



RAYSTAR

曜凌光電股份有限公司

住址: 42878 台中市大雅区科雅路 25 號 5F WEB: <http://www.Raystar-Optronics.com>
5F., No.25, Keya Rd., Daya Dist., Taichung E-mail: sales@raystar-optronics.com
City 428, Taiwan Tel:886-4-2565-0761 Fax : 886-4-2565-0760

RFF700M-EIW-DRN

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	2015/12/07		First issue
A	2016/01/21		Modify Static electricity test
B	2016/08/11		Modify Vibration test
C	2016/10/08		Modify Summary
D	2018/04/26		Modify Contour Drawing
E	2019/09/02		Modify Instructions Table
F	2020/04/10		Add Relationship & Flash Memory Size & SD card format & Uniformity

Contents

1.Module Classification Information

2.Summary

3.General Specification

4.Interface

5.Contour Drawing

6.Absolute Maximum Ratings

7.Electrical Characteristics

8.DC Characteristics

9.AC Characteristics

10. Waveform

11.Optical Characteristics

12.Reliability

13.Initial Code For Reference

14.Other

1.Module Classification Information

R	F	F	70	0M	-	E	I	W	-	D	R	N
1	2	3	4	5	-	6	7	8	-	9	10	11

Item	Description	
1	R : Raystar Optonics Inc.	
2	Display Type : F→TFT Type, J→ Custom TFT	
3	Solution: A: 128x160 B:320x234 C:320x240 D:480x234 E:480x272 F:800x480 G:640x480 H:1024x600 I:320x480 J:240x320 K:1280x800 L:240x400 M:1024x768 N:128x128 O:480x800 P:640x320 Q:800x600 S:480x128 T:800x320	
4	Display Size : 7.0" TFT	
5	Version Code.	
6	Model Type: A : TFT LCD E : TFT+FR+CONTROL BOARD J : TFT+FR+A/D BOARD N : TFT+FR+A/D BOARD+CONTROL BOARD S : TFT+FR+POWER BOARD (DC TO DC) 1 : TFT+CONTROL BOARD	6 : TFT+FR H : TFT+D/V BOARD I : TFT+FR+D/V BOARD B : TFT+POWER BD
7	Polarizer Type, Temperature range, View direction	I→Transmissive, W. T, 6:00 ; C→Transmissive, N. T, 6:00 L→Transmissive, W.T,12:00 ; F→Transmissive, N.T,12:00 Y→Transmissive,W.T, IPS TFT ; A→Transmissive, N.T, IPS TFT Z→Transmissive, W.T, O-TFT R→Transmissive, Super W.T, O-TFT N→Transmissive, Super W.T, 6:00; Q→Transmissive, Super W.T, 12:00 V→Transmissive, Super W.T, VA TFT
8	Backlight	W : LED, White H : LED, High Light White F : CCFL, White
9	Driver Method	D: Digital A: Analog L : LVDS M:MIPI
10	Interface	N : without control board A : 8Bit B : 16Bit S: SPI-4 (preservation) R:Uart U:USB I: I2C
11	TS	N : Without TS S : RTP (preservation) C : capacitive touch panel capacitive touch panel (G-F-F) G : capacitive touch panel(G-G)

2.Summary

TFT 7.0" is a TN transmissive type color active matrix TFT liquid crystal display that uses 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.

RAYSTAR OPTRONICS

3.General Specifications

- Size: 7.0 inch
- Dot Matrix: 800 x RGBx480(TFT) dots
- Module dimension: 166.2(W) x 101.2(H) x 13.3 (D) mm
- Active area: 154.08 x 85.92 mm
- Dot pitch: 0.0642 x 0.179 mm
- LCD type: TFT, Normally White, Transmissive
- View Direction: 12 o'clock
- Gray Scale Inversion Direction: 6 o'clock
- Aspect Ratio: 16:9
- Backlight Type: LED, Normally White
- Interface: Uart 19200 Baud rate/SPI
- With /Without TP: Without TP
- Surface: Anti-Glare
- Operating mode: Slave mode
- Flash Memory Size: 32M bits
- SD card format: FAT, exFAT

