

TFT-LCD Module Datasheet

ITEM NO.: TST50WV05AR

Version: V2.0

| ITEM | Specification | Unit |
|--------------------------------|--|-------|
| LCD Type | a-Si TFT, Transmissive, Normally white, TN | - |
| LCD Size | 5.0 | inch |
| Resolution (W x H) | 800 x (RGB) x 480 | pixel |
| LCM (W x H x D) | 120.7(W) x 75.8(H) x 4.1(D) | mm |
| Active Area (W x H) | 108 (W) x 64.8 (H) | mm |
| Dot Pitch (W x H) | 0.045(W) X 0.135(H) | mm |
| Viewing Direction | 6 o'clock | - |
| Gray Scale Inversion Direction | 12 o'clock | - |
| Viewing Angle | Top:50, Bottom:70; Left/ Right:70 | deg. |
| Color Depth | 16.7M | - |
| Pixel Arrangement | RGB-stripe | - |
| Backlight Type | 14 LEDs | - |
| Surface Luminance | 500 | cd/m2 |
| Surface Treatment | Anti-Glare | - |
| Driver IC | Source: ILI6122 + Gate: ILI5960 | - |
| Interface Type | RGB24-bit | - |
| Input Voltage | 3.3 | V |
| With/Without TP | Optional | - |
| Weight | TBD. | g |

Note 1: RoHS compliant

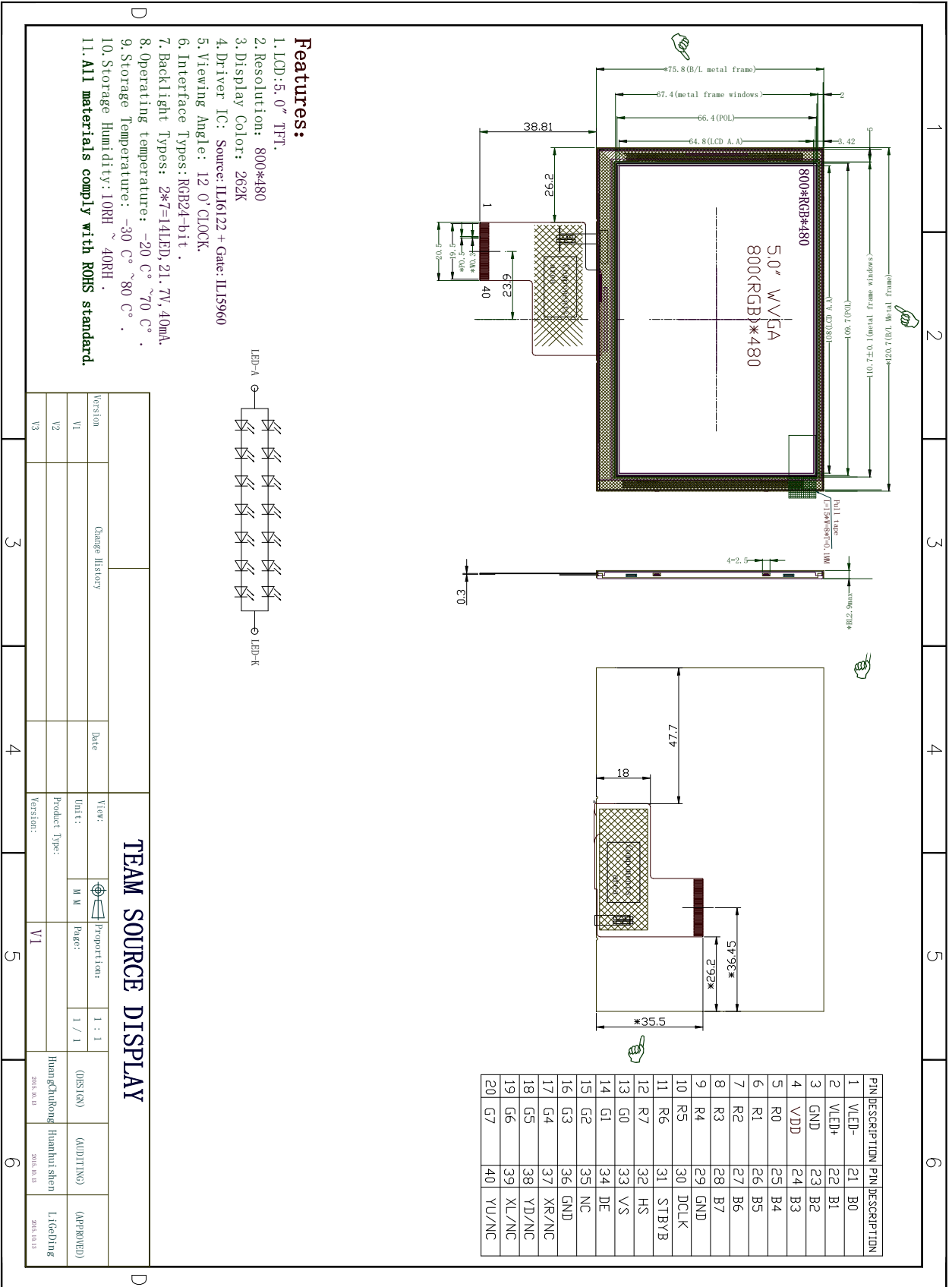
Note 2: LCM weight tolerance: ± 5%.

