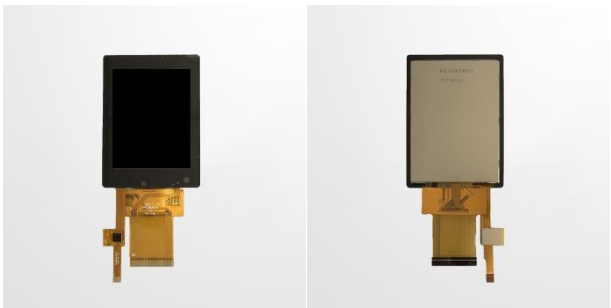
Densitron

# DMT028QVHXCMI-1A
# PRODUCT SPECIFICATION

Version 1.0
May 25, 2022



| *Customer's Approval* | |
|---|---|
| *Signature* | *Date* |
| | |

*Prepared by Victoria Ho*
*Approved by Eric Wan*

# Revision History

| VERSION | DATE | DESCRIPTION | AUTHOR |
|---|---|---|---|
| A | May 03, 2019 | Preliminary | Filip Kaczorowski |
| 1.0 | May 25, 2022 | 1) Add Cover Photo – p.1<br>2) Changed CTP driver IC – p.6 (from FT6326 to FT6336U)<br>3) Update Pin Define – p.11<br>4) Add Packaging – p.29 | Victoria Ho |
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# Legal Notice

Densitron

# Table of Contents



# 1. General Description

## 1.1 Main Features

| Item | Contents |
|---|---|
| Screen Size | 2.8” Diagonal |
| Display Format | 240 x RGB x 320 Dots |
| N° of Colour | 65K/262K |
| Active Area | 43.20 mm (V) x 57.60 mm (H) |
| LCD Type | IPS TFT |
| Mode | Transmissive / Normally Black |
| Viewing Direction | All Round |
| TFT Interface | 8/9/16/18 bit 8080 MCU 3/4-wire SPI<br>3/4-wire SPI+16/18-bit RGB |
| TFT Driver IC | ST7789V |
| Backlight Type | LED White, 6 chips |
| Operating Temperature | -20°C ~ +70°C |
| Storage Temperature | -30°C ~ +80°C |
| RoHS compliant | Compliant to RoHS 2.0 |

## 1.2 Touch Features

| Item | Contents |
|---|---|
| Touch Panel | CTP |
| Resolution | 240 x RGB x 320 Dots |
| Touch Interface | $I^2C$ |
| Bonding Type | 43.20 mm (V) x 57.60 mm (H) |
| CTP Driver IC | FT6336U |
| Touch mode | Single point and Gestures |

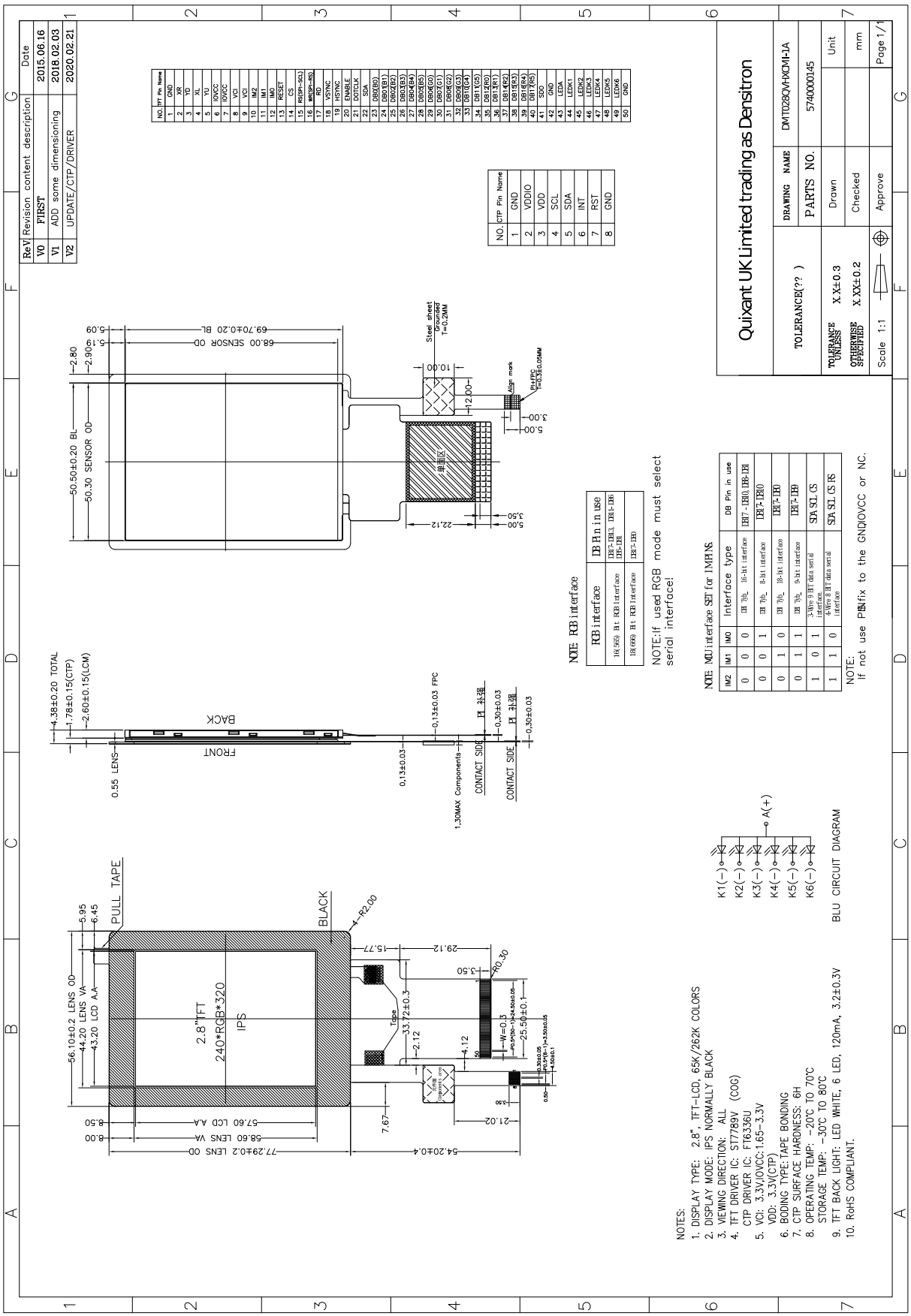
# 2. Mechanical Specification

## 2.1 Mechanical Characteristics

| Item | Characteristic | Unit |
|---|---|---|
| Overall Dimensions | 56.10 mm (H) x 77.29 mm (V) x 4.38 mm (D) | mm |
| Pixel Pitch | 0.180 (H) x 0.180 (V) | µm |
| Weight | 30 | g |

## 2.2 Mechanical Drawing



# 3. Electrical Specification

## 3.1 Absolute Maximum Ratings

| Item | Symbol | Condition | Min | Max | Unit | Note |
|---|---|---|---|---|---|---|
| Power Supply Voltage LCM | VCI | | -0.3 | 4.6 | V | |
| Digital Interface Supply Voltage | IOVCC | | -0.3 | 4.6 | V | |
| Operating Temperature | TOP | | -20 | 70 | °C | 1 |
| Storage Temperature | TST | | -30 | 80 | °C | 1,2,3 |

**Note 1.** 90 % RH Max for Ta<50 °C, and 60% RH for Ta≥50°C.
**Note 2.** In case of below 0°C, the response time of liquid crystal (LC) becomes slower and the colour of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's characteristic.
**Note 3.** Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

