        |  |
| F   | 44-9241058                                   | OUTER BOX LABEL | 16              | PCS          | 0.0500        | 152X102            |  |
| E   | 44-9321838                                   | EPE BOARD       | 32              | PCS          | 0.1000        | 480X380X140        |  |
| D   | 44-9301643                                   | OUTER BOX       | 16              | PCS          | 0.0500        | 500X400X300        |  |
| C   | AV101FHT-T10-28P0                            | MODULE          | 320             | PCS          |               | 244.85X159.25X6.74 |  |
| B   | 44-9432519                                   | PLASTIC TRAY    | 176             | PCS          | 0.5500        | 420X320X25         |  |
| A   | 44-9331264                                   | VACUUM BAG      | 16              | PCS          | 0.0500        | 700X615            |  |
| NO. | ITEM NO.                                     | DESCRIPTION     | QTY/<br>PALETTE | BAAN<br>UNIT | BOM<br>DOSAGE | SIZE               |  |

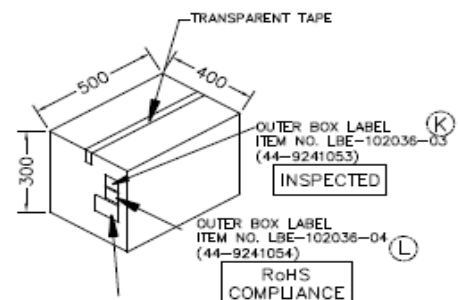
PLASTIC TRAY  
ONE TRAY FOR 2 PCS MODULE  
ITEM NO.: 44-9432519  
MATERIAL: TRANSPARENT PET T=1.2mm  
PLASTIC TRAY SIZE: 420(L) X 320(W) X 25(H)mm



- 2 PCS/TRAY X 10 TRAYS/OUTER BOX = 20 PCS/OUTER BOX.
- EMPTY TRAY ADD ON TOP FOR ANTI-STATIC PURPOSE.  
(最上层吸塑盘为空盘)
- EACH TRAY SHOULD BE ROTATED 180°.  
(每层吸塑盘需旋转180度摆放)
- AFTER PUT THE TRAY INTO VACUUM BAG, SEAL THE OPENING BY TRANSPARENT TAPE  
(把吸塑盘装入真空袋后并用透明胶纸封住)
- EACH BOX SHOULD BE PLACED ONE ANTI-STATIC PLASTIC SHEET ON THE TOP&BOTTOM.  
(每个纸箱之吸塑盘最上面&最下面须各放 1 块防静电胶板)



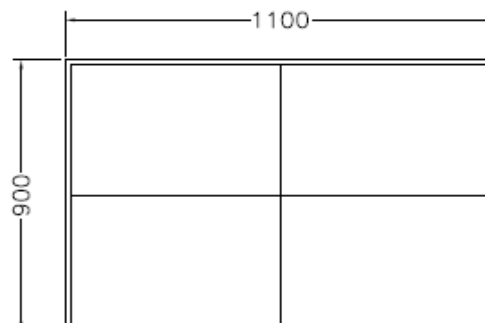
OUTER BOX ITEM:  
44-9301643



### OUTER BOX

- 2 PCS/TRAY X 10 TRAYS/OUTER BOX = 20 PCS/OUTER BOX.
- PUT THE TRAYS WITH VACUUM BAGS INTO THE OUTER BOX  
(把吸塑盘装入纸箱)
- EACH BOX SHOULD BE PLACED AN EPE BOARD ON THE TOP & BOTTOM.  
(每个纸箱的最上面 & 最下面须各放 1 块珍珠棉)

PALLET: 44-9441220



> 4 BOXES PER LEVEL (每层放4个BOX)  
> 4 LEVEL PER PALLET (每卡板放4层)

