



RVT70AQFFWC00

LCD TFT Datasheet

Rev.1.1

2015-09-21

| ITEM | CONTENTS | UNIT |
|--------------------------------|----------------------------------|-------------------|
| LCD Type | TFT/Transmissive/Normally white | / |
| Size | 7.0 | Inch |
| Viewing Direction | 12:00 (without image inversion) | O' Clock |
| Gray Scale Inversion Direction | 6:00 | O' Clock |
| LCM (W × H × D) | 165.60 ×100.60× 11.34 | mm ³ |
| Active Area (W × H) | 154.08 × 85.92 | mm ² |
| Dot Pitch (W × H) | 0.1926 × 0.179 | mm ² |
| Number Of Dots | 800 (RGB) × 480 | / |
| Driver IC | FT813 | / |
| Backlight Type | 21 LEDs | / |
| Surface Luminance | 350 | cd/m ² |
| Interface Type | SPI/QSPI | / |
| Color Depth | 16.7M | / |
| Pixel Arrangement | RGB Vertical Stripe | / |
| Surface Treatment | Clear | |
| Input Voltage | 3.3 | V |
| With/Without TSP | Projected Capacitive Touch Panel | / |
| Weight | 21.05 | g |

Note 1: RoHS compliant

Note 2: LCM weight tolerance: ± 5%.

REVISION RECORD

| REVNO. | REVDATE | CONTENTS | REMARKS |
|--------|------------|--|---------|
| 1.0 | 2015-05-12 | Initial Release | |
| 1.1 | 2015-09-21 | Update total thickness, color depth and weight information | |

CONTENTS

| | |
|--|----|
| REVISION RECORD..... | 2 |
| CONTENTS | 2 |
| 1 MODULE CLASSIFICATION INFORMATION | 3 |
| 2 MODULE DRAWING..... | 4 |
| 3 ABSOLUTE MAXIMUM RATINGS..... | 5 |
| 4 ELECTRICAL CHARACTERISTICS..... | 5 |
| 5 ELECTRO-OPTICAL CHARACTERISTICS | 5 |
| 6 INTERFACE DESCRIPTION | 7 |
| 7 FT813 CONTROLLER SPECIFICATIONS | 8 |
| 7.1 Serial host interface..... | 8 |
| 7.2 Block Diagram..... | 9 |
| 7.3 Host interface SPI mode 0 | 9 |
| 7.4 Backlight driver block diagram | 9 |
| 8 LCD TIMING CHARACTERISTICS | 10 |
| 8.1 Clock and data input time diagram | 10 |
| 8.2 Parallel RGB input timing table | 10 |
| 9 CAPACITIVE TOUCH SCREEN PANEL SPECIFICATIONS | 11 |
| 9.1 Mechanical characteristics | 11 |
| 9.2 Electrical characteristics | 11 |
| 10 RELIABILITY TEST..... | 12 |
| 11 LEGAL INFORMATION..... | 13 |

1 MODULE CLASSIFICATION INFORMATION

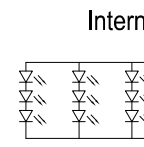
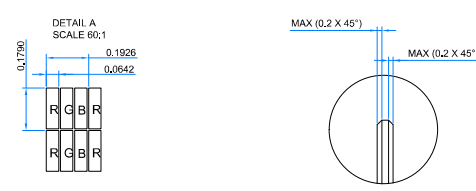
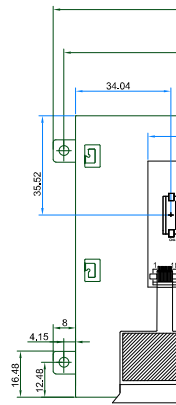
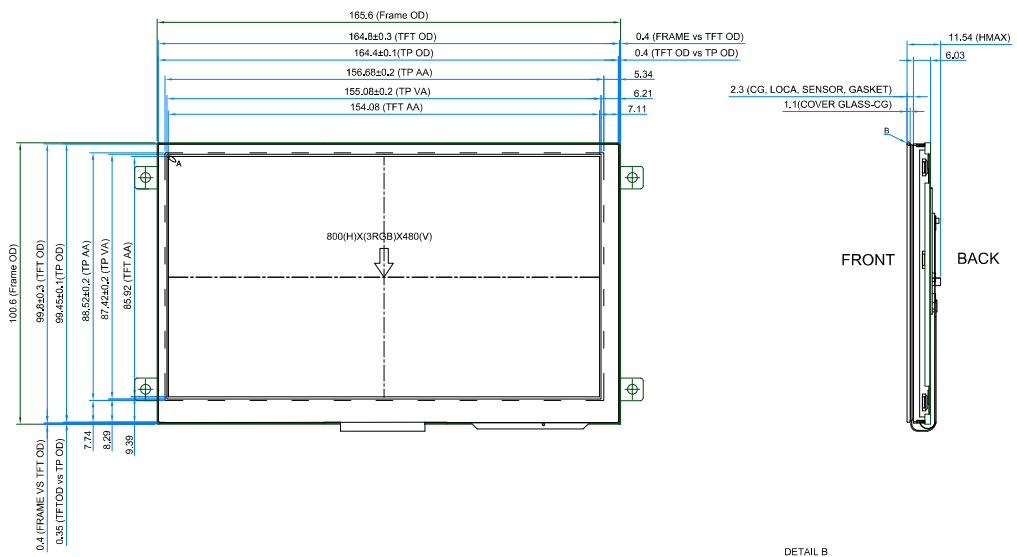
| | | | | | | | | | |
|-----------|----------|-----------|----------|----------|----------|----------|----------|----------|-----------|
| RV | T | 70 | A | Q | F | F | W | C | 00 |
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |

| | | |
|-----|-------------------------|---|
| 1. | BRAND | RV – Riverdi |
| 2. | PRODUCT TYPE | T – TFT Standard F – TFT Custom |
| 3. | DISPLAY SIZE | 35 – 3.5” 43 – 4.3” 50 – 5.0” 70 – 7.0” |
| 4. | MODEL SERIAL NO. | A(A-Z) |
| 5. | RESOLUTION | Q – 800x480 px |
| 6. | INTERFACE | T – TFT LCD, RGB L – TFT LCD, LVDS S – TFT + Controller SSD1963 F – TFT + Controller FT813 |
| 7. | FRAME | N – No Frame F – Mounting Frame |
| 8. | BACKLIGHT TYPE | W – LED White |
| 9. | TOUCH PANEL | N – No Touch Panel R – Resistive Touch Panel C – Capacitive Touch Panel |
| 10. | VERSION | 00 (00-99) |

LCD TFT Datasheet Rev.1.1

RVT70AQFFWC00

| PIN | DESC |
|-----|-----------|
| 1 | VDD |
| 2 | GND |
| 3 | SPL_SCLK |
| 4 | MISO/IO0 |
| 5 | MOSI/IO1 |
| 6 | CS |
| 7 | INT |
| 8 | PD |
| 9 | NC |
| 10 | AUDIO_OUT |
| 11 | GPIO0/IO2 |
| 12 | GPIO1/IO3 |
| 13 | GPIO2 |
| 14 | GPIO3 |
| 15 | NC |
| 16 | NC |
| 17 | BLVDD |
| 18 | BLVDD |
| 19 | BLGND |
| 20 | BLGND |



- NOTES:
1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
 2. 7.0 INCH PROJECTIVE CAPACITIVE TOUCH PANEL.
 3. OPERATION VOLTAGE: VDD=3.3V
 4. VIEWING DIRECTION: 12 O'CLOCK
 5. LED BACKLIGHT: 21-LED WHITE, BUILT-IN INVERTER
 6. IC CONTROLLER: FT813
 7. CTP IC DRIVER: FT5406
 8. CTP MULTI FINGER: UP TO 5
 9. OPERATING TEMP.: -20°C ~ 70°C
 10. STORAGE TEMP.: -30°C ~ 80°C
 11. SURFACE LUMINANCE: 350 cd/m²
 12. GENERAL TOLERANCE: ±0.2
 13. RoHS COMPLIANT

| | | |
|------|------------------------|------------|
| 1.1 | Update total thickness | 2015.09.21 |
| 1.0 | Initial case | 2015.05.10 |
| Ver. | DESCRIPTION | DATE |

| |
|----------|
| CUSTOMER |
| DRAWN |
| DFTG CHK |
| ENGR CHK |
| APPROVAL |

3 ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|--------------------------------|-----------------|------|----------------|------|
| Supply Voltage For Logic | VDD | -0.3 | 3.6 | V |
| Input Voltage For Logic | VIN | -0.3 | VDD | V |
| Input Voltage For LED Inverter | BLVDD | -0.3 | 0.7 | V |
| Operating Temperature | T _{OP} | -20 | 70 | °C |
| Storage Temperature | T _{ST} | -30 | 80 | °C |
| Humidity | RH | - | 90% (Max 60°C) | RH |

