



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 Optonics, Inc.

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RFJ350N-AVW-DNN

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	2015/04/14		First issue
A	2015/04/28		Modify Reliability
B	2015/11/04		Modify Initial Code
C	2016/01/21		Modify Static electricity test
D	2016/08/11		Modify Vibration test
E	2017/03/06		Add Aspect Ratio
F	2020/01/17		Modify Contour Drawing

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14.Other

1.Module Classification Information

R	F	J	35	0N	-	A	V	W	-	D	N	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 : 3.5” 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 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)			

2.Summary

The 3.5 " VA Mono TFT that is offers improved contrast ,viewing angle, brightness and response time over traditional passive monochrome products. Increased display brightness display brightness is a key factor for design engineers when selecting a display that must vividly show pictures and alphanumeric data.The TFT cell is manufactured using high aperture panel technology and high transmission polarizer. The result is a clear and extremely bright display.

RAYSTAR OPTRONICS

3.General Specifications

- Size: 3.5 inch
- Dot Matrix: 240 x 320 dots
- Module dimension: 62.9 x 86.54 x 4.1 mm
- Active area: 53.28 x 71.04 mm
- Dot pitch: 0.222 x 0.222 mm
- LCD type: TFT, Mono Transmissive
- View Direction: Wide View
- Aspect Ratio: Portrait
- Gray Scale: 16 Gray scale (4BPP)/ 4 Gray scale (2BPP)/ 2 Gray scale (1BPP)
- Driver IC: ST7511
- Backlight Type: LED, Normally White
- With /Without TP: Without TP
- Surface: Glare

* Mono tone slight changed by temperature and driving voltage.

4.Interface

4.1. LCM PIN Definition

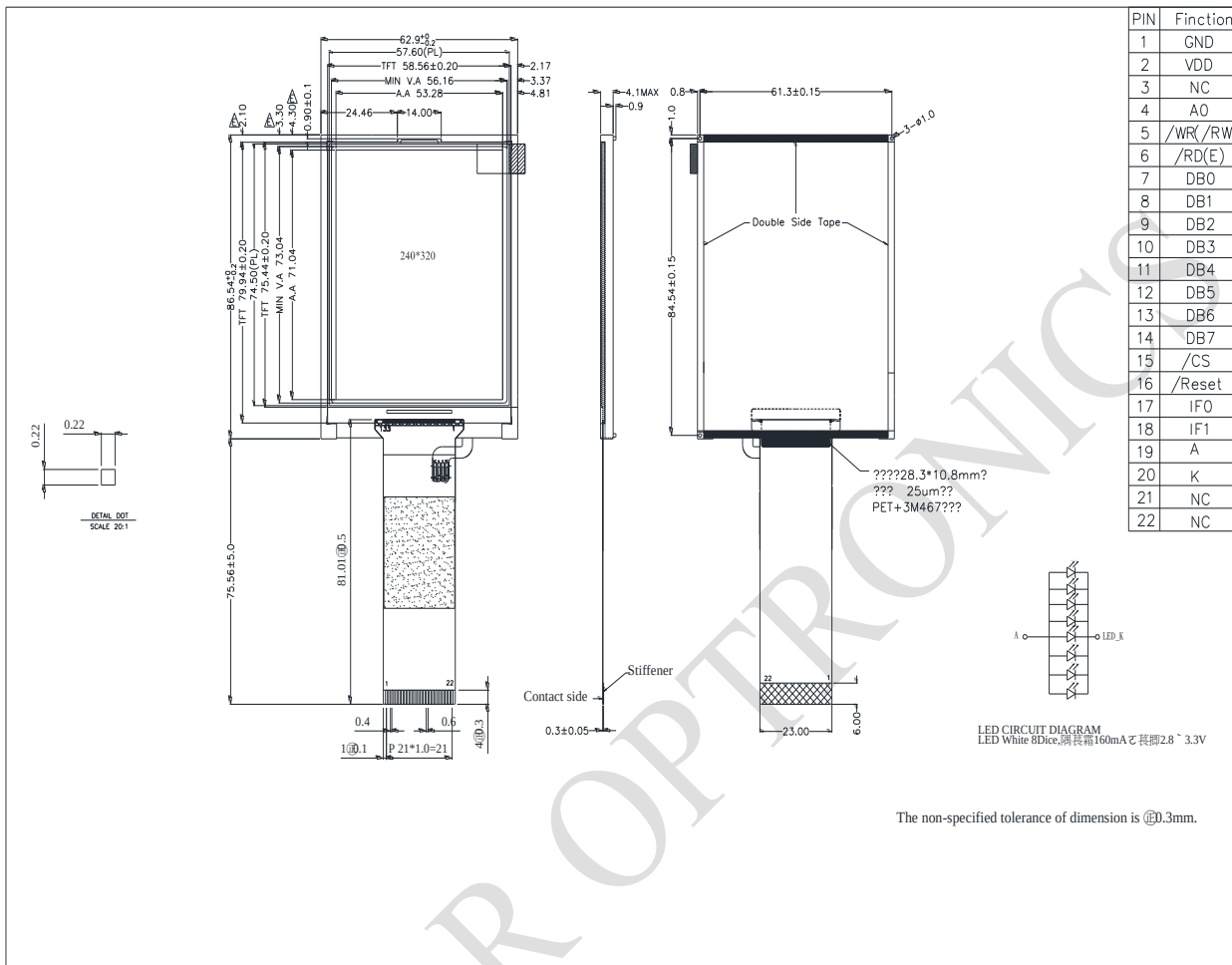
Pin	Symbol	Function	Remark
1	GND	System ground	
2	VDD	Power Supply : +3.3V	
3	NC	No connect	
4	A0	Data/Command select	
5	/WR(RW)	Write strobe signal	
6	/RD(E)	Read strobe signal	
7	DB0	Data bus	
8	DB1	Data bus	
9	DB2	Data bus	
10	DB3	Data bus	
11	DB4	Data bus	
12	DB5	Data bus	
13	DB6	Data bus	
14	DB7	Data bus	
15	/CS	Chip select	
16	/RESET(RSTB)	Hardware reset	
17	IF0	Mode select	Note1
18	IF1		
19	A	LED +	
20	K	LED -	
21	NC	No connect	
22	NC	No connect	

