



RAYSTAR

RAYSTAR Optronics, Inc.
曜凌光電股份有限公司



曜凌光電股份有限公司

Raystar Optronics, Inc.

T: +886-4-2565-0761 | F: +886-4-2565-0760

salescontact@raystar-optronics.com | www.raystar-optronics.com

RF41010N-AYW-LNN-000

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	2023/03/24		First issue
A	2023/05/06		Correct Pixel pitch
B	2023/06/20		Modify Backlight Type ,Power Sequence & Definition of Color of CIE Coordinate and NTSC Ratio
C	2023/07/14		Modify Driver IC & Surface

Contents

1. Module Classification Information
2. Summary
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10. Optical Characteristics
11. Reliability
12. Other

1.Module Classification Information

R	F	4	101	0N	-	A	Y	W	-	L	N	N	-	000
1	2	3	4	5	-	6	7	8	-	9	10	11	-	12

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: 1920x1200				
4	Display Size : 10.1” 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)		6 : TFT+FR H : TFT+D/V BOARD I : TFT+FR+D/V BOARD B : TFT+POWER BD 1 : TFT+CONTROL BOARD		
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 ; V→Transmissive, Super W.T, VA TFT A→Transmissive, N.T, IPS TFT ;Q→Transmissive, Super W.T, 12:00 Z→Transmissive, W.T, O-TFT R→Transmissive, Super W.T, O-TFT N→Transmissive, Super W.T, 6:00;			
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 Interface R: RS232 U:USB I: I2C			
11	TS	N : Without TS S : resistive touch panel C : capacitive touch panel capacitive touch panel (G-F-F) G : capacitive touch panel(G-G) G1:Capacitive touch panel (G-G)+OCA			
12	Serial No.	00:Sales code 0:Version			

2.Summary

TFT 10.1" is a color active matrix TFT LCD using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 10.1 inch diagonally measured active area with WUXGA resolutions (1920 horizontal by 1200 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors.

RAYSTAR OPTRONICS

3.General Specifications

- Size: 10.1 inch
- Dot Matrix: 1920(H) X RGB X 1200(V) dots
- Module dimension: 231.40 x152.3 x 9.1 Max mm
- Active area: 216.8064(H) x 135.504(V) mm
- Pixel pitch: 0.11292(H) x 0.11292(V) mm
- LCD type: TFT, Normally Black, Transmissive
- Interface: 2ch-LVDS
- Driver IC: FL5893DA or equivalent
- Viewing Angle: 80/80/80/80
- Aspect Ratio: 16:10
- Backlight Type: Normally White (Blue LED with QD)
- With /Without TP: Without TP
- Surface: Glare

*Color tone slight changed by temperature and driving voltage.