4 ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|---------------------------------------|---------------------------------|--------|-------|--------|------|
| 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 |
| Input Current (Exclude LED Backlight) | IDD | - | TBD | - | mA |
| LED Backlight Current | IDD _{backlight} (@ 5V) | - | 450 | 540 | mA |
| Input Voltage ' H ' level | V _{IH} | 0.7VDD | - | VDD | V |
| Input Voltage ' L ' level | V _{IL} | 0 | - | 0.2VDD | V |
| LED Life Time | - | 30000 | 50000 | - | Hrs |

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

5 ELECTRO-OPTICAL CHARACTERISTICS

| ITEM | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT | REMARK | NOTE |
|----------------------------|------------|-----------------------|-----|-----|-------|-------------------|--------|------|
| Response Time | Tr+Tf | θ=0° φ=0° Ta=25 | - | 20 | 35 | ms | FIG 1. | 4 |
| Contrast Ratio | Cr | | 400 | 500 | - | --- | FIG 2. | 1 |
| Luminance Uniformity | δ WHITE | | 70 | 75 | - | % | FIG 2. | 3 |
| Surface Luminance | Lv | | - | 350 | - | cd/m ² | FIG 2. | 2 |
| Viewing Angle Range | θ | φ = 90° | 40 | 50 | - | deg | FIG 3. | 6 |
| | | φ = 270° | 60 | 70 | - | deg | FIG 3. | |
| | | φ = 0° | 60 | 70 | - | deg | FIG 3. | |
| | | φ = 180° | 60 | 70 | - | deg | FIG 3. | |
| CIE (x, y) Chromaticity | Red | θ=0° φ=0° Ta=25 | x | - | - | - | FIG 2. | 5 |
| | | | y | - | - | - | | |
| | Green | | x | - | - | - | | |
| | | | y | - | - | - | | |
| | Blue | | x | - | - | - | | |
| | | | y | - | - | - | | |
| | White | | x | - | 0.280 | - | | |
| | | | y | - | 0.310 | - | | |

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

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

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

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

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

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

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

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

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

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

Figure 1. The definition of response time

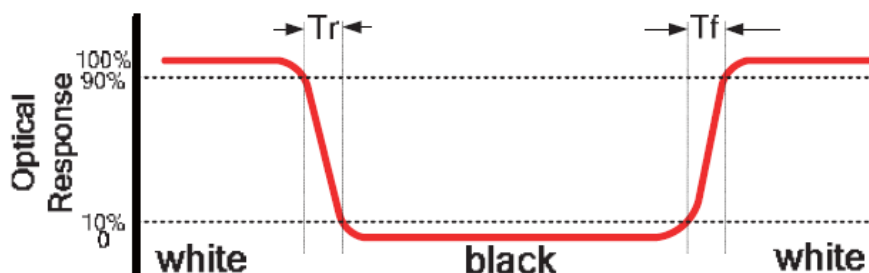


Figure 2.Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

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

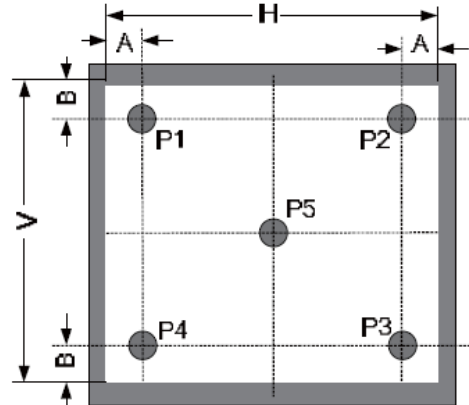
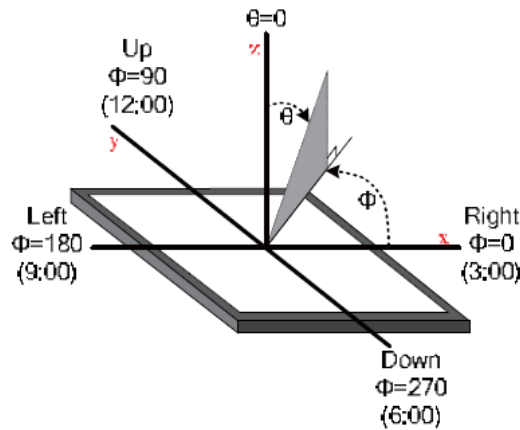


