



RAYSTAR

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RFC350M-EIW-DRS

SPECIFICATION

CUSTOMER:

APPROVED BY	
PCB VERSION	
DATE	

FOR CUSTOMER USE ONLY

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

Release DATE:

TFT Display Inspection Specification: <https://www.raystar-optronics.com/download/products.htm>

Precaution in use of TFT module: <https://www.raystar-optronics.com/download/declaration.htm>

Revision History

VERSION	DATE	REVISED PAGE NO.	Note
0	2014/10/13		First issue
A	2015/05/27		Add SPI Timing Characteristics Modify Instructions Table. Add Resistance Touch Panel General Specifications. Modify Reliability. Modify Interface: RS232 19200 Baud rate/SPI & VDD=>VBUS.
B	2016/01/21		Modify Static electricity test
C	2016/05/19		Modify RS232->Uart .
D	2016/08/11		Modify Vibration test
E	2016/10/17		Modify Summary
F	2017/03/30		Add Aspect Ratio
G	2017/07/19		Modify FPC
H	2019/11/18		Add Operating mode Modify LED voltage
I	2020/04/15		Add Relationship and Flash Memory Size and Uniformity

Contents

1. Module Classification Information
2. Summary
3. General Specification
4. Interface
5. Contour Drawing
6. Absolute Maximum Ratings
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8. DC Characteristics
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10. Waveform
11. Optical Characteristics
12. Reliability
13. Touch Panel Information
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2.Summary

TFT 3.5" is a TN transmissive type color active matrix TFT liquid crystal display that use amorphous silicon TFT as switching devices. This module is composed of a TFT_LCD module, it is usually designed for industrial application and this module follows RoHs,

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3.General Specifications

- Size: 3.5 inch
- Dot Matrix: 320 x RGBx240(TFT) dots
- Module dimension: 100(W) x 66.44(H) x 8.9(D) mm
- Active area: 70.08 x 52.56 mm
- Dot pitch: 0.219 x 0.073 mm
- LCD type: TFT, Normally White, Transmissive
- View Direction: 12 o'clock
- Gray Scale Inversion Direction: 6 o'clock
- Aspect Ratio: 4:3
- Backlight Type: LED, Normally White
- Interface: Uart 19200 Baud rate/SPI
- With /Without TP: With RTP
- Surface: Anti-Glare
- Operating mode: Slave mode
- Flash Memory Size: 32M bits

*Color tone slight changed by temperature and driving voltage

4.Interface

CON 2			
Pin	Symbol	I/O	Function
1	GND	Power Supply	Power Ground
2	TX	O	Uart Transmit pin
3	RX	I	Uart Receive pin
4	VBUS	Power Supply	Power supply : 5V
5	D+	I/O	USB Data +
6	D-	I/O	USB Data -
7	GND	Power Supply	Power Ground
8	/RST	I	Reset (active Low)
9	GND	Power Supply	Power Ground
10	PWM	O	Pulse width modulation
11	GND	Power Supply	Power Ground
12	VBUS	Power Supply	Power supply : 5V

CON 3			
Pin	Symbol	I/O	Function
1	GND	Power Supply	Power Ground
2	SW1	I	Switch (active low)
3	SW2	I	Switch (active low)
4	SW3	I	Switch (active low)
5	SW4	I	Switch (active low)
6	GND	Power Supply	Power Ground
7	SDI	O	Master Input Slave Output (MISO)
8	SDO	I	Master Output Slave Input (MOSI)
9	SCK	I	Serial Clock
10	SCS	I	Serial Chip selection
11	SPI_INT	O	Serial Interrupt
12	VBUS	Power Supply	Power supply : 5V

6. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-20	—	+70	°C
Storage Temperature	TST	-30	—	+80	°C

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

- Temp. $\leq 60^{\circ}\text{C}$, 90% RH MAX. Temp. $> 60^{\circ}\text{C}$, Absolute humidity shall be less than 90% RH at 60°C

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7. Electrical Characteristics

7.1. Operating conditions:

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Supply Voltage For LCM	VBUS	—	4.5	5	5.5	V	—
Supply Current For LCM	IBUS	—	—	160	240	mA	Note1
Power Consumption	—	VBUS=5V	—	800	1320	mW	VBUS=5V Note 2

