



RiTFT-50 series

5" EVE3 SERIES LCD TFT

Rev.1.0

2018-10-22

| ITEM | CONTENTS | UNIT |
|--------------------------------|---------------------------------------|----------|
| LCD Type | TFT/Transmissive/Normally white | / |
| Size | 5.0 | Inch |
| Viewing Direction | 12:00 (without image inversion) | O' Clock |
| Gray Scale Inversion Direction | 6:00 | O' Clock |
| Number of Dots | 800 x (RGB) x 480 | / |
| Driver IC | BT81x | / |
| Interface Type | SPI/QSPI | / |
| Module Memory Size | 1 MB (BT81x) + 64 Mb (external flash) | / |
| Color Depth | 16.7M | / |
| Pixel Arrangement | RGB Vertical Stripe | / |
| Surface Treatment | Anti-glare / Clear (for CTP) | / |
| Input Voltage | 3.3 | V |

Note 1: RoHS, REACH SVHC compliant

Note 2: LCM weight tolerance: $\pm 5\%$.

REVISION RECORD

| REVNO. | REVDATE | CONTENTS | REMARKS |
|--------|------------|-----------------|---------|
| 1.0 | 2018-10-22 | Initial Release | |

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1 MODULE CLASSIFICATION INFORMATION

| | | | | | | | | | |
|-----------|----------|-----------|----------|----------|----------|----------|----------|----------|-----------|
| RV | T | 50 | X | Q | B | X | W | X | 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 | 50 – 5.0” |
| 4. | MODEL SERIAL NO. | A (A-Z) Ux - UxTouch |
| 5. | RESOLUTION | Q– 800x480 px |
| 6. | INTERFACE | B – TFT + Controller BT81x |
| 7. | FRAME | N – No Frame F – Mounting Frame U – UxTouch |
| 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) |

2 ASSEMBLY GUIDE - INTEGRATION

Three options of rear side adhesive tape are available: double side adhesive tape 0.2 mm with 3M 467MP glue, foam double side adhesive tape 0.5 mm with DST 3M 9495LE glue or without any tape. There are also two versions of glass color: black and white.

Rear side adhesive tape options:

| | | |
|---|--|---|
|  |  |  |
| Double side adhesive tape with DST 3M 9495LE glue (total thickness 0.2mm) | Foam double side adhesive tape with 3M 9495LE glue (total thickness 0.5mm) | Without tape |

Cover glass color options:

| | |
|--|---|
|  |  |
| BLACK | WHITE |

Product options:

| NAME OF THE PRODUCT | PART NUMBER | DESCRIPTION |
|------------------------|----------------|---|
| RiTFT-50 | RVT50AQBWNW00 | BT816, no touch panel |
| RiTFT-50-RES | RVT50AQBWNWR00 | BT816, resistive touch panel |
| RiTFT-50-CAP | RVT50AQBWNWC00 | BT815, capacitive touch panel |
| RiTFT-50-FR | RVT50AQBFWN00 | BT816, no touch panel, mounting frame |
| RiTFT-50-RES-FR | RVT50AQBFWR00 | BT816, resistive touch panel, mounting frame |
| RiTFT-50-CAP-FR | RVT50AQBFWC00 | BT815, capacitive touch panel, mounting frame |
| RiTFT-50-CAP-UX | RVT50UQBNWC00 | BT815, uxTouch, black cover glass, 0.2mm DST |
| | RVT50UQBNWC01 | BT815, uxTouch, black cover glass, 0.5 mm DST |
| | RVT50UQBNWC02 | BT815, uxTouch, black cover glass, no DST |
| | RVT50UQBNWC03 | BT815, uxTouch, white cover glass, 0.2mm DST |
| | RVT50UQBNWC04 | BT815, uxTouch, white cover glass, 0.5 mm DST |
| | RVT50UQBNWC05 | BT815, uxTouch, white cover glass, no DST |

2.1 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" and 7.0" display sizes.

UxTouch models with double-side adhesive tape (PN with endings 00, 01, 03, 04) can be mounted by connecting the glass to the housing. Riverdi recommends to use 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 and Figure 2 below show examples of using support elements.

Figure 1. Example of using support brackets

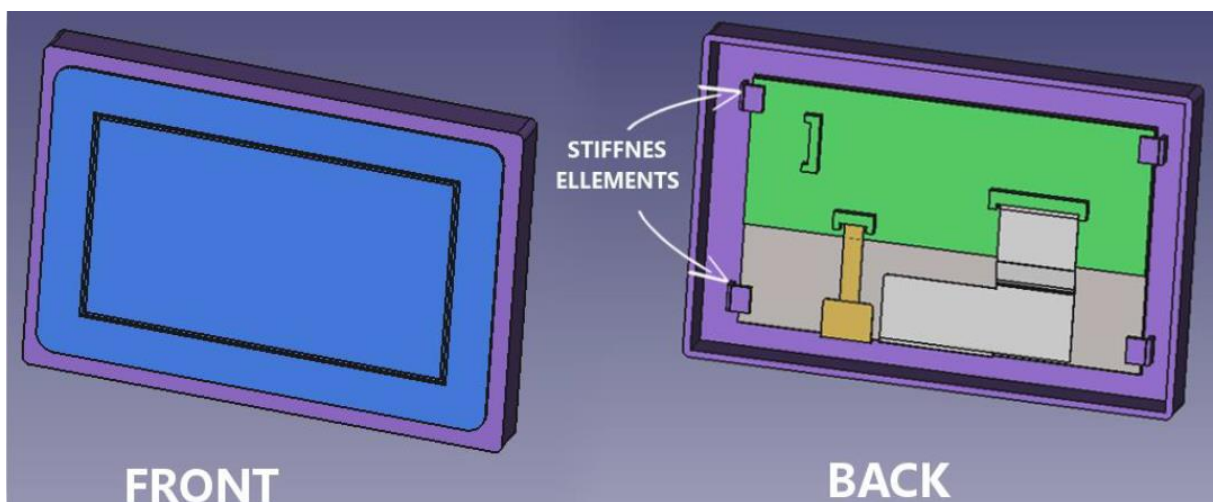
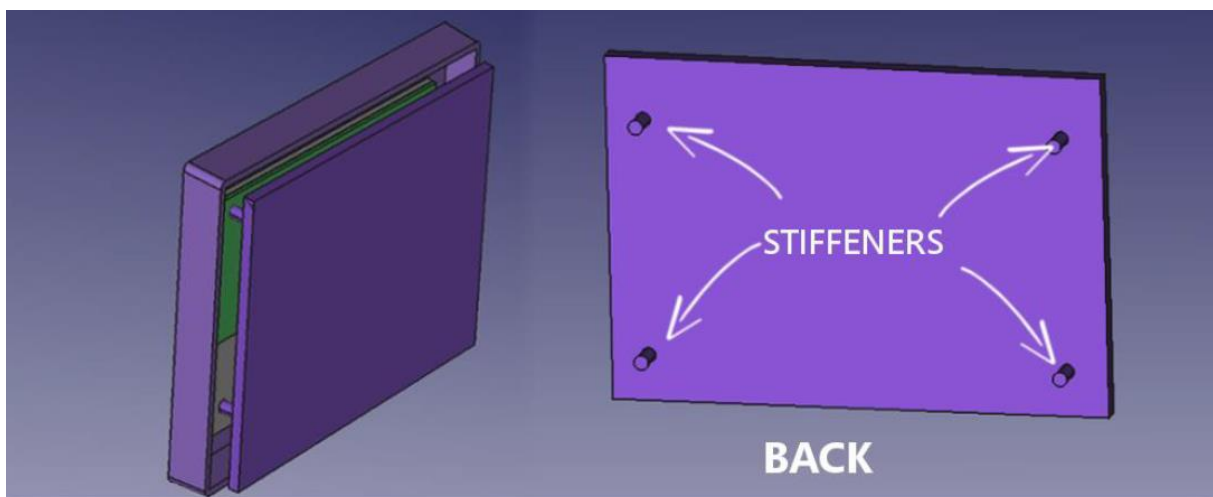


