DISPLAY Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 240320B MMX-PW-N

3,5” MONO - TFT

Product Specification **Version: 4**

11.08.2016

Revision History

VERSION	DATE	Note
0	14.04.2015	First Issue
1	28.04.2015	Modify Reliability
2	04.11.2015	Modify Initial Code
3	21.01.2016	Modify Static Electricity Test
4	11.08.2016	Modify Vibration Test

Contents

1. Summary

This technical specification applies to 3.45’ Mono TFT-LCD panel. The 3.45’ Mono TFT-LCD panel is designed for camcorder, digital camera application and other electronic products which require high quality flat panel displays. This module follows RoHS.

2. General Specifications

- Size: 3.5 Inch
- Dot Matrix: 240 x 320 dots
- Module dimension: 62.90 x 86.54 x 4.10 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
- Gray Scale: 16 Gray scale (4BPP) / 4 Gray scale (2BPP) / 2 Gray scale (1BPP)
- Driver IC: ST7511 (Sitronix)
- Backlight Type: LED, Normally White
- With / Without TP: Without TP
- Surface: Glare

* Mono tone slight changed by temperature and driving voltage.

3. Interface

3.1. LCM PIN Definition

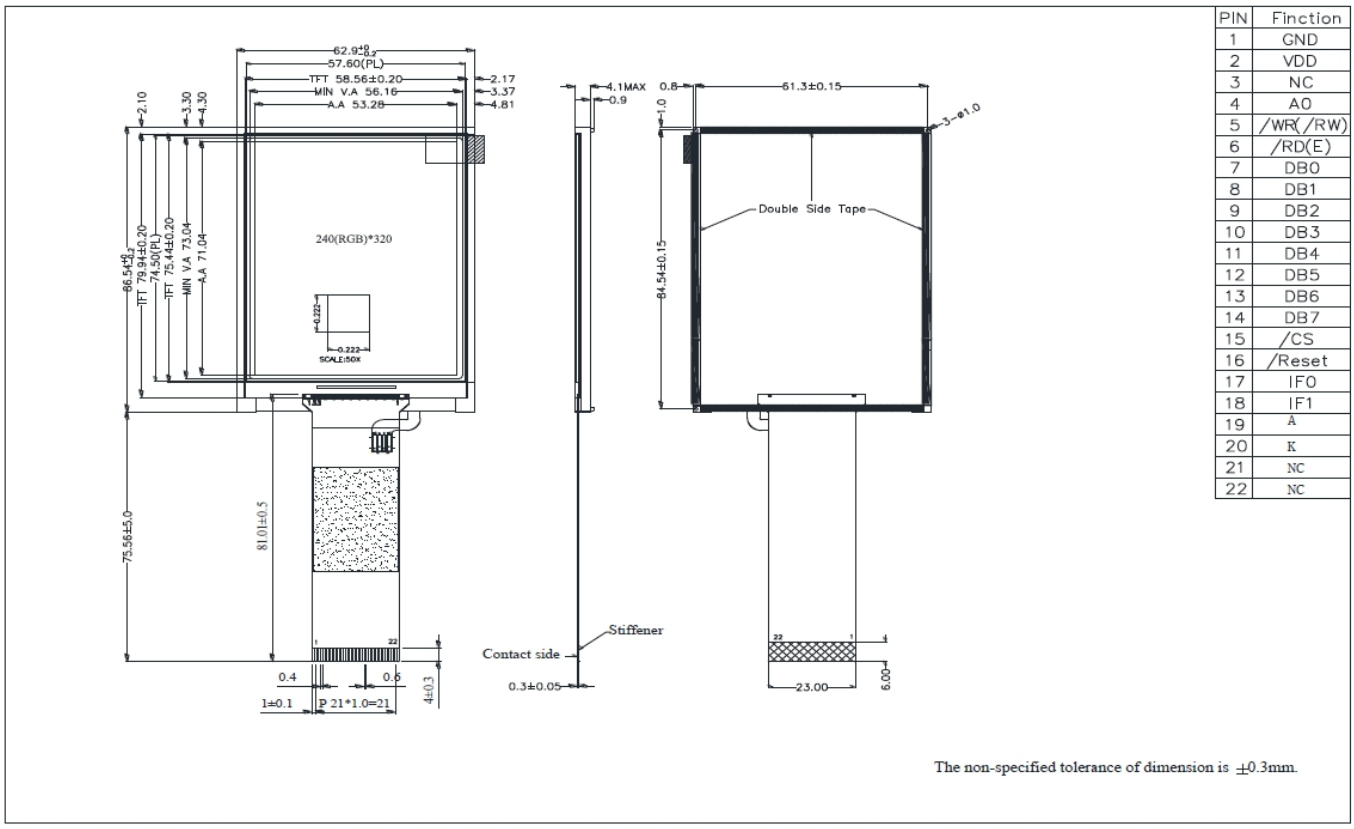
Pin	Symbol	Function	Remark
1	GND	System ground	
2	VDD	Power Supply : +3.3V	
3	NC	No connect	
4	A0	Data/Command select	
5	/WR(R/W)	Write strobe signal	
6	/RD(E)	Read strobe signal	
7	DB0	Data bus	
8	DB1	Data bus	
9	DB2	Data bus	
10	DB3	Data bus	
11	DB4	Data bus	
12	DB5	Data bus	
13	DB6	Data bus	
14	DB7	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	
H	H	Serial 4-Line series MCU			-	-	D7=SCL, D0=SDA, D[6:1]
H	L	Serial 3-Line series MCU		-	-	-	are not used

