



RVT4.3A480272TFWC00

LCD TFT Datasheet

Rev.2.0.0
2017-05-25

| ITEM | CONTENTS | UNIT |
|--------------------------------|----------------------------------|-------------------|
| LCD Type | TFT/Transmissive/Normally white | / |
| Size | 4.3 | Inch |
| Viewing Direction | 12:00 (without image inversion) | O' Clock |
| Gray Scale Inversion Direction | 6:00 | O' Clock |
| LCM (W × H × D) | 106.30 x 68.00 x 5.20 | mm ³ |
| Active Area (W × H) | 95.04 × 53.86 | mm ² |
| Dot Pitch (W × H) | 0.066 × 0.198 | mm ² |
| Number Of Dots | 480 (RGB) × 272 | / |
| Driver IC | HX8257A + FT5306 | / |
| Backlight Type | 10 LEDs | / |
| Surface Luminance | 500 | cd/m ² |
| Interface Type | 24bit RGB | / |
| Color Depth | 16.7M | / |
| Pixel Arrangement | RGB Vertical Stripe | / |
| Surface Treatment | Anti-glare | |
| Input Voltage | 3.3 | V |
| With/Without TSP | Projected Capacitive Touch Panel | / |
| Weight | 78 | g |

Note 1: RoHS compliant

Note 2: LCM weight tolerance: ± 5%.

REVISION RECORD

| REVNO. | REVDATE | CONTENTS | REMARKS |
|--------|------------|---|---------|
| 1.0 | | Initial Release | |
| 1.1 | 2014-11-12 | | |
| 1.2 | 2014-12-04 | Add HVDSL pin information, add touch panel detailed information | |
| 1.3 | 2015-01-19 | Update product thickness, LED lifetime and add CTP interface description | |
| 1.4 | 2015-02-06 | Update dimensions information on mechanical drawing | |
| 1.5 | 2015-02-24 | Update Color Depth, Update TP Ink View Area dimensions | |
| 1.6 | 2015-04-16 | Update Interface Description | |
| 1.7 | 2015-05-21 | Update Mechanical drawing | |
| 1.8 | 2015-06-12 | Update Surface Treatment information | |
| 1.9 | 2016-02-02 | Update TP dimensions and total thickness | |
| 1.10 | 2016-08-12 | Added Inspection Standards | |
| 2.0.0 | 2017-05-25 | Glass change, new TFT open dimension, FFC shape, new IC controller and updated pinout | |

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1 MODULE CLASSIFICATION INFORMATION

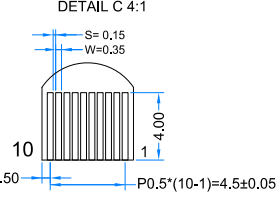
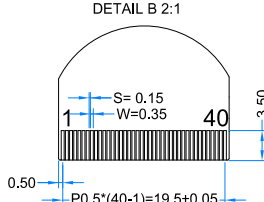
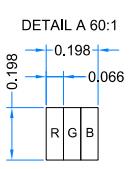
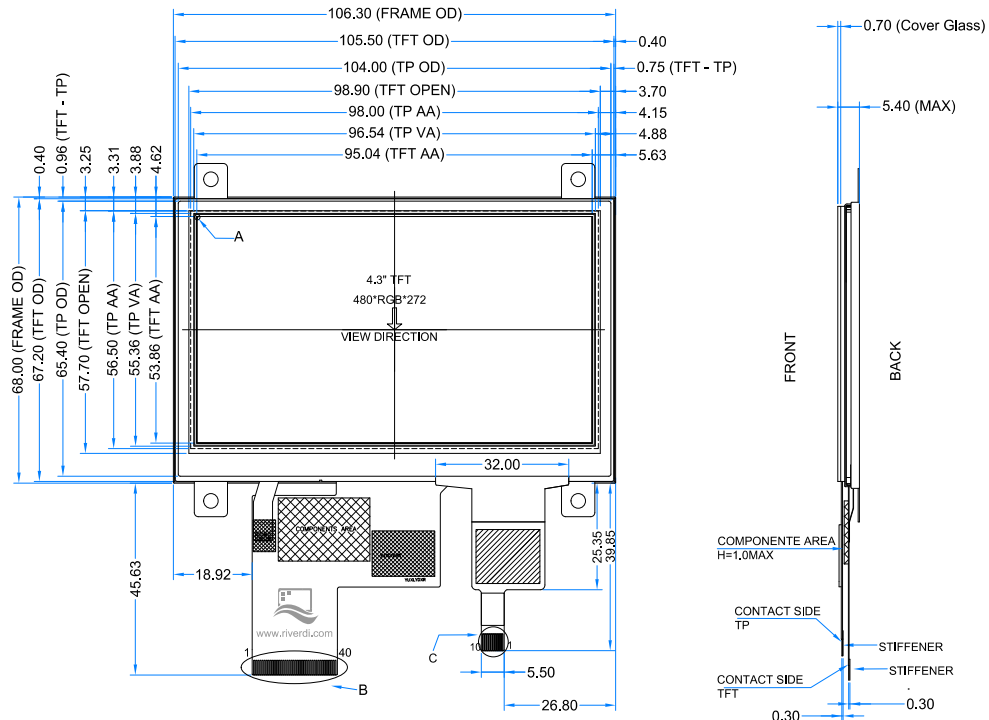
| | | | | | | | | | |
|-----------|----------|------------|----------|---------------|----------|----------|----------|----------|-----------|
| RV | T | 4.3 | A | 480272 | T | F | W | C | 00 |
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |

| | | |
|-----|-------------------------|---|
| 1. | BRAND | RV – Riverdi |
| 2. | PRODUCT TYPE | T – TFT Standard F – TFT Custom |
| 3. | DISPLAY SIZE | 3.5 – 3.5” 4.3 – 4.3” 5.7 – 5.7” 7.0 – 7.0” |
| 4. | MODEL SERIAL NO. | A (A-Z) |
| 5. | RESOLUTION | 320240 – 320x240 px 480272 – 480x272 px 800480 – 800x480 px |
| 6. | INTERFACE | T – TFT LCD, RGB L – TFT LCD, LVDS C – TFT + Controller |
| 7. | FRAME | N – No Frame F – Mounting Frame |
| 8. | BACKLIGHT TYPE | W – LED White |
| 9. | TOUCH PANEL | N – No Touch Panel R – Resistive Touch Panel C – Capacitive Touch Panel |
| 10. | VERSION | 00 (00-99) |

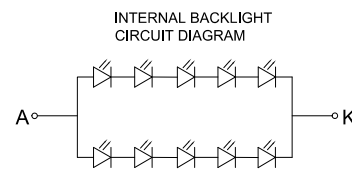
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RVT4.3A480272TFWC00

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



- NOTES:
1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
 2. RESOLUTION: 480x272
 3. VIEWING DIRECTION: 12 O'CLOCK
 4. TFT IC CONTROLLER: HX8257A
 5. TP IC CONTROLLER: FT5306
 6. OPERATING TEMP.: -20°C ~ 70°C
 7. STORAGE TEMP.: -30°C ~ 80°C
 8. LED BACKLIGHT: 10-LED WHITE
 9. SURFACE LUMINANCE: 500 cd/m²
 10. OPERATING VOLTAGE: 3.3V
 11. GENERAL TOLERANCE: ±0.2
 12. RoHS COMPLIANT



| | | |
|-------|--|------------|
| 2.0.0 | Glass change, new TFT open dimension, FFC shape. New IC controller and updated pinout. | 2017.05.26 |
| Ver. | DESCRIPTION | DATE |

| |
|---------------|
| CUSTOMER APVL |
| DRAWN |
| DFTG CHK |
| ENGR CHK |
| APPROVAL |
| RIVERDI SP. Z |

3 ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|--------------------------------|-----------------|---------|----------------|------|
| Supply Voltage For LCD Logic | VDD | -0.3 | 4.5 | V |
| Supply Voltage For CTP Logic | VDD-VSS | -0.3 | 3.6 | V |
| Input Voltage For Logic | VIN | VSS-0.5 | VDD | V |
| LED forward current (each LED) | IF | - | 25 | mA |
| Operating Temperature | T _{OP} | -20 | 70 | °C |
| Storage Temperature | T _{ST} | -30 | 80 | °C |
| Humidity | RH | - | 90% (Max 60°C) | RH |

4 ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT | NOTES |
|---------------------------|-----------------|--------|------|--------|------|------------|
| Supply Voltage For Module | VDD | 3.0 | 3.3 | 3.6 | V | |
| Input Current | IDD | - | 19.5 | TBD | mA | VDD = 3.3V |
| Input Voltage ' H ' level | V _{IH} | 0.7VDD | - | VDD | V | |
| Input Voltage ' L ' level | V _{IL} | VSS | - | 0.3VDD | V | |

Note 1: The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C.

5 BACKLIGHT CHARACTERISTICS

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT |
|---------------------------|----------------|-------|-------|------|------|
| Voltage for LED backlight | V _I | 15.0 | 16.0 | 17.0 | V |
| Current for LED backlight | I _I | - | 40 | 60 | mA |
| LED Life Time | - | 30000 | 50000 | - | Hrs |

Note: The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C.

6 ELECTRO-OPTICAL CHARACTERISTICS

| ITEM | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT | REMARK | NOTE |
|-------------------------|---------|-----------------------|-----|-------|-------|-------------------|----------|------|
| Response Time | Tr+Tf | θ=0° φ=0° Ta=25 | - | 20 | 30 | ms | Figure 1 | 4 |
| Contrast Ratio | Cr | | 320 | 400 | - | --- | Figure 2 | 1 |
| Luminance Uniformity | δ WHITE | | 80 | - | - | % | Figure 2 | 3 |
| Surface Luminance | Lv | | 440 | 550 | - | cd/m ² | Figure 2 | 2 |
| Viewing Angle Range | θ | φ = 90° | 35 | 50 | - | deg | Figure 3 | 6 |
| | | φ = 270° | 55 | 70 | - | deg | Figure 3 | |
| | | φ = 0° | 55 | 70 | - | Deg | Figure 3 | |
| | | φ = 180° | 55 | 70 | - | Deg | Figure 3 | |
| CIE (x, y) Chromaticity | Red | θ=0° φ=0° Ta=25 | x | 0.570 | 0.620 | 0.670 | Figure 2 | 5 |
| | | | y | 0.294 | 0.344 | 0.394 | | |
| | Green | | x | 0.256 | 0.306 | 0.356 | | |
| | | | y | 0.513 | 0.563 | 0.613 | | |
| | Blue | | x | 0.083 | 0.133 | 0.183 | | |
| | | | y | 0.099 | 0.149 | 0.199 | | |
| | White | | x | 0.250 | 0.300 | 0.350 | | |
| | | | y | 0.280 | 0.330 | 0.380 | | |

Note 1. Contrast Ratio(CR) is defined mathematically as below, for more information see Figure 1.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see Figure 2.