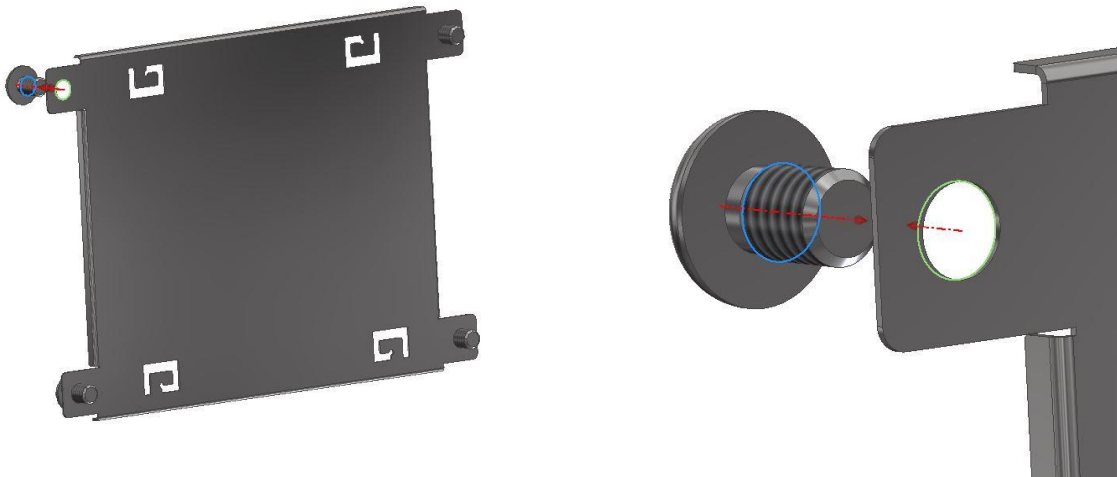
Figure 2. Example of using fixing sleeves



2.2 Mounting frame

For dimensions 3.5", 4.3", 5.0" and 7.0" the product with mounting frame version is available. Thanks to the four catches attached to the side, frame provides strong assembly to the surface by mounting element (like the screw, see Figure 3). The frames are specially designed to fit Riverdi products perfectly. The diameter of the mounting hole is 3.5mm.

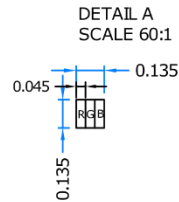
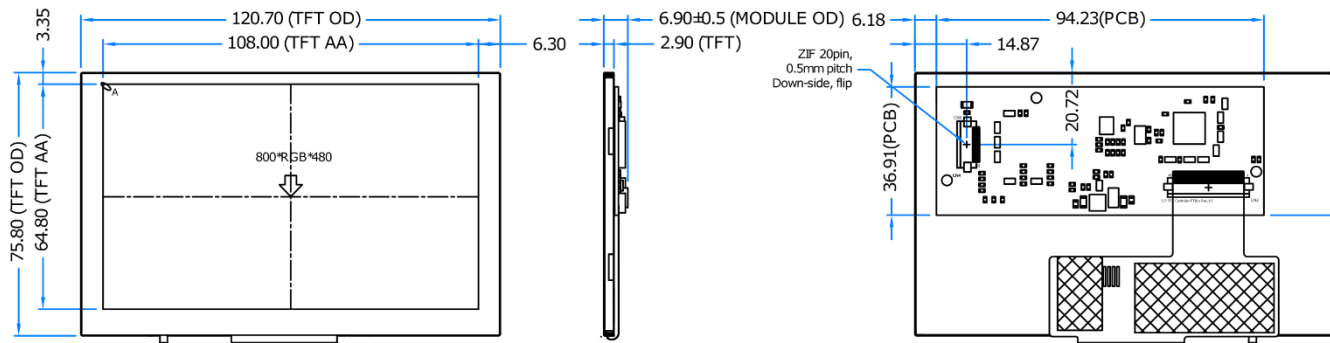
Figure 3. Mounting frame



LCD TFT Datasheet Rev.1.0
 RiTFT-50 series

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| Revision: | |
| 1.0 | |

RiTFT-50



GENERAL NOTES:

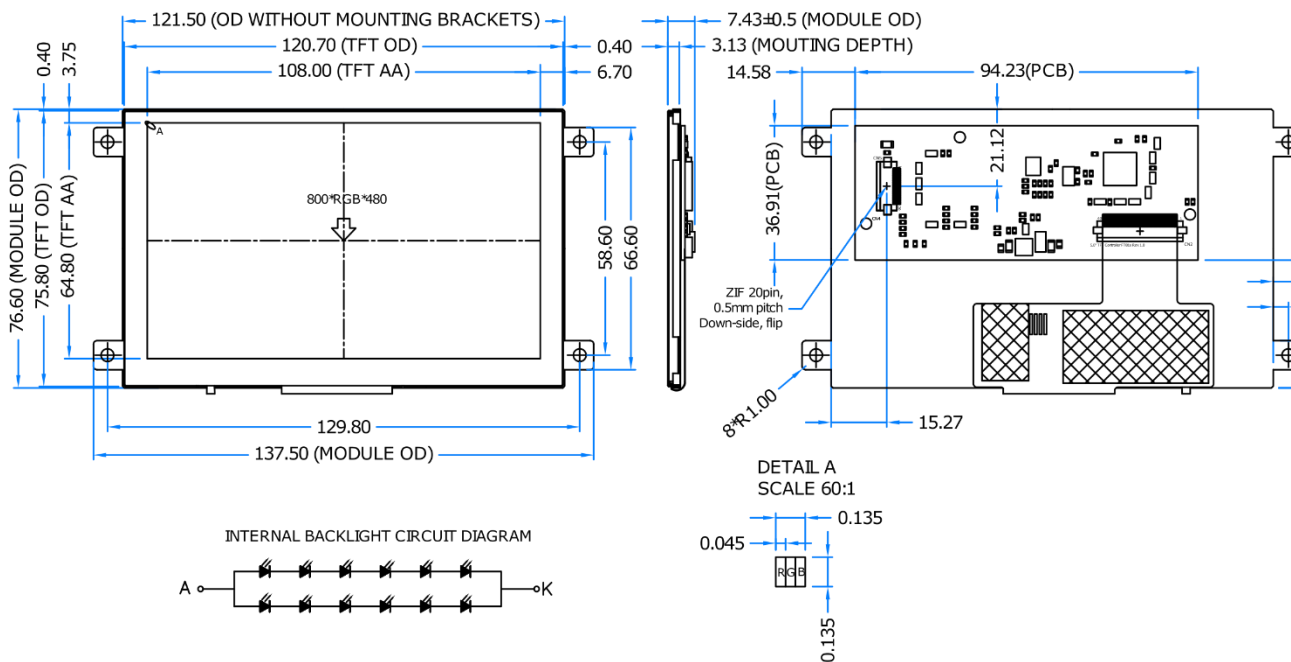
1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
2. OPERATING VOLTAGE: VDD=3.3V
3. VIEWING DIRECTION: 12 O'CLOCK
4. IC DRIVER: BT816
5. OPERATING TEMP.: -20°C ~ 70°C
6. STORAGE TEMP.: -30°C ~ 80°C
7. LED BACKLIGHT: 12 WHITE LED, BUILT-IN INVERTER

