# Shenzhen Leadtek Electronics Co.,Ltd

# PRODUCT SPECIFICATION

# TFT-LCD MODULE

## Module No：LTK040WVBLM10-V0

☑ Preliminary Specification

☐ Approval Specification

| Designed by | Checked by | Approved by |
|---|---|---|
|  |  |  |

## Final Approval by Customer

| Approved by | Comment |
|---|---|
| | |

※The specification of “TBD” should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

# 1.Document Revision History

| Version | Contents | Date | Note |
|---|---|---|---|
| V0 | NEW | 2023.10.07 | |
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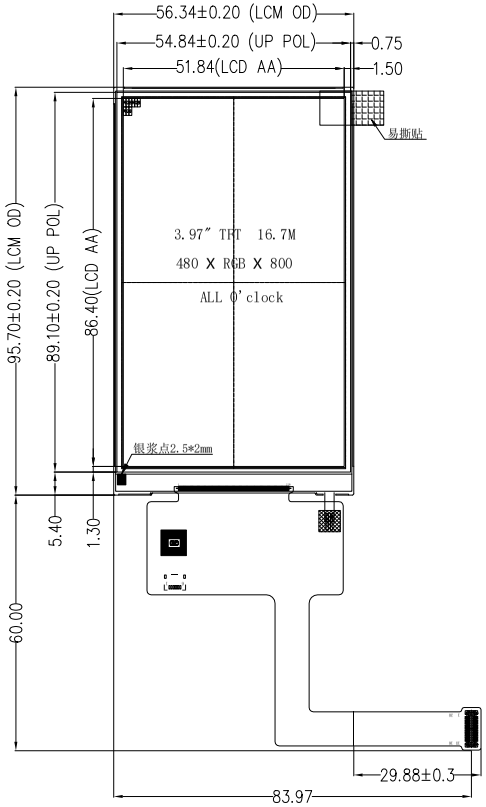
## 2. General Description

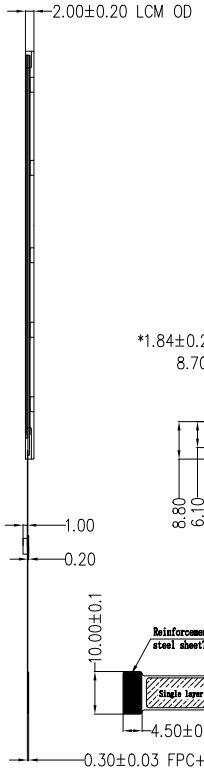
| No | Item | Specification | Unit |
|---|---|---|---|
| 1 | Screen Size | 3.97 | inch |
| 2 | LCD Type | TFT | mm |
| 3 | LCD manufacturer | BOE | mm |
| 4 | Viewing Direction | ALL O'CLOCK | Best Image |
| 5 | Display Mode | 480*3RGB（H）X800 （V） | Pixel |
| 6 | Resolution | Normally Black | - |
| 7 | Active Area | 51.84（H）*86.40（V） | mm |
| 8 | Outline Dimension | 56.34（H）*95.70（V）*2.0（T） | mm |
| 9 | Driver IC | ST7701S | without RAM |
| 10 | Interface | 2 lines MIPI | - |
| 11 | Back Light | White Led*8 | - |
| 12 | Operating temperature | -20 ~ +70 | ℃ |
| 13 | Storage temperature | -30 ~ +80 | ℃ |
| 14 | Weight | TBD | g |

## 3.EXTERNAL DIMENSIONS

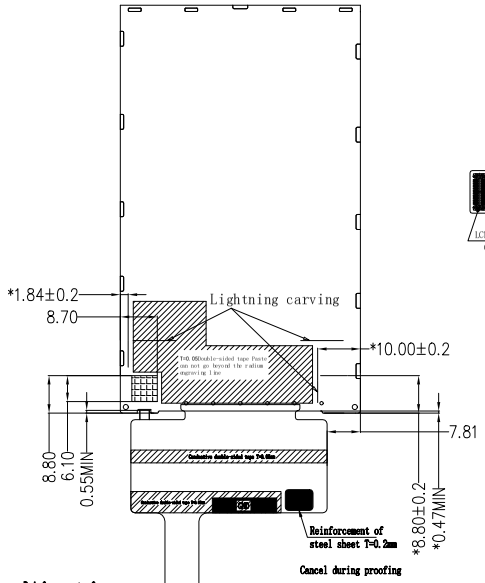
## Front View



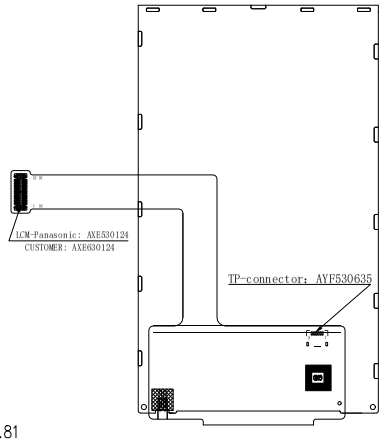

## Side View




## Back View




## Back View




FPC bending diagram

FPC Start shipping

| NO | PIN NAME |
|---|---|
| 1 | GND |
| 2 | MTP_PWR |
| 3 | IOVCC |
| 4 | VCI |
| 5 | TE |
| 6 | GND |
| 7 | DSI_D1P |
| 8 | DSI_D1N |
| 9 | GND |
| 10 | DSI_CLKP |
| 11 | DSI_CLKN |
| 12 | GND |
| 13 | DSI_DOP |
| 14 | DSI_DON |
| 15 | GND |
| 16 | GND |
| 17 | NC |
| 18 | LED_K |
| 19 | LED_K |
| 20 | LED_A |
| 21 | LED_A |
| 22 | NC |
| 23 | GND |
| 24 | NC |

CPT

| | | | |
|---|---|---|---|
| 1 | GND | 25 | RESET(1) |
| 2 | CTP_/RST | 26 | CTP_RESET(2) |
| 3 | CTP_SCL2.8V | 27 | CTP_SCL(3) |
| 4 | CTP_SDA2.8V | 28 | CTP_SDA(4) |
| 5 | CTP_INT | 29 | CTP_INT(5) |
| 6 | CTP 2.8V | 30 | CTP 2.8V(6) |

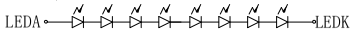
TFT Notes:

1. Display : 3.97"BOE, TFT IPS
2. Resolution: 480xRGBx800
3. LCD Viewing Direction:ALL
4. DisplayMode: Normally Black
5. LCD Driver: ST7701S
6. OPERATING VOLTAGE:VDD 2.8~3.3V
7. Luminance: 250cd/m2(min)300cd/m2(Type)(LCM)
8. *:Critical dimension : ( ) Reference dimension; Unmarked tolerance: ±0.2mm
9. OPERATING TEMP: -20° C~ +70° C
10. STORAGE TEMP: -30° C~ +80° C
11. Requirements on Environmental Protection: ROHS

| |
|---|
| COVER GLASS (1.1mm) |
| OCA1 (0.125mm) |
| ITO Film1 (0.125mm) |
| OCA2 (0.05mm) |
| ITO Film1 (0.125mm) |
| OCA(0.2mm) |
| LCM (2.1mm) |

LCM+CTP:OCA bonding

(8LED)




