
| | |
|-------------------|----------------------|
| PRODUCT | : LCD MODULE |
| MODEL NO . | : SC3A |
| SUPPLIER | :KUMAN |
| DATE | :March21,2018 |

SPECIFICATION

Revision:1.1

SC3A (-1)

| For Customer's Acceptance | |
|---------------------------|---------|
| Approved by | Comment |
| | |

| | Signature | Date |
|-------------|-----------|------|
| Prepared by | | |
| Checked by | | |
| Approved by | | |

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1 General Description

QD3502 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit a backlight unit, The panel size is 3.5 inch and the resolution is 320x480. High image quality a-Si TFT LCD module. Partial-screen display function is available. Sleep and Stand-by modes are available for power saving.

1.1 Features

| No | Item | Specification | Remark |
|----|-------------------|---------------------|--------|
| 1 | Display Mode | Normally Black | |
| 2 | Screen Size | 3.5 inch (diagonal) | |
| 3 | Resolution | 320XRGBX480 | |
| 4 | Color Number | 262K | |
| 5 | Color Arrangement | RGB-stripe | |
| 6 | Driver IC | ILI9486 | |
| 7 | Back Light | White LED*6 | |
| 8 | Viewing Direction | 12O'CLOCK | |
| 9 | Interface | MCU 8 位 | |
| 10 | Surface Treatment | UV Cut | |

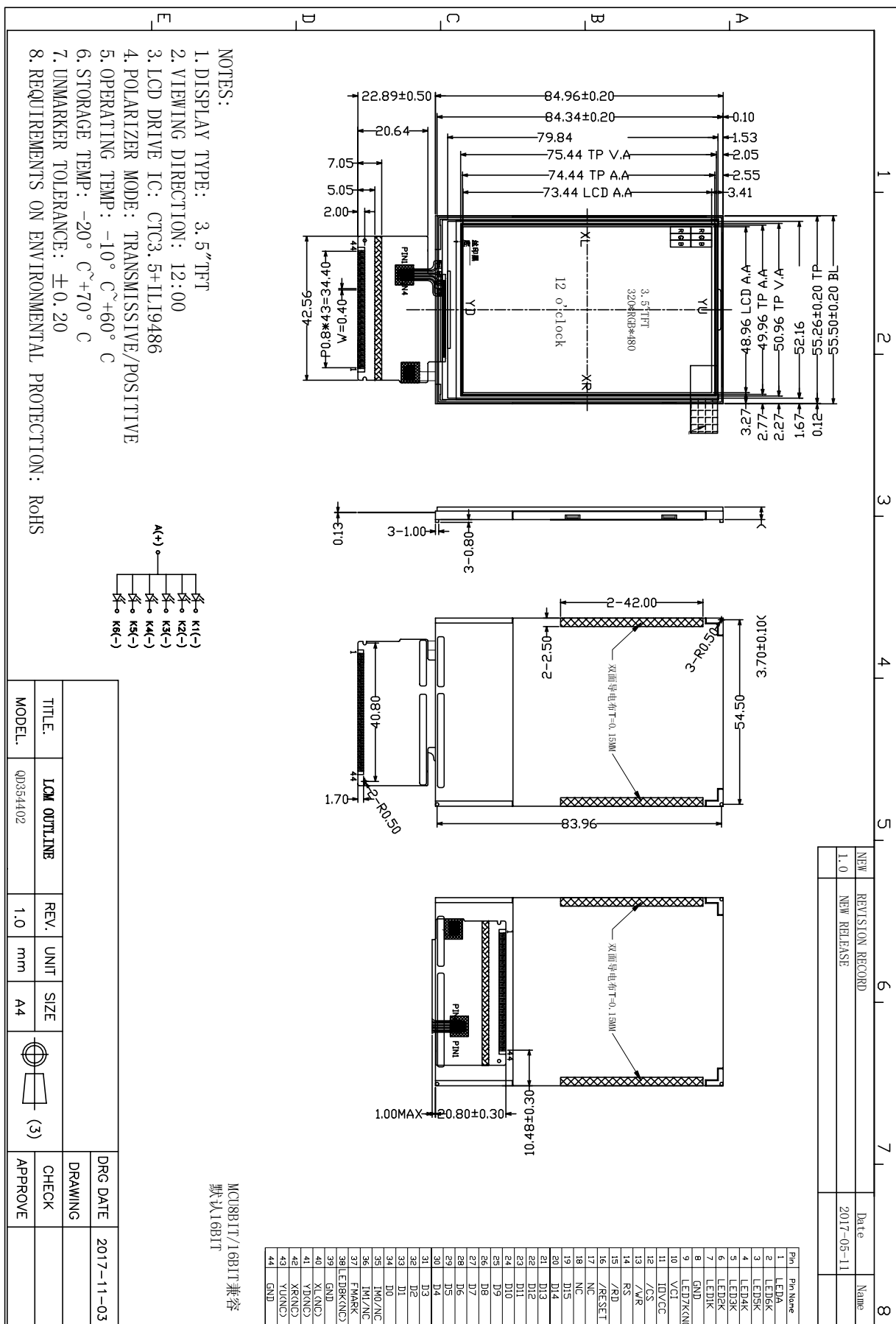
1.2 Application

- ◆ Mobile phone.
- ◆ Portable multimedia device.