9. LCM SURFACE LUMINANCE 600 cd/m²
10. GENERAL TOLERANCE: ±0.2 mm
11. RoHS COMPLIANT

| |
|-----------------|
| PN: RVT50AQBWNW |
| SN: ### |
| DRAWN: P.M. |
| CHECKED: |
| APPR: |

| | |
|-----------|--|
| Revision: | |
| 1.0 | |

RiTFT-50-FR



GENERAL NOTES:

1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
2. OPERATING VOLTAGE: VDD=3.3V
3. VIEWING DIRECTION: 12 O'CLOCK
4. IC DRIVER: BT816
5. OPERATING TEMP.: -20°C ~ 70°C
6. STORAGE TEMP.: -30°C ~ 80°C
7. LED BACKLIGHT: 12 WHITE LED, BUILT-IN INVERTER

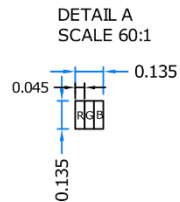
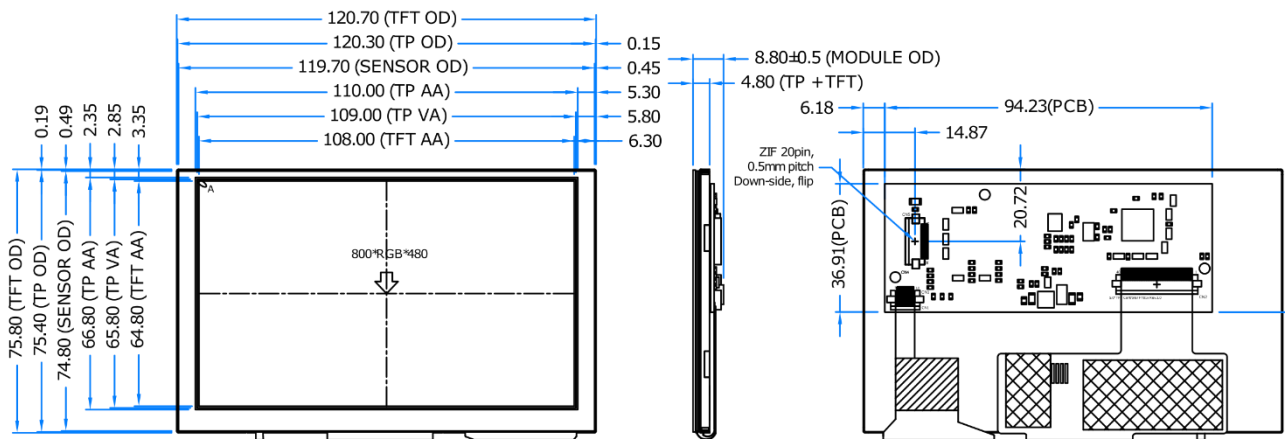
9. LCM SURFACE LUMINANCE 600 cd/m²
10. GENERAL TOLERANCE: ±0.2 mm
11. RoHS COMPLIANT

| |
|-----------------|
| PN: RVT50AQBFWN |
| SN: ### |
| DRAWN: P.M. |
| CHECKED: |
| APPR: |

LCD TFT Datasheet Rev.1.0
 RiTFT-50 series

| | |
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| Revision: | |
| 1.0 | |

RiTFT-50-CAP



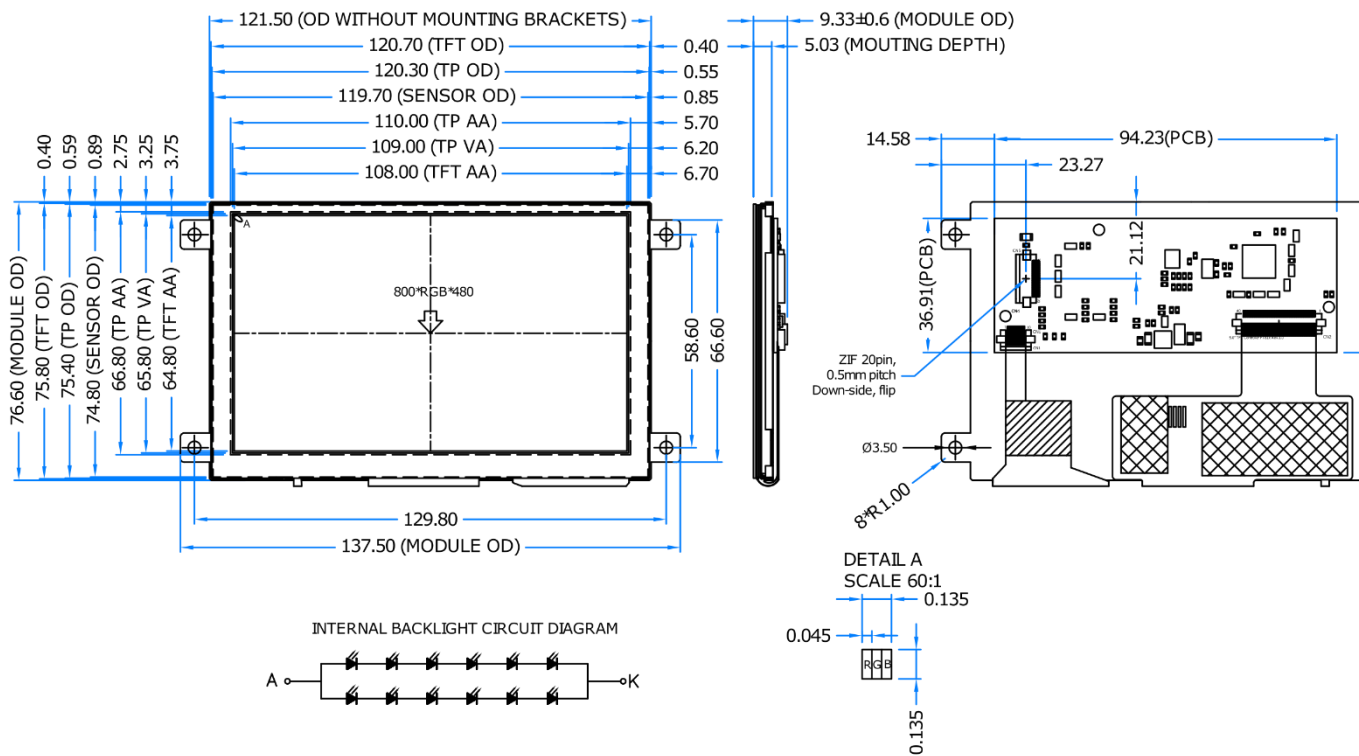
GENERAL NOTES:
 1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
 2. OPERATING VOLTAGE: VDD=3.3V
 3. VIEWING DIRECTION: 12 O'CLOCK
 4. IC DRIVER: BT815
 5. IC DRIVER CTP: FT5446
 6. OPERATING TEMP.: -20°C ~ 70°C
 7. STORAGE TEMP.: -30°C ~ 80°C
 8. LED BACKLIGHT: 12 WHITE LED, BUILT-IN INVERTER

