



RVT101HVBNC00

## EVE4 IPS 10.1" LCD TFT DATASHEET

Rev.1.2  
2021-07-16

| ITEM                           | CONTENTS  | UNIT              |
|--------------------------------|---|-------------------|
| LCD Type                       | TFT/Transmissive/Normally Black/IPS               | /                 |
| Size                           | 10.1  | Inch              |
| Viewing Direction              | Free  | /                 |
| Outside Dimensions (W x H x D) | 257.96 x 168.60 x 13.17                           | mm                |
| Active Area (W x H)            | 216.96 x 135.60                                   | mm                |
| Pixel Pitch (W x H)            | 0.1695 x 0.1695                                   | mm                |
| Resolution                     | 1280 x 800  | /                 |
| Brightness                     | 800   | cd/m <sup>2</sup> |
| Color Depth                    | 16.7 M  | /                 |
| Pixel Arrangement              | RGB Vertical Stripe                               | /                 |
| Driver IC of Board             | BT817Q  | /                 |
| Interface                      | SPI/QSPI  | /                 |
| Host Connector                 | RiBUS, ZIF 20 pin, 0.5mm pitch, down-side contact | /                 |
| With/Without Touch             | With Projected Capacitive Touch Panel             | /                 |
| CTP Driver                     | ILI2132A  | /                 |
| Supply Voltage for Module      | 3.3   | V                 |
| Supply Voltage for Backlight   | 5.0 ÷ 12.0  | V                 |
| Weight                         | 430   | g                 |

**Note 1:** RoHS3 compliant**Note 2:** LCM weight tolerance: ± 5%.



## 1. REVISION RECORD

| REV NO. | REV DATE   | CONTENTS  | REMARKS |
|---------|------------|---|---------|
| 1.0     | 2021-04-19 | Initial Release   |         |
| 1.1     | 2021-06-03 | Adding assembly guide<br>Updating the drawing                                 |         |
| 1.2     | 2021-07-16 | Updating the drawing (dimensions in inches, adding the speaker), New template |         |



## 2. CONTENTS

|   |    |
|---|----|
| 1. REVISION RECORD.....                               | 2  |
| 2. CONTENTS.....                                      | 3  |
| 3. MODULE CLASSIFICATION INFORMATION.....             | 4  |
| 4. ASSEMBLY GUIDE.....                                | 5  |
| 4.1 uxTouch ASSEMBLY.....                             | 5  |
| 5. MODULE DRAWING.....                                | 6  |
| 6. ABSOLUTE MAXIMUM RATINGS.....                      | 7  |
| 7. ELECTRICAL CHARACTERISTICS.....                    | 7  |
| 8. BACKLIGHT ELECTRICAL CHARACTERISTICS.....          | 7  |
| 9. ELECTRO-OPTICAL CHARACTERISTICS.....               | 8  |
| 10. INTERFACES DESCRIPTION.....                       | 10 |
| 10.1 P1 connector - RiBUS description.....            | 10 |
| 10.2 P2 connector description.....                    | 10 |
| 11. BT817Q CONTROLLER SPECIFICATION.....              | 11 |
| 11.1 Serial host interface.....                       | 11 |
| 11.2 Block diagram.....                               | 12 |
| 11.3 Host interface SPI mode 0.....                   | 12 |
| 11.4 Backlight driver block diagram.....              | 13 |
| 12. TIMING CHARACTERISTICS.....                       | 14 |
| 12.1 LVDS interface characteristic.....               | 14 |
| 12.2 Timing table.....                                | 14 |
| 13. CAPACITIVE TOUCH SCREEN PANEL SPECIFICATIONS..... | 15 |
| 13.1 Mechanical characteristics.....                  | 15 |
| 13.2 Electrical characteristics.....                  | 15 |
| 14. MODULE INITIALIZATION.....                        | 16 |
| 15. INSPECTION.....                                   | 17 |
| 15.1 Inspection condition.....                        | 17 |
| 15.2 Inspection standard.....                         | 18 |
| 16. RELIABILITY TEST.....                             | 19 |
| 17. LEGAL INFORMATION.....                            | 20 |



### 3. MODULE CLASSIFICATION INFORMATION

| RV | T  | 101 | H  | V  | B  | N  | W  | C  | 00  |
|----|----|-----|----|----|----|----|----|----|-----|
| 1. | 2. | 3.  | 4. | 5. | 6. | 7. | 8. | 9. | 10. |

| NO. | PARAMETER        | SYMBOL                           |
|-----|------------------|----------------------------------|
| 1.  | BRAND            | RV – Riverdi                     |
| 2.  | PRODUCT TYPE     | T – TFT Standard                 |
| 3.  | DISPLAY SIZE     | 101 – 10.1"                      |
| 4.  | MODEL SERIAL NO. | H – High Brightness, IPS         |
| 5.  | RESOLUTION       | V – 1280 x 800 px                |
| 6.  | INTERFACE        | B – SPI/QSPI                     |
| 7.  | FRAME            | N – Without Mounting Metal Frame |
| 8.  | BACKLIGHT TYPE   | W – LED White                    |
| 9.  | TOUCH PANEL      | C – With Capacitive Touch Panel  |
| 10. | VERSION          | 00 – (00-99)                     |

