EVE2 5"

This datasheet gives detailed information about the Riverdi 5" 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**.

ORDER NOW
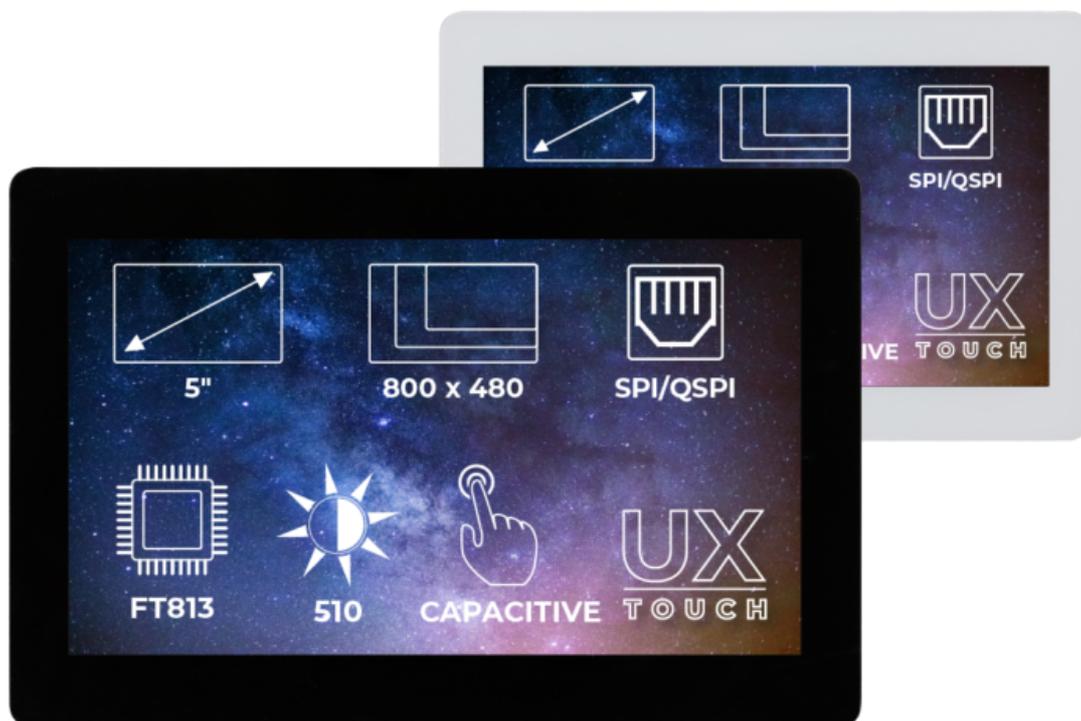
Rev.1.0
2019-06-07

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) × 480	/
Driver IC		FT81x	/
Interface Type		SPI/QSPI	/
Brightness	no touch module	600	cd/m2
	CTP module	510	
	RTP module	480	
Color Depth		262k	/
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	Initial Release	

Table of Content

1. Module classification information

RV	T	50	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**	**50 – 5.0"**
4.	**MODEL SERIAL NO.**	x (A-Z)
5.	**RESOLUTION**	**Q– 800×480 px**
6.	**INTERFACE**	**F– TFT+controller FT8xx**
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 467MP glue or without any tape.

There are also two versions of glass color: black and white.

Rear side adhesive tape options:
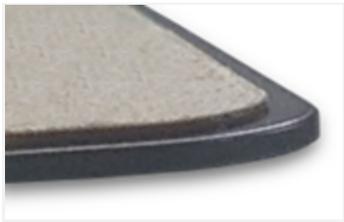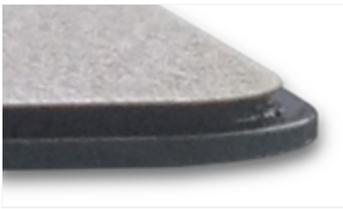
Double side adhesive tape with DST 3M 467MP glue (total thickness 0.2mm)	Foam double side adhesive tape with 3M 467MP glue (total thickness 0.5mm)	Without tape

Cover glass color options:

BLACK	WHITE
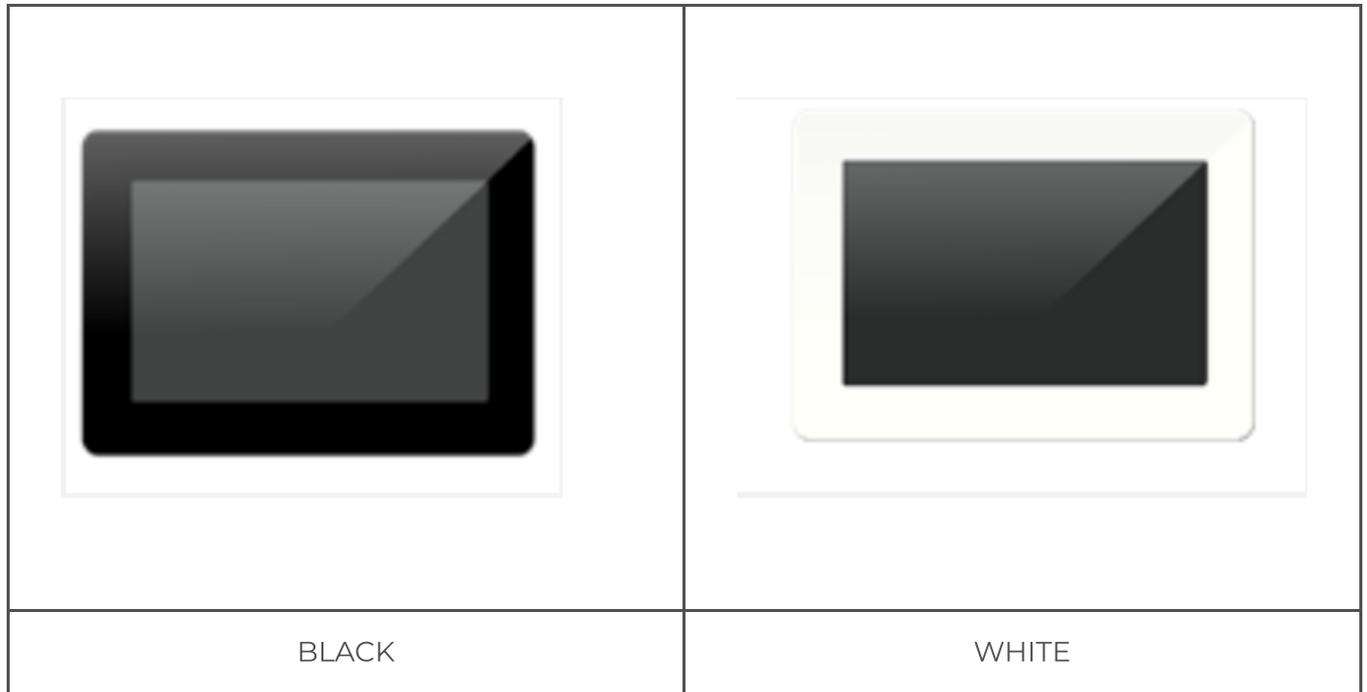
Product options:

| PART NUMBER	DESCRIPTION
RVT50UQFNWC00	FT813, uxTouch, black cover glass, 0.2mm DST
RVT50UQFNWC01	FT813, uxTouch, black cover glass, 0.5 mm DST
RVT50UQFNWC02	FT813, uxTouch, black cover glass, no DST
RVT50UQFNWC03	FT813, uxTouch, white cover glass, 0.2mm DST
RVT50UQFNWC04	FT813, uxTouch, white cover glass, 0.5 mm DST
RVT50UQFNWC05	FT813, 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 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
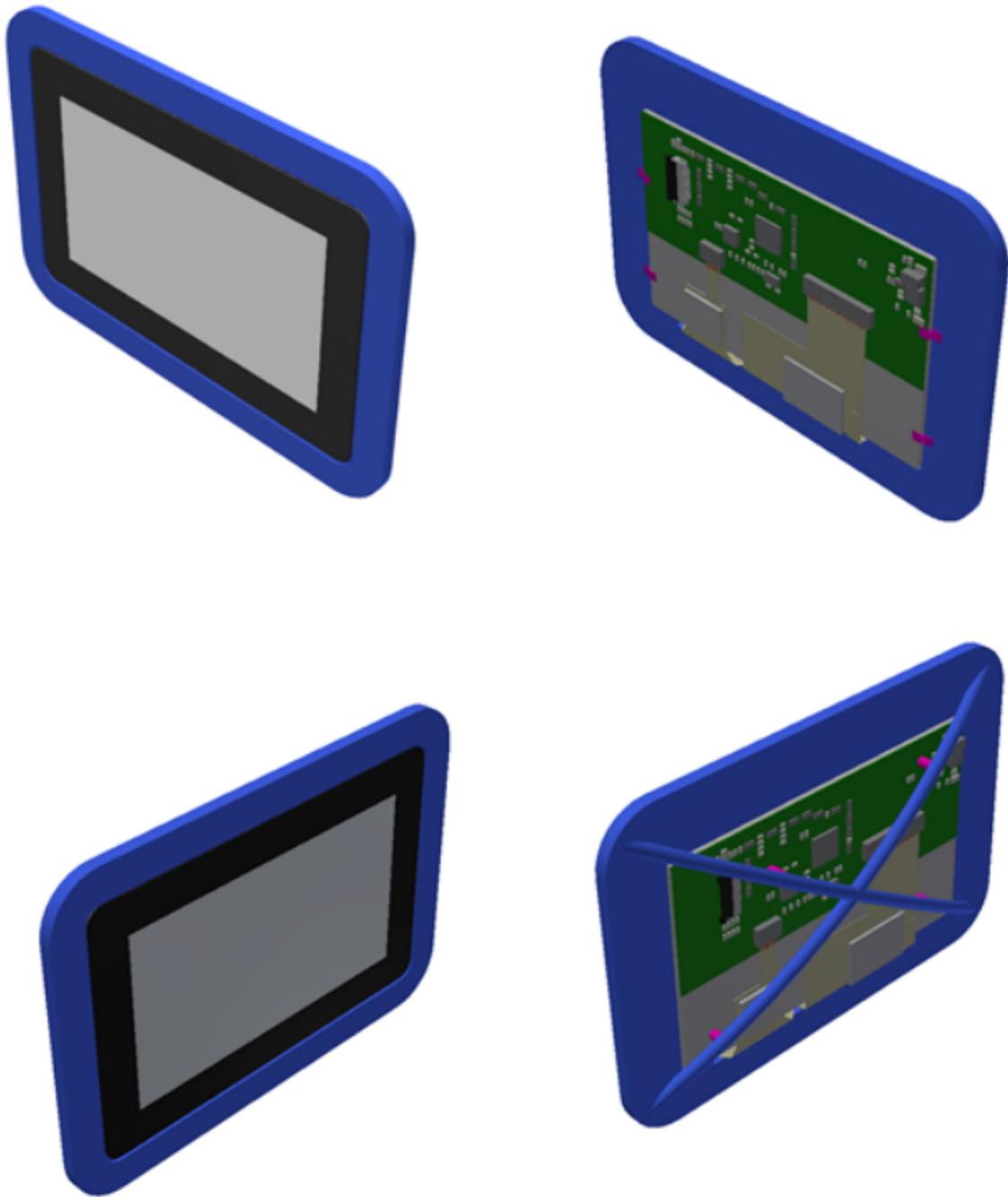
2.2. Mounting frame

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
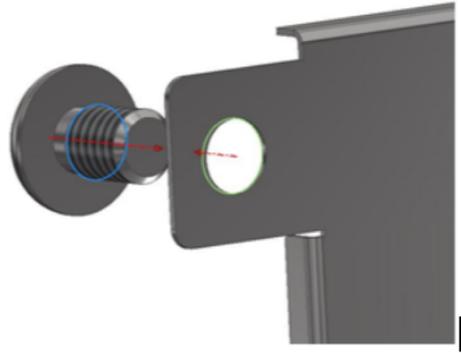
3. Drawings

