EVE2 7"

This datasheet gives detailed information about the Riverdi 7" EVE2 displays. The displays come in different versions: with **capacitive, resistive, or no touchscreen**, with a decorative **cover glass**, as well as with our without a **metal mounting frame**.

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Rev.2.0
2020-02-12

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

Number of Dots		800 x (RGB) × 480	/
Driver IC		FT81x	/
Interface Type		SPI/QSPI	/
Brightness	no touch module	500	cd/m2
	CTP module	450	
	RTP module	400	
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: ± 5%.

Revision Record

REV NO.	REVDATE	CONTENTS	REMARKS
1.0	2019-06-07	Rev 1.0	
2.0	2020-02-12	Rev 2.0	**Note 1:** Due to the EOL of the RVT7.0A800480TNWN00 module, all modules combined are updated and marked with V2 at the end of the PN. **Note 2:** Update Brightness, External dimensions, Timing Characteristics.

Table of Content

1. Module classification information

RV	T	70	x	Q	F	x	W	x	0x
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

1.	BRAND	RV – Riverdi
2.	PRODUCT TYPE	T – TFT Standard
3.	DISPLAY SIZE	70 – 7.0"
4.	MODEL SERIAL NO.	A (A-Z) U-UxTouch
5.	RESOLUTION	Q– 800×480 px
6.	INTERFACE	F– TFT+controller FT81x
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	0x (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:
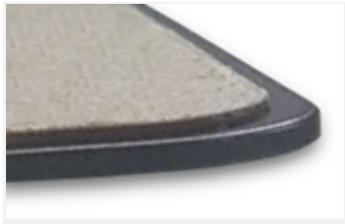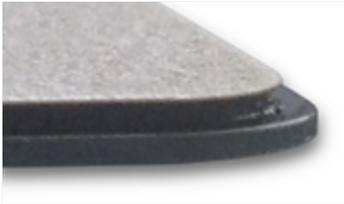
Double side adhesive tape with DST 3M 9495LE glue (total thickness 0.2mm)	Foam double side adhesive tape with 3M 9495LE glue (total thickness 0.5mm)	Without tape

Cover glass color options:

|	
BLACK	WHITE

Product options:

PART NUMBER	DESCRIPTION
RVT70AQFNWN00 V2	FT813, No mounting frame, No touch panel, Rev 2.0
RVT70AQFNWR00 V2	FT813, No mounting frame, RTP, Rev 2.0
RVT70AQFNWC00 V2	FT813, No mounting frame, CTP, Rev 2.0
RVT70AQFFWN00 V2	FT813, With mounting frame, No touch panel, Rev 2.0
RVT70AQFFWR00 V2	FT813, With mounting frame, RTP, Rev 2.0
RVT70AQFFWC00 V2	FT813, With mounting frame, CTP, Rev 2.0
RVT70UQFNWC00 V2	FT813, uxTouch, black cover glass, 0.2mm DST, Rev 2.0
RVT70UQFNWC01 V2	FT813, uxTouch, black cover glass, 0.5 mm DST, Rev 2.0
RVT70UQFNWC02 V2	FT813, uxTouch, black cover glass, no DST, Rev 2.0
RVT70UQFNWC03 V2	FT813, uxTouch, white cover glass, 0.2mm DST, Rev 2.0
RVT70UQFNWC04 V2	FT813, uxTouch, white cover glass, 0.5 mm DST, Rev 2.0
RVT70UQFNWC05 V2	FT813, uxTouch, white cover glass, no DST, Rev 2.0