4.Interface

4.1. TFT LCD MODULE

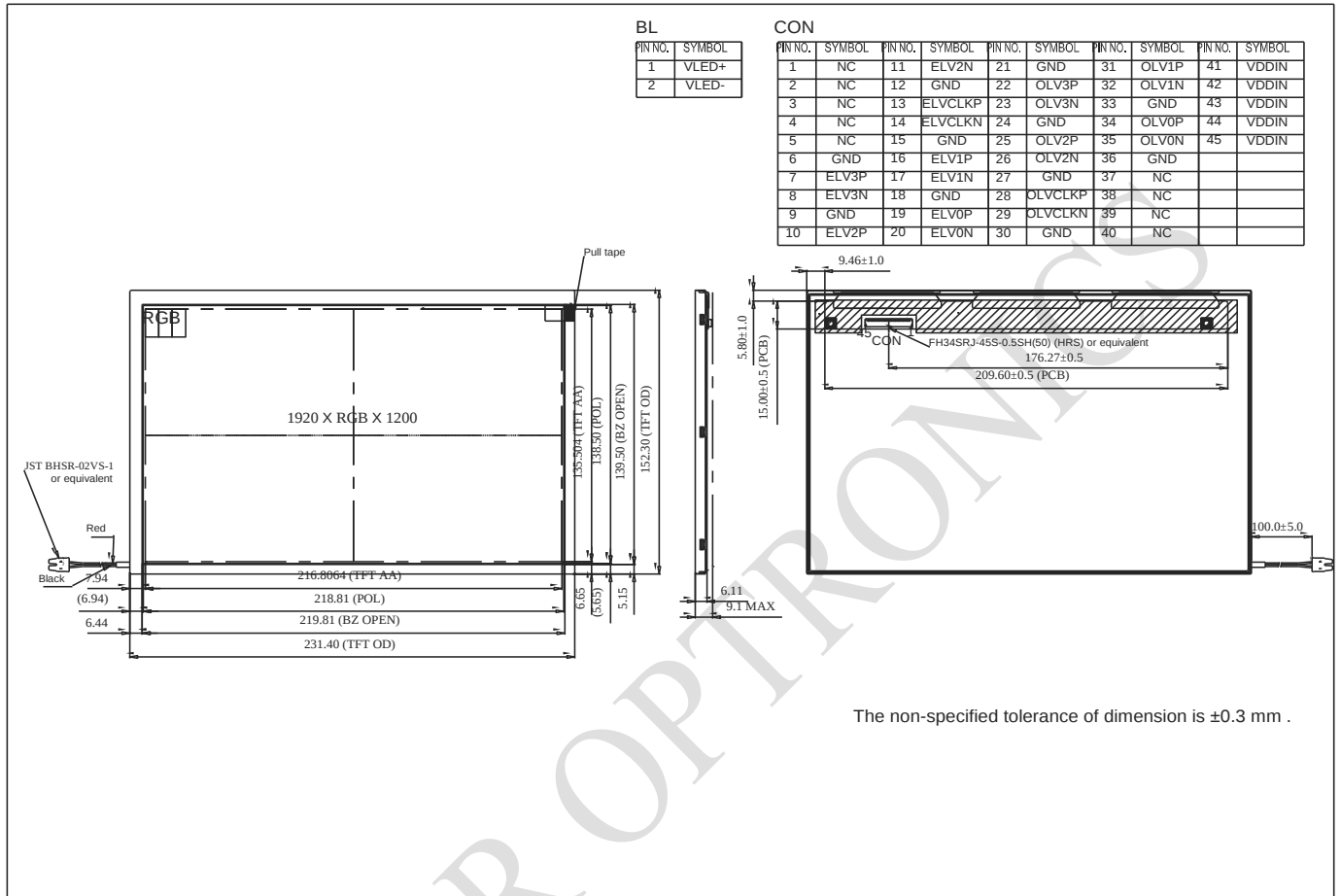
Pin No.	Symbol	Description
1-5	NC	No connection
6	GND	Ground
7	ELV3P	EVEN LVDS Positive data signal (+)
8	ELV3N	EVEN LVDS Negative data signal (-)
9	GND	Ground
10	ELV2P	EVEN LVDS Positive data signal (+)
11	ELV2N	EVEN LVDS Negative data signal (-)
12	GND	Ground
13	ELVCLKP	EVEN LVDS Positive CLK signal (+)
14	ELVCLKN	EVEN LVDS Negative CLK signal (-)
15	GND	Ground
16	ELV1P	EVEN LVDS Positive data signal (+)
17	ELV1N	EVEN LVDS Negative data signal (-)
18	GND	Ground
19	ELV0P	EVEN LVDS Positive data signal (+)
20	ELV0N	EVEN LVDS Negative data signal (-)
21	GND	Ground
22	OLV3P	Odd LVDS Positive data signal (+)
23	OLV3N	Odd LVDS Negative data signal (-)
24	GND	Ground
25	OLV2P	Odd LVDS Positive data signal (+)
26	OLV2N	Odd LVDS Negative data signal (-)
27	GND	Ground
28	OLVCLKP	Odd LVDS Positive CLK signal (+)
29	OLVCLKN	Odd LVDS Negative CLK signal (-)
30	GND	Ground
31	OLV1P	Odd LVDS Positive data signal (+)
32	OLV1N	Odd LVDS Negative data signal (-)
33	GND	Ground

34	OLV0P	Odd LVDS Positive data signal (+)
35	OLV0N	Odd LVDS Negative data signal (-)
36	GND	Ground
37 -39	NC	No connection (PIN39 and PIN40 cannot be short-circuited together)
40	NC	No connection alone
41-45	VDDIN	Power supply VDDIN=3.3V (Typ.)