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

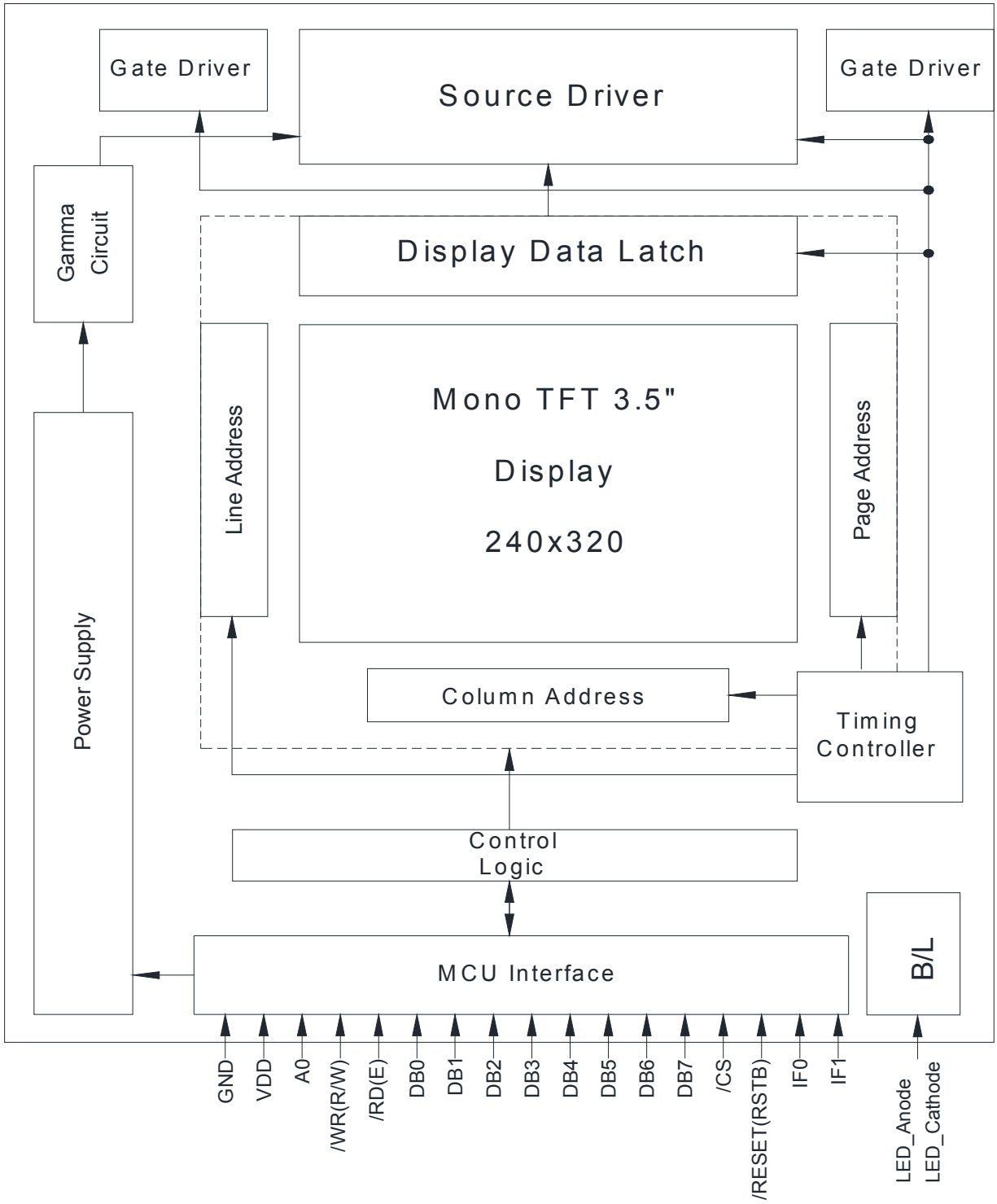
4. Counter Drawing



PIN	Finction
1	GND
2	VDD
3	NC
4	A0
5	/WR(/RW)
6	/RD(E)
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	/CS
16	/Reset
17	IF0
18	IF1
19	A
20	K
21	NC
22	NC

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

5. Block Diagram

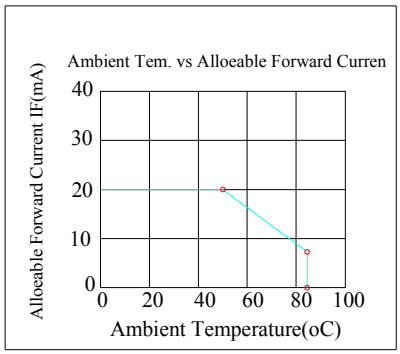


6. Absolute Maximum Ratings

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

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



7. Electrical Characteristics

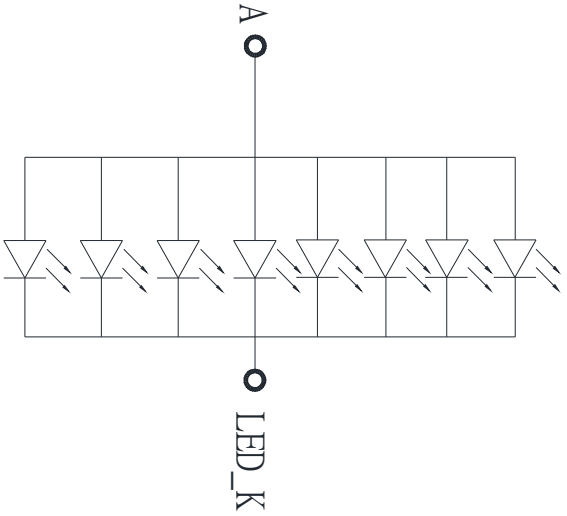
7.1. Operating conditions:

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	—	—	13.0	—	mA	Note1
Power Consumption	—	—	—	—	46.8	mW	

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

7.2. 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 Lifetime		—	50,000	—	Hr	Note 2,3,4