## 3.2 Electrical Characteristics

| Item | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| Supply Voltage | VCI | Ta=25˚C | 2.4 | 2.8 | 3.3 | V | |
| Digital Interface Supply Voltage | IOVCC | Ta=25˚C | 1.65 | 1.8 | 3.3 | | |
| Input Voltage for Logic | VIH | | 0.7IOVCC | - | IOVCC | V | |
| | GND | | GND | - | 0.3 IOVCC | V | |
| Output Voltage for Logic | VOH | | 0.8IOVCC | - | IOVCC | V | |
| | VOL | | GND | - | 0.2IOVCC | V | |
| Current Consumption | IDD | | - | 6.8 | - | mA | 1 |

**Note 1:** The specified power consumption is under the conditions of VDD=3.3V.

## 3.3 Interface Pin Assignment

### 3.3.1 TFT Pin define

| No. | Symbol | Function |
|---|---|---|
| 1 | GND | Ground. |
| 2 | XR(NC) | Touch panel Right Glass Terminal |
| 3 | YD(NC) | Touch panel Bottom Film Terminal |
| 4 | XL(NC) | Touch panel Left Glass Terminal |
| 5 | YU(NC) | Touch panel Top Film Terminal |
| 6 | IOVCC | Supply voltage for IO (1.8-3.3V). |
| 7 | IOVCC | Supply voltage for IO (1.8-3.3V). |
| 8 | VCI | Supply voltage (3.3V). |
| 9 | VCI | Supply voltage (3.3V). |
| 10 | IM2 | MPU Parallel interface bus and serial interface select If use RGB Interface must select serial interface. Fix this pin at IOVCC and GND. |
| 11 | IM1 | Line synchronizing signal for RGB Interface mode. If not used, please connect to GND or IOVCC. |
| 12 | IM0 | Pixel clock signal for RGB Interface mode. If not used, please connect to GND or IOVCC. |
| 13 | RESET | This signal will reset the device and must be applied to properly initialize the chip. |
| 14 | CS | Chip select input pin (“Low” enable). Fix this pin at IOVCC or GND when not in use. |
| 15 | RS(SPI-SCL) | This pin is used to select “Data or Command” in the parallel interface. When D/CX = ‘1‘, data is selected. When D/CX = ‘0‘, command is selected. This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface. Fix this pin at IOVCC or GND when not in use. |
| 16 | WR(SPI-RS) | The data is applied on the rising edge of the SCL signal. Fix this pin at IOVCC or GND when not in use. |
| 17 | RD | Serves as a read signal and MCU read data at the rising edge. Fix this pin at IOVCC or GND when not in use |
| 18 | VSYNC | Frame synchronizing signal for RGB interface operation. Fix this pin at IOVCC or GND when not in use. |
| 19 | HSYNC | Line synchronizing signal for RGB interface operation. Fix this pin at IOVCC or GND when not in use. |
| 20 | ENABLE | Data enable signal for RGB interface operation. Fix this pin at IOVCC or GND when not in use. |

| No. | Symbol | Function |
|---|---|---|
| 21 | DOTCLK | Dot clock signal for RGB interface operation. Fix this pin at IOVCC or GND when not in use. |
| 22 | SDA | Serial input signal. The data is applied on the rising edge of the SCL signal.<br>If not used, fix this pin at IOVCC or GND. |
| 23-40 | DB0-DB7 | Data bus.<br>If not used pin, fix this pin to GND. |
| 41 | SDO | SPI interface output pin.<br>-The data is output on the falling edge of the SCL signal.<br>-If not used, let this pin open. |
| 42 | GND | Ground. |
| 43 | LEDA | Anode pin of backlight |
| 44 | LEDK1 | Cathode pin of backlight |
| 45 | LEDK2 | Cathode pin of backlight |
| 46 | LEDK3 | Cathode pin of backlight |
| 47 | LEDK4 | Cathode pin of backlight |
| 48 | LEDK5 | Cathode pin of backlight |
| 49 | LEDK6 | Cathode pin of backlight |
| 50 | GND | Ground. |

### 3.3.2 CTP Pin Define

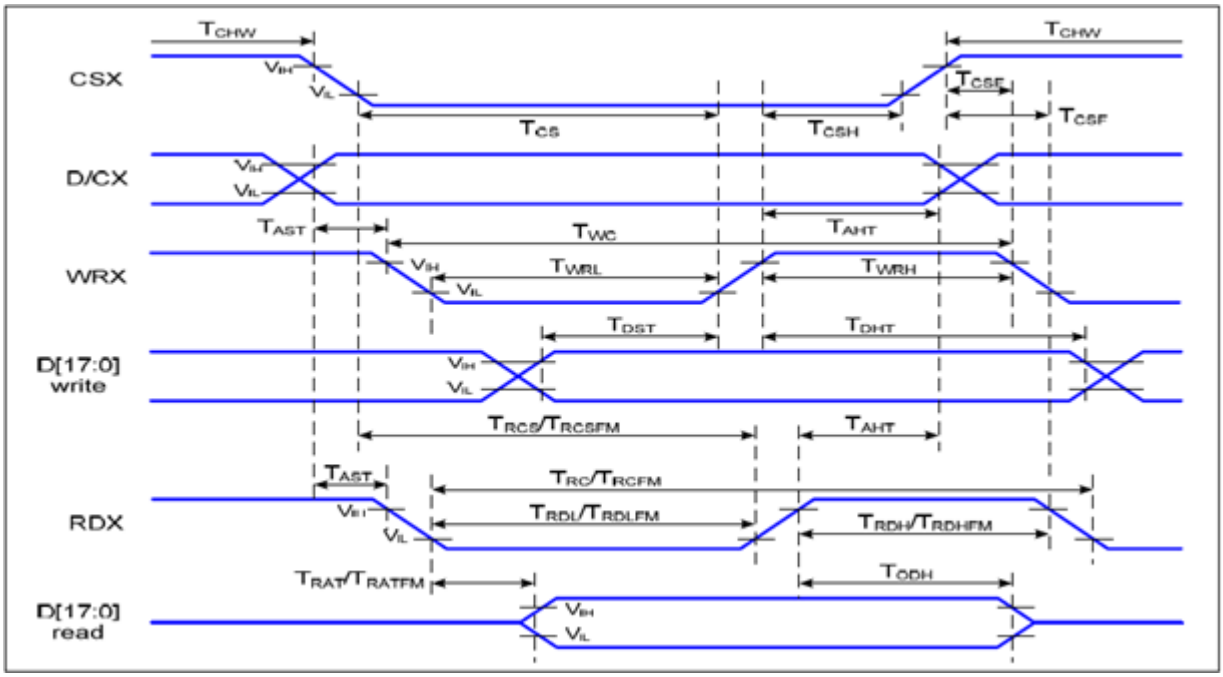
| No. | Symbol | Function |
|---|---|---|
| 1 | GND | Ground. |
| 2 | VDDIO | I/O power supply voltage. |
| 3 | VDD | Supply voltage. |
| 4 | SCL | I2C clock input. |
| 5 | SDA | I2C data input and output |
| 6 | INT | External interrupt to the host. |
| 7 | RST | External Reset, Low is active. |
|  | GND | Ground. |