4.2. Backlight PIN Definition

Pin No.	Symbol	Description
1	VLED+	Red, LED_ Anode
2	VLED-	Black, LED_ Cathode

5. Contour Drawing



The non-specified tolerance of dimension is ± 0.3 mm .

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. ≤ 60°C, 90% RH MAX. Temp. > 60°C, Absolute humidity shall be less than 90% RH at 60°C

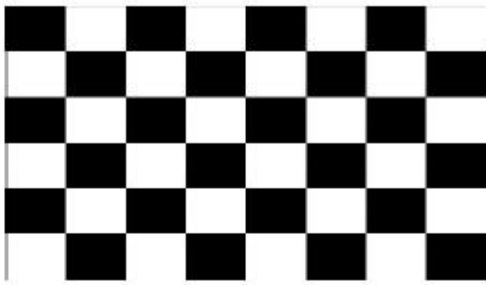
7. Electrical Characteristics

7.1. Typical Operation Conditions (At Ta = 25 °C,)

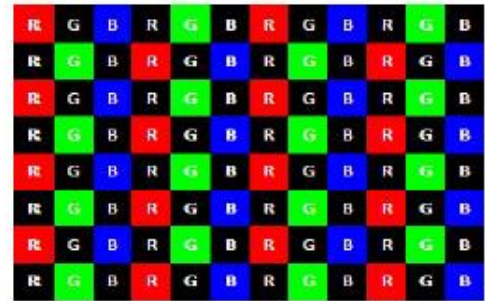
Item	Symbol	Min	Typ.	Max.	Unit	Unit
Power Supply Voltage	VDDIN	3.0	3.3	3.6	V	
	VRP	-	-	300	mV	Ripple
Power Supply Current	IDD	-	300	360	mA	Note 1
Power Consumption	PLCD	-	1	1.2	W	
Rush current	IRUSH	-	-	3.0	A	Note 2

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VDDIN=3.3V, Frame rate fV=60Hz and Clock frequency = 80MHz. Test Pattern of power supply current

a) Typ : Mosaic 8 x 6 Pattern(L0/L255)



b) Max : skip subPixel(L255)

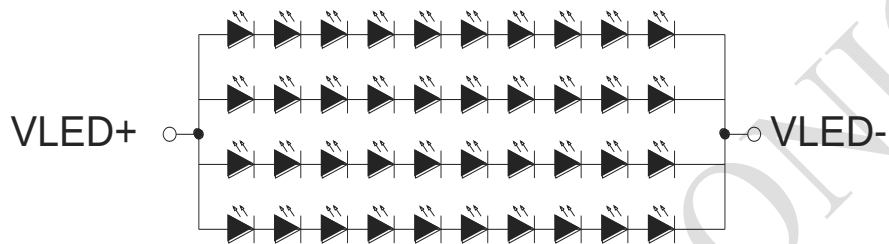


2. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

7.2. Backlight Driving Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage of white LED backlight	VL	26.0	29.0	33.0	V	Note 1
Current for LED backlight	IL	-	200	-	mA	
LED life time	-	50,000	-	-	Hr	Note2

Note 1 : There are 1 Groups LED



CIRCUIT DIAGRAM(LED 4*10=40 DIES)