Note1:

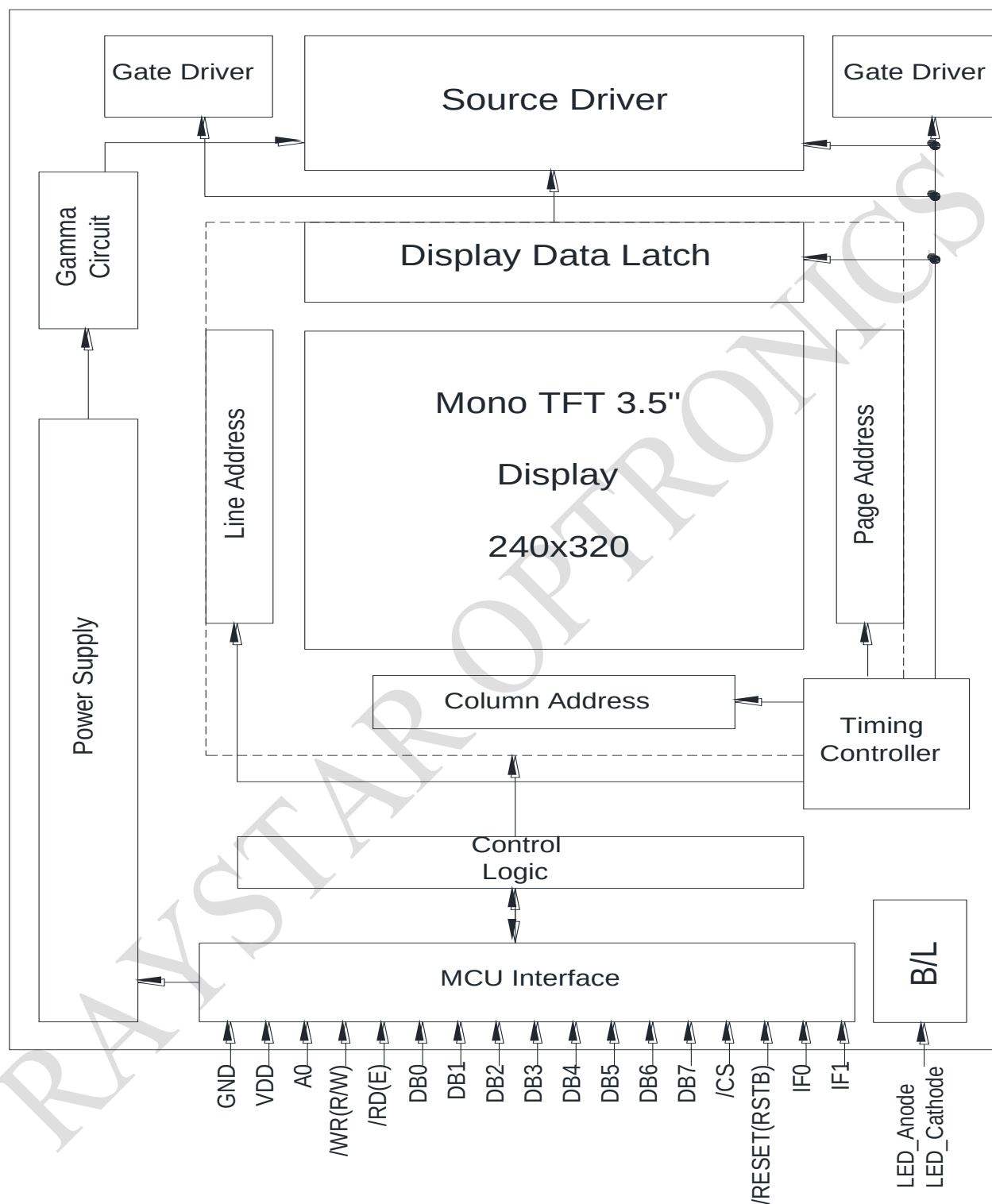
Setting		MCU Type	Interface Pin Function				
IF1	IF0		CSB	A0	RWR	ERD	D[7:0]
L	L	Parallel 8080 series MCU	CSB	A0	/WR	/RD	D[7:0]
L	H	Parallel 6800 series MCU			R/W	E	D[7:0]
H	H	Serial 4-Line series MCU			-	-	D7=SCL, D0=SDA, D[6:1] are not used
H	L	Serial 3-Line series MCU			-	-	

The un-used pins are marked as “-” and should be connected to “H” by VDDI.

5. Contour Drawing



6. Block Diagram



7. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-30	—	+80	°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

8. Electrical Characteristics

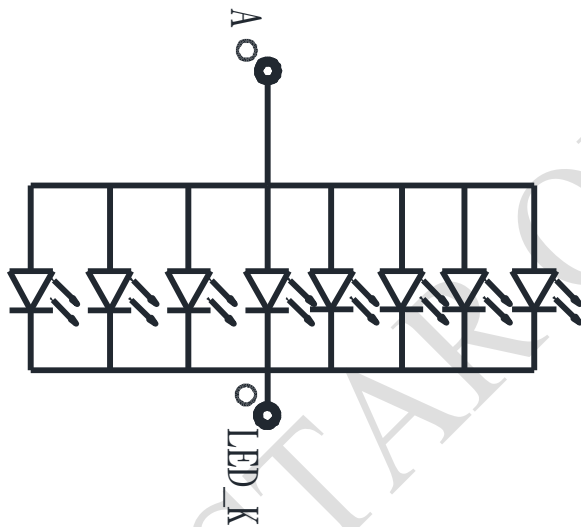
8.1. Operating conditions:

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Supply Voltage For LCM	VDD	—	3.0	3.3	3.6	V	
Supply Current For LCM	IDD	—	—	13	—	mA	Note1
Power Consumption	—	—	—	—	46.8	mW	

Note1: This value is test for VDD=3.3V only

8.2. LED driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current		—	160	—	mA	
Power Consumption		—	—	—	mW	
LED voltage	A-K	2.8	3.0	3.3	V	Note 1
LED Life Time		—	50,000	—	Hr	Note 2,3,4