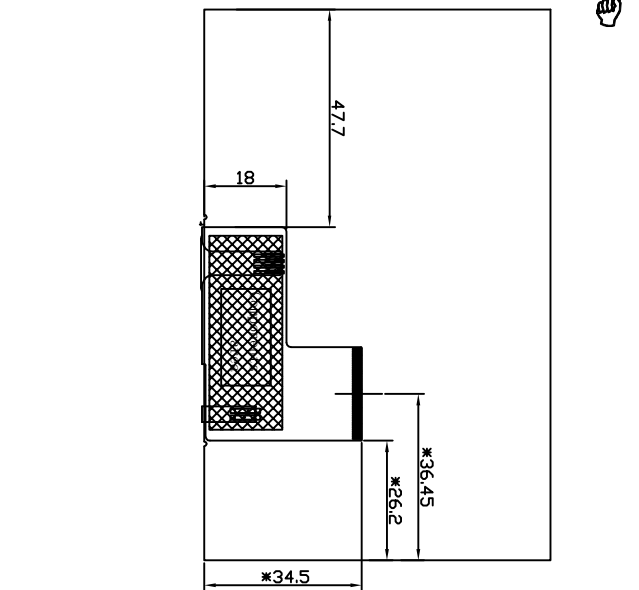
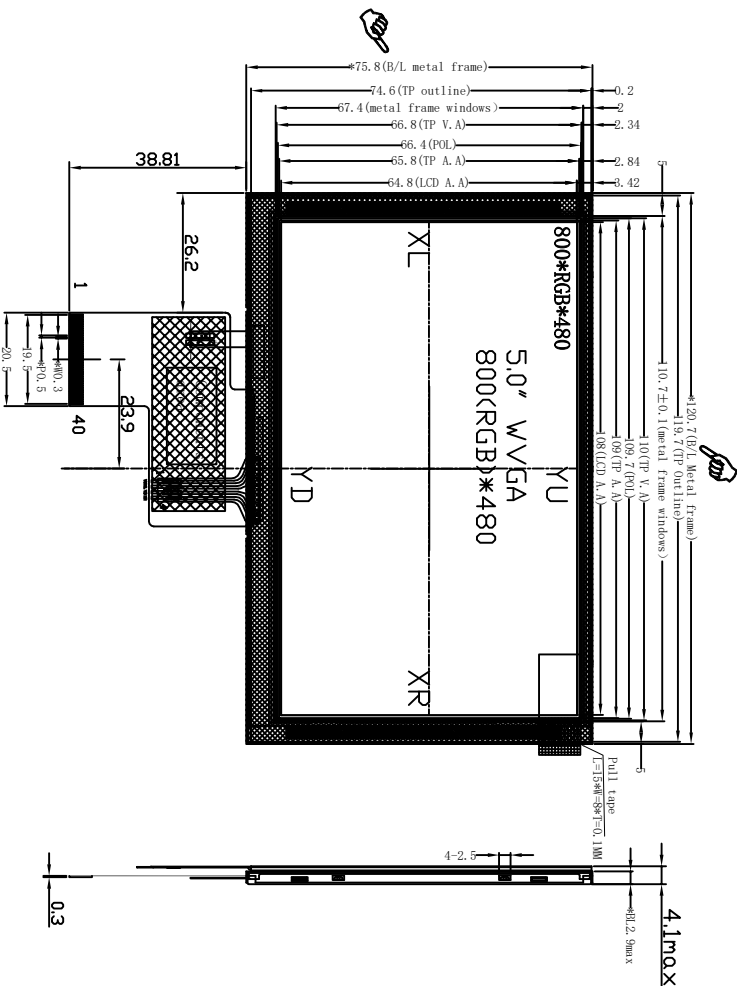
| Version No. | Date | Content | Remark |
|-------------|------------|-------------------|--------|
| V1.0 | 2015-10-20 | Initial Release | |
| V2.0 | 2015-12-10 | Viewing Direction | |
| | | | |