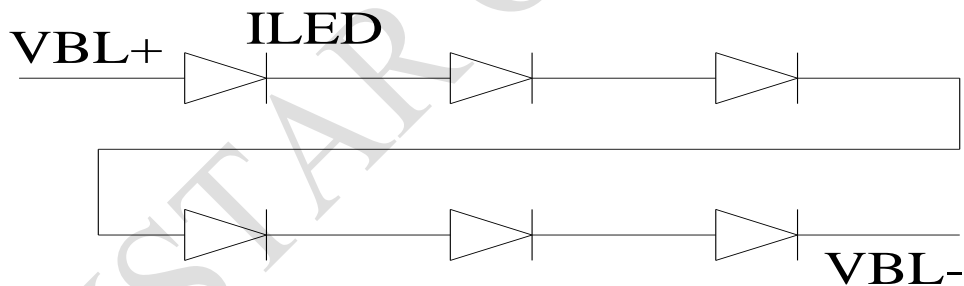
Note 1 : This value is test for VBUS=5V , Ta=25 °C only

Note 2 : Power consumption is include Backlight driver system

7.2. LED driving conditions (LED Driver system build in)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current		-	20	-	mA	
Power Consumption		336	384	408	mW	
LED voltage	LED+	16.8	19.2	20.4	V	Note 1
LED Life Time		-	50,000	-	Hr	Note 2,3,4