Note 2 : $T_a = 25\text{ }^{\circ}\text{C}$

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

Note 4 : The single LED lamp case

8.Interface timing Parameter and AC/DC Parameter

The 10.1" is operated by the DE only

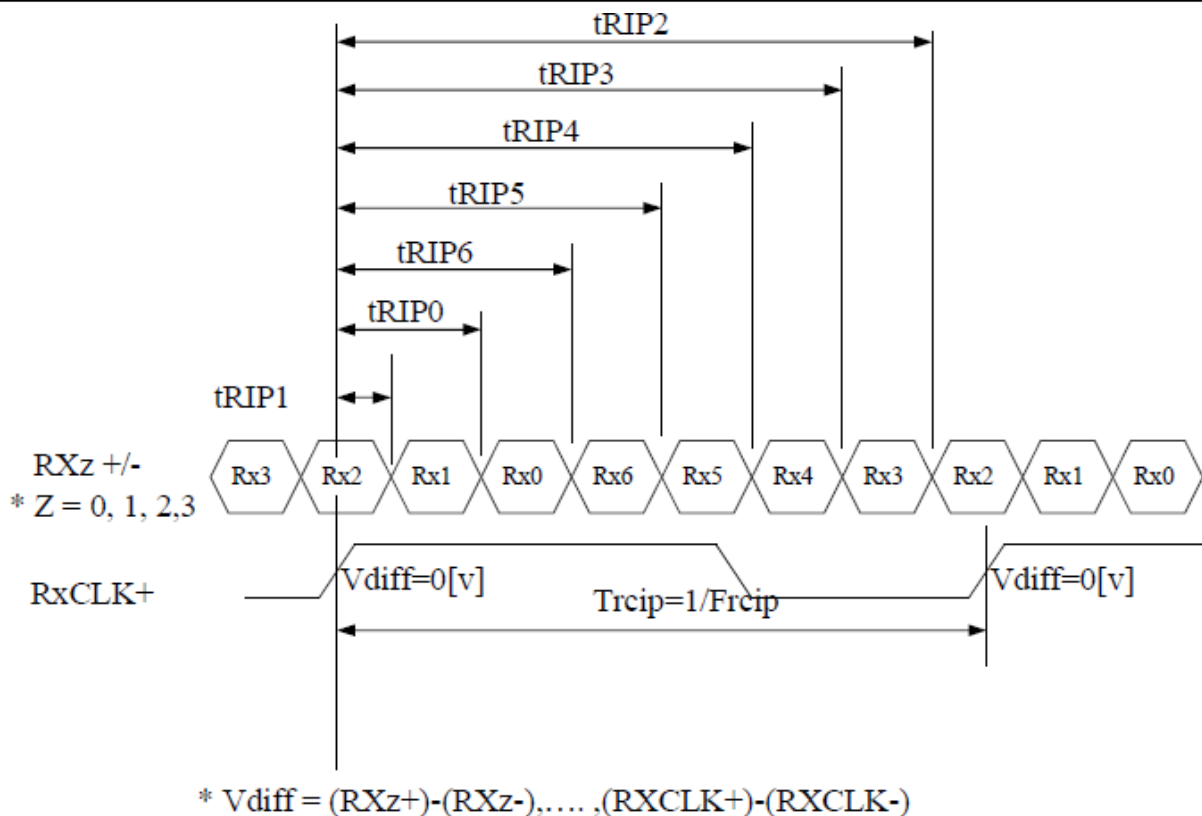
Table1. LVDS Timing Parameter

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK Frequency	Fdclk	74.5	77.56	85	MHz
Horizontal display area	Thd	960			DCLK
HSYNC period time	Th	989	1040	1248	DCLK
Horizontal Blank	THB	29	80	288	DCLK
HSYNC pulse width	Thp	2	10	255	DCLK
HSYNC back porch	thbp	3	6	255	DCLK
HSYNC Front porch	thfp	24	64	260	DCLK
Vertical display area	Tvd	1200			H
VSYNC period time	Tv	1243	1243	1560	H
Vertical Blank	TVB	43	43	360	H
VSYNC Pluse width	Tvp	4	4	20	H
VSYNC back porch	Tvbp	20	20	255	H
VSYNC front porch	Tvfp	19	19	260	H
Frequency	fV	-	60	-	Hz