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1 Product drawings

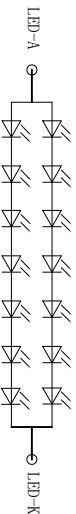




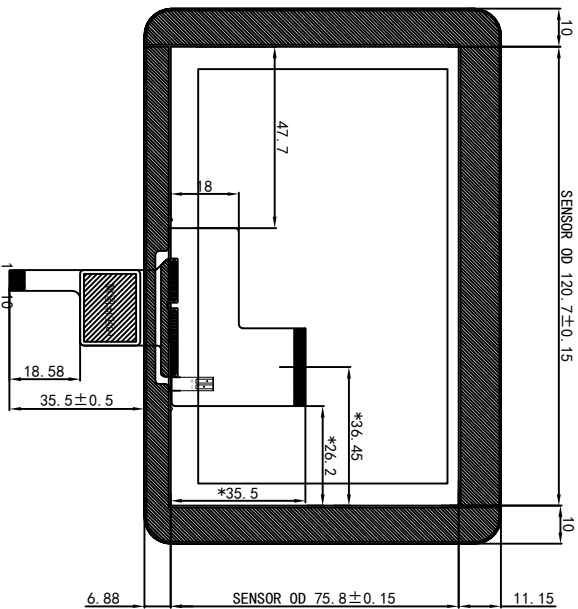
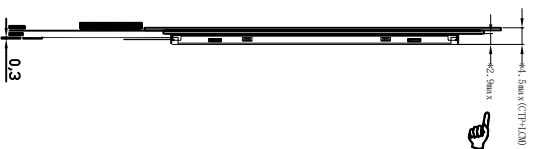
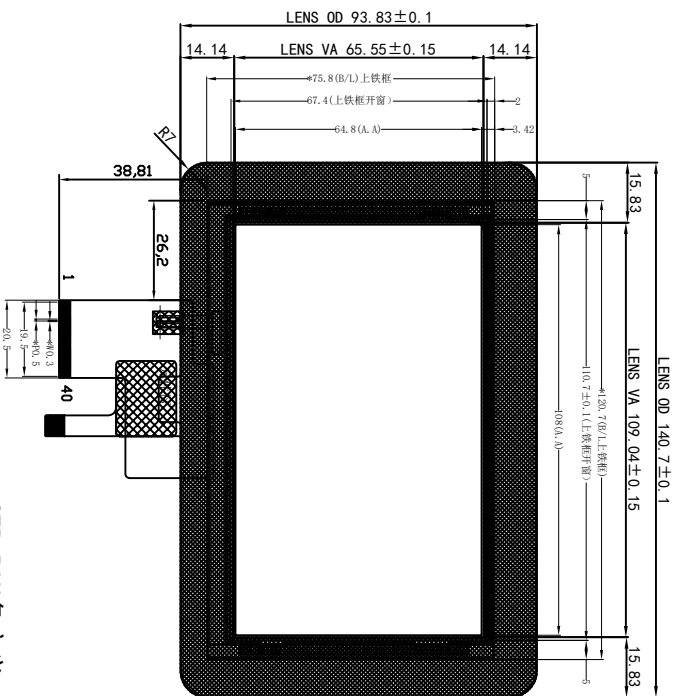
| PIN | DESCRIPTION | PIN | DESCRIPTION |
|-----|-------------|-----|-------------|
| 1 | VLED- | 21 | B0 |
| 2 | VLED+ | 22 | B1 |
| 3 | GND | 23 | B2 |
| 4 | VDD | 24 | B3 |
| 5 | R0 | 25 | B4 |
| 6 | R1 | 26 | B5 |
| 7 | R2 | 27 | B6 |
| 8 | R3 | 28 | B7 |
| 9 | R4 | 29 | GND |
| 10 | R5 | 30 | DCLK |
| 11 | R6 | 31 | STBYB |
| 12 | R7 | 32 | HS |
| 13 | G0 | 33 | VS |
| 14 | G1 | 34 | DE |
| 15 | G2 | 35 | NC |
| 16 | G3 | 36 | GND |
| 17 | G4 | 37 | XR/NC |
| 18 | G5 | 38 | YD/NC |
| 19 | G6 | 39 | XL/NC |
| 20 | G7 | 40 | YU/NC |

Features:

1. LCD: 5.0" TFT.
2. Resolution: 800*480
3. Display Color: 262K
4. Driver IC: Source: ILI6122 + Gate: ILI5960
5. Viewing Angle: 60° CLOCK.
6. Interface Types: RGB24-bit.
7. Backlight Types: 2*7=14LED, 21. 7V, 40mA.
8. Operating temperature: -20 C° ~ 70 C°.
9. Storage Temperature: -30 C° ~ 80 C°.
10. Storage Humidity: 10RH ~ 40RH.
11. All materials comply with ROHS standard.



| Item | Symbol | min. | typ. | max. | Unit | Condition |
|-----------------------|--------|-------------------|------|-------|-------------------|------------|
| Luminance | Lv | 450 | 500 | — | cd/m ² | If=20*3 mA |
| Uniformity | Avg | 80 | — | — | % | |
| Colour Coordinate | X | 0.280 | — | 0.290 | V | |
| | Y | 0.280 | — | 0.290 | | |
| Forward Voltage | Vf | 21 | 21.7 | 22.4 | V | |
| Contrast ratio | CR | 400 | 500 | — | V | |
| | | Operating Voltage | VDD | 2.8 | | |



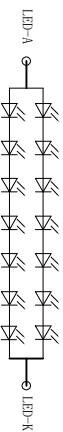
| PIN DESCRIPTION | PIN DESCRIPTION |
|-----------------|-----------------|
| 1 VLED- | 21 B0 |
| 2 VLED+ | 22 B1 |
| 3 GND | 23 B2 |
| 4 VDD | 24 B3 |
| 5 R0 | 25 B4 |
| 6 R1 | 26 B5 |
| 7 R2 | 27 B6 |
| 8 R3 | 28 B7 |
| 9 R4 | 29 GND |
| 10 R5 | 30 DCLK |
| 11 R6 | 31 STBYB |
| 12 R7 | 32 HS |
| 13 G0 | 33 VS |
| 14 G1 | 34 DE |
| 15 G2 | 35 NC |
| 16 G3 | 36 GND |
| 17 G4 | 37 XR/NC |
| 18 G5 | 38 YD/NC |
| 19 G6 | 39 XL/NC |
| 20 G7 | 40 YU/NC |

CTP PIN角定义

| PIN NO | DIRECTION |
|--------|-----------|
| 1 | NC |
| 2 | NC |
| 3 | RST |
| 4 | GND |
| 5 | TWT |
| 6 | SDA |
| 7 | SCL |
| 8 | GND |
| 9 | GND |
| 10 | VDD |

Features:

1. LCD: 5.0" TFT.
2. Resolution: 800*480
3. Display Color: 262K
4. Driver IC: TBD.
5. Viewing Angle: 6 0° CLOCK.
6. Interface Types: RGB24-bit .
7. Backlight Types: 7*2=14LED, 21. 7V, 40mA.
8. Operating temperature: -20 C° ~ 70 C° .
9. Storage Temperature: -30 C° ~ 80 C° .
10. Storage Humidity: 10RH ~ 40RH .
11. All materials comply with ROHS standard.