2.1. UxTouch assembly

UxTouch are LCD TFT displays with specially designed projected capacitive touch panels. UxTouch display can be mounted without any holed 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
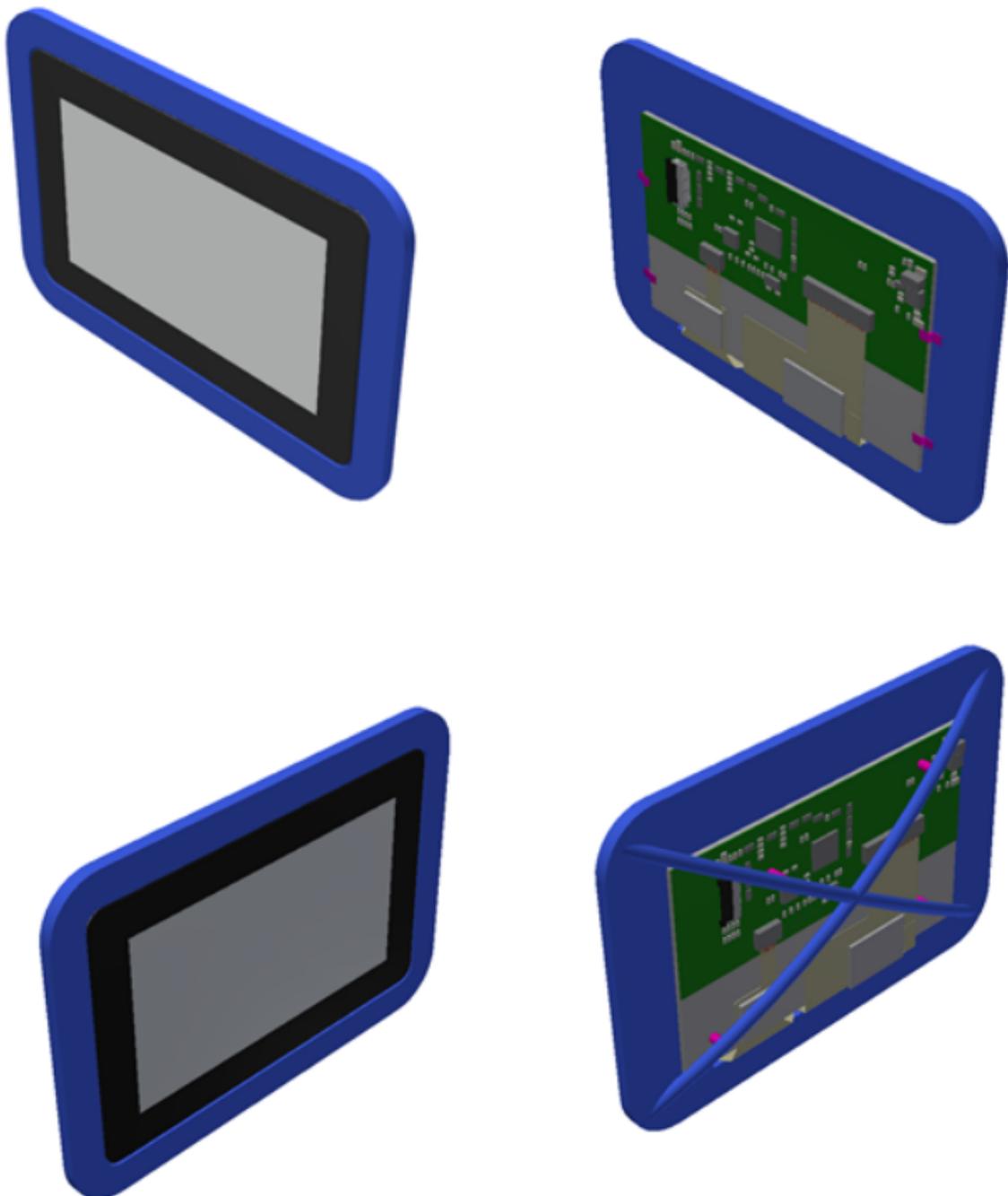
2.2. Mounting frame

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 2. Mounting frame
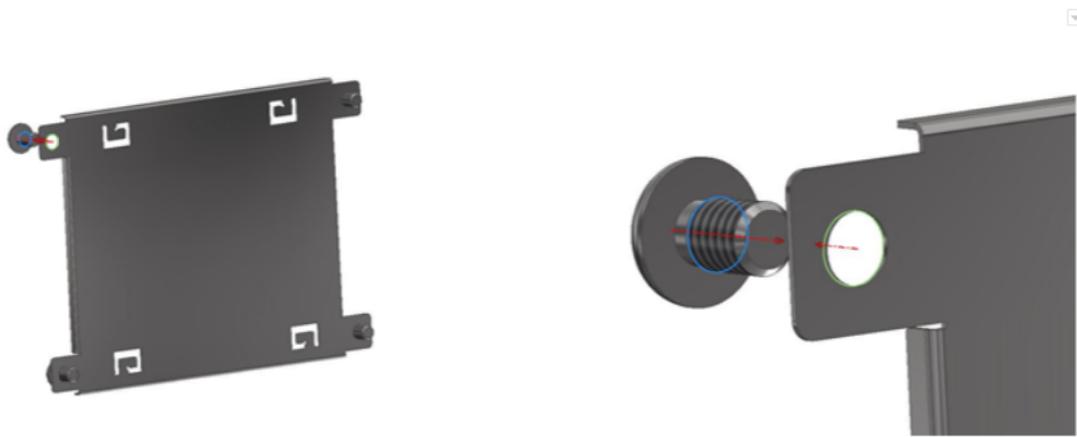
3. Module drawing