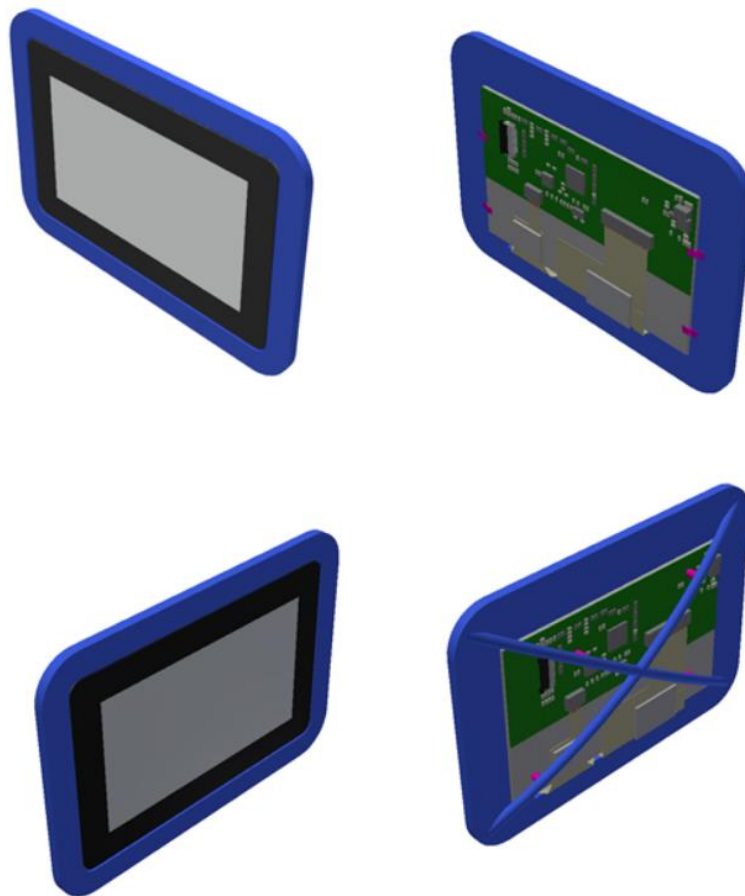
## 4. ASSEMBLY GUIDE

### 4.1 uxTouch ASSEMBLY

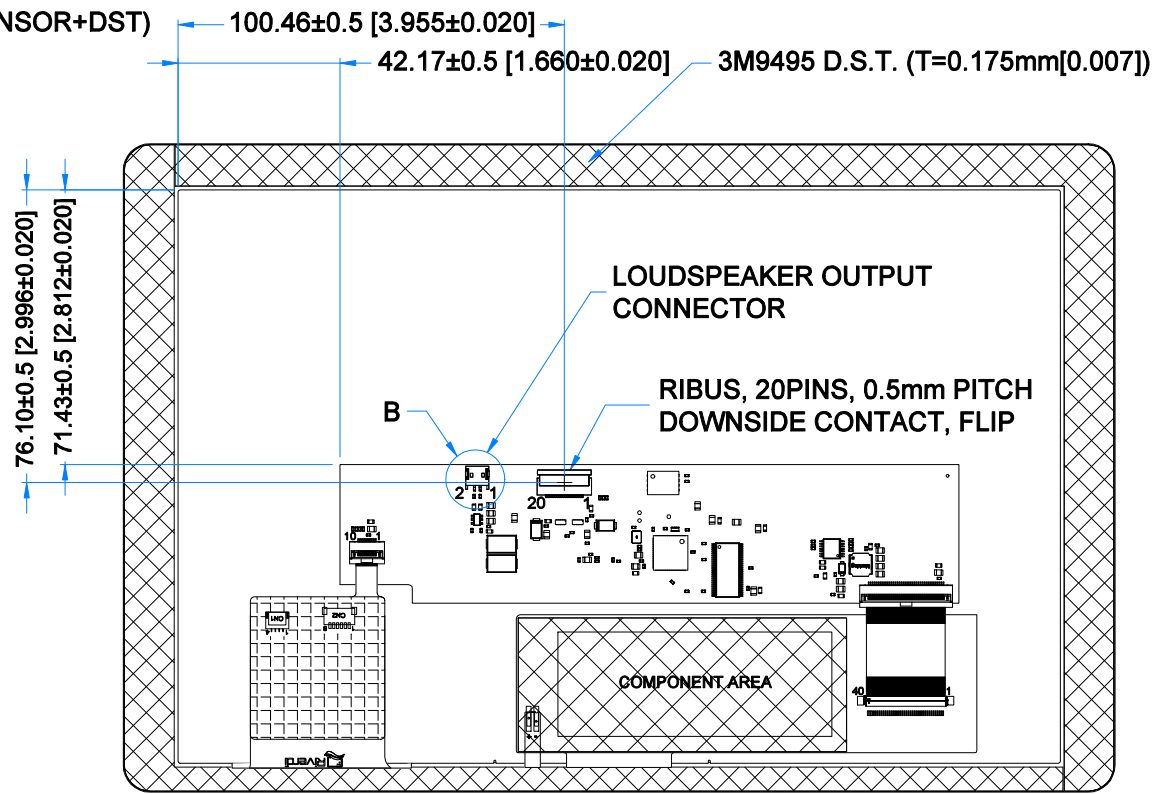
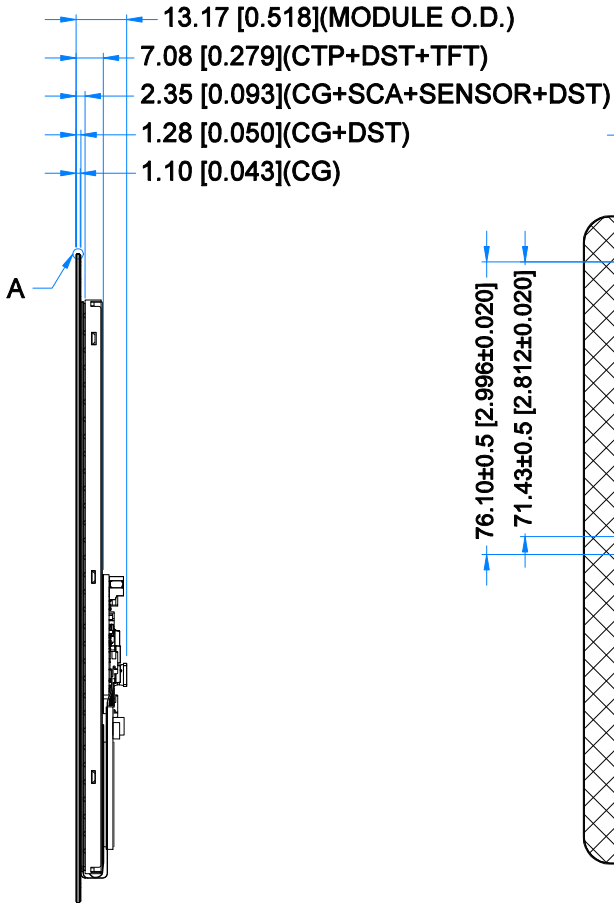
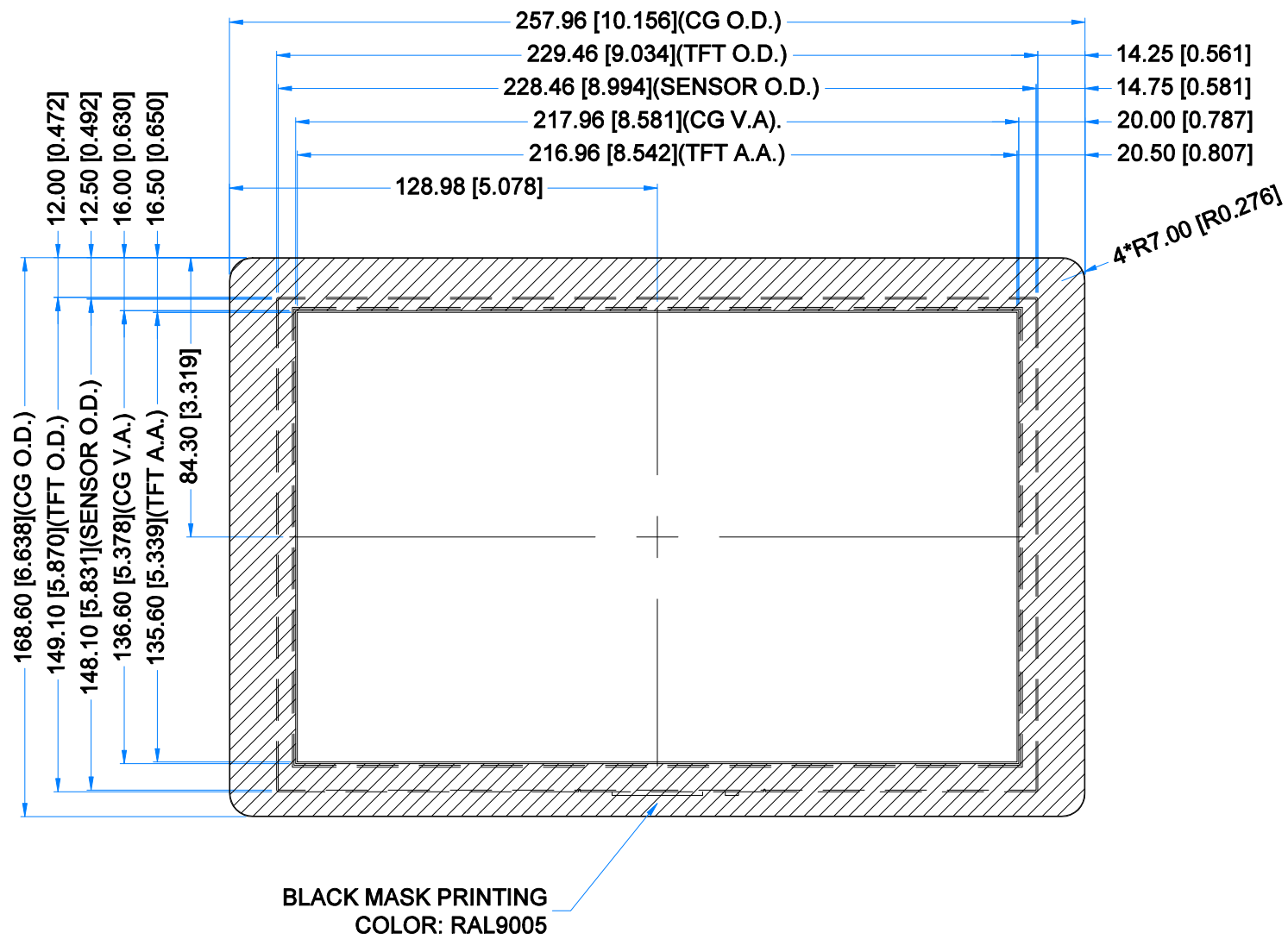
uxTouch are LCD TFT displays with specially designed projected capacitive touch panels. uxTouch display can be mounted without any hole in the housing. Our standard uxTouch displays include double-sided adhesive tape (DST) to stick TFT easily to the housing. Basic series include 4.3", 5.0", 7.0" and 10.1" display sizes.