L_v = Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)

Note 3. The uniformity in surface luminance δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see Figure 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

Note 4. Response time is the time required for the display to transition from white to black (Rise Time, T_r) and from black to white (Decay Time, T_f). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope series.

Note 5. CIE (x, y) chromaticity, the x, y value is determined by measuring luminance at each test position 1 through 5, and then make average value.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see Figure 3.

Note 7. For viewing angle and response time testing, the testing data is based on Autronic-Melchers's ConoScope series. Instruments for Contrast Ratio, Surface Luminance, Luminance Uniformity, CIE the test data is based on TOPCON's BM-5 photo detector.

Figure 1. The definition of response time

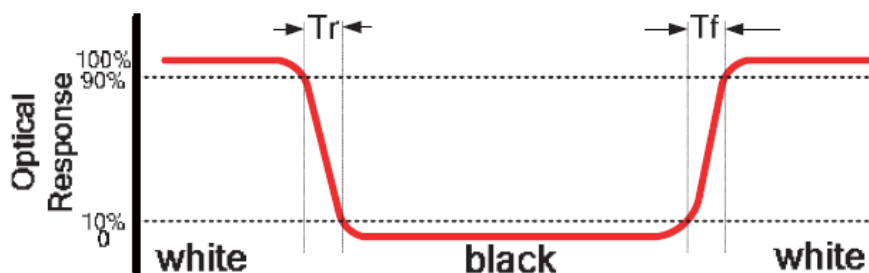


Figure 2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

A : 5 mm
 B : 5 mm
 H, V : Active Area
 Light spot size $\varnothing=5\text{mm}$, 500mm distance from the LCD surface to detector lens
 measurement instrument is TOPCON's luminance meter BM-5

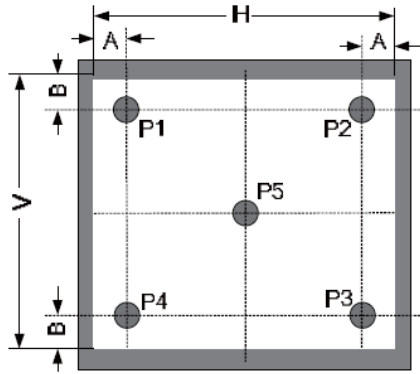
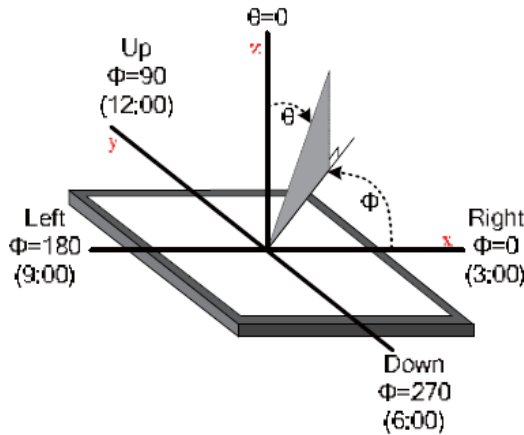


Figure 3. The definition of viewing angle



7 INTERFACE DESCRIPTION

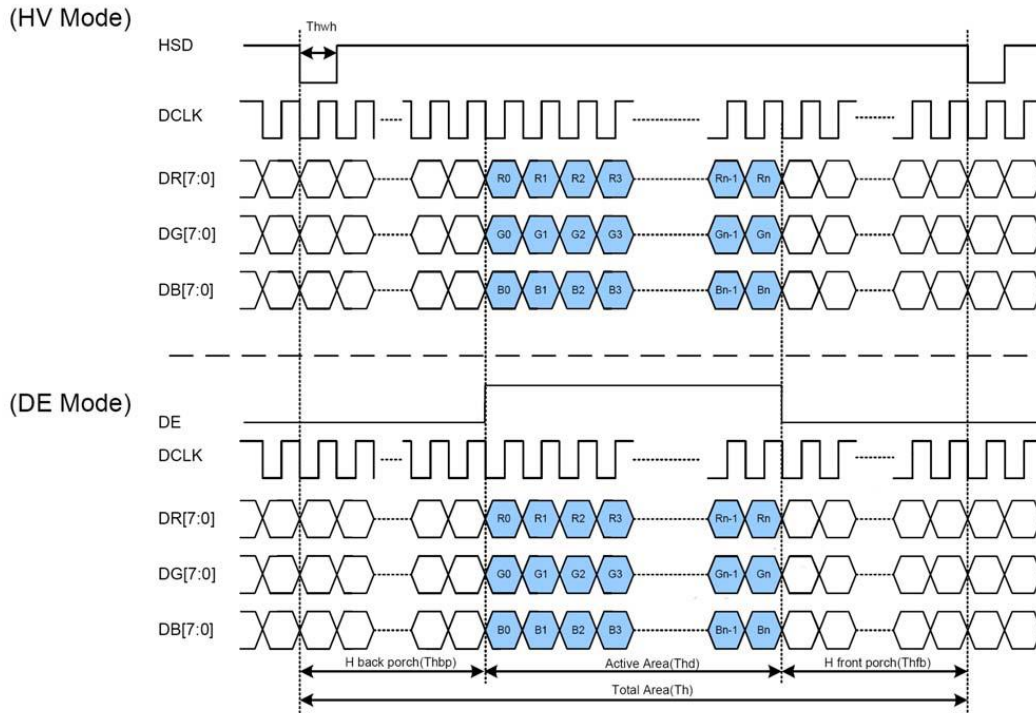
| PIN NO. | SYMBOL | DESCRIPTION | NOTE |
|---------|--------|-----------------------------|------|
| 1 | VLED- | Cathode Of LED Backlight | |
| 2 | VLED+ | Anode Of LED Backlight | |
| 3 | GND | Power Ground | |
| 4 | VDD | Power Voltage | |
| 5-12 | R0-R7 | Red Data (R0-LSB, R7-MSB) | |
| 13-20 | G0-G7 | Green Data (G0-LSB, G7-MSB) | |
| 21-28 | B0-B7 | Blue Data (B0-LSB, B7-MSB) | |
| 29 | GND | Power Ground | |
| 30 | DCLK | Pixel Clock | |
| 31 | DISP | Display On/Off | |
| 32 | HSYNC | Horizontal Sync Signal | |
| 33 | VSNC | Vertical Sync Signal | |
| 34 | DE | Data Enable | |
| 35 | NC | No Connect | |
| 36 | GND | Power Ground | |
| 37 | NC | No Connect | |
| 38 | NC | No Connect | |
| 39 | NC | No Connect | |
| 40 | NC | No Connect | |