4. Absolute maximum ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage for Logic	VDD	-0.3	5.0	V
Input Voltage for Logic	VIN	-0.3	VDD	V
Input Voltage for LED Inverter	BLVDD	-0.3	7.0	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-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	IDDbacklight	–	450	540	mA	BLVDD=5V
Input Voltage 'H' level	VIH	0.7VDD	–	VDD	V	
Input Voltage 'L' level	VIL	0	–	0.2VDD	V	
LED Life Time	–	30000	50000	–	Hrs	Note1

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

6. Electro-optical characteristics

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	REMARK	NOTE

Parameter			Symbol	Condition	Min	Typ	Max	Unit	Figure	No.
Response Time			Tr+Tf		–	20	35	ms	Figure 4	4
Contrast Ratio			Cr	θ=0° ∅=0° Ta=25	400	500	–	—	Figure 5	1
Luminance Uniformity			δ WHITE		70	75	–	%	Figure 5	3
Surface Luminance	TFT		Lv		400	500	–	cd/m2	Figure 5	2
	TFT+CTP				360	450	–			
	TFT+RTP				320	400	–			
Viewing Angle Range			θ	∅ = 90°	40	50	–	deg	Figure 6	6
				∅ = 270°	60	70	–	deg	Figure 6	
				∅ = 0°	60	70	–	deg	Figure 6	
				∅ = 180°	60	70	–	deg	Figure 6	
CIE (x, y) Chromaticity	Red	x		θ=0° ∅=0° Ta=25	0.522	0.572	0.622		Figure 5	5
		y			0.300	0.350	0.400			
	Green	x			0.311	0.361	0.411			
		y			0.526	0.576	0.626			
	Blue	x			0.097	0.147	0.197			
		y			0.038	0.088	0.138			
	White	x			0.266	0.316	0.366			
		y			0.266	0.316	0.366			

Note 1. Contrast Ratio(CR) is defined mathematically as below, for more information see Figure 4 .

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

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information, see Figure 4 .

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

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 4 .

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

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 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 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.