9. LCM SURFACE LUMINANCE 510 cd/m²
 10. GENERAL TOLERANCE: ±0.2 mm
 11. RoHS COMPLIANT

| |
|-----------------|
| PN: RVT50AQBNCW |
| SN: ### |
| DRAWN: P.M. |
| CHECKED: |
| APPR: |

| | |
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| Revision: | |
| 1.0 | |

RiTFT-50-CAP-FR



GENERAL NOTES:

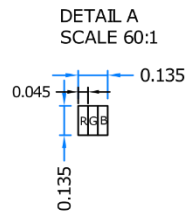
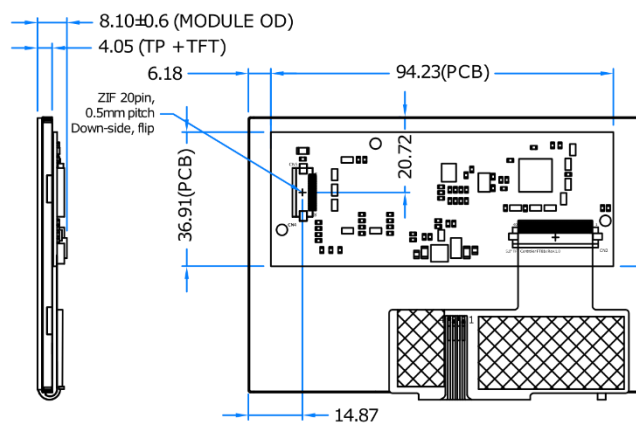
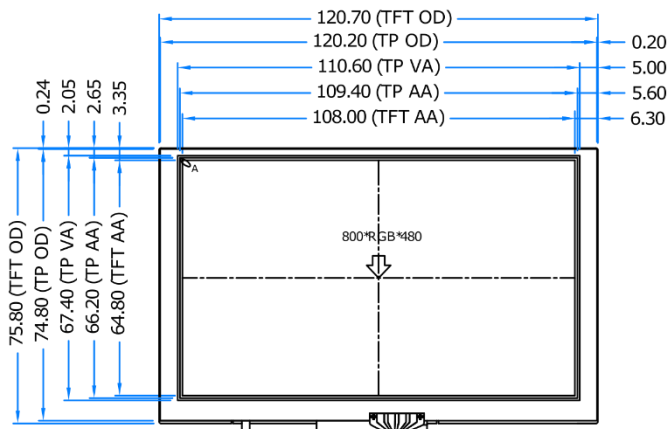
1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
2. OPERATING VOLTAGE: VDD=3.3V
3. VIEWING DIRECTION: 12 O'CLOCK
4. IC DRIVER: BT815
5. IC DRIVER CTP: FT5446
6. OPERATING TEMP.: -20°C ~ 70°C
7. STORAGE TEMP.: -30°C ~ 80°C
8. LED BACKLIGHT: 12 WHITE LED, BUILT-IN INVERTER

9. LCM SURFACE LUMINANCE 510 cd/m²
 10. GENERAL TOLERANCE: ±0.2 mm
 11. RoHS COMPLIANT

PN: RVT50AQBFWCC
 SN: ###
 DRAWN: P.M.
 CHECKED:
 APPR:

| | |
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| Revision: | |
| 1.0 | |

RiTFT-50-RES



GENERAL NOTES:

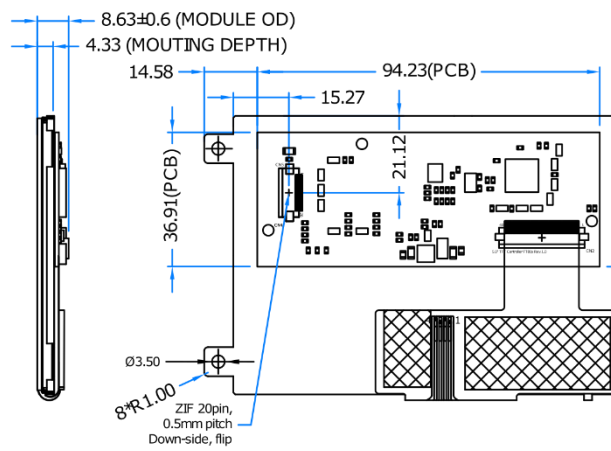
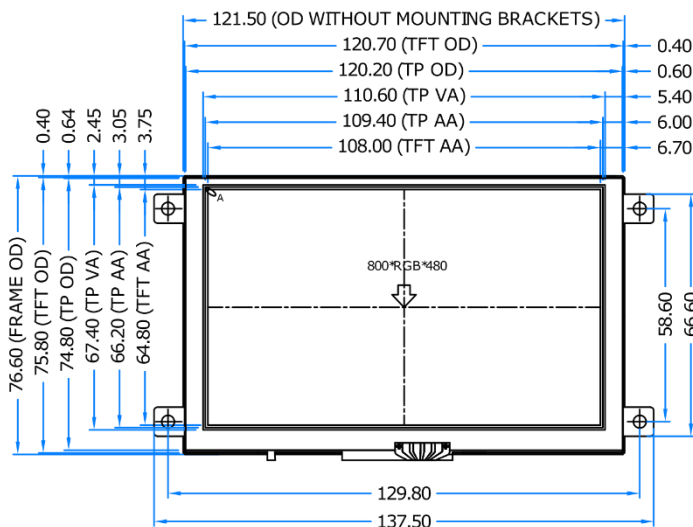
1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
2. OPERATING VOLTAGE: VDD=3.3V
3. VIEWING DIRECTION: 12 O'CLOCK
4. IC DRIVER: BT816
5. OPERATING TEMP.: -20°C ~ 70°C
6. STORAGE TEMP.: -30°C ~ 80°C
7. LED BACKLIGHT: 12 WHITE LED, BUILT-IN INVERTER

9. LCM SURFACE LUMINANCE 480 cd/m²
10. GENERAL TOLERANCE: ±0.2 mm
11. RoHS COMPLIANT

| |
|------------------|
| PN: RVT50AQBWNWR |
| SN: ### |
| DRAWN: P.M. |
| CHECKED: |
| APPR: |

| | |
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| Revision: | |
| 1.0 | |

RiTFT-50-RES-FR



DETAIL A
SCALE 60:1



GENERAL NOTES:

1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
2. OPERATING VOLTAGE: VDD=3.3V
3. VIEWING DIRECTION: 12 O'CLOCK
4. IC DRIVER: BT816
5. OPERATING TEMP.: -20°C ~ 70°C
6. STORAGE TEMP.: -30°C ~ 80°C
7. LED BACKLIGHT: 12 WHITE LED, BUILT-IN INVERTER