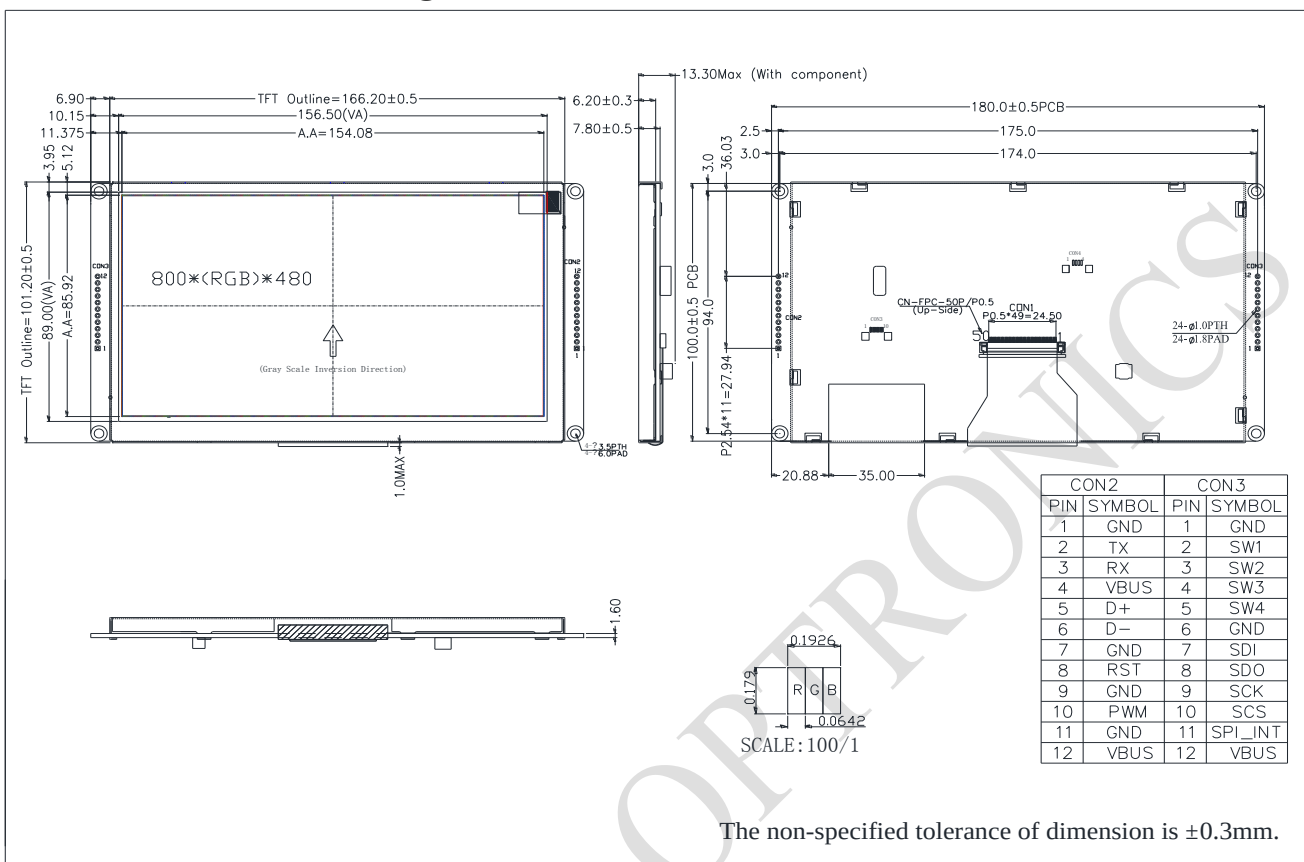
*Color tone slight changed by temperature and driving voltage

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_IN	O	Serial Interrupt
12	VBUS	Power Supply	Power supply : 5V

5. Contour Drawing



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

1. 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

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	—	—	450	670	mA	Note1
Power Consumption	—	VBUS=5V	—	2250	3685	mW	VBUS=5V Note 2