Note 1 : There are 1 Groups LED



Note 2 : Ta = 25 °C

Note 3 : Brightness to be decreased to 50% of the initial value

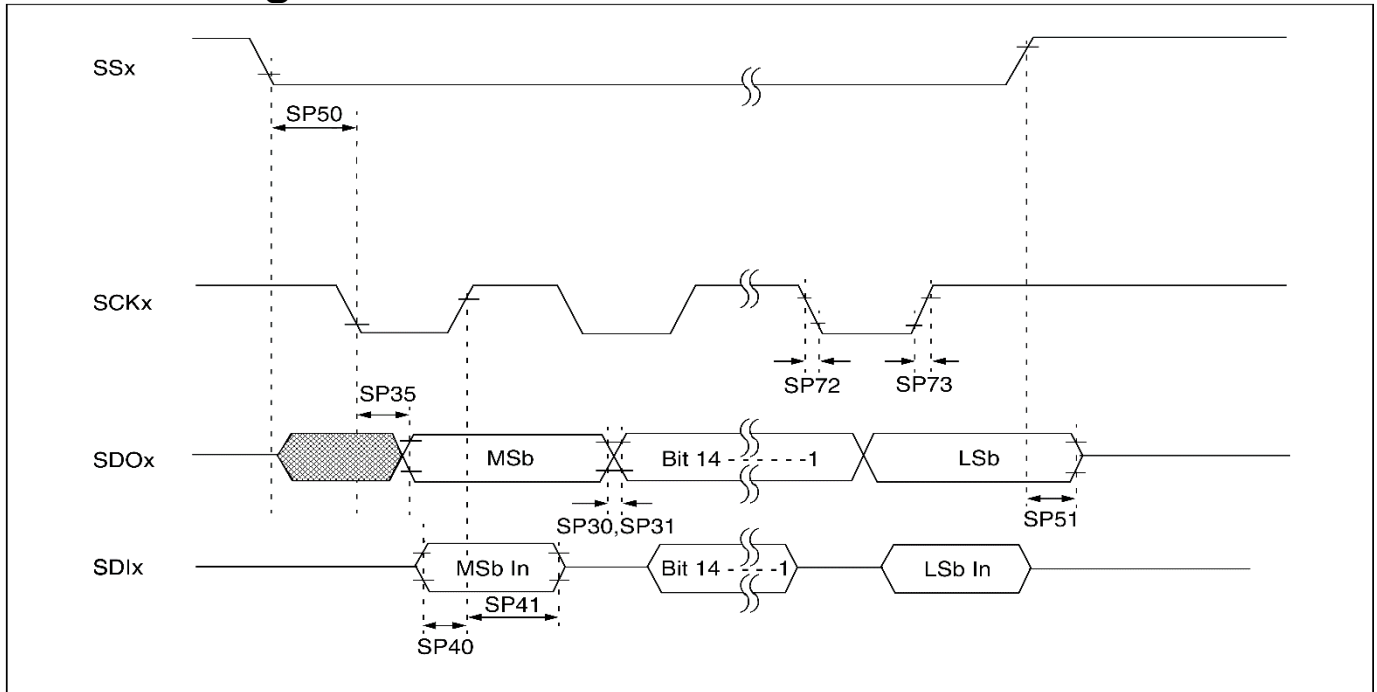
Note 4 : The single LED lamp case

8.DC CHARATERISTICS

Parameter	Symbol	Rating			Unit	Condition
		Min	Typ	Max		
Low level input voltage	V_{IL}	0	-	0.3VBUS	V	
High level input voltage	V_{IH}	0.7VBUS	-	VBUS	V	

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9.SPI Timing Characteristics



AC CHARACTERISTICS			Standard Operating Conditions: 2.0V to 3.6V (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for Industrial				
Param No.	Symbol	Characteristic	Min	Typ ⁽¹⁾	Max	Units	Conditions
SP70	TscL	SCKx Input Low Time	250	—	—	ns	
SP71	TscH	SCKx Input High Time	250	—	—	ns	
SP72	TscF	SCKx Input Fall Time ⁽²⁾	—	10	25	ns	
SP73	TscR	SCKx Input Rise Time ⁽²⁾	—	10	25	ns	
SP30	TdoF	SDOx Data Output Fall Time ⁽²⁾	—	10	25	ns	
SP31	TdoR	SDOx Data Output Rise Time ⁽²⁾	—	10	25	ns	
SP35	Tsch2doV, TscL2doV	SDOx Data Output Valid after SCKx Edge	—	—	30	ns	
SP40	TdiV2scH, TdiV2scL	Setup Time of SDIx Data Input to SCKx Edge	20	—	—	ns	
SP41	Tsch2diL, TscL2diL	Hold Time of SDIx Data Input to SCKx Edge	20	—	—	ns	
SP50	TssL2scH, TssL2scL	$\overline{\text{SSx}}$ to SCKx \uparrow or SCKx Input	120	—	—	ns	
SP51	TssH2doZ	$\overline{\text{SSx}}$ \uparrow to SDOx Output High-Impedance ⁽³⁾	10	—	50	ns	
SP52	Tsch2ssH TscL2ssH	$\overline{\text{SSx}}$ after SCKx Edge	50	—	—	ns	

10. Instructions Table

10.1. UART Mode

Text Mode

Instruction of text mode

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
SB 1	PL	SB 2	SB 3	M D	W R	TR	X H	XL	Y H	YL	S R	S G	SB	B R	B G	B B	TA SDA	EB 1	EB 2	EB 3

Graphic Mode

Instruction of Graphic mode:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SB1	PL	SB2	SB3	MD	RR	XH	XL	YH	YL	PH	PL	EB1	EB2	EB3	SB1

Pixel Mode

Instruction of Pixel mode

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SB1	PL	SB2	SB3	MD	RR	XH	XL	YH	YL	PR	PG	PB	EB1	EB2	EB3

Geometry Mode

Instruction of geometry mode

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
SB 1	PL	SB 2	SB 3	M D	R R	XS H	XS L	YS H	YS L	XE H	XE L	YE H	YE L	LS	LR	LG	LB	EB 1	EB 2	EB 3

Clean Mode

Instruction of Clean Mode

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SB1	PL	SB 2	SB 3	MD	XSH	XSL	YSH	YSL	XEH	XEL	YEH	YEL	EB1	EB2	EB3

PWM Mode

Instruction of Pixel mode

1	2	3	4	5	6	7	8	9	10	11	12	13
SB1	PL	SB2	SB3	MD	PS	PFH	PFL	PDH	PDL	EB1	EB2	EB3

Backlight Mode

Instruction of Clean Mode

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SB1	PL	SB2	SB3	MD	RR	XH	XL	YH	YL	PR	PG	PB	EB1	EB2	EB3

10.2. SPI Mode

Text Mode

Instruction of text mode

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0x31	SB 3	MD	WR	TR	XH	XL	YH	YL	SR	SG	SB	BR	BG	B B	TA SDA

Graphic Mode

Instruction of Graphic mode:

1	2	3	4	5	6	7	8	9	10
0x31	SB3	MD	RR	XH	XL	YH	YL	PH	PL

Pixel Mode

Instruction of Pixel mode

1	2	3	4	5	6	7	8	9	10	11
0x31	SB3	MD	RR	XH	XL	YH	YL	PR	PG	PB

Geometry Mode

Instruction of geometry mode

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0x31	SB 3	MD	RR	XS H	XSL	YS H	YSL	XE H	XEL	YE H	YEL	LS	LR	LG	LB

Clean Mode

Instruction of Clean Mode

1	2	3	4	5	6	7	8	9	10	11
0x31	SB3	MD	XSH	XSL	YSH	YSL	XEH	XEL	YEH	YEL

PWM Mode

Instruction of Pixel mode

1	2	3	4	5	6	7	8
0x31	SB3	MD	PS	PFH	PFL	PDH	PDL

Backlight Mode

Instruction of Clean Mode

1	2	3	4	5	6	7	8	9	10	11
0x31	SB3	MD	RR	XH	XL	YH	YL	PR	PG	PB

11. Optical Characteristics

Item	Symbol	Condition.	Min	Typ.	Max.	Unit	Remark	
Response time	Tr	$\theta=0^\circ$ 、 $\Phi=0^\circ$	-	10		.ms	Note 3	
	Tf		-	15		.ms		
Contrast ratio	CR	At optimized viewing angle	300	350	-	-	Note 4	
Color Chromaticity	White	$\theta=0^\circ$ 、 $\Phi=0$	Wx	0.26	0.31	0.36		Note 2,6,7
			Wy	0.28	0.33	0.38		
Viewing angle (Gray Scale Inversion Direction)	Hor.	$CR \geq 10$	ΘR	-	55		Deg.	Note 1
			ΘL	-	55			
	Ver.		ΦT	-	45			
			ΦB	-	50			
Brightness	-	-	250	300	-	cd/m2	Center of display	
Uniformity	(U)	-	75	-	-	%	Note 5	

Ta=25±2°C, VDD/IDD=5V/160mA

Note 1: Definition of viewing angle range

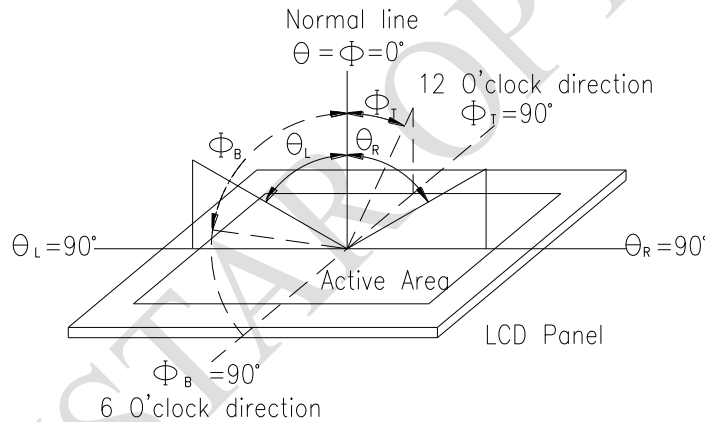


Fig. 11.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

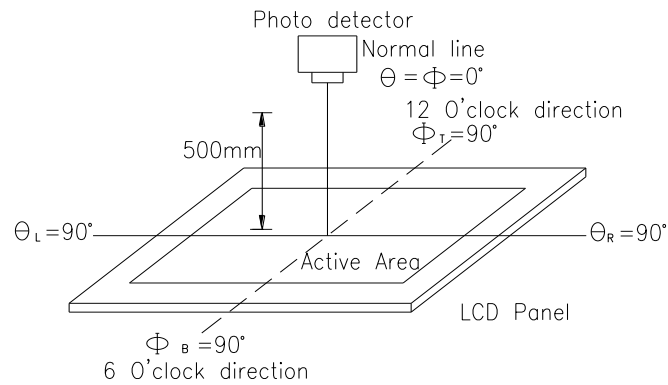
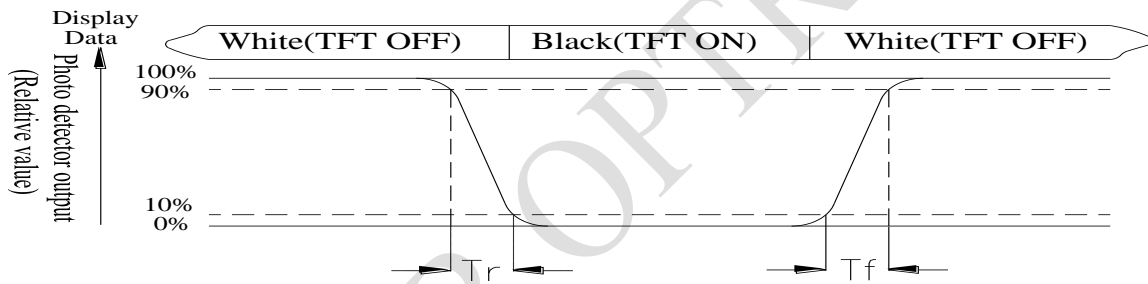