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

Figure 3. The definition of response time
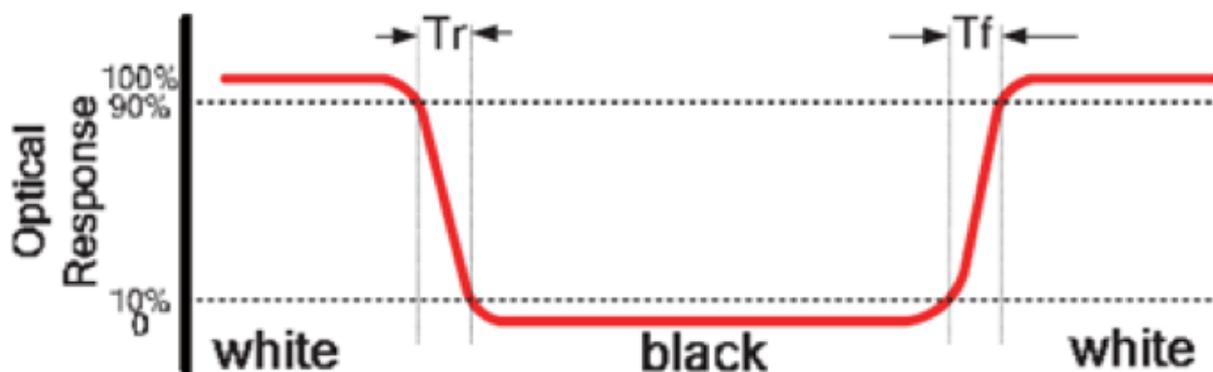
Figure 4. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size ∅=5mm, 500mm distance from the
LCD surface to detector lens
measurement instrument is TOPCON's luminance
meter BM-5
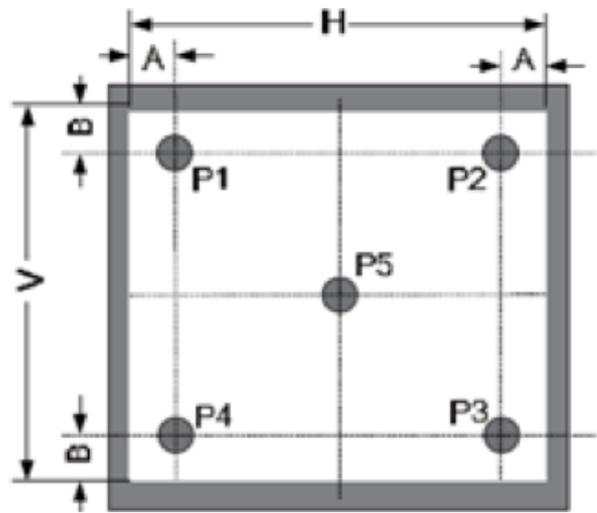
Figure 5.The definition of viewing angle
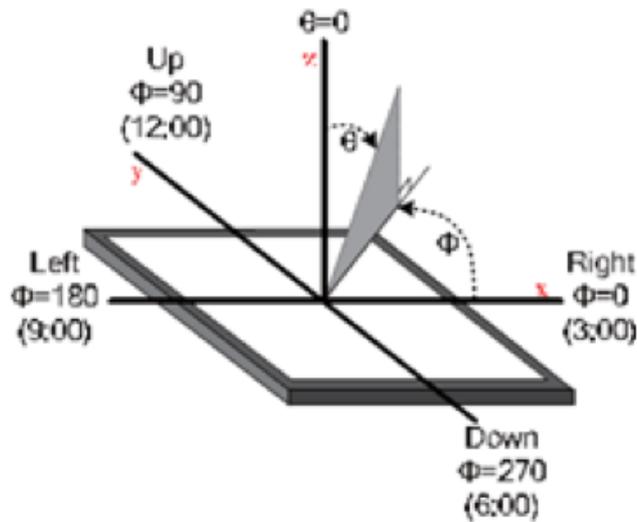
7. Interface description

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

8. FT81x Controller specifications

FT81x 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

8.1. Serial host interface

Figure 6. SPI interface connection
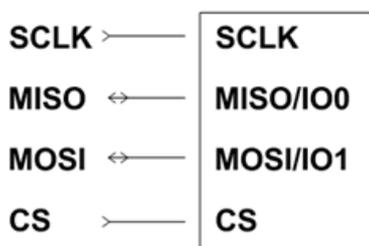
Figure 7. SPI interface connection
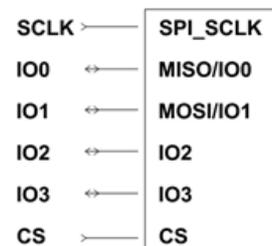
SPI Interface – the SPI slave interface operates up to 30MHz.

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.