uxTouch models with double-side adhesive tape can be mounted by connecting the glass to the housing. Riverdi recommends using support brackets assembled to display's back. An additional support will stiffen the whole structure and minimize the influence of external factors such as vibration. Figure 1 below shows examples of using support elements.

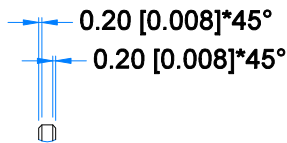
*Figure 1. Example of using support brackets*



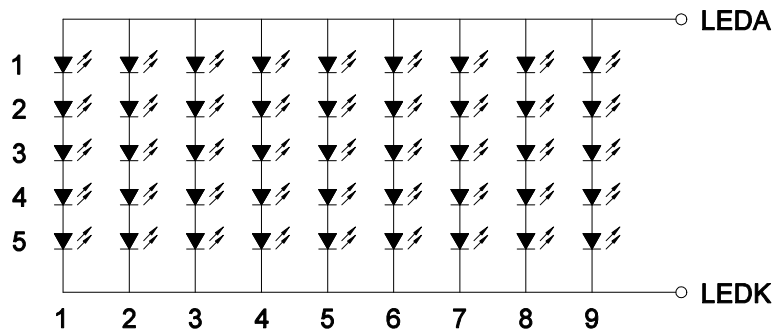
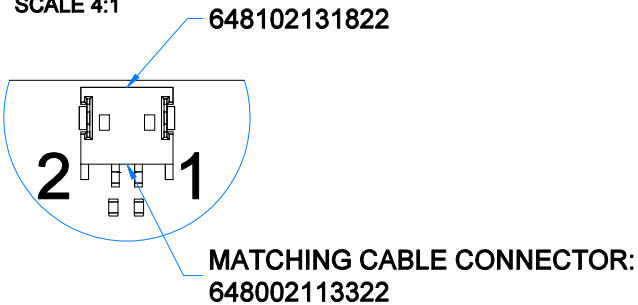
| Revision: | Changes:                                    | Date:      |
|-----------|---|------------|
| 1.0       | Initial Case                                | 2020.12.09 |
| 1.1       | PCB Update And Dimension Overhaul           | 2021.04.20 |
| 1.2       | Adding Speaker PN And Matching Connector PN | 2021.07.08 |



DETAIL A  
SCALE 4:1



DETAIL B  
SCALE 4:1



LED Diagram Circuit

**LCD NOTES:**  
1. LCD TYPE: TRANSMISSIVE, NORMALLY BLACK, IPS  
2. RESOLUTION: 1280x800  
3. VIEWING ANGLE: FREE  
4. SURFACE LUMINANCE: 800 cd/m<sup>2</sup>  
5. DRIVING IC ON THE BOARD: BT817Q  
6. INTERFACE: SPI/QSPI  
7. SUPPLY VOLTAGE FOR MODULE: 3.3 V  
8. SUPPLY VOLTAGE FOR BACKLIGHT: 5.0 + 12.0 V, BUILT-IN LED INVERTER