Note 1: Displays marked with „rev.2.0” printing, have the ability to select the operating mode: HV mode or DE mode. HVDSL=“H”: Set under HV mode, VSD and HSD signal have to provide by system. HVDSL=“L”: Set under DE mode, DE signal have to provide by system. By default: Internal pulled weak low.

8 LCD TIMING CHARACTERISTICS

8.1 Clock and data input time diagram

Figure 4. Clock and data input time diagram



8.2 Parallel RGB input timing table

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|------------------|-----------|-----|-----|-----|------|
| DCLK Frequency | Fclk | 5 | 9 | 12 | MHz |
| VSD Period Time | T_v | 277 | 288 | 400 | H |
| VSD Display Area | T_{vd} | | 272 | | H |
| VSD Back Porch | T_{vb} | 3 | 8 | 31 | H |
| VSD Front Porch | T_{vfp} | 2 | 8 | 97 | H |
| HSD Period Time | T_h | 520 | 525 | 800 | DCLK |
| HSD Display Area | T_{hd} | | 480 | | DCLK |
| HSD Back Porch | T_{hbp} | 36 | 40 | 255 | DCLK |
| HSD Front Porch | T_{hfp} | 4 | 5 | 65 | DCLK |

9 CAPACITIVE TOUCH SCREEN PANEL SPECIFICATIONS

9.1 Mechanical characteristics

| DESCRIPTION | INL SPECIFICATION | REMARK |
|------------------------|-------------------|--------------------|
| Touch Panel Size | 4.3 inch | |
| Outline Dimension (OD) | 104.0mm x 65.4mm | Cover Lens Outline |
| Product Thickness | 1.7mm | |
| Glass Thickness | 0.7mm | |
| Ink View Area | 96.54mm x 55.36mm | |
| Sensor Active Area | 98.0mm x 56.5mm | |
| Input Method | 5 Finger | |
| Activation Force | Touch | |
| Surface Hardness | ≥7H | |

9.2 Electrical characteristics

| DESCRIPTION | SPECIFICATION | |
|-------------------------|----------------------|---------|
| Operating Voltage | DC 2.8~3.3V | |
| Power Consumption (IDD) | Active Mode | 10~18mA |
| | Sleep Mode | 30~50μA |
| Interface | I ² C | |
| Linearity | <1.5% | |
| Controller | FT5306 | |
| I2C address | 0x38 (7 bit address) | |
| Resolution | 1280*768 | |

9.3 Interface description

| PIN NO. | SYMBOL | DESCRIPTION | REMARK |
|---------|--------|---------------------------|--------|
| 1 | VSS | Power Ground | |
| 2 | VDD | Power For CTP | |
| 3 | SCL | I2C SCL | |
| 4 | NC | - | |
| 5 | SDA | I2C SDA | |
| 6 | NC | - | |
| 7 | /RST | Reset pin | |
| 8 | /WAKE | Wake signal from host | |
| 9 | /INT | Interrupt signal from CTP | |
| 10 | VSS | Power Ground | |

9.4 Interface timing characteristics

| PARAMETER | MIN | MAX | UNIT |
|--|-----|-----|------|
| SCL Frequency | 0 | 400 | kHz |
| Bus Free Time Between a STOP and START Condition | 4.7 | / | µs |
| Hold Time (repeated) START Condition | 4.0 | / | µs |
| Data Setup Time | 250 | / | ns |
| Setup Time for Repeated START Condition | 4.7 | / | µs |
| Setup Time for STOP Condition | 4.0 | / | µs |

