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LMT080ENEFWA

LCD Module User Manual

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1. Summary

1.1 General Description

This is a 8.0 inch a-Si TFT-LCD module with Normal-black technology. It is composed of a TFT-LCD panel, a driver circuit, FPC, and a LED backlight unit.

1.2 Features

- Interface: RGB 24bits with TCON
- Surface treatment: Anti-Glare
- Compliant with the European RoHS Directive (2011/65/EU) and Delegated Directive (2015/863/EU, Amending Annex II of 2011/65/EU)

2. General Specifications

Feature		Spec	Unit
Display Spec	Size	8.0 inches	
	Resolution	800(RGB) x 600	
	Pixel Pitch	0.2025(H) x 0.2025 (V)	mm
	TFT Active Area	162.0 (W) x121.5 (H)	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT, Normally Black	
	Surface Treatment	Anti-Glare	
	Viewing Direction	All	
Mechanical Characteristics	LCM (W x H x D)	183.0×141.0×5.6	mm
	Weight	210	g
Optical Characteristics	Luminance	350	cd/m ²
	Contrast Ratio	1000:1	
	NTSC	50	%
	Viewing Angle	89/89/89/89	degree
Electrical Characteristics	Interface	RGB 24 bits	
	Color Depth	16.7 Million	color
	Power Consumption	LCD: TBD Backlight: 1620	mW

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
Connector	0.5pitch 50pin FPC
Matching connector	FH52-50S-0.5SH or compatible

Table 3.1.1 Connector information

Pin No.	Symbol	I/O	function	Remarks
1	LED+	P	LED Anode	
2	LED+	P	LED Anode	
3	LED-	P	LED Cathode	
4	LED-	P	LED Cathode	
5	GND	P	Power ground	
6	NC	N	No connection	
7	VCC	P	Power supply 3.3V	
8	MODE	I	DE/SYNC mode select	MODE=1, DE mode; MODE=0, HSD/VSD mode.
9	DE	I	Data input enable	
10	VS	I	Vertical sync input	Fix to GND when not used.
11	HS	I	Horizontal sync Input	
12	B7	I	Blue data(MSB)	
13	B6	I	Blue data	
14	B5	I	Blue data	
15	B4	I	Blue data	
16	B3	I	Blue data	
17	B2	I	Blue data	
18	B1	I	Blue data	
19	B0	I	Blue data(LSB)	
20	G7	I	Green data(MSB)	
21	G6	I	Green data	
22	G5	I	Green data	
23	G4	I	Green data	
24	G3	I	Green data	
25	G2	I	Green data	
26	G1	I	Green data	
27	G0	I	Green data(LSB)	

28	R7	I	RED data(MSB)	
29	R6	I	RED data	
30	R5	I	RED data	
31	R4	I	RED data	
32	R3	I	RED data	
33	R2	I	RED data	
34	R1	I	RED data	
35	R0	I	RED data(LSB)	
36	GND	P	Power ground	
37	DCLK	I	Clock for input data	Latch data at falling edge.
38	GND	P	Power ground	
39	NC	N	No connection	
40	NC	N	No connection	
41	VGH	P	No connection	
42	VGL	P	No connection	
43	AVDD	P	No connection	
44	RESET	I	Global reset pin	Controlled by MCU or connected with RC delay.
45	NC	N	No connection	
46	NC	N	No connection	
47	NC	N	No connection	
48	GND	P	Power ground	
49	NC	N	No connection	
50	NC	N	No connection	

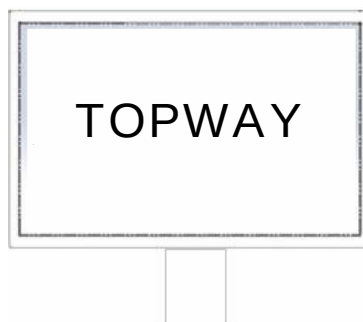
Table 3.1.2 Pin Assignment for LCD Interface

Note1: I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection

Note2: All of the GND pins should be connected to the system ground.

Note3: This LCD module supports SYNC & SYNC-DE & DE mode, the pin setting is different from each other. Please refer to the descriptions.

Note4: Display direction is shown as the figure below:



4. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VCC	-0.5	5.0	V	Note1
	AVDD	-0.5	12	V	
	VGH	-0.3	+20	V	
	VGL	VGH-32	+0.3	V	
Input voltage	V _{IN}	-0.5	5.0	V	
Operating Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	
Relative Humidity Note2	RH	--	≤95	%	Ta≤40°C
		--	≤85	%	40°C < Ta≤50°C
		--	≤55	%	50°C < Ta≤60°C
		--	≤36	%	60°C < Ta≤70°C
		--	≤24	%	70°C < Ta≤80°C
Absolute Humidity	AH	--	≤70	g/m ³	Ta>70°C

Table 4.1 Absolute Maximum Ratings

Note1: Input voltage include all input data.

