

TFT SPECIFICATION

| | |
|-----------------|------------------------|
| Part Number | USMP-T123-192072CDV-A2 |
| Size | 12.3" |
| Resolution | 1920 x 720 |
| Brightness | 1000 cd/m ² |
| Contrast | 1000:1 |
| Viewing Angle | 85/85/85/85 |
| Operating Temp. | -30 ~ 80°C |
| | |
| | |
| | |

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| Issue Date | Approved by (customer use) | Checked by | Prepared by |
|------------|----------------------------|------------|-------------|
| | | | |

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1. GENERAL DESCRIPTION

A Color TFT LCD supplied by USMP. This main Module has a 12.3 inch diagonally measured active display area with 1920(RGB) X 720 resolutions. Each pixel is divided into Red, Green and Blue sub-pixels and dots that are arranged in vertical stripes. LCD color is determined with Dithering 16.7M Color signal for each pixel. It has been designed to apply the interface method that enables low power, high speed, and high contrast. It is intended to support applications where thin thickness, wide viewing angle, low power are critical factors and graphic displays are important.

2. FEATURES

| | |
|------------------------|--------------------------------|
| Display Mode | Transmissive Type |
| | TFT LCD, Normally Black |
| Display Format | RGB 1920(RGB) x 720 Strip type |
| Color | 16.7M color |
| Interface | 2 ports LVDS data bus ,24bit |
| Viewing Direction | All |
| Backlight type / color | LED / white * 60 |

3. MECHANICAL SPECIFICATION

3.1. LCM

| Item | Specifications | Unit |
|---------------------|-------------------------------|------|
| Dimensional outline | 330.0(W)×150.75(H)× 17.98(D)* | mm |
| Resolution | 1920(R,G,B)×720 | dot |
| Active area | 292.032(W)×109.512(H) | mm |
| Pixel pitch | 0.1521(W)×0.1521(H) | mm |

* Exclude FPC, Have include polarizer

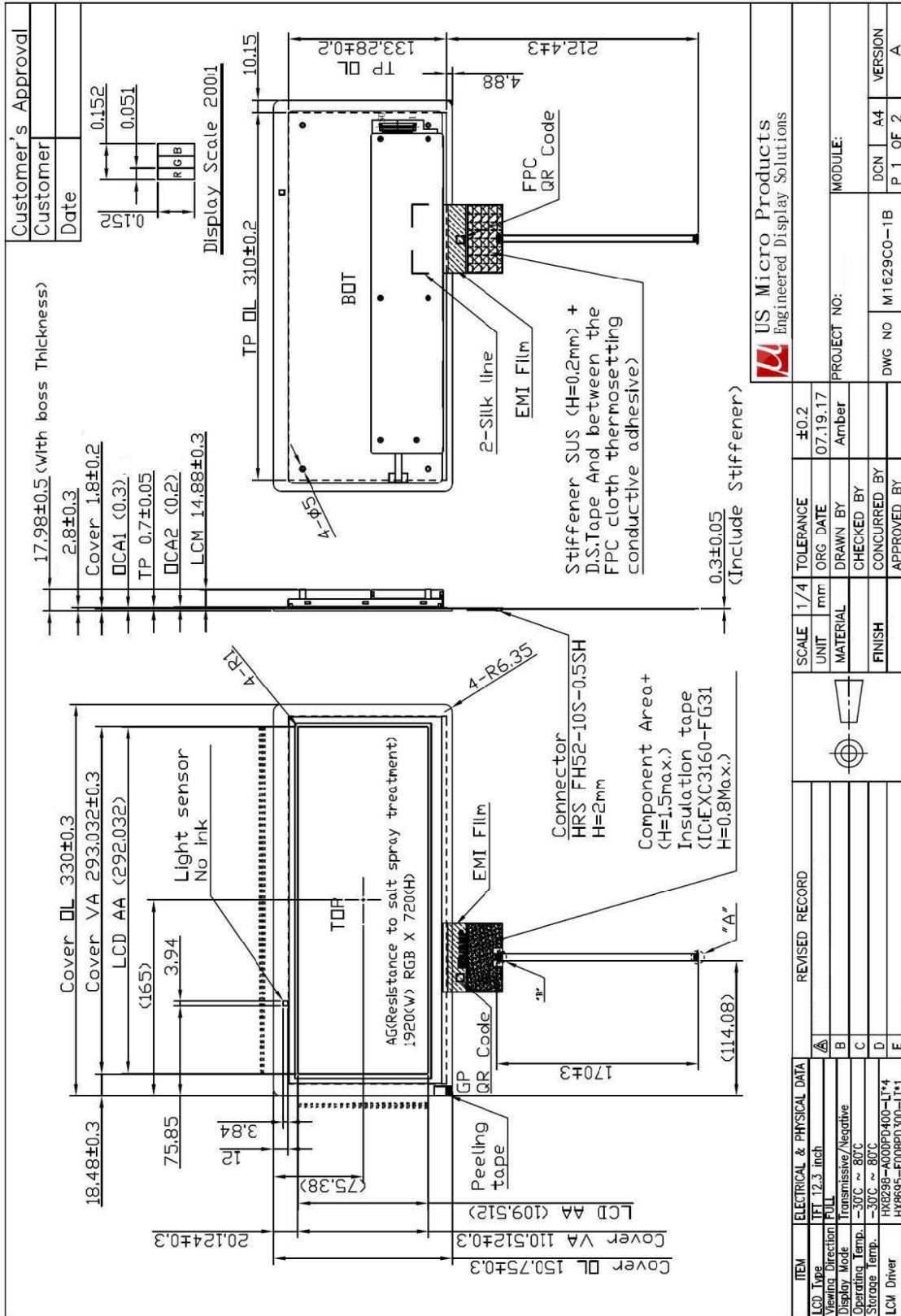
3.2. Capacitive Touch Panel

| Item | Contents | Unit |
|--------------------------------------|--|------|
| Type | Transparent Type Projective Capacitive Touch Panel | |
| Input Mode | Finger , 2 point | |
| Structure | Single sides ITO sensor glass with glass cover | |
| IC | EXC3160 | |
| Cover outline | 330.0 x 150.75 | mm |
| TP AA | 294.032 x 111.512 | mm |
| Cover VA | 293.032 x 110.512 | mm |
| TP thickness | 0.7± 0.05 | mm |
| Cover thickness | 1.8± 0.2 | mm |
| Total thickness | 3 ± 0.5 | mm |
| Surface Treatment | AG(Etching) | |
| Interface | USB 、I ² C | |
| Salt Water Proof | Up to 3.5% salt concentration* | |
| Nominal finger size (diam.) | 8 | mm |
| Accuracy center | ±2.5 | mm |
| Accuracy edge | ±3.0 | mm |
| Finger separation (center to center) | 20 | mm |
| Transmittance | > 85% | |
| Palm rejection | Yes | |
| Report rate | 100 | Hz |
| Cover glass hardness | ≥ 8H | ** |

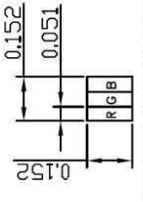
*Note: Spraying droplet on the sensing area by handheld sprayer without any ghost points.