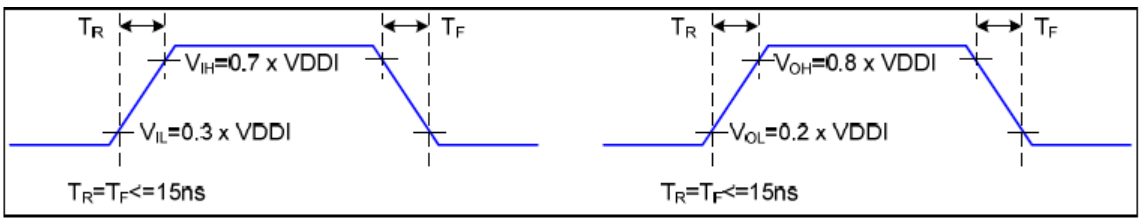
  

## 3.4 Timing Characteristics

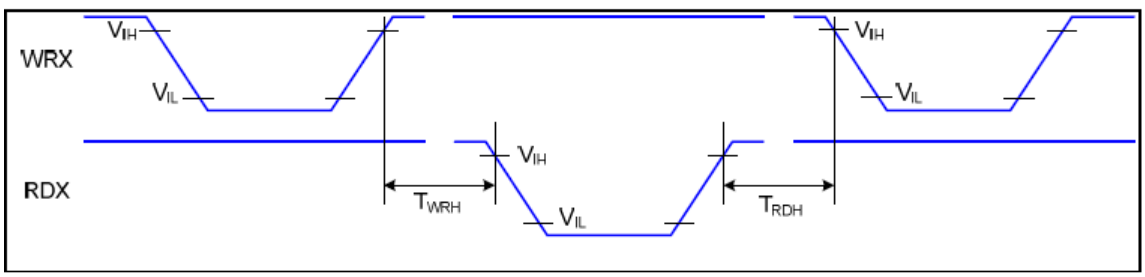
### 3.4.1 AC Characteristics

8080 Series MCU parallel interface timing characteristics: 18/16/9/8-bit bus




**Rising and Falling Timing for I/O Signal**




**Write-to-Read and Read-to-Write Timing**

*Note: The rising time and falling time (Tr, Tf) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.*

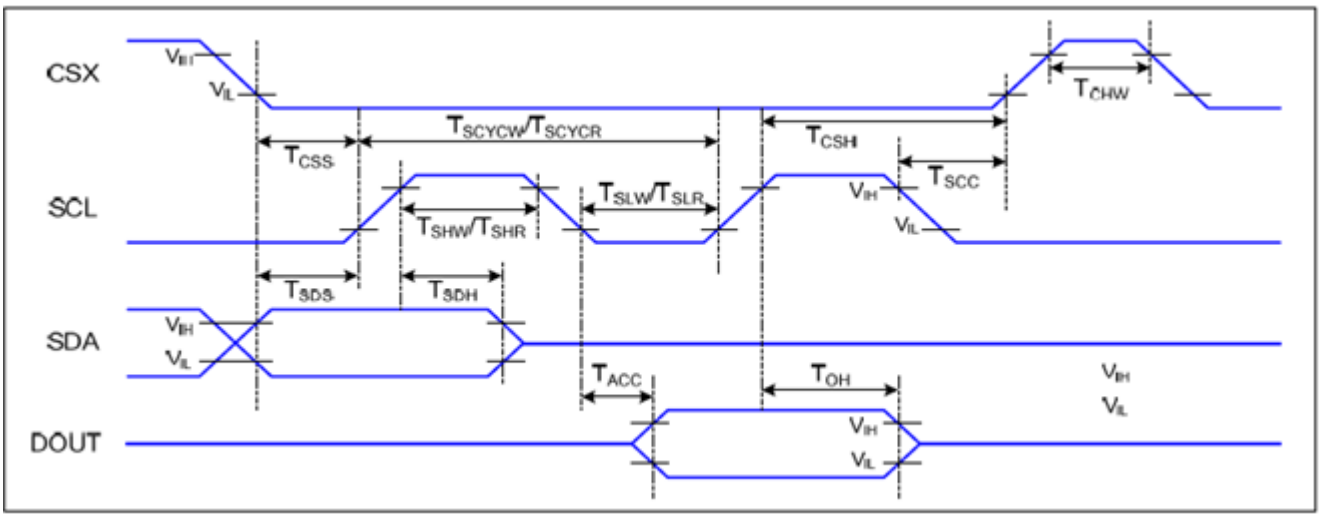
| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|---|---|---|---|---|---|---|
| D/CX | $T_{AST}$ | Address setup time | 0 | | ns | - |
| | $T_{AHT}$ | Address hold time (Write/Read) | 10 | | ns | |
| CSX | $T_{CHW}$ | Chip select "H" pulse width | 0 | | ns | - |
| | $T_{CS}$ | Chip select setup time (Write) | 15 | | ns | |
| | $T_{RCS}$ | Chip select setup time (Read ID) | 45 | | ns | |
| | $T_{RCSFM}$ | Chip select setup time (Read FM) | 355 | | ns | |
| | $T_{CSF}$ | Chip select wait time (Write/Read) | 10 | | ns | |
| | $T_{CSH}$ | Chip select hold time | 10 | | ns | |
| WRX | $T_{WC}$ | Write cycle | 66 | | ns | |
| | $T_{WRH}$ | Control pulse "H" duration | 15 | | ns | |
| | $T_{WRL}$ | Control pulse "L" duration | 15 | | ns | |
| RDX (ID) | $T_{RC}$ | Read cycle (ID) | 160 | | ns | When read ID data |
| | $T_{RDH}$ | Control pulse "H" duration (ID) | 90 | | ns | |
| | $T_{RDL}$ | Control pulse "L" duration (ID) | 45 | | ns | |
| RDX (FM) | $T_{RCFM}$ | Read cycle (FM) | 450 | | ns | When read from frame memory |
| | $T_{RDHFM}$ | Control pulse "H" duration (FM) | 90 | | ns | |
| | $T_{RDLFM}$ | Control pulse "L" duration (FM) | 355 | | ns | |
| D[17:0] | $T_{DST}$ | Data setup time | 10 | | ns | For CL=30pF |
| | $T_{DHT}$ | Data hold time | 10 | | ns | |
| | $T_{RAT}$ | Read access time (ID) | | 40 | ns | |
| | $T_{RATFM}$ | Read access time (FM) | | 340 | ns | |
| | $T_{ODH}$ | Output disable time | 20 | 80 | ns | |