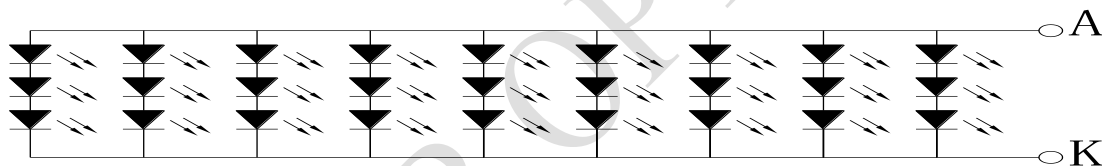
Note 1 : This value is test for VBUS=5V , Ta=25 °C only

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	-	-	180	-	mA	-
Power Consumption	-	1620	-	1890	mW	-
LED voltage	A~K	9.0	-	10.5	V	Note 1
LED Life Time	-	-	50,000	-	Hr	Note 2,3,4

Note 1 : There are 1 Groups LED



Backlight LED Circuit

Note 2 : Ta = 25 °C

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

Note 4 : The single LED lamp case

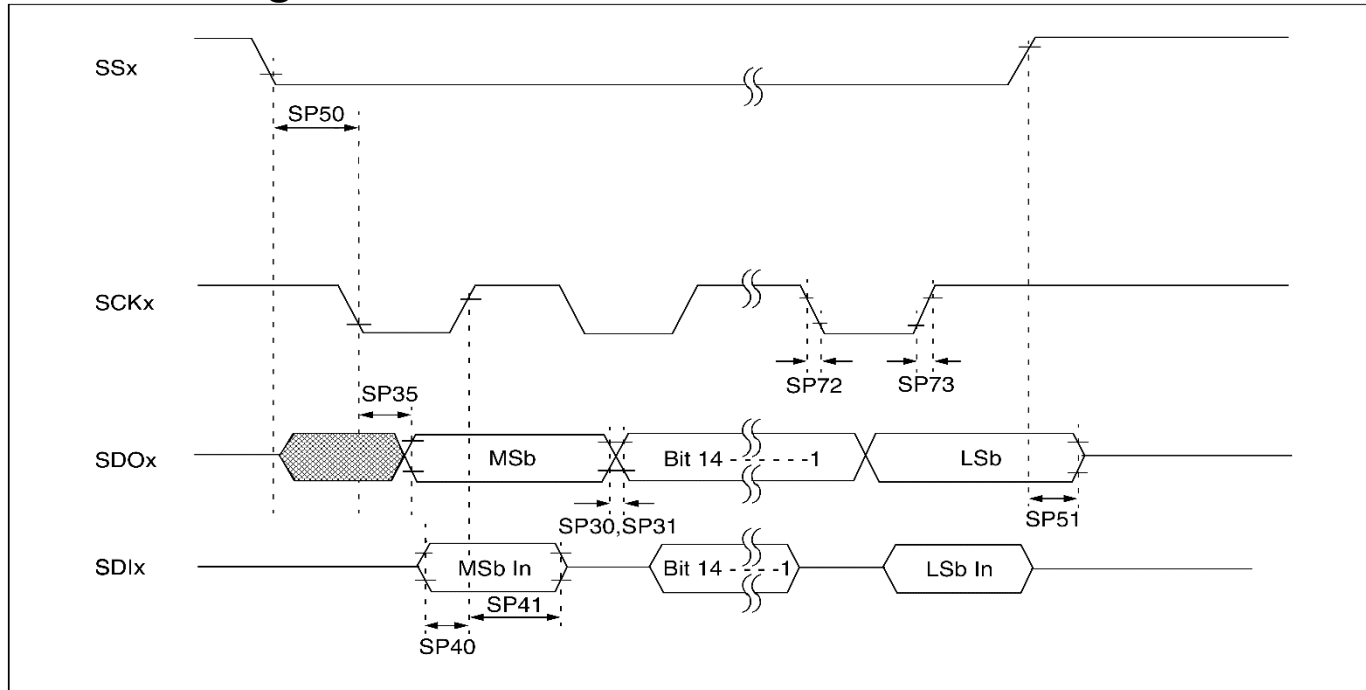
8.DC CHARATERISTICS

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

Note1:

VBUS is 5V and it will generate 3.3V (VDD) by themselves to support all system ,so all the other control signal is 3.3V level, including SPI, UART, SW and PWM.