**TP NOTES:**  
1. TP STRUCTURE: G+G  
2. CG THICKNESS: 1.10mm  
3. SURFACE HARDNESS: 7H  
4. DRIVER IC: ILI2132A  
5. INTERFACE: SPI/QSPI VIA RIBUS AND BT817Q

**GENERAL NOTES:**  
1. ZERO BAD PIXEL FOR TFT  
2. OPERATING TEMPERATURE: -20°C ~ 70°C  
3. STORAGE TEMPERATURE: -30°C ~ 80°C  
4. WITHOUT INDIVIDUAL TOLERANCE: ±0.3mm  
5. RoHS3 COMPLIANT

PN: RVT101HVBNC00

SN:

DRAWN: M.Natywa

2021.04.20

1:1.97

CHECKED: K.Brodacka

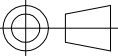
2021.07.08

[mm]

APPR:

ISO A3

P. 1 of 1





## 6. ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                   | SYMBOL          | MIN  | MAX  | UNIT | NOTE      |
|---|-----------------|------|------|------|-----------|
| Supply Voltage for Module                   | VDD             | 0    | 3.6  | V    | NOTE 1    |
| Digital I/O signals (SPI/QSPI/GPIO) Voltage | -               | -0.5 | 3.3  |      | NOTE 1, 2 |
| Supply voltage for Backlight                | BLVDD           | -0.3 | 14.0 |      | NOTE 1    |
| Operating Temperature                       | T <sub>OP</sub> | -20  | 70   | °C   |           |
| Storage Temperature                         | T <sub>ST</sub> | -30  | 80   | °C   |           |
| Storage Humidity (@ 25 ± 5°C)               | H <sub>ST</sub> | 10   | -    | % RH |           |
| Operating Ambient Humidity (@ 25 ± 5°C)     | H <sub>OP</sub> | 10   | -    | % RH |           |

**Note 1.** Exceeding maximum values may cause improper operation or permanent damage to the unit.

**Note 2.** Digital I/O signals are to be connected to pins 3 ÷ 9, 11 and 12 pins at RiBUS connector (P1).

## 7. ELECTRICAL CHARACTERISTICS

| PARAMETER                 | SYMBOL           | MIN | TYP | MAX | UNIT | NOTE   |
|---------------------------|------------------|-----|-----|-----|------|--------|
| Supply Voltage for Module | VDD              | 3.0 | 3.3 | 3.6 | V    |        |
| Current Drawn from VDD    | I <sub>VDD</sub> | 270 | 500 | TBD | mA   | NOTE 1 |
| Input Voltage "H" Level   | V <sub>IH</sub>  | 2.0 | -   | 3.3 | V    |        |
| Input Voltage "L" Level   | V <sub>IL</sub>  | -   | -   | 0.8 | V    |        |

**Note 1.** The minimum current drawn from VDD is defined with the condition that there is no communication on SPI and the backlight is off.

The maximum current drawn from VDD is defined with the condition that the LCD displays a white screen with 100% of the backlight.

## 8. BACKLIGHT ELECTRICAL CHARACTERISTICS

| PARAMETER                       | SYMBOL                   | MIN | TYP    | MAX  | UNIT  | NOTE   |
|---------------------------------|--------------------------|-----|--------|------|-------|--------|
| Supply Voltage for Backlight    | BLVDD                    | 5.0 | 9.0    | 14.0 | V     |        |
| Current drawn from BLVDD @5.0V  | I <sub>BLVDD=5.0V</sub>  | TBD | 1370   | TBD  | mA    |        |
| Current drawn from BLVDD @7.0V  | I <sub>BLVDD=7.0V</sub>  | TBD | 860    | TBD  |       |        |
| Current drawn from BLVDD @9.0V  | I <sub>BLVDD=9.0V</sub>  | TBD | 670    | TBD  |       |        |
| Current drawn from BLVDD @12.0V | I <sub>BLVDD=12.0V</sub> | TBD | 470    | TBD  |       |        |
| Lifetime                        | -                        | -   | 50.000 | -    | hours | NOTE 1 |

**Note 1.** Operating life means the period in which the LED brightness goes down to 50% of the initial brightness. Typical operating lifetime is the estimated parameter.

## 9. ELECTRO-OPTICAL CHARACTERISTICS

| ITEM                    | SYMBOL         | CONDITION                                      | MIN  | TYP  | MAX  | UNIT              | RMK    | NOTE |
|-------------------------|----------------|--|------|------|------|-------------------|--------|------|
| Response Time           | Tr+Tf          | $\theta=0^\circ$<br>$\phi=0^\circ$<br>Ta=25 °C | -    | 25   | 35   | ms                | FIG 2. | 4    |
| Contrast Ratio          | Cr             |  | 800  | 1000 | -    | ---               | FIG 3. | 1    |
| Luminance Uniformity    | $\delta$ WHITE |  | -    | 75   | -    | %                 | FIG 3. | 3    |
| Surface Luminance       | Lv             |  | -    | 800  | -    | cd/m <sup>2</sup> | FIG 3. | 2    |
| Viewing Angle Range     | $\theta$       | $\phi = 90^\circ$                              | 75   | 85   | -    | deg               | FIG 4. | 6    |
|                         |                | $\phi = 270^\circ$                             | 75   | 85   | -    | deg               | FIG 4. |      |
|                         |                | $\phi = 0^\circ$                               | 75   | 85   | -    | deg               | FIG 4. |      |
|                         |                | $\phi = 180^\circ$                             | 75   | 85   | -    | deg               | FIG 4. |      |
| CIE (x, y) Chromaticity | Rx             | $\theta=0^\circ$<br>$\phi=0^\circ$<br>Ta=25 °C | 0.22 | 0.26 | 0.30 | -                 | FIG 3. | 5    |
|                         | Ry             |  | 0.20 | 0.24 | 0.28 | -                 |        |      |
|                         | Gx             |  | 0.34 | 0.38 | 0.42 | -                 |        |      |
|                         | Gy             |  | 0.50 | 0.54 | 0.58 | -                 |        |      |
|                         | Bx             |  | 0.10 | 0.14 | 0.18 | -                 |        |      |
|                         | By             |  | 0.09 | 0.13 | 0.17 | -                 |        |      |
|                         | Wx             |  | 0.28 | 0.32 | 0.36 | -                 |        |      |
|                         | Wy             |  | 0.29 | 0.33 | 0.37 | -                 |        |      |

**Note 1.** Contrast Ratio (CR) is defined mathematically as below, for more information see Figure 3.

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

**Note 2.** Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see Figure 3.

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

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

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

**Note 4.** Response time is the time required for the display to transition from white to black (Rise Time, Tr) and from black to white (Decay Time, Tf). For additional information see Figure 2. 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 calculating the 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 LCD surface. For more information see Figure 4.