## 3.4.2 Display Serial Interface Timing Characteristics

*IOVCC = 1.65 to 3.3V VCI = 2.4 to 3.3V AGND = DGND = 0V Ta = -20 to 70°C*

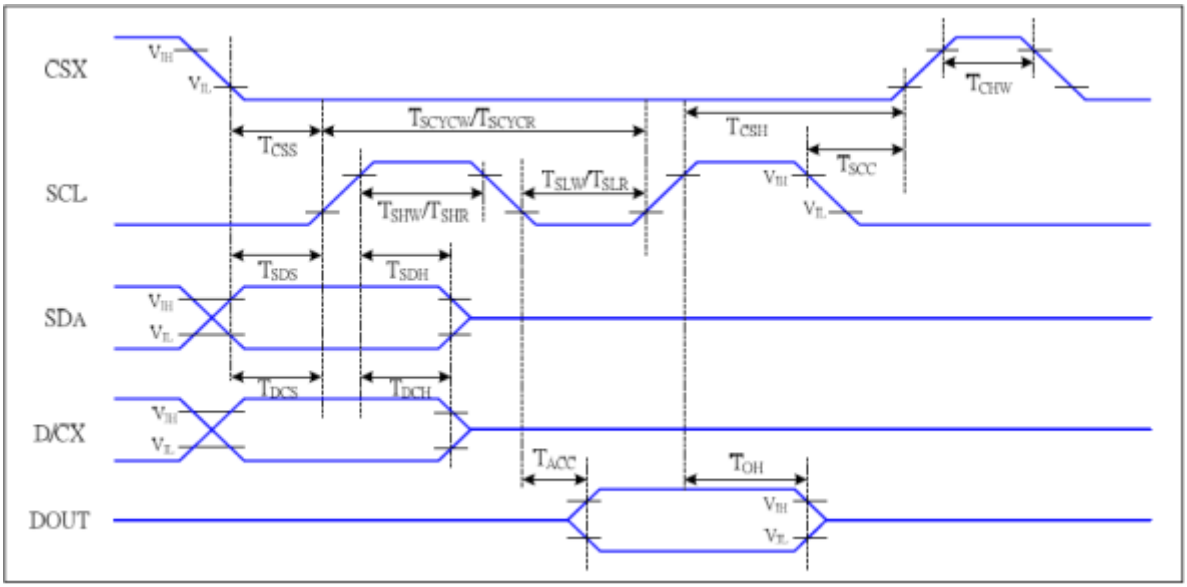
3-line SPI system




| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | $T_{CSS}$ | Chip select setup time (write) | 15 | | ns | |
| | $T_{CSH}$ | Chip select hold time (write) | 15 | | ns | |
| | $T_{CSS}$ | Chip select setup time (read) | 60 | | ns | |
| | $T_{SCC}$ | Chip select hold time (read) | 65 | | ns | |
| | $T_{CHW}$ | Chip select "H" pulse width | 40 | | ns | |
| SCL | $T_{SCYCW}$ | Serial clock cycle (Write) | 66 | | ns | |
| | $T_{SHW}$ | SCL "H" pulse width (Write) | 15 | | ns | |
| | $T_{SLW}$ | SCL "L" pulse width (Write) | 15 | | ns | |
| | $T_{SCYCR}$ | Serial clock cycle (Read) | 150 | | ns | |
| | $T_{SHR}$ | SCL "H" pulse width (Read) | 60 | | ns | |
| | $T_{SLR}$ | SCL "L" pulse width (Read) | 60 | | ns | |
| SDA (DIN) | $T_{SDS}$ | Data setup time | 10 | | ns | |
| | $T_{SDH}$ | Data hold time | 10 | | ns | |
| DOUT | $T_{ACC}$ | Access time | 10 | 50 | ns | For maximum CL=30pF |
| | $T_{OH}$ | Output disable time | 15 | 50 | ns | For minimum CL=8pF |

4-line SPI system

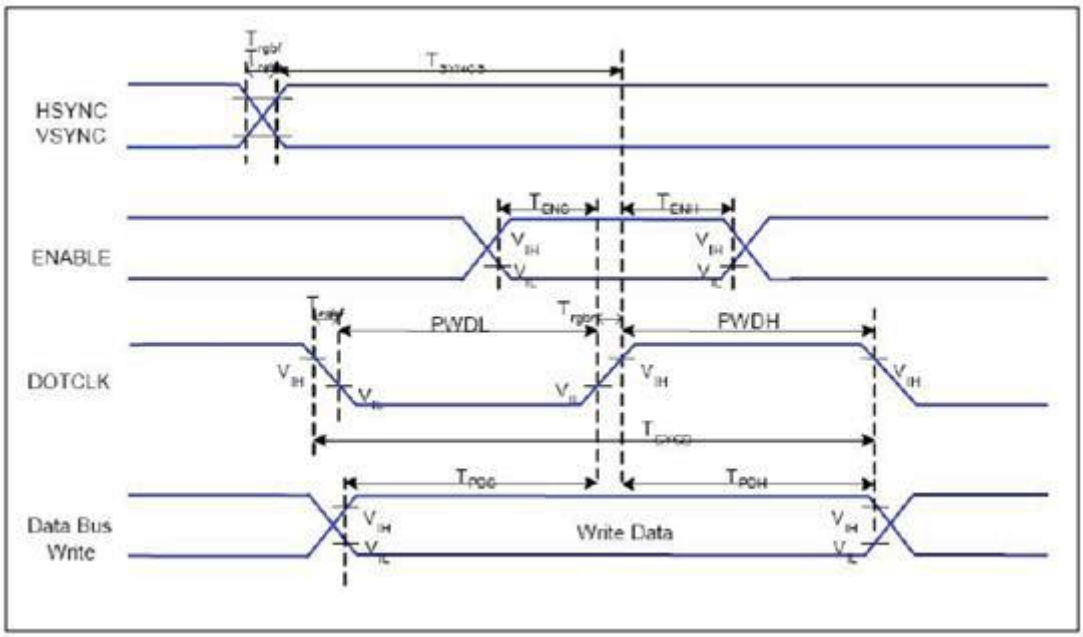



| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | $T_{CSS}$ | Chip select setup time (write) | 15 | | ns | |
| | $T_{CSH}$ | Chip select hold time (write) | 15 | | ns | |
| | $T_{CSS}$ | Chip select setup time (read) | 60 | | ns | |
| | $T_{SCC}$ | Chip select hold time (read) | 65 | | ns | |
| | $T_{CHW}$ | Chip select "H" pulse width | 40 | | ns | |
| SCL | $T_{SCYCW}$ | Serial clock cycle (Write) | 66 | | ns | -write command & data ram |
| | $T_{SHW}$ | SCL "H" pulse width (Write) | 15 | | ns | |
| | $T_{SLW}$ | SCL "L" pulse width (Write) | 15 | | ns | |
| | $T_{SCYCR}$ | Serial clock cycle (Read) | 150 | | ns | -read command & data ram |
| | $T_{SHR}$ | SCL "H" pulse width (Read) | 60 | | ns | |
| | $T_{SLR}$ | SCL "L" pulse width (Read) | 60 | | ns | |
| D/CX | $T_{DCS}$ | D/CX setup time | 10 | | ns | |
| | $T_{DCH}$ | D/CX hold time | 10 | | ns | |
| SDA (DIN) | $T_{SDS}$ | Data setup time | 10 | | ns | |
| | $T_{SDH}$ | Data hold time | 10 | | ns | |
| DOUT | $T_{ACC}$ | Access time | 10 | 50 | ns | For maximum CL=30pF |
| | $T_{OH}$ | Output disable time | 15 | 50 | ns | For minimum CL=8pF |