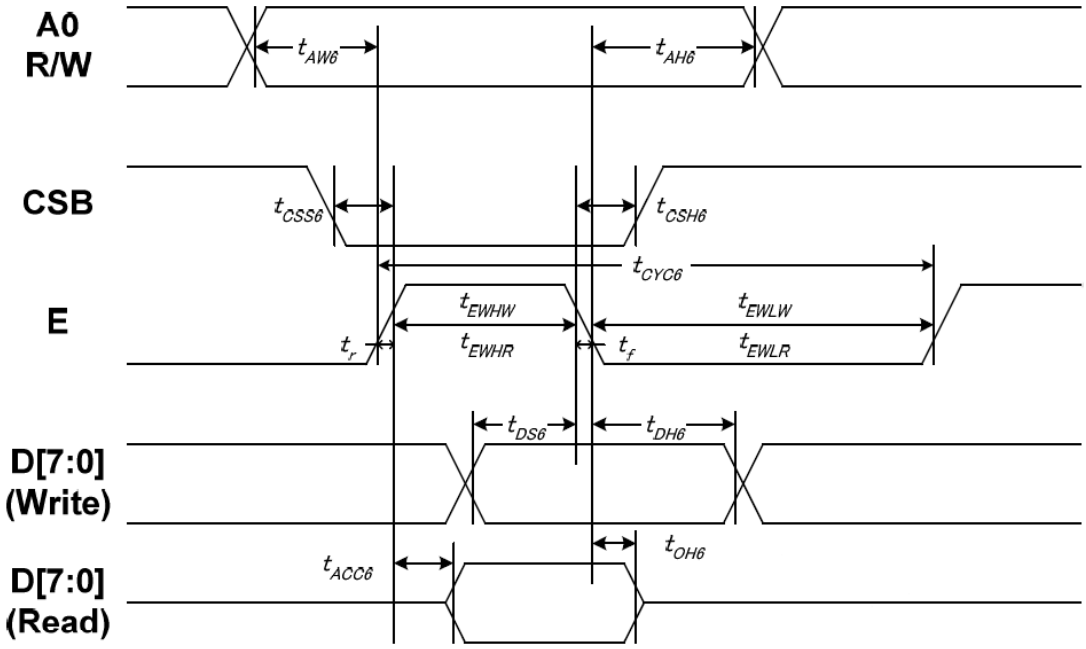
Note 1: Power supply the back light specification
Note 2: Ta = 25°C
Note 3: Brightness to be decreased to 50% of the initial value
Note 4: The single LED lamp case

8. DC CHARATERISTICS

Parameter	Symbol	Rating			Unit	Condition
		Min	Typ	Max		
Low Level Input Voltage	V_{IL}	0	-	$0.3V_{DD}$	V	
High Level Input Voltage	V_{IH}	$0.7V_{DD}$	-	V_{DD}	V	