Note 1 : Power supply the back light specification

Note 2 : Ta = 25 °C

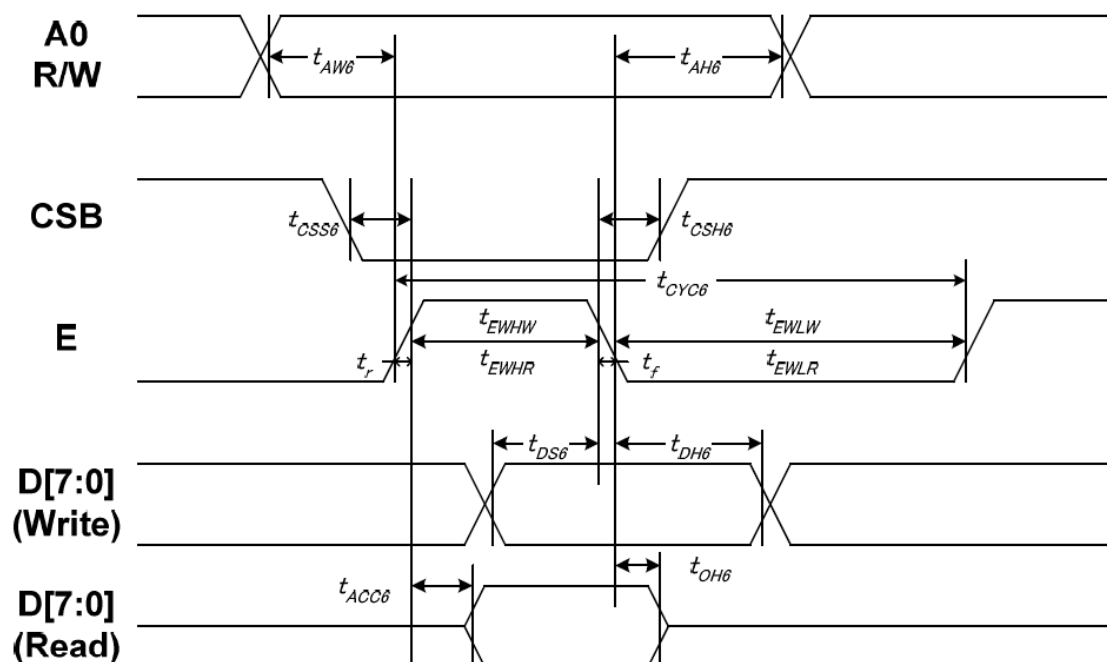
Note 3 : Brightness to be decreased to 50% of the initial value

Note 4 : The single LED lamp case

9.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}	0.7VDD	-	VDD	V	

10.1. System Bus Timing for 6800 Series MPU



Item	Signal	Symbol	Condition	Min	Max	Unit
Address setup time	A0	tAW6	-	10	-	ns
Address hold time		tAH6	-	0	-	
System cycle time	E	tCYC6	-	200	-	
Enable L pulse width (WRITE)		tEWLW	-	100	-	
Enable H pulse width (WRITE)		tEWHW	-	100	-	
Enable L pulse width (READ)		tEWLR	-	130	-	
Enable H pulse width (READ)		tEWHR	-	130	-	
CSB setup time	CSB	tCSS6	-	100	-	
CSB hold time		tCSH6	-	100	-	
Write data setup time	D[7:0]	tDS6	-	70	-	
Write data hold time		tDH6	-	20	-	
Read data access time		tACC6	CL = 100 pF	-	80	
Read data output disable time		tOH6	CL = 100 pF	15	80	

