



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.

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## RFJ350N-AVW-DNN

### SPECIFICATION

CUSTOMER:

<b>APPROVED BY</b>	
<b>PCB VERSION</b>	
<b>DATE</b>	

FOR CUSTOMER USE ONLY

<b>SALES BY</b>	<b>APPROVED BY</b>	<b>CHECKED BY</b>	<b>PREPARED BY</b>

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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12. Reliability
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14. Other

# 1. Module Classification Information

<b>R</b>	<b>F</b>	<b>J</b>	<b>35</b>	<b>0N</b>	<b>-</b>	<b>A</b>	<b>V</b>	<b>W</b>	<b>-</b>	<b>D</b>	<b>N</b>	<b>N</b>
1	2	3	4	5	-	6	7	8	-	9	10	11

<b>Item</b>	<b>Description</b>	
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 : 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)

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## 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.

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### 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(R/W)	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	

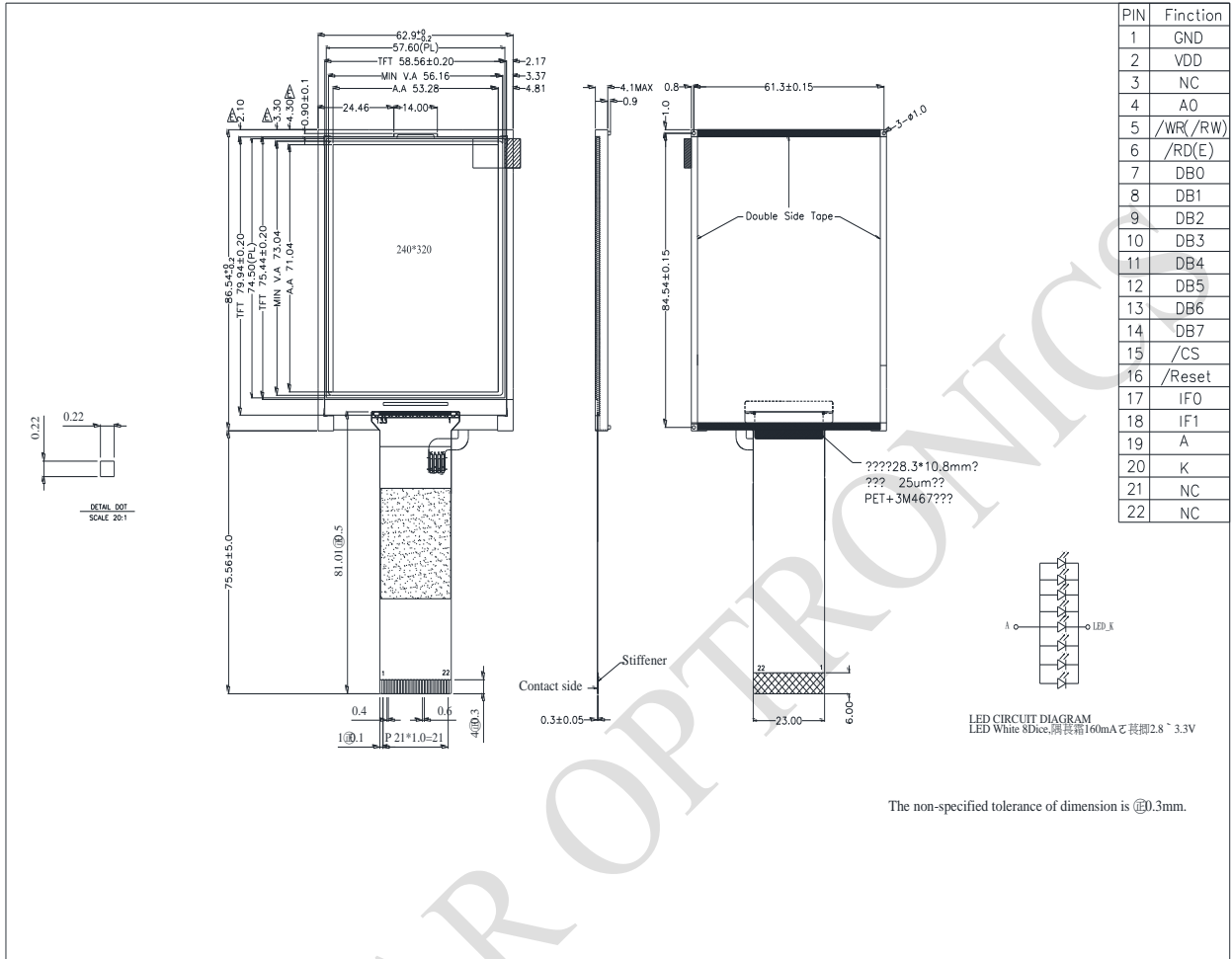
Note1:

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			-	-	

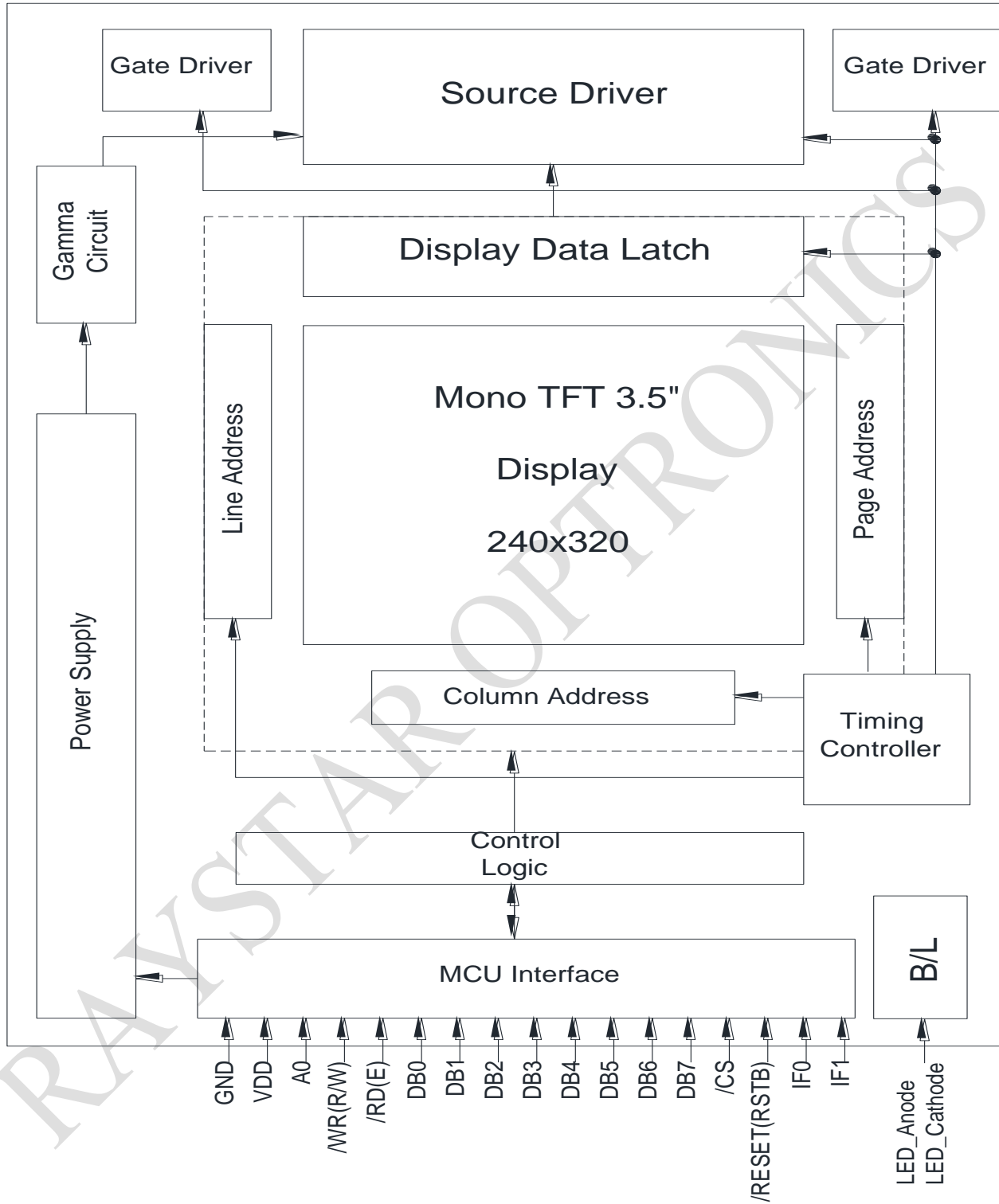
The un-used pins are marked as "-" and should be connected to "H" by VDDI.