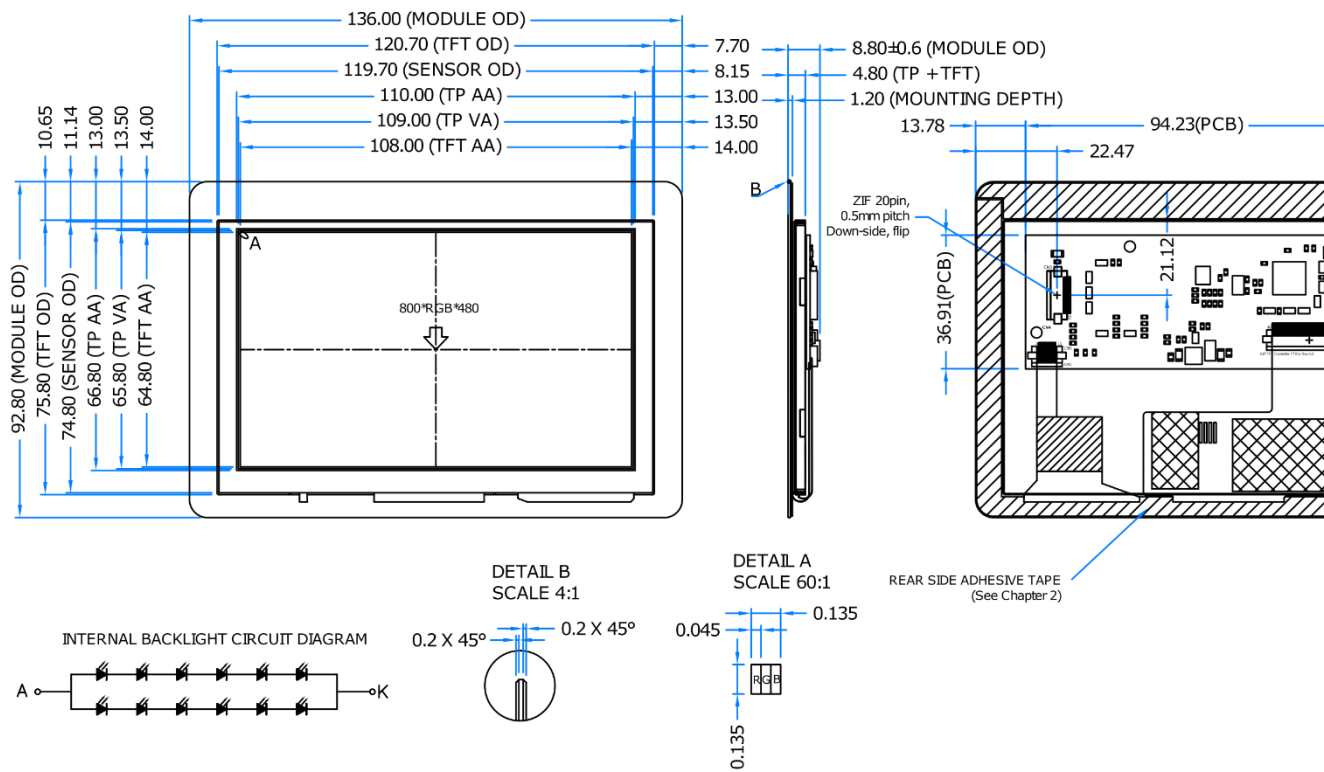
9. LCM SURFACE LUMINANCE 480 cd/m²
10. GENERAL TOLERANCE: ±0.2 mm
11. RoHS COMPLIANT

| |
|------------------|
| PN: RVT50AQBFWRC |
| SN: ### |
| DRAWN: P.M. |
| CHECKED: |
| APPR: |

LCD TFT Datasheet Rev.1.0
 RiTFT-50 series

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| Revision: | |
| 1.0 | |

RiTFT-50-UX



GENERAL NOTES:

1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
2. OPERATING VOLTAGE: VDD=3.3V
3. VIEWING DIRECTION: 12 O'CLOCK
4. IC DRIVER: BT815
5. IC DRIVER CTP: FTS446
6. OPERATING TEMP.: -20°C ~ 70°C
7. STORAGE TEMP.: -30°C ~ 80°C
8. LED BACKLIGHT: 12 WHITE LED, BUILT-IN INVERTER

9. LCM SURFACE LUMINANCE 510 cd/m²
10. GENERAL TOLERANCE: ±0.2 mm
11. RoHS COMPLIANT

PN: RVT50UQBWNWC
 SN: ###
 DRAWN: P.M.
 CHECKED:
 APPR:

4 ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|---------------------------------|-----------------|-----|----------------|------|
| Supply Voltage for Logic | VDD | 0 | 4.0 | V |
| Supply Voltage for LED inverter | BLVDD | 0 | 7.0 | V |
| Input Voltage for Logic | VIN | 0 | 4.0 | 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 |

5 ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT | NOTES |
|-----------------------------------|--------------------------|--------|-----|--------|------|------------|
| Supply Voltage For Module | VDD | 3.0 | 3.3 | 3.6 | V | |
| Input Voltage for LED Inverter | BLVDD | 2.8 | 5.0 | 5.5 | V | |
| LED Backlight Current | IDD _{backlight} | - | 290 | 363 | mA | BLVDD=3.3V |
| LED Backlight Current | IDD _{backlight} | - | 180 | 225 | mA | BLVDD=5V |
| Input Voltage 'H' level | V _{IH} | 0.8VDD | - | VDD | V | |
| Input Voltage 'L' level | V _{IL} | 0 | - | 0.2VDD | V | |
| Input Current | I _{in} | | TBD | | mA | |
| Input Current for module with CTP | I _{inc} | | TBD | | mA | |

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

6 BACKLIGHT CHARACTERISTICS

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT |
|---------------------------|----------------|-------|-------|------|------|
| Voltage for LED backlight | V _I | 17.4 | 18.3 | 19.6 | V |
| Current for LED backlight | I _I | 30 | 40 | 50 | mA |
| LED Life Time | - | 30000 | 50000 | - | Hrs |

Note: The LED Supply Voltage is defined by the numbers of LED at Ta=25°C and I_L= 40mA.

7 ELECTRO-OPTICAL CHARACTERISTICS

| ITEM | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT | REMARK | NOTE |
|-------------------------|---------|-----------------------|-------|-------|-------|-------------------|----------|------|
| Response Time | Tr+Tf | θ=0° φ=0° Ta=25 | - | 20 | - | ms | Figure 4 | 4 |
| Contrast Ratio | Cr | | - | 500 | - | --- | Figure 5 | 1 |
| Luminance Uniformity | δ WHITE | | 75 | 80 | - | % | Figure 5 | 3 |
| Surface Luminance | TFT | Lv | 540 | 600 | - | cd/m ² | Figure 5 | 2 |
| | TFT+CTP | | 500 | 540 | - | | | |
| | TFT+RTP | | 450 | 500 | - | | | |
| Viewing Angle Range | θ | φ = 90° | 40 | 50 | - | deg | Figure | 6 |
| | | φ = 270° | 60 | 70 | - | deg | Figure 6 | |
| | | φ = 0° | 60 | 70 | - | deg | Figure | |
| | | φ = 180° | 60 | 70 | - | deg | Figure 6 | |
| CIE (x, y) Chromaticity | Red | x | 0.540 | 0.590 | 0.640 | Figure 5 | 5 | |
| | | y | 0.300 | 0.350 | 0.400 | | | |
| | Green | x | 0.298 | 0.348 | 0.398 | | | |
| | | y | 0.520 | 0.570 | 0.620 | | | |
| | Blue | x | 0.095 | 0.145 | 0.195 | | | |
| | | y | 0.060 | 0.110 | 0.160 | | | |
| | White | x | 0.270 | 0.320 | 0.370 | | | |
| | | y | 0.310 | 0.360 | 0.410 | | | |

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

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

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

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 .

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

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 .

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.

Note 8. For TFT module, Gray scale reverse occurs in the direction of panel viewing angle.