**Note : Test technique by JIS K5400.

4. MECHANICAL DIMENSION



| |
|---------------------|
| Customer's Approval |
| Customer |
| Date |



| ELECTRICAL & PHYSICAL DATA | | REVISION RECORD | |
|----------------------------|--------------|-----------------|----------|
| Item | DESCRIPTION | SCALE | 1/4 |
| UNIT | mm | TOLERANCE | ±0.2 |
| MATERIAL | Drawn By | ORG. DATE | 07.19.17 |
| FINISH | Checked By | Drawn By | Amber |
| | Concurred By | Checked By | |
| | Approved By | Concurred By | |
| | Approved By | | |

| | |
|-------------|------------|
| PROJECT NO: | MODULE: |
| DWG NO | M1629C0-1B |
| DCN | A4 |
| VERSION | A |

Customer's Approval
Customer _____
Date _____

* Excluding TP FFC, and COF is folded while shipping

| TP PIN Define | |
|---------------|-------------------|
| No. | Symbol Function |
| 1 | GND P |
| 2 | VDD Power(3.3V) P |
| 3 | VDD Power(3.3V) P |
| 4 | VDD Power(3.3V) P |
| 5 | GND P |
| 6 | NTC1 I |
| 7 | WP I |
| 8 | SCLK I |
| 9 | SDAT I |
| 10 | AGMODE I |
| 11 | NTC2 P |
| 12 | GND P |
| 13 | DLV0N I |
| 14 | DLV0P I |
| 15 | GND P |
| 16 | DLV1N I |
| 17 | DLV1P I |
| 18 | GND P |
| 19 | DLV2N I |
| 20 | DLV2P I |
| 21 | GND P |
| 22 | DLVCLKN I |
| 23 | DLVCLKP I |
| 24 | GND P |
| 25 | DLV3N I |
| 26 | DLV3P I |
| 27 | GND P |
| 28 | ELV0N I |
| 29 | ELV0P I |
| 30 | GND P |
| 31 | ELV1N I |
| 32 | ELV1P I |
| 33 | GND P |
| 34 | ELV2N I |
| 35 | ELV2P I |
| 36 | GND P |
| 37 | ELVCLKN I |
| 38 | ELVCLKP I |
| 39 | GND P |
| 40 | ELV3N I |
| 41 | ELV3P I |
| 42 | GND P |
| 43 | LED(A) P |
| 44 | LED(A) P |
| 45 | LED(K) P |
| 46 | LED(K) P |
| 47 | LED(K) P |
| 48 | LED(K) P |
| 49 | LED(K) P |
| 50 | LED(K) P |

TOP

BOT

NOTES :

- Silicone applied to cover whole pin surface , but NOT IC.
- The Dimension In Brackets" () " Are For Reference Only .
- M3.0xP0.5 Screw Holes Are Allowed Screw Torque of System : 6.0 kgf.cm Max .
- LCM Connector : FH28-50S-0.5SH
- TP FFC shipped with the product, no assembly
- Cover Lens surface Etching AG Gloss 80°±15°
- Mask Color : Pantone Black C; High temperature ceramic paint.

REVISION RECORD

| SCALE | 1/4 | TOLERANCE | ±0.2 |
|----------|-----|--------------|----------|
| UNIT | mm | ORG DATE | 07.19.17 |
| MATERIAL | | DRAWN BY | Amber |
| FINISH | | CHECKED BY | |
| | | CONCURRED BY | |
| | | APPROVED BY | |

US Micro Products
Engineered Display Solutions

PROJECT NO: _____ MODULE: _____

DWG NO M1629C0-1B DCN A4 VERSION A

P 2 OF 2

5. MAXIMUM RATINGS

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

| Items | Symbol | Min. | Max. | Unit | Note |
|-----------------------|--------|------|------|------|---------------------|
| Power Voltage | VDD | 3.0 | 3.6 | Volt | |
| Operating Temperature | Top | -40 | 85 | °C | Ambient temperature |
| Storage Temperature | Tst | -40 | 90 | °C | Ambient temperature |
| Humidity | - | - | 90 | %RH | Note 1 |

Note :

Note1: HTHE +65°C + 4°C, %RH : 93% + /- 5%

Note2: The specification above is for IC chip only. For the module reliability criteria, please refer to section 11.

6. ELECTRICAL CHARACTERISTICS

A. Typical operating conditions

| Item | Symbol | Values | | | Unit | Remark | |
|----------------------------------|---------|-----------------|---------|------|---------|--------|-------|
| | | Min. | Typ. | Max. | | | |
| Supply Voltage for Source Driver | VDD | 3.0 | 3.3 | 3.6 | V | Note1 | |
| LCD Current Operating mode | IDD | | 500 | 1120 | mA | | |
| Output Voltage | H level | V _{OH} | VDD-0.4 | | VDD | V | Note1 |
| | L Level | V _{OL} | VSS | | VSS+0.4 | V | Note1 |
| Input Voltage | H level | V _{IH} | 0.7*VDD | - | VDD | V | Note1 |
| | L Level | V _{IL} | VSS | - | 0.3*VDD | V | Note1 |
| Frame Rate | Fr | | 60 | | Hz | Note1 | |

Note1: The specification above is based on IC datasheet.

B. CTP Typical operating conditions

| Item | Symbol | Values | | | Unit | Remark |
|----------------------------|---------------|---------|------|------|------|--------|
| | | Min. | Typ. | Max. | | |
| Supply Power | VDD – GND | 3.0 | 3.3 | 3.6 | V | Note1 |
| Crystal Clock | Crystal Clock | - | 12 | - | MHz | - |
| Input High Level Voltage | VIH | VDD-0.8 | - | - | V | - |
| Input Low Level Voltage | VIL | - | - | 0.8 | V | - |
| Output High Level Voltage | VOH | VDD-0.4 | - | - | V | I=2mA |
| Output Low Level Voltage | VOL | - | - | 0.4 | V | I=2mA |
| High Voltage Power | VDDH | - | - | 14 | V | - |
| CTP Current Operating mode | IDD | - | 8.4 | 12.6 | mA | Note 2 |
| Power Consumption | P | - | 28 | 42 | mW | Note 2 |

Note1: For I²C interface mode.

Note2: For Reference data.