Figure 3.The definition of viewing angle



6 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/ IO0 | SPI MISO Signal / IO0 Signal, Internally 47k Pull UP |
| 5 | MOSI/ IO1 | SPI MOSI Signal / IO1 Slave Address Bit 0, Internally 47k Pull UP |
| 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 |

7 FT813 CONTROLLER SPECIFICATIONS

FT813 or EVE (Embedded Video Engine) 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.

7.1 Serial host interface

Figure 4. SPI interface connection

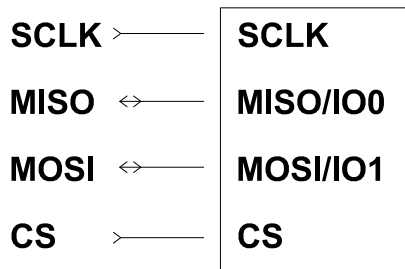
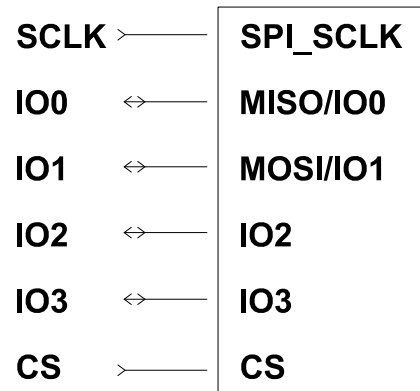


Figure 5. QSPI interface connection



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

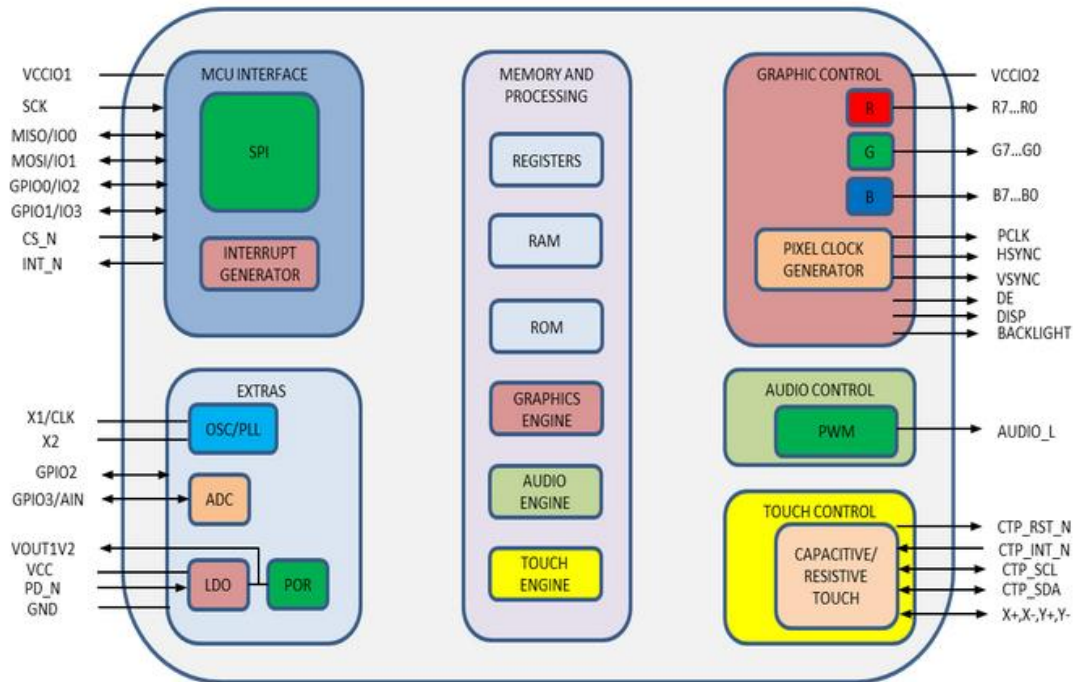
Only SPI mode 0 is supported. The SPI interface is selected by default (MODE pin is internally pulled low by 47k resistor).

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.