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
SB1	PL	SB2	SB3	MD	WR	TR	XH	XL	YH	YL	SR	SG	SB	BR	BG	BB	SDATA	EB1	EB2	EB3

Graphic Mode

Instruction of Graphic mode:

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

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
SB1	PL	SB2	SB3	MD	RR	XSH	XSL	YSH	YSL	XEH	XEL	YEH	YEL	LS	LR	LG	LB	EB1	EB2	EB3

Clean 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	XSH	XSL	YSH	YSL	XEH	XEL	YEH	YEL	EB1	EB2	EB3

PWM Mode

Instruction of PWM 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

Power Mode

Instruction of Power mode:

1	2	3	4	5	6	7	8	9	10
SB1	PL	SB2	SB3	MD	PS	PF	EB1	EB2	EB3

Backlight Mode

Instruction of Backlight Mode:

1	2	3	4	5	6	7	8	9	10
SB1	PL	SB2	SB3	MD	BH	BL	EB1	EB2	EB3

TP Compensation Mode

Instruction of Calibration Mode for RTP:

1	2	3	4	5	5	7	8
SB1	PL	SB2	SB3	MD	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	17	18	19
0x31	SB3	MD	WR	TR	XH	XL	YH	YL	SR	SG	SB	BR	BG	BB	SDATA	0x0A	0x00	0x0D

Graphic Mode

Instruction of Graphic mode:

1	2	3	4	5	6	7	8	9	10	11	12	13
0x31	SB3	MD	RR	XH	XL	YH	YL	PH	PL	0x0A	0x00	0x0D

Pixel Mode

Instruction of Pixel mode:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
0x31	SB3	MD	RR	XH	XL	YH	YL	PR	PG	PB	0x0A	0x00	0x0D

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
0x31	SB3	MD	RR	XSH	XSL	YSH	YSL	XEH	XEL	YEH	YEL	LS	LR	LG	LB	0x0A	0x00	0x0D

Clean Mode

Instruction of Clean Mode:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
0x31	SB3	MD	XSH	XSL	YSH	YSL	XEH	XEL	YEH	YEL	0x0A	0x00	0x0D

PWM Mode

Instruction of PWM mode:

1	2	3	4	5	6	7	8	9	10	11
0x31	SB3	MD	PS	PFH	PFL	PDH	PDL	0x0A	0x00	0x0D

Power Mode

Instruction of Power mode:

1	2	3	4	5	6	7	8
0x31	SB3	MD	PS	PF	0x0A	0x00	0x0D

Backlight Mode

Instruction of Backlight Mode:

1	2	3	4	5	6	7	8
0x31	SB3	MD	BH	BL	0x0A	0x00	0x0D

TP Compensation Mode

Instruction of Calibration Mode for RTP:

1	2	3	4	5	6
0x31	SB3	MD	0x0A	0x00	0x0D

11. Optical Characteristics

Item	Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time	Tr	$\theta=0^\circ$ 、 $\Phi=0^\circ$	-	10	20	.ms	Note 3
	Tf		-	15	30	.ms	
Contrast ratio	CR	At optimized viewing angle	400	500	-	-	Note 4
Color Chromaticity	White	$\theta=0^\circ$ 、 $\Phi=0^\circ$	0.26	0.31	0.36	-	Note 2,5,6
	Wy		0.28	0.33	0.38	-	
Viewing angle (Gray Scale Inversion Direction)	Hor.	θ_R	60	70	-	Deg.	Note 1
		θ_L	60	70	-		
	Ver.	Φ_T	40	50	-		
		Φ_B	60	70	-		
Brightness	-	-	350	460	-	cd/m ²	Center of display
Uniformity	(U)	-	70	-	-	%	Note 5