| Item | Symbol | min. | typ. | max. | Unit | Condition |
|-------------------|-------------------|-----------------|------|-------|-------------------|-----------------------|
| Luminance | L _v | 80 | 480 | — | cd/m ² | T=20±3mA |
| | Avg | 80 | — | — | % | |
| Colour Coordinate | X | 0.280 | — | 0.290 | — | T=20±3mA |
| | Y | 0.280 | — | 0.290 | — | |
| Forward Voltage | V _f | 21 | 21.7 | 22.4 | V | I _f =20mA |
| | V _r | — | — | — | — | |
| Contrast ratio | CR | 400 | 500 | — | — | V _{DD} =3.3V |
| | Operating Voltage | V _{DD} | 2.8 | 3.0 | 3.3 | |

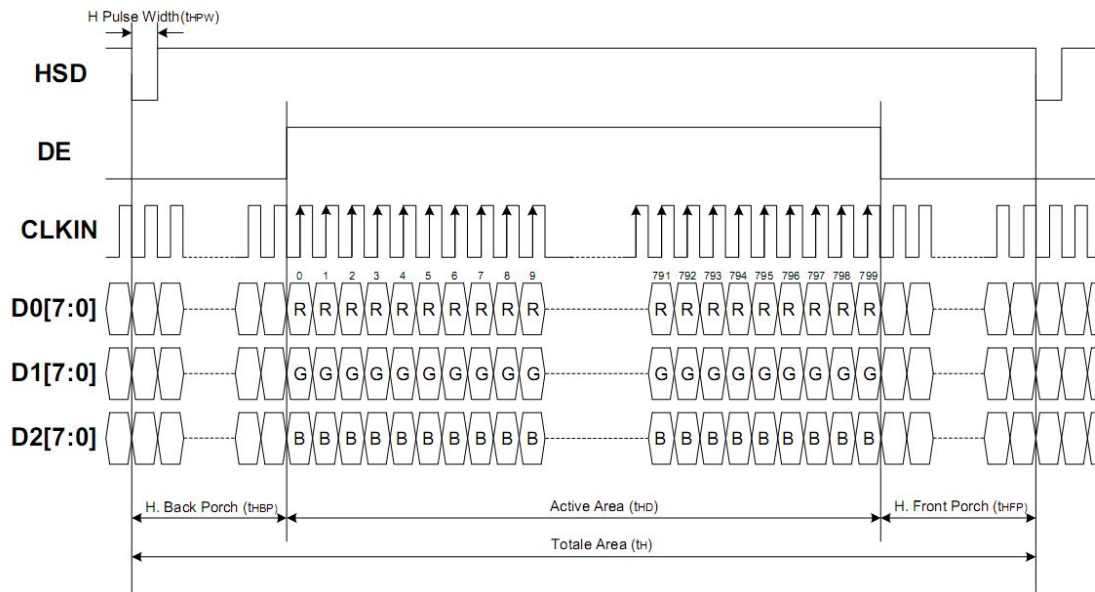
注: 标注 请重点确认 尺寸中带有“*”为重点管控尺寸 SHENZHEN TEAM SOURCE DISPLAY TECH. CO, LTD

| 版本 (Version) | 变更记录 (Change History) | 日期 (Date) | 视角 (View): | 比例 (Proportion): | 设计 (DESIGN) | 审核 (AUDITING) | 批准 (APPROVED) |
|--------------|-----------------------|-------------|------------|------------------|-------------|---------------|---------------|
| V1 | 增加标注: 修改焊接参数 | 2015. 8. 28 | M M | 1 / 1 | | | |
| V2 | | | | | | | |
| V3 | | | | | | | |

2 Interface description

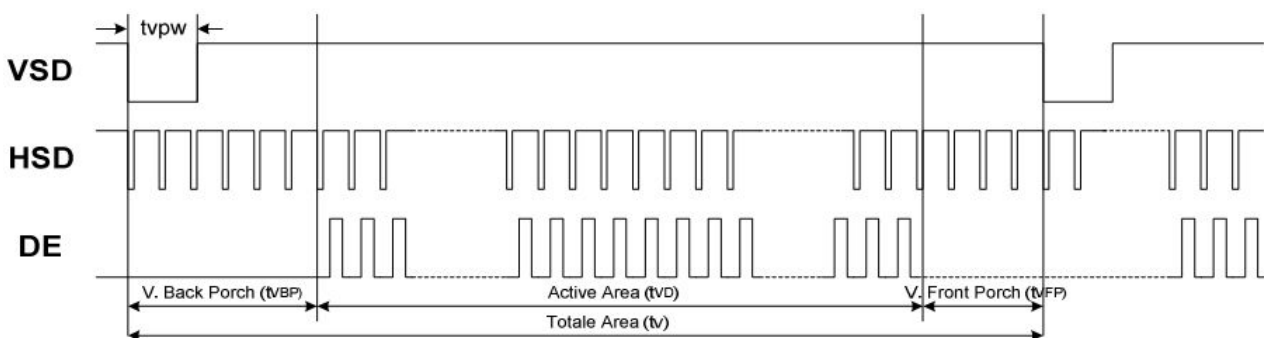
| PIN NO. | Symbol | description |
|---------|--------|--|
| 1 | VLED- | Backlight K Cathode input pin. |
| 2 | VLED+ | Backlight A Aothod input pin. |
| 3 | GND | System Ground. (0V) |
| 4 | VDD | Power supply +2.8V |
| 5~12 | R0~R7 | Red Data BUS |
| 13~20 | G0~G7 | Green Data BUS |
| 21~28 | B0~B7 | Blue Data BUS |
| 29 | GND | System Ground. (0V) |
| 30 | DCLK | Clock for input data. Data latched at rising/falling edge of this signal. Default is falling edge. |
| 31 | STBYB | Standby mode control. (Normally pull high) STBYB="L", enter standby mode for power saving. Timing controller and source driver will turn off, all outputs are Hi-Z. STBYB="H", normal operation. |
| 32 | HS | Horizontal sync input in digital parallel RGB. Negative polarity. |
| 33 | VS | Vertical sync input in digital parallel RGB. Negative polarity. |
| 34 | DE | Input data enable control. When DE mode, active High to enable data input. (Normally pull low) |
| 35 | NC | |
| 36 | GND | System Ground. (0V) |
| 37 | XR/NC | The touch panel X Right pin |
| 38 | YD/NC | The touch panel Y Down pin |
| 39 | XL/NC | The touch panel X Left pin |
| 40 | YU/NC | The touch panel Y Up pin |

