

MDT0350BSH-MONO	240 x 320	SPI/Parallel Interface	TFT Module
(MCT035H6X240320PWL)			
Specification			
Version: 6		Date: 06/03/2017	
Revision			
1	14/04/2015	First issue	
2	28/04/2015	Modify Reliability	
3	04/11/2015	Modify Initial Code	
4	21/01/2016	Modify Static electricity test	
5	11/08/2016	Modify Vibration test	
6	06/03/2017	Add Aspect Ratio	

Display Features			
Display Size	3.5"		
Resolution	240 x 320		
Orientation	Portrait		
Appearance	MONO		
Logic Voltage	3.3V		
Interface	SPI/Parallel		
Brightness	500 cd/m ²		
Touchscreen	---		
Module Size	62.90 x 86.54 x 4.10mm		
Operating Temperature	-30°C ~ +80°C		
Pinout	22 way FFC		
Pitch	1.00mm		
		Box Quantity	Weight / Display
		---	---

* - For full design functionality, please use this specification in conjunction with the ST7511 specification.(Provided Separately)

Display Accessories	
Part Number	Description

Optional Variants	
Appearances	Voltage

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.

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.



Interface

1. LCM PIN Definition

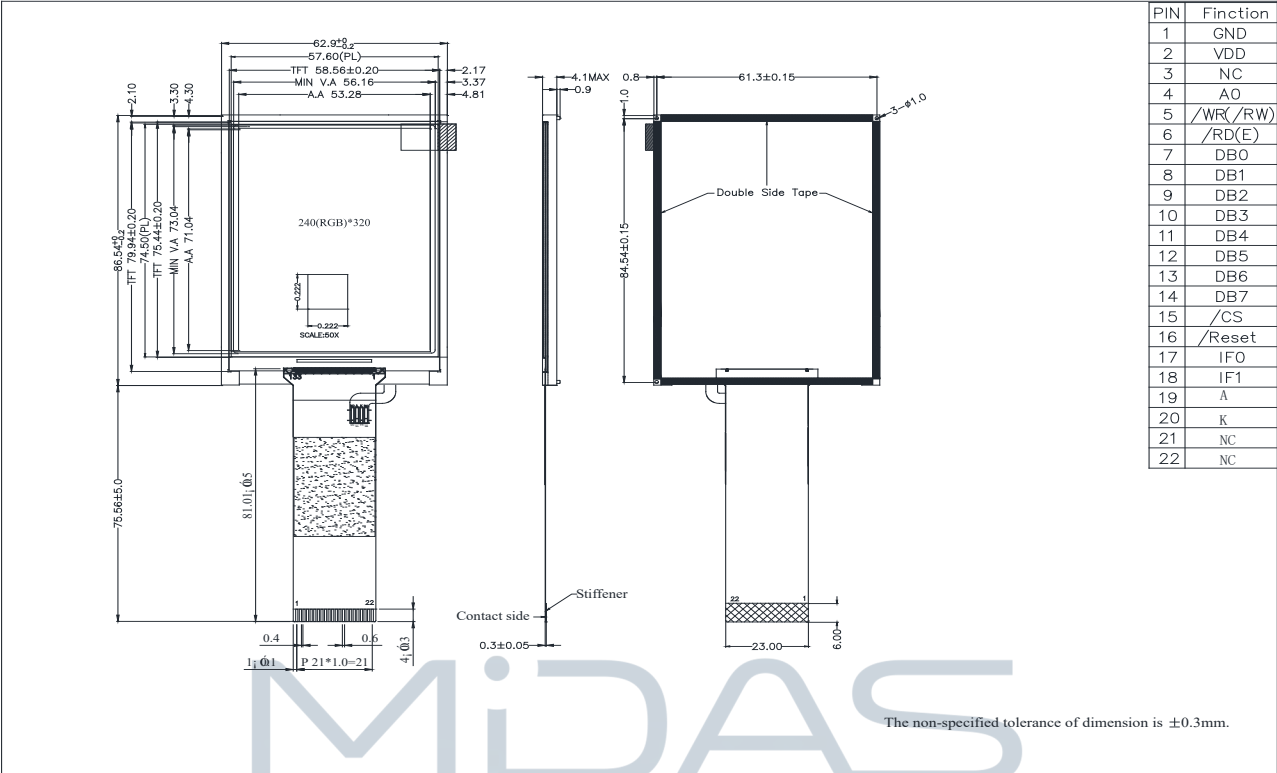
Pin	Symbol	Function	Remark
1	GND	System ground	
2	VDD	Power Supply : +3.3V	
3	NC	No connect	
4	A0	Data/Command select	
5	/WR(R/W)	Write strobe signal	
6	/RD(E)	Read strobe signal	
7	DB0	Data bus	
8	DB1	Data bus	
9	DB2	Data bus	
10	DB3	Data bus	
11	DB4	Data bus	
12	DB5	Data bus	
13	DB6	Data bus	
14	DB7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