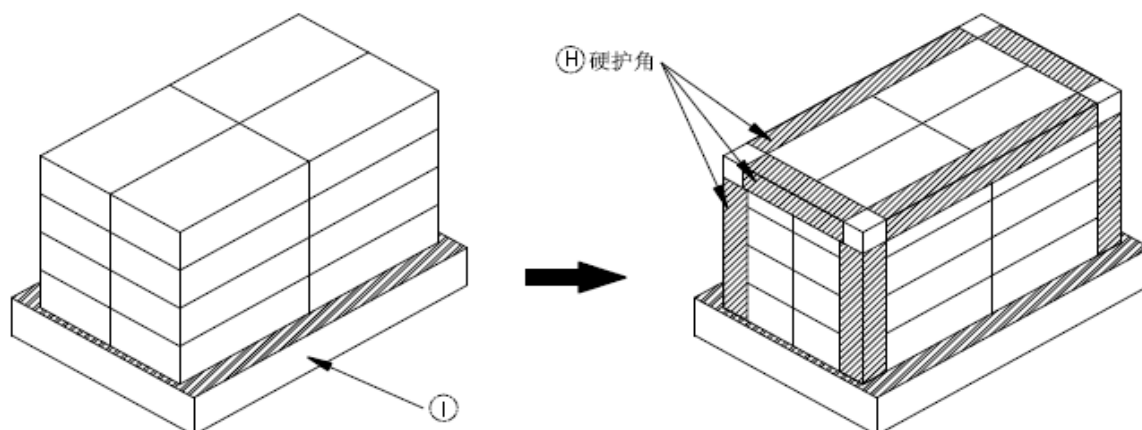
2 PCS/TRAY X10 TRAYS/OUTER BOX X4 OUTER BOX/LEVEL X 4 LEVEL/PALLET = 320 PCS/PALLET.

1.STACK THE CARTON BOXES ON THE PALLET.

(把纸箱放在卡板上)

2.PUT THE HARD EDGES ON THE EIGHT SIDES, USE TRANSPARENT TAPE TO FIX.

(把纸护角放在纸箱的八条侧边，并用透明胶纸固定)

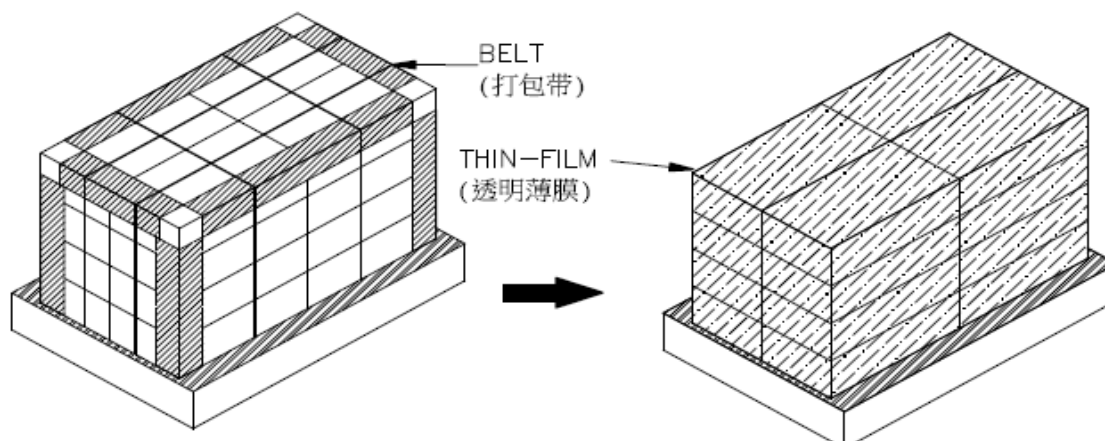


3. WRAP THE CARTONS BOXES WITH BELTS ON THE PALLET.

(用打包带将纸箱及卡板包扎好)

4.USE THE THIN FILM TO WRAP ALL THE CARTON BOXES.