2 Outline Dimension

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

| Parameter | Specifications | Unit |
|--------------------|--|-------------------|
| Outline dimensions | 55.5 (W) x 84.96(H) x 3.7+-0.1(D) (LCM,no include FPC) | mm |
| Active area | 48.96(W) x 73.44(H) | mm |
| Resolution | 320(H)RGBx 480(V) dots | - |
| Dot size | 0.153(H) x 0.153 | mm |
| Module brightness | 300 | cd/m ² |



3 Electrical Characteristics

3.1 TFT-LCD Module

Ta=25°C

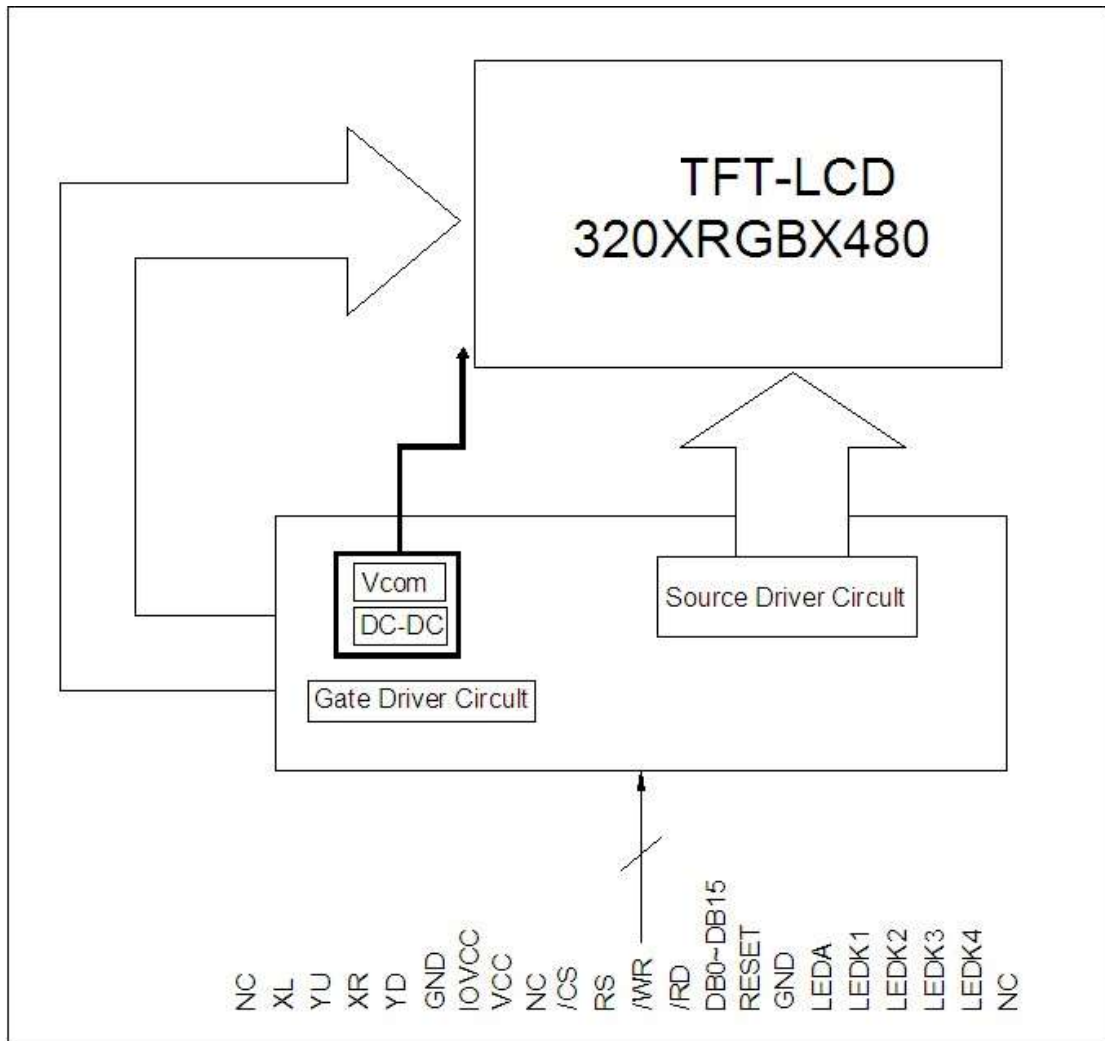
| Item | Symbo | Value | | | Unit | Notes |
|--------------------------|-------|-------|-----|-----|------|-------|
| | | Min | Typ | Max | | |
| Supply Voltage for logic | Vcc | 2.5 | 2.8 | 3.3 | V | |
| | Vci | 2.5 | 2.8 | 3.3 | | |
| TFT Gate ON Voltage | VGH * | 11.5 | | 19 | V | |
| TFT Gate OFF Voltage | VGL | -15.5 | | -7 | V | |
| Operating temperature | Top | -20 | | +70 | °C | |
| Storage temperature | Tst | -30 | | +80 | °C | |

3.2 Back-Light Unit

| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-----------------|--------|-------|------|------|-------|---------------------|
| Current | IF | -- | 90 | 120 | mA | IF=120mA VF=3.2V |
| Forward voltage | VF | 3.0x6 | 3.2 | 3.4 | V | |
| Chroma | X | 0.240 | | 0.28 | | |
| | Y | 0.250 | | 0.29 | | |
| Brightness | L | 4500 | | | Cd/m2 | |
| Uniformity | UBL | 80 | | | % | |

- 12 LED
- The luminous intensity of LED is strongly dependent on the driving current.
- It is recommended the input of backlight to be constant current rather than constant voltage.