9.5 I2C Read/Write Interface Description

Figure 5. Write N bytes to I2C slave

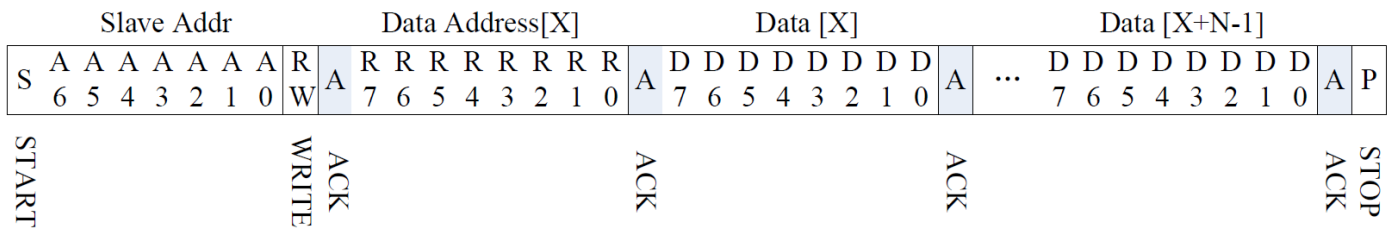


Figure 6. Set Data Address

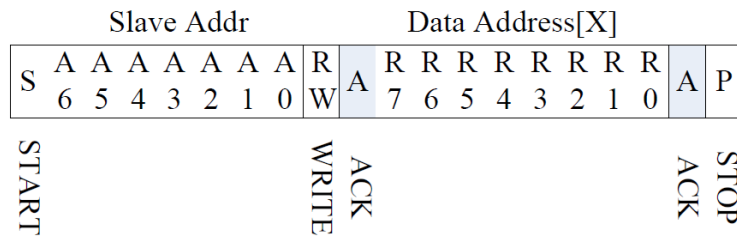
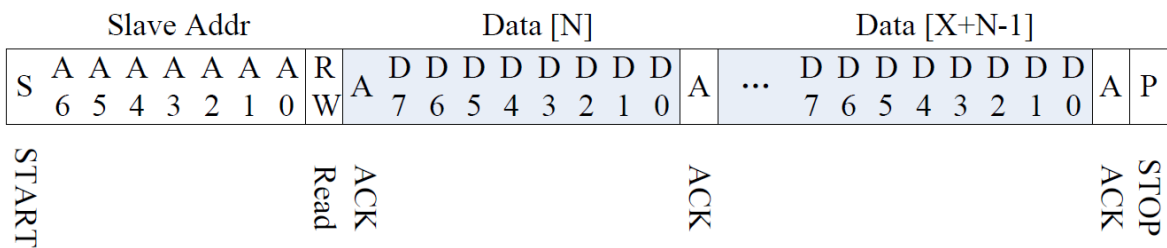
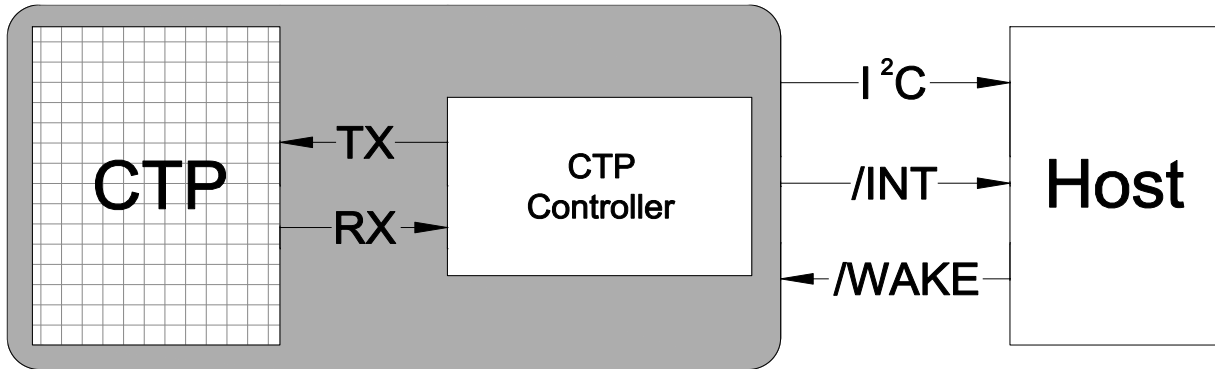


Figure 7. Read X bytes from I2C Slave



9.6 Communication of the I²C interface with Host

Figure 8. Communication of the I2C interface with Host



9.7 Touch data read protocol

| ADDRESS | NAME | BIT 7 | BIT 6 | BIT 5 | BIT 4 | BIT 3 | BIT 2 | BIT 1 | BIT 0 | HOST ACCESS | |
|---------|-------------|---------------------------------------|-------|-------|--|--|-------|-------|-------|-------------|----|
| 00h | DEVIDE_MODE | Device Mode[2:0] | | | | | | | | | RW |
| 01h | GEST_ID | Gesture ID[7:0] | | | | | | | | | R |
| 02h | TD_STATUS | | | | | Number of touch points[3:0] | | | | | R |
| 03h | TOUCH1_XH | 1 st Event Flag | | | 1 st Touch X Position[11:8] | | | | | | R |
| 04h | TOUCH1_XL | 1 st Touch X Position[7:0] | | | | | | | | | R |
| 05h | TOUCH1_YH | 1 st Touch ID[3:0] | | | | 1 st Touch X Position[11:8] | | | | | R |
| 06h | TOUCH1_YL | 1 st Touch Y Position[7:0] | | | | | | | | | R |
| 07h | | | | | | | | | | | R |
| 08h | | | | | | | | | | | R |
| 09h | TOUCH2_XH | 2 nd Event Flag | | | 2 nd Touch X Position[11:8] | | | | | | R |
| 0Ah | TOUCH2_XL | 2 nd Touch X Position[7:0] | | | | | | | | | R |
| 0Bh | TOUCH2_YH | 2 nd Touch ID[3:0] | | | | 2 nd Touch X Position[11:8] | | | | | R |
| 0Ch | TOUCH2_YL | 2 nd Touch Y Position[7:0] | | | | | | | | | R |
| 0Dh | | | | | | | | | | | R |
| 0Eh | | | | | | | | | | | R |
| 0Fh | TOUCH3_XH | 3 rd Event Flag | | | 3 rd Touch X Position[11:8] | | | | | | R |
| 10h | TOUCH3_XL | 3 rd Touch X Position[7:0] | | | | | | | | | R |
| 11h | TOUCH3_YH | 3 rd Touch ID[3:0] | | | | 3 rd Touch X Position[11:8] | | | | | R |
| 12h | TOUCH3_YL | 3 rd Touch Y Position[7:0] | | | | | | | | | R |
| 13h | | | | | | | | | | | R |
| 14h | | | | | | | | | | | R |
| 15h | TOUCH4_XH | 4 th Event Flag | | | 4 th Touch X Position[11:8] | | | | | | R |
| 16h | TOUCH4_XL | 4 th Touch X Position[7:0] | | | | | | | | | R |
| 17h | TOUCH4_YH | 4 th Touch ID[3:0] | | | | 4 th Touch X Position[11:8] | | | | | R |
| 18h | TOUCH4_YL | 4 th Touch Y Position[7:0] | | | | | | | | | R |
| 19h | | | | | | | | | | | R |
| 1Ah | | | | | | | | | | | R |
| 1Bh | TOUCH5_XH | 5 th Event Flag | | | 5 th Touch X Position[11:8] | | | | | | R |
| 1Ch | TOUCH5_XL | 5 th Touch X Position[7:0] | | | | | | | | | R |
| 1Dh | TOUCH5_YH | 5 th Touch ID[3:0] | | | | 5 th Touch X Position[11:8] | | | | | R |
| 1Eh | TOUCH5_YL | 5 th Touch Y Position[7:0] | | | | | | | | | R |