4. Absolute maximum ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage for Logic	VDD	-0.3	4.0	V
Input Voltage for Logic	VIN	VSS-0.5	VDD+0.3	V
LED forward current	IF	–	60	mA
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	3.3	5.5	V	
LED Backlight Current	IDDbacklight	–	290	363	mA	BLVDD=3.3V
LED Backlight Current	IDDbacklight	–	180	225	mA	BLVDD=5V
Input Voltage 'H' level	Vih	0.8VDD	–	VDD	V	
Input Voltage 'L' level	Vil	-0.3	–	0.2VDD	V	
Voltage for LED backlight	Vi	17.4	18.3	19.6	V	
Current for LEd backlight	Il	30	40	50	mA	
Power consumption	Wbl	522	732	980	mW	
LED Life Time	–	30000	50000	–	Hrs	Note1

6. Electro-optical characteristics

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	REMARK	NOTE
Response Time		Tr+Tf		–	20	–	ms	Figure 4	4
Contrast Ratio		Cr	θ=0° ∅=0° Ta=25	–	500	–	—	Figure 5	1
Luminance Uniformity		δ WHITE		75	80	–	%	Figure 5	3
Surface Luminance	TFT	Lv		540	600	–	cd/m2	Figure 5	2
	TFT+CTP			500	540	–			
	TFT+RTP			450	500	–			

				Min	Typ	Max	Unit	Reference	
Viewing Angle Range	θ	∅ = 90°		40	50	–	deg	Figure	6
		∅ = 270°		60	70	–	deg	Figure 6	
		∅ = 0°		60	70	–	deg	Figure	
		∅ = 180°		60	70	–	deg	Figure 6	
CIE (x, y) Chromaticity	Red	x	θ=0° ∅=0° Ta=25	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 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.

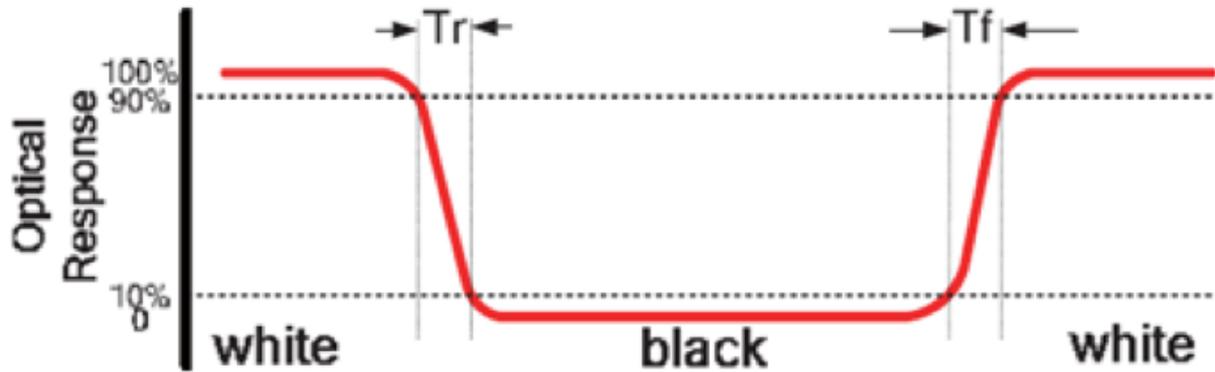Figure 3. The definition of response time