# 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  $60^{\circ}\text{C}$

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## 8. Electrical Characteristics

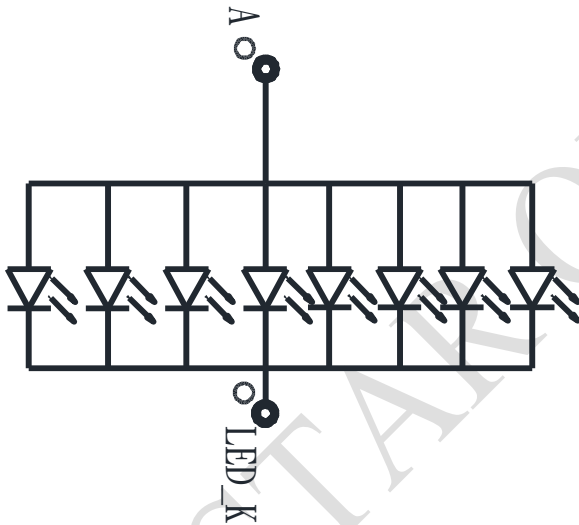
### 8.1. Operating conditions:

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

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

Note 4 : The single LED lamp case

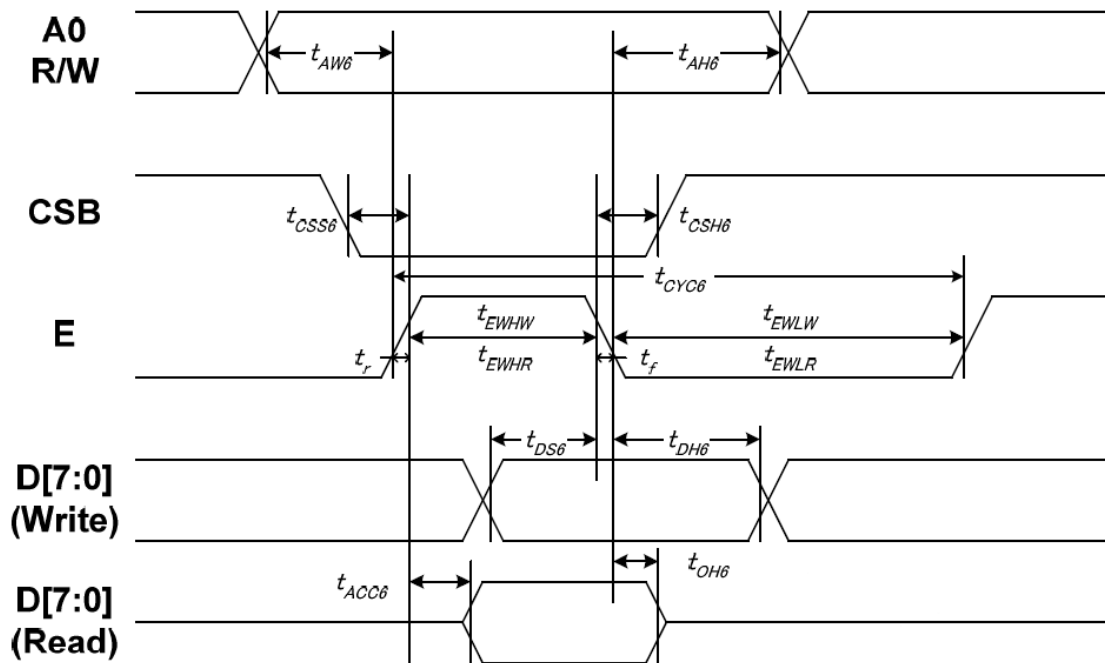
## 9.DC CHARATERISTICS

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	

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## 10.AC CHARATERISTICS

### 10.1. System Bus Timing for 6800 Series MPU

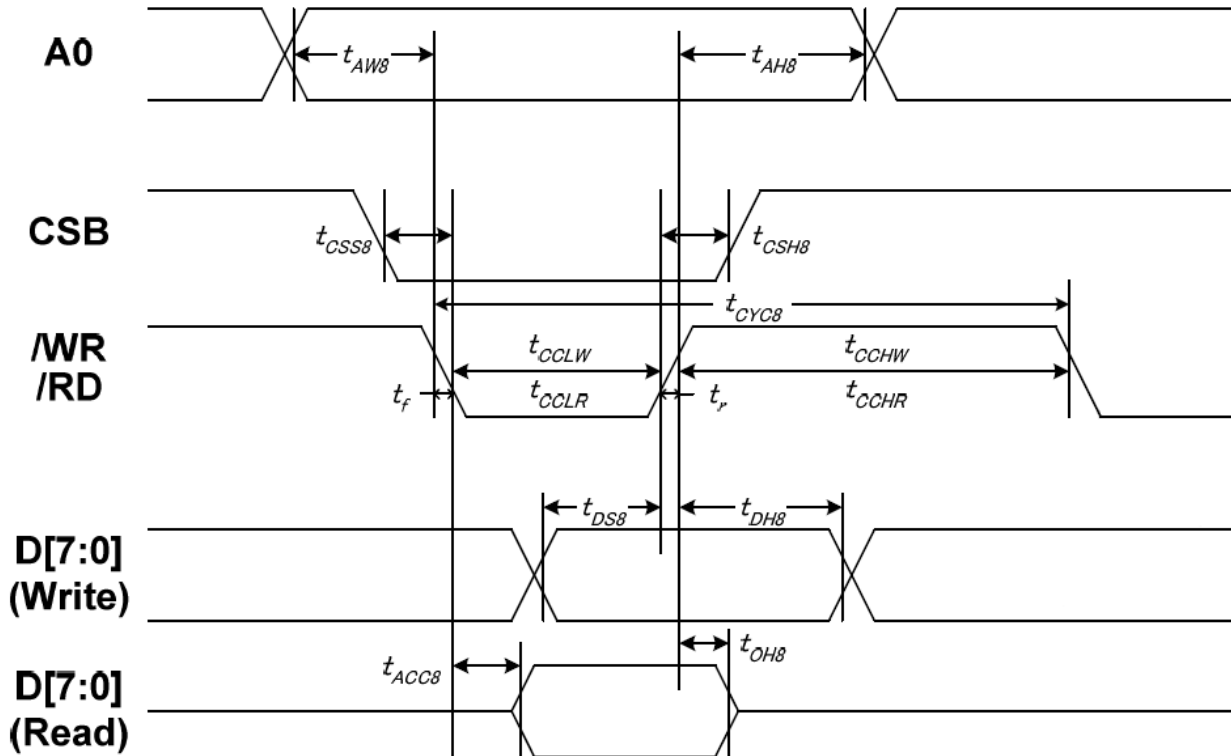


Item	Signal	Symbol	Condition	Min	Max	Unit
Address setup time	A0	tAW6	-	10	-	ns
Address hold time		tAH6	-	0	-	
System cycle time	E	tCYC6	-	200	-	
Enable L pulse width (WRITE)		tEHLW	-	100	-	
Enable H pulse width (WRITE)		tEHLR	-	100	-	
Enable L pulse width (READ)		tEHLR	-	130	-	
Enable H pulse width (READ)	tEHLR	-	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	

Note:

- 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.
- All timing is specified using 20% and 80% of VDDI as the reference.
- $t_{CCLW}$  and  $t_{CCLR}$  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).