IF=20mA, VF=24±2.4V

| REV | DESCRIPTION | DATE | NAME |
|---|---|---|---|
| 1 | NEW | 2023.10.07 | Jerry |

LEADTEK COMPANY LIMITED

LEADTEK DISPLAY

| SCALE:1/1 | UNIT:mm | PAGE:1/1 | | Approve | Check | Drawn |
|---|---|---|---|---|---|---|
| Part No: | LTK040WVBLM10 | | VER:V0 | Ian | Jack | Jerry |
| Customer No: | | | | | | |

# 4. Interface Specification

| NO. | Symbol | Function | Remark |
|---|---|---|---|
| 1 | GND | Power Ground | |
| 2 | MTP_PWM(NC) | NC | |
| 3 | IOVCC 1.8V | I/O Power supply : 1.65V ~ 3.3V | |
| 4 | VCI 2.8V | Power supply : 2.6V ~ 3.6V | |
| 5 | TE | Tearing effect output pin is used to synchronize MCU frame writing, | |
| 6 | GND | Power Ground | |
| 7 | MIPI_1P | MIPI-DSI clock data Lane 1 pegative-end input/output pin. | |
| 8 | MIPI_1N | MIPI-DSI clock data Lane 1 nositive-end input/output pin. | |
| 9 | GND | Power Ground | |
| 10 | MIPI_CKP | MIPI-DSI clock data Lane pegative-end input pin. | |
| 11 | MIPI_CKN | MIPI-DSI clock data Lane nositive-end input pin. | |
| 12 | GND | Power Ground | |
| 13 | MIPI_0P | MIPI-DSI clock data Lane 1 pegative-end input/output pin. | |
| 14 | MIPI_0N | MIPI-DSI clock data Lane 1 nositive-end input/output pin. | |
| 15 | GND | Power Ground | |
| 16 | GND | Power Ground | |
| 17 | NC | NC | |
| 18 | LEDK | Power supply for backlight cathode input terminal. | |
| 19 | LEDK | Power supply for backlight cathode input terminal. | |
| 20 | LEDA | Power supply for backlight anode input terminal. | |

| | | | |
|---|---|---|---|
| 21 | LEDA | Power supply for backlight anode input terminal. | |
| 22 | NC | NC | |
| 23 | GND | Power Ground | |
| 24 | NC | NC | |
| 25 | RESET | Reset signal input terminal. Active at 'L'. | |
| 26 | CTP_RST | Touch panel reset | |
| 27 | CTP_SCL | Touch panel I2C clock | |
| 28 | CTP_SDA | Touch panel I2C data | |
| 29 | CTP_INT | Touch panel interrupt output | |
| 30 | CTP_VCC | Touch panel Power supply 2.8~3.3V | |

# 5.Electrical Characteristics

## 5.1TFT DC Characteristics

| Characteristics | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Supply Voltage for I/O | IOVCC | 1.65 | 1.8 | 3.3 | V |
| Supply Voltage for(DC/DC) | VCC | 2.6 | 2.8 | 3.6 | V |
| | | | | | |
| | | | | | |

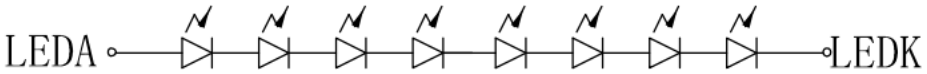
## 5.2 LED Backlight Specification

The back-light system is an edge-lighting type with 8 white LEDs. The characteristics of the back-light are shown in the following tables.

| Item | Symbol | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Forward voltage | Vf | 21.6 | 24.0 | 26.4 | V | -- |
| Forward current | IF | -- | 20 | -- | mA | -- |
| Luminance(With LCD) | Lv | -- | 300 | - | $cd/m^2$ | -- |
| LED life time | N/A | -- | 30,000 | -- | Hr | Note 1 |

Note:(1) The “LED life time” is defined as the module brightness decrease to 50% of original brightness at IL=20mA/LED. The LED life time could be decreased if operating IL is larger than 25mA/LED.

**LED circuit：**




（8LED） IF=20mA, VF=24±2.4V

# 6.Timing Characteristics

**Timing POWER ON/OFF SEQUENCE**

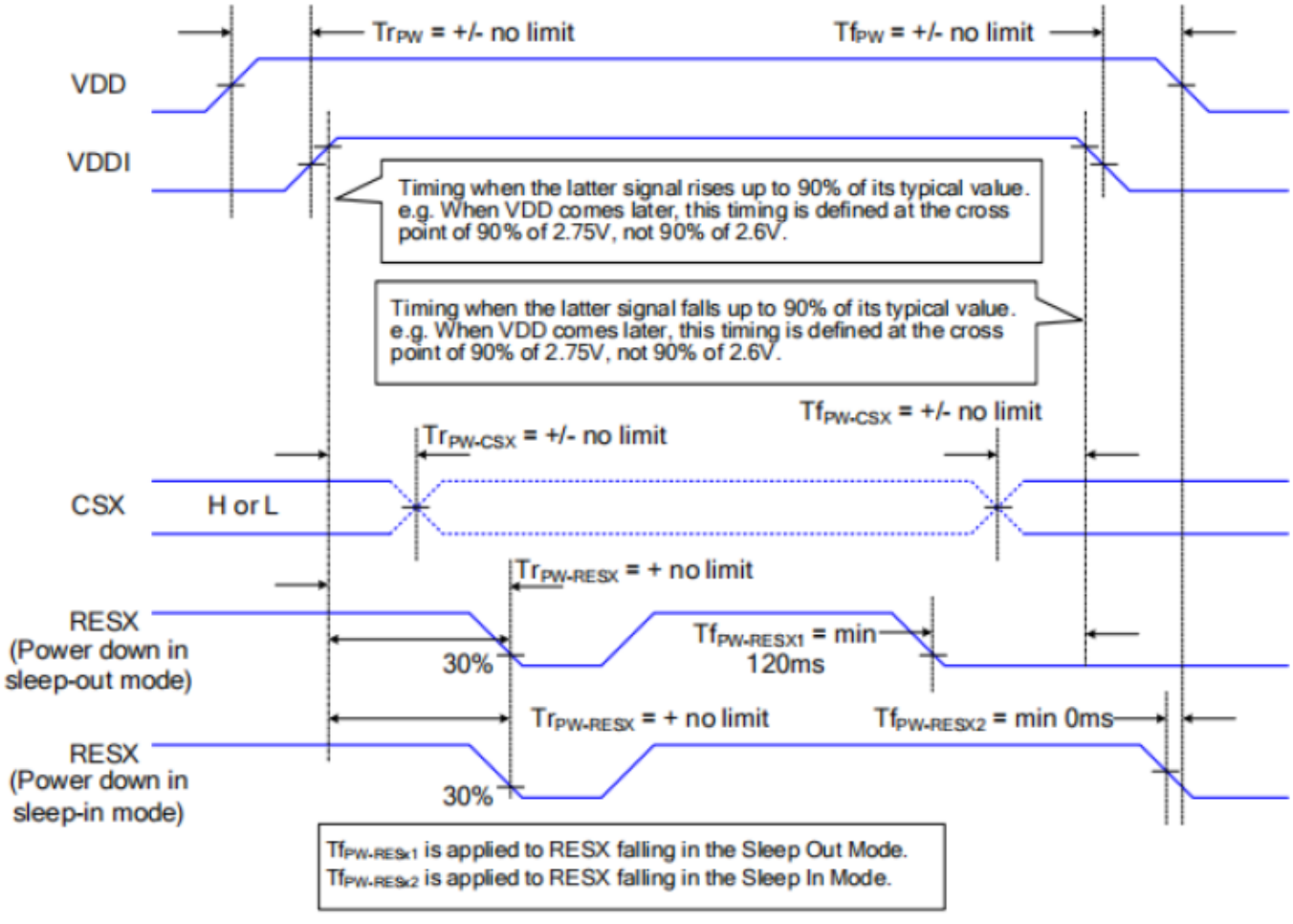
VDDI and VDDA can be applied or powered down in any order. During the Power Off sequence, if the LCD is in the Sleep Out mode, VDDA and VDDI must be powered down with minimum 120msec. If the LCD is in the Sleep In mode, VDDA and VDDI can be powered down with minimum 0msec after the RESX is released.