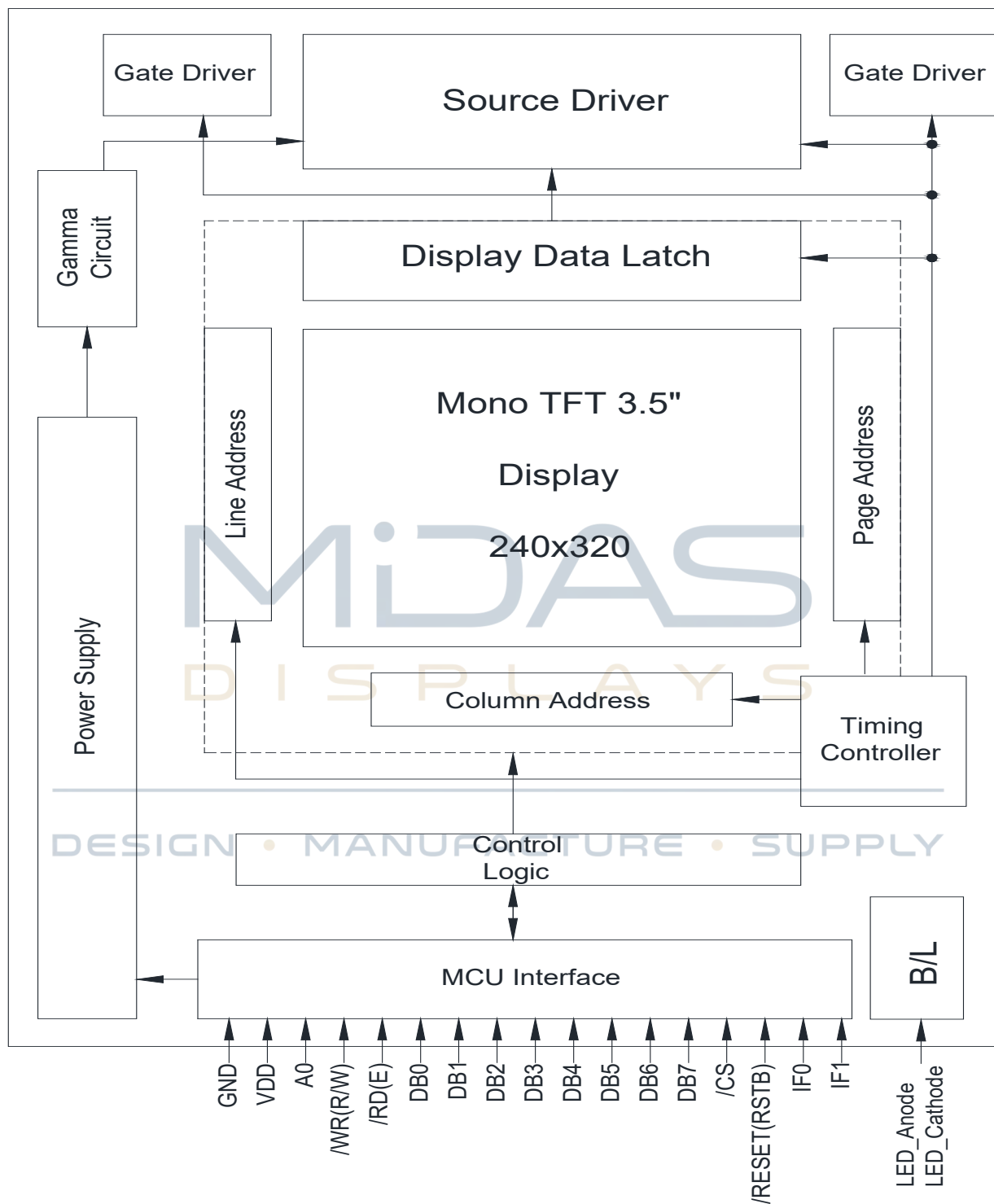
The un-used pins are marked as “-” and should be connected to “H” by VDDI.