<Table 2. LVDS AC Timing Specification>

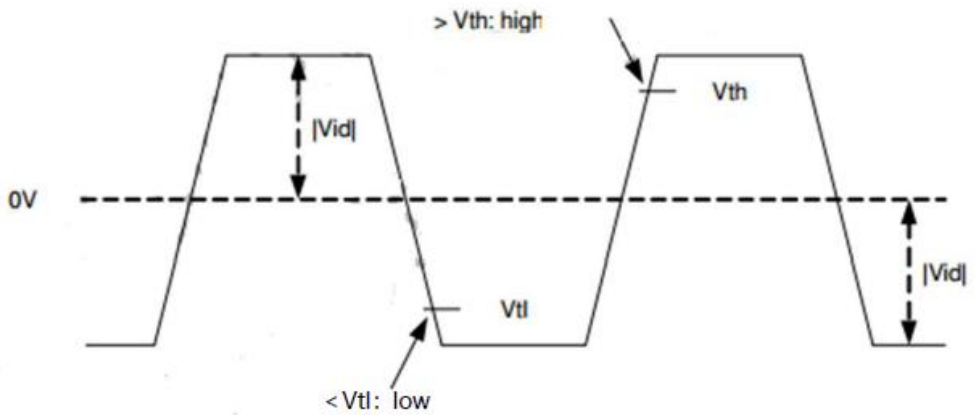
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKfrequency	Frcip	20	-	85	MHZ	
CLKIN Period	tRCIP	11.76	-	-	nsec	
Input Data 0	tRIP1	$tRCIP/7 \times (-0.2)$	0.0	$tRCIP/7 \times 0.2$	nsec	
Input Data 1	tRIP0	$tRCIP/7 \times 0.8$	$tRCIP/7$	$tRCIP/7 \times 1.2$	nsec	
Input Data 2	tRIP6	$tRCIP/7 \times 1.8$	$tRCIP/7 \times 2$	$tRCIP/7 \times 2.2$	nsec	
Input Data 3	tRIP5	$tRCIP/7 \times 2.8$	$tRCIP/7 \times 3$	$tRCIP/7 \times 3.2$	nsec	
Input Data 4	tRIP4	$tRCIP/7 \times 3.8$	$tRCIP/7 \times 4$	$tRCIP/7 \times 4.2$	nsec	
Input Data 5	tRIP3	$tRCIP/7 \times 4.8$	$tRCIP/7 \times 5$	$tRCIP/7 \times 5.2$	nsec	
Input Data 6	tRIP2	$tRCIP/7 \times 5.8$	$tRCIP/7 \times 6$	$tRCIP/7 \times 6.2$	nsec	