3 Display Timing characteristics



Horizontal Input Timing

| Parameter | Symbol | min | Typ. | max | Unit |
|--------------------------|------------------|-----|------|------|-------|
| Horizontal display area | tHD | - | 800 | - | CLKIN |
| CLKIN frequency | f _{clk} | - | 33.3 | 50 | MHz |
| 1 Horizontal line period | t _H | 862 | 1056 | 1200 | CLKIN |
| HSD pulse width | Min. | - | 1 | - | |
| | Typ. | - | - | - | |
| | Max. | - | 40 | - | |
| HSD back porch | t _{HBP} | 46 | 46 | 46 | |
| HSD front porch | t _{HFP} | 16 | 210 | 354 | |



Vertical Input Timing

| Parameter | Symbol | min | Typ. | max | Unit |
|-----------------------|------------------------------|-----|------|-----|------|
| Vertical display area | tVD | - | 480 | - | HSD |
| VSD period time | t _v | 510 | 525 | 650 | |
| VSD pulse width | T _{V_{VPW}} | 1 | - | 20 | |
| VSD back porch | t _{VBP} | 23 | 23 | 23 | |
| VSD front porch | t _{VFP} | 7 | 22 | 147 | |

4 INITIAL CODE

Don't need to be initialized

5 Absolute Maximum Ratings

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|---------------------------|-----------|------|----------------|------|
| Supply Voltage (Analog) | VDD~GND | -0.5 | +5.0 | V |
| Logic signal voltage(I/O) | IOVDD~GND | -0.5 | +5.0 | V |
| Operating Temperature | TOP | -20 | 70 | ° C |
| Storage Temperature | TST | -30 | 80 | ° C |
| Humidity | RH | - | 90%(Max 60° C) | RH |

6 Electrical Characteristics

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|----------------------------|--------|---------|-----|---------|------|
| Analog operating voltage | VDD | 3.0 | 3.3 | 3.6 | V |
| Logic operating voltage | IOVDD | 3.0 | 3.3 | 3.6 | V |
| Input Current | IDD | - | TBD | - | mA |
| Input Voltage ' H ' level | VIH | 0.7VDD | - | VDD | V |
| Input Voltage ' L ' level | VIL | GND | - | 0.3VDD | |
| Output Voltage ' H ' level | VOH | VDD-0.4 | - | -- | |
| Output Voltage ' L ' level | VOL | -- | - | GND+0.4 | |

7 Backlight Characteristics

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT |
|---------------------------|-----------------|-------|-------|------|------|
| Voltage for LED backlight | V _f | - | 21.7 | 23.1 | V |
| Current for LED backlight | I _f | - | 40 | - | mA |
| Power consumption | W _{bl} | - | 868 | - | mW |
| Uniformity | Avg | 80 | - | - | % |
| LED Life Time | - | 30000 | 40000 | - | Hrs |

Note:

1. The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60%RH ±5 %.
2. The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions.
3. Typical operating life time is an estimated data.
4. Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded .Functional operation should be restricted to the conditions described under normal operating conditions.

8 LCD Optical specifications

Without touch panel

| Item | Symbol | Condition | Specification | | | Unit | Remark |
|---|--------|----------------------|---------------|-------|-------|-------|--------|
| | | | Min | Typ | Max | | |
| Response time (By Quick) | Tr+Tf | $\theta = 0^\circ$ | - | 10 | 20 | ms | Note 2 |
| Contrast ratio | CR | $\theta = 0^\circ$ | 400 | 500 | - | | Note 3 |
| Viewing angle | Top | $CR \geq 10$ | 40 | 50 | - | Deg. | Note 4 |
| | Bottom | $CR \geq 10$ | 60 | 70 | - | | |
| | Left | $CR \geq 10$ | 60 | 70 | - | | |
| | Right | $CR \geq 10$ | 60 | 70 | - | | |
| Color chromaticity (CF only with ITO, light source is C light, CIE 1931) | Wx | $\theta = 0^\circ$ | 0.26 | 0.31 | 0.36 | | Note 1 |
| | Wy | | 0.28 | 0.33 | 0.38 | | |
| | Rx | | 0.600 | 0.620 | 0.640 | | |
| | Ry | | 0.324 | 0.344 | 0.364 | | |
| | Gx | | 0.286 | 0.306 | 0.326 | | |
| | Gy | | 0.543 | 0.563 | 0.583 | | |
| | Bx | | 0.113 | 0.133 | 0.153 | | |
| | By | | 0.129 | 0.149 | 0.169 | | |
| NTSC | | | 57% | 60% | - | | |
| Transmittance | Trans | | 3.73 | 4.66 | - | % | |
| Luminous | L | Viewing normal angle | --- | 500 | -- | Cd/m2 | |