Contour Drawing



DESIGN • MANUFACTURE • SUPPLY

Block Diagram



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

Electrical Characteristics

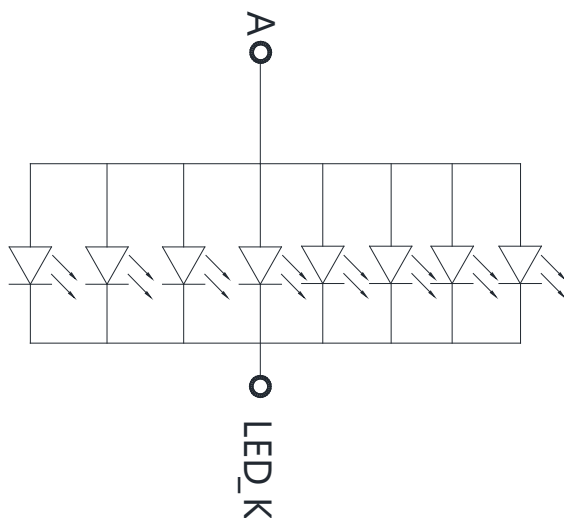
1. Operating conditions:

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

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.

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	

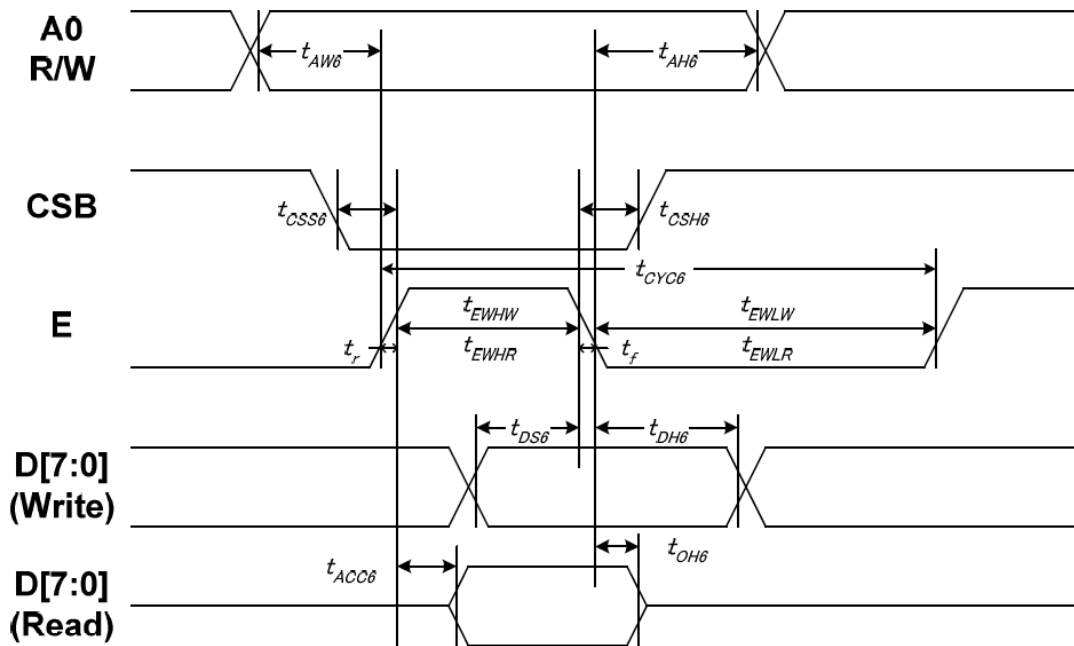
MIDAS
DISPLAYS

DESIGN • MANUFACTURE • SUPPLY



AC CHARATERISTICS

1. System Bus Timing for 6800 Series MPU

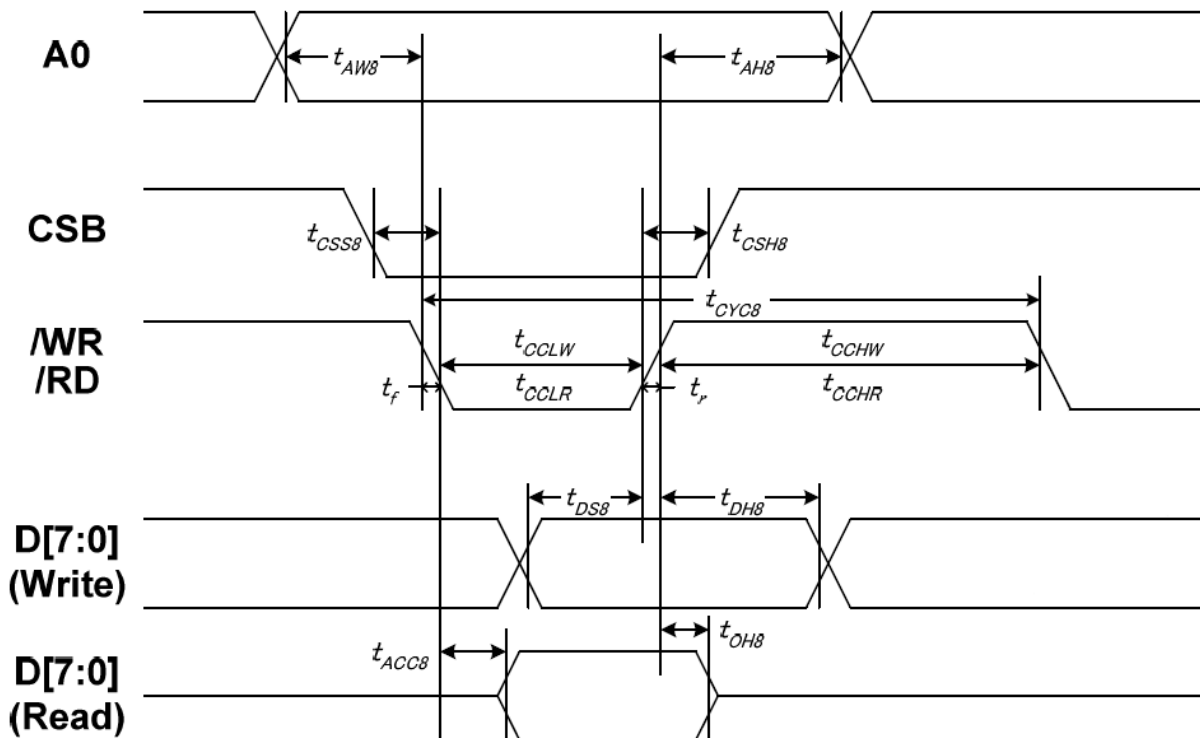


Item	Signal	Symbol	Condition	Min	Max	Unit
Address setup time	A0	tAW6	-	10	-	ns
Address hold time		tAH6	-	0	-	
System cycle time	E	tCYC6	-	200	-	
Enable L pulse width (WRITE)		tEHLW	-	100	-	
Enable H pulse width (WRITE)		tEHWLW	-	100	-	
Enable L pulse width (READ)		tEHLR	-	130	-	
Enable H pulse width (READ)		tEHWLW	-	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, $(t_r + t_f) \leq (t_{CYC6} - t_{CCLW} - t_{CCHW})$ for $(t_r + t_f) \leq (t_{CYC6} - t_{CCLR} - t_{CCHR})$ 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).

