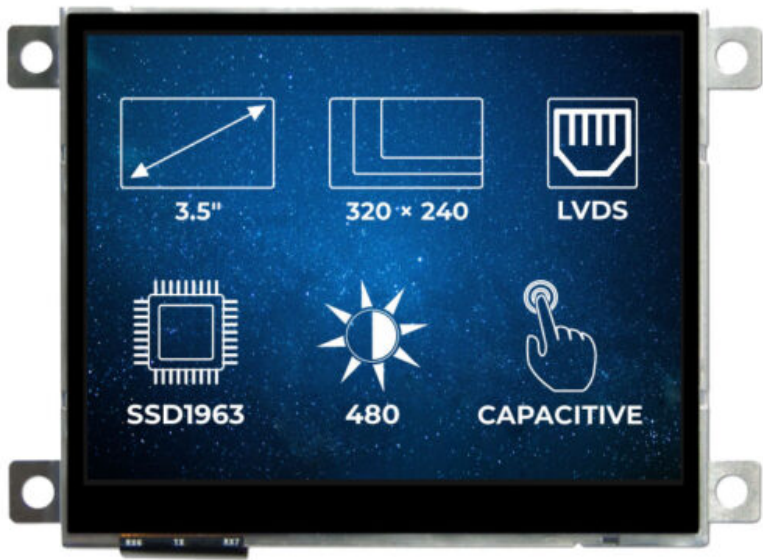


SSD1963 3.5"



This datasheet gives detailed information about the Riverdi 3.5" SSD1963 displays with an SPI interface. The displays come in different versions: with **capacitive, resistive, or no touchscreen**, 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	3.5	Inch
Viewing Direction	12:00 (without image inversion)	O' Clock
Gray Scale Inversion Direction	6:00	O' Clock

Number of Dots		320 x (RGB) × 240	/
Driver IC		SSD1963	/
Interface Type		Parallel 8/16b (i80 by default) – SPI	/
Brightness	no touch module	540	cd/m2
	CTP module	480	
	RTP module	540	
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	

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2. Assembly guide – integration	10.1.1. For capacitive touch panel
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4. Absolute maximum ratings	10.2.1. Mechanical For capacitive touch panel
5. Electrical characteristics	10.2.2. Mechanical For resistive touch panel
6. Electro-optical characteristics	10.3. Capacitive touch panel parameters
7. Interface description	10.3.1. Interface timing characteristics
8. Interface timing characteristics	10.3.2. I2C Read/Write Interface description
8.1. 8080 mode	10.3.3. Communication of the I2C interface with host
8.2. Parallel 8080-series Interface Timing	10.3.4. Touch data read protocol
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9.2. 24Bit GB Mode for 320xRGBx240	11 Inspection
10 Touch panel specifications	11.1. Inspection condition
	11.2. Inspection standard

1. Module classification information

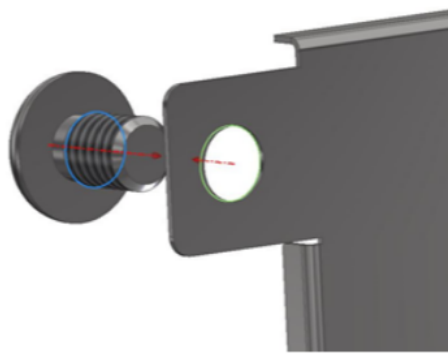
RV	T	3.5	A	320 240	C	x	W	x	36
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

1.	BRAND	RV – Riverdi
2.	PRODUCT TYPE	T – TFT Standard
3.	DISPLAY SIZE	35 – 3.5”
4.	MODEL SERIAL NO.	A (A-Z)
5.	RESOLUTION	320240– 320×240 px
6.	INTERFACE	C – TFT+controller
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	36 (00-99)

2. Mounting frame

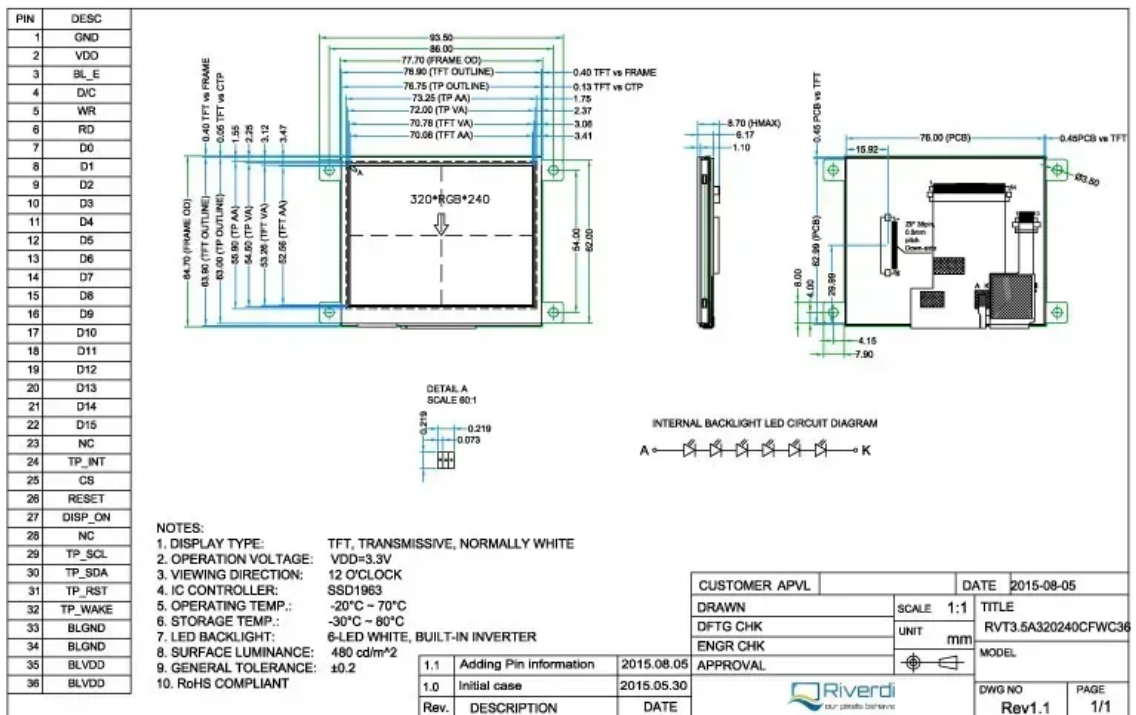
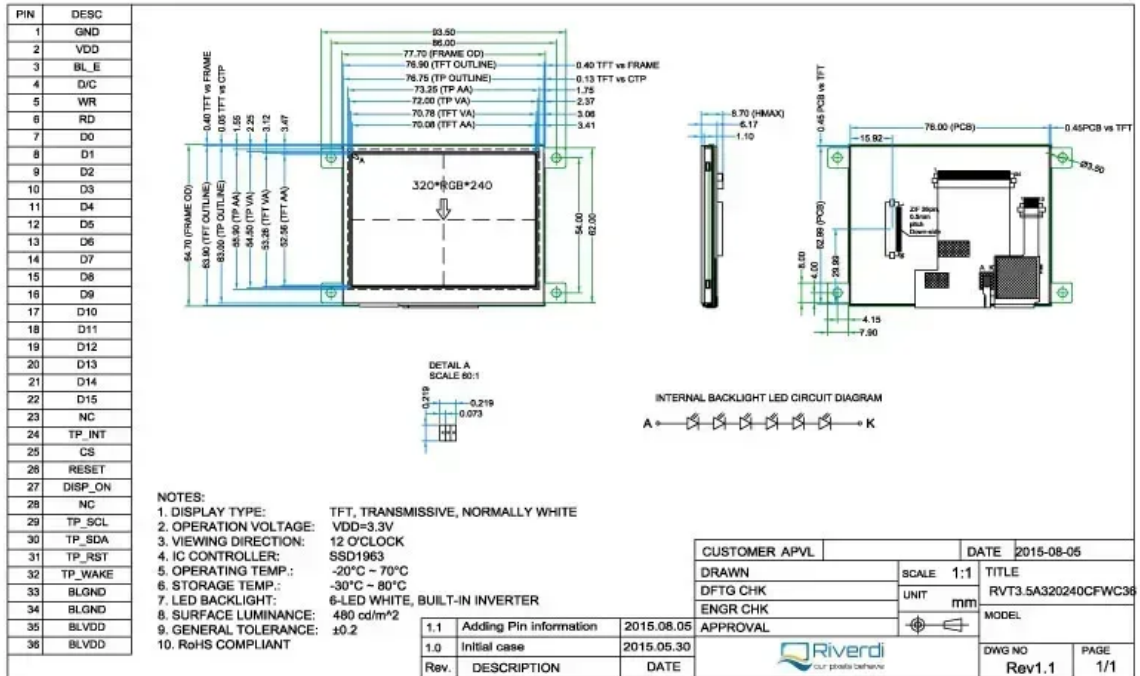
For dimensions 3.5”, 4.3”, 5.0” and 7.0” the product with mounting frame version is available. Thanks to the four catches attached to the side, frame provides strong assembly to the surface by mounting element (like the screw, see Figure 3). The frames are specially designed to fit Riverdi products perfectly.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

