



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

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1. Module Classification Information
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3. General Specification
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12. Reliability
13. 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 Optronics 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	<table border="0"> <tr> <td>W : LED, White</td><td>H : LED, High Light White</td></tr> <tr> <td>F : CCFL, White</td><td></td></tr> </table>	W : LED, White	H : LED, High Light White	F : CCFL, White	
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 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: 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

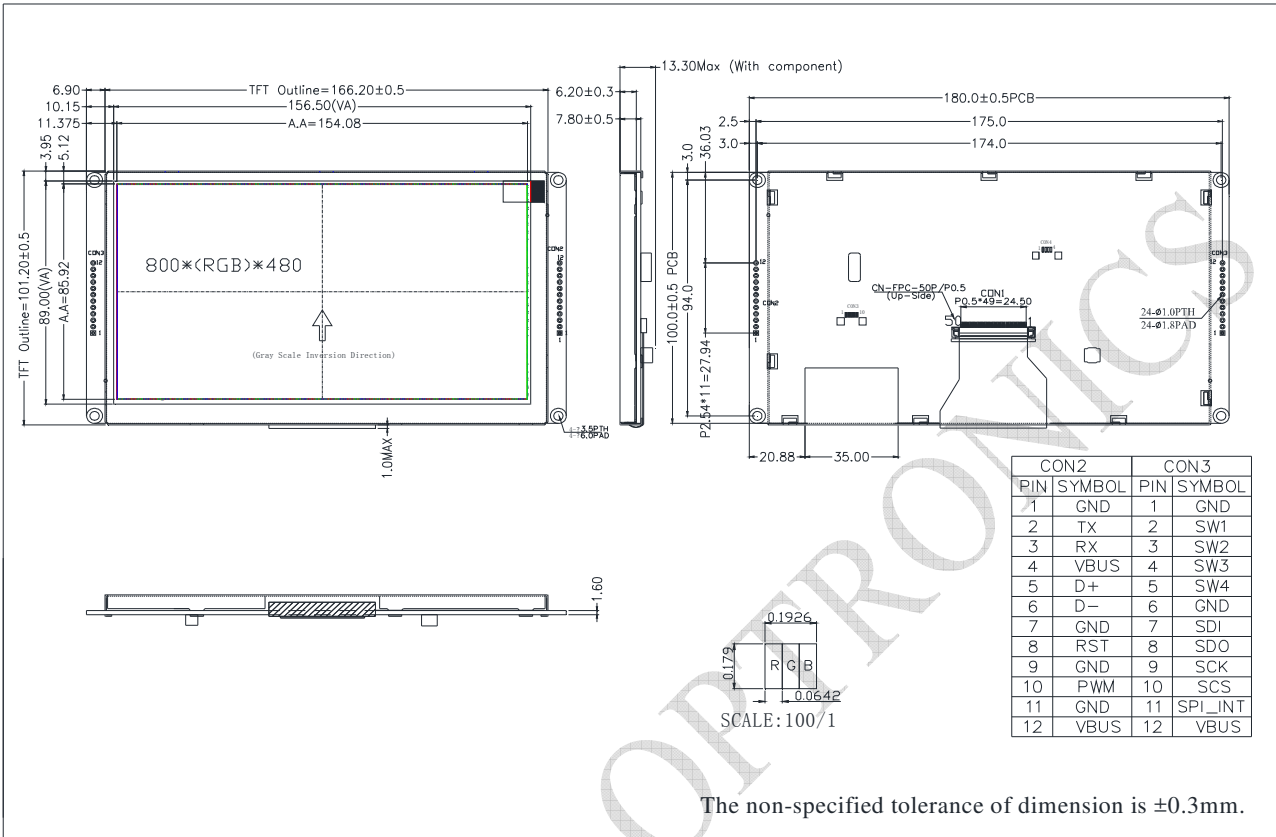
*Color tone slight changed by temperature and driving voltage