Ta=25±2℃, IL=180mA

Note 1: Definition of viewing angle range

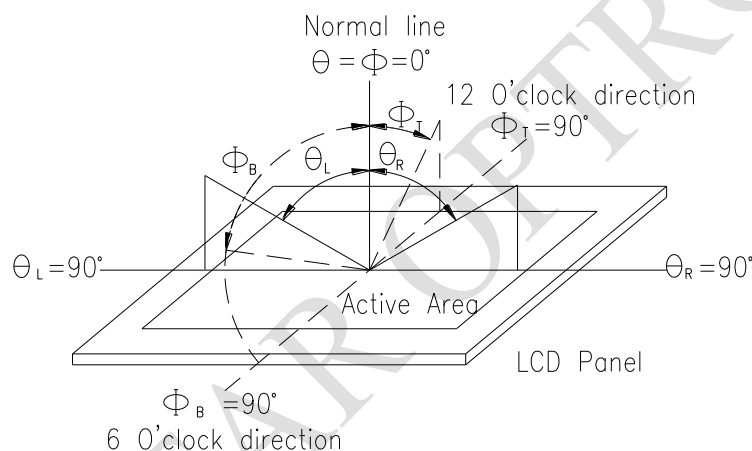


Fig. 11.1. Definition of viewing angle

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.

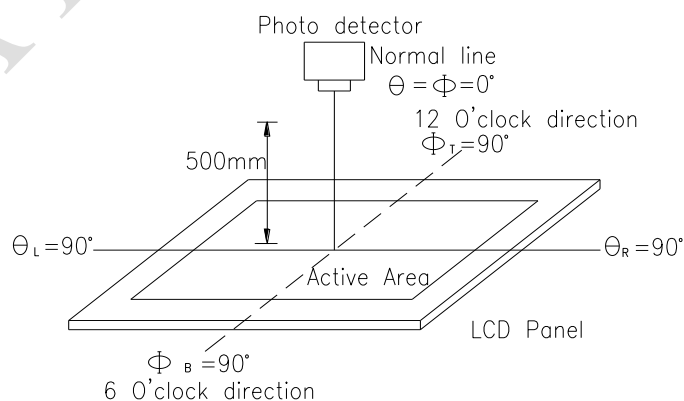
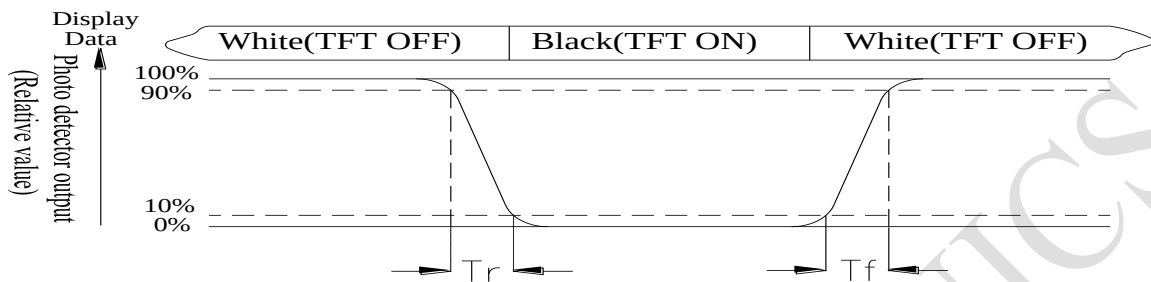


Fig. 11.2. Optical measurement system setup

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.