4 Block Diagram



5 TFT-LCM Interface Specification

| Pin No. | Symbol | Functional |
|---------|----------|--|
| 1 | LEDA | Power supply Anode input for backlight |
| 2~7 | LEDK | Power supply Cathode input for backlight |
| 8 | GND | Power Ground |
| 9 | NC | NC |
| 10 | VCC | Power supply input for LCM:2.8V |
| 11 | IOVCC | Power supply input for LCM: 1.8V |
| 12 | CS | Chip select input pin. |
| 13 | WR | A write strobe signal can be input via this pin and initiallizes a write |
| 14 | RS | Data/Instruction s |
| 15 | RD | A read strobe signal can be input via this pin and initiallizes a read |
| 16 | RESET | Reset signal input Pin |
| 17,18 | NC | NC |
| 19~34 | DB15~DB0 | Data bus |
| 35,36 | NC | NC |
| 37 | FMARK | Serve as a TE (Tearing Effect) output signal |
| 38 | NC | NC |
| 39 | GND | Power Ground |
| 40 | XL/NC | X- |
| 41 | YD/NC | X- |
| 42 | XR/NC | X+ |
| 43 | YU/NC | Y+ |
| 44 | GND | Power Ground |

6 Description of Interface'Signal

6.1 RGB Interface Timing

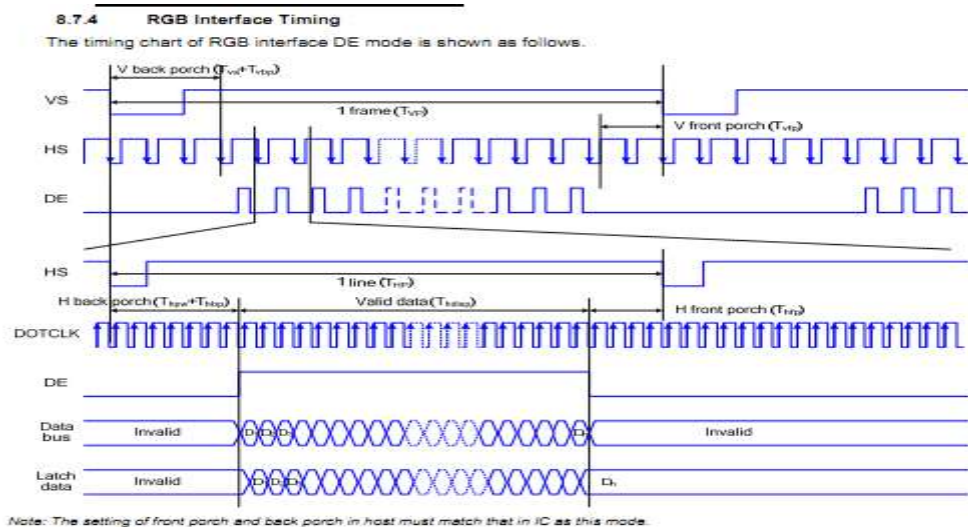


Figure 28 Timing Chart of Signals in RGB Interface DE Mode

6.2 DC Characteristics

7.2 DC Characteristics

| Parameter | Symbol | Condition | Specification | | | Unit | Related Pins |
|---|--------|--------------------------|---------------|------|---------|------|-----------------------|
| | | | MIN. | TYP. | MAX. | | |
| Power & Operation Voltage | | | | | | | |
| System Voltage | VDD | Operating voltage | 2.5 | 2.8 | 4.8 | V | |
| Interface Operation Voltage | VDDI | I/O Supply Voltage | 1.65 | 1.8 | 3.3 | V | |
| Gate Driver High Voltage | VGH | | 11.5 | | 18 | V | Note 4 |
| Gate Driver Low Voltage | VGL | | -7.6 | | -12 | V | |
| Gate Driver Supply Voltage | | VGH-VGL | - | | 30 | V | Note 5 |
| Input / Output | | | | | | | |
| Logic-High Input Voltage | VIH | | 0.7VDDI | | VDDI | V | Note 1 |
| Logic-Low Input Voltage | VIL | | VSS | | 0.3VDDI | V | Note 1 |
| Logic-High Output Voltage | VOH | IOH = -1.0mA | 0.8VDDI | | VDDI | V | Note 1 |
| Differential Input High Threshold Voltage | VIT+ | | | 0 | 50 | mV | MIPI_CLK MIPI_Data |
| Differential Input Low Threshold Voltage | VIT- | | -50 | 0 | | mV | |
| Single-ended Receiver Input Operation Voltage Range | VIR | | 0.5 | | 1.2 | V | |
| Logic-Low Output Voltage | VOL | IOL = +1.0mA | VSS | | 0.2VDDI | V | Note 1 |
| Logic-High Input Current | IIH | VIN = VDDI | | | 1 | uA | Note 1 |
| Logic-Low Input Current | IIL | VIN = VSS | -1 | | | uA | Note 1 |
| Input Leakage Current | IIL | IOH = -1.0mA | -0.1 | | 0.1 | uA | Note 1 |
| VCOM Voltage | | | | | | | |
| VCOM amplitude | VCOM | | | VSS | | V | |
| Source Driver | | | | | | | |
| Gamma Reference Voltage(Positive) | VAP | | 4.4 | | 6.4 | V | |
| Gamma Reference Voltage(Negative) | VAN | | -2.6 | | -4.6 | V | |
| Source Output Settling Time | Tr | Below with 99% precision | | | 10 | us | Note 2 |