### 3.4.3 Parallel RGB Interface Timing Characteristics

*IOVCC = 1.65 to 3.3V VCI = 2.4 to 3.3V AGND = DGND = 0V Ta = -20 to 70°C*

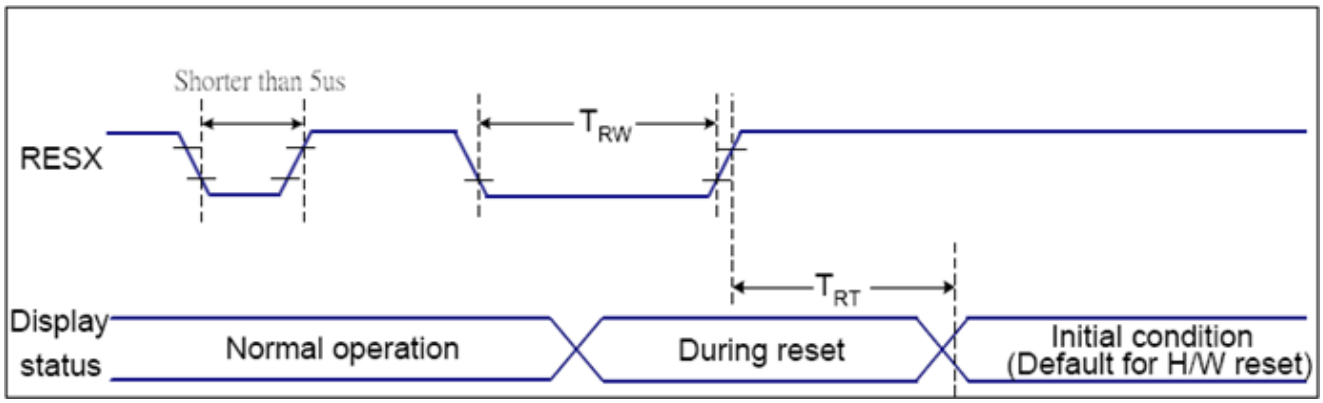



| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|---|---|---|---|---|---|---|
| HSYNC, VSYNC | $T_{SYNCS}$ | VSYNC, HSYNC Setup Time | 30 | - | ns | |
| ENABLE | $T_{ENS}$ | Enable Setup Time | 25 | - | ns | |
| | $T_{ENH}$ | Enable Hold Time | 25 | - | ns | |
| DOTCLK | PWDH | DOTCLK High-level Pulse Width | 60 | - | ns | |
| | PWDL | DOTCLK Low-level Pulse Width | 60 | - | ns | |
| | $T_{CYCD}$ | DOTCLK Cycle Time | 120 | - | ns | |
| | Trghr, Trghf | DOTCLK Rise/Fall time | - | 20 | ns | |
| DB | $T_{PDS}$ | PD Data Setup Time | 50 | - | ns | |
| | $T_{PDH}$ | PD Data Hold Time | 50 | - | ns | |

### 3.4.4 Reset Timing Characteristics

*IOVCC = 1.65 to 3.3V VCI = 2.4 to 3.3V AGND = DGND = 0V Ta = -20 to 70°C*




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

Note.

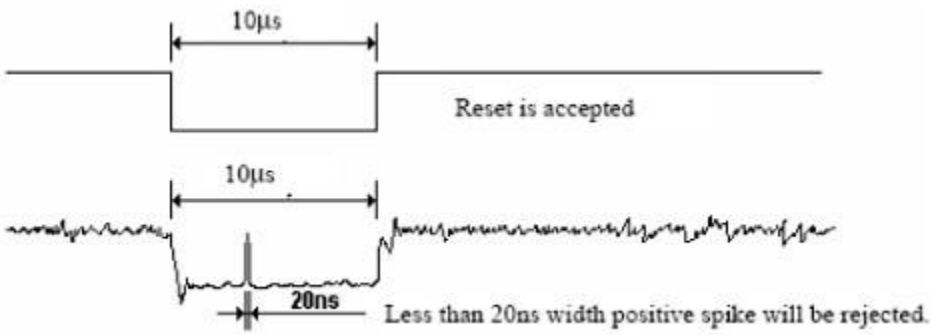
1. The reset cancel includes required time for loading the ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is a HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not cause irregular system resets 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 reset period, the display will be blank (Maximum time 120 ms, when reset starts in sleep out mode. The display remains in a blank state in sleep in mode). It will then return to the default condition for a hardware reset.

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




5. Reset is applied during sleep in mode.

6. Reset applied during sleep out mode

7. It is necessary to wait 5msec after releasing RESX before sending commands. The sleep out command cannot be sent for 120msec.

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# 4. Optical Specification

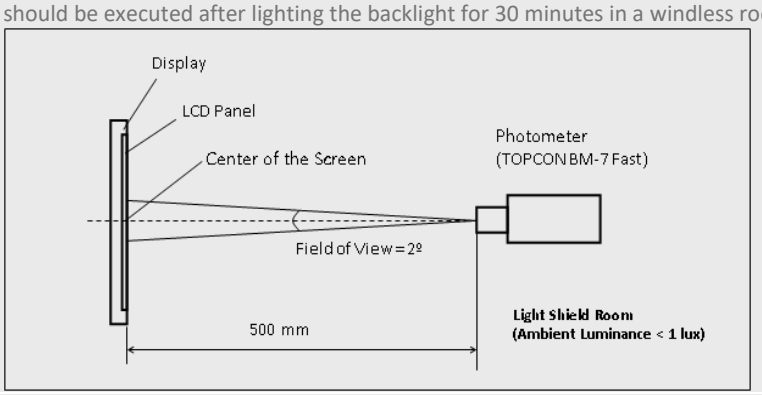
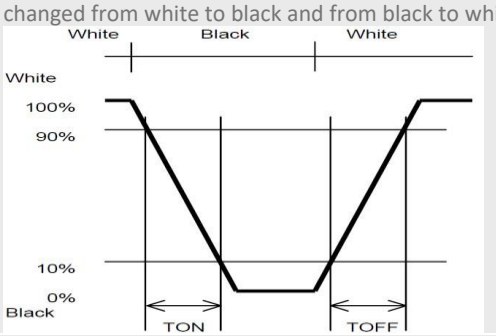
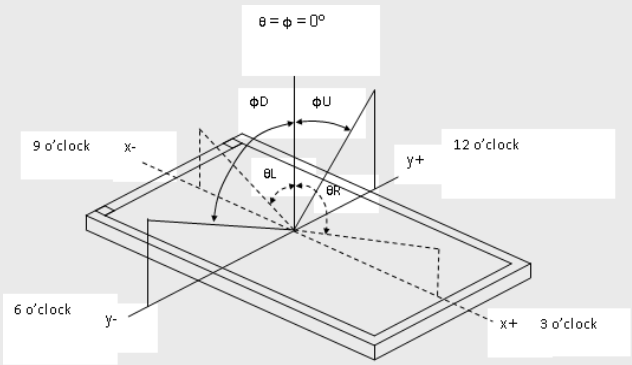
## 4.1 Optical Characteristics

Measuring instruments ： LCD-5100, Eldim, Topcon BM-7
Driving condition: VDD = 3.3V, VSS = 0V
Backlight: IF=120mA
Measured temperature: Ta ＝ 25 ˚C

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Response Time | | TR+TF | θ=Φ=0° Normal Viewing Angle | - | 30 | 40 | ms | 2 |
| Contrast Ratio | | CR | | 600 | 800 | - | | 3 |
| Viewing Angle | Left | θL | CR ≥ 10 | - | 80 | - | deg | 4 |
| | Right | θR | | - | 80 | - | deg | |
| | Up | ϕU | | - | 80 | - | deg | |
| | Down | ϕD | | - | 80 | - | deg | |
| Colour Chromaticity | Red | Rx | CR ≥ 10 | 0.613 | 0.633 | 0.653 | - | 5 |
| | | Ry | | 0.325 | 0.345 | 0.365 | - | |
| | Green | Gx | | 0.311 | 0.331 | 0.351 | - | |
| | | Gy | | 0.600 | 0.620 | 0.640 | - | |
| | Blue | Bx | | 0.125 | 0.145 | 0.165 | - | |
| | | By | | 0.048 | 0.068 | 0.088 | - | |
| | White | Wx | | 0.268 | 0.308 | 0.348 | - | |
| | | Wy | | 0.288 | 0.328 | 0.368 | - | |
| Centre Brightness | | | | 580 | 630 | - | cd/m² | 6 |
| Brightness Distribution | | | | | 80 | - | % | 7 |