7. Backlight Characteristic

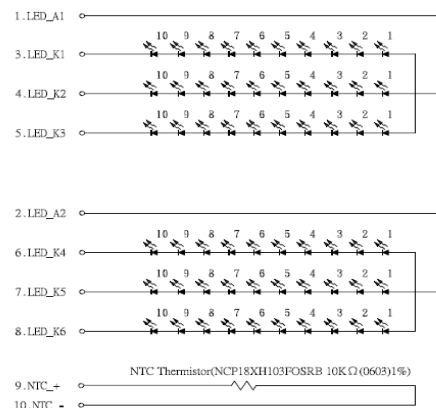
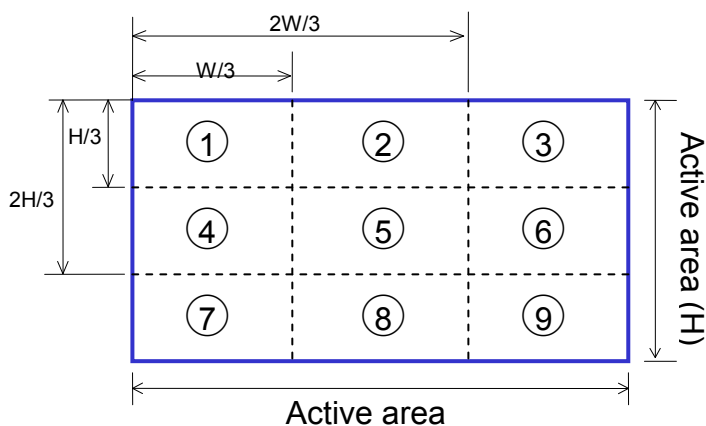
| Item | Symbol | Values | | | Unit | Test condition |
|-----------------------------------|-----------------|--------------------|------|------|-------------------|---|
| | | Min. | Typ. | Max. | | |
| LED Current(per chain) | I _{AK} | | 77 | | mA | |
| LED Voltage | V _{AK} | 24 | --- | 35 | V | |
| LCM Surface Luminance | L _s | 800 | 1000 | | Cd/m ² | |
| Power consumption | | | 13.9 | 16.5 | W | |
| LCM Surface brightness uniformity | L _D | 70 | | | % | |
| Number of LED | | 60 | | | pcs | |
| Connection mode | P | 6Parallel/10Serial | | | | |
| LED life time | | 50000 | | | | I _{AK} =90mA/chain, 25°C L50% |

Note:

- 1.GP suggest using constant current driving this backlight unit .
- 2.The LED chip luminance decrease to be 50% of original
 - a. Test Instrument: BM-5 (Distance =500mm; Field = 1°)
 - b. Light Source: LED * 60 (White)
 - c. Measure Brightness: 1 ~ 9
 - d. Uniformity = (Min. Brightness / Max. Brightness)*100%
 - e. Uniformity ≥ 70%

Note :

The maximum difference between LED voltages |(A1-K1)-(A2-K2)| of a single display shall be less than 1.0 V @ 20 mA ◦



LED Circuit Diagram (I_f=462mA)

8. MODULE FUNCTION DESCRIPTION

8.1. LCM PIN Description

| Pin | Symbol | I/O | Function |
|-----|---------|-----|--|
| 1 | GND | P | System Ground |
| 2 | VDD | P | System Power(3.3V) |
| 3 | VDD | P | System Power(3.3V) |
| 4 | VDD | P | System Power(3.3V) |
| 5 | GND | P | System Ground |
| 6 | NTC1 | | Connected to NTC Thermistor in Backlight |
| 7 | WP | I | Write Protect for EEPROM |
| 8 | SCLK | I | Serial clock input for EEPROM |
| 9 | SDAT | I | Serial data input for EEPROM |
| 10 | AGMODE | I | Aging Mode |
| 11 | NTC2 | | Connected to NTC Thermistor in Backlight |
| 12 | GND | P | System Ground |
| 13 | OLV0N | I | LVDS Differential Data Pair |
| 14 | OLV0P | I | LVDS Differential Data Pair |
| 15 | GND | P | System Ground |
| 16 | OLV1N | I | LVDS Differential Data Pair |
| 17 | OLV1P | I | LVDS Differential Data Pair |
| 18 | GND | P | System Ground |
| 19 | OLV2N | I | LVDS Differential Data Pair |
| 20 | OLV2P | I | LVDS Differential Data Pair |
| 21 | GND | P | System Ground |
| 22 | OLVCLKN | I | LVDS Differential Clock Pair |
| 23 | OLVCLKP | I | LVDS Differential Clock Pair |
| 24 | GND | P | System Ground |
| 25 | OLV3N | I | LVDS Differential Data Pair |
| 26 | OLV3P | I | LVDS Differential Data Pair |
| 27 | GND | P | System Ground |
| 28 | ELV0N | I | LVDS Differential Data Pair |

| | | | |
|----|---------|---|------------------------------|
| 29 | ELV0P | I | LVDS Differential Data Pair |
| 30 | GND | P | System Ground |
| 31 | ELV1N | I | LVDS Differential Data Pair |
| 32 | ELV1P | I | LVDS Differential Data Pair |
| 33 | GND | P | System Ground |
| 34 | ELV2N | I | LVDS Differential Data Pair |
| 35 | ELV2P | I | LVDS Differential Data Pair |
| 36 | GND | P | System Ground |
| 37 | ELVCLKN | I | LVDS Differential Clock Pair |
| 38 | ELVCLKP | I | LVDS Differential Clock Pair |
| 39 | GND | P | System Ground |
| 40 | ELV3N | I | LVDS Differential Data Pair |
| 41 | ELV3P | I | LVDS Differential Data Pair |
| 42 | GND | P | System Ground |
| 43 | LED(A) | P | LED_A Anode |
| 44 | LED(A) | P | LED_A Anode |
| 45 | LED(K) | P | LED_K Cathode |
| 46 | LED(K) | P | LED_K Cathode |
| 47 | LED(K) | P | LED_K Cathode |
| 48 | LED(K) | P | LED_K Cathode |
| 49 | LED(K) | P | LED_K Cathode |
| 50 | LED(K) | P | LED_K Cathode |