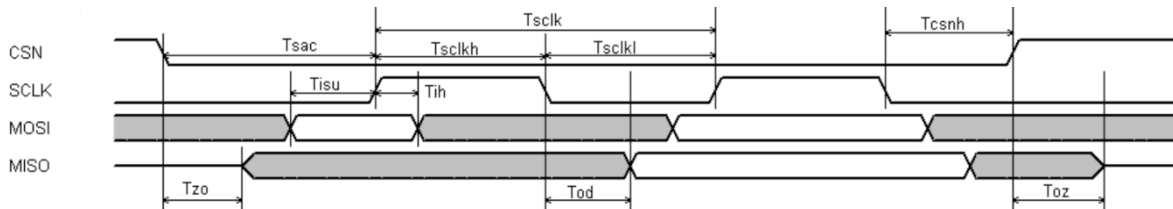
7.2 Block Diagram

Figure 6. FT813 Block diagram



7.3 Host interface SPI mode 0

Figure 7. SPI timing diagram



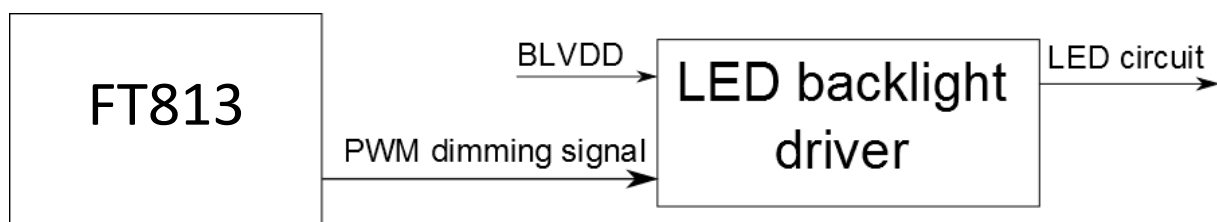
For more information about FT813 controller please go to official FT81x website.

<http://www.ftdichip.com/Products/ICs/FT81X.html>

7.4 Backlight driver block diagram

Backlight enable signal is internally connected to FT813 Backlight control pin. This pin is controlled by two FT813's registers. One of them specifies the PWM output frequency, second one specifies the duty cycle. Refer to FT813 datasheet for more information.