## 4.2 Test Method

| Note | Item | Test Method |
|---|---|---|
| 1 | Setup | The display should be stabilised at a given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilise the luminance, measurements should be executed after lighting the backlight for 30 minutes in a windless room.<br>  |
| 2 | Response time | Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.<br>  |
| 3 | Contrast ratio | Measure maximum brightness and minimum brightness at the centre of the screen by displaying raster or window pattern. Then calculate the ratio between these two values.<br><br>Contrast Ratio (CR) = Brightness of unselected position (white) / Brightness of selected position (black) |
| 4 | Viewing angle<br>Horizontal θ<br>Vertical Ø | Move the luminance meter from right to left and up and down and determinate the angles where contrast ratio is 10<br>  |
| 5 | Colour chromaticity | Measure chromaticity coordinates x and y of CIE1931 colorimetric system |
| 6 | Centre brightness | Measure the brightness at the centre of the screen |
| 7 | Brightness distribution | (Brightness distribution) = 100 x B/A %<br>A: max. brightness of the 9 points<br>B: min. brightness of the 9 points |

# 5. Backlight Specification

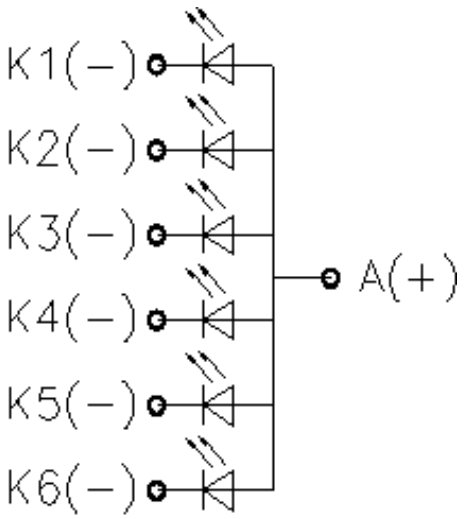
## 4.3 LED Driving Conditions

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Forward Current | IF | Ta=25 °C | 90 | 120 | - | mA |
| Forward Voltage | VF | Ta= 25°C | | 3.2 | | V |
| LED life time | Hr | | | | 50k | hour |

Note:

- The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.
- This figure is given as a reference purpose only, and not a guarantee.
- This figure is estimated for an LED operating alone.
  The performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature.
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.

## 4.4 LED Circuit




BLU CIRCUIT DIAGRAM

LED Circuit Drawing

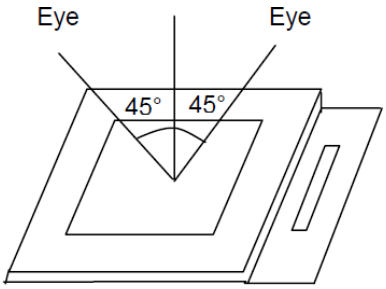
  

# 6. Quality Assurance Specification

## 6.1 Delivery Inspection Standards

### 6.1.1 Inspection Conditions

Inspection distance: 30 cm ± 2 cm
Viewing angle: ±45°




## 6.2 Environmental Conditions

Ambient temperature: 25°C ±5°C
Ambient humidity: 65±10% RH
Ambient illumination: 300~700 lux

## 6.3 Sampling Conditions

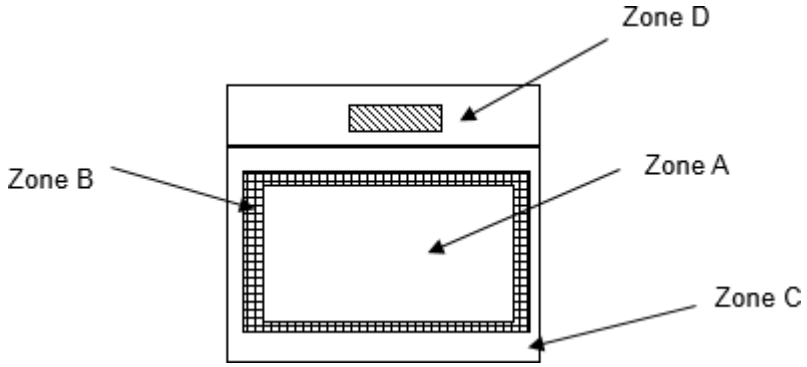
1. Lot size: quantity of shipment lot per model
2. Sampling method:

| | | |
|---|---|---|
| Sampling Plan | | GB/T 2828-2003 |
| | | Normal inspection, Class II |
| AQL | Major Defect | 0.65% |
| | Minor Defect | 1.5% |

| No | Items to be inspected | Criteria | Classification of defects |
|---|---|---|---|
| 1 | Functional defects | 1) No display, Open or miss line<br>2) Display abnormally, Short<br>3) Backlight no lighting, abnormal lighting.<br>4) TP no function | Major |
| 2 | Missing | Missing component | |
| 3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed | |
| 4 | Color tone | Color unevenness, refer to limited sample | Minor |
| 5 | Spot Line defect | Light dot， Dim spot,Polarizer Bubble ;<br>Polarizer accidented spot. | |
| 6 | Soldering appearance | Good soldering , Peeling off is not allowed. | |

### 6.3.1 Definition of Area



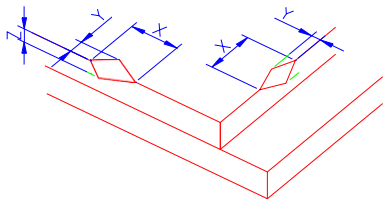

Zone A : Effective Viewing Area(Character or Digit can be seen)
Zone B : Viewing Area except Zone A
Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)
Zone D : IC Bonding Area
Note:
As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

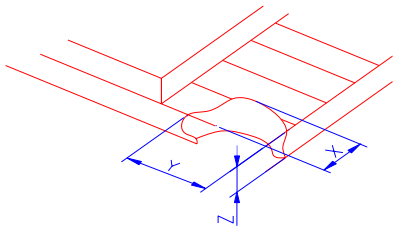
### 6.3.2 Basic Principle

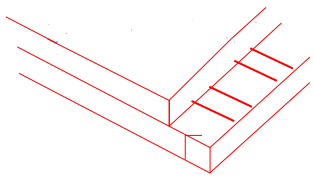
A set of sample to indicate the limit of acceptable quality level shall be discussed should a dispute occur.

## 6.4 Inspection Criteria

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0 LCD<br>Crack/Broken<br>NOTE:<br>X: Length<br>Y: Width<br>Z: Height<br>L: Length of ITO,<br>T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 

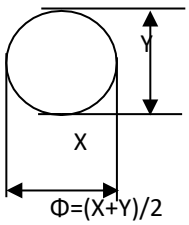
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr>
</table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 

<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr>
</table></td></tr>
<tr><td>(3) LCD crack</td><td>  <br>Crack<br>Not allowed</td></tr>
</table>

2.0

Spot defect




① light dot（ LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain ）

| Size (mm) \ Zone | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.10 | Ignore | | Ignore |
| 0.10<Φ≤0.25 | 3( distance≧10mm) | | |
| 0.25<Φ≤0.3 | 2 | | |
| Φ>0.35 | 0 | | |

②Dim spot（ LCD/TP/Polarizer dim dot, light leakage、dark spot ）

| Size (mm) \ Zone | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.1 | Ignore | | Ignore |
| 0.10<Φ≤0.25 | 3( distance≧10mm) | | |
| 0.25<Φ≤0.3 | 2 | | |
| Φ>0.35 | 0 | | |