Figure 4. The definition of response time

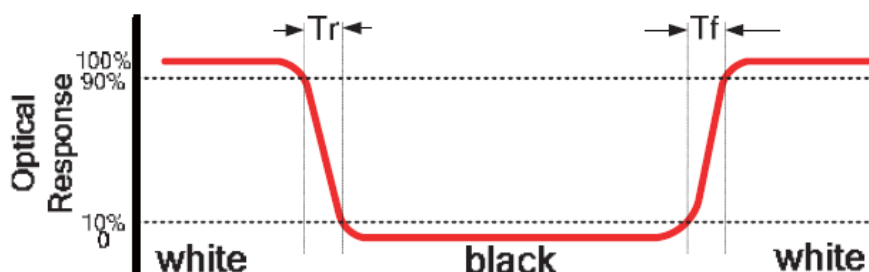


Figure 5. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

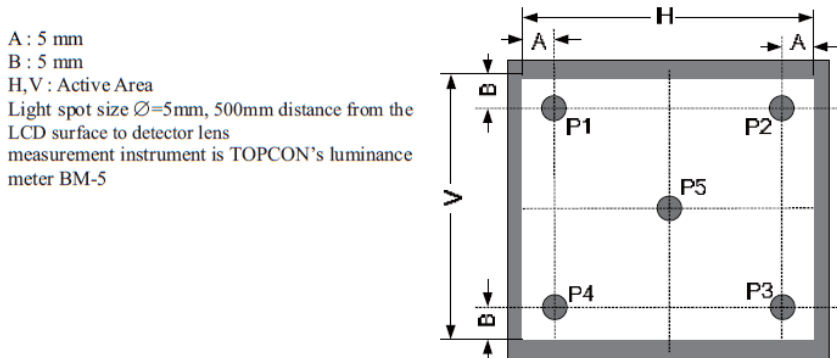
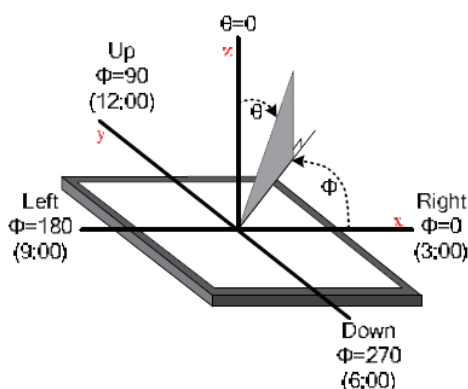


Figure 6. The definition of viewing angle



8 INTERFACE DESCRIPTION

| PIN NO. | SYMBOL | DESCRIPTION |
|---------|-----------|--|
| 1 | VDD | Power Supply |
| 2 | GND | Ground |
| 3 | SPI_SCLK | SPI SCK Signal, Internally 47k Pull UP |
| 4 | MISO/ IO1 | SPI MISO Signal / SPI Quad mode: SPI data line 1 |
| 5 | MOSI/ IO0 | SPI MOSI Signal / SPI Quad mode: SPI data line 0 |
| 6 | CS | SPI Chip Select Signal , Internally 47k Pull UP |
| 7 | INT | Interrupt Signal, Active Low, Internally 47k Pull UP |
| 8 | PD | Power Down Signal, Active Low, Internally 47k Pull UP |
| 9 | NC | Not Connected |
| 10 | AUDIO_OUT | Audio Out Signal |
| 11 | GPIO0/IO2 | SPI Single mode: General purpose IO0/ SPI Quad mode: SPI data line 2 |
| 12 | GPIO1/IO3 | SPI Single mode: General purpose IO1/ SPI Quad mode: SPI data line 3 |
| 13 | GPIO2 | General purpose IO2 |
| 14 | GPIO3 | General purpose IO3 or analog input for ADC |
| 15 | NC | Not Connected |
| 16 | NC | Not Connected |
| 17 | BLVDD | Backlight Power Supply, Can Be Connected to VDD |
| 18 | BLVDD | Backlight Power Supply, Can Be Connected to VDD |
| 19 | BLGND | Backlight Ground, Internally connected to GND |
| 20 | BLGND | Backlight Ground, Internally connected to GND |

9 BT8x CONTROLLER SPECIFICATIONS

BT8x or EVE3 (Embedded Video Engine 3) 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.

9.1 Serial host interface

Figure 7. SPI interface connection

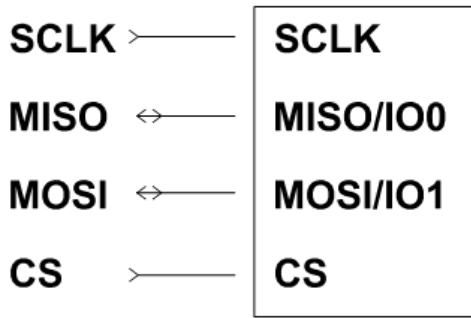
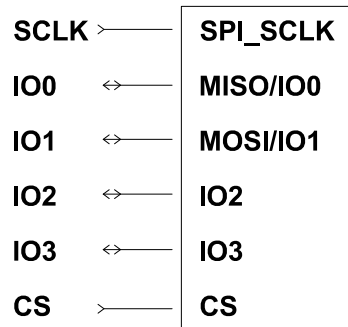


Figure 8. QSPI interface connection



SPI Interface – the SPI slave interface operates up to 30MHz.

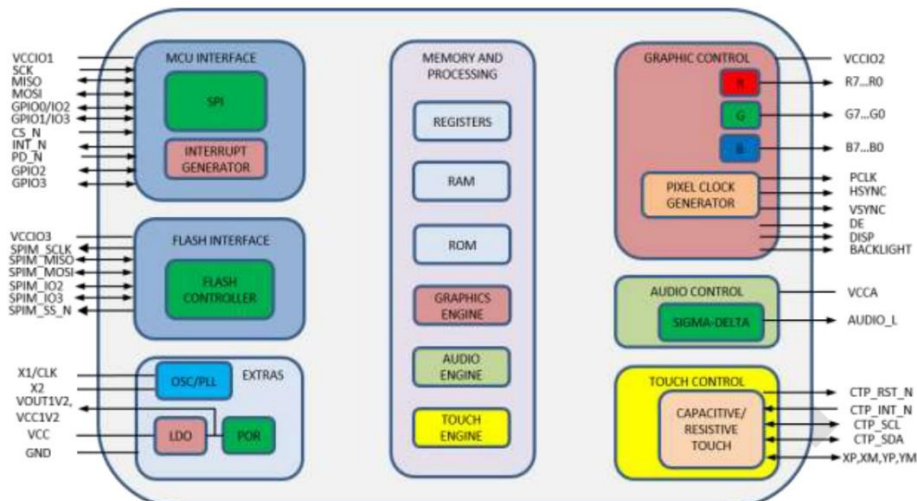
Only SPI mode 0 is supported. The SPI interface is selected by default (MODE pin is internally pulled low by 47k resistor).

QSPI Interface – the QSPI slave interface operates up to 30MHz. Only SPI mode 0 is supported. The QSPI can be configured as a SPI slave in SINGLE, DUAL or QUAD data bus 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.