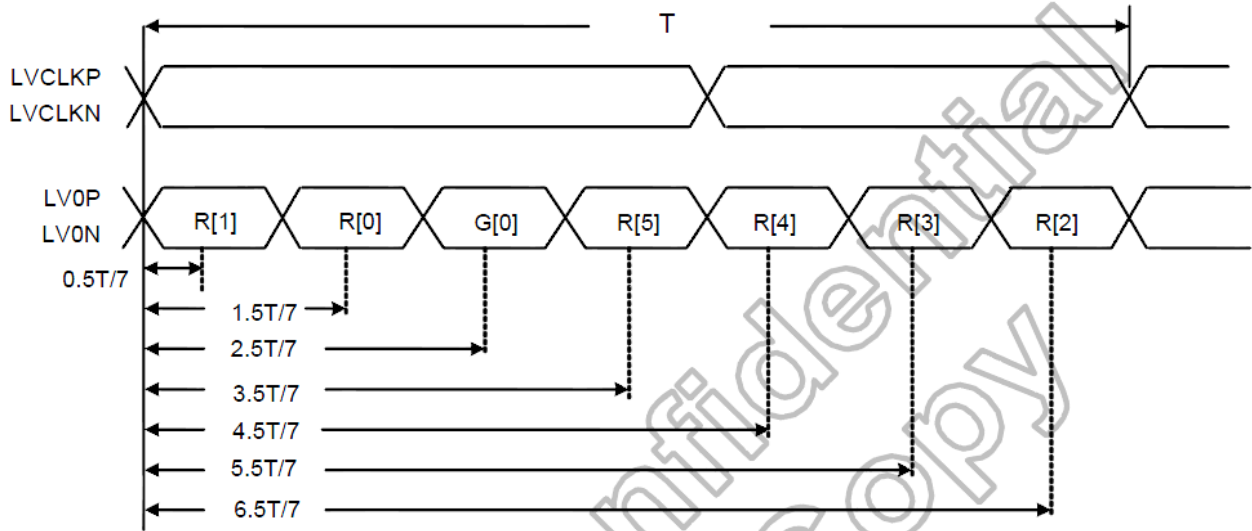
8.2. CTP PIN Description

| | | | |
|----|---------------------------|---|--|
| 1 | GND | P | Digital Ground |
| 2 | DA- | I | USB D- |
| 3 | DA+ | I | USB D+ |
| 4 | V _{IN} (VDD_USB) | P | Digital Power (5V) for USB ($\pm 0.25V$) |
| 5 | V _{IN} (VDD_I2C) | P | Digital Power (3.3V~3.6V) for I2C |
| 6 | SDA | I | A serial data pin for I2C interface |
| 7 | SCL | I | A serial clock pin for I2C interface |
| 8 | INT | I | Interrupt output pin to host |
| 9 | RESET | I | Hardware reset pin |
| 10 | GND | P | Digital Ground |

8.3. Timing characteristics

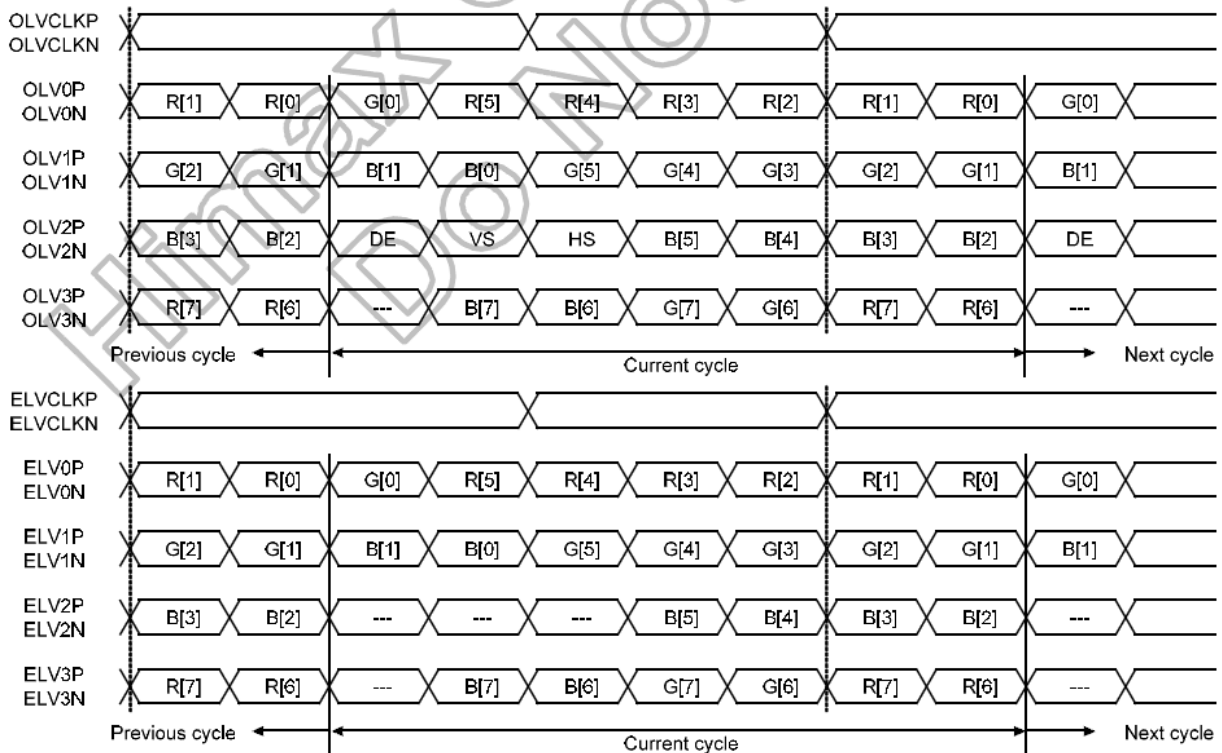
8.3.1. LVDS receiver

Ideal strobe position for LVDS input

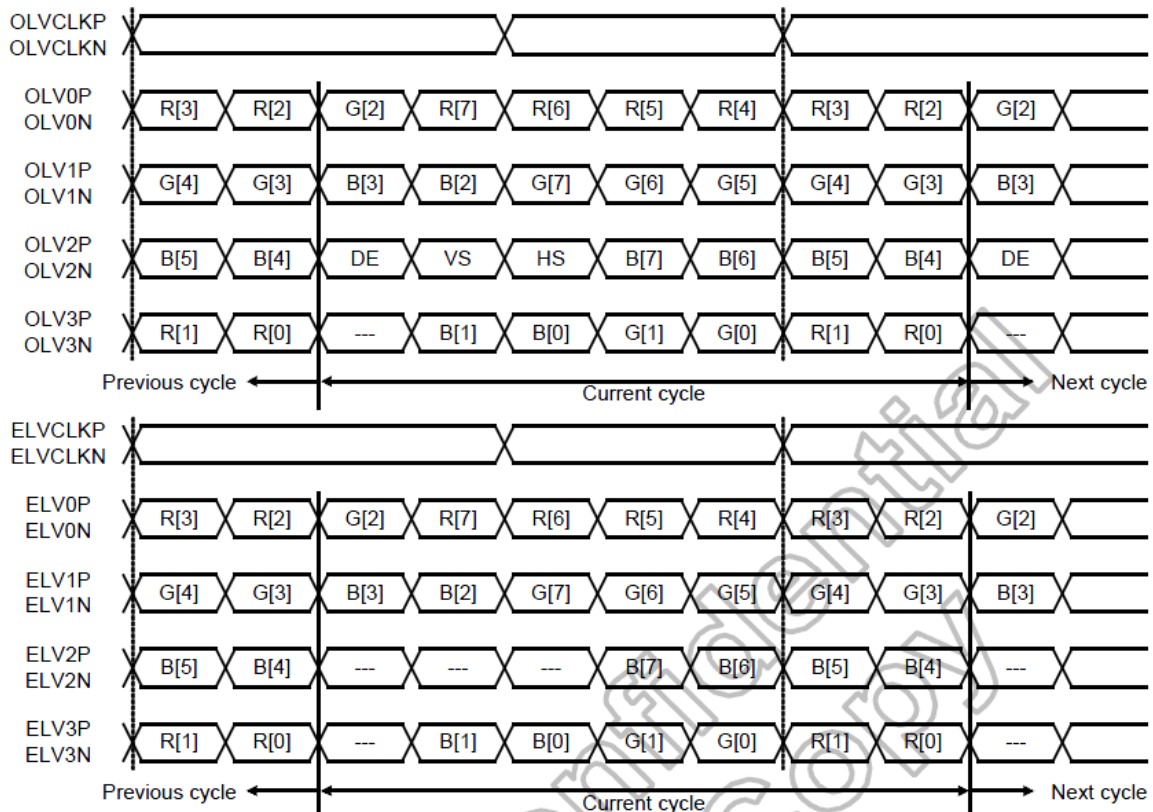


LVDS input data ideal storbe position

8.3.2. LVDS input data mapping



LVDS input data mapping(VESA format)