Fig. 11.2. Optical measurement system setup

Note 3: Definition of Response time:

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time, T_r , is the time between photo detector output intensity changed from 90% to 10%. And fall time, T_f , is the time between photo detector output intensity changed from 10% to 90%



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (reference the picture in below). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\min}/L_{\max} \times 100\%$$

L = Active area length

W = Active area width

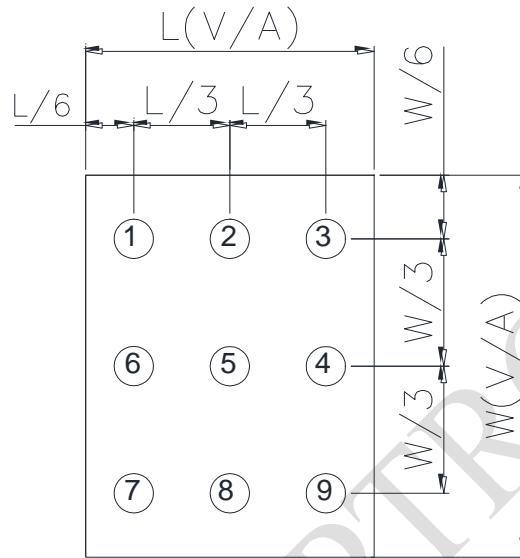


Fig11.3. Definition of uniformity

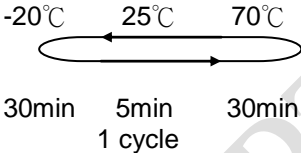
Note 6: Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

12. Reliability

Content of Reliability Test (Wide temperature, -20°C~70°C)