$$\text{Luminance Uniformity (U)} = \text{Lmin/Lmax} \times 100\%$$

L = Active area length

W = Active area width

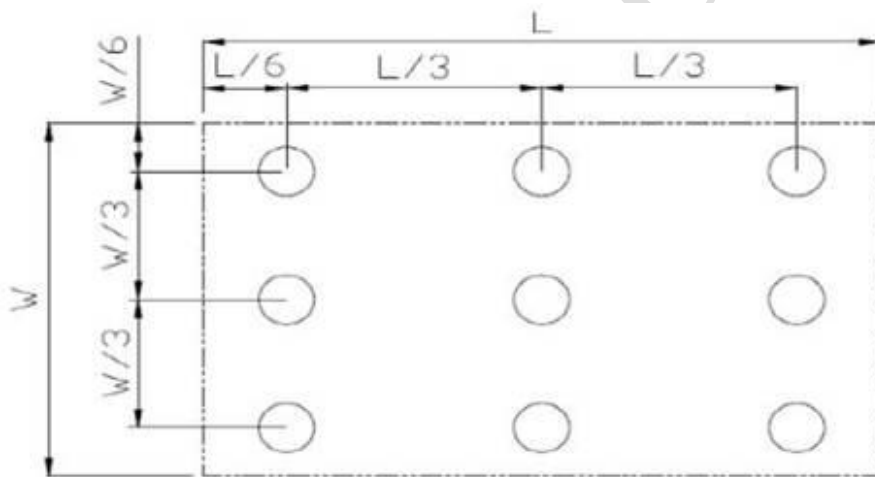


Fig11.3. Definition of uniformity

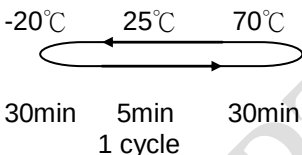
Note 6: Definition of color chromaticity (CIE 1931)

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 	-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.Relationship

13.1. 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.

13.2. User Guide

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

RAYSTAR OPTRONICS

LCM Sample Estimate Feedback Sheet		
Module Number : _____		
1 、 Panel Specification :		
1. Panel Type :	☐ Pass	☐ NG , _____
2. View Direction :	☐ Pass	☐ NG , _____
3. Numbers of Dots :	☐ Pass	☐ NG , _____
4. View Area :	☐ Pass	☐ NG , _____
5. Active Area :	☐ Pass	☐ NG , _____
6. Operating Temperature :	☐ Pass	☐ NG , _____
7. Storage Temperature :	☐ Pass	☐ NG , _____
8. Others : _____		
2 、 Mechanical Specification :		
1. PCB Size :	☐ Pass	☐ NG , _____
2. Frame Size :	☐ Pass	☐ NG , _____
3. Material of Frame :	☐ Pass	☐ NG , _____
4. Connector Position :	☐ Pass	☐ NG , _____
5. Fix Hole Position :	☐ Pass	☐ NG , _____
6. Backlight Position :	☐ Pass	☐ NG , _____
7. Thickness of PCB :	☐ Pass	☐ NG , _____
8. Height of Frame to PCB :	☐ Pass	☐ NG , _____
9. Height of Module :	☐ Pass	☐ NG , _____
10. Others :	☐ Pass	☐ NG , _____
3 、 Relative Hole Size :		
1. Pitch of Connector :	☐ Pass	☐ NG , _____
2. Hole size of Connector :	☐ Pass	☐ NG , _____
3. Mounting Hole size :	☐ Pass	☐ NG , _____
4. Mounting Hole Type :	☐ Pass	☐ NG , _____
5. Others :	☐ Pass	☐ NG , _____
4 、 Backlight Specification :		
1. B/L Type :	☐ Pass	☐ NG , _____
2. B/L Color :	☐ Pass	☐ NG , _____
3. B/L Driving Voltage (Reference for LED Type) : ☐ Pass ☐ NG , _____		
4. B/L Driving Current :	☐ Pass	☐ NG , _____
5. Brightness of B/L :	☐ Pass	☐ NG , _____
6. B/L Solder Method :	☐ Pass	☐ NG , _____
7. Others :	☐ Pass	☐ NG , _____

>> Go to page 2 <<

Module Number : _____

5 、 Electronic Characteristics of Module :

1.Input Voltage :	☐ Pass	☐ NG , _____
2.Supply Current :	☐ Pass	☐ NG , _____
3.Driving Voltage for LCD :	☐ Pass	☐ NG , _____
4.Contrast for LCD :	☐ Pass	☐ NG , _____
5.B/L Driving Method :	☐ Pass	☐ NG , _____
6.Negative Voltage Output :	☐ Pass	☐ NG , _____
7.Interface Function :	☐ Pass	☐ NG , _____
8.LCD Uniformity :	☐ Pass	☐ NG , _____
9.ESD test :	☐ Pass	☐ NG , _____
10.Others :	☐ Pass	☐ NG , _____

6 、 Summary :

Sales signature : _____

Customer Signature : _____

Date : / /