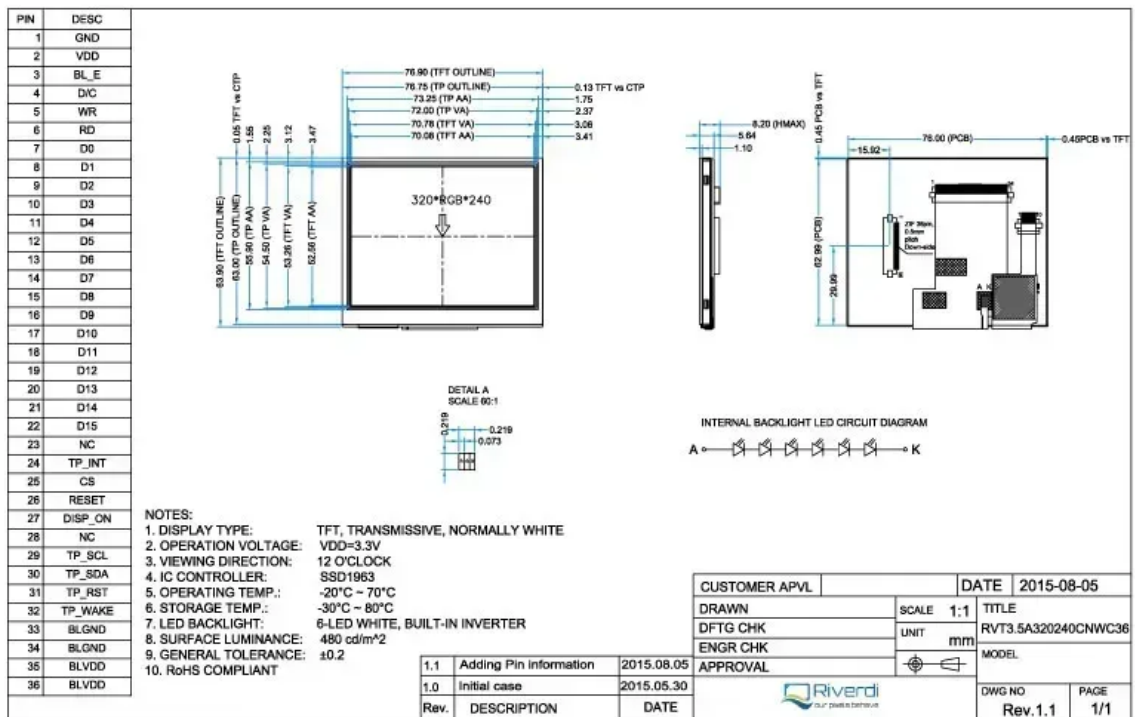
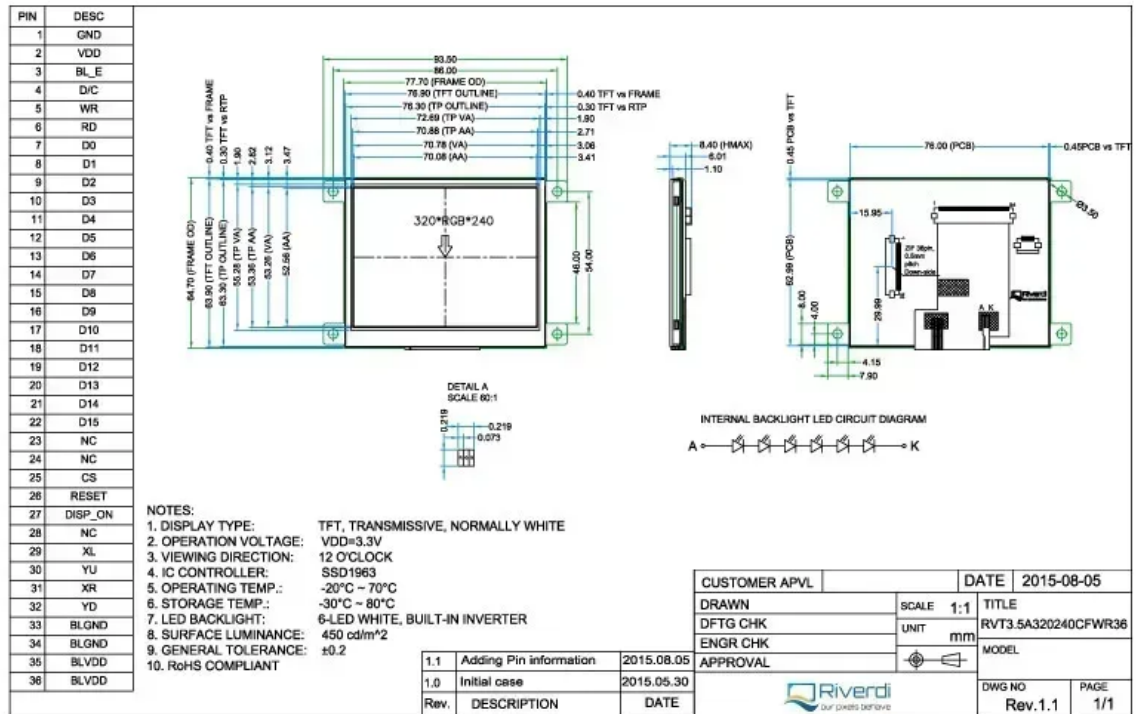
Figure 1. Mounting frame



PART NUMBER	DESCRIPTION
RVT3.5A320240CNWN36	SSD1963
RVT3.5A320240CNWR36	SSD1963, RTP
RVT3.5A320240CNWC36	SSD1963, CTP
RVT3.5A320240CFWN36	SSD1963, Frame
RVT3.5A320240CFWR36	SSD1963, Frame, RTP
RVT3.5A320240CFWC36	SSD1963, Frame, CTP