Table 2 Basic DC Characteristics

6.3 AC

Characteristics

7.5.4 RGB Interface Characteristics :

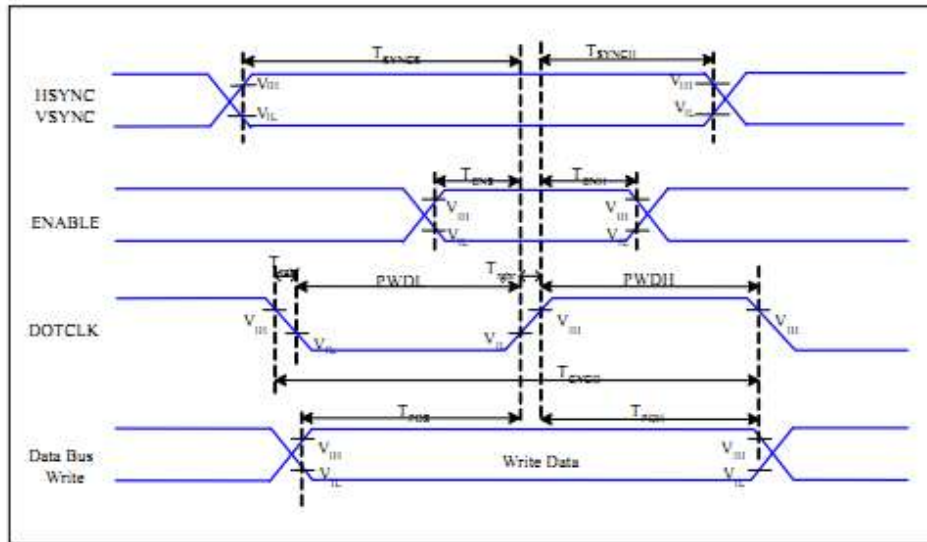


Figure 4 RGB Interface Timing Characteristics

VDDI=1.8, VDD=2.8, AGND=DGND=0V, $T_s=25^\circ\text{C}$

| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|--------------|----------------------|-------------------------------|-----|-----|------|-------------|
| HSYNC, VSYNC | T_{syncs} | VSYSN, HSYN Setup Time | 5 | - | ns | |
| ENABLE | T_{ens} | Enable Setup Time | 5 | - | ns | |
| | T_{enH} | Enable Hold Time | 5 | - | ns | |
| DOTCLK | $PWDH$ | DOTCLK High-level Pulse Width | 13 | - | ns | |
| | $PWDL$ | DOTCLK Low-level Pulse Width | 13 | - | ns | |
| | T_{cycb} | DOTCLK Cycle Time | 28 | - | ns | |
| | T_{rghr}, T_{rghf} | DOTCLK Rise/Fall time | - | 15 | ns | |
| DB | T_{pds} | PD Data Setup Time | 5 | - | ns | |
| | T_{pdH} | PD Data Hold Time | 5 | - | ns | |

Table 7 18/16 Bits RGB Interface Timing Characteristics

6.4 Reset Timing

7.5.6 Reset Timing:

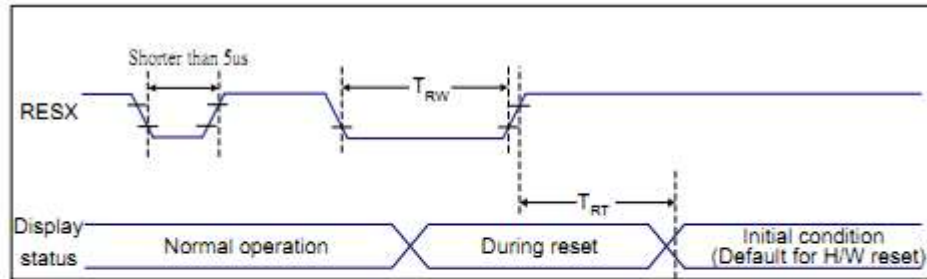


Figure 10 Reset Timing

VDDI=1.8, VDD=2.8, AGND=DGND=0V, $T_a=25^\circ\text{C}$

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

Table 10 Reset Timing

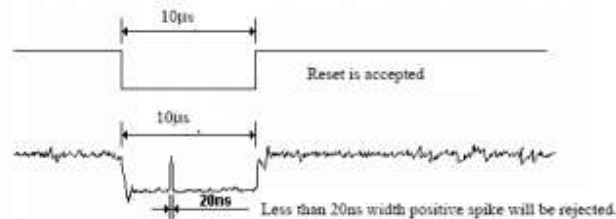
Notes:

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.