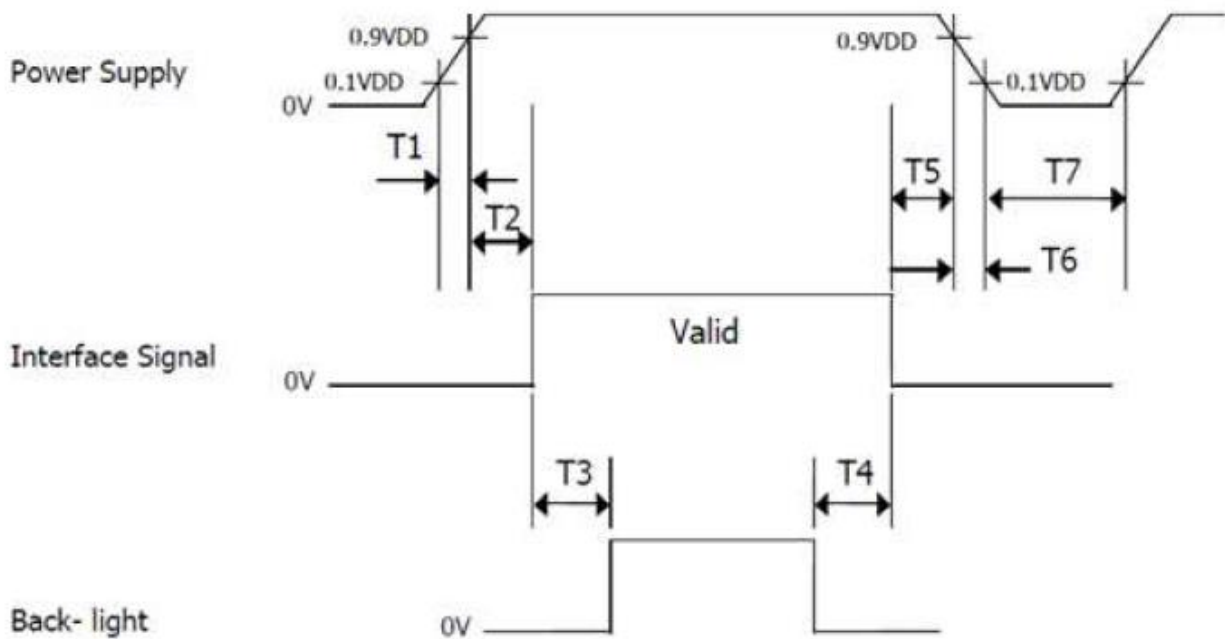
<Table 3. LVDS DC Timing Specification>

Item	Symbol	Condition	MIN	TYP	MAX	Unit
Differential input high Threshold voltage	Vth	Vcm=1.2V	-	-	+0.1	V
Differential input low Threshold voltage	Vtl	-	-0.1	-	-	V
Differential input common Threshold voltage	Vcm	-	1	1.2	1.7- Vid /2	V
LVDS input voltage	Vinlv	-	0.7	-	1.7	V
Differential input voltage	Vid	-	0.35	-	0.6	V
Differential input leakage voltage	Ilvleak	-	-10	-	+10	uA

Differential:
LVCLKP(R)-LVCLKN(R)
LVD[3:0]P(R)-
LVD[3:0]N(R)



9.Power Sequence



< Table4. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0	-	10	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	500	-	-	ms
T5	0	-	50	ms
T6	0	-	10	ms
T7	500	-	-	ms

10. Optical Characteristics

Item	Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time	Tr+Tf	$\theta=0^\circ$ 、 $\phi=0^\circ$	-	30	35	.ms	Note 3
Contrast ratio	CR	At optimized viewing angle	700	900	-	-	Note 4
Color Chromaticity	White	Wx	0.235	0.285	0.335	-	Note 2,6,7
		Wy	0.277	0.327	0.377	-	
Viewing angle	Hor.	θ_R	70	80	-	Deg.	Note 1
		θ_L	70	80	-		
	Ver.	ϕ_T	70	80	-		
		ϕ_B	70	80	-		
Brightness	-	-	400	500	-	cd/m ²	Center of display
Uniformity	(U)	-	70	-	-	%	Note 5
NTSC Ratio	NTSC	-	100	-	120	%	Note 8

Ta=25±2°C

Note 1: Definition of viewing angle range

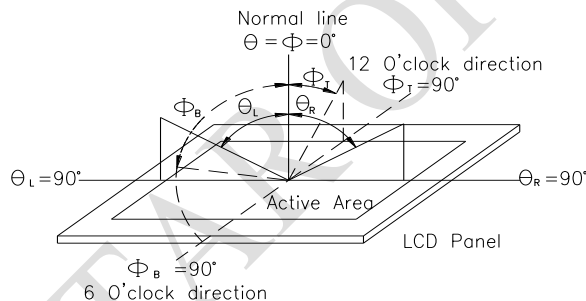


Fig. 10.1. Definition of viewing angle

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-7 or BM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

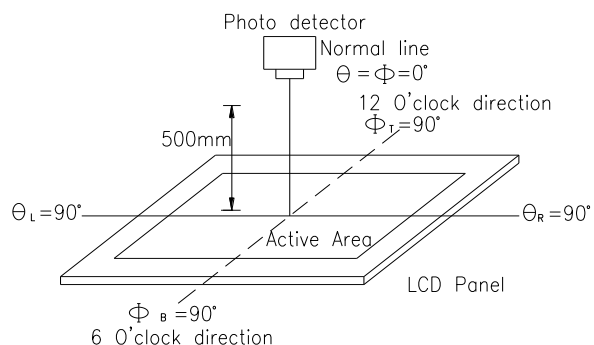
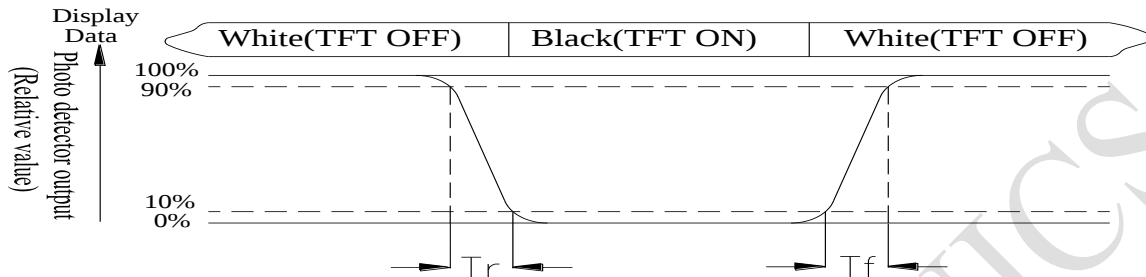