3. Drawings





NOTES:

1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
2. OPERATION VOLTAGE: VDD=3.3V
3. VIEWING DIRECTION: 12 O'CLOCK
4. IC CONTROLLER: SSD1963
5. OPERATING TEMP.: -20°C ~ 70°C
6. STORAGE TEMP.: -30°C ~ 80°C
7. LED BACKLIGHT: 6-LED WHITE, BUILT-IN INVERTER
8. SURFACE LUMINANCE: 540 cd/m²
9. GENERAL TOLERANCE: ±0.2
10. RoHS COMPLIANT

CUSTOMER APVL		DATE	2015-08-05
DRAWN	SCALE 1:1	TITLE	
DFTG CHK	UNIT mm	RV73.5A320240CNWN36	
ENGR CHK		MODEL	
APPROVAL			

Rev.	DESCRIPTION	DATE
1.1	Adding Pin Information	2015.08.05
1.0	Initial case	2015.05.30

APPROVAL

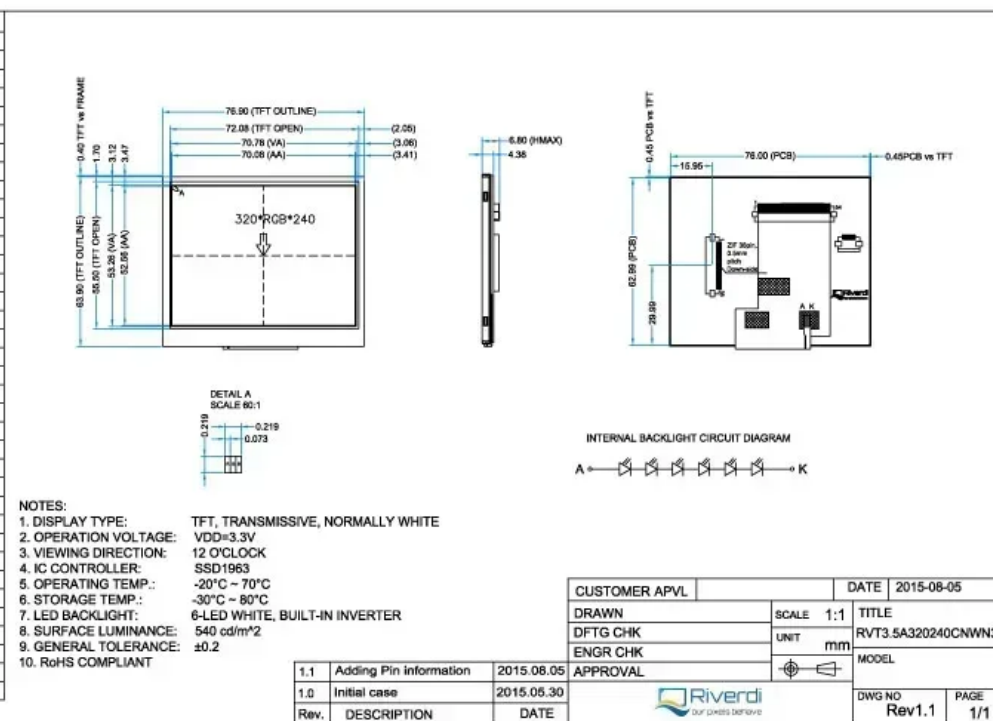
Signature: *[Signature]*

Stamp: Riverdi our passion for design

DWG NO: Rev1.1

PAGE: 1/1

PIN	DESC
1	GND
2	VDD
3	BL_F
4	D/C
5	WR
6	RD
7	D0
8	D1
9	D2
10	D3
11	D4
12	D6
13	D6
14	D7
15	D8
16	D9
17	D10
18	D11
19	D12
20	D13
21	D14
22	D15
23	NC
24	NC
25	CS
26	RESET
27	DISP_ON
28	NC
29	NC
30	NC
31	NC
32	NC
33	BLGND
34	BLVDD
35	BLVDD
36	BLVDD



4. Absolute maximum ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage for Logic	V _{DD}	-0.3	4.6	V
Input Voltage for Logic	V _{IN}	-0.3	V _{DD}	V
Input voltage for LED inverter	BLV _{DD}	-0.3	7.0	V
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	V _{DD}	3.0	3.3	3.6	V	
Input Voltage for LED Inverter	BLV _{DD}	2.8	3.3	5.5	V	
Input Voltage 'H' level for BL_E pin	BL_Eh	1.5	–	5.5	V	
Input Voltage 'L' level for BL_E pin	BL_El	0	–	0.7	V	
Input current (exclude LED backlight)	I _{DD}	–	31	39	mA	V _{DD} =3.3V
LED backlight current	I _{DD} backlight	–	150	187	mA	BL _{DD} =3.3v
LED backlight current	I _{DD} backlight	–	95	119	mA	BL _{DD} =5v
Total Input Current (Include LED backlight 100%)	I _{DD} total	–	181	226	mA	BLV _{DD} =3.3V
Input Voltage 'H' level	V _{ih}	0.7V _{DD}	–	V _{DD}	V	
Input Voltage 'L' level	V _{il}	0	–	0.2V _{DD}	V	
LED Life Time	–	40000	50000	–	Hrs	Note1

Note1: 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
Response Time		Tr+Tf	$\theta=0^{\circ}$ $\phi=0^{\circ}$ Ta=25°C	—	25	30	ms	Figure 1	4
Contrast Ratio		Cr		—	350	—	—	Figure 2	1
Luminance Uniformity		δ WHITE		75	80	—	%	Figure 2	3
Surface Luminance	TFT	Lv		—	540	—	cd/m2	Figure 2	2
	TFT+CTP			—	480	—			
	TFT+RTP			—	450	—			
Viewing Angle Range		θ	$\phi = 90^{\circ}$	30	40	—	deg	Figure 3	6
			$\phi = 270^{\circ}$	50	60	—	deg	Figure 3	
			$\phi = 0^{\circ}$	50	60	—	deg	Figure 3	
			$\phi = 180^{\circ}$	50	60	—	deg	Figure 3	
CIE (x, y) Chromaticity	Red	x	$\theta=0^{\circ}$ $\phi=0^{\circ}$ Ta=25°C	0.574	0.624	0.674	Figure 2	5	
		y		0.318	0.368	0.418			
	Green	x		0.3	0.35	0.4			
		y		0.5	0.55	0.6			
	Blue	x		0.093	0.143	0.193			
		y		0.069	0.119	0.169			
	White	x		0.26	0.31	0.36			
		y		0.283	0.333	0.383			
NTSC	—	—	—	—	50	—	%	—	

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

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

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

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

Note 3. The uniformity in surface luminance 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 3.