(纸箱外面附上薄膜)



## 外箱标签说明

1 DID: **BOE-20190604-000001**



2 BYD PN: **12752802-00**



3 Manufaurer: **BOE**

4 MPN: **AV101FHT-T10-28P0**



5 CPN: **12752802-00**

6 DC: **1925**

8 QTY: **20** PCS

9 COO: **CHN**



10 **Automotive Grade**

7 Lot No: **ABCDEFGHIJK**

1、DID：输入为 BOE+包装日期（YYYYMMDD）+系列号（000001），系列号为 16 进制，第十箱为 00000 啊，第 17 箱为 000010；

2、BYD PN：为固定 12752802-00；

3、Manufaurer：为固定 BOE；

4、MPN：为产品 Item AV101FHT-T10-28P0；

5、CPN：为固定 12752802-00；

6、D/C：为包装年周(WWYY)；

7、Lot No：物料生产的批次号，要求以工单为单位，即一个工单为一个批次，其批次格式由供应商内部定义，但不能重复

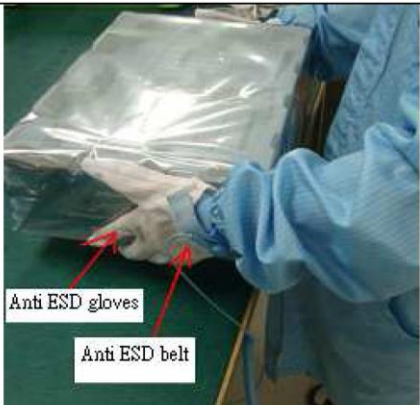
8、QTY：包装数量20；

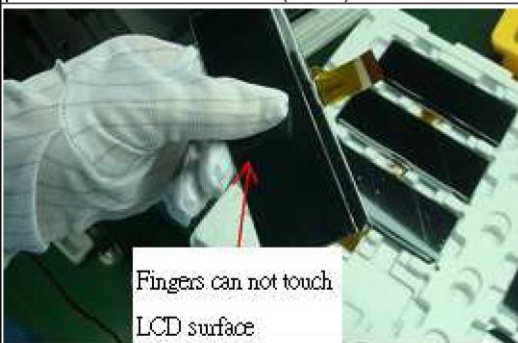
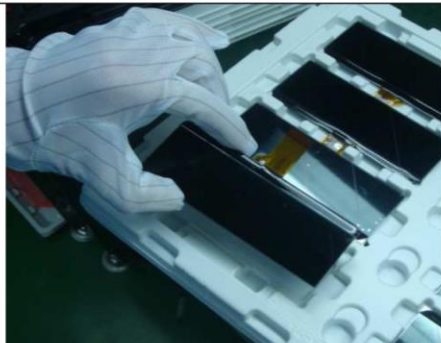
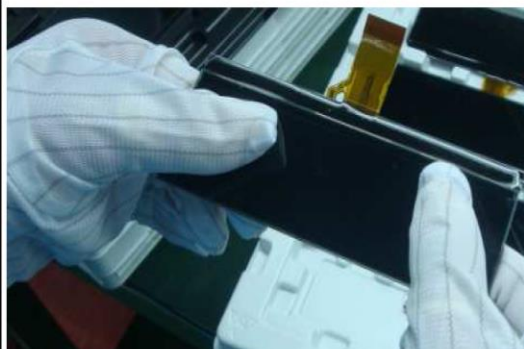
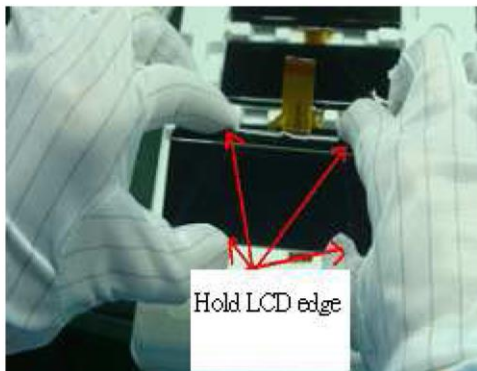
9、COO：为固定 CHN。