③ Polarizer accidented spot

| Size (mm) \ Zone | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.2 | Ignore | | Ignore |
| 0.3<Φ≤0.5 | 2( distance≧10mm) | | |
| Φ>0.5 | 0 | | |

④Pixel bad points（ light dot，Dim dot, color dot）

| Size (mm) \ Zone | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.1 | Ignore | | Ignore |
| 0.15<Φ≤0.25 | 2( distance≧10mm) | | |
| Φ>0.3 | 0 | | |

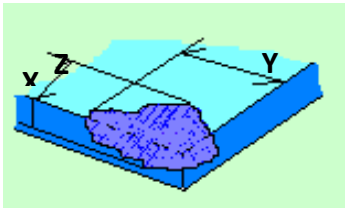
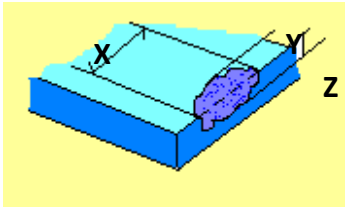
⑤ Polarizer Bubble

| Size (mm) \ Zone | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.2 | Ignore | | Ignore |
| 0.3<Φ≤0.4 | 3(distance≧10m) | | |
| 0.5<Φ≤0.6 | 2 | | |
| 0.6<Φ | 0 | | |

<table>
<tr><td>3.0</td><td>Line defect (LCD/TP /Polarizer backlight black/white line, scratch, stain)</td><td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Length(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤4.0</td><td colspan="2">N≤3</td></tr>
<tr><td>0.07<W≤0.08</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td></tr>
<tr><td>4.0</td><td>Electronic Components SMT</td><td>Not allow missing parts， solderless connection， cold solder joint， mismatch， The positive and negative polarity opposite</td></tr>
<tr><td>5.0</td><td>Display color& Brightness</td><td>1. Color： Measuring the color coordinates, The measurement standard according to the datasheet or samples.<br>2. Brightness： Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.</td></tr>
<tr><td rowspan="4">6.0</td><td rowspan="4">PCT Related</td><td>PCT Cover sensor accidented black/white spot</td><td>
<table>
<tr><td rowspan="2">Size Φ(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">3(distance≧10mm）</td></tr>
<tr><td>0.20<Φ≤0.25</td><td colspan="2">2</td></tr>
<tr><td>Φ > 0.3</td><td colspan="2">0</td></tr>
</table>
</td></tr>
<tr><td>PCT Cover scratch</td><td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Ignore(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤4.0</td><td colspan="3">N≤3</td></tr>
<tr><td>0.07<W≤0.08</td><td>L≤3.0</td><td colspan="3">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td></tr>
<tr><td>PCT Cover Pinhole/ Lack of ink</td><td>
<table>
<tr><td>Zone / Size (mm)</td><td>Acceptable Qty</td></tr>
<tr><td></td><td>C</td></tr>
<tr><td>Φ≤0.1</td><td>Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td>3(distance≧10mm)</td></tr>
<tr><td>0.25<Φ≤0.3</td><td>2</td></tr>
<tr><td>Φ>0.35</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>PCT Bonding bubble/ accidented spot</td><td>
<table>
<tr><td rowspan="2">Size Φ(mm)</td><td colspan="2">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td></tr>
<tr><td>0.15<Φ≤0.2</td><td colspan="2">3(distance≧10mm ）</td></tr>
<tr><td>0.2<Φ≤0.25</td><td colspan="2">2</td></tr>
<tr><td>Φ>0.25</td><td colspan="2">0</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td></td><td>Assembly deflection</td><td colspan="2">beyond the edge of backlight ≤0.2mm</td></tr>
<tr><td></td><td></td><td>TP cover broken<br>X：length<br>Y：width<br>Z：height</td><td>
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>X≤0.5mm</td><td>Y≤0.5mm</td><td>Z<cover thickness</td></tr>
</table>
* Circuitry broken is not allowed.
</td><td> 
</td></tr>
<tr><td></td><td></td><td>TP cover broken<br>X：length<br>Y：width<br>Z：height</td><td>
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>X≤0.3mm</td><td>Y≤0.3mm</td><td>Z<LCD thickness</td></tr>
</table>
* Circuitry broken is not allowed.
</td><td> 
</td></tr>
</table>

Criteria (Functional Items)

| Number | Items | Criteria (mm) |
|---|---|---|
| 1 | No display | Not allowed |
| 2 | Missing segment | Not allowed |
| 3 | Short | Not allowed |
| 4 | Backlight no lighting | Not allowed |
| 5 | TP no function | Not allowed |

### 6.4.1 Classification of Defects

Visual defects (except no or wrong label) are treated as minor defects, while electrical defects are treated as major defects.
Two minor defects are equal to one major defect in lot sampling inspection.

### 6.4.2 Identification / marking criteria

Any unit with illegible / wrong / double or no marking / label shall be rejected.

## 6.5 Dealing with Customer Complaints

### 6.5.1 Non-conforming analysis

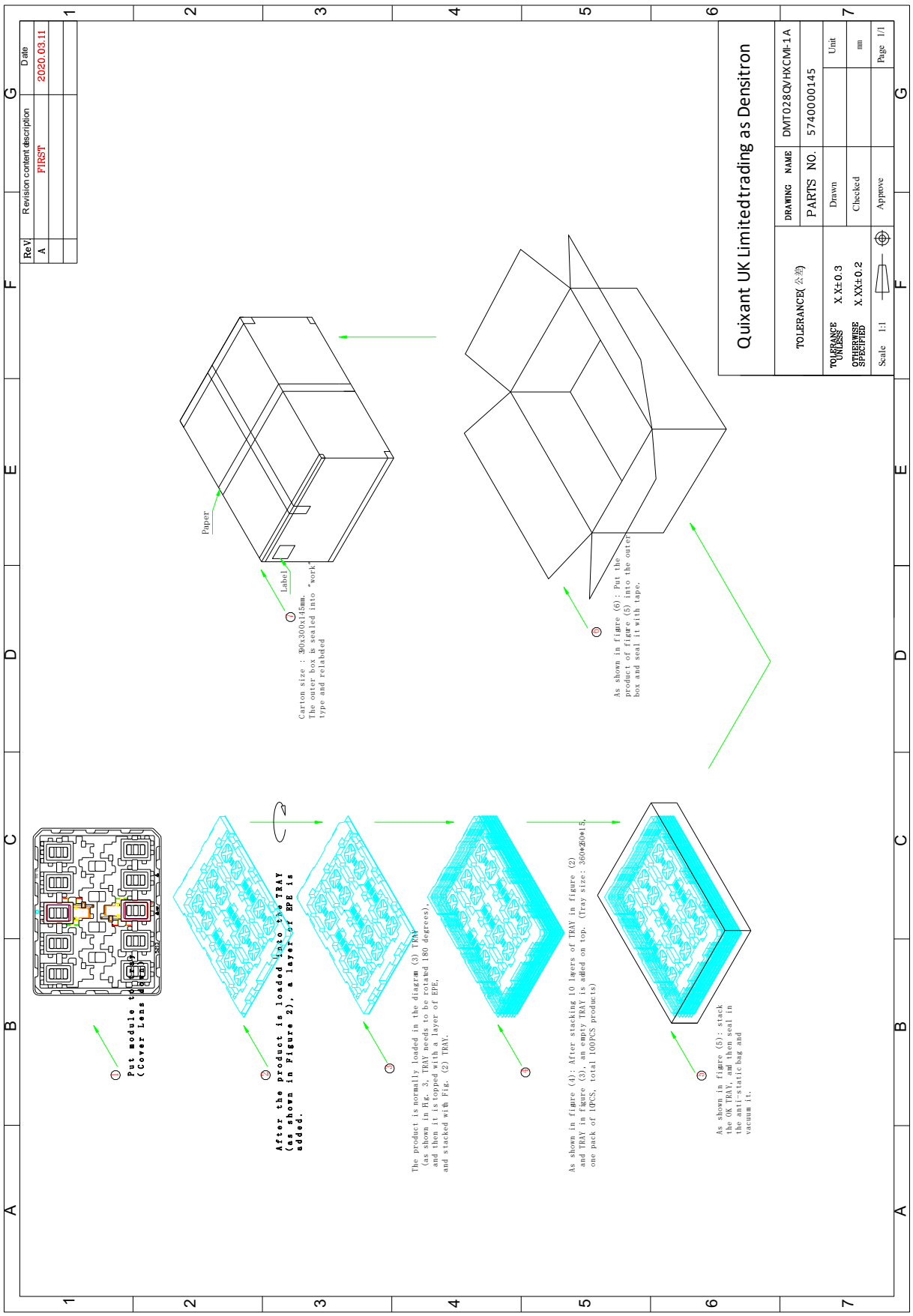
Purchaser should supply Densitron with detailed data of non-conforming sample.
After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.
If the analysis cannot be completed on time, Densitron must inform the purchaser.