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

Note 4. Response time is the time required for the display to transition from white to black (Rise Time, Tr) and from black to white (Decay Time, Tf). For additional information see 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 2. The definition of response time

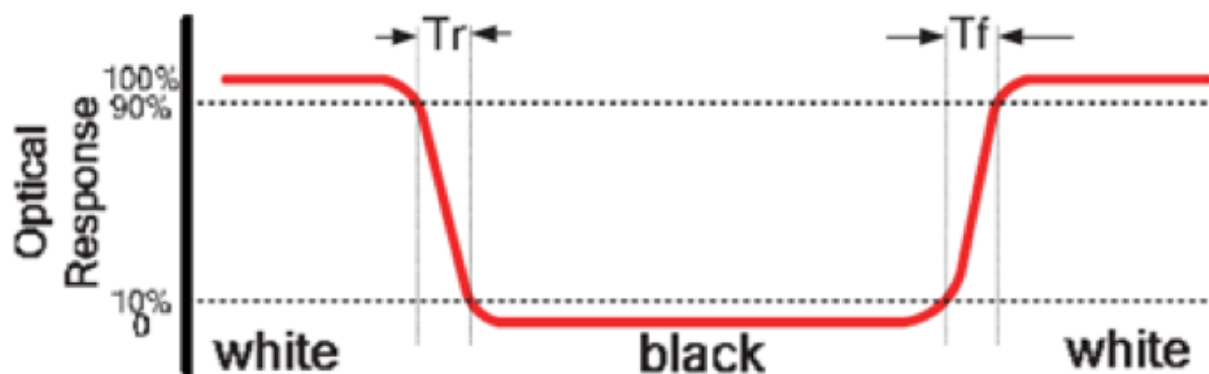


Figure 3. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

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

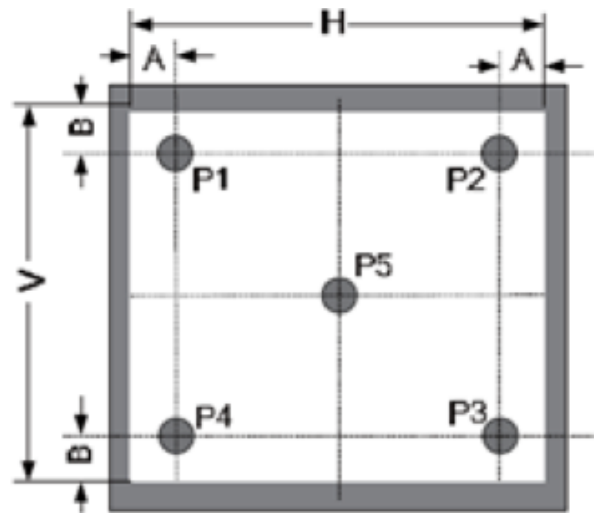
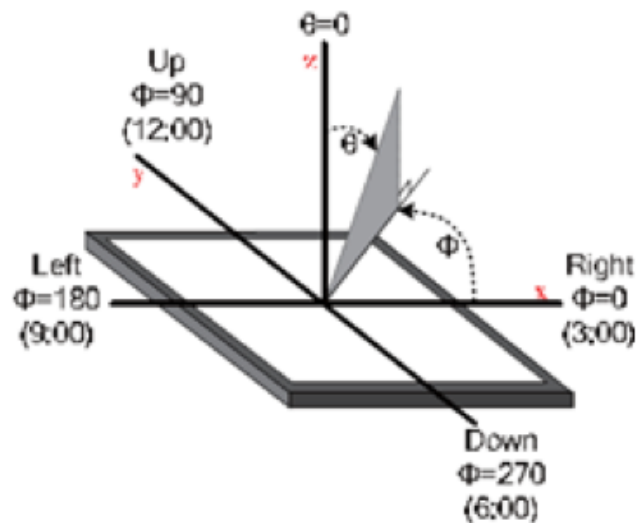


Figure 4.The definition of viewing angle



7. Interface description

PIN NO.	SYMBOL	I/O	DESCRIPTION
1	GND	P	Power Ground
2	VDD	P	Power Supply: +3.3V
3	BL_E	I	Backlight Control Signal, H: On/L: Off (internally pulled-up to BLVDD)
4	D/C	I	Data/Command Select
5	WR	I	Write Strobe Signal
6	RD	I	Read Strobe Signal
7-22	D0-D15	I	Data Bus. Pins not used should be floating.

23	NC	–	No Connection
24	TP_INT (CTP module)	–	Touch panel INT
	NC (RTP module)	–	No Connection
	NC (no touch module)	–	No Connection
25	CS	I	Chip Select
26	RESET	I	Hardware reset
27	DISP ON	I	Display Control H: On/L: Off (internally pulled-up)
28	NC	–	No Connection
29	TP_SCL (CTP module)	–	Touch Panel I2C SCL Signal
	XL (RTP module)	–	Touch left electrode
	NC (no touch module)	–	No Connection
30	TP_SDA (CTP module)	–	Touch Panel I2C SDA Signal
	YU (RTP module)	–	Touch up electrode
	NC (no touch module)	–	No Connection
31	TP_RST (CTP module)	–	Touch Panel I2C RST Signal
	XR	–	Touch right electrode
	NC (no touch module)	–	No Connection
32	TP_WAKE(CTP module)	–	Touch Panel I2C WAKE Signal
	YD	–	Touch down electrode
	NC (no touch module)	–	No Connection
33	BLGND	–	Backlight ground, can be connected to GND
34	BLGND	–	Backlight ground, can be connected to GND
35	BLVDD	–	Backlight power supply, can be connected to VDD
36	BLVDD	–	Backlight power supply, can be connected to VDD

8. Interface timing characteristics

8.1. 8080 mode

The 8080 mode MCU interface consist of CS#, D/C#, RD#, WR#, D[15:0]. This interface use WR# to define a write cycle and RD# for read cycle. If the WR# goes low when the CS# signal is low, the data or command will be latched into the system at the rising edge of WR#.

Similarly, the read cycle will start when RD# goes low and end at the rising edge of RD#.

Interface	Cycle	D[17]	D[16]	D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]
16 bits (565)	1 st			R5	R4	R3	R2	R1	G5	G4	G3	G2	G1	G0	B5

format)															
16 bits	1 st			R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4
	2 nd			B7	B6	B5	B4	B3	B2	B1	B0	R7	R6	R5	R4
	3 rd			G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4
12 bits	1 st							R7	R6	R5	R4	R3	R2	R1	R0
	2 nd							G3	G2	G1	G0	B7	B6	B5	B4
9 bits	1 st											R5	R4	R3	R2
	2 nd											G2	G1	G0	B5
8 bits	1 st											R7	R6	R5	R4
	2 nd											G7	G6	G5	G4
	3 rd											B7	B6	B5	B4

8.2. Parallel 8080-series Interface Timing

Figure 5. Parallel 8080-series Interface Timing Diagram (Write Cycle)