With Resistive touch panel

| Item | Symbol | Condition | Specification | | | Unit | Remark |
|---------------|--------|----------------------|---------------|------|------|-------|------------|
| | | | Min. | Typ. | Max. | | |
| Viewing angle | Top | $CR \geq 10$ | - | 45 | - | Deg. | Note 2,6,7 |
| | Bottom | $CR \geq 10$ | - | 65 | - | | |
| | Left | $CR \geq 10$ | - | 65 | - | | |
| | Right | $CR \geq 10$ | - | 65 | - | | |
| Luminous | L | Viewing normal angle | --- | 460 | -- | Cd/m2 | |

With Capacitive touch panel

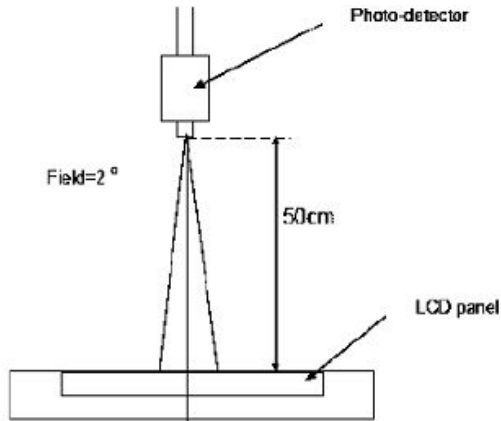
| Item | Symbol | Condition | Specification | | | Unit | Remark |
|---------------|--------|----------------------|---------------|------|------|-------|------------|
| | | | Min. | Typ. | Max. | | |
| Viewing angle | Top | $CR \geq 10$ | - | 40 | - | Deg. | Note 2,6,7 |
| | Bottom | $CR \geq 10$ | - | 60 | - | | |
| | Left | $CR \geq 10$ | - | 60 | - | | |
| | Right | $CR \geq 10$ | - | 60 | - | | |
| Luminous | L | Viewing normal angle | --- | 450 | -- | Cd/m2 | |

Test Conditions:

1. VCC=3.3V, VLED=5.0V. The ambient temperature is 25. °C
2. The test systems refer to Note 2.

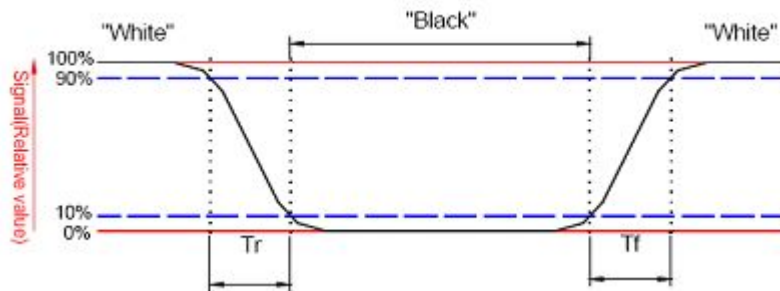
Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)



Note 2: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

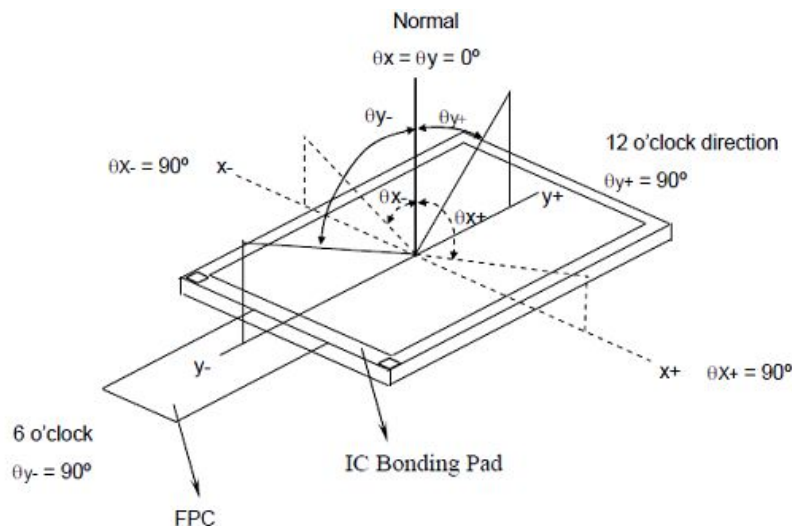


Note 3: Definition of contrast ratio:

Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

Note 4: Definition of viewing angle



9 Touch Panel specifications

| ITEM | VALUE | | | UNIT | REMARK |
|-----------------------|-----------|-----|--------|---------|---------------------------|
| | Min | Typ | Max | | |
| Linearity | - | - | 1.5 | % | Analog X and Y directions |
| Terminal Resistance | 400 | - | 1000 | Ω | x |
| | 150 | - | 400 | | y |
| Insulation Resistance | 20 | - | - | MΩ | DC 25V |
| Voltage | - | 3 | 10 | V | DC |
| Chattering | - | - | 10 | ms | 100kΩ pull-up |
| Transparency | 90 | - | - | % | - |
| Operation Force | 30 | - | 120 | g | - |
| Endurance | 1,000,000 | - | - | Touches | 100g Operation Force |
| | - | - | 30,000 | Slides | |
| Surface Hardness | 3 | - | - | H | - |