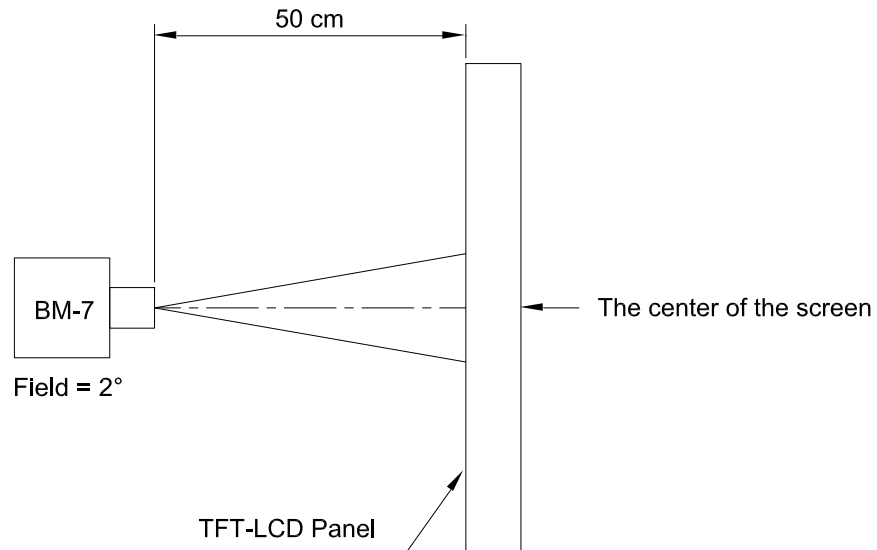
4. Spike Rejection also applies during a valid reset pulse as shown below:



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

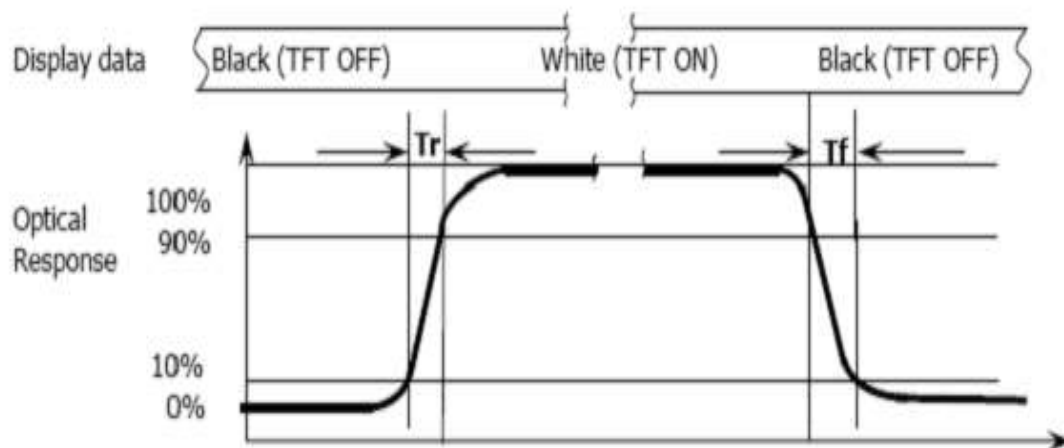
Note 1: The brightness test equipment setup
 $I_B=60\text{mA}$, Field= 2° (As measuring “black” image, field= 2° is the best testing condition.)