9.8 Data description.

DEVICE_MODE

This register is the device mode register, configure it to determine the current mode of the chip.

| ADDRESS | BIT ADDRESS | REGISTER NAME | DESCRIPTION |
|---------|-------------|-------------------|---|
| 00h | 6:4 | Device Mode [2:0] | 000b Work Mode 100b Factory Mode – Read Raw Data |

GEST_ID

This register describes the gesture of a valid touch.

| ADDRESS | BIT ADDRESS | REGISTER NAME | DESCRIPTION |
|---------|-------------|------------------|---|
| 01h | 7:0 | Gesture ID [7:0] | Gesture ID 0x10 Move Up 0x14 Move Down 0x18 Move Right 0x48 Zoom In 0x49 Zoom Out 0x00 No Gesture |

TD_STATUS

This register is the Touch Data status register.

| ADDRESS | BIT ADDRESS | REGISTER NAME | DESCRIPTION |
|---------|-------------|------------------------------|--|
| 02h | 3:0 | Number of Touch Points [2:0] | How Many Points Detected 1-5 is Valid |
| | 7:4 | | |

TOUCHn_XH(n:1-10)

This register describes MSB of the X coordinate of the nth touch point and the corresponding event flag.

| ADDRESS | BIT ADDRESS | REGISTER NAME | DESCRIPTION |
|-----------------|-------------|-------------------------|---|
| 03h ~ 39h | 7:6 | Event Flag | 00b: Put Down 01b: Put Up 10b: Contact 11b: Reserved |
| | 5:4 | | Reserved |
| | 3:0 | Touch X Position [11:8] | MSB of Touch X Position in Pixels |

TOUCHn_XL(n:1-10)

This register describes LSB of the X coordinate of the nth touch point.

| ADDRESS | BIT ADDRESS | REGISTER NAME | DESCRIPTION |
|-----------------|-------------|------------------------|---------------------------------------|
| 04h ~ 3Ah | 7:0 | Touch X Position [7:0] | LSB of the Touch X Position in Pixels |

TOUCHn_YH(n:1-10)

This register describes MSB of the Y coordinate of the nth touch point and corresponding touch ID.

| ADDRESS | BIT ADDRESS | REGISTER NAME | DESCRIPTION |
|---------|-------------|-------------------------|-----------------------------------|
| 05h | 7:4 | Touch ID[3:0] | Touch ID of Touch Point |
| ~ | 3:0 | Touch X Position [11:8] | MSB of Touch Y Position in Pixels |
| 3Bh | | | |

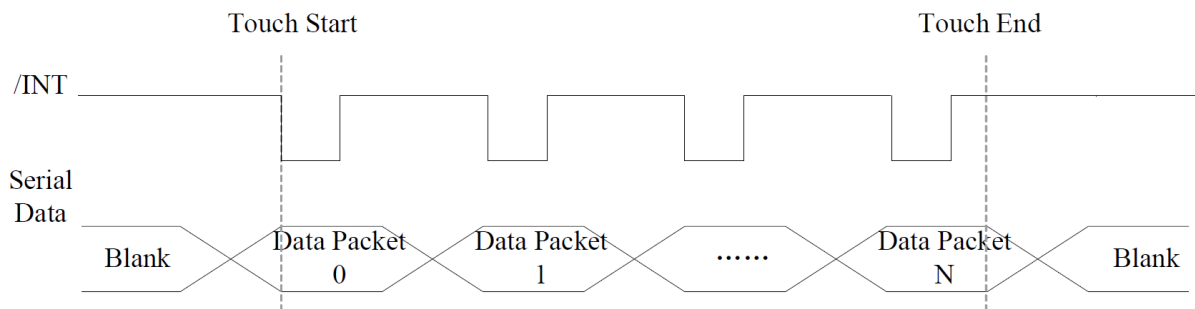
TOUCHn_YL(n:1-10)

This register describes LSB of the Y coordinate of the nth touch point.

| ADDRESS | BIT ADDRESS | REGISTER NAME | DESCRIPTION |
|---------|-------------|------------------------|---------------------------------------|
| 05h | 7:0 | Touch X Position [7:0] | LSB of the Touch Y Position in Pixels |
| ~ | | | |
| 3Bh | | | |

9.9 Interrupt Trigger Mode

Figure 9. Interrupt trigger mode timing



10 INSPECTION

Standard acceptance/rejection criteria for TFT module.