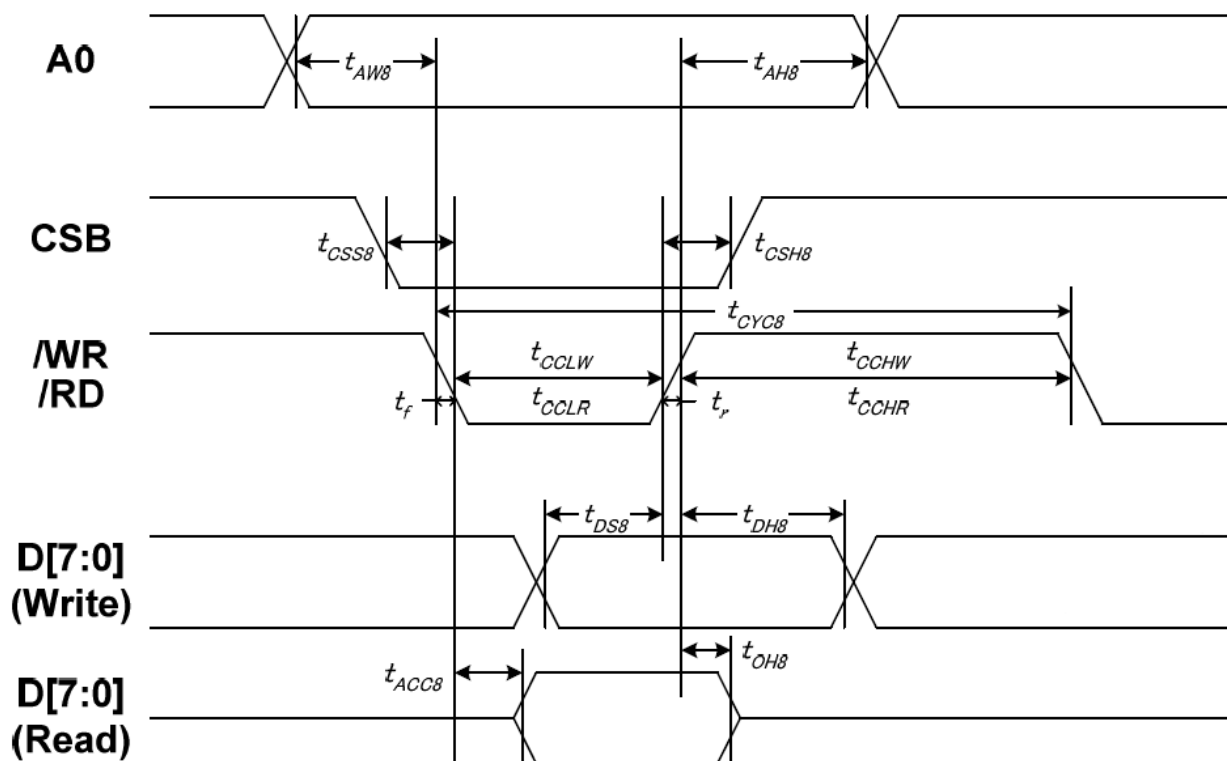
1. The input signal rise time and fall time (t_r , t_f) is specified at 15 ns or less. When the system cycle time

2. All timing is specified using 20% and 80% of VDDI as the reference.

“L” level.CSB and /WR (or /RD) cannot act at the same time and CSB should be 100ns wider than

/WR (or /RD).

10.2. System Bus Timing for 8080 Series MPU



Item	Signal	Symbol	Condition	Min	Max	Unit
Address setup time	A0	tAW8	-	10	-	ns
Address hold time		tAH8	-	0	-	
System cycle time	/WR	tCYC8	-	200	-	
/WR L pulse width (WRITE)		tCCLW	-	100	-	
/WR H pulse width (WRITE)	/RD	tCCHW	-	100	-	
/RD L pulse width (READ)		tCCLR	-	120	-	
/RD H pulse width (READ)	CSB	tCCHR	-	120	-	
CSB setup time		tCSS8	-	100	-	
CSB hold time	D[7:0]	tCSH8	-	100	-	
Write data setup time		tDS8	-	70	-	
Write data hold time		tDH8	-	20	-	
Read data access time	D[7:0]	tACC8	CL = 100 pF	-	80	
Read data output disable time		tOH8	CL = 100 pF	15	80	

Note:

1. The input signal rise time and fall time (t_r , t_f) is specified at 15 ns or less. When the system cycle time

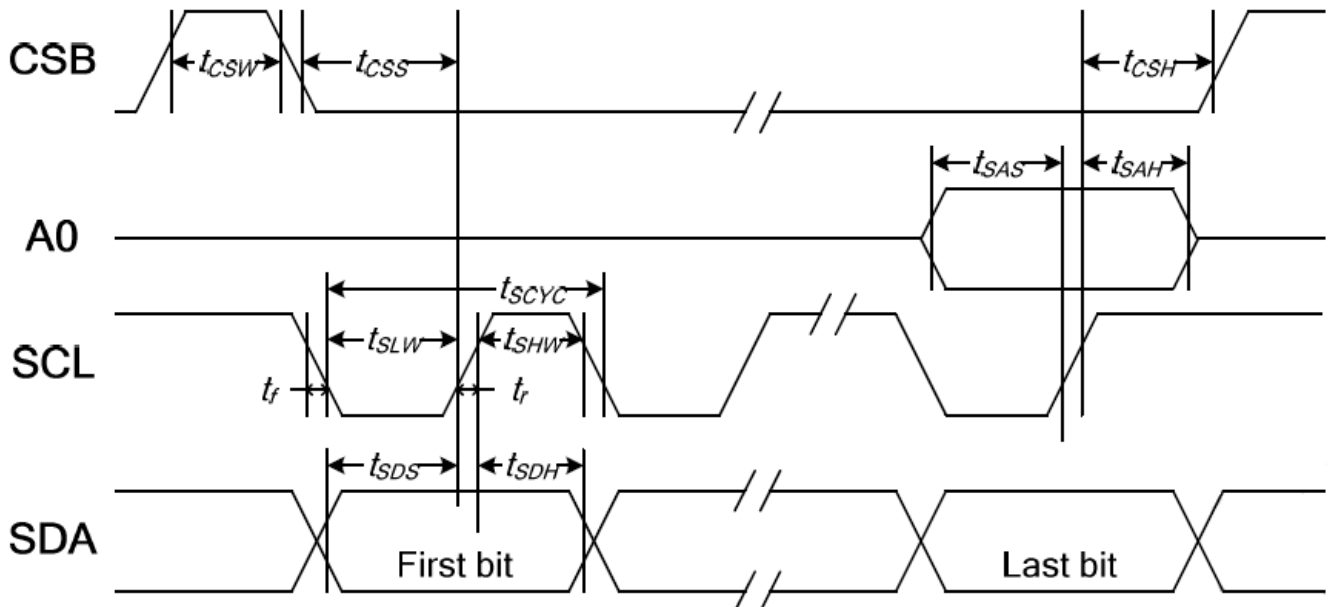
is extremely fast, $(t_r + t_f) \leq (t_{CYC8} - t_{CCLW} - t_{CCHW})$ for $(t_r + t_f) \leq (t_{CYC8} - t_{CCLR} - t_{CCHR})$ are specified.

2. All timing is specified using 20% and 80% of VDDI as the reference.

3. tCCLW and tCCLR are specified as the overlap between CSB being "L" and /WR and /RD being at the

"L" level. CSB and /WR (or /RD) cannot act at the same time and CSB should be 100ns wider than /WR (or /RD).