## 10.2. System Bus Timing for 8080 Series MPU

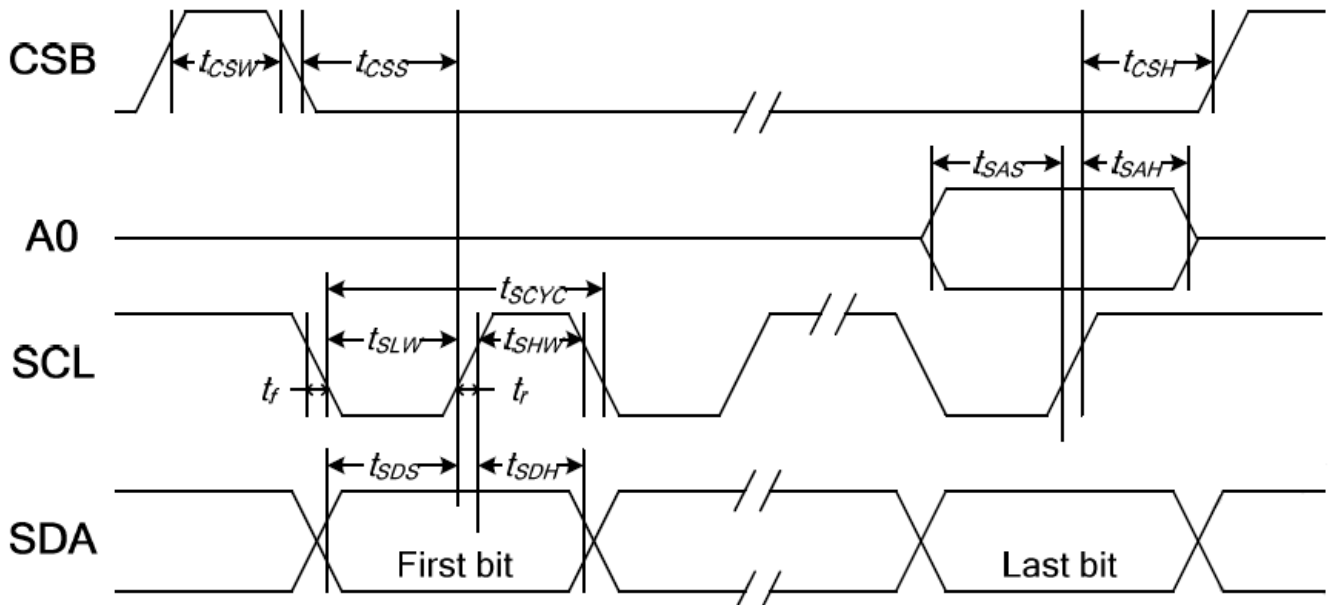


Item	Signal	Symbol	Condition	Min	Max	Unit
Address setup time	A0	tAW8	-	10	-	ns
Address hold time		tAH8	-	0	-	
System cycle time		tCYC8	-	200	-	
/WR L pulse width (WRITE)	/WR	tCCLW	-	100	-	
/WR H pulse width (WRITE)		tCCHW	-	100	-	
/RD L pulse width (READ)	/RD	tCCLR	-	120	-	
/RD H pulse width (READ)		tCCHR	-	120	-	
CSB setup time	CSB	tCSS8	-	100	-	
CSB hold time		tCSH8	-	100	-	
Write data setup time	D[7:0]	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:

- 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.
- All timing is specified using 20% and 80% of VDDI as the reference.
- $t_{CCLW}$  and  $t_{CCLR}$  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



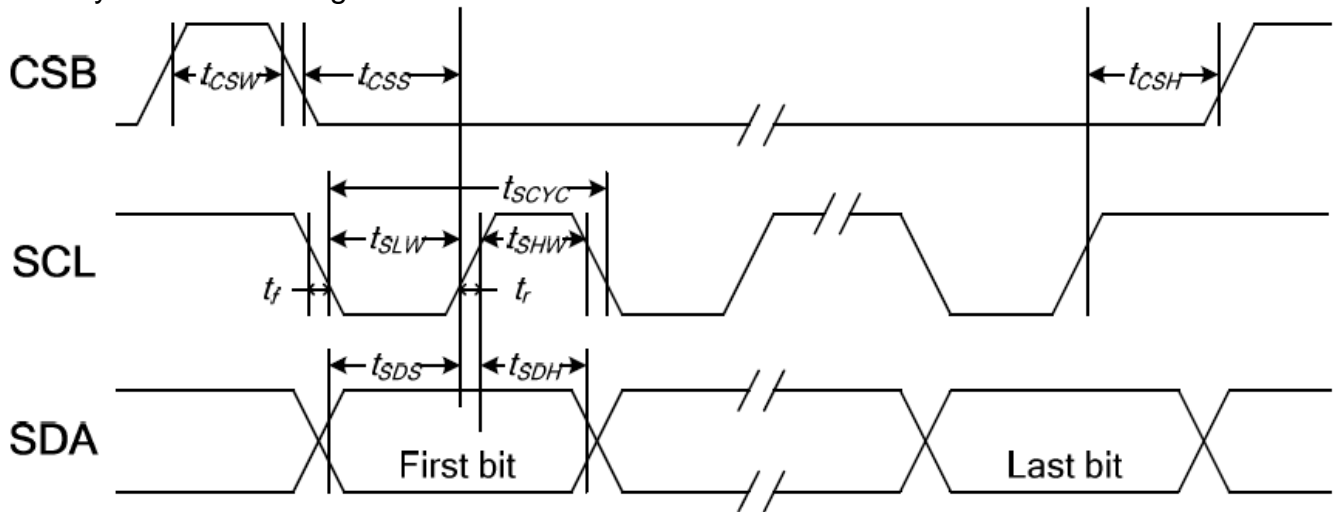
Item	Signal	Symbol	Condition	Min	Max	Unit
Serial clock period	SCL	tSCYC	-	80	-	ns
SCL "H" pulse width		tSHW	-	40	-	
SCL "L" pulse width		tSLW	-	40	-	
Address setup time	A0	tSAS	-	40	-	
Address hold time		tSAH	-	40	-	
Data setup time	SDA	tSDS	-	15	-	
Data hold time		tSDH	-	20	-	
CSB-SCL time	CSB	tCSS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