CSX can be applied at any timing or can be permanently grounded. RESX has high priority over CSX.

Notes:

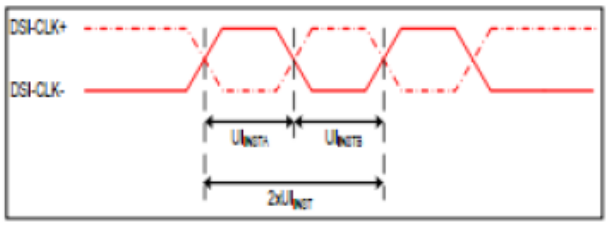
1. There will be no damage to the ST7701S if the power sequences are not met.
2. There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.
3. There will be no abnormal visible effects on the display between the end of Power On Sequence and before receiving the Sleep Out command, and also between receiving the Sleep In command and the Power Off Sequence.
4. If the RESX line is not steadily held by the host during the Power On Sequence as defined in Sections 9.1 and 9.2, then it will be necessary to apply the Hardware Reset (RESX) after the completion of the Host Power On Sequence to ensure correct operations. Otherwise, all the functions are not guaranteed.

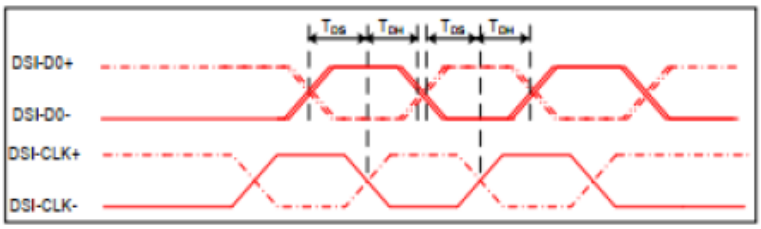
The power on/off sequence is illustrated below



## DSI-MIPI Interface Timing Characteristics of IC

### High Speed Mode




**DSI clock channel timing**

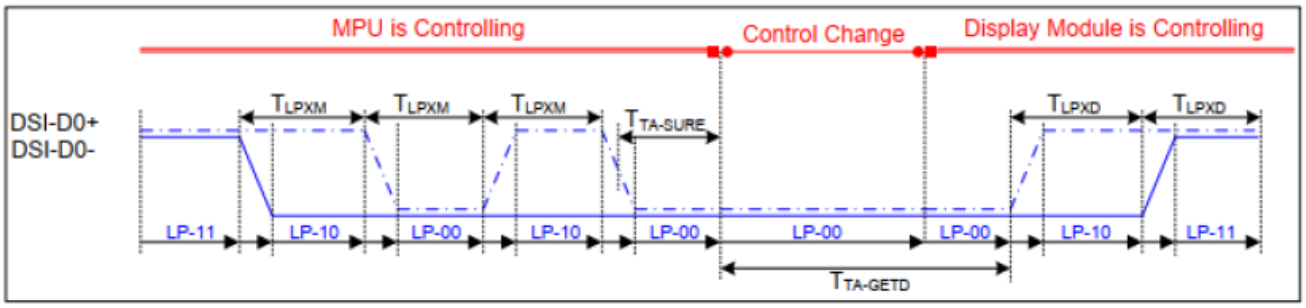
**Rising and falling time on clock and data channel**

*VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃*

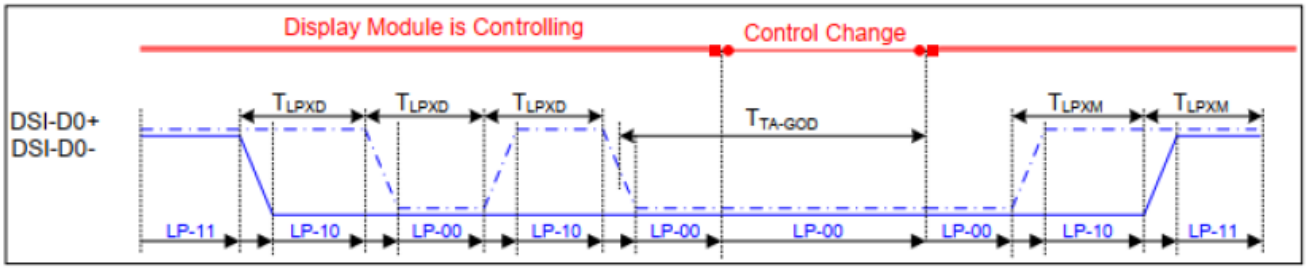
| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|---|---|---|---|---|---|---|
| DSI-CLK+/- | $2xUI_{INSTA}$ | Double UI instantaneous | 4 | 25 | ns | |
| DSI-CLK+/- | $UI_{INSTA}$ $UI_{INSTB}$ | UI instantaneous halfs | 2 | 12.5 | ns | $UI = UI_{INSTA} = UI_{INSTB}$ |
| DSI-Dn+/- | tDS | Data to clock setup time | 0.15 | - | UI | |
| DSI-Dn+/- | tDH | Data to clock hold time | 0.15 | - | UI | |