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

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

- 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	—	—	450	670	mA	Note 1
Power Consumption	—	VBUS=5V	—	2250	3685	mW	VBUS=5V Note 2

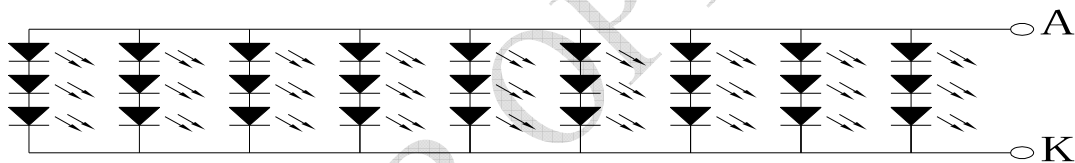
Note 1 : This value is test for VBUS=5V , Ta=25 °C only

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

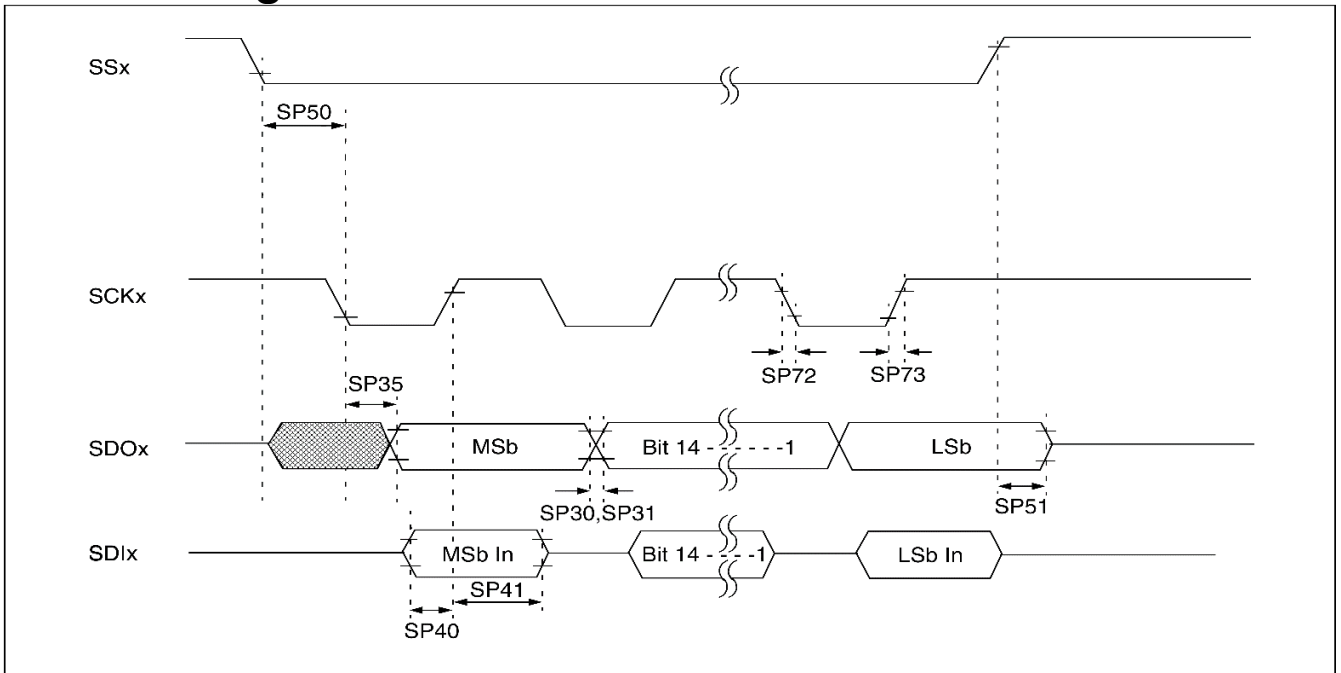
Parameter	Symbol	Rating			Unit	Condition
		Min	Typ	Max		
Low level input voltage	V_{IL}	0	-	0.3VDD	V	
High level input voltage	V_{IH}	0.7 VDD	-	VDD	V	

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.