Capacitive Touch Panel specifications

Mechanical characteristics

| DESCRIPTION | INL SPECIFICATION | REMARK |
|------------------------|-------------------|--------------------|
| Touch Panel Size | 5.0 | |
| Outline Dimension (OD) | 140.7x93.83mm | Cover Lens Outline |
| Product Thickness | 1.6mm(max) | |
| Glass Thickness | 0.7mm | |
| Ink View Area | 109.04x65.55mm | |
| Sensor Active Area | 109.04x65.55mm | |
| Input Method | 5 Fingers | |
| Activation Force | Touch | |
| Surface Hardness | ≥6H | |

Electrical characteristics

| DESCRIPTION | | SPECIFICATION |
|--------------------------|-------------|------------------|
| Operating Voltage | | DC 2.8~3.3V |
| Power Consumption (IDD) | Active Mode | 12~4.5mA |
| | Sleep Mode | TBD |
| Interface | | I ² C |
| Controller IC | | FT5336 |
| I ² C address | | 0x70 |
| Resolution | | 800x480 |

Interface description

| PIN NO. | SYMBOL | DESCRIPTION | REMARK |
|---------|--------|---------------------------|--------|
| 1 | NC | Not Connected | |
| 2 | NC | Not Connected | |
| 3 | RST | Reset pin | |
| 4 | GND | Ground | |
| 5 | INT | Interrupt signal from CTP | |
| 6 | SDA | I2C data signal | |
| 7 | SCL | I2C clock input | |
| 8 | GND | Ground | |
| 9 | GND | Ground | |
| 10 | VCC | Power supply | |

Interface timing characteristics

| PARAMETER | MIN | MAX | UNIT |
|--|-----|------|------|
| SCL Frequency | - | 400K | Hz |
| Bus Free Time Between a STOP and START Condition | 4.7 | - | uS |
| Hold Time (repeated) START Condition | 4.0 | - | uS |
| Data Setup Time | 250 | - | nS |
| Setup Time for Repeated START Condition | 4.7 | - | uS |
| Setup Time for STOP Condition | 2.0 | - | uS |

10 RELIABILITY TEST

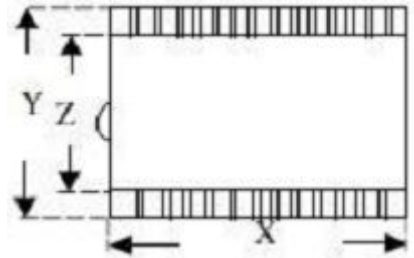
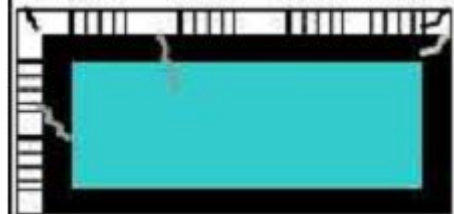
| NO. | TEST ITEM | TEST CONDITION | INSPECTION AFTER TEST |
|-----|----------------------------|---|--|
| 1 | High Temperature Storage | 80±2°C/96 hours | Inspection after 2~4 hours storage at room temperature and humidity. The condensation is not accepted. The sample shall be free from defects: 1. Air bubble in the LCD 2. Seal leak 3. Non-display 4. Missing segments 5. Glass crack |
| 2 | Low Temperature Storage | -30±2°C/96 hours | |
| 3 | High Temperature Operating | 70±2°C/96 hours | |
| 4 | Low Temperature Operating | -20±2°C/96 hours | |
| 5 | Temperature Cycle | -30±2°C ~ 25~ 80± 2°C × 10 cycles (30 min.) (5min.) (30min.) | |
| 6 | Damp Proof Test | 60°C ±5°C × 90%RH/96 hours | |
| 7 | Vibration Test | Frequency 10Hz~55Hz | |

| | | | |
|----|------------------------------|---|--|
| | | Stroke: 1.5mm Sweep: 10Hz~150 Hz~10Hz 2 hours For each direction of X, Y, Z | |
| 8 | Shock Test | Half-sine, wave, 300m/s | |
| 9 | Packing Drop Test | Height: 80 cm 1 corner, concrete floor | |
| 10 | Electrostatic Discharge Test | C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 30 times Contact: ±4KV,20 times | |

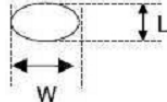
11 Inspection standards

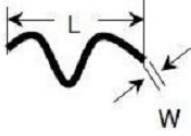
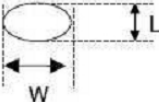
11.1 Visual inspection criterion in cosmetic

11.1.1 Glass defect

| NO. | Defect | Criteria | Remark |
|-----|------------------|--------------------------|--|
| 1 | Dimension(Minor) | By engineering diagram |  |
| 2 | Cracks(Major) | Extensive crack [Reject] |  |