Figure 4. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity
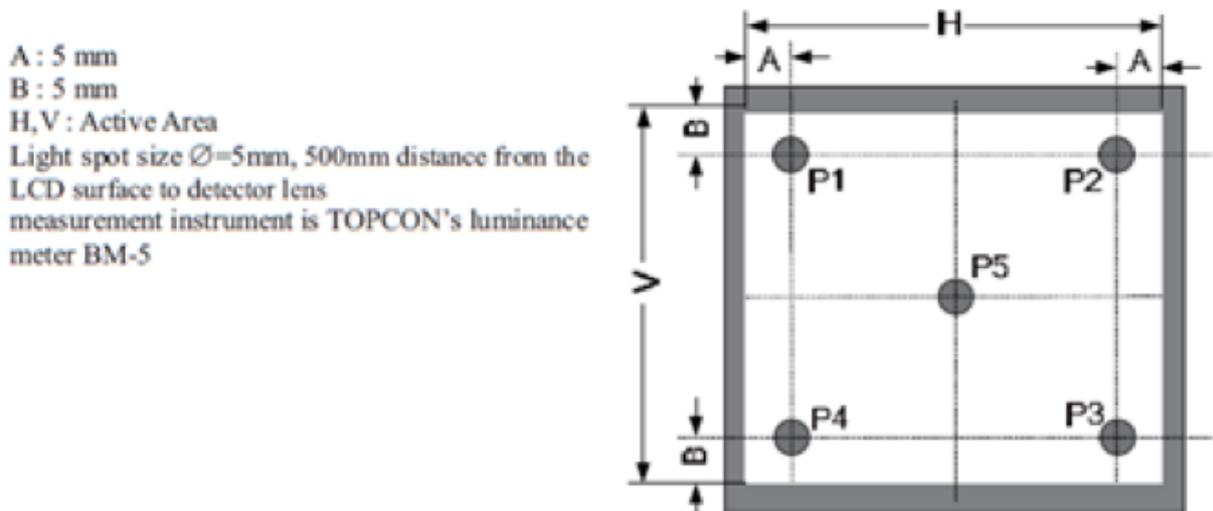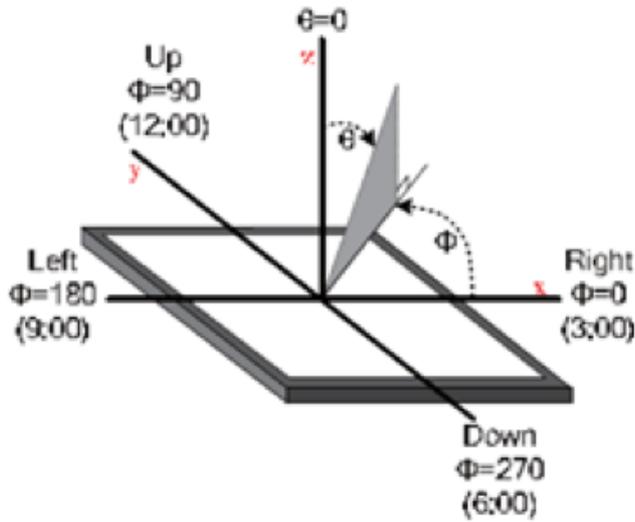
A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size Ø=5mm, 500mm distance from the
LCD surface to detector lens
measurement instrument is TOPCON's luminance
meter BM-5

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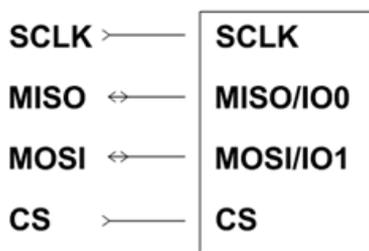
Figure 7. SPI interface connection
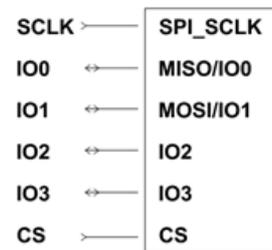
SPI Interface – the SPI slave interface operates up to 30MHz.

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.
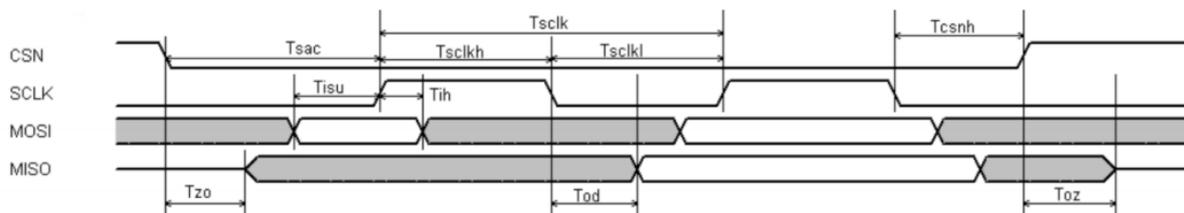
8.2. Block diagram