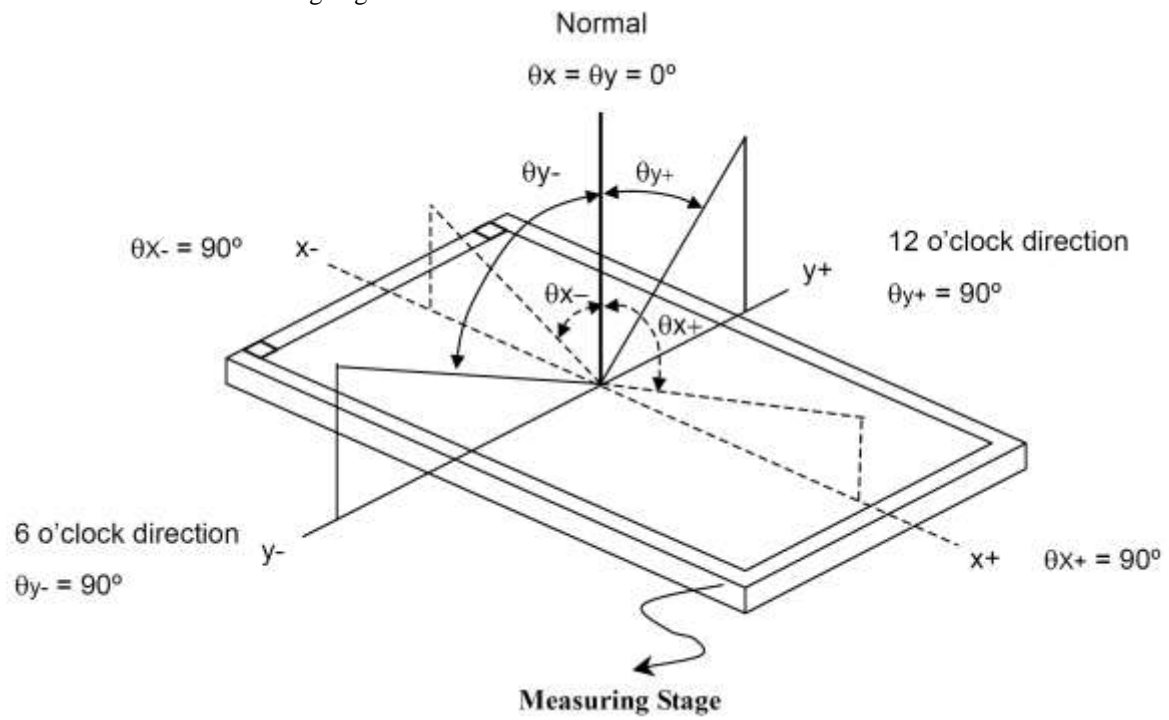
Note 2: Definition of contrast ratio (C.R)

$$\text{C.R} = \frac{\text{Brightness When LCD is at "White" State}}{\text{Brightness When LCD is at "Black" State}}$$

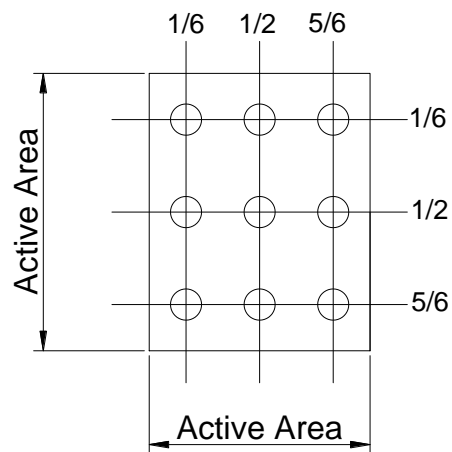
Note 3: Definition of response time



Note 4: Definition of viewing angle



Note 5: Definition of uniformity (U_n)

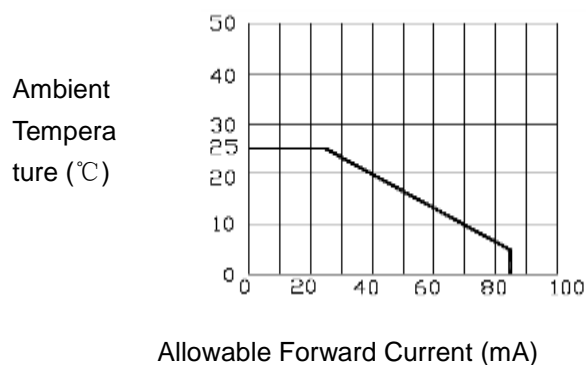


$$U_n = \frac{B_{\min}}{B_{\max}} \times 100\%$$

8 Environment Absolute Maximum Ratings

| Item | Symbol | Min | Max | Unit | Remark |
|-----------------------------|--------|-----|-----|------|---------|
| Operation temperature range | Top | -20 | 70 | °C | Ambient |
| Storage temperature range | Tst | -30 | 80 | °C | Ambient |

- Corrosive gas environment is not acceptable.
- TFT-LCD color will change slightly depending on environment temperature. This phenomenon is reversible. Current reduction rate of LED backlight is according to the graph indicated below:



9 Reliability Test Items

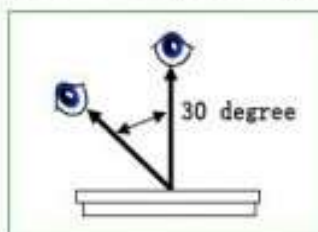
| Test Item | Test Condition |
|---|---|
| High Temperature Operation | 70°C for 24 hours |
| Low Temperature Operation | -20°C for 24 hours |
| High Temperature Storage | 70°C for 24 hours |
| Low Temperature Storage | -40°C for 24 hours |
| High Temperature Operation Humidity Operation | 50°C, 95%RH for 48 hours |
| Thermal Shock | -30°C storage one hour, rise to 70°C within 15s, high temperature one hour, drop to 30°C within 15s, circulate ten repeatedly |
| Vibration Test (No Operation) | Frequency: 10~55Hz Amplitude: 1.0mm Sweep Time: 11min Test Period: 6 Cycles for each direction of X, Y, Z |
| Static electricity test | Touch 6KV, air touch 10KV |

10 Inspection Standard

This standard apply to TFT module specification.