11.1.2 LCM appearance defect

| NO. | Defect | Criteria | | Remark |
|-----|-------------------|---|-----------------|---|
| | | Spec | Permissible Qty | |
| 1 | Round type(Minor) | $\phi \leq 0.1\text{mm}$ | Disregard | 1. $\phi = (W+L)/2$, L:Length,W=Width 2.Disregard if out of A.A  |
| | | $0.1\text{mm} < \phi \leq 0.2\text{mm}$ | 3 | |
| | | $\phi > 0.2\text{mm}$ | 0 | |
| 2 | Line type(Minor) | $W \leq 0.03\text{mm}$ | Disregard | 1. L:Length,W=Width 2.Disregard if out of A.A |
| | | $L \leq 3.0\text{mm}$ and $0.03\text{mm} < W \leq 0.05\text{mm}$ | 2 | |

| | | | | |
|---|-----------------------|---|-----------|---|
| | | $L \leq 3.0\text{mm}$ and $0.05\text{mm} < W \leq 0.1\text{mm}$ | 1 |  |
| | | $W > 0.10\text{mm}$ or $L > 3.0\text{mm}$ | 0 | |
| 3 | Polarizer dent(Minor) | $\phi \leq 0.2\text{mm}$ | Disregard | 1. $\phi = (W+L)/2$, L:Length, W=Width 2. Disregard if out of A.A  |
| | | $0.2\text{mm} < \phi \leq 0.3\text{mm}$ | 2 | |
| | | $0.3\text{mm} < \phi \leq 0.5\text{mm}$ | 1 | |
| | | $\phi > 0.5\text{mm}$ | 0 | |

11.1.3 FPC

| NO. | Defect | Criteria | Remark |
|-----|-----------------------|-------------------------|--------|
| 1 | Copper peeling(Minor) | Copper peeling [Reject] | |
| 2 | Damaged | Damaged[Reject] | |

11.1.4 Black tape

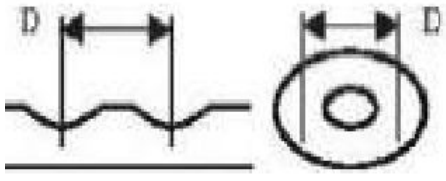
| NO. | Defect | Criteria | Remark |
|-----|----------------------|------------------------|--------|
| 1 | Shift(Minor) | IC exposed [Reject] | |
| 2 | No black tape(Minor) | No black tape [Reject] | |

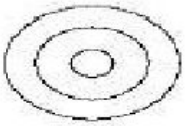

11.1.5 Silicon

| NO. | Defect | Criteria | Remark |
|-----|---------------------------|----------------------|--------|
| 1 | Amount of silicon (Minor) | ITO exposed [Reject] | |

11.1.6 Touch Panel

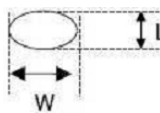
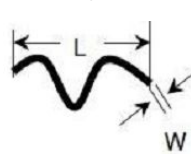
| Defect | Criteria | Remark |
|----------|--|--------|
| TP shift | Click on the TP, the distance between the show position and click position $> 1.5\text{mm}$ [Reject] | |

| | | | |
|---|--------------------|----------------|--|
| TP Circle, Dent Dot, Bubble MI | Size(mm) | Accessible QTY |  |
| | $D \leq 0.20$ | Access | |
| | $0.2 < D \leq 0.3$ | 2 | |
| | $0.3 < D \leq 0.5$ | 1 | |
| | $D > 0.5$ | 0 | |

| | | |
|---|--|--|
| TP Ripple MI | 1.(Figure A): Ripple $D > 5\text{mm}$ [Reject] 2.(Figure B): Ripple area $< 1/7$ TP area and not impact fonts display effect [Access] |  A  B |
| Remark: Tear up the protective film to inspect. The distance of two dirt must $> 10\text{mm}$; The white dot found in manufacture is conformity to 0.1mm , if $> 0.1\text{mm}$ [Reject] | | |

11.2 Visual inspection criterion in electrical display

| NO. | Defect | Criteria | | Remark |
|-----|------------------------|-------------|-----------------|--------|
| | | Spec. | Permissible Qty | |
| 1 | No display (Major) | Not allowed | | |
| 2 | Missing line (Major) | Not allowed | | |
| 3 | Darker or lighter Line | Not allowed | | |

| | | | | |
|---|--------------------------------|---|-----------|---|
| | (Major) | | | |
| 4 | Weak line(Major) | By limited sample | | |
| 5 | Bright / Dark point (Minor) | Bright point | 1 | 1:1sub-pixel: 1R or 1G or 1B 2:Point defect area 1/2 sub pixel. |
| | | Dark point | 2 | |
| 6 | Round type (Minor) | $\phi \leq 0.1\text{mm}$ | Disregard | 1. $\phi = (W+L)/2$, L:Length,W=Width 2.Disregard if out of A.A  |
| | | $0.1 < \phi \leq 0.2$ | 3 | |
| | | $\phi > 0.2\text{mm}$ | 0 | |
| 7 | Line type (Minor) | $W \leq 0.03\text{mm}$ | Disregard | 1. L:Length,W=Width 2.Disregard if out of A.A  |
| | | $L \leq 3.0\text{mm}$ and $0.03\text{mm} < W \leq 0.05\text{mm}$ | 2 | |
| | | $L \leq 3.0\text{mm}$ and $0.05\text{mm} < W \leq 0.1\text{mm}$ | 1 | |
| | | $W > 0.10\text{mm}$ or $L > 3.0\text{mm}$ | 0 | |
| 8 | Mura (Minor) | By 5% ND filter invisible | | |

11.3 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)

12 Suggestions for using LCD modules

12.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated, clean it with soft cloth. If the LCM is severely contaminated, use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer. The following solvents is especially prohibited: water , ketone Aromatic solvents etc.

5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
7. Don't disassemble the LCM.
8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD modules.
 - Tools required for assembling, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

12.2 Storage

1. Store in an ambient temperature of 5 to 45 °C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.