LVDS input data mapping(JEIDA format)

8.3.3.LVDS input port mirror by ROM code setting

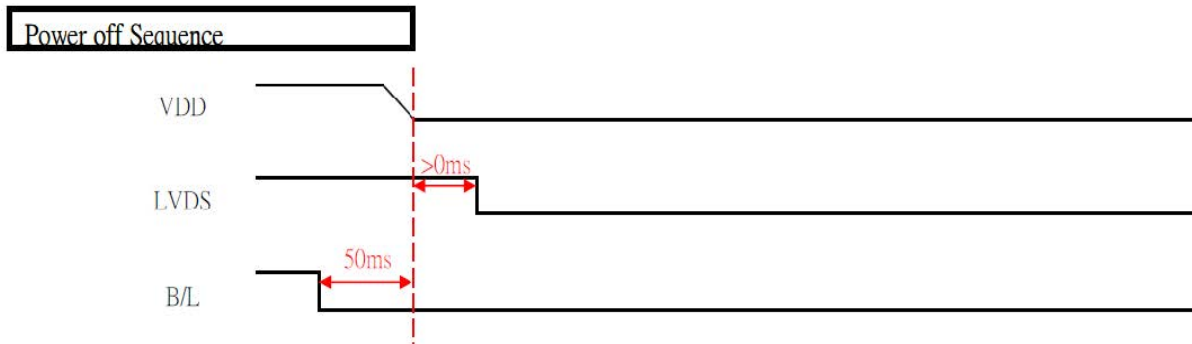
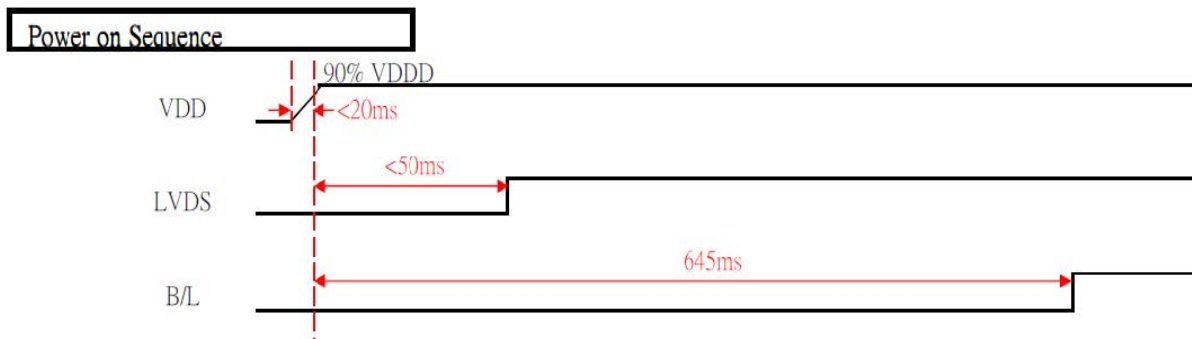
| Type | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---------|---------|-----------|---------|--------------------|---------|---------|------------------|------------------|
| Pin no. | Default | Port swap | Mirror | Mirror & port swap | Single1 | Single2 | Mirror & single1 | Mirror & single2 |
| 7 | OLV0N | ELV0N | OLV3P | ELV3P | LV0N | - | LV3P | - |
| 8 | OLV0P | ELV0P | OLV3N | ELV3N | LV0P | - | LV3N | - |
| 9 | OLV1N | ELV1N | OLVCLKP | ELVCLKP | LV1N | - | LVCLKP | - |
| 10 | OLV1P | ELV1P | OLVCLKN | ELVCLKN | LV1P | - | LVCLKN | - |
| 11 | OLV2N | ELV2N | OLV2P | ELV2P | LV2N | - | LV2P | - |
| 12 | OLV2P | ELV2P | OLV2N | ELV2N | LV2P | - | LV2N | - |
| 13 | OLVCLKN | ELVCLKN | OLV1P | ELV1P | LVCLKN | - | LV1P | - |
| 14 | OLVCLKP | ELVCLKP | OLV1N | ELV1N | LVCLKP | - | LV1N | - |
| 15 | OLV3N | ELV3N | OLV0P | ELV0P | LV3N | - | LV0P | - |
| 16 | OLV3P | ELV3P | OLV0N | ELV0N | LV3P | - | LV0N | - |
| 19 | ELV0N | OLV0N | ELV3P | OLV3P | - | LV0N | - | LV3P |
| 20 | ELV0P | OLV0P | ELV3N | OLV3N | - | LV0P | - | LV3N |
| 21 | ELV1N | OLV1N | ELVCLKP | OLVCLKP | - | LV1N | - | LVCLKP |
| 22 | ELV1P | OLV1P | ELVCLKN | OLVCLKN | - | LV1P | - | LVCLKN |
| 23 | ELV2N | OLV2N | ELV2P | OLV2P | - | LV2N | - | LV2P |
| 24 | ELV2P | OLV2P | ELV2N | OLV2N | - | LV2P | - | LV2N |
| 25 | ELVCLKN | OLVCLKN | ELV1P | OLV1P | - | LVCLKN | - | LV1P |
| 26 | ELVCLKP | OLVCLKP | ELV1N | OLV1N | - | LVCLKP | - | LV1N |
| 27 | ELV3N | OLV3N | ELV0P | OLV0P | - | LV3N | - | LV0P |
| 28 | ELV3P | OLV3P | ELV0N | OLV0N | - | LV3P | - | LV0N |

9. POWER ON/OFF SEQUENCE

Special care should be taken that the large current may cause a permanent damage to the LSI when voltage is applied to the LCD drive power supply terminals in the condition that the logic power supply terminals are floating.

9.1. Power Supply NO/OFF Sequence

The following sequences are recommended from the image display to the power supply OFF.