1. Inspection condition:

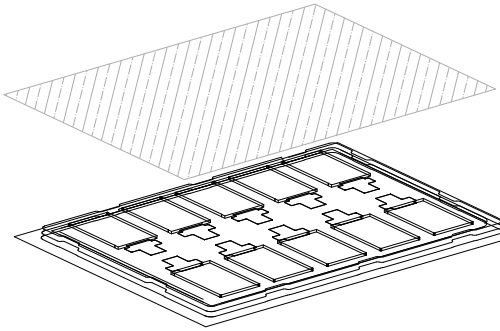
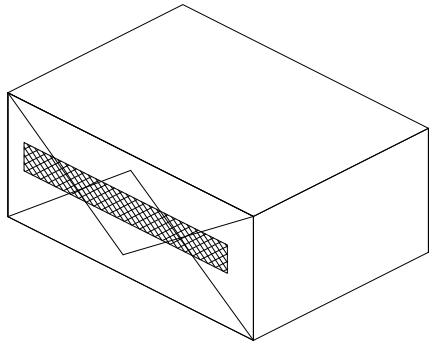
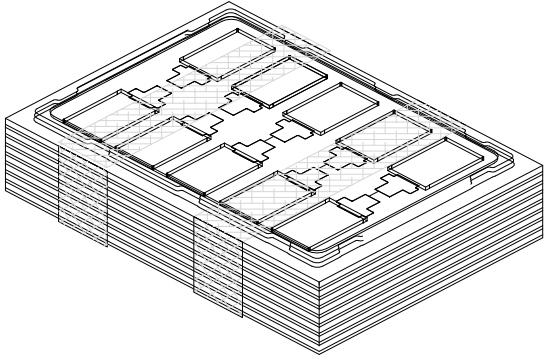
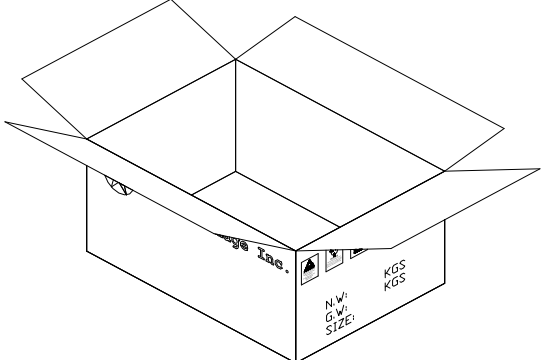
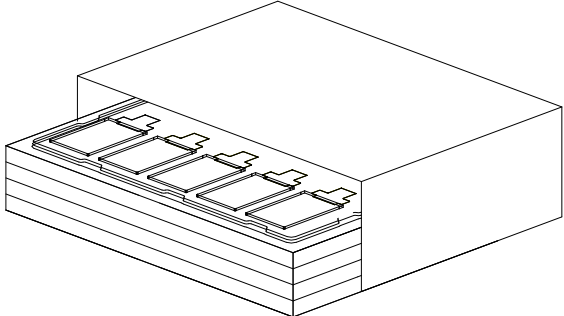
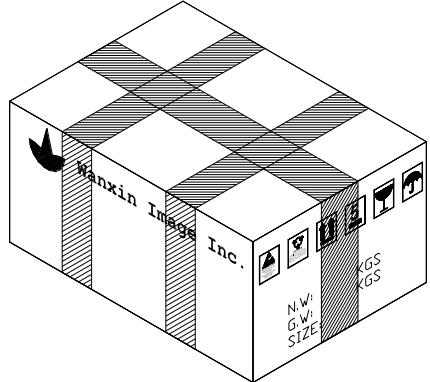
Under daylight lamp 20~40W, product distance inspector' eye 30cm.incline degree 30° .