10.3. System Bus Timing for 4-Line Serial Interface

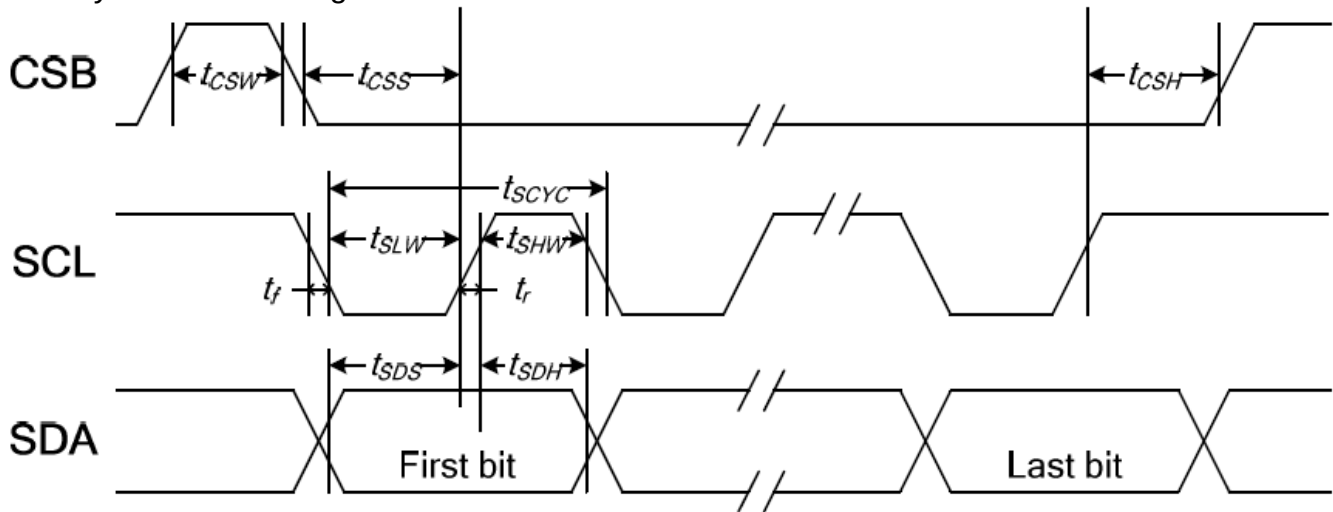


Item	Signal	Symbol	Condition	Min	Max	Unit
Serial clock period	SCL	tSCYC	-	80	-	ns
SCL "H" pulse width		tSHW	-	40	-	
SCL "L" pulse width		tSLW	-	40	-	
Address setup time	A0	tSAS	-	40	-	
Address hold time		tSAH	-	40	-	
Data setup time	SDA	tSDS	-	15	-	
Data hold time		tSDH	-	20	-	
CSB-SCL time	CSB	tCSS	-	40	-	
CSB-SCL time		tCSH	-	40	-	
CSB "H" pulse width		tCSW	-	15	-	

Note:

1. The input signal rise and fall time (t_r , t_f) are specified at 15 ns or less.
2. All timing is specified using 20% and 80% of VDDI as the standard.

10.4. System Bus Timing for 3-Line Serial Interface



Item	Signal	Symbol	Condition	Min	Max	Unit
Serial clock period	SCL	t_{SCYC}	-	80	-	ns
SCL "H" pulse width		t_{SHW}	-	40	-	
SCL "L" pulse width		t_{SLW}	-	40	-	
Data setup time	SDA	t_{SDS}	-	15	-	
Data hold time		t_{SDH}	-	20	-	
CSB-SCL time	CSB	t_{CSS}	-	40	-	
CSB-SCL time		t_{CSH}	-	40	-	
CSB "H" pulse width		t_{CSW}	-	15	-	

Note:

1. The input signal rise and fall time (t_r , t_f) are specified at 15 ns or less.
2. All timing is specified using 20% and 80% of VDDI as the standard.

11. Optical Characteristics

Item		Symbol	Temp	Condition.	Min	Typ.	Max.	Unit	Remark
Response time		Tr	25℃	θ=0°、 φ=0	-	35	-	.ms	Note 3
		Tf	25℃		-		-		
Contrast ratio		CR	25℃	At optimized viewing angle	-	900	-	-	Note 4
Viewing angle (Gray Scale Inversion Direction)	Hor.	ΘR	25℃	CR≥10	80			Deg.	Note 1 Note 2
		ΘL	25℃		80				
	Ver.	ΦB	25℃		80				
		ΦT	25℃		80				
Brightness		-	25℃	-	400	500	-	cd/m ₂	Center of display