**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 2. The definition of response time

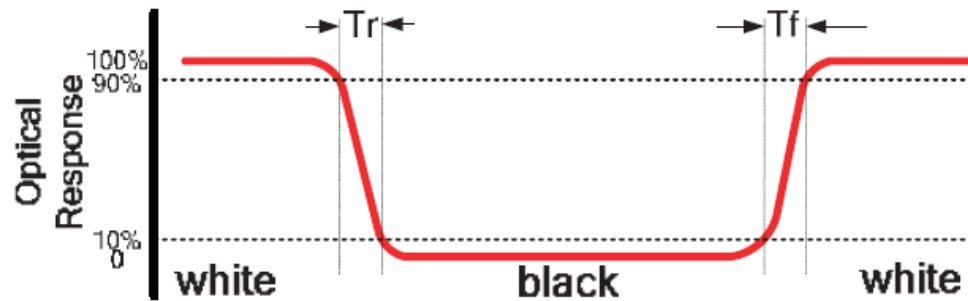
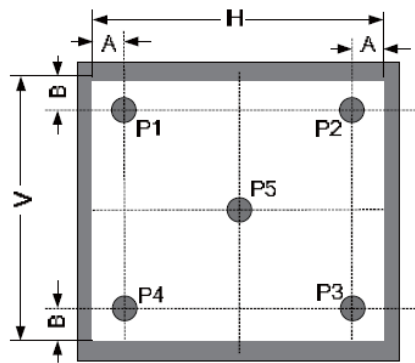


Figure 3. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity



A: 5mm

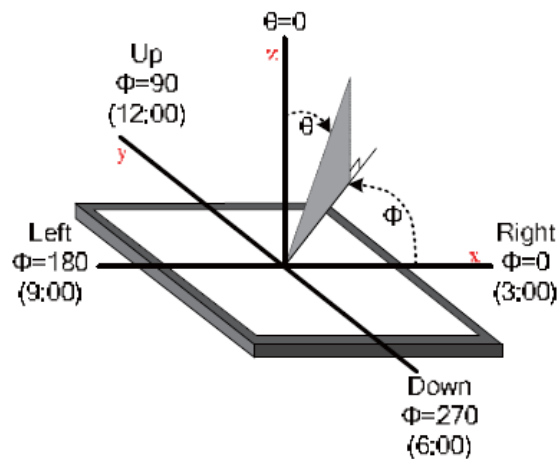
B: 5mm

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 4. The definition of viewing angle





## 10. INTERFACES DESCRIPTION

### 10.1 P1 connector - RiBUS description

| PIN NO. | CONNECTOR   | DESCRIPTION  | NOTE   |
|---------|-------------|--|--------|
| 1       | VDD         | Supply voltage for module; TYP 3.3 V   |        |
| 2       | GND         | Ground   |        |
| 3       | SPI_SCLK    | SPI SCK signal   |        |
| 4       | MISO/ IO.1  | SPI MISO signal / SPI Quad mode: SPI data line 1                               |        |
| 5       | MOSI/ IO.0  | SPI MOSI signal / SPI Quad mode: SPI data line 0                               |        |
| 6       | CS          | SPI chip select signal   |        |
| 7       | INT         | Interrupt signal from device to the system, Active Low, Internally 47k Pull UP |        |
| 8       | RST/PD      | Reset / Power down signal, Active Low, Internally Pulled UP 47k                |        |
| 9       | GPIO.0      | GPIO.0   |        |
| 10      | DISP_AUDIO  | Display audio in/out   | NOTE 1 |
| 11      | GPIO.1/IO.2 | SPI Single/Dual mode: General purpose IO0.<br>QSPI mode: SPI data line 2       |        |
| 12      | GPIO.2/IO.3 | SPI Single/Dual mode: General purpose IO1.<br>QSPI mode: SPI data line 3       |        |
| 13      | NC          | Not connected  |        |
| 14      | NC          | Not connected  |        |
| 15      | NC          | Not connected  |        |
| 16      | NC          | Not connected  |        |
| 17      | BLVDD       | Supply voltage for backlight   |        |
| 18      | BLVDD       | Supply voltage for backlight   |        |
| 19      | BLGND       | Backlight Ground, Internally connected to GND                                  |        |
| 20      | BLGND       | Backlight Ground, Internally connected to GND                                  |        |

**Note 1.** Requirements for audio external signal voltage will be announced after samples have been tested.

### 10.2 P2 connector description

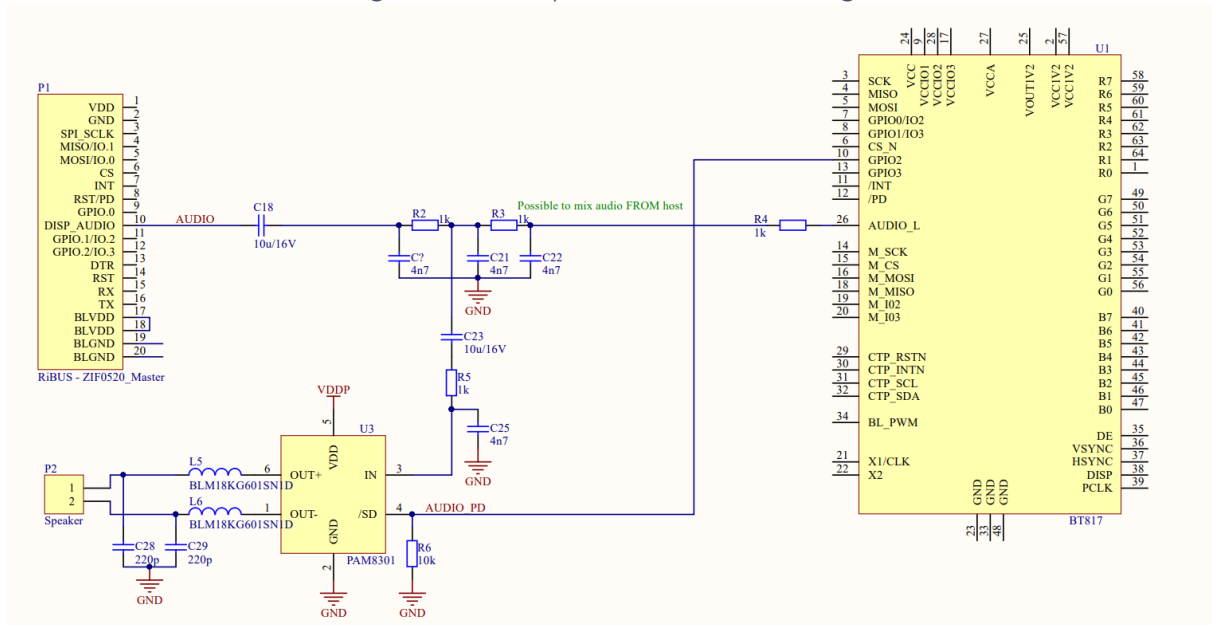
| PIN NO. | SYMBOL    | DESCRIPTION               | NOTE   |
|---------|-----------|---------------------------|--------|
| 1       | SPEAKER + | Speaker coil "+" terminal | NOTE 1 |
| 2       | SPEAKER - | Speaker coil "-" terminal |        |