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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
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	Wx	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

Ta=25±2°C, IL=180mA

Note 1: Definition of viewing angle range

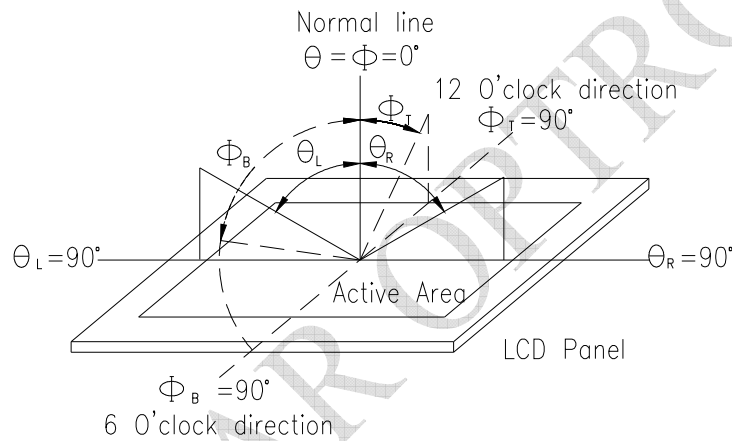


Fig. 11.1. Definition of viewing angle

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.

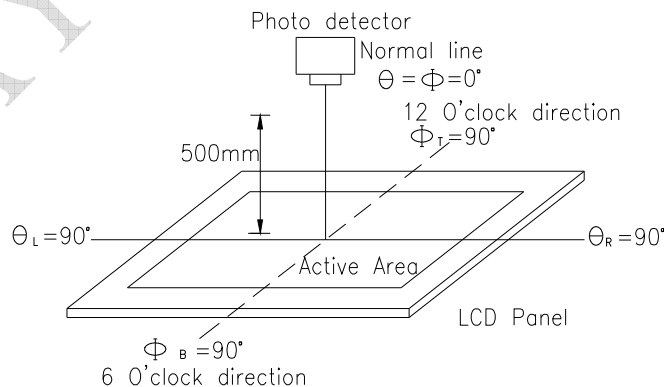
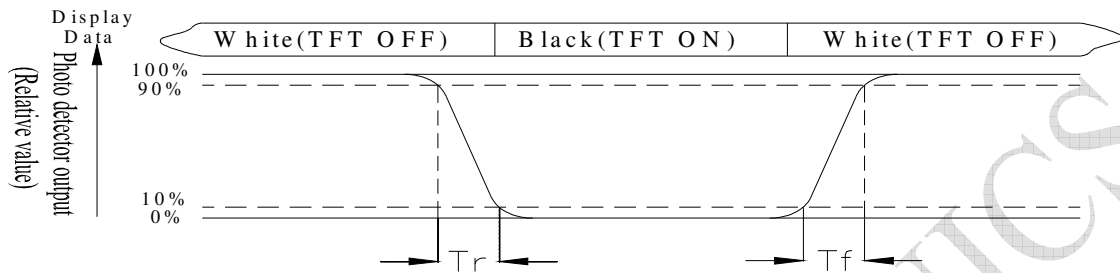


Fig. 11.2. Optical measurement system setup

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: White $V_i = V_{i50} \pm 1.5V$

Black $V_i = V_{i50} \pm 2.0V$

“±” means that the analog input signal swings in phase with VCOM signal.

“±” means that the analog input signal swings out of phase with VCOM signal.

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

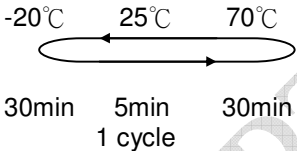
Note 6: Definition of color chromaticity (CIE 1931)

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;">  </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.

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; margin-right: 100px;">Sales signature : _____</p> <p style="text-align: right; margin-right: 100px;">Customer Signature : _____ <u>Date</u> : / / _____</p>		