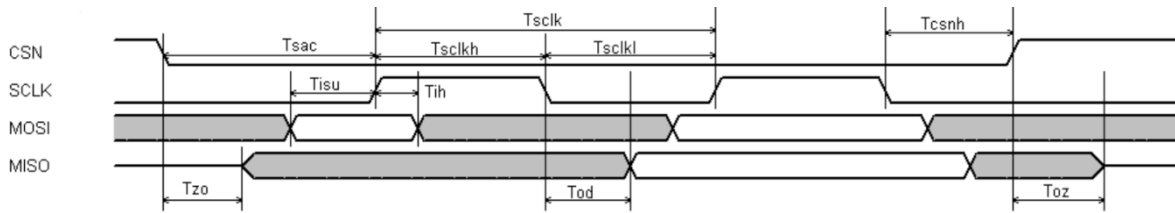
9.2 Block Diagram

Figure 9. BT8x Block diagram



9.3 Host interface SPI mode 0

Figure 10. SPI timing diagram



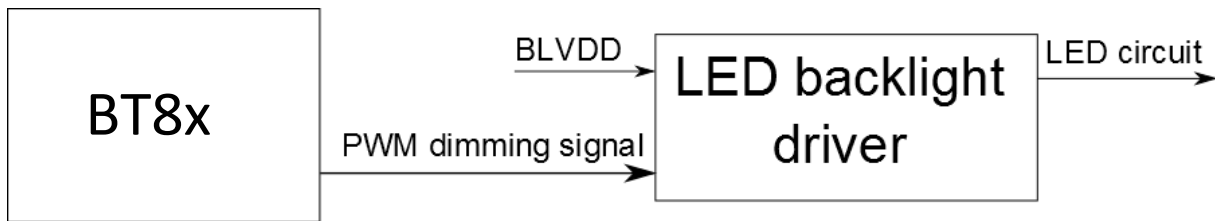
For more information about BT8x controller please go to official BT8x website.

<https://www.ftdichip.com/Products/ICs/BT81X.html>

9.4 Backlight driver block diagram

Backlight enable signal is internally connected to BT8x Backlight control pin. This pin is controlled by two BT8x’s registers. One of them specifies the PWM output frequency, second one specifies the duty cycle. Refer to BT8x datasheet for more information.

Figure 11. Backlight driver block diagram



10 LCD TIMING CHARACTERISTICS

10.1 Clock and data input time diagram

Figure 12. Horizontal input timing diagram

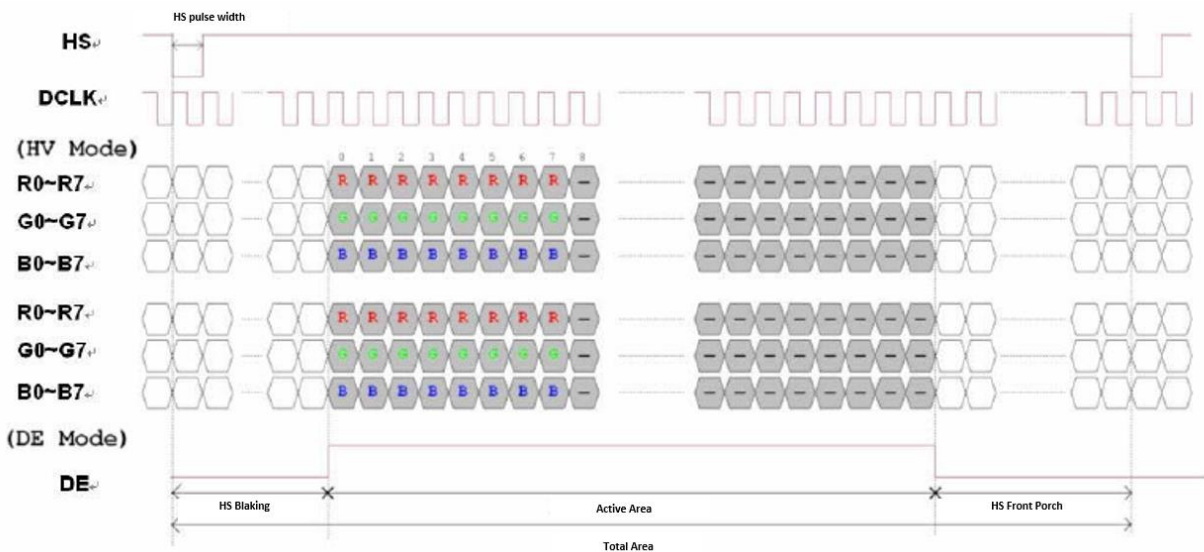
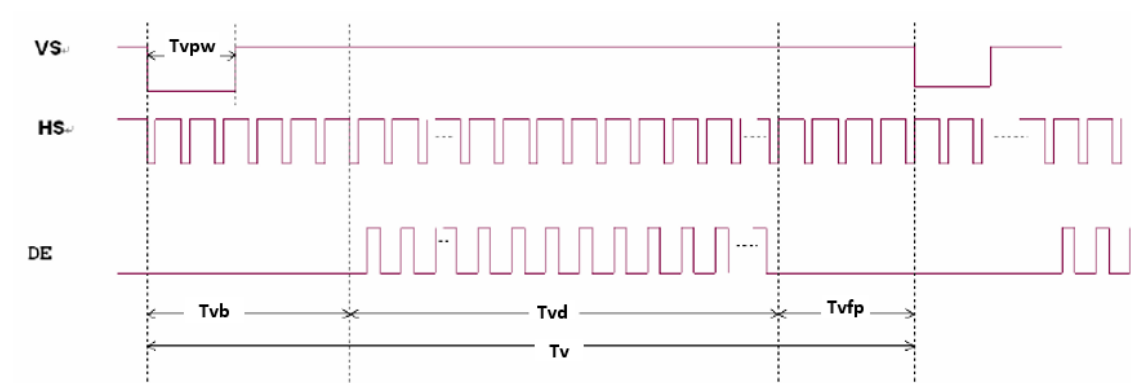


Figure 13.. Vertical input timing diagram



10.2 Parallel RGB timing table

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|-------------------------|--------|-----|-----|------|------|
| Horizontal Display Area | Thd | - | 800 | - | DCLK |
| DCLK Frequency | Fclk | - | 30 | 50 | MHz |
| One Horizontal Line | Th | 889 | 928 | 1143 | DCLK |
| HS pulse width | Thpw | 1 | 48 | 255 | DCLK |
| HS Blanking | Thb | - | 88 | - | DCLK |
| HS Front Porch | Thfp | 1 | 40 | 255 | DCLK |
| Vertical Display Area | Tvd | - | 480 | - | TH |
| VS period time | Tv | 513 | 525 | 767 | TH |
| VS pulse width | Tvpw | 3 | 3 | 255 | TH |
| VS Blanking | Tvb | - | 32 | - | TH |
| VS Front Porch | Tvfp | 1 | 13 | 255 | TH |

11 TOUCH SCREEN PANEL SPECIFICATIONS

11.1 Electrical characteristics

Note: Avoid operating with hard or sharp material such as a ball point pen or a mechanical pencil except a polyacetal pen (tip R0.8mm or less) or a finger