The audio circuit allows for the following 3 things:

1. To play sounds from BT817Q on internal amplifier U3.
2. To play sounds from host on internal amplifier U3.
3. To play sounds from BT817Q on external amplifier.

**Note 1.** The loudspeaker assembly (loudspeaker + cables + plug compatible with P2 connector) will be sold separately. The documentation of the loudspeaker assembly will be released soon.

Figure 5. The simplified audio circuit design



**Note 2.** Controller board in RVTI01HVBNC00 is equipped with the separate 512Mb flash memory chip, which allows to store up to 110 full resolution (1280 \* 800 pixels, JPG) images. If you need to change the memory size, please contact us: [contact@riverdi.com](mailto:contact@riverdi.com)

## 11. BT817Q CONTROLLER SPECIFICATION

BT817Q or EVE4 (Embedded Video Engine 4) simplifies the system architecture for advanced human machine interfaces (HMIs) by providing functionality for display, audio, and touch as well as an object-oriented architecture approach that extends from display creation to the rendering of the graphics.

### 11.1 Serial host interface

Figure 6. SPI single/dual interface connection

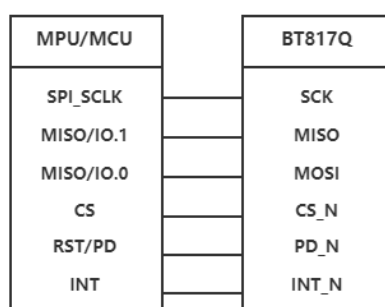
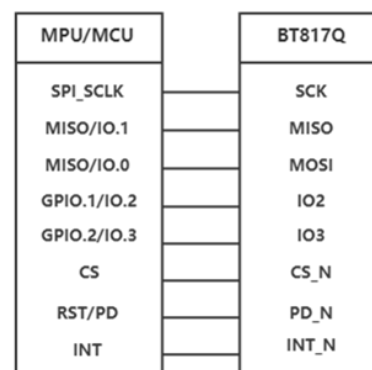


Figure 7. QSPI interface connection



**SPI Interface** – the SPI slave interface operates up to 30MHz (It depends on EVE4 system clock frequency and needs verification in Riverdi lab).

Only SPI mode 0 is supported. The SPI interface is selected by default.

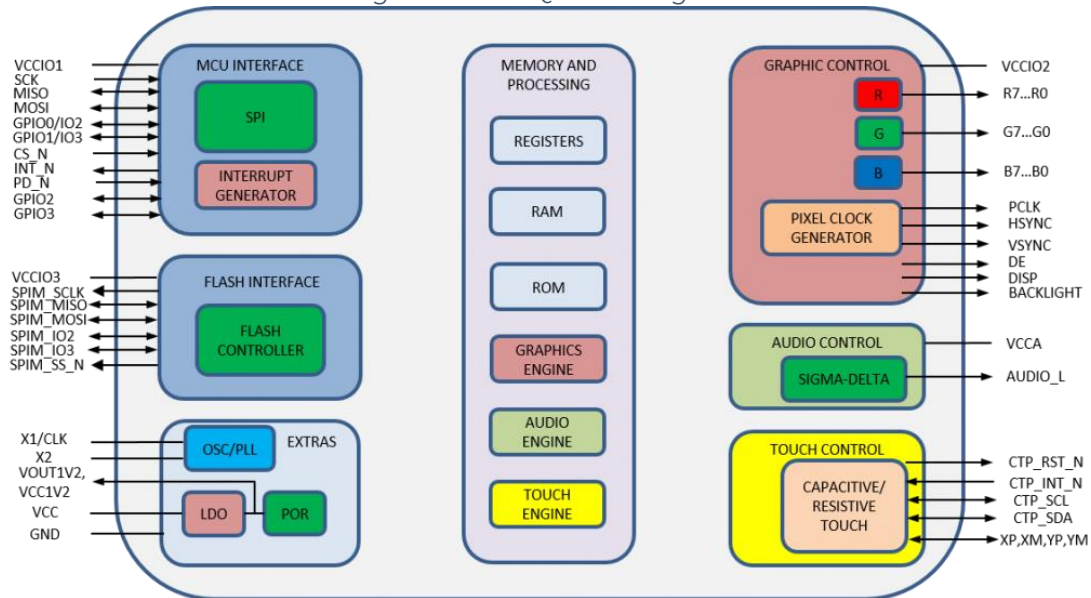
**QSPI Interface** – the QSPI slave interface operates up to 30MHz (It depends on EVE 4 system clock frequency and will be verified in Riverdi lab). Only SPI mode 0 is supported.

The QSPI can be configured as a SPI slave in SINGLE, DUAL or QUAD channel modes.

By default, the SPI slave operates in the SINGLE channel mode with MOSI as input from the master and MISO as output to the master. DUAL and QUAD channel modes can be configured through the SPI slave itself. To change the channel modes, write to register REG\_SPI\_WIDTH.