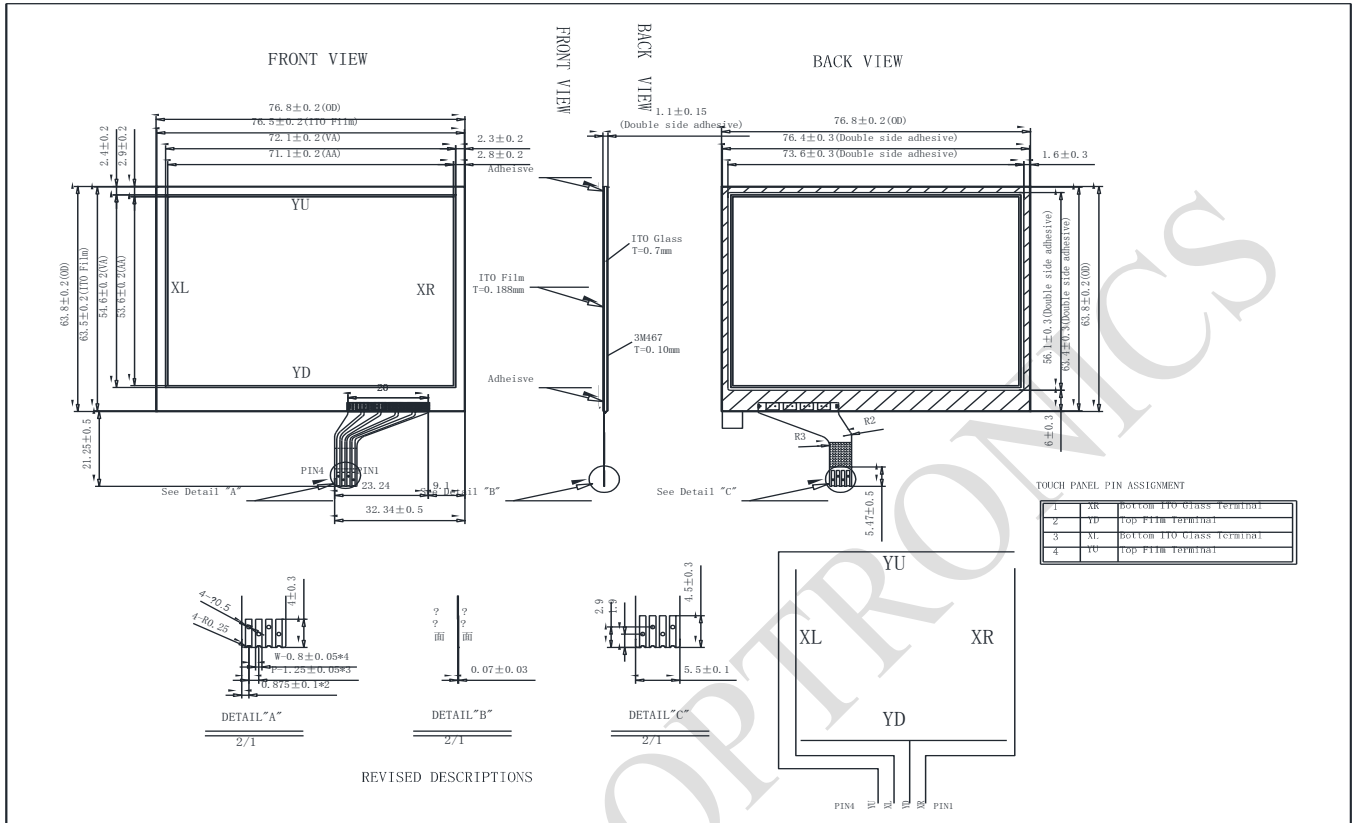
Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60°C,90%RH max	60°C,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation <div style="text-align: center;">  <p>-20°C 25°C 70°C</p> <p>30min 5min 30min</p> <p>1 cycle</p> </div>	-20°C/70°C 10 cycles	—
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 3 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact) ,±800v(air), RS=330Ω CS=150pF 10 times	—

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

13.Touch Panel Information



13.1. Resistance Touch Panel General Specifications

Item	Description
Driving condition	DC5V
Operating force	60~150g
Linearity max	$\leq \pm 1.5\%$
Insulating resistance	$> 20M\Omega$, 25V(DC)
Light transparence	70%
Structure type	ITO Film/ITO Glass(F/G)
Surface Hardness	3H typ
Pen Hitting Durability (with the silicon rubber)	$> 1000,000$ times
X resistance	200~1100 Ω
Y resistance	200~1100 Ω

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14. Relationship

14.1. Commands Reference Guide

If you want to know the details of how to use the command, you can see the PDF named M-series TFT Commands Reference Guide.

14.2. User Guide

If you want to learn more about how to use UI software, you can see the PDF named M-Series User Guide.

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LCM Sample Estimate Feedback Sheet

Module Number : _____

1 、 Panel Specification :

1. Panel Type :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. View Direction :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. Numbers of Dots :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. View Area :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Active Area :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6. Operating Temperature :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7. Storage Temperature :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
8. Others :	_____	

2 、 Mechanical Specification :

1. PCB Size :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. Frame Size :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. Material of Frame :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. Connector Position :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Fix Hole Position :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6. Backlight Position :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7. Thickness of PCB :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
8. Height of Frame to PCB :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
9. Height of Module :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
10. Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

3 、 Relative Hole Size :

1. Pitch of Connector :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. Hole size of Connector :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. Mounting Hole size :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. Mounting Hole Type :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

4 、 Backlight Specification :

1. B/L Type :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. B/L Color :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. B/L Driving Voltage (Reference for LED Type) :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. B/L Driving Current :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Brightness of B/L :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6. B/L Solder Method :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7. Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

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Module Number : _____		
5 · <u>Electronic Characteristics of Module</u> :		
1.Input Voltage :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2.Supply Current :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3.Driving Voltage for LCD :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4.Contrast for LCD :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5.B/L Driving Method :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6.Negative Voltage Output :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7.Interface Function :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
8.LCD Uniformity :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
9.ESD test :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
10.Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6 · <u>Summary</u> :		
<p style="text-align: right;"> Sales signature : _____ Customer Signature : _____ Date : / / _____ </p>		