10 Automotive Grade;

## 10. Handling Cautions

### 10.1 Packing removal and handling requirement

| Requirement                                                                           | Wrong                                                                                                                                                                                                  | Correct                                                                                                                                                                    |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Get one package each times & hold the package by both hands with proper ESD shielding |  <p>Without ESD gloves and ESD belt</p> <p>Hold the modules by one hand and without proper ESD shielding ( Fail )</p> |  <p>Anti ESD gloves<br/>Anti ESD belt</p> <p>Hold the modules by both hands ( Pass )</p> |
| Prohibit to stack inner package over 3 layers                                         |  <p>Over 3 layers ( Fail )</p>                                                                                      |  <p>Not exceed 3 layers ( Pass )</p>                                                   |
| Total packing tray height must within 40 cm                                           |  <p>packing tray over 40 cm</p> <p>Over 40 cm ( Fail )</p>                                                          |  <p>40 CM</p> <p>Lower than 40 cm ( Pass )</p>                                         |

| Requirement                                                                                         | Wrong                                                                                                                                                                                                                  | Correct                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Packing tray must rotate 180° in each layer when stack together                                     |  <p>Tray without 180° rotation between each layer</p> <p>Tray without 180° rotation, It will have pressure on the module ( Fail )</p> |  <p>Equal spacing</p> <p>Tray with 180° rotation ( Pass )</p>                                 |
| Prohibit to touch LCD surface by fingers                                                            |  <p>Fingers can not touch LCD surface</p> <p>Hold LCD and touch its surface ( Fail )</p>                                             |  <p>Hold LCD edge by hand ( Pass )</p>                                                       |
| During assembly, prohibit to press on LCD surface by fingers, Must hold the LCD edges by both hands |  <p>During assembly, press on LCD surface ( Fail )</p>                                                                              |  <p>Hold LCD edge</p> <p>During assembly, use both hands to hold LCD edge only ( Pass )</p> |

## 10.2 Mounting of module

- Please power off the display module before it is disconnected or connected to the application.
- If the connection to the application is not good, following problems may result.
  1. Significant noise on signals between display module and application
  2. Unstable display performance
  3. Parts on the module will be heat up or damaged

- The LCD module must be handled with care.
- Protective film (Laminator) is applied on surface for protection against scratches and dirt. Please avoid electrostatic charge build-up when peeling off the laminator.

### 10.3 Precautions in Mounting

- When metal part of the LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth.
- Wipe off water drops or finger grease immediately when found. Prolonged contact with water may cause discoloration or spots.
- The LCD module contains glass which breaks or cracks easily if dropped or bumped on hard surface. Please handle with care.
- The display and IC on module are sensitive to electrostatic discharge; please make sure equipments and operators are properly ground before and during handling.

### 10.4 Adjusting module

- Adjusting volumes on the rear face of the module have been set to its optimal before shipment. Therefore, do not change any adjusted values. If adjusted values are changed, the display may not perform to specification.

### 10.5 Others

- Do not expose the module to direct sunlight or intensive ultraviolet rays for prolonged hours
- Store the module at room temperature condition.
- If LCD panel breaks, liquid crystal may escape from the panel. Avoid bringing it to eyes or mouth contact. When liquid crystal sticks on hands, clothes or feet, wash it out immediately with soap.
- Observe all other precautionary requirements as in handling general electronic components.
- Please adjust the voltage of common electrode as materials of attachment by 1 module.
- Do not expose the display module to harmful gases such as acid and alkali gasses, which will corrode electronic components.
- Do not disassemble the display module because it can cause permanent damage and will void the warranty agreement.

## 11. Definitions

| Data sheet status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Objective Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | This data sheet contains target or goal specifications for product development.       |
| Preliminary Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | This data sheet contains preliminary data; supplementary data may be published later. |
| Product Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | This data sheet contains final product specification.                                 |
| Limiting values                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                       |
| Limiting values given are in accordance with the Absolute Maximum Rating. Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operating of the device at these or any other conditions above those given in the Characteristics sections of the specification is not implied. Expose to limiting values for extended periods may affect device reliability.<br>Device is functional within the limiting conditions doesn't imply the same performance over the covered conditions, customer is required to decide the best range for the final applications. |                                                                                       |

## 12. Life Support Applications

These products are not designed for use in life saving appliances, devices or systems where malfunctioning of these products can reasonably be expected to result in personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree full non liability of Varitronix Limited for any damages or losses resulting from such improper use or sale.