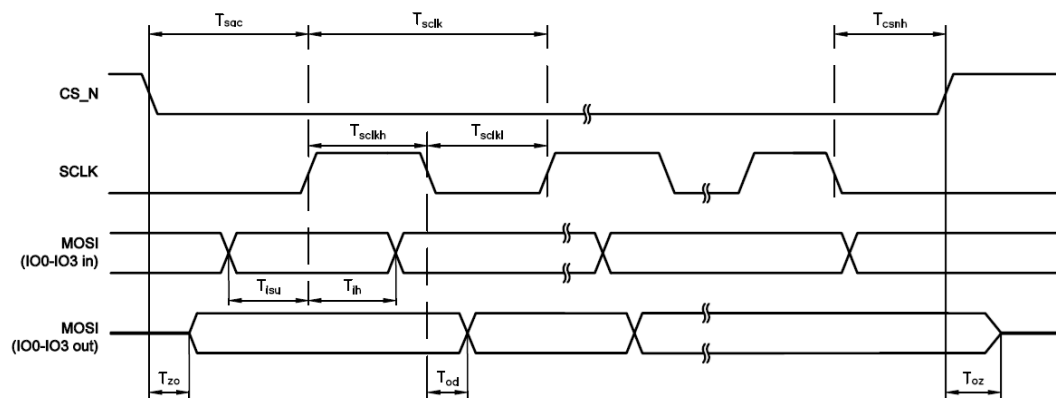
## 11.2 Block diagram

Figure 8. BT817Q Block diagram



## 11.3 Host interface SPI mode 0

Figure 9. SPI timing diagram



The meanings of the timings in the Figure 9 are defined in the table below.

| PARAMETER         | DESCRIPTION             | VCCIO=1.8V |     | VCCIO=2.5V |     | VCCIO=3.3V |     | UNIT |
|-------------------|-------------------------|------------|-----|------------|-----|------------|-----|------|
|                   |                         | Min        | Max | Min        | Max | Min        | Max |      |
| T <sub>sclk</sub> | SPI clock period        | 33.3       | -   | 33.3       | -   | 33.3       | -   | ns   |
| T <sub>sckl</sub> | SPI clock low duration  | 13         | -   | 13         | -   | 13         | -   |      |
| T <sub>sckh</sub> | SPI clock high duration | 13         | -   | 13         | -   | 13         | -   |      |
| T <sub>sac</sub>  | SPI access time         | 4          | -   | 3.5        | -   | 3          | -   |      |
| T <sub>isu</sub>  | Input Setup             | 4          | -   | 3.5        | -   | 3          | -   |      |
| T <sub>ih</sub>   | Input Hold              | 0          | -   | 0          | -   | 0          | -   |      |
| T <sub>zo</sub>   | Output enable delay     | -          | 16  | -          | 13  | 11         | -   |      |
| T <sub>oz</sub>   | Output disable delay    | -          | 13  | -          | 11  | 10         | -   |      |
| T <sub>od</sub>   | Output data delay       | -          | 15  | -          | 12  | 11         | -   |      |
| T <sub>csnh</sub> | CSN hold time           | 0          | -   | 0          | -   | 0          | -   |      |

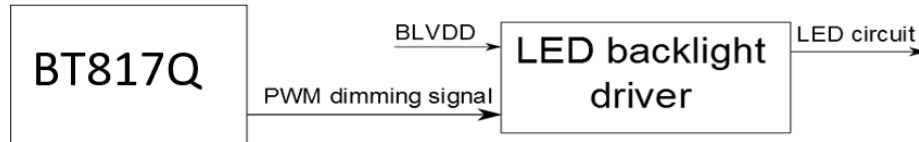
For more information about BT817Q controller please go to official BT81x website.

<https://brtchip.com/bt81x/>

## 11.4 Backlight driver block diagram

Backlight enable signal is internally connected to BT817Q backlight control pin. This pin is controlled by two BT817Q's registers. One of them specifies the PWM output frequency, second one specifies the duty cycle. Refer to BT817Q datasheet for more information. After we have done the test on samples, more detailed description will be given in this document.

Figure 10. Backlight driver block diagram



The LED backlight driver used in this module does not burst the LED current. Therefore, it does not generate audible noises on the output capacitor. It is equipped with soft start subsystem, which increases LED lifetime, as LED current peaks are reduced significantly.



## 13. CAPACITIVE TOUCH SCREEN PANEL SPECIFICATIONS

### 13.1 Mechanical characteristics

| DESCRIPTION              | SPECIFICATION         | REMARK  |
|--------------------------|-----------------------|---------|
| Touch Panel Size         | 10.1 inch             | uxTouch |
| Outline Dimension of CTP | 257.96 mm x 168.60 mm |         |
| Product Thickness        | 2.35 mm               |         |
| Glass Thickness          | 1.1 mm                |         |
| CTP View Area            | 217.96 mm x 136.60 mm |         |
| Sensor Active Area       | 218.96mm x 137.60 mm  |         |
| Surface Hardness         | 7H                    |         |

### 13.2 Electrical characteristics

| DESCRIPTION             |             | SPECIFICATION | REMARK |
|-------------------------|-------------|---------------|--------|
| Power Consumption (IDD) | Active Mode | 90 mA         | Note 1 |
|                         | Sleep Mode  | 10 mA         | Note 1 |
| Linearity               |             | +/- 1.5mm     |        |
| Controller              |             | ILI2132A      |        |
| Resolution              |             | 1280 x 800    |        |

**Note 1.** These 2 values will be verified on the real samples.



## 14. MODULE INITIALIZATION

1. There is no need to set touch calibration matrix (REG\_TOUCH\_TRANSFORM\_A-F registers in BT817Q) as touch panel resolution and orientation are the same as display, so default values in BT817Q are correct.
2. Initialization data, timings and example codes are available on the Riverdi GitHub, at address: <https://github.com/riverdi/riverdi-eve>
3. REGISTER VALUES:

|               |       |
|---------------|-------|
| REG_HSIZE     | 1280  |
| REG_VSIZE     | 800   |
| REG_HCYCLE    | 1440  |
| REG_HOFFSET   | 88    |
| REG_HSYNC0    | 0     |
| REG_HSYNC1    | 20    |
| REG_VCYCLE    | 838   |
| REG_VOFFSET   | 23    |
| REG_VSYNC0    | 0     |
| REG_VSYNC1    | 10    |
| REG_PCLK      | 1     |
| REG_SWIZZLE   | 0     |
| REG_PCLK_POL  | 1     |
| REG_CSPREAD   | 0     |
| REG_DITHER    | 0     |
| REG_PCLK_FREQ | 0x8c1 |
| REG_PCLK_2X   | 0     |