10.1 Inspection condition

Ambient conditions:

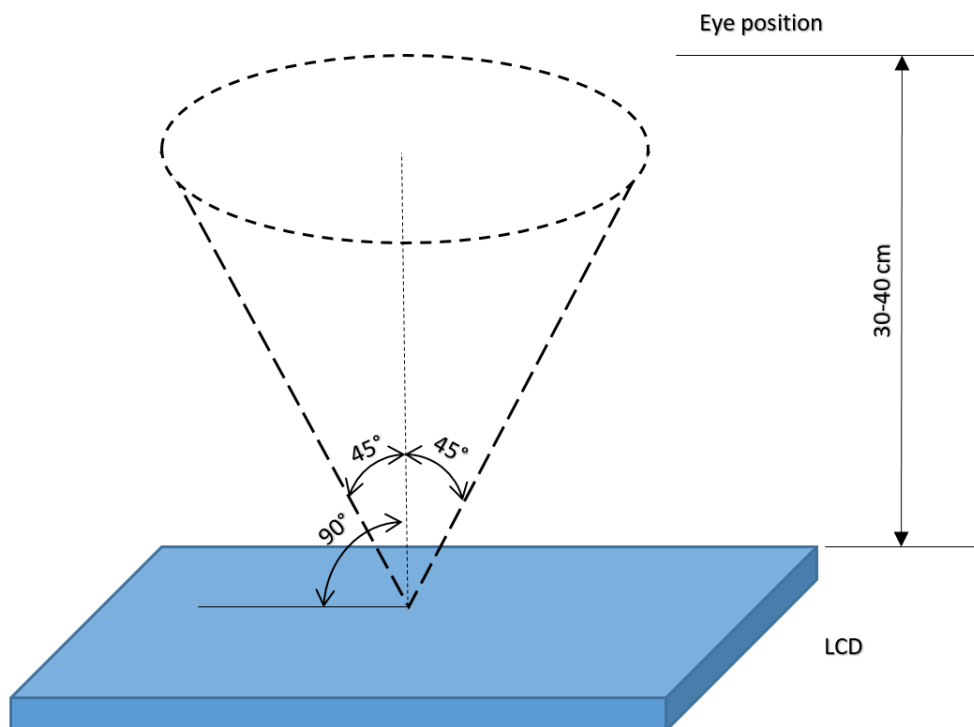
- Temperature: $25\pm^{\circ}\text{C}$
- Humidity: $(60\pm 10)\%RH$
- Illumination: Single fluorescent lamp non-directive (300 to 700 lux)

Viewing distance:

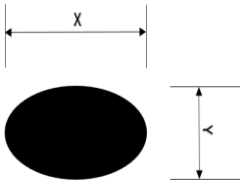
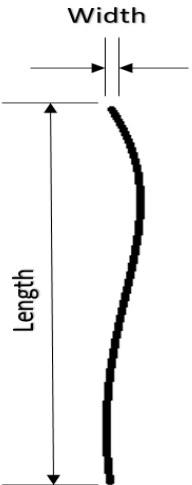
$35\pm 5\text{cm}$ between inspector bare eye and LCD.

Viewing Angle:

U/D: $45^{\circ}/45^{\circ}$, L/R $45^{\circ}/45^{\circ}$



10.2 Inspection standard

| Item | Criterion | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---------------|--|------------------|---------------|------------|---------------|---------------------|----------|---------------------|---------|-----------------|---|---------|-----------------|---|----------|---|------------|--|--|--------|-------|---------------|---|----------|---------|---------|-----------------|---|---------|-----------------|---|----------|---|
| <p>Black spots, white spots, light leakage, Foreign Particle (round Type)</p> | <div style="display: flex; align-items: center; justify-content: center;">  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="2" style="background-color: #cccccc;">Size < 5"</th> </tr> <tr> <th>Average Diameter</th> <th>Qualified Qty</th> </tr> </thead> <tbody> <tr> <td>D < 0.2 mm</td> <td>Ignored</td> </tr> <tr> <td>0.2 mm < D < 0.3 mm</td> <td>3</td> </tr> <tr> <td>0.3 mm < D < 0.5 mm</td> <td>2</td> </tr> <tr> <td>0.5 mm < D</td> <td>0</td> </tr> </tbody> </table> </div> <div style="text-align: center; margin: 10px 0;"> $D = \frac{(x + y)}{2}$ </div> <p>*Spots density: 10 mm²</p> | Size < 5" | | Average Diameter | Qualified Qty | D < 0.2 mm | Ignored | 0.2 mm < D < 0.3 mm | 3 | 0.3 mm < D < 0.5 mm | 2 | 0.5 mm < D | 0 | | | | | | | | | | | | | | | | | | | | | | |
| Size < 5" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Average Diameter | Qualified Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D < 0.2 mm | Ignored | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.2 mm < D < 0.3 mm | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.3 mm < D < 0.5 mm | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.5 mm < D | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>LCD black spots, white spots, light leakage (line Type)</p> | <div style="display: flex; align-items: center; justify-content: center;">  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="3" style="background-color: #cccccc;">Size < 5"</th> </tr> <tr> <th>Length</th> <th>Width</th> <th>Qualified Qty</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>W < 0.02</td> <td>Ignored</td> </tr> <tr> <td>L < 3.0</td> <td>0.02 < W < 0.05</td> <td rowspan="2">2</td> </tr> <tr> <td>L < 2.5</td> <td>0.05 < W < 0.08</td> </tr> <tr> <td>-</td> <td>0.08 < W</td> <td>0</td> </tr> </tbody> </table> </div> <div style="text-align: center; margin: 10px 0;"> <table border="1" style="background-color: #cccccc;"> <thead> <tr> <th colspan="3" style="background-color: #cccccc;">Size >= 5"</th> </tr> <tr> <th>Length</th> <th>Width</th> <th>Qualified Qty</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>W < 0.02</td> <td>Ignored</td> </tr> <tr> <td>L < 3.0</td> <td>0.02 < W < 0.05</td> <td rowspan="2">4</td> </tr> <tr> <td>L < 2.5</td> <td>0.05 < W < 0.08</td> </tr> <tr> <td>-</td> <td>0.08 < W</td> <td>0</td> </tr> </tbody> </table> </div> <p>*Spots density: 10 mm²</p> | Size < 5" | | | Length | Width | Qualified Qty | - | W < 0.02 | Ignored | L < 3.0 | 0.02 < W < 0.05 | 2 | L < 2.5 | 0.05 < W < 0.08 | - | 0.08 < W | 0 | Size >= 5" | | | Length | Width | Qualified Qty | - | W < 0.02 | Ignored | L < 3.0 | 0.02 < W < 0.05 | 4 | L < 2.5 | 0.05 < W < 0.08 | - | 0.08 < W | 0 |
| Size < 5" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Length | Width | Qualified Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | W < 0.02 | Ignored | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| L < 3.0 | 0.02 < W < 0.05 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| L < 2.5 | 0.05 < W < 0.08 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | 0.08 < W | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Size >= 5" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Length | Width | Qualified Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | W < 0.02 | Ignored | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| L < 3.0 | 0.02 < W < 0.05 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| L < 2.5 | 0.05 < W < 0.08 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | 0.08 < W | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Item | Criterion | |
|-----------------------------------|----------------------------------|---------------|
| Clear spots | Size < 5" | |
| | Average Diameter | Qualified Qty |
| | D < 0.2 mm | Ignored |
| | 0.2 mm < D < 0.3 mm | 3 |
| | 0.3 mm < D < 0.5 mm | 2 |
| | 0.5 mm < D | 0 |
| | Size >= 5" | |
| | Average Diameter | Qualified Qty |
| | D<0.2 mm | Ignored |
| | 0.2 mm < D < 0.3 mm | 4 |
| | 0.3 mm < D < 0.5 mm | 2 |
| | 0.5 mm < D | 0 |
| | *Spots density: 10 mm | |
| | Polarizer bubbles | Size < 5" |
| Average Diameter | | Qualified Qty |
| D < 0.2 mm | | Ignored |
| 0.2 mm < D < 0.5 mm | | 3 |
| 0.5 mm < D < 1 mm | | 2 |
| 1 mm < D | | 0 |
| Total Q'ty | | 3 |
| Size >= 5" | | |
| Average Diameter | | Qualified Qty |
| D<0.25 mm | | Ignored |
| 0.25 mm < D < 0.5 mm | | 3 |
| 0.5 mm < D | | 0 |
| Electrical Dot Defect | | Size < 5" |
| | | item |
| | Black do defect | 4 |
| | Bright dot defect | 2 |
| | Total Dot | 5 |
| | Size >= 5" | |
| | item | Qualified Qty |
| | Black do defect | 5 |
| | Bright dot defect | 2 |
| | Total Dot | 5 |

| Item | Criterion | | |
|--------------------------------|-----------------------------------|----------------|---------------|
| Touch panel spot | Size < 5" | | |
| | Average Diameter | Qualified Qty | |
| | D < 0.2 mm | Ignored | |
| | 0.2 mm < D < 0.4 mm | 5 | |
| | 0.4 mm < D < 0.5 mm | 2 | |
| | 0.5 mm < D | 0 | |
| | Size >= 5" | | |
| | Average Diameter | Qualified Qty | |
| | D<0.25 mm | Ignored | |
| | 0.25 mm < D < 0.5 mm | 4 | |
| 0.5 mm < D | 0 | | |
| Touch panel White line Scratch | Size < 5" | | |
| | Length | Width | Qualified Qty |
| | - | W< 0.02 | Ignored |
| | L < 3.0 | 0.02 < W <0.05 | 2 |
| | L < 2.5 | 0.05 < W <0.08 | |
| | - | 0.08 < W | 0 |
| | Size >= 5" | | |
| | Length | Width | Qualified Qty |
| | - | W< 0.03 | Ignored |
| | L < 5.0 | 0.03 < W <0.05 | 2 |
| - | 0.05 < W | 0 | |

11 RELIABILITY TEST

| NO. | TEST ITEM | TEST CONDITION |
|-----|----------------------------|---|
| 1 | High Temperature Storage | 80±2°C/240hours |
| 2 | Low Temperature Storage | -30±2°C/240hours |
| 3 | High Temperature Operating | 70±2°C/240hours |
| 4 | Low Temperature Operating | -20±2°C/240hours |
| 5 | Temperature Cycle | -30±2°C~25~80±2°C × 20 cycles (30min.) (5min.) (30min.) |
| 6 | Damp Proof Test | 60°C ±5°C × 90%RH/240hours |
| 7 | Vibration Test | Frequency 10Hz~55Hz Amplitude of vibration : 1.5mm Sweep: 10Hz~55Hz~10Hz X, Y, Z 2 hours for each direction. |
| 8 | Package Drop Test | Height:60 cm 1 corner,3 edges,6 surfaces |
| 9 | ESD Test | Air: ±4KV 150pF/330Ω 5 times Contact: ±2KV 150pF/330Ω 5 time |

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