9. AC CHARATERISTICS

9.1 System Bus Timing for 6800 Series MPU

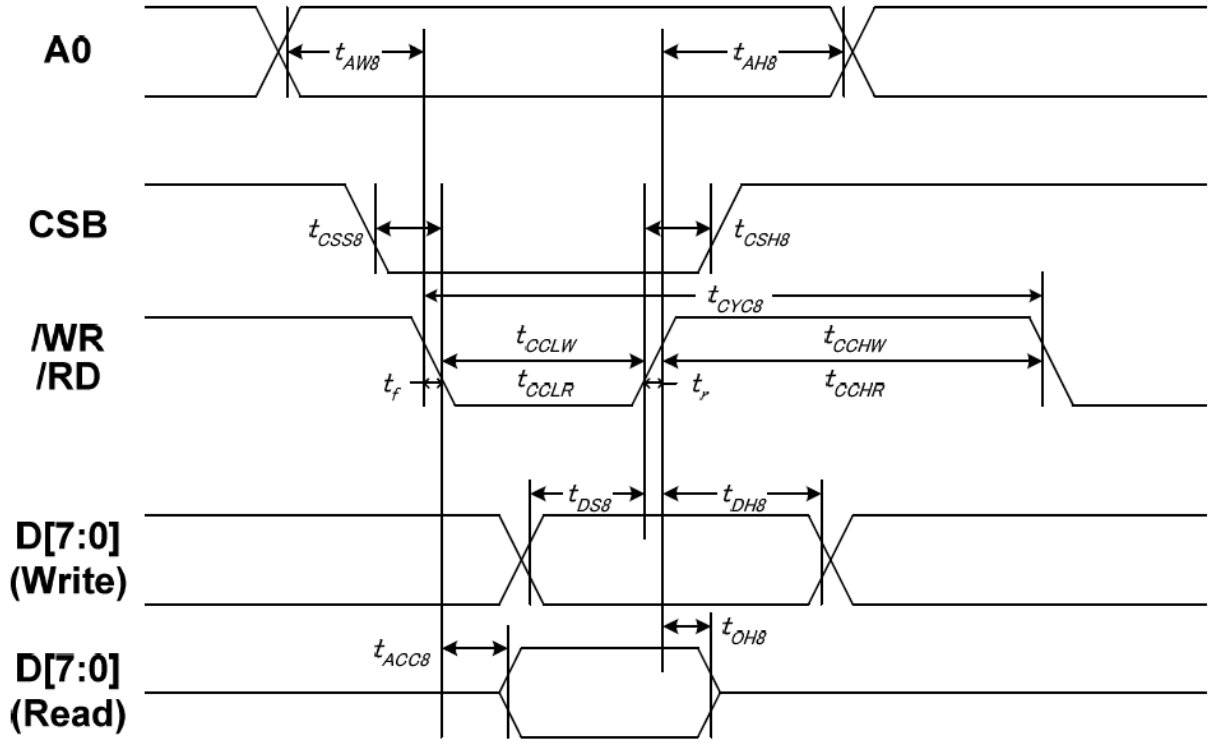


Item	Signal	Symbol	Condition	Min	Max	Unit
Address setup time	A0	tAW6	-	10	-	ns
Address hold time		tAH6	-	0	-	
System cycle time	E	tCYC6	-	200	-	
Enable L pulse width (WRITE)		tEWLW	-	100	-	
Enable H pulse width (WRITE)		tEWHW	-	100	-	
Enable L pulse width (READ)		tEWLR	-	130	-	
Enable H pulse width (READ)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

Note:

1. The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
   When the system cycle time is extremely fast,
   (tr + tf) ≤ (tCYC8 – tCCLW – tCCHW) for (tr + tf) ≤ (tCYC8 – tCCLR – tCCHR) 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).