## 15. INSPECTION

Standard acceptance/rejection criteria for TFT module

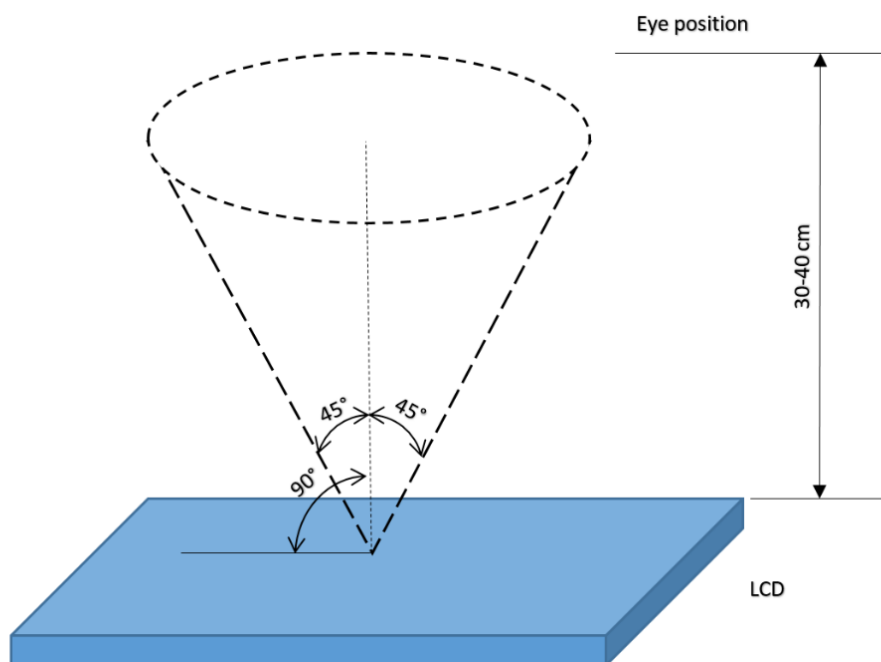
### 15.1 Inspection condition

Ambient conditions:

- Temperature:  $25 \pm 2^{\circ}\text{C}$
- Humidity:  $(60 \pm 10) \% \text{RH}$
- Illumination: Single fluorescent lamp non-directive (300 to 700 lux)

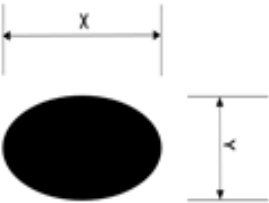
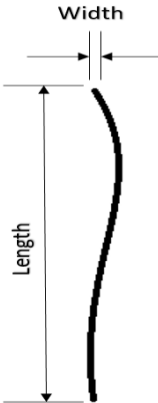
Viewing distance:  $35 \pm 5\text{cm}$  between inspector bare eye and LCD.

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



## 15.2 Inspection standard

The LCD TFT has zero bad pixels. Please refer the item "Bright/Dark dots".

| ITEM   | CRITERION  |  |                         |               |
|--|--|--|-------------------------|---------------|
| Black spots,<br>white spots,<br>light leakage,<br>Foreign Particle<br>(round Type) | <div><br/><math>D=(x+y)/2</math><br/>Spots density: 10 mm</div> | Size =10.1"                              |                         |               |
|  |  | Average Diameter                         | Qualified Qty           |               |
|  |  | $D \leq 0.2 \text{ mm}$                  | Ignored                 |               |
|  |  | $0.2 \text{ mm} < D \leq 0.3 \text{ mm}$ | $N \leq 4$              |               |
|  |  | $0.5 \text{ mm} < D$                     | $N = 0$                 |               |
| LCD black spots,<br>white spots,<br>light leakage<br>(line Type)                   | <div><br/>Spots density: 10 mm</div>                           | Size =10.1"                              |                         |               |
|  |  | Length                                   | Width                   | Qualified Qty |
|  |  | -  | $W \leq 0.05$           | Ignored       |
|  |  | $L \leq 5.0$                             | $0.05 < W \leq 0.1$     | $N \leq 3$    |
|  |  | $5.0 < L$                                | $0.10 < W$<br>$5.0 < L$ | $N = 0$       |
| Bright/Dark<br>Dots  | Size =10.1"  |  |                         |               |
|  | Item   |  | Qualified Qty           |               |
|  | Bright dots  |  | 0                       |               |
|  | Dark dots  |  | 0                       |               |
|  | Cluster Bright Dots or Dark Dots   |  | 0                       |               |
|  | Total Bright and Dark Dots   |  | 0                       |               |
| Clear spots  | Size $\geq 5"$   |  |                         |               |
|  | Average Diameter   |  | Qualified Qty           |               |
|  | $D < 0.2 \text{ mm}$   |  | Ignored                 |               |
|  | $0.2 \text{ mm} < D < 0.3 \text{ mm}$  |  | 4                       |               |
|  | $0.3 \text{ mm} < D < 0.5 \text{ mm}$  |  | 2                       |               |
|  | $0.5 \text{ mm} < D$   |  | 0                       |               |
|  | Spots density: 10 mm   |  |                         |               |
| Touch panel<br>spot  | Size $\geq 5"$   |  |                         |               |
|  | Average Diameter   |  | Qualified Qty           |               |
|  | $D < 0.25 \text{ mm}$  |  | Ignored                 |               |
|  | $0.25 \text{ mm} < D < 0.5 \text{ mm}$   |  | 4                       |               |
|  | $0.5 \text{ mm} < D$   |  | 0                       |               |
|  | Size $\geq 5"$   |  |                         |               |
|  | Length   | Width                                    | Qualified Qty           |               |
|  |  |  |                         |               |



|             |           |                   |         |
|-------------|-----------|-------------------|---------|
| Touch panel | -         | $W < 0.03$        | Ignored |
| White line  | $L < 5.0$ | $0.03 < W < 0.05$ | 2       |
| Scratch     | -         | $0.05 < W$        | 0       |

## 16. RELIABILITY TEST

| NO. | TEST ITEM                           | TEST CONDITION   | NOTE   |
|-----|-------------------------------------|--|--------|
| 1   | High Temperature Storage            | 80°C/120 hours   | Note 1 |
| 2   | Low Temperature Storage             | -30°C/120 hours  |        |
| 3   | High Temperature Operating          | 70 °C /120 hours   |        |
| 4   | Low Temperature Operating           | -20°C/120 hours  |        |
| 5   | High Temperature and High Humidity  | Humidity 40°C, 90%RH, 120Hrs   |        |
| 6   | Thermal Cycling Test (No operation) | -20°C for 30min, 70°C for 30 min.<br>100 cycles. Then test at room temperature after 1 hour  | Note 2 |
| 7   | Vibration Test                      | Frequency: 10 ÷ 55 Hz.<br>Stroke: 1.5 mm.<br>Sweep: 10Hz ÷ 55Hz ÷ 10 Hz.<br>2 hours for each direction of X, Y, Z<br>(Total 6 hours) |        |
| 8   | Package Drop Test                   | Height: 60 cm<br>1 corner, 3 edges, 6 surfaces   |        |

**Note 1.** Sample quantity for each test item is 5 ÷ 10 pcs.

**Note 2.** Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.



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