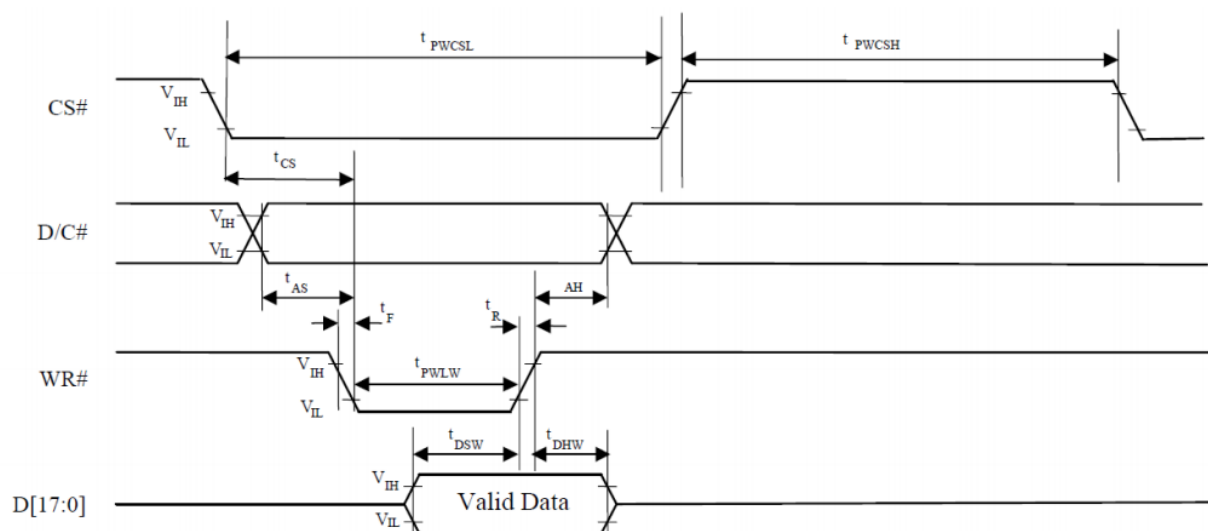
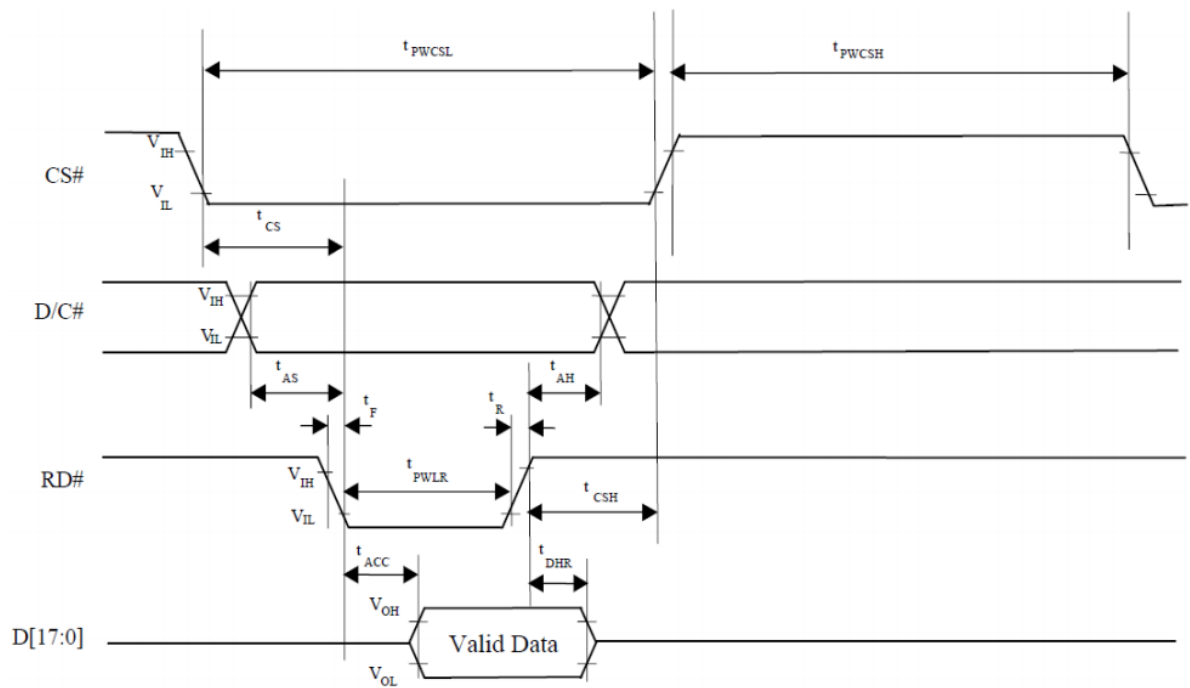


Figure 6. Parallel 8080-series Interface Timing Diagram (Read Cycle)



9. LCD timing characteristics

9.1. Timing chart

Timing parameter (VDD=3.3V, GND=0V, Ta=25 °C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
CLK Clock Time	Tclk	1/Max(FCLK)	–	1/Min(FCLK)	ns	–
CLK Pulse Duty	Tchw	40	50	60	%	TCLK
HSYNC to CLK	Thc	–	–	1	CLK	–
HSYNC Width	Thwh	1	–	–	CLK	–
VSYNC Width	Tvwh	1	–	–	ns	–
HSYNC Period Time	Th	60	63.56	67	ns	–
VSYNC Set-up Time	Tvst	12	–	–	ns	–
VSYNC Hold Time	Tvhd	12	–	–	ns	–
HSYNC Setup Time	Thst	12	–	–	ns	–
HSYNC Hold Time	Thhd	12	–	–	ns	–
Data Set-up Time	Tdsu	12	–	–	ns	D00~D23 to CLK
Data Hold Time	Tdhd	12	–	–	ns	D00~D23 to CLK
DEN Set-up Time	Tesu	12	–	–	ns	DEN to CLK