10.ELECTRO-OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in dark room or equivalent state with the methods shown in Note 1.

| Parameter | | Symbol | Min. | Typ. | Max. | Units | Note |
|-------------------------------------|-------------------------------------|------------|-------|-------|-------|-------------------|------------------|
| Luminance of white | | Lwh | 800 | 1000 | - | cd/m ² | 3 |
| Contrast Ratio | | CR | 700 | 1000 | - | - | 5 |
| CIE color Coordinates | White | x | 0.233 | 0.283 | 0.333 | - | BM7; 2° angle |
| | | y | 0.255 | 0.305 | 0.355 | | |
| | Red | x | 0.595 | 0.645 | 0.695 | | |
| | | y | 0.277 | 0.327 | 0.377 | | |
| | Green | x | 0.218 | 0.268 | 0.318 | | |
| | | y | 0.553 | 0.603 | 0.653 | | |
| | Blue | x | 0.085 | 0.135 | 0.185 | | |
| | | y | 0.072 | 0.122 | 0.172 | | |
| NTSC | | | 60 | 69.1 | | % | |
| Response Time | | Tr+Tf | --- | 25 | 40 | ms | 4 25°C |
| Viewing Angle (with Polarizer) | Y axis down ($\psi=180^\circ$) | ψ_L | 80 | 85 | --- | Degree | 5 |
| | Y axis up ($\psi=0^\circ$) | ψ_H | 80 | 85 | --- | | |
| | X axis right ($\psi=90^\circ$) | θ_R | 80 | 85 | --- | | |
| | X axis left ($\psi=270^\circ$) | θ_L | 80 | 85 | --- | | |

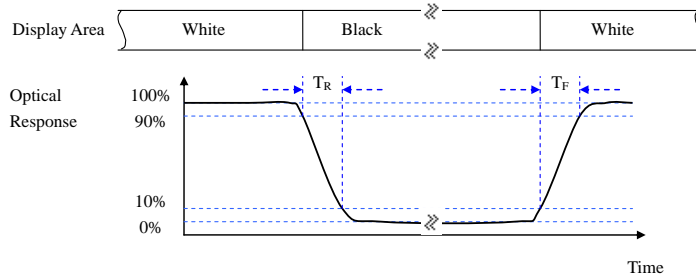
Note:

1. Test equipment setup

After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

2. Definition of response time: T_R and T_F

The figure below is the output signal of the photo detector.



3. Definition of contrast ratio:

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

$$\text{White } V_i = V_{i50\%} \pm 1.5V$$

$$\text{Black } V_i = V_{i50\%} \mp 2.0V$$

"±" means that the analog input signal swings in phase with VCOM signal.

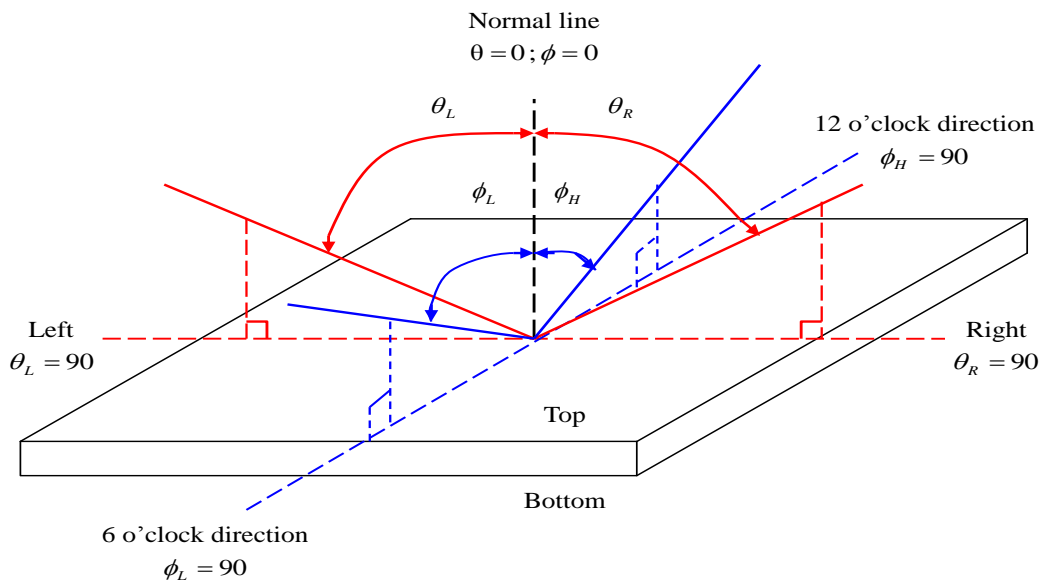
"∓" means that the analog input signal swings out of phase with VCOM signal.

$V_{i50\%}$: The analog input voltage when transmission is 50%.

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

4. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

5. Definition of viewing angle:



CTP OPTICAL CHARACTERISTIC

| Item | Specifications | Remark |
|--------------|--------------------------------|--------|
| Transparency | $\geq 85\%$ @wave length 550nm | Note 1 |
| Haze | $\leq 6.5\%$ | |

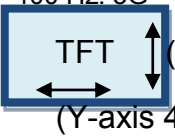
Note 1 : After stabilizing the panel, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by NIPPON NDH-5000.

11.RELIABILITY

11.1.MTTF

The LCD module shall be designed to meet a minimum MTTF value of 50,000 hours with normal condition. (25°C in the room without sunlight; not include life time of backlight)

11.2.TESTS

| NO. | ITEM | CONDITION | CRITERION |
|-----|--|--|---|
| 1 | High Temperature Operating | +80°C 240 hrs | <ul style="list-style-type: none"> ◦ No defect of Electronics Function In Room Temperature Are Allowable. ◦ IDD of LCD in Pre-and post-test should follow specification |
| 2 | Low Temperature Operating | -30°C 240 hrs | |
| 3 | High Temperature Non-Operating | +80°C 240 hrs | |
| 4 | Low Temperature Non-Operating | -30°C 240 hrs | |
| 5 | High Temperature/ Humidity Operating | +60°C ,90%RH ,240hrs | |
| 6 | Temperature Shock Non-Operating | -30°C ↔ 80°C (30min) (5min) (30min) 50cycles, | |
| 7 | Electrostatic Discharge Test Non-Operating | HBM: ±2kV | |
| 8 | Vibration (Non-operation) (TBD, ES1 Check) | Sinewave 8~33.3 Hz: 1.3mm 33.3~400 Hz: 3G (Z-axis 2hr)  (X-axis 4hr) (Y-axis 4hr) | 1. No function failure and cosmetic defects (IIS) |
| 9 | Mechanical Shock | 100G, 6ms, ±X,±Y,±Z Duration : 3 times for each direction Reference : IEC68-2-27Ea | 2. No glass broken |