8.2. Block diagram

Figure 8. FT81x Block diagram
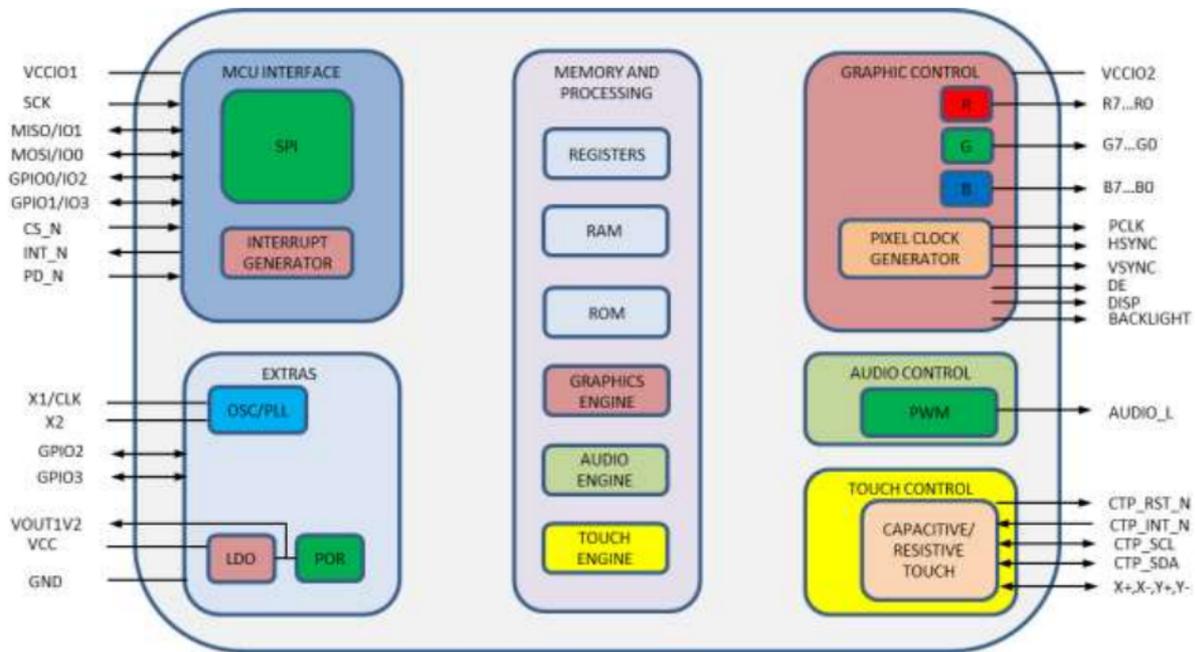
8.3. Host Interface SPI mode 0

Figure 9. SPI timing diagram
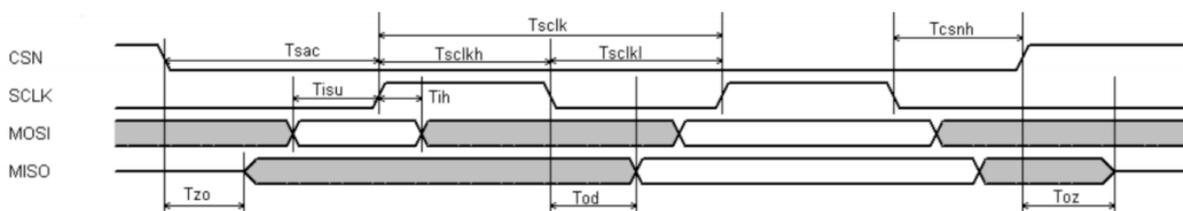
For more information about FT813 controller please go to official FT81x website.

8.4. Backlight driver block diagram

Backlight enable signal is internally connected to FT81x Backlight control pin. This pin is controlled by two FT81x's registers. One of them specifies the PWM output frequency, second one specifies the duty cycle. Refer to FT81x datasheet for more information.

Figure 10. Backlight driver block diagram
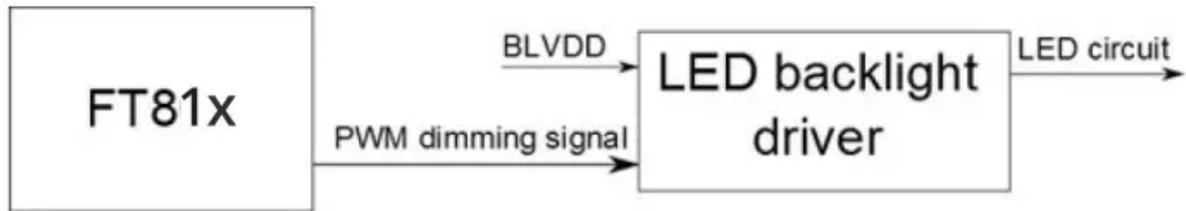
9. LCD timing characteristics