Figure 7. DE mode timing diagram

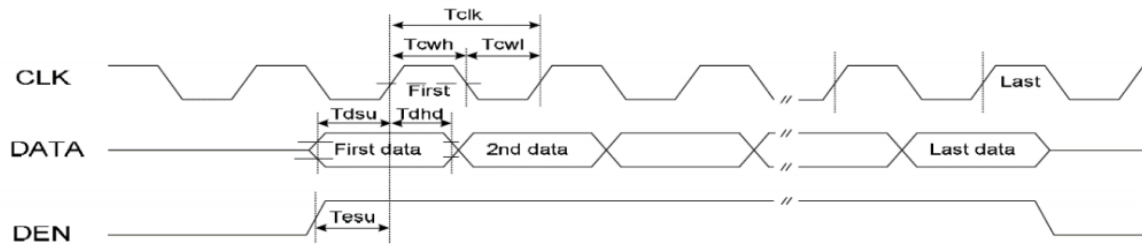


Figure 8. SYNC mode timing diagram

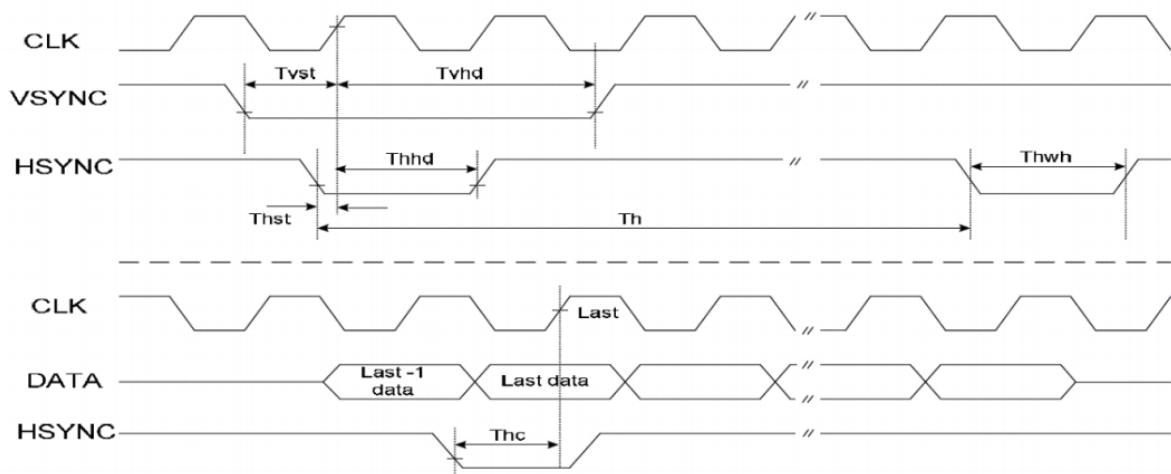
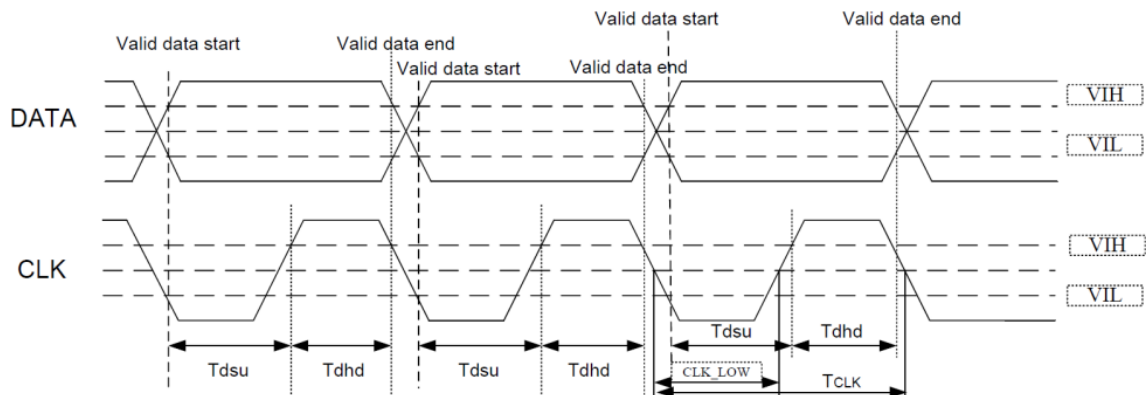


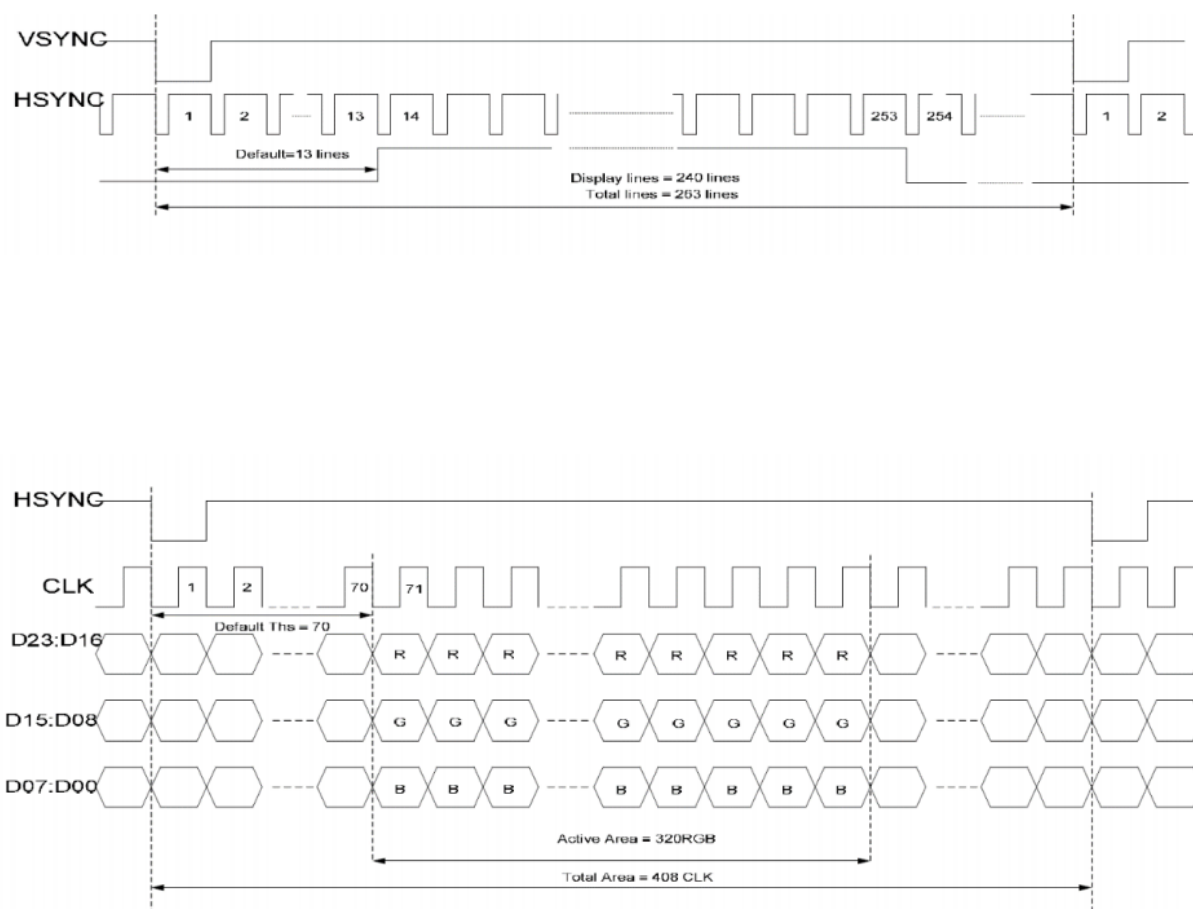
Figure 9. Timing diagram



9.2. 24Bit GB Mode for 320xRGBx240

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
CLK Frequency	Fclk	7.0	8.0	9.0	MHz	VDD=3.0V~3.6V
CLK Cycle Time	Tclk	143	125	111	ns	–
CLK Pulse Duty	Tcwh	40	50	60	%	–
Time that HSYNC to 1st Data Input (NTSC)	Ths	40	70	255	CLK	DDLY=70 Offset=0(fixed)

Figure 10. 24 bit RGB SYNC mode timing



10. Touch panel specifications

10.1. 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

10.1.1. For capacitive touch panel

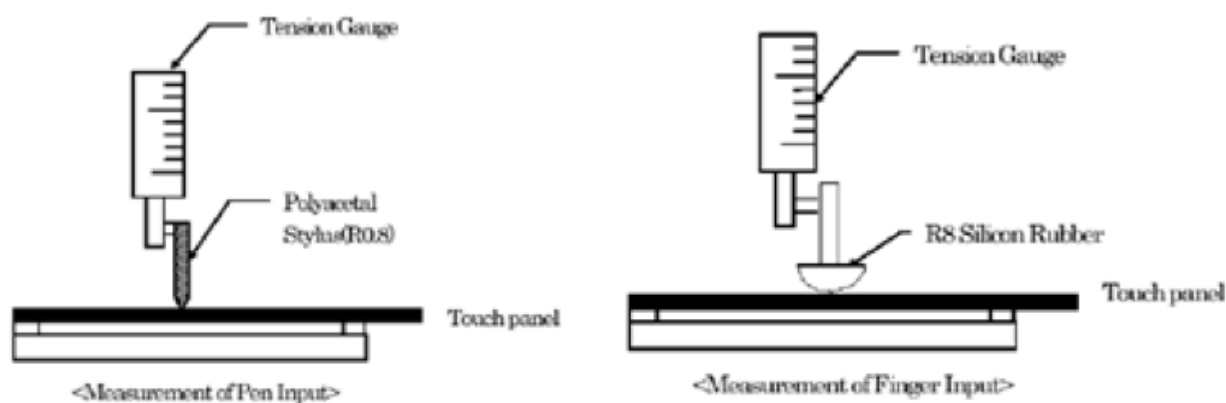
DESCRIPTION		SPECIFICATION
Operating Voltage		DC 2.8~3.6V
Power Consumption (IDD)	Active Mode	10~18mA
	Sleep Mode	30~50μA
Interface		I ² C
Linearity		<1.5%
Controller		FT5346
I2C address		0x38 (7 bit address)
Resolution		896*640

10.1.2. For resistive touch panel

ITEM	VALUE			UNIT	REMARK
	Min.	Typ.	Max.		
Linearity	-3.0	–	1.5	%	Analog X and Y directions
Terminal Resistance	200	–	900	Ω	X
	100	–	600	Ω	Y
Insulation Resistance	20	–	–	MΩ	DC 25V
Voltage	–	–	10	V	DC
Chattering	–	–	10	ms	100kΩ pull-up
Transparency	78	–	–	%	JIS K7105

10.2. 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.