**Mipi Interface- High Speed Mode Timing Characteristics**

### Lowe Power Mode




**Bus Turnaround (BTA) from display module to MPU Timing**



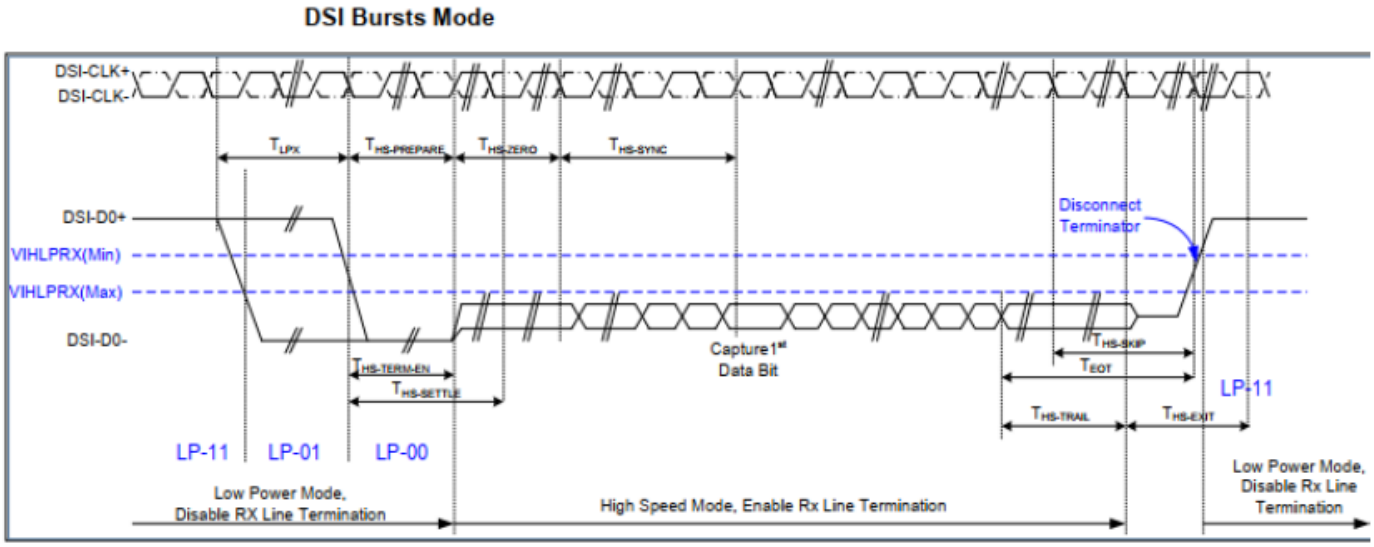

**Bus Turnaround (BTA) from MPU to display module Timing**

*VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃*

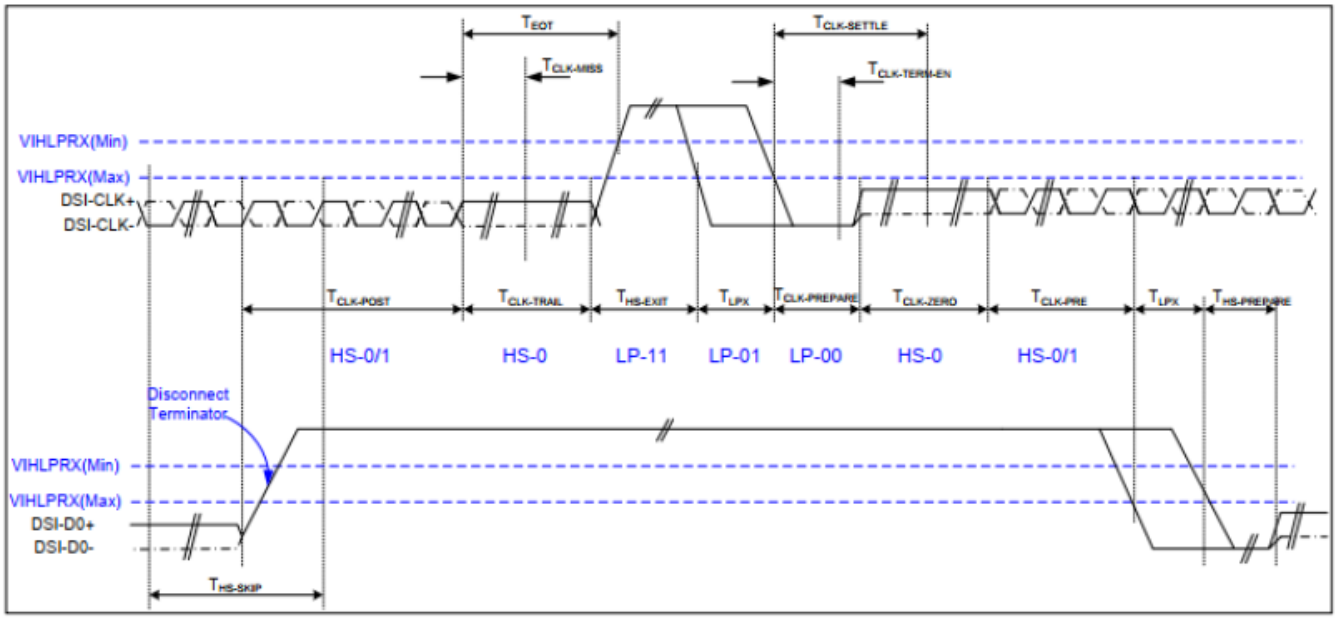
| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|---|---|---|---|---|---|---|
| DSI-D0+/- | TLPXM | Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module | 50 | 75 | ns | Input |
| DSI-D0+/- | TLPXD | Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module | 50 | 75 | ns | Output |
| DSI-D0+/- | TTA-SURED | Time-out before the MPU start driving | $T_{LPXD}$ | $2xT_{LPXD}$ | ns | Output |
| DSI-D0+/- | TTA-GETD | Time to drive LP-00 by display module | $5xT_{LPXD}$ | | ns | Input |
| DSI-D0+/- | TTA-GOD | Time to drive LP-00 after turnaround request-MPU | $4xT_{LPXD}$ | | ns | Output |

**Mipi Interface Low Power Mode Timing Characteristics**

## DSI Bursts Mode




**Data lanes-Low Power Mode to/from High Speed Mode Timing**




**Clock lanes- High Speed Mode to/from Low Power Mode Timing**

*VDDI=1.8, VDD=2.8, AGND=DGND=0V, Ta=25 ℃*

| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|---|---|---|---|---|---|---|
| Low Power Mode to High Speed Mode Timing | | | | | | |
| DSI-Dn+/- | TLPX | Length of any low power state period | 50 | - | ns | Input |
| DSI-Dn+/- | THS-PREPARE | Time to drive LP-00 to prepare for HS transmission | 40+4 UI | 85+6 UI | ns | Input |
| DSI-Dn+/- | THS-TERM-EN | Time to enable data receiver line termination measured from when Dn crosses VILMAX | - | 35+4 UI | ns | Input |
| DSI-Dn+/- | THS-PREPARE + THS-ZERO | THS-PREPARE + time to drive HS-0 before the sync sequence | 140+ 10UI | - | ns | Input |
| High Speed Mode to Low Power Mode Timing | | | | | | |
| DSI-Dn+/- | THS-SKIP | Time-out at display module to ignore transition period of EoT | 40 | 55+4 UI | ns | Input |
| DSI-Dn+/- | THS-EXIT | Time to drive LP-11 after HS burst | 100 | - | ns | Input |
| DSI-Dn+/- | THS-TRAIL | Time to drive flipped differential state after last payload data bit of a HS transmission burst | 60+4 UI | - | ns | Input |
| High Speed Mode to/from Low Power Mode Timing | | | | | | |
| DSI-CLK+/- | TCLK-POS | Time that the MPU shall continue sending HS clock after the last associated data lane has transition to LP mode | 60+5 2UI | - | ns | Input |
| DSI-CLK+/- | TCLK-TRAIL | Time to drive HS differential state after last payload clock bit of a HS transmission burst | 60 | - | ns | Input |
| DSI-CLK+/- | THS-EXIT | Time to drive LP-11 after HS burst | 100 | - | ns | Input |
| DSI-CLK+/- | TCLK-PREPARE | Time to drive LP-00 to prepare for HS transmission | 38 | 95 | ns | Input |
| DSI-CLK+/- | TCLK-TERM-EN | Time-out at clock lan display module to enable HS transmission | -- | 38 | ns | Input |
| DSI-CLK+/- | TCLK-PREPARE + TCLK-ZERO | Minimum lead HS-0 drive period before starting clock | 300 | - | ns | Input |
| DSI-CLK+/- | TCLK-PRE | Time that the HS clock shall be driven prior to any associated data lane beginning the transition from LP to HS mode | 8UI | - | ns | Input |
| DSI-CLK+/- | TEOT | Time form start of TCLK-TRAIL period to start of LP-11 state | - | 105n s+12 UI | ns | Input |