9.2 System Bus Timing for 8080 Series MPU

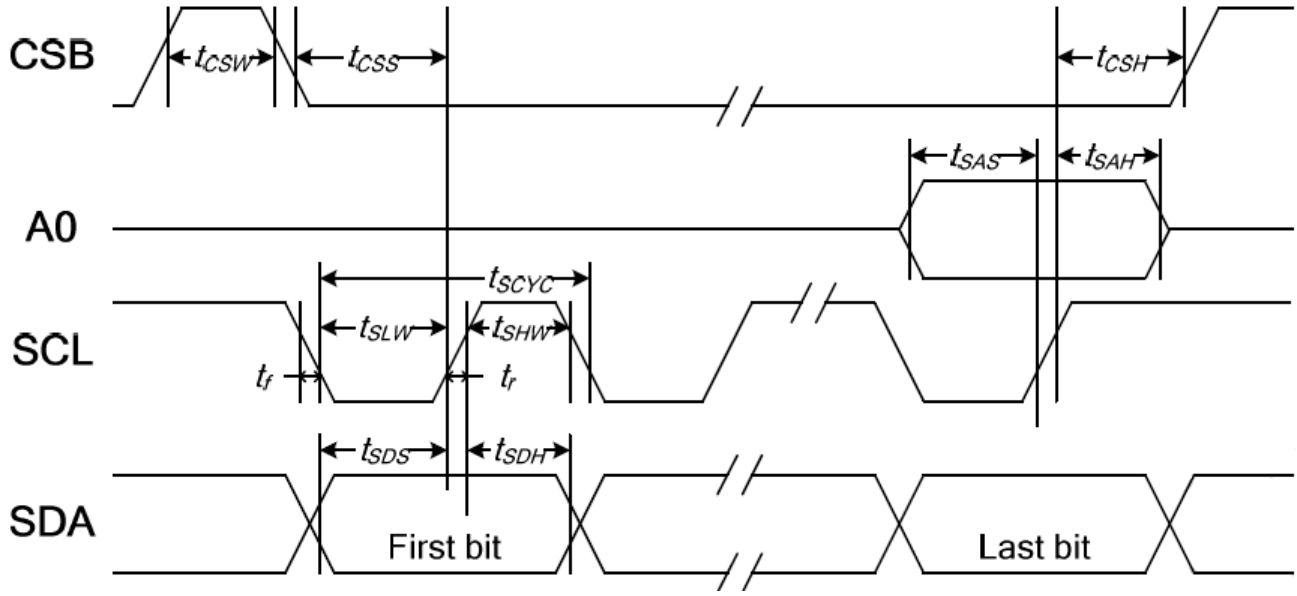


Item	Signal	Symbol	Condition	Min	Max	Unit
Address setup time	A0	tAW8	-	10	-	ns
Address hold time		tAH8	-	0	-	
System cycle time	/WR	tCYC8	-	200	-	
/WR L pulse width (WRITE)		tCCLW	-	100	-	
/WR H pulse width (WRITE)		tCCHW	-	100	-	
/RD L pulse width (READ)	/RD	tCCLR	-	120	-	
/RD H pulse width (READ)		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		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 (tr, tf) is specified at 15 ns or less.
   When the system cycle time is extremely fast,
   (tr + tf) ≤ (tCYC8 – tCCLW – tCCHW) for (tr + tf) ≤ (tCYC8 – tCCLR – tCCHR) 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).

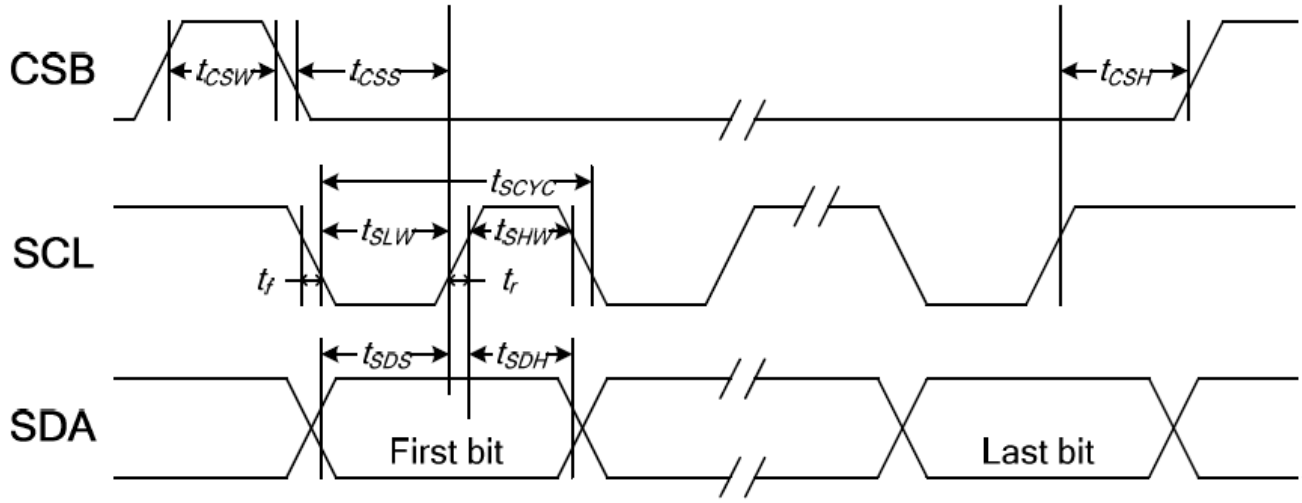
9.3 System Bus Timing for 4-Line Serial Interface



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 (tr, tf) are specified at 15 ns or less.
2. All timing is specified using 20% and 80% of VDDI as the standard.