Figure 8. FT812 Block diagram
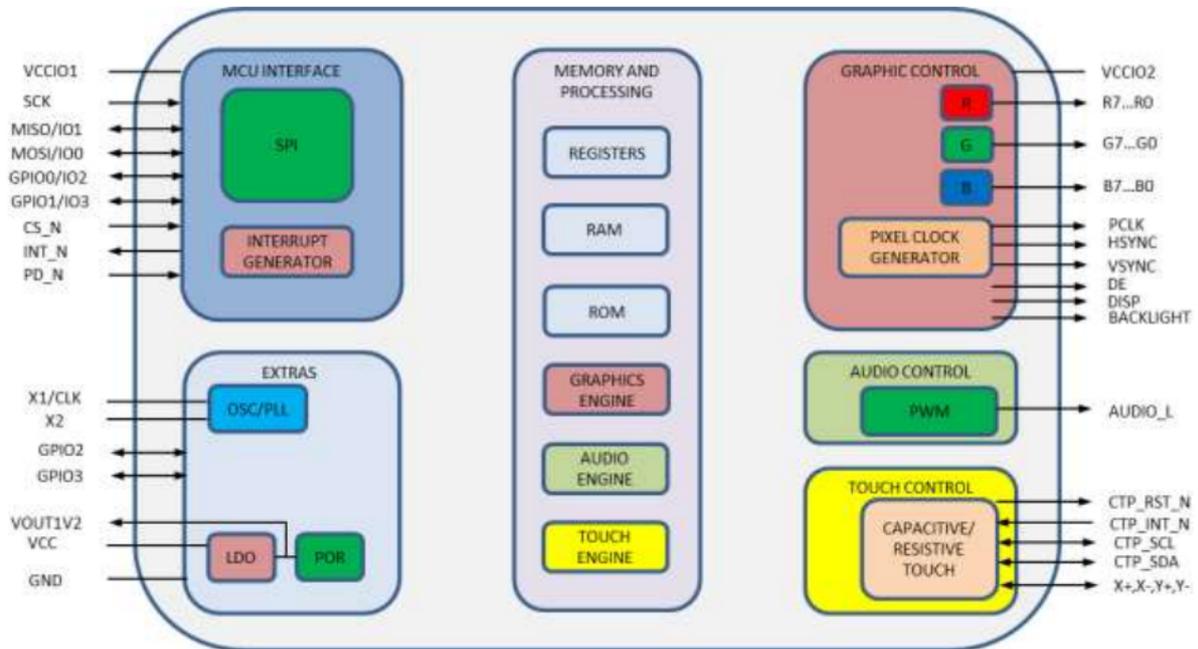
## 8.3. Host Interface SPI mode 0

Figure 9. SPI timing diagram

For more information about FT812 controller please go to official FT81x website.

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

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
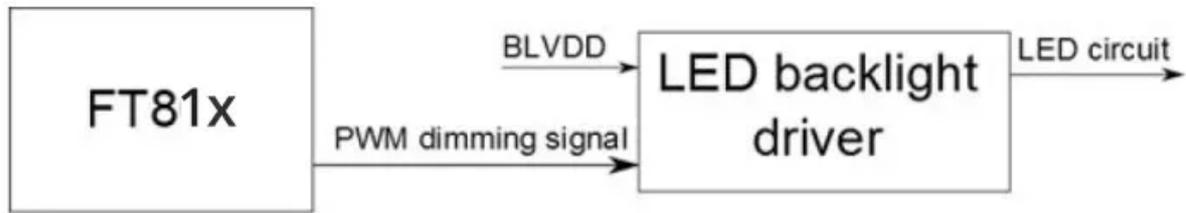
9. LCD timing characteristics