## Reset Description:

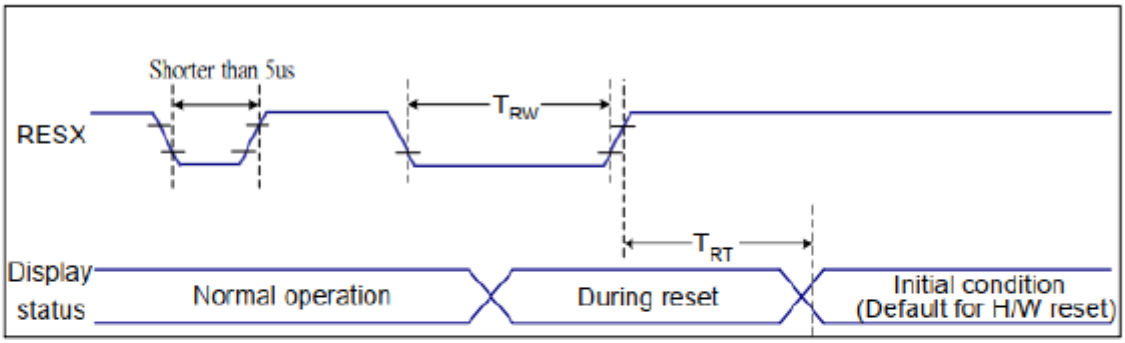



**Figure 9 Reset Timing**

*VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃*

| Related Pins | Symbol | Parameter | MIN | MAX | Unit |
|---|---|---|---|---|---|
| RESX | TRW | Reset pulse duration | 10 | - | us |
| | TRT | Reset cancel | - | 5 (Note 1, 5) | ms |
| | | | | 120(Note 1, 6, 7) | ms |

**Table 9 Reset Timing**

*Notes:*

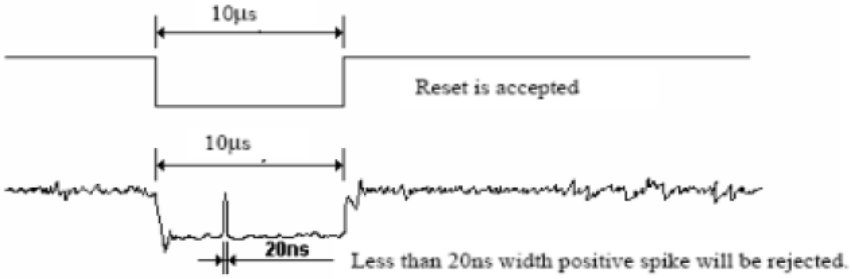
*1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.*

*2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:*

| RESX Pulse | Action |
|---|---|
| Shorter than 5us | Reset Rejected |
| Longer than 9us | Reset |
| Between 5us and 9us | Reset starts |

*3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.*

*4. Spike Rejection also applies during a valid reset pulse as shown below:*




*5. When Reset applied during Sleep In Mode.*

*6. When Reset applied during Sleep Out Mode.*

*7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.*

# 7.Optical Specification

| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Response time | Tr+Tf | Θ=0O<br>Ø=0o<br>Ta=25˚C | | 35 | | ms | |
| Contrast ratio | Cr | | 550 | 800 | | | |
| Color gamut | S（%） | | - | - | | % | |
| Luminance uniformity | WHITE | | 80 | | | % | |
| Viewing angle range | Θx+ | CR≧10<br>Ta=25˚C | 80 | 85 | | deg | |
| | Θx- | | 80 | 85 | | deg | |
| | Θy+ | | 80 | 85 | | deg | |
| | Θy- | | 80 | 85 | | deg | |
| LCM Luminance（with TP） | LV | Θ=0o<br>Ø=0o<br>Ta=25˚C | | 300 | | | |
| CIE(X,Y)Chromaticity | White(X) | | 0.277 | 0.292 | 0.307 | | |
| | White(Y) | | 0.318 | 0.333 | 0.348 | | |

Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. 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 . (see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

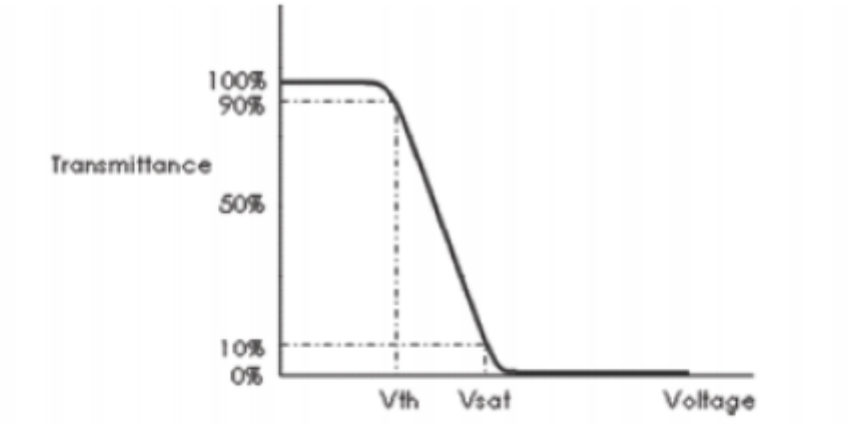
$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Transmittance is the Value with Polarizer

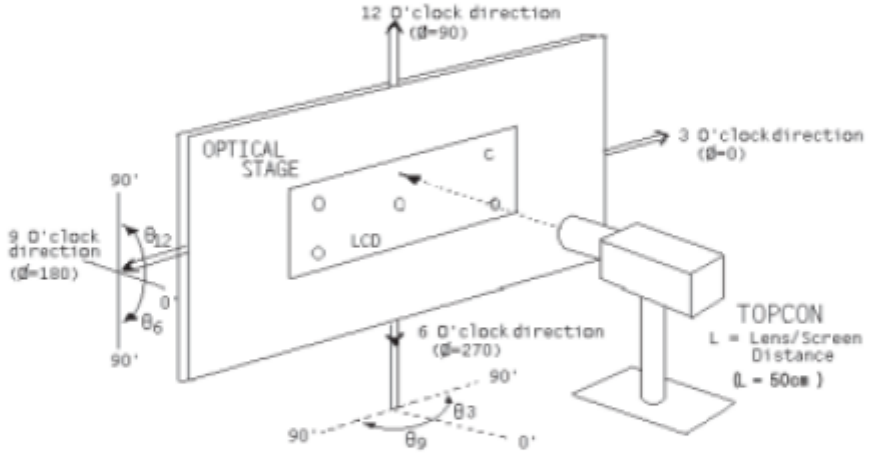
4. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

5. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

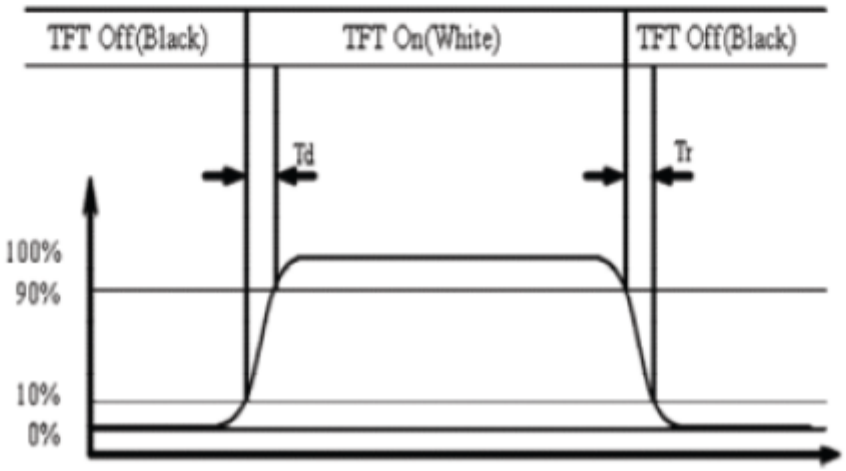
## Figure 1. The Definition of Vth & Vsat




## Figure 2. Measurement Set Up




## Figure 3. Response Time Testing



# 8.Reliability Test Items

| Item | Test Condition | Criterion |
|---|---|---|
| High Temperature Operation | 70 ℃, 48 hrs | Note1，Note2 |
| Low temperature operation | -20 ℃, 48 hrs | |
| High Temperature Storage | 80 ℃, 48 hrs | |
| Low Temperature Storage | -30 ℃, 48 hrs | |
| High Temp. & High Humidity Storage | 40 ℃, 80％ RH, 48hrs | |
| Thermal Shock (Static) | -20℃, 30 min /60℃, 30 min, 2 0 cycles | |

Note1:Evaluation should be tested after storage at room temperature for two hours.

Note2:

Pass: Normal display image no line defect.

Fail: No display image, or line defects.

Partial transformation of the module parts should be ignored.

# 9.Precautions

Please pay attentions to the followings as using the LCD module.

**Handling**

(a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.

(b) Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display s urface with hard materials.

(c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.

(d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.

(e) Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride to clean t he display surface. It might damage the touch panel surface permanently. The recommended solvents are water and Isopropyl alcohol.

(f) Wipe off water droplets or oil immediately.

(g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.

(h) Do not touch the output pins directly with bare hands.

(i) Do not disassemble the LCD module.

(j) Do not lift the FPC of Touch Panel.

**Storage**

(a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.

(b) Do not expose the LCD modules to sunlight directly.

(c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.

(d) Avoid condensation of water. It may cause improper operation.

(e) Please stack only up to the number stated on carton box for storage and transportation. Excessive w eight will cause deformation and damage of carton box.

Operation (a) When mounting or dismounting the LCD modules, turn the power off.

(b) Protect the LCD modules from electric shock.

(c) The Driver IC control algorithms stated above should always obeyed to avoid damaging the LSI an d electronic circuit.

(d) Be careful to avoid mixing up the polarity of power supply for backlight.

(e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cau se non-recoverable damage of electronic components or, nevertheless, burning.

(f) When a static image is displayed for a long time, remnant image is likely to occur.

(g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.

(h) Most of the touch screens have air vent to equalize the inside air pressure to the outside one. The air vent must

be open and liquid contact must be avoided as the liquid may be absorbed if the liq uid is accumulated near the air vent.

(i) For the fragility of ITO film, it should avoid to use too tapering pen as the input material.

(a) If a cushion is used between bezel/housing and film must be choose as free as enough to absorb t he expansion and contraction to avoid the distortion of film.

(b) The cushion must be placed out of the Viewing Area.

(c) Bezel/Housing edge must be posited between Key Area and Viewing Area. The edge enters the Ke y Area may cause unexpected input if the gap is too narrow or foreign particles like dusts exist be tween Bezel/Housing and ITO film.

(d) Mounting example:

The corner part has conductivity. Do not touch any metal part after mounting.

**Others**

a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.

b) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the di splay surface.

c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic c harge can be minimized.

# 10.HSF Requirements

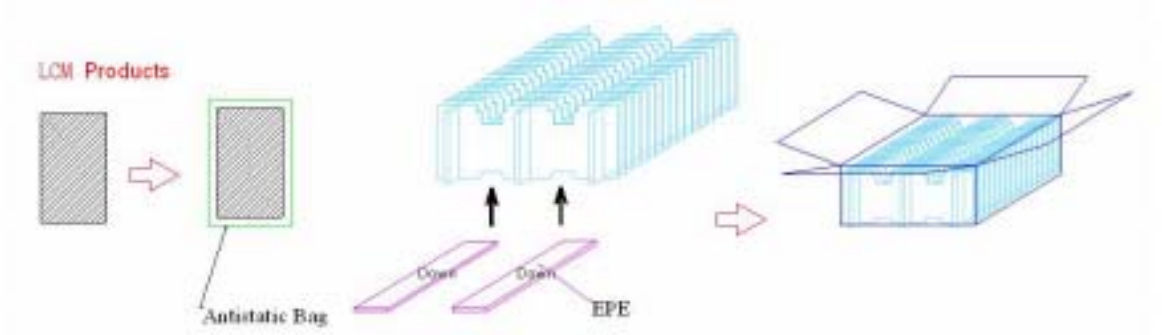
☑ RoHS( Restriction of the use of certain Hazardous Substances)

☐HF (Halogen Free)

☐REACH (Regulation the Registration, Evaluaton, Authorization and Restricton of Chemicals)

☐ Other regulations

# 11.Packaging diagram




第一步

将产品装入静电袋

第二步

把长卡、短卡组成卡阵（短卡朝向一致）形状和数量按照 BOM 实际物料，卡阵底部放对应的白色珍珠棉后装箱

第三步

每个卡槽内放两片产品，2 片产品显示面相对，中间粉色珍珠棉一起

First step

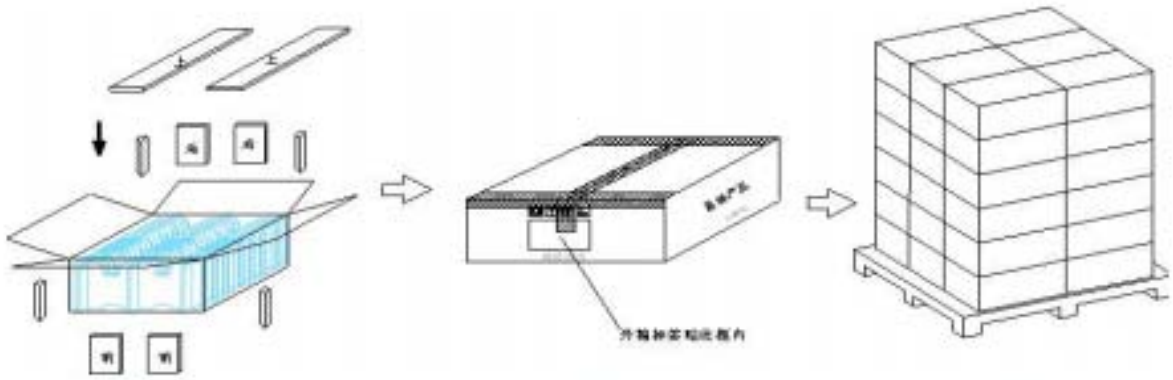
Putting every piece of LCM into anti-static bag.