Figure 8. Backlight driver block diagram



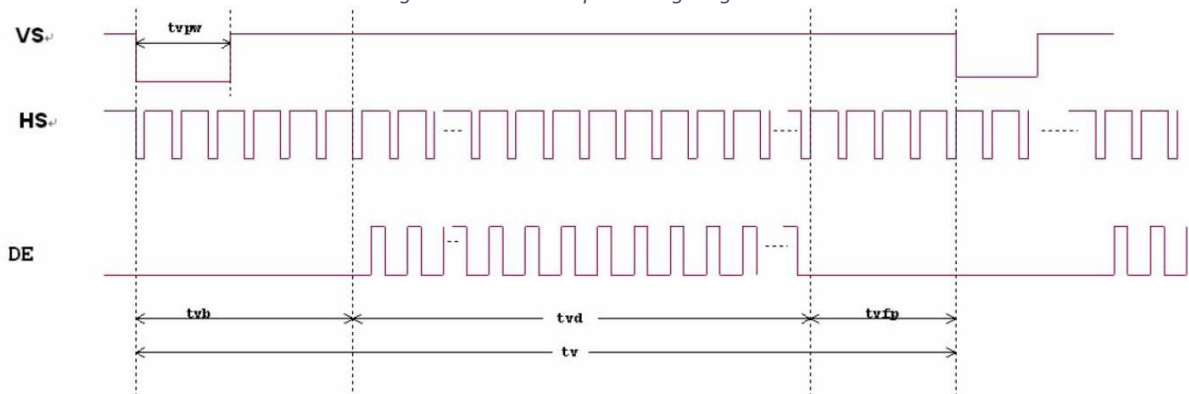
8 LCD TIMING CHARACTERISTICS

8.1 Clock and data input time diagram

Figure 9. Horizontal input timing diagram



Figure 10. Vertical input timing diagram



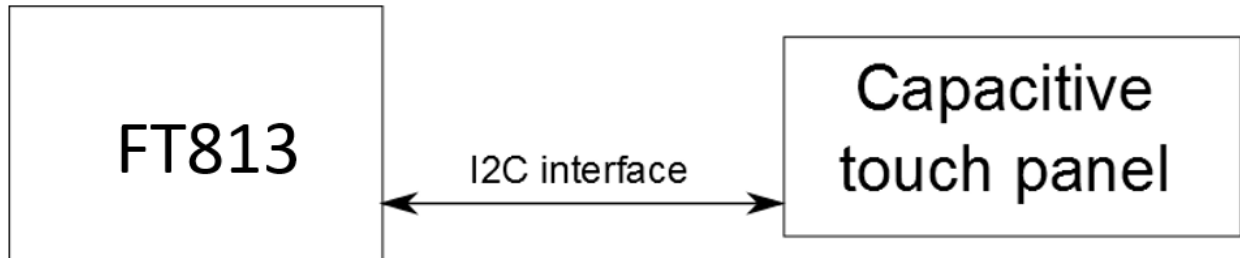
8.2 Parallel RGB input timing table

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|------------------|--------|------|------|------|------|
| DCLK Frequency | Fclk | 26.4 | 33.3 | 46.8 | MHz |
| VSD Period Time | tv | 510 | 525 | 650 | TH |
| VSD Display Area | tvd | | 480 | | TH |
| VSD Blanking | tvb | | 23 | | TH |
| VSD Front Porch | tvfp | 7 | 22 | 147 | TH |
| VSD Pulse Width | tpw | 1 | - | 20 | TH |
| HSD Pulse Width | thpw | 1 | - | 40 | DCLK |
| HSD Period Time | th | 862 | 1056 | 1200 | DCLK |
| HSD Display Area | thd | | 800 | | DCLK |
| HSD Blanking | thb | | 46 | | DCLK |
| HSD Front Porch | thfp | 16 | 210 | 354 | DCLK |

9 CAPACITIVE TOUCH SCREEN PANEL SPECIFICATIONS

The Capacitive Touch Panel is directly connected to FT813 module. Therefore communication with Capacitive Touch Panel is simplified to read registers of FT813.

Figure 11. Capacitive Touch Panel Connection



9.1 Mechanical characteristics

| DESCRIPTION | INL SPECIFICATION | REMARK |
|------------------------|--------------------|--------------------|
| Touch Panel Size | 7 inch | |
| Outline Dimension (OD) | 164.4mm x 99.45mm | Cover Lens Outline |
| Product Thickness | 2.3mm | |
| Glass Thickness | 1.1mm | |
| Ink View Area | 155.08mm x 87.42mm | |
| Sensor Active Area | 156.68mm x 88.52mm | |
| Input Method | 5 Finger | |
| Activation Force | Touch | |
| Surface Hardness | ≥7H | |

9.2 Electrical characteristics

| DESCRIPTION | SPECIFICATION |
|-------------------------|----------------------|
| Operating Voltage | DC 2.8~3.3V |
| Power Consumption (IDD) | Active Mode |
| | Sleep Mode |
| Interface | I ² C |
| Linearity | <1.5% |
| Controller | FT5406 |
| I2C address | 0x38 (7 bit address) |
| Resolution | 1792*1024 |

10 RELIABILITY TEST

| NO. | TEST ITEM | TEST CONDITION |
|-----|----------------------------|---|
| 1 | High Temperature Storage | 80±2°C/240hours |
| 2 | Low Temperature Storage | -30±2°C/240hours |
| 3 | High Temperature Operating | 70±2°C/240hours |
| 4 | Low Temperature Operating | -20±2°C/240hours |
| 5 | Temperature Cycle | -30±2°C~25~80±2°C × 20 cycles (30min.) (5min.) (30min.) |
| 6 | Damp Proof Test | 60°C ±5°C × 90%RH/240hours |
| 7 | Vibration Test | Frequency 10Hz~55Hz Amplitude of vibration : 1.5mm Sweep: 10Hz~55Hz~10Hz X, Y, Z 2 hours for each direction. |
| 8 | Package Vibration Test | Random vibration :0.15G*G/HZ from 5-200HZ,-6dB/Octave from 200-500HZ of each direction of X.Y. Z (6 hours for total) |
| 9 | Package Drop Test | Height:60 cm 1 corner,3 edges,6 surfaces |
| 10 | ESD Test | ± 2KV, Human body mode,100pF/1500Ω |
| 11 | Mechanical Shock | 100G 6ms, X, Y, Z 3 times for each direction |

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