9.4 System Bus Timing for 3-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	-	
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 (tr, tf) are specified at 15 ns or less.
2. All timing is specified using 20% and 80% of VDDI as the standard.

10. Optical Characteristics

Item		Symbol	Temp	Condition.	Min	Typ.	Max.	Unit	Remark
Response Time		Tr	25°C	θ=0°、Φ=0	-	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.	ΘR	25°C	CR≧10	80			Deg.	Note 1 Note 2
		ΘL	25°C		80				
	Ver.	ΦB	25°C		80				
		ΦT	25°C		80				
Brightness		-	25°C	-	400	500	-	cd/m^2	Center of display

Ta=25±2°C, IL=160mA

Note 1: Definition of viewing angle range

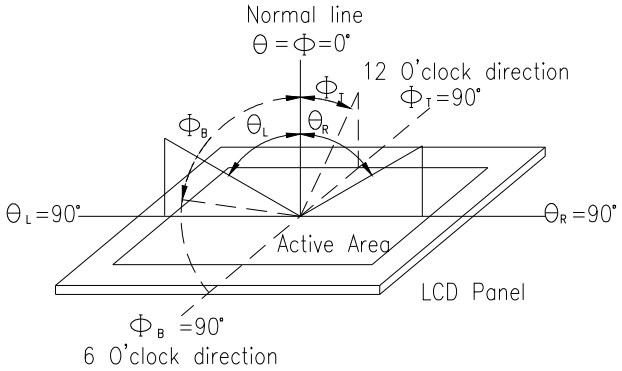


Fig. 11.1. Definition of viewing angle

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.

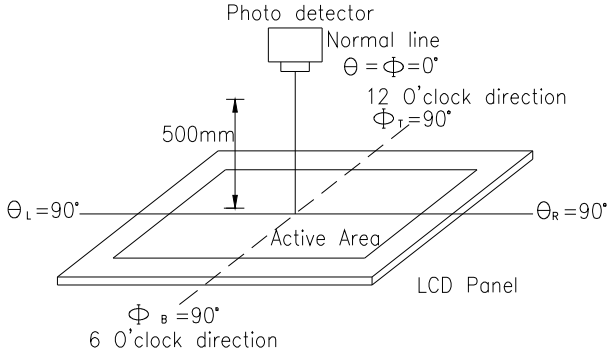
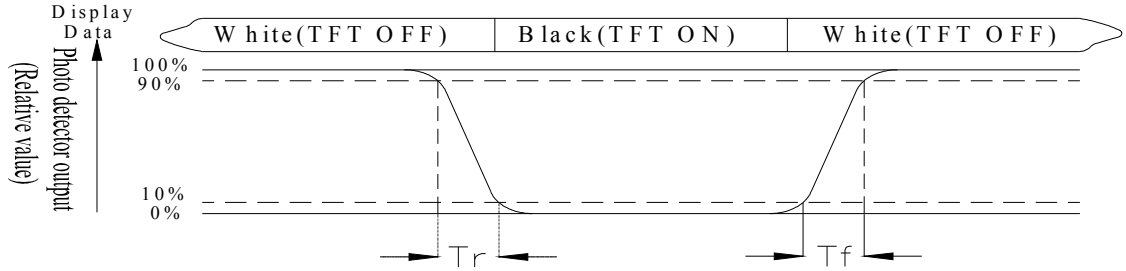


Fig. 11.2. Optical measurement system setup

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, Tr, is the time between photo detector output intensity changed from 90%to 10%. And fall time, Tf, 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.

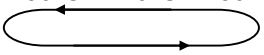
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: White Vi = Vi50 ± 1.5V
Black Vi = Vi50 ± 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.

11. 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□,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 25°C 80°C  30min 5min 30min 1 cycle	-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.

12. 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);
}
```