Fig. 10.2. Optical measurement system setup

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

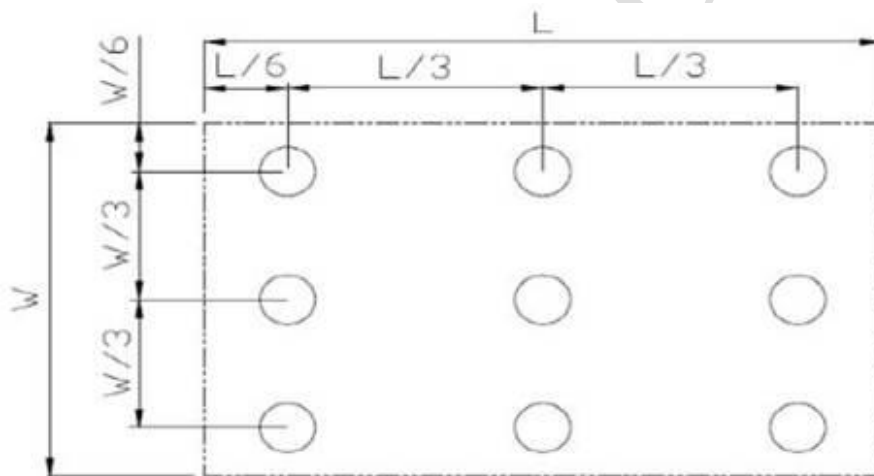


Fig 10.3. Definition of uniformity

Note 6: Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

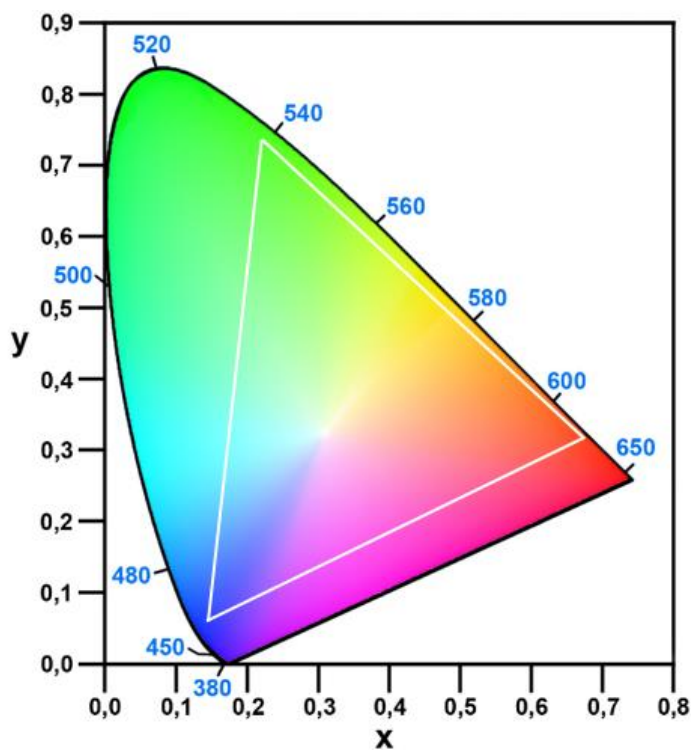
Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

Note 8: Definition of Color of CIE Coordinate and NTSC Ratio

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

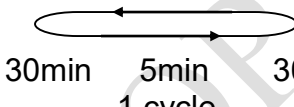
NTSC Ratio= 111.02%

	x	y
R	0.686	0.306
G	0.221	0.738
B	0.146	0.053



11. 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 25°C 70°C  30min 5min 30min 1 cycle	-20°C/70°C 10 cycles	—
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 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=±6KV(contact), ±8KV(air), RS=330Ω CS=150pF 10 times	4

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.

Note4: Temporary degradation or loss in operation or function, which is able to be recovered by self-recovery function.

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 : / /