### 6.5.2 Handling of non-conforming displays

If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.
Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.
Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standar

# 7. Packaging


Quixant UK Limitedtrading as Densitron
DRAWING NAME DMT028QVHXCMI-1A
PARTS NO. 5740000145
TOLERANCE(公差)
TOLERANCE UNLESS OTHERWISE SPECIFIED
X.X±0.3
X.XX±0.2
Drawn
Checked
Approve
Scale 1:1
Unit
mm
Page 1/1
Rev Revision content description Date
A FIRST 2020.03.11
Paper
Label
Carton size : 300x300x145mm.
The outer box is sealed into "work" type and relabded
As shown in figure (6) : Put the product of figure (5) into the outer box and seal it with tape.
Put module to TRAY (Cover Lens down)
After the product is loaded into the TRAY (as shown in Figure 2), a layer of EPE is added.
The product is normally loaded in the diagram (3) TRAY (as shown in Fig. 3, TRAY needs to be rotated 180 degrees), and then it is topped with a layer of EPE, and stacked with Fig. (2) TRAY.
As shown in figure (4): After stacking 10 layers of TRAY in figure (2) and TRAY in figure (3), an empty TRAY is added on top. (Tray size: 360*300*15, one pack of 10PCS, total 100PCS products)
As shown in figure (5): stack the OK TRAY, and then seal in the anti-static bag and vacuum it.

# 8. Reliability Specification

## 8.1Reliability Tests

| Test Item | | Test Condition | | Sample Size |
|---|---|---|---|---|
| Durability Test | High Temperature Operation | Ta= 70˚C | 96h | 3pcs |
| | Low Temperature Operation | Ta=-20˚C | 96h | 3pcs |
| | High Temperature Storage | Tp= 80°C | 96h | 3pcs |
| | Low Temperature Storage | Tp= -30°C | 96h | 3pcs |
| | ESD Test | 150pF, 330Ω, ±6KV (Contact)/±8KV (Air), 5 Points/panel, 10 times/point | | 3pcs |
| | Thermal Shock Resistance | The sample should be allowed to stand the following 5 cycles of operation: LTS for 30 minutes -> normal temperature for 5 minutes -> HTS for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours | | 3pcs |
| | Box Drop Test | 1 Corner 3 Edges 6 faces, 66 cm (Medium Box) | | 1 box |

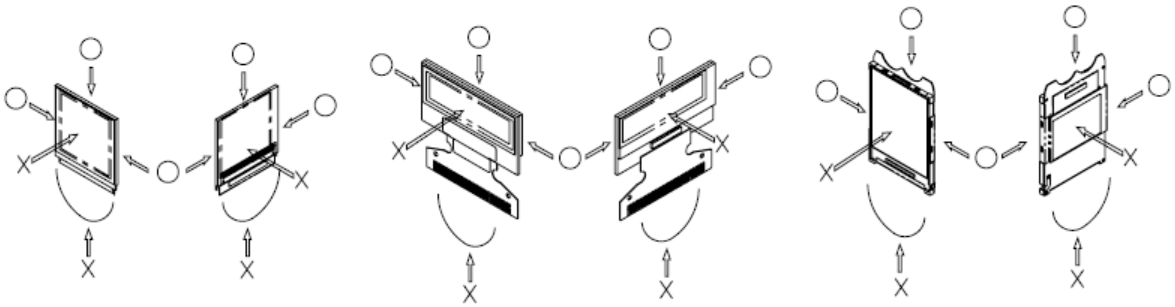
Note: Ta=ambient temperature Tp= Panel temperature

Notes:
1. No dew condensation to be observed.
2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
3. No cosmetic or functional defects should be allowed.
4. Total current consumption should be less than twice the initial value.

# 9. Handling Precautions

## 9.1 Handling Precautions

1) Since the display panel is being made of glass, do not apply mechanical impacts such as dropping from a high position.
2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
3) If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water
4) If pressure is applied to the display surface or its neighbourhood of the display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
5) The polarizer covering the surface of the display module is soft and easily scratched. Please be careful when handling the display module.
6) When the surface of the polarizer of the display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
   a. Scotch Mending Tape No. 810 or an equivalent
   b. Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
   c. Also, pay attention that the following liquid and solvent may spoil the polarizer:
      - Water
      - Ketone
      - Aromatic Solvents
7) Hold the display module very carefully when placing it into the system housing. Do not apply excessive stress or pressure to display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases.



8) Do not apply stress to the LSI chips and the surrounding molded sections.
9) Do not disassemble nor modify the display module.
10) Do not apply input signals while the logic power is off.
11) Pay sufficient attention to the working environments when handing display modules to prevent occurrence of element breakage accidents by static electricity.
   a. Be sure to make human body grounding when handling display modules.
   b. Be sure to ground tools to use or assembly such as soldering irons.
   c. To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
   d. Protective film is being applied to the surface of the display panel of the display module. Be careful since static electricity may be generated when exfoliating the protective film.
12) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. If the display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).
13) If electric current is applied when the display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

## 9.2 Storage Precautions

1) When storing display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps, etc. and, also, avoiding high temperature and high humidity environments or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Densitron) At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
2) If electric current is applied when water drops are adhering to the surface of the display module, when the display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

## 9.3 Designing Precautions

1) The absolute maximum ratings are the ratings which cannot be exceeded for display module, and if these values are exceeded, panel damage may be happen.
2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.
3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)
4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighbouring devices.
5) As for EMI, take necessary measures on the equipment side basically.
6) When fastening the display module, fasten the external plastic housing section.
7) If power supply to the display module is forcibly shut down by such errors as taking out the main battery while the display panel is in operation, we cannot guarantee the quality of this display module.

## 9.4 Operation Precautions

1) It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.
2) Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation.
3) Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged.
4) To protect display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the display modules.
   a. Pins and electrodes
   b. Pattern layouts such as the FPC
5) When the driver is being exposed (COG), semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if the driver is exposed to light, malfunctioning may occur.
   a. Design the product and installation method so that the driver may be shielded from light in actual usage.
   b. Design the product and installation method so that the driver may be shielded from light during the inspection processes.
6) Although the display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
7) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

## 9.5 Other Precautions

1) Request the qualified companies to handle industrial wastes when disposing of the display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.