Ta=25±2°C, IL=160mA

Note 1: Definition of viewing angle range

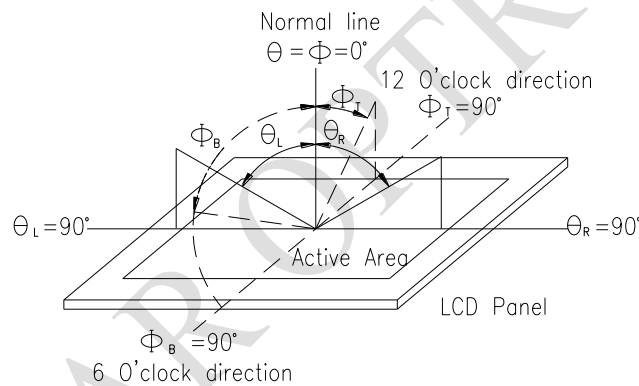


Fig. 11.1. Definition of viewing angle

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

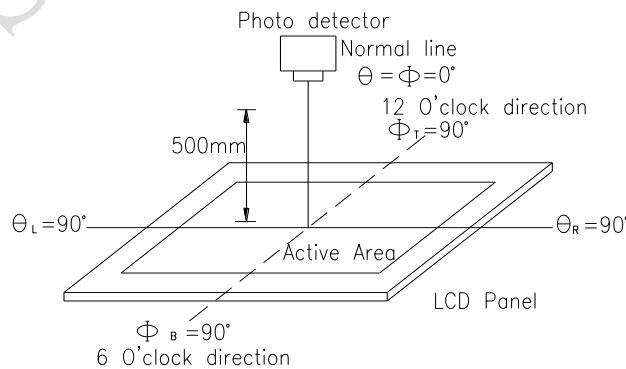
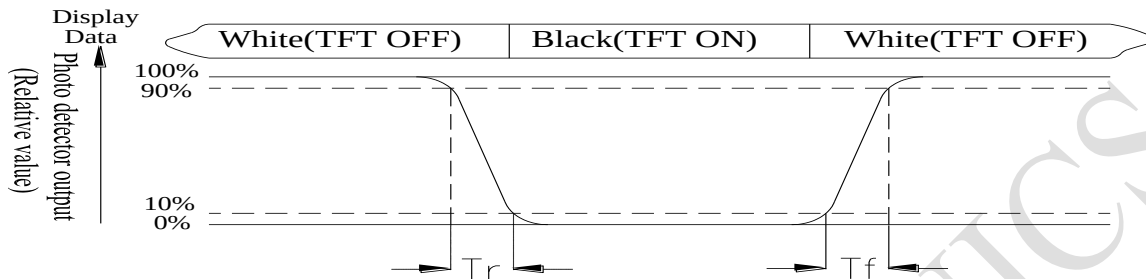


Fig. 11.2. Optical measurement system setup

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.

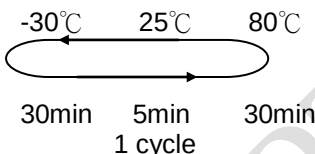
“±” means that the analog input signal swings out of phase with VCOM signal.

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

Note 6: 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 (Super Wide temperature, -30°C~80°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.	80°C 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-30°C 200hrs	1
High Temperature/ Humidity storage	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 	-30°C/80°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=±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.Initial Code For Reference

```
void Initial_code()
{
    Write_Command(0xae);
    Write_Data(0xa5);

    Write_Command(0x61);
    Write_Data(0x8f);
    Write_Data(0x04);
    Write_Data(0xa5);
    Write_Data(0xa5);

    Write_Command(0x62);
    Write_Data(0x42);
    Write_Data(0x0b);
    Write_Data(0x0c);
    Write_Data(0xa5);

    Write_Command(0x33);
    Write_Data(0x07);
    Write_Data(0x2c);
    Write_Data(0x09);
    Write_Data(0x2a);

    Write_Command(0x63);
    Write_Data(0x09);
    Write_Data(0x17);
    Write_Data(0xa5);
    Write_Data(0xa5);

    Write_Command(0x24);
    Write_Data(0x01);
    Write_Data(0xa5);
    Write_Data(0xa5);
    Write_Data(0xa5);

    Write_Command(0x22);
    Write_Data(0x00);
    Write_Data(0xa5);
    Write_Data(0xa5);
    Write_Data(0xa5);

    Write_Command(0x91);
    Write_Data(0x00);
    Write_Data(0x17);
    Write_Data(0x1b);
```

Write_Data(0x1d);

Write_Command(0x92);

Write_Data(0x1f);

Write_Data(0x21);

Write_Data(0x23);

Write_Data(0x25);

Write_Command(0x93);

Write_Data(0x27);

Write_Data(0x29);

Write_Data(0x2a);

Write_Data(0x2c);

Write_Command(0x94);

Write_Data(0x2e);

Write_Data(0x31);

Write_Data(0x34);

Write_Data(0x3f);

Write_Command(0x99);

Write_Data(0x00);

Write_Data(0x17);

Write_Data(0x1b);

Write_Data(0x1d);

Write_Command(0x9a);

Write_Data(0x1f);

Write_Data(0x21);

Write_Data(0x23);

Write_Data(0x25);

Write_Command(0x9b);

Write_Data(0x27);

Write_Data(0x29);

Write_Data(0x2a);

Write_Data(0x2c);

Write_Command(0x9c);

Write_Data(0x2e);

Write_Data(0x31);

Write_Data(0x34);

Write_Data(0x3f);

Write_Command(0x12);

Write_Data(0xa5);

Write_Command(0x15);

```
Write_Data(0xa5);  
}
```

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 : / /