9.1. Clock and data input time diagram
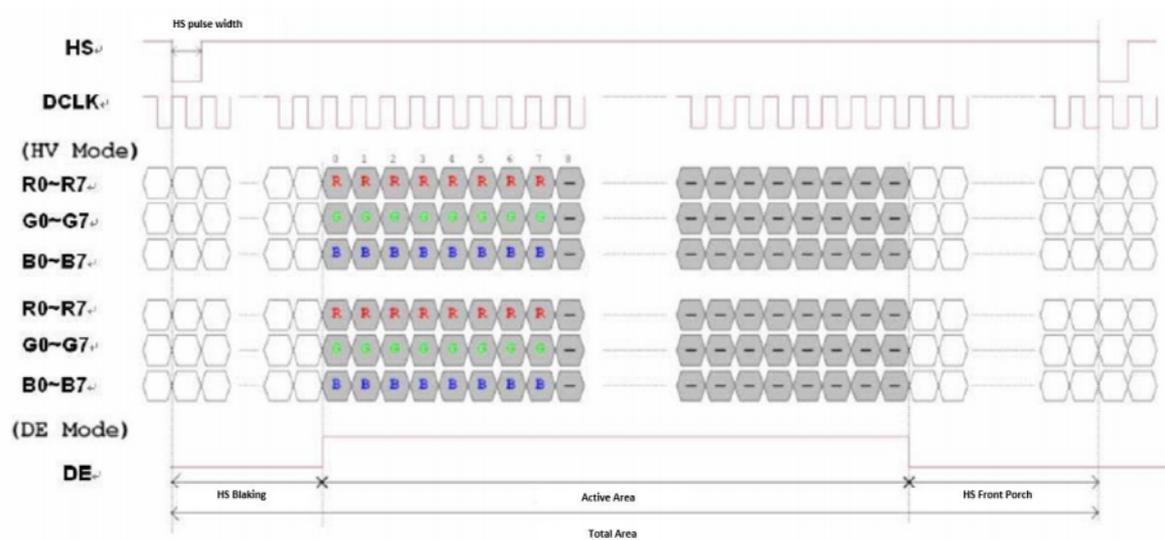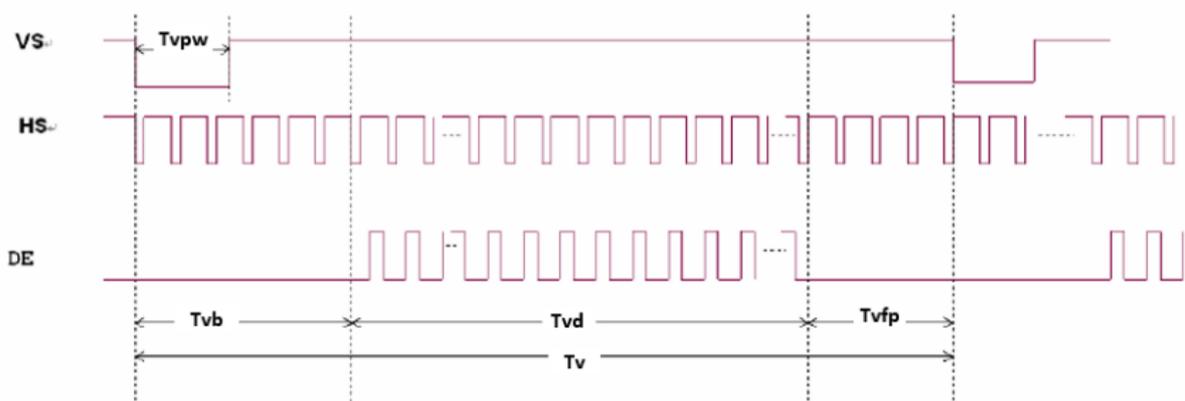
Figure 11. Horizontal input timing diagram

Figure 12. Vertical input timing diagram

9.2. Parallel RGB input timing table

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
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

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
	Sleep Mode	30~50µA
Interface		I2C

Linearity	<1.5%
Controller	FT5446
I2C address	0x38 (7-bit address)
Resolution	1280*768

10.1.2. 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

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	4.3 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	1.7mm	
Glass Thickness	0.7mm	
Ink View Area	97.0mm x 55.5mm	
Sensor Active Area	97.4mm x 56.4mm	
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	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 |