11.1.1 For capacitive touch panel

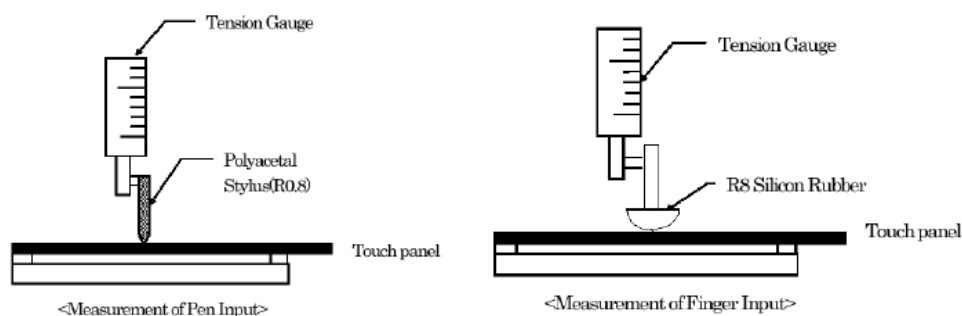
| DESCRIPTION | | SPECIFICATION |
|-------------------------|-------------|----------------------|
| Operating Voltage | | DC 2.8~3.3V |
| Power Consumption (IDD) | Active Mode | TBD mA |
| | Sleep Mode | TBD μ A |
| Interface | | I ² C |
| Controller | | FT5446 |
| I2C address | | 0x38 (7 bit address) |
| Resolution | | 800*480 |

11.1.2 For resistive touch panel

| ITEM | VALUE | | | UNIT | REMARK |
|-----------------------|-------|------|------|------|---------------------------|
| | Min. | Typ. | Max. | | |
| Linearity | -1.5 | - | 1.5 | % | Analog X and Y directions |
| Terminal Resistance | 350 | - | 1000 | Ω | X |
| | 100 | - | 450 | Ω | Y |
| Insulation Resistance | - | - | - | MΩ | DC 25V |
| Voltage | - | - | 10 | V | DC |
| Chattering | - | - | 10 | ms | 100kΩ pull-up |
| Transparency | 80 | - | - | % | JIS K7105 |

11.2 Mechanical characteristics

Note 1: Force test condition, Input DC 5V on X direction, Drop off Polyacetal Stylus (R0.8), until output voltage stabilize, then get the R8.0mm Silicon rubber and do finger Activation force test. Next step, 9 points.



Note 2: Measurement surface area conditions, Scratch 100,000 times straight line on the film with a stylus change every 20,000 times with Force: 250gf, Speed: 60mm/sec by R0.8 polaceteal stylus.

Note 3: Pitting test, Pit 1, 000, 000 times on the film with R0.8 silicon rubber with Force: 250gf and Speed: 2 times/sec.

11.2.1 For capacitive touch pane

| DESCRIPTION | INL SPECIFICATION | REMARK |
|----------------------------------|--------------------|--------------------|
| Touch Panel Size | 5.0 inch | |
| Outline Dimension (OD) | 120.3mm x 75.4mm | Cover Lens Outline |
| Outline Dimension (OD) - UxTouch | 136.0mm x 92.8mm | Cover Lens Outline |
| Product Thickness | 1.9mm | |
| Glass Thickness | 0.7mm | |
| Ink View Area | 109.00mm x 65.80mm | |
| Sensor Active Area | 110.0mm x 66.8mm | |
| Input Method | 5 Finger | |
| Activation Force | Touch | |
| Surface Hardness | ≥7H | |

11.2.2 For resistive touch panel

Note 1: Force test condition, Input DC 5V on X direction, drop off Polyacetal Stylus (R0.8), until output voltage stabilize, then get the R8.0mm Silicon rubber and do finger Activation force test. Next step, 9 points.

| ITEM | VALUE | | | UNIT | REMARK |
|-------------------------------|---------------|------|------|------------|-----------|
| | Min. | Typ. | Max. | | |
| Activation Force | 80 | - | - | gf | Note 1 |
| Durability-Surface Scratching | Write 100,000 | - | - | characters | Note 2 |
| Durability-Surface Pitting | 1,000,000 | - | - | touches | Note 3 |
| Surface Hardness | 3 | - | - | H | JIS K5400 |

12 INSPECTION

Standard acceptance/rejection criteria for TFT module.

12.1 Inspection condition

Ambient conditions:

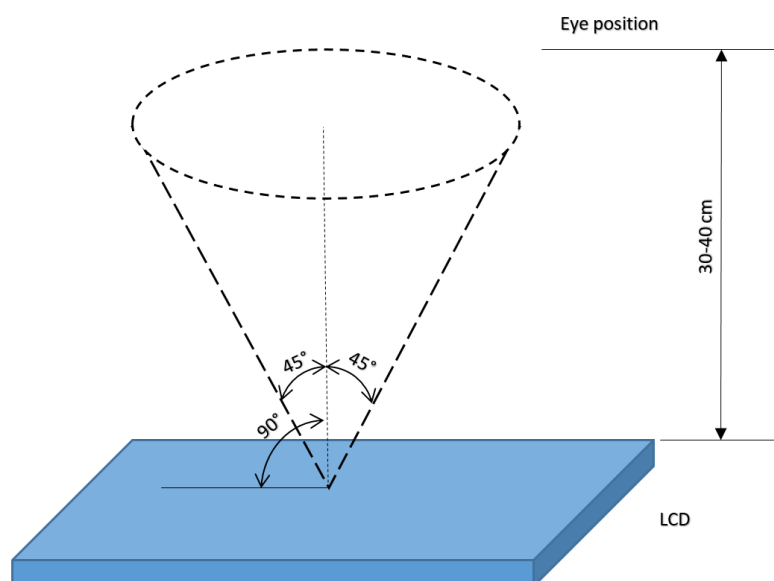
- Temperature: $25\pm^{\circ}\text{C}$
- Humidity: $(60\pm 10)\% \text{RH}$
- Illumination: Single fluorescent lamp non-directive (300 to 700 lux)

Viewing distance:

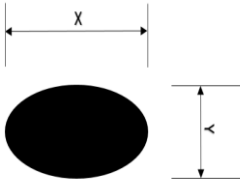
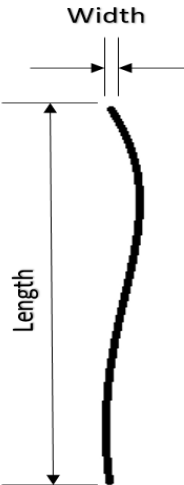
$35\pm 5\text{cm}$ between inspector bare eye and LCD.

Viewing Angle:

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



12.2 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 mm</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="margin: 10px 0;"> <table border="1" style="width: 100%;"> <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 mm</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 | |

13 RELIABILITY TEST

| NO. | TEST ITEM | TEST CONDITION | REMARKS |
|-----|----------------------------|--|----------|
| 1 | High Temperature Storage | 80±2°C/240hours | Note 2 |
| 2 | Low Temperature Storage | -30±2°C/240hours | Note 1,2 |
| 3 | High Temperature Operating | 70±2°C/240hours | |
| 4 | Low Temperature Operating | -20±2°C/240hours | Note 1 |
| 5 | Temperature Cycle | -30±2°C~25±2°C ~80±2°C × 20 cycles (30min.) (5min.) (30min.) | Note 1,2 |
| 6 | Damp Proof Test | 60°C ±5°C × 90%RH/240hours | |
| 7 | Vibration Test | Frequency 10Hz~55Hz Amplitude of vibration : 1.5mm Sweep time: 12 min 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 times | |
| 10 | ESD Test for RTP | Air: ±8KV 150pF/330Ω 5 times Contact: ±4KV 150pF/330Ω 5 times | |

Note 1: Without water condensation.

Note 2: The function test shall be conducted after 2 hours storage at the room temperature and humidity after removed from the test chamber.

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