Second step

Assemble a carton matrix with the right white EPE down below ,then place them into the carton.

Third step

Put a pink EPE between 2 pcs products(face to face) while insert all of them into the carton matrix.



第四步

装箱后，按照 BOM 实际物料在纸箱内侧与卡阵避空位置放白色泡棉

第五步

用胶带封箱，贴外箱标签

第六步

将箱子整齐的放在栈板上并包裹，最高可堆叠泡棉：6 层；

Fourth step

Insert all other white EPE into the right place of the carton matrix .

Fifth step

seal the carton with cellulose tape ;Stick on a carton label,

Sixth step

Place the boxes together on a pallet (6 layers at most),

# 12.IIS Standard

# 12. INSPECTION STANDARD

## 12.1. QUALITY :

THE QUALITY OF GOODS SUPPLIED TO PURCHASER SHALL COME UP TO THE FOLLOWING STANDARD.

### 12.1.1. THE METHOD OF PRESERVING GOODS

AFTER DELIVERY OF GOODS FROM CHENGHAO TO PURCHASER. PURCHASER SHALL CONTROL THE LCM AT -10 ℃ TO 40 ℃ ,AND IT MIGHT BE DESIRABLE TO KEEP AT THE NORMAL ROOM TEMPERATURE AND HUMIDITY UNTIL INCOMING INSPECTION OR THROWING INTO PROCESS LINE.

### 12.1.2. INCOMING INSPECTION

(A) THE METHOD OF INSPECTION

IF PURCHASER MAKE AN INCOMING INSPECTION , A SAMPLING PLAN SHALL BE APPLIED ON THE CONDITION THAT QUALITY OF ONE DELIVERY SHALL BE REGARDED AS ONE LOT.

(B) THE STANDARD OF QUALITY

ISO-2859-1 ( SAME AS MIL-STD-105E ) , LEVEL Ⅱ SINGLE PLAN.

| CLASS | AQL(%) |
|---|---|
| CRITICAL | 0.4 % |
| MAJOR | 0.65 % |
| MINOR | 1.5 % |
| TOTAL | 1.5 % |

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

(C) MEASURE

IF AS THE RESULT OF ABOVE RECEIVING INSPECTION , A LOT OUT IS DISCOVERED. PURCHASER SHALL BE INFORM SELLER OF IT WITHIN SEVEN DAYS. BUT FIRST SHIPMENT WITHIN FOURTEEN DAYS.

### 12.1.3. WARRANTY POLICY

CHENGHAO WILL PROVIDE ONE-YEAR WARRANTY FOR THE PRODUCTS ONLY IF UNDER SPECIFICATION OPERATING CONDITIONS. U.R.T. WILL REPLACE NEW PRODUCTS FOR THESE DEFECT PRODUCTS WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF CHENGHAO.

## 12.2. CHECKING CONDITION

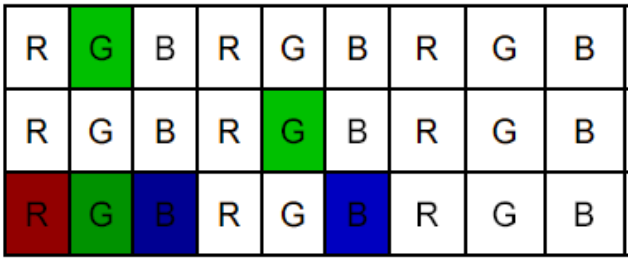
**12.2.1.** CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

**12.2.2.** CHECKER SHALL SEE OVER 300±25 mm WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

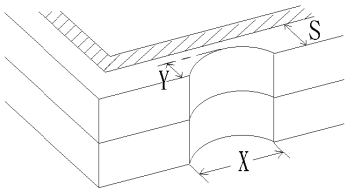
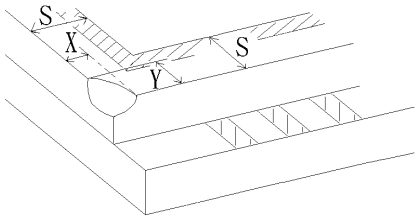
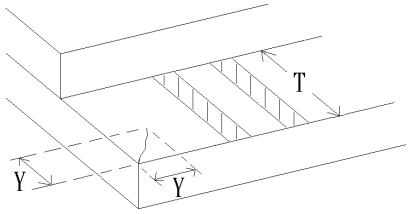
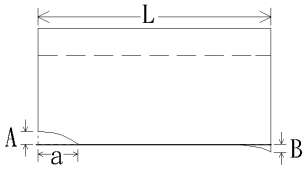
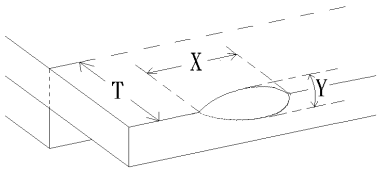
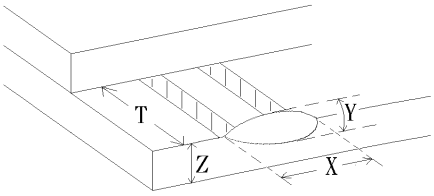
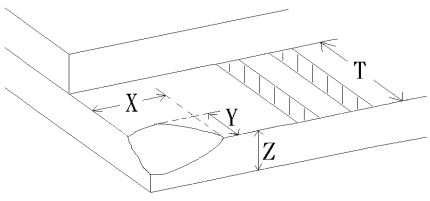
## 12.3. INSPECTION PLAN :

| CLASS | ITEM | JUDGEMENT | CLASS |
|---|---|---|---|
| PACKING & INDICATE | 1. OUTSIDE AND INSIDE PACKAGE | "MODEL NO." , "LOT NO." AND "QUANTITY" SHOULD INDICATE ON THE PACKAGE. | Minor |
| | 2. MODEL MIXED AND QUANTITY | OTHER MODEL MIXED.....REJECTED<br>QUANTITY SHORT OR OVER.....REJECTED | Critical |
| | 3. PRODUCT INDICATION | "MODEL NO." SHOULD INDICATE ON THE PRODUCT | Major |
| ASSEMBLY | 4. DIMENSION,<br>LCD GLASS SCRATCH<br>AND SCRIBE DEFECT. | ACCORDING TO SPECIFICATION OR DRAWING. | Major |
| APPEARANCE | 5. VIEWING AREA | POLARIZER EDGE OR LCD'S SEALING LINE IS VISABLE IN THE VIEWING AREA<br>……..REJECTED | Minor |
| | 6. BLEMISH、BLACK SPOT、<br>WHITE SPOT IN THE LCD<br>AND LCD GLASS CRACKS | ACCORDING TO STANDARD OF VISUAL INSPECTION ( INSIDE VIEWING AREA ) | Minor |
| | 7. BLEMISH、BLACK SPOT<br>WHITE SPOT AND SCRATCH<br>ON THE POLARIZER | ACCORDING TO STANDARD OF VISUAL INSPECTION ( INSIDE VIEWING AREA ) | Minor |
| | 8. BUBBLE IN POLARIZER | ACCORDING TO STANDARD OF VISUAL INSPECTION ( INSIDE VIEWING AREA ) | Minor |
| | 9. LCD'S RAINBOW COLOR | STRONG DEVIATION COLOR ( OR NEWTON RING) OF LCD.....REJECTED.<br>OR ACCORDING TO LIMITED SAMPLE<br>( IF NEEDED, AND INSIDE VIEWING AREA ) | Minor |
| ELECTRICAL | 10. ELECTRICAL AND OPTICAL CHARACTERISTICS<br>( CONTRAST、VOP、<br>CHROMATICITY … ETC ) | ACCORDING TO SPECIFICATION OR DRAWING . ( INSIDE VIEWING AREA ) | Critical |
| | 11.MISSING LINE | MISSING DOT、LINE、CHARACTER<br>....REJECTED | Critical |
| | 12.SHORT CIRCUIT、<br>WRONG PATTERN DISPLAY | NO DISPLAY、WRONG PATTERN DISPLAY、CURRENT CONSUMPTION OUT OF SPECIFICATION..... REJECTED | Critical |
| | 13. DOT DEFECT (FOR COLOR AND TFT) | ACCORDING TO STANDARD OF VISUAL INSPECTION | Minor |