2. System Bus Timing for 8080 Series MPU

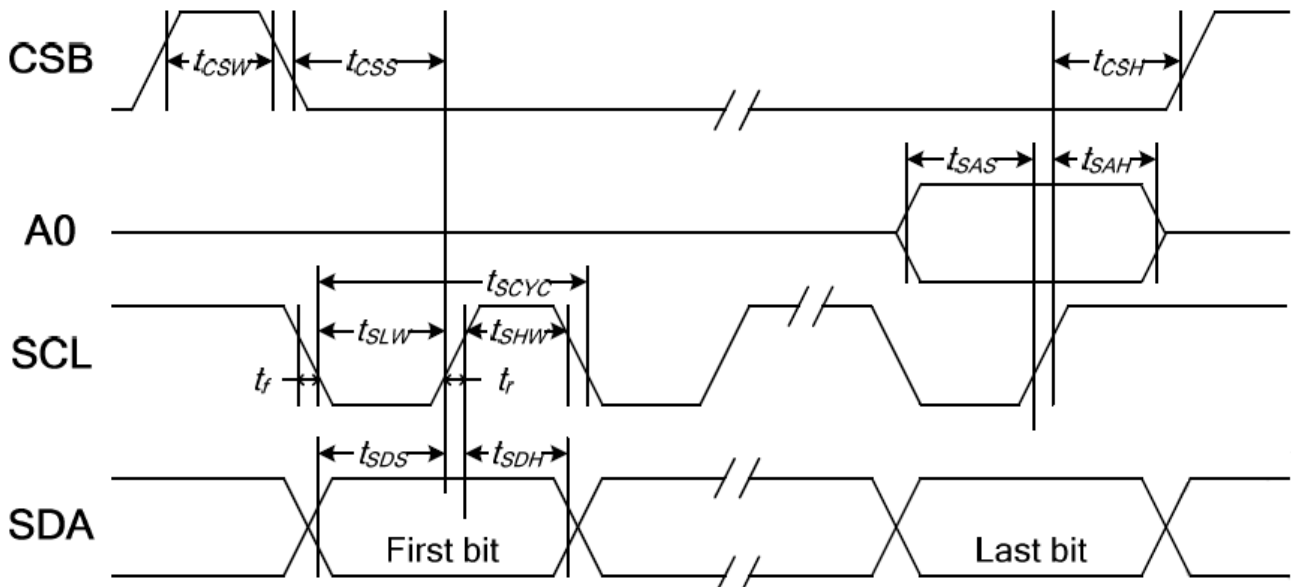


Item	Signal	Symbol	Condition	Min	Max	Unit
Address setup time	A0	t_{AW8}	-	10	-	ns
Address hold time		t_{AH8}	-	0	-	
System cycle time	/WR	t_{CYC8}	-	200	-	
/WR L pulse width (WRITE)		t_{CCLW}	-	100	-	
/WR H pulse width (WRITE)		t_{CCHW}	-	100	-	
/RD L pulse width (READ)		t_{CCLR}	-	120	-	
/RD H pulse width (READ)	/RD	t_{CCHR}	-	120	-	
CSB setup time	CSB	t_{CSS8}	-	100	-	
CSB hold time		t_{CSH8}	-	100	-	
Write data setup time	D[7:0]	t_{DS8}	-	70	-	
Write data hold time		t_{DH8}	-	20	-	
Read data access time		t_{ACC8}	CL = 100 pF	-	80	
Read data output disable time		t_{OH8}	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).