2. Inspection standard

| NO. | Item | Inspection standard | Rate | | | | | | | | | | | | | | | |
|-------------------------|----------------------|--|---------------------|-------------------|-------------------|--------|-------------------------|--------|-------------------------|----------------------|-------------------------|--------------|----------------------|---|-------|------------|--------------------------------|--|
| 2.1 | Dot | <p>Case of Dot defect is below</p> <p>① Bright Dot (whit spot) : "0"</p> <p>② Dark Dot (black spot) : "0" (In case of Dark Dot on Main TFT LCD)</p> <p>- NG if there's full Dot defect.</p> <p>- Damaged less than the size of sub-pixel is not counted as defect</p> <p>- Dots darker than the size of sub-pixel are not defined as bright dot defect</p> <table border="1"> <tr> <th>area size (mm)</th> <th>Acceptable number</th> </tr> <tr> <td>$\Phi \leq 0.10$</td> <td>ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.15$</td> <td>3</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.20$</td> <td>2</td> </tr> <tr> <td>$0.25 < \Phi \leq 0.25$</td> <td>1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </table> | area size (mm) | Acceptable number | $\Phi \leq 0.10$ | ignore | $0.10 < \Phi \leq 0.15$ | 3 | $0.15 < \Phi \leq 0.20$ | 2 | $0.25 < \Phi \leq 0.25$ | 1 | $0.25 < \Phi$ | 0 | minor | | | |
| area size (mm) | Acceptable number | | | | | | | | | | | | | | | | | |
| $\Phi \leq 0.10$ | ignore | | | | | | | | | | | | | | | | | |
| $0.10 < \Phi \leq 0.15$ | 3 | | | | | | | | | | | | | | | | | |
| $0.15 < \Phi \leq 0.20$ | 2 | | | | | | | | | | | | | | | | | |
| $0.25 < \Phi \leq 0.25$ | 1 | | | | | | | | | | | | | | | | | |
| $0.25 < \Phi$ | 0 | | | | | | | | | | | | | | | | | |
| 2.2 | line | <table border="1"> <tr> <th colspan="2">Size (mm)</th> <th>Acceptable number</th> </tr> <tr> <td>ignore</td> <td>$W \leq 0.03$</td> <td>ignore</td> </tr> <tr> <td>$L \leq 4.0$</td> <td>$0.03 < W \leq 0.04$</td> <td>2</td> </tr> <tr> <td>$L \leq 4.0$</td> <td>$0.04 < W \leq 0.05$</td> <td>1</td> </tr> <tr> <td></td> <td>$0.05 < W$</td> <td>Treat with dot non-conformance</td> </tr> </table> | Size (mm) | | Acceptable number | ignore | $W \leq 0.03$ | ignore | $L \leq 4.0$ | $0.03 < W \leq 0.04$ | 2 | $L \leq 4.0$ | $0.04 < W \leq 0.05$ | 1 | | $0.05 < W$ | Treat with dot non-conformance | |
| Size (mm) | | Acceptable number | | | | | | | | | | | | | | | | |
| ignore | $W \leq 0.03$ | ignore | | | | | | | | | | | | | | | | |
| $L \leq 4.0$ | $0.03 < W \leq 0.04$ | 2 | | | | | | | | | | | | | | | | |
| $L \leq 4.0$ | $0.04 < W \leq 0.05$ | 1 | | | | | | | | | | | | | | | | |
| | $0.05 < W$ | Treat with dot non-conformance | | | | | | | | | | | | | | | | |

11 Package

| | |
|--|---|
| <p>1</p>  | <p>4</p>  |
| <p>10 pcs per tray + 1 cover (EPE)</p> | <p>Packing bag</p> |
| <p>2</p>  | <p>5</p>  |
| <p>15 trays + 1 dummy tray = 150 ps</p> | <p>Putting bag into carton Protected by 2 pieces of cushion EPE sheet</p> |
| <p>3</p>  | <p>6</p>  |
| <p>Putting trays into anti-electrostatic bag</p> | <p>Packing carton with sealing tape Carton outline size: 400×295×145 (mm)</p> |

12 Precautions

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

12.1 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 surface 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 the 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.

12.2 Storage

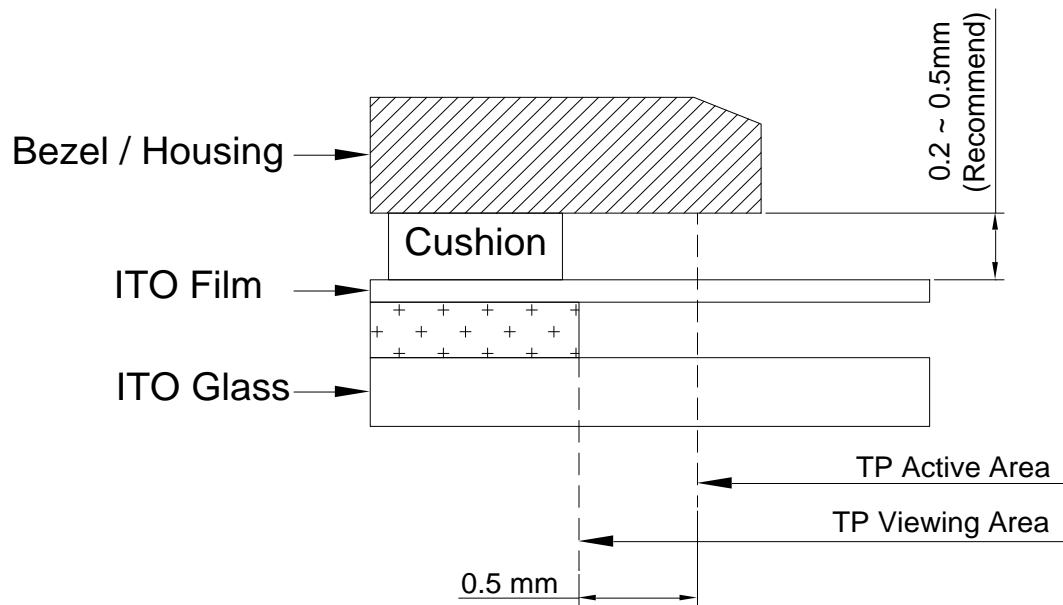
- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

12.3Operation

- (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 and 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 cause 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 liquid 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.

12.4Touch Panel Mounting Notes

- (a) If a cushion is used between bezel/housing and film must be choose as free as enough to absorb the 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 Key Area may cause unexpected input if the gap is too narrow or foreign particles like dusts exist between Bezel/Housing and ITO film.
- (d) Mounting example:



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

12.5Others

- If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
- For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.
- It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.

13 Records of Version

| Version | Revise Date | Page | Content |
|---------|-------------|------|--------------|
| A | 2018-05-04 | All | New released |
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