9.1. Clock and data input time diagram

Figure 11. Horizontal input timing diagram

Figure 12. Vertical input timing diagram
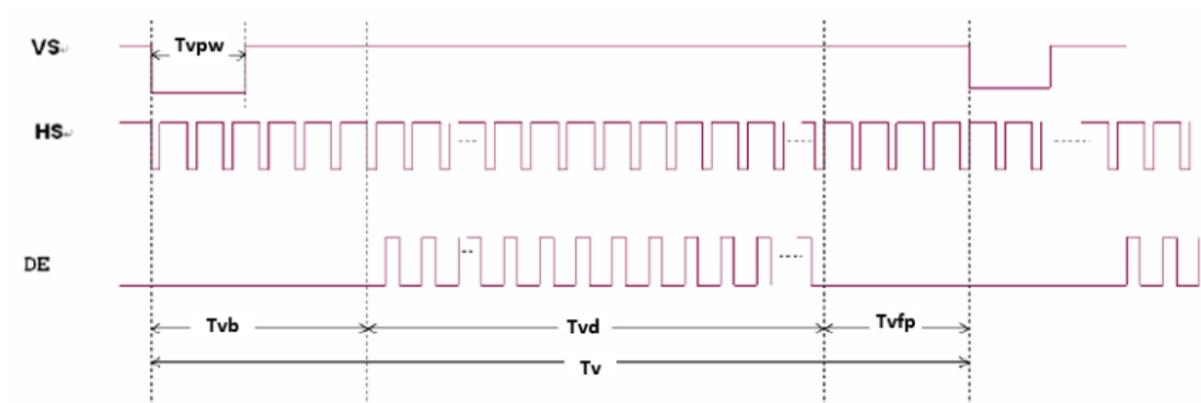
9.2. Parallel RGB input timing table

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
DCLK Frequency	Fclk	26	30	36	MHz
VSD Period Time	tv	515	525	535	TH
VSD Display Area	tvd	480			TH
VSD Blanking	tvb	10			TH
VSD Front Porch	tvfp	12	22	32	TH
VSD Pulse Width	tvpw	–	13	–	TH
HSD Pulse Width	thpw		30		DCLK
HSD Period Time	th	1026	1056	1086	DCLK
HSD Display Area	thd	800			DCLK
HSD Blanking	thb	16			DCLK
HSD Front Porch	thfp	180	210	240	DCLK

10. Touch screen panel specifications

10.1. Electrical characteristics

10.1.1. For capacitive touch panel

DESCRIPTION		SPECIFICATION
Operating Voltage		DC 2.8~3.3V
Power Consumption (IDD)	Active Mode	10~18mA

Item	Value	Unit	Remark
Sleep Mode	30~50µA		
Interface	I2C		
Linearity	<1.5%		
Controller	FT5426		
I2C address	0x38 (7-bit address)		
Resolution	1792*1024		

10.1.2. For resistive touch panel

ITEM	VALUE			UNIT	REMARK
	Min.	Typ.	Max.		
Linearity	-3.0	–	3.0	%	Analog X and Y directions
Terminal Resistance	440	–	1100	Ω	X
	100	–	420	Ω	Y
Insulation Resistance	25	–	–	MΩ	DC 25V
Voltage	–	–	10	V	DC
Chattering	–	–	10	ms	100kΩ pull-up
Transparency	78	–	–	%	JIS K7105

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

10.2. Mechanical characteristics

10.2.1 for capacitive touch panel

DESCRIPTION	INL SPECIFICATION	REMARK
Touch Panel Size	7 inch	
Outline Dimension (OD)	165.60mm x 100.60mm	Cover Lens Outline
Outline Dimension (OD)- UxTouch	179.96mm x 119.00mm	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	

10.2.2. For resistive touch panel

ITEM	VALUE			UNIT	REMARK
	Min.	Typ.	Max.		
Activation Force	20	–	100	gf	

Durability-Surface Scratching	**Write 100,000**	–	–	**characters**	
Durability-Surface Pitting	**1,000 000**	–	–	**touches**	
Surface Hardness	**3**	–	–	**H**	**JIS K5400**

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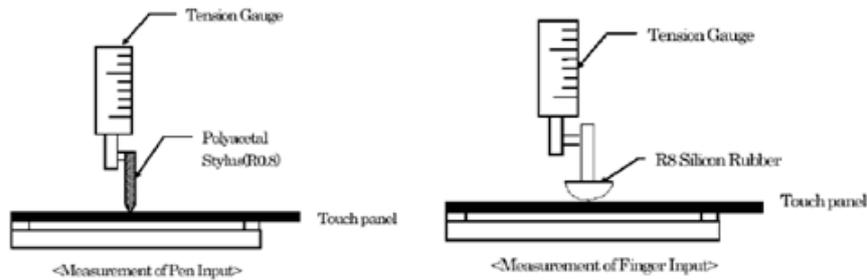
Note 2: Measurement surface area conditions, Scratch 100,000 times straight line on the film with a stylus change every 20,000 times with Force: 250gf, Speed: 60mm/sec by R0.8 polaceteal stylus.