Note2: Ta means the ambient temperature. It is necessary to limit the relative humidity to the specified temperature range. Condensation on the module is not allowed.

Note3: The absolute maximum rating values of this product are not allowed to be exceeded at any times. A module should be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme condition, the module may be permanently destroyed.

5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

Item	Symbol	Min	Typ	Max	Unit	Remark
Power Voltage&Current	VCC	3.0	3.3	3.6	V	Digital Supply Voltage
	I _{VCC}	--	TBD	--	mA	
	AVDD	--	10.4	--	V	Analog Supply Voltage
	I _{AVDD}	--	TBD	--	mA	
	VGH	--	19	--	V	Gate On Voltage
	I _{VGH}	--	TBD	--	mA	
	VGL	--	-7	--	V	Gate Off Voltage
	I _{VGL}	--	TBD	--	mA	
Input voltage	V _{IH}	0.7VCC	--	VCC		
	V _{IL}	0	--	0.3VCC		
Power Consumption	P	--	TBD	--	mW	All white pattern

Table 5.1.1 Operating Voltages

Note1: Input voltage includes R0~R7, G0~G7, B0~B7, DCLK, HS, VS, MODE, DE, L/R, U/D, RESET.

5.2 DC Characteristics for Backlight Driving

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I _F	-	180	225	mA	27 LEDs (3 LED Serial, 9 LED Parallel)
Forward Voltage	V _F	8.1	9.0	9.6	V	
Backlight Power Consumption	W _{BL}	-	1.62	2.18	W	
Operating Life Time	-	20000	-	-	Hrs	I _{LED} =20mA

Table 5.2.1 LED Backlight Characteristics

Note1: I_F is defined for total channel.

Note2: Optical performance should be evaluated at Ta=25℃ only.

Note3: If LED is driven by high current, high ambient temperature & humidity condition, The life time of LED will be reduced.

Note4: Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is estimated data.

5.3 Recommended Power ON/OFF Sequence

Item	Symbol	Min	Typ	Max	Unit	Remark
VCC 3.3V rising time	T1	0	-	5	ms	
VCC to AVDD on time	T2	-	TBD	-	ms	
AVDD to VGL on time	T3	-	TBD	-	ms	
VGL to VGH on time	T4	-	TBD	-	ms	
VGH to DATA on time	T5	-	TBD	-	ms	
DATA to BL on time	T6	-	TBD	-	ms	

Figure 5.3.1 Power on/off sequence

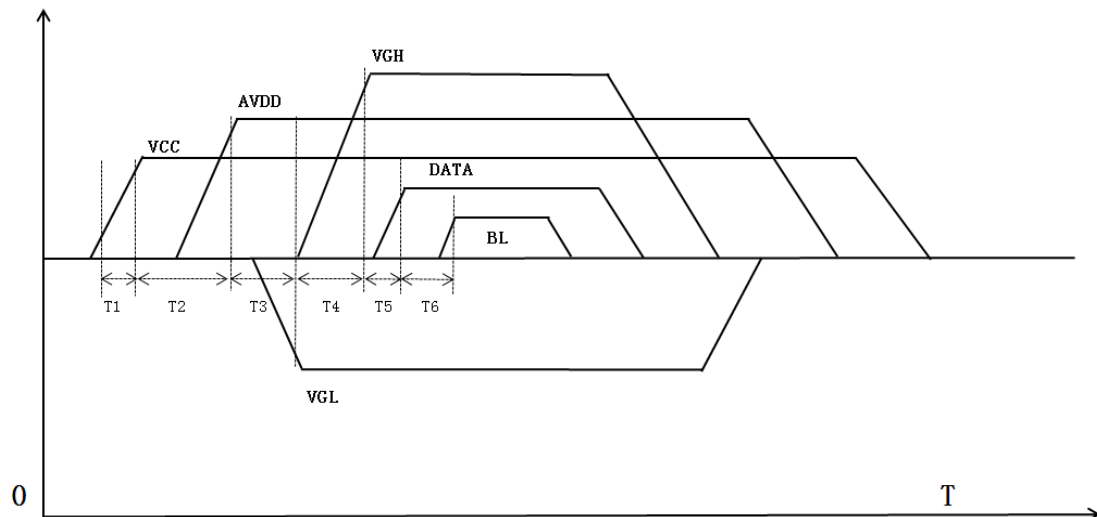


Figure 5.3.2 Power on/off sequence

Note1: The low level of these signals and analog powers are GND level.

Note2: All of the power and signals should be kept at GND level before power on. If there are residual voltages on them, the LCD might not work properly.

Note3: The power on/off sequence is the first version. It will be updated when the design is fixed.

Note4: BL is the voltage applied to backlight. Keep it turned off until the display has stabilized.

5.4 LCD Module Block Diagram