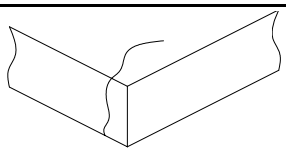
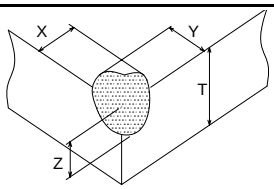
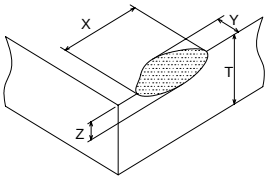
## 12.4. STANDARD OF VISUAL INSPECTION

<table>
<tr><th>NO.</th><th>CLASS</th><th>ITEM</th><th>JUDGEMENT</th></tr>
<tr><td>12.4.1</td><td>MINOR</td><td>BLACK AND WHITE SPOT<br>FOREIGN MATERIEL<br>DUST IN THE CELL<br>BLEMISH<br>SCRATCH</td><td>(A) ROUND TYPE: unit : mm.
<table>
<tr><th>DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>Φ ≦ 0.1</td><td>DISREGARD</td></tr>
<tr><td>0.1 < Φ ≦ 0.25</td><td>3 (D>5mm)</td></tr>
<tr><td>0.25 < Φ</td><td>0</td></tr>
</table>
NOTE: Φ=(LENGTH+WIDTH)/2<br>(B) LINEAR TYPE: unit : mm.
<table>
<tr><th>LENGTH</th><th>WIDTH</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>------</td><td>W ≦0.03</td><td>DISREGARD</td></tr>
<tr><td>L ≦ 5.0</td><td>0.03 < W ≦0.07</td><td>3 (D>5mm)</td></tr>
<tr><td>------</td><td>0.07 < W</td><td>FOLLOW ROUND TYPE</td></tr>
</table></td></tr>
<tr><td>12.4.2</td><td>MINOR</td><td>BUBBLE IN POLARIZER<br>DENT ON POLARIZER</td><td>unit : mm.
<table>
<tr><th>DIAMETER</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>Φ ≦0.2</td><td>DISREGARD</td></tr>
<tr><td>0.2 < Φ ≦ 0.5</td><td>2 (D>5mm)</td></tr>
<tr><td>0.5 < Φ</td><td>0</td></tr>
</table></td></tr>
<tr><td>12.4.3</td><td>MINOR</td><td>Dot Defect</td><td>
<table>
<tr><th>Items</th><th>ACC. Q'TY</th></tr>
<tr><td>Bright dot</td><td>N≦ 4 (D>5mm)</td></tr>
<tr><td>Dark dot</td><td>N≦ 4 (D>5mm)</td></tr>
</table>
Pixel Define<br> 

Not 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.<br>Not 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.<br>Not 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green ,blue pattern.</td></tr>
</table>

| NO. | CLASS | ITEM | JUDGEMENT |
|---|---|---|---|
| 12.4.4 | MINOR | LCD GLASS CHIPPING |  Y > S Reject |
| 12.4.5 | MINOR | LCD GLASS CHIPPING |  X or Y > S Reject |
| 12.4.6 | MAJOR | LCD GLASS GLASS CRACK |  Y > (1/2) T Reject |
| 12.4.7 | MAJOR | LCD GLASS SCRIBE DEFECT |  1. a> L/3 , A>1.5mm. Reject<br>2. B : ACCORDING TO DIMENSION |
| 12.4.8 | MINOR | LCD GLASS CHIPPING ( ON THE TERMINAL AREA ) |  Φ= (x+y)/2 > 2.5 mm Reject |
| 12.4.9 | MINOR | LCD GLASS CHIPPING ( ON THE TERMINAL SURFACE ) |  Y > (1/3) T Reject |
| 12.4.10 | MINOR | LCD GLASS CHIPPING |  Y > T Reject |

## 12.5 INSPECTION STANDARD OF TOUCH PANEL (Contains the CTP)

| NO. | CLASS | ITEMS | | JUDGEMENT | |
|---|---|---|---|---|---|
| 12.5.1 | MAJOR | Touch Panel Crack | |  | Reject |
| 12.5.2 | MINOR | Touch Panel Chipping | Corner |   | X≦2mm, Y≦2mm, Z＜1/2T　Accept |
| | | | Edge |   | X≦3mm, Y≦3mm, Z＜1/2T　Accept |
| 12.5.3 | MINOR | Scratch Dust and Foreign materiel (Linear Type) | | W≦0.05, L≦5.0mm | Accept |
| | | | | 0.05mm<W≦0.07mm；L≦5.0mm Distance between seratch＞5.0mm | Accept 3 ea Max. |
| | | | | W>0.07mm | Reject |
| 12.5.4 | MINOR | Scratch Dust and Foreign materiel (Round Type：Φ=(Length+Width)/2) | | Φ≦0.25mm | Accept |
| | | | | 0.25mm＜Φ≦0.35mm Distance between spots＞5.0mm | Accept 5 ea Max. |
| | | | | Φ＞0.35mm | Reject |
| 12.5.5 | MINOR | Touch Panel Dent / Fish Eyes | | Φ≦0.35mm | Accept |
| | | | | 0.35mm＜Φ≦1.0mm Distance ＞5.0mm | Accept 3 ea Max. |
| | | | | Φ＞1.0mm | Reject |
| 12.5.6 | MINOR | Touch Panel Air Bubble | | Φ≦0.2mm | Accept |
| | | | | 0.2mm＜Φ≦0.5mm Distance between bubbles＞5.0mm | Accept 3 ea Max. |
| | | | | Φ＞0.5mm | Reject |
| 12.5.7 | MINOR | Touch Panel Printing area Scratch | | 0.03mm＜W≦0.05mm, L≦5mm Distance between scratch＞5.0mm | Accept 3 ea Max. |
| | | | | W＞0.05mm or L＞5mm ( W>0.05 Follow 8.5.4 Round type ) | Reject |
| 12.5.8 | MINOR | Touch Panel White Haze Mark / Dust | | Can not be removed | Reject |