10.2.1 for capacitive touch panel

DESCRIPTION	INL SPECIFICATION	REMARK
Touch Panel Size	3.5 inch	
Outline Dimension (OD)	76.75 mm x 63.00mm	Cover Lens Outline
Product Thickness	1.26 mm± 0.1mm	
Glass Thickness	0.7 mm± 0.1mm	
Ink View Area	72.85mm x 55.50mm	
Sensor Active Area	73.25mm x 55.90mm	
Input Method	5 Finger	
Activation Force	Touch	
Surface Hardness	≥7H	

10.2.2. 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	20	–	–	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

10.3. Capacitive touch panel parameters

10.3.1. Interface timing characteristics

PARAMETER	MIN	MAX	UNIT
SCL Frequency	0	400	kHz
Bus Free Time Between a STOP and START Condition	4.7	/	µs
Hold Time (repeated) START Condition	4.0	/	µs
Data Setup Time	250	/	ns
Setup Time for Repeated START Condition	4.7	/	µs
Setup Time for STOP Condition	4.0	/	µs

10.3.2. I2C Read/Write Interface description

Figure 11. Write N bytes to I2C slave

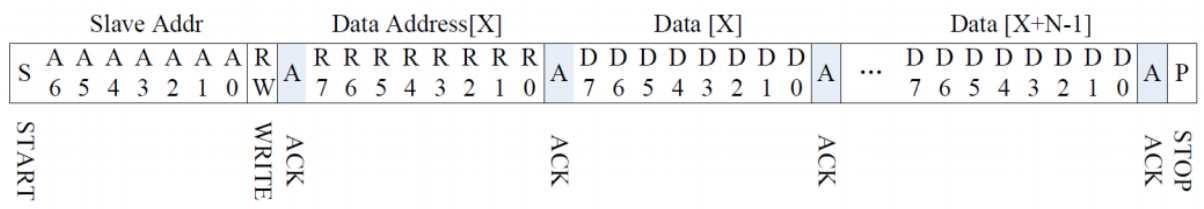


Figure 12. Set Data Address

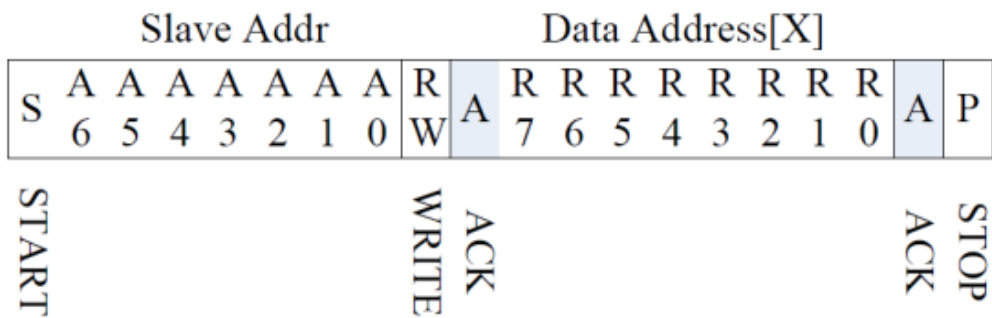
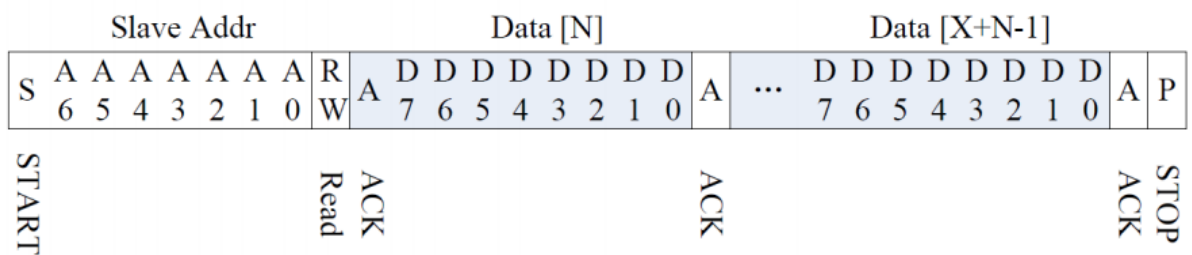


Figure 12. Read X bytes from I2C Slave



10.3.3. Communication of the I2C interface with host

Figure 13. Communication of the I2C interface with Host

17h	TOUCH4_YH	4th Touch ID[3:0]				4th Touch X Position[11:8]				R
18h	TOUCH4_YL	4th Touch Y Position[7:0]								R
19h										R
1Ah										R
1Bh	TOUCH5_XH	5th Event Flag				5th Touch X Position[11:8]				R
1Ch	TOUCH5_XL	5th Touch X Position[7:0]								R
1Dh	TOUCH5_YH	5th Touch ID[3:0]				5th Touch X Position[11:8]				R
1Eh	TOUCH5_YL	5th Touch Y Position[7:0]								R

10.3.5 Data description

DEVICE_MODE

This register is the device mode register, configure it to determine the current mode of the chip.

ADRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
00h	6:4	Device Mode [2:0]	000b Work Mode 100b Factory Mode – Read Raw Data

GEST_ID

This register describes the gesture of a valid touch.

ADRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
01h	7:0	Gesture ID [7:0]	Gesture ID 0x10 Move Up 0x14 Move Down 0x18 Move Right 0x48 Zoom In 0x49 Zoom Out 0x00 No Gesture

TD_STATUS

This register is the Touch Data status register.

ADRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
02h	3:0	Number of Touch Points [2:0]	How Many Points Detected 1-5 is Valid
	7:4		

TOUCHn_XH(n:1-10)

This register describes MSB of the X coordinate of the nth touch point and the corresponding event flag.

ADRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
03h ~ 39h	7:6	Event Flag	00b: Put Down 01b: Put Up 10b: Contact 11b: Reserved
	5:4		Reserved
	3:0	Touch X Position [11:8]	MSB of Touch X Position in Pixels

TOUCHn_XL(n:1-10)

This register describes LSB of the X coordinate of the nth touch point.

ADRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
04h ~ 3Ah	7:0	Touch X Position [7:0]	LSB of the Touch X Position in Pixels

TOUCHn_YH(n:1-10)

This register describes MSB of the Y coordinate of the nth touch point and corresponding touch ID.

ADRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
05h ~ 3Bh	7:4	Touch ID[3:0]	Touch ID of Touch Point
	3:0	Touch X Position [11:8]	MSB of Touch Y Position in Pixels

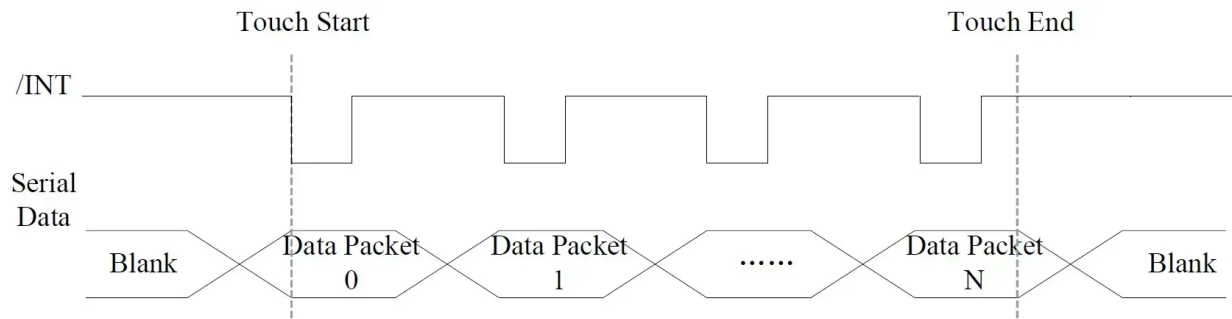
TOUCHn_YL(n:1-10)

This register describes LSB of the Y coordinate of the nth touch point.

ADRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
05h ~ 3Bh	7:0	Touch X Position [7:0]	LSB of the Touch Y Position in Pixels

10.3.6 Interrupt Trigger Mode

Figure 14. Interrupt trigger mode timing



11. Inspection

Standard acceptance/rejection criteria for TFT module.

11.1. Inspection condition

Ambient conditions:

- Temperature: $25 \pm 1^\circ\text{C}$
- Humidity: $(60 \pm 10) \% \text{RH}$
- Illumination: Single fluorescent lamp non-directive (300 to 700 lux)

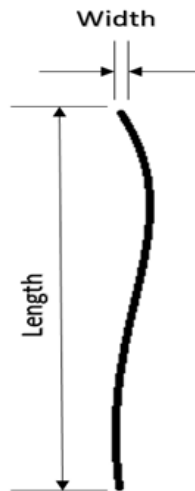
Viewing distance:

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

Viewing Angle:

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

LCD black spots,
white spots, light
leakage (line Type)



*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

	<table><tr><td>D<0.25 mm</td><td>Ignored</td></tr><tr><td>0.25 mm < D < 0.5 mm</td><td>3</td></tr><tr><td>0.5 mm < D</td><td>0</td></tr></table>	D<0.25 mm	Ignored	0.25 mm < D < 0.5 mm	3	0.5 mm < D	0																										
D<0.25 mm	Ignored																																
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0.5 mm < D	0																																
Electrical Dot Defect	<table><tr><td colspan="2">Size < 5"</td></tr><tr><td>item</td><td>Qualified Qty</td></tr><tr><td>Black do defect</td><td>4</td></tr><tr><td>Bright dot defect</td><td>2</td></tr><tr><td>Total Dot</td><td>5</td></tr></table> <table><tr><td colspan="2">Size >= 5"</td></tr><tr><td>item</td><td>Qualified Qty</td></tr><tr><td>Black do defect</td><td>5</td></tr><tr><td>Bright dot defect</td><td>2</td></tr><tr><td>Total Dot</td><td>5</td></tr></table>	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												
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Bright dot defect	2																																
Total Dot	5																																
Item	Criterion																																
Touch panel spot	<table><tr><td colspan="2">Size < 5"</td></tr><tr><td>Average Diameter</td><td>Qualified Qty</td></tr><tr><td>D < 0.2 mm</td><td>Ignored</td></tr><tr><td>0.2 mm < D < 0.4 mm</td><td>5</td></tr><tr><td>0.4 mm < D < 0.5 mm</td><td>2</td></tr><tr><td>0.5 mm < D</td><td>0</td></tr></table> <table><tr><td colspan="2">Size >= 5"</td></tr><tr><td>Average Diameter</td><td>Qualified Qty</td></tr><tr><td>D<0.25 mm</td><td>Ignored</td></tr><tr><td>0.25 mm < D < 0.5 mm</td><td>4</td></tr><tr><td>0.5 mm < D</td><td>0</td></tr></table>	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										
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Touch panel White Line Scratch	<table><tr><td colspan="2">Size < 5"</td><td></td></tr><tr><td>Length</td><td>Width</td><td>Qualified Qty</td></tr><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></table> <table><tr><td colspan="2">Size >= 5"</td><td></td></tr><tr><td>Length</td><td>Width</td><td>Qualified Qty</td></tr><tr><td>–</td><td>W< 0.03</td><td>Ignored</td></tr><tr><td>L < 5.0</td><td>0.03 < W <0.05</td><td>2</td></tr><tr><td>–</td><td>0.05 < W</td><td>0</td></tr></table>	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
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12. Reliability test

NO.	TEST ITEM	TEST CONDITION	INSPECTION AFTER TEST
1	High Temperature Storage	80±2°C/240 hours	Inspection after 2~4 hours storage at room temperature, the sample shall be free from defects: 1. Air bubble in the LCD 2. Seal leak 3. Non-display 4. Missing segments 5. Glass crack 6. Current Idd is twice higher than initial value 7. The surface shall be free from damage 8. Linearity must be no more than 1.5% by the linearity tester 9. The Electric characteristics requirements shall be satisfied
2	Low Temperature Storage	-30±2°C/240 hours	
3	High Temperature Operating	70±2°C/240 hours	
4	Low Temperature Operating	-20±2°C/240 hours	
5	Temperature Cycle	-30±2°C~25~70±2°C × 30 cycles	
6	Damp Proof Test	60°C ±5°C × 90%RH/160 hours	
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~55Hz~10Hz 2 hours For each direction of X, Y, Z (6 hours for total)	
8	Mechanical Shock	60G 6ms, ± X, ± Y, ± Z 3 times for each direction	
9	Packing Drop Test	Height: 80 cm 1 corner, 3 edges, 6 surfaces	
10	Package Vibration Test	Random vibration: 0.015G ² /Hz from 5-200Hz -6dB/Octave from 200-500Hz 2 hours for each direction of X, Y, Z (6 hours for total)	
11	Electrostatic Discharge	Air: ±8KV 150pF/330Ω 5 times Contact: ±4KV 150pF/330Ω 5 times	

12	Hitting Test	<p>1,000,000 times in the same point</p> <p>Hitting pad: tip R3.75mm, Silicone rubber, Hardness: 40deg.</p> <p>Load: 2.45N</p> <p>Hitting speed: Twice/sec</p> <p>Electric load: none</p> <p>Test area should be at 1.8mm inside of insulation.</p>
13	Pen Sliding Durability Test	<p>100,000 times minimum</p> <p>Hitting pad: tip R0.8mm plastic pen</p> <p>Load: 1.47N</p> <p>Sliding speed: 60 mm/sec</p> <p>Electric load: none</p> <p>Test area should be at 1.8mm inside of insulation.</p>
<p>Remark:</p> <p>1. The test samples should be applied to only one test item.</p> <p>2. Sample size for each test item is 5~10pcs.</p> <p>3. For Damp Proof Test, Pure water(Resistance 10MΩ) should be used.</p> <p>4. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.</p> <p>5. EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.</p> <p>6. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.</p>		

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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Updated on April 30, 2020

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