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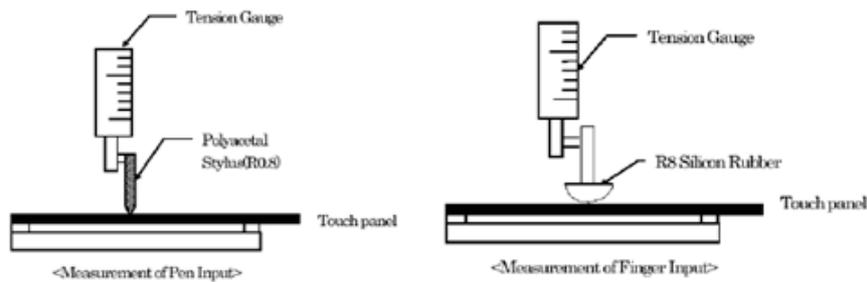
Note 2: Measurement surface area conditions, Scratch 100,000 times straight line on the film with a stylus change every 20,000 times with Force: 250gf, Speed: 60mm/sec by R0.8 polaceteal stylus.

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.

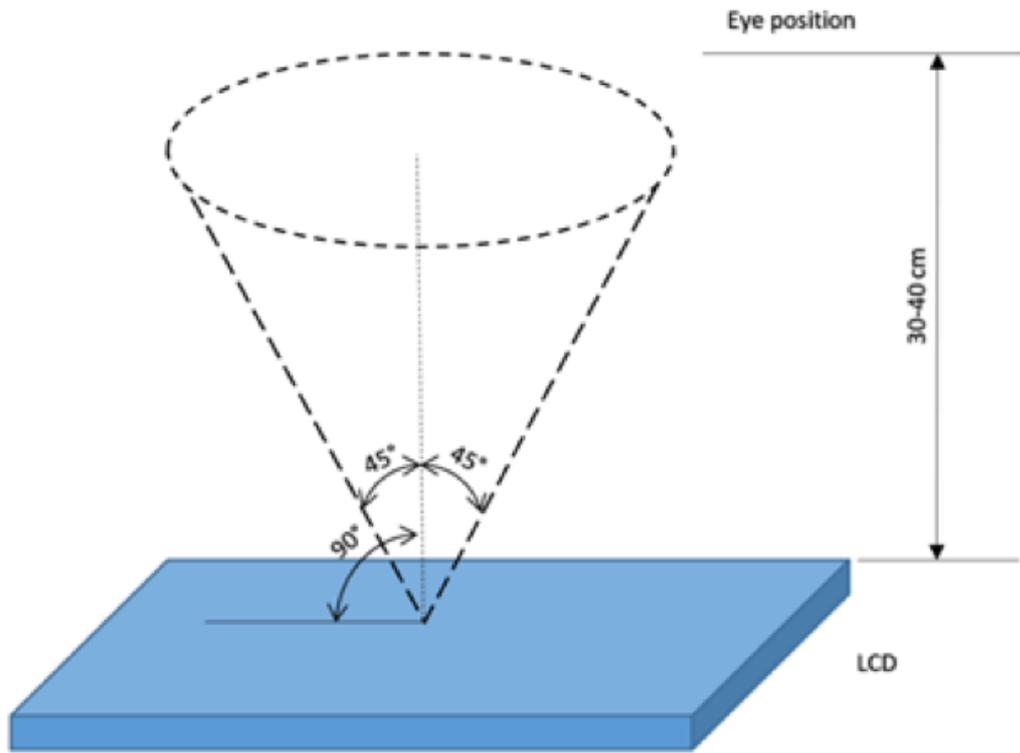## 11.1. Inspection condition

Ambient conditions:

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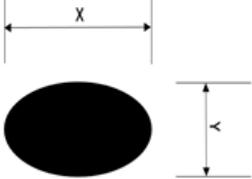
Viewing distance:

35±5cm between inspector bare eye and LCD.
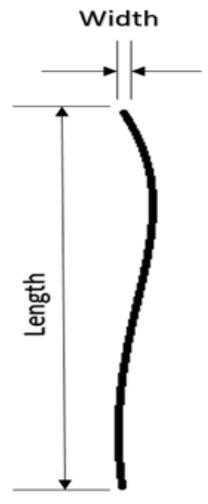
Viewing Angle:

U/D: 45°/45°, L/R 45°/45°

Eye position

30–40 cm

LCD

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)		**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

*Spots density: 10 mm

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	
–	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, 12min 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 time

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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