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. Inspection

Standard acceptance/rejection criteria for TFT module.

11.1. Inspection condition

Ambient conditions:

- Temperature: 25±°C
- Humidity: (60±10) %RH
- Illumination: Single fluorescent lamp non-directive (300 to 700 lux)

Viewing distance:

35±5cm between inspector bare eye and LCD.

Viewing Angle:

U/D: 45°/45°, L/R 45°/45°

Eye position

30-40 cm

LCD

45° 45°

90°
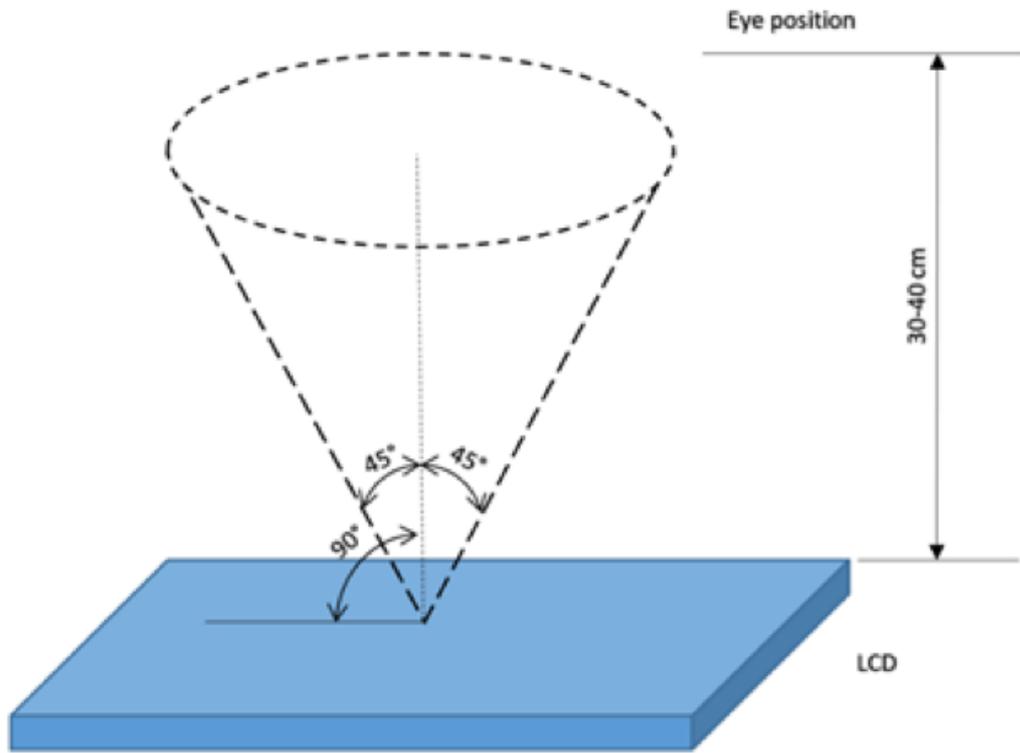
11.2 Inspection standard

Item	Criterion		
Black spots, white spots, light leakage, Foreign Particle (round Type)	$$D = \frac{(x + y)}{2}$$ *Spots density: 10 mm	**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
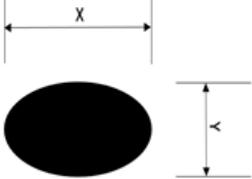
| **LCD black spots, white spots, light leakage (line Type)** | Width / Length diagram *Spots density: 10 mm |
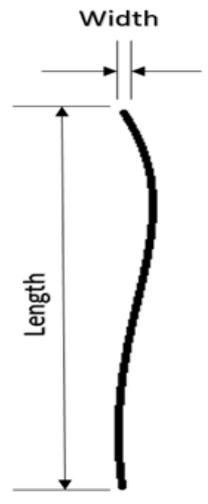
Size < 5"		
Length	Width	Qualified Qty
–	W< 0.02	Ignored
L < 3.0	0.02 < W <0.05	2
L < 2.5	0.05 < W <0.08	
–	0.08 < W	0

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	Qualified Qty
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	2
–	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

12. 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	Air: ±8KV 150pF/330Ω 5 times Contact: ±4KV 150pF/330Ω 5 times
11	Mechanical Shock	100G 6ms, X, Y, Z 3 times for each direction

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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