## 11. Optical Characteristics

Item	Symbol	Temp	Condition.	Min	Typ.	Max.	Unit	Remark
Response time	Tr	25°C	$\theta=0^\circ$ , $\phi=0^\circ$	-	35	-	.ms	Note 3
	Tf	25°C		-		-		
Contrast ratio	CR	25°C	At optimized viewing angle	-	900	-	-	Note 4
Viewing angle (Gray Scale Inversion Direction)	Hor.	$\Theta_R$	25°C	CR $\geq 10$	80		Deg.	Note 1 Note 2
		$\Theta_L$	25°C		80			
	Ver.	$\Phi_B$	25°C		80			
		$\Phi_T$	25°C		80			
Brightness	-	25°C	-	400	500	-	cd/m <sup>2</sup>	Center of display

Ta=25±2°C, IL=160mA

Note 1: Definition of viewing angle range

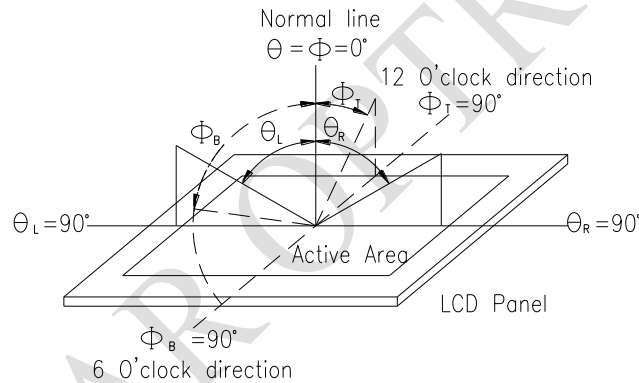


Fig. 11.1. Definition of viewing angle

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.

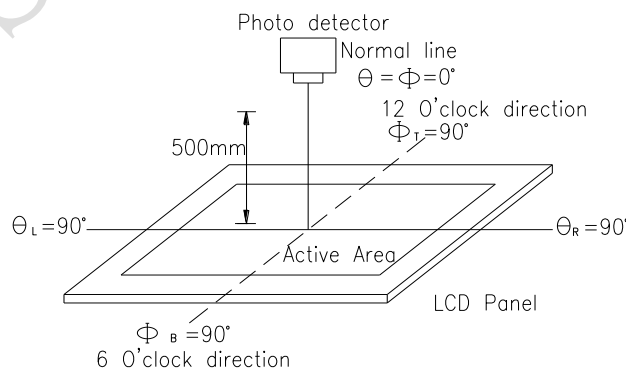
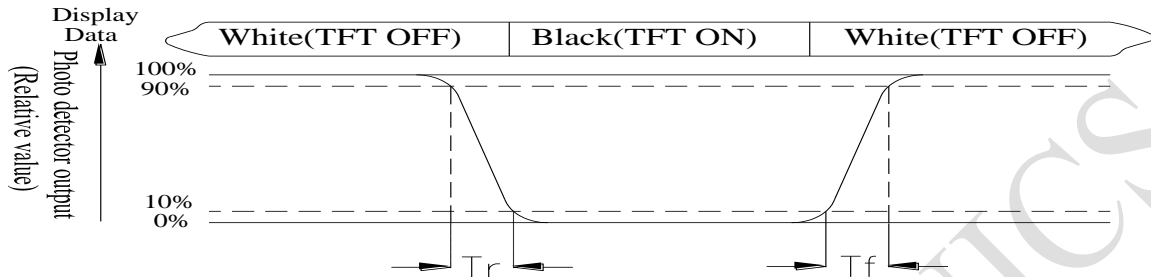


Fig. 11.2. Optical measurement system setup

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.

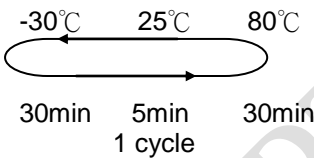
“±” means that the analog input signal swings out of phase with VCOM signal.

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 : 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.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);  
}
```

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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 , _____

&gt;&gt; Go to page 2 &lt;&lt;



Module Number : \_\_\_\_\_

**5 · Electronic Characteristics of Module :**

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 · Summary :**

Sales signature : \_\_\_\_\_

Customer Signature : \_\_\_\_\_

Date : / /