3. System Bus Timing for 4-Line Serial Interface

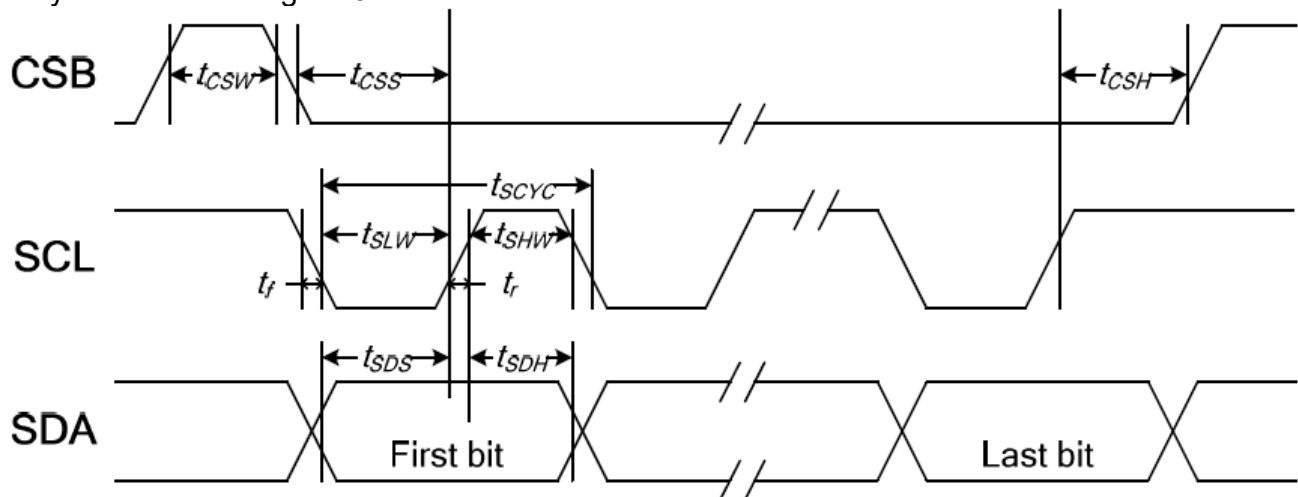


Item	Signal	Symbol	Condition	Min	Max	Unit
Serial clock period	SCL	tSCYC	-	80	-	ns
SCL "H" pulse width		tSHW	-	40	-	
SCL "L" pulse width		tSLW	-	40	-	
Address setup time	A0	tSAS	-	40	-	
Address hold time		tSAH	-	40	-	
Data setup time	SDA	tSDS	-	15	-	
Data hold time		tSDH	-	20	-	
CSB-SCL time	CSB	tCSS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

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 (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.

DESIGN • MANUFACTURE • SUPPLY

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

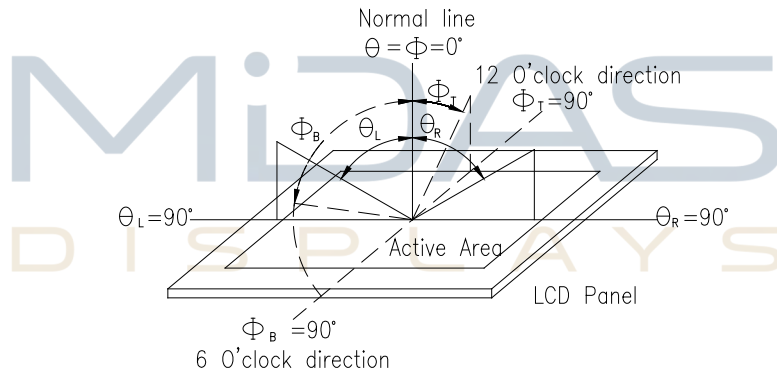


Fig. 1. Definition of viewing angle

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.

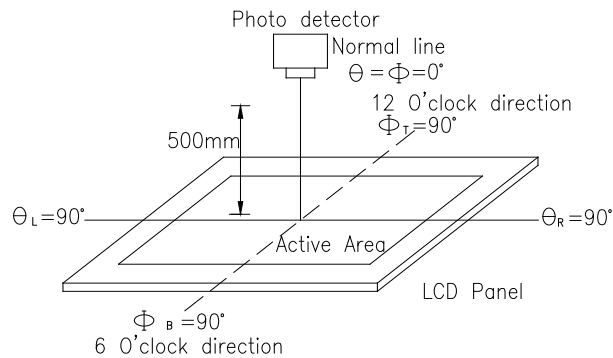
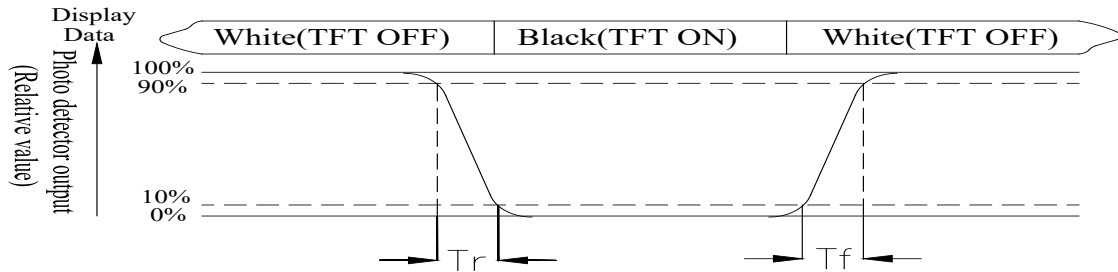


Fig. 2. Optical measurement system setup

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.

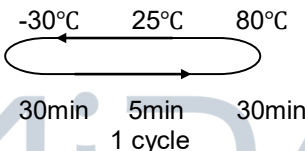
The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 6: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

DESIGN • MANUFACTURE • SUPPLY

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 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.

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);
```

```
}
```