| | | | |
|----|-----------------|--|--|
| 10 | Salt Fog Test | <p>1. Temp. of the chamber:35°C 2. Temp. of the saturation tower: 47°C 3. Liquor: 5% NaCl (by weight) 4. PH value of the liquor:6.5 (25C°) Duration : 360 hours</p> | <p>1. Cover glass surface treatment can't peel off 2. Function Test please refer to Note 6</p> |
| 11 | Solar Radiation | <p>Solar Radiation Standard: MIL-STD-810G Test Overview: Expose Front Side of sample to solar radiation using the test parameters stated. Test Parameters: Source Intensity: 1120W/m2 ± 10% Test Cycle: 24 hr. cycle consisting of: 20 hr. irradiation at indicated source intensity. 1 hour of dark and water spray on front. 3 hours of dark at 95% RH. Number of Cycles: 56 Maximum Chamber Temp.: +49°C. Periodic Monitoring: (56 Cycle Test) Evaluate all three samples every 7 cycles for degradation comparison and to be photographed. The photograph to be sent to us for review by the time the report is available. Pass/Fail Criteria: To pass, all samples must be free from any external signs of deterioration or water intrusion. Very slight fading is allowed on samples returned at the end of exposure. Reference : MIL-STD-810G</p> | <p>1. No Cosmetic failures (meet IIS) 2. Function Test please refer to Note 6, and allow slightly display fading (no major function failure).</p> |

Note 1: Test after 24 hours in room temperature.

Note 2: The sampling above is individually for each reliability testing condition.

Note 3: The color fading of polarizing filter should not care.

Note 4: All of the reliability testing chamber above, is using D.I. water. (Min value: 1.0 MΩ -cm)

Note 5: In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after software resetting, it would be judged as a good part.

Note 6: Based on customer's enclosure design, the enclosure should provide enough protection against water or moisture penetrate into the LCM led to function fail.

11.3. Color performance

| No. | ITEM | Criterion (initial) |
|-----|----------------|---------------------|
| 1 | Luminance | >50% |
| 2 | NTSC | >50% |
| 3 | Contrast Ratio | >50% |

12.INSPECTION CRITERIA

12.1.Inspection Conditions

12.1.1.Environmental conditions

The environmental conditions for inspection shall be as follows

Room temperature: $23\pm 5^{\circ}\text{C}$

Humidity: $50\pm 20\% \text{RH}$

12.1.2.The external visual inspection

With a single 1000 ± 200 lux fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes.

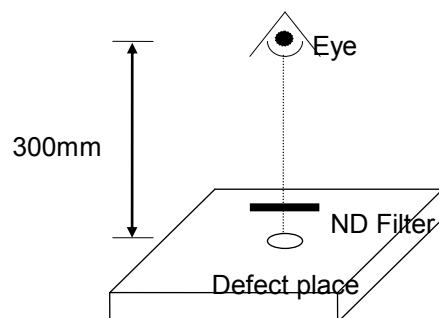
12.2.Light Method

12.2.1.Environment lamp under 1000 ± 200 lux, Viewing direction for inspection over

30 cm

12.2.2.The distance from eye to defect around 300mm, the distance from ND Filter to

defect around 25~30mm



12.3. Classification Of Defects

12.3.1. Major defect

A major defect refers to a defect that may substantially degrade usability for product applications.

12.3.2. Minor defect

A minor defect refers to a defect which is not considered to be able substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation.

Notes: If the LCD/LCM 's cosmetic and display performance do not specify in "inspection criterion", it should be based on these delivered samples.

12.4. Sampling & Acceptable Quality Level

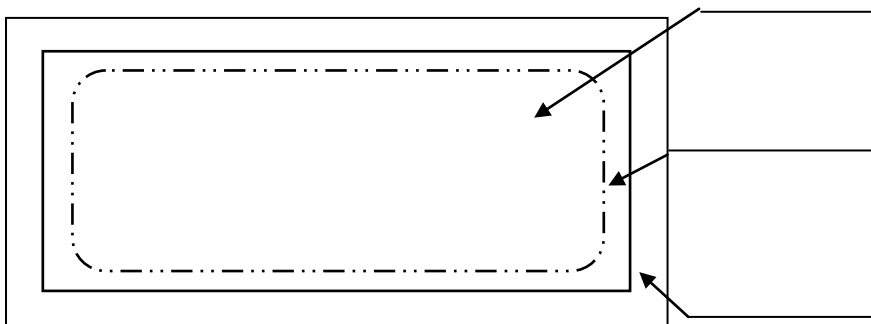
Level II, MIL-STD-105E

| | Major | Minor |
|--------------------|-------|--------|
| Cosmetic | 1.0 % | 1.5 % |
| Electrical-display | 0.4% | 0.65 % |

12.5. Definition Of Inspection Area

V.A: Viewing Area

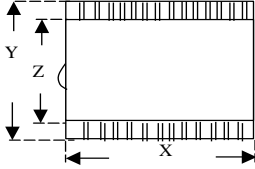
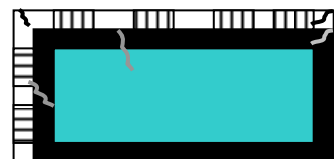
A.A: Active Area



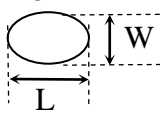
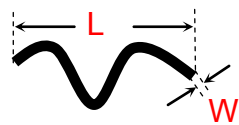
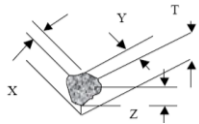
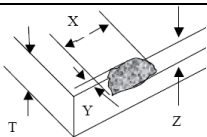
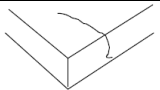
12.6.Items and Criteria

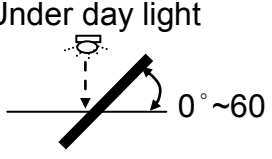
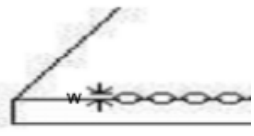
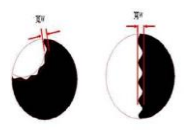
12.6.1.Visual inspection criterion in cosmetic

(1) Glass defect

| No | Defect | Criteria | Remark |
|----|----------------------|---------------------------------|---|
| 1 | Dimension (Minor) | By engineering diagram |  |
| 2 | Cracks (Major) | Extensive crack 【Reject】 |  |

(2) LCM appearance defect with in V.A

| No | Item | Criteria | Remark | |
|----|------------------------|--|---|-----------|
| 1 | Round type (Minor) | Spec. | 1. $\phi = (L+W)/2$, L: Length, W: Width 2. Disregard if out of <u>V.A.</u>  | |
| | | $\phi < 0.20\text{mm}$ | | Disregard |
| | | $0.20\text{mm} \leq \phi \leq 0.60\text{mm}$ | | 5 |
| 2 | Line type (Minor) | Defect Spec. | 1: L: Length, W: Width 2: Disregard if out of <u>V.A.</u>  | |
| | | $W \leq 0.10\text{mm}$ and $L \leq 10\text{mm}$ | | Disregard |
| | | $L \leq 10\text{mm}$ and $0.10\text{mm} < W \leq 0.25\text{mm}$ | | 4 |
| | | $W > 0.25\text{mm}$ or $L > 10\text{mm}$ | 0 | |
| 3 | Corner chip (Minor) | $X \leq 3.0\text{mm}, Y \leq 3.0\text{mm}, Z \leq T$ 【Disregard】 |  | |
| 4 | Edge chip (Minor) | $X \leq 3.0\text{mm}, Y \leq 3.0\text{mm}, Z \leq T$ 【Disregard】 |  | |
| 5 | Crack (Major) | Not allowed |  | |

| | | | | |
|---|------------------------------------|--------------------------|-----------------------|--|
| 6 | Newton's ring (Minor) | Defect Spec. | Permissible Q'ty | Under day light  |
| | | $\phi \leq 7\text{mm}$ | Disregard | |
| | | $\phi > 7\text{mm}$ | 0 | |
| 7 | Chipping (Minor) | $W \leq 0.2 \text{ mm}$ | Disregard |  |
| 8 | Saw edge (Minor) | $W \leq 0.3\text{mm}$ | Disregard |  |
| 9 | Ink peel off · Pin hole (Minor) | $\phi \leq 0.2\text{mm}$ | Disregard | |
| | | $\phi > 0.2\text{mm}$ | 0 (fix with print) | |

(3) FPC

| No | Defect | Criteria | Remark |
|----|---------------------------|----------------|-----------------|
| 1 | Copper peeling (Major) | Copper peeling | 【Reject】 |

(4) Black tape

| No | Defect | Criteria | Remark |
|----|--------------------------|---------------|-----------------|
| 1 | Shift (Minor) | IC exposed | 【Reject】 |
| 2 | No black tape (Minor) | No black tape | 【Reject】 |




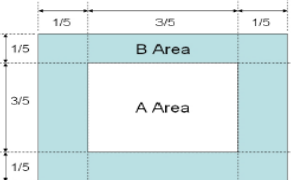
(5) Silicon

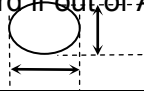

| No | Defect | Criteria | Remark |
|----|------------------------------|-------------|-----------------|
| 1 | Amount of silicon (Minor) | ITO exposed | 【Reject】 |

(6) Bezel

| No | Defect | Criteria | Remark |
|----|--------------------------------|--|----------------------------|
| 1 | Oxidized spot (Minor) | Oxidized spot, rust 【Reject】 | |
| 2 | Outline deformation (Major) | By engineering diagram | |
| 3 | Greasiness (Minor) | Greasiness 【Reject】 | |
| 4 | Spots, round Type (Minor) | $H \leq$ By engineering diagram 【Disregard】 | H=Total height (thickness) |
| 5 | Plating (Minor) | Bubble, peeling 【Reject】 | |

12.6.2. Visual inspection criterion in electrical display

| No | Defect | Criteria | Remark | |
|------------------|-----------------------------------|--------------------|--|-------|
| 1 | No display (Major) | Not allowed |  | |
| 2 | Missing line (Major) | Not allowed |  | |
| 3 | Darker or lighter line (Major) | Not allowed |  | |
| 4 | Weak line (Minor) | By limit sample | | |
| 5 | Bright / Dark point (Minor) | | 1.1 sub-pixel: 1R or 1G or 1B 2. Point defect area $\geq 1/2$ sub pixel.  | |
| | | | | Total |
| | | Bright point | | 2 |
| | | Dark dot point | | 3 |
| | | Bright +Dark point | | 4 |
| Two adjacent dot | 5 | | | |

| | | | | |
|---|-----------------------|--|------------------|--|
| 6 | Weak Bright point | can not see through 5% ND filter | | |
| 7 | Round type (Minor) | Spec. | Permissible Q'ty | 1. $\phi = (L+W)/2$, L: Length, W: Width 2. Disregard if out of A.A.  |
| | | $\phi < 0.20\text{mm}$ | Disregard | |
| | | $0.20\text{mm} \leq \phi \leq 0.60\text{mm}$ | 6 | |
| | | $0.60\text{mm} < \phi$ | 0 | |
| 8 | Line type (Minor) | Defect Spec. | Permissible Q'ty | 1. L: Length, W: Width 2. Disregard if out of A.A.  |
| | | $W \leq 0.10\text{mm}$ and $L \leq 10\text{mm}$ | Disregard | |
| | | $0.10\text{mm} < W \leq 0.30\text{mm}$ and $L \leq 10\text{mm}$ | 5 | |
| | | $W > 0.25\text{mm}$ or $L > 10\text{mm}$ | 0 | |
| 9 | Mura (Minor) | By 5% ND filter invisible | | |

12.6.3.Others

1. Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)
3. Polarizer, more than 0.5mm in size reduction rejected.

13.ILLUSTRATION OF LCD DATE CODE

TBD

14.RoHS COMPLIANT WARRANTY

RoHS Hazardous substances including:

- Cd < 100 ppm
- Pb < 1000 ppm
- Hg < 1000 ppm
- Cr +6 < 1000 ppm
- PBDE < 1000 ppm
- PBB < 1000 ppm

15. PRECAUTIONS FOR USE

15.1. Safety

- (1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
- (2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
- (3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

15.2. Storage Conditions

- (1) Store the panel or module in a dark place where the temperature is $23\pm 5^{\circ}\text{C}$ and the humidity is below $50\pm 20\%\text{RH}$.
- (2) Store in anti-static electricity container.
- (3) Store in clean environment, free from dust, active gas, and solvent.
- (4) Do not place the module near organics solvents or corrosive gases.
- (5) Do not crush, shake, or jolt the module.
- (6) Do not exposed to direct sun light of fluorescent lamps.

15.3. Installing LCD Module

Attend to the following items when installing the LCM.

- (1) Cover the surface with a transparent protective plate or touch panel to protect the polarizer and LC cell.
- (2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be $\pm 0.1\text{mm}$.

15.4. Precautions For Operation

- (1) Viewing angle varies with the change of liquid crystal driving voltage (V_0). Adjust V_0 to show the best contrast.
- (2) Driving the LCD in the voltage above the limit will shorten its lifetime.
- (3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
- (4) When turning the power on, input each signal after the positive/negative voltage becomes stable.

(5) Do not apply water or any liquid on product which composed of T/P.

15.5. Handling Precautions

- (1) Avoid static electricity which can damage the CMOS LSI; please wear the wrist strap when handling.
- (2) The polarizing plate of the display is very fragile. so, please handle it very carefully.
- (3) Do not give external shock.
- (4) Do not apply excessive force on the surface; it may cause display abnormal .
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (6) Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (7) Do not operate it above the absolute maximum rating.
- (8) Do not remove the panel or frame from the module.
- (9) Do not apply water or any liquid on product, which composed of T/P.

15.6. Warranty

- (1) The period is within 12 months since the date of shipping out under normal using and storage conditions.
- (2) The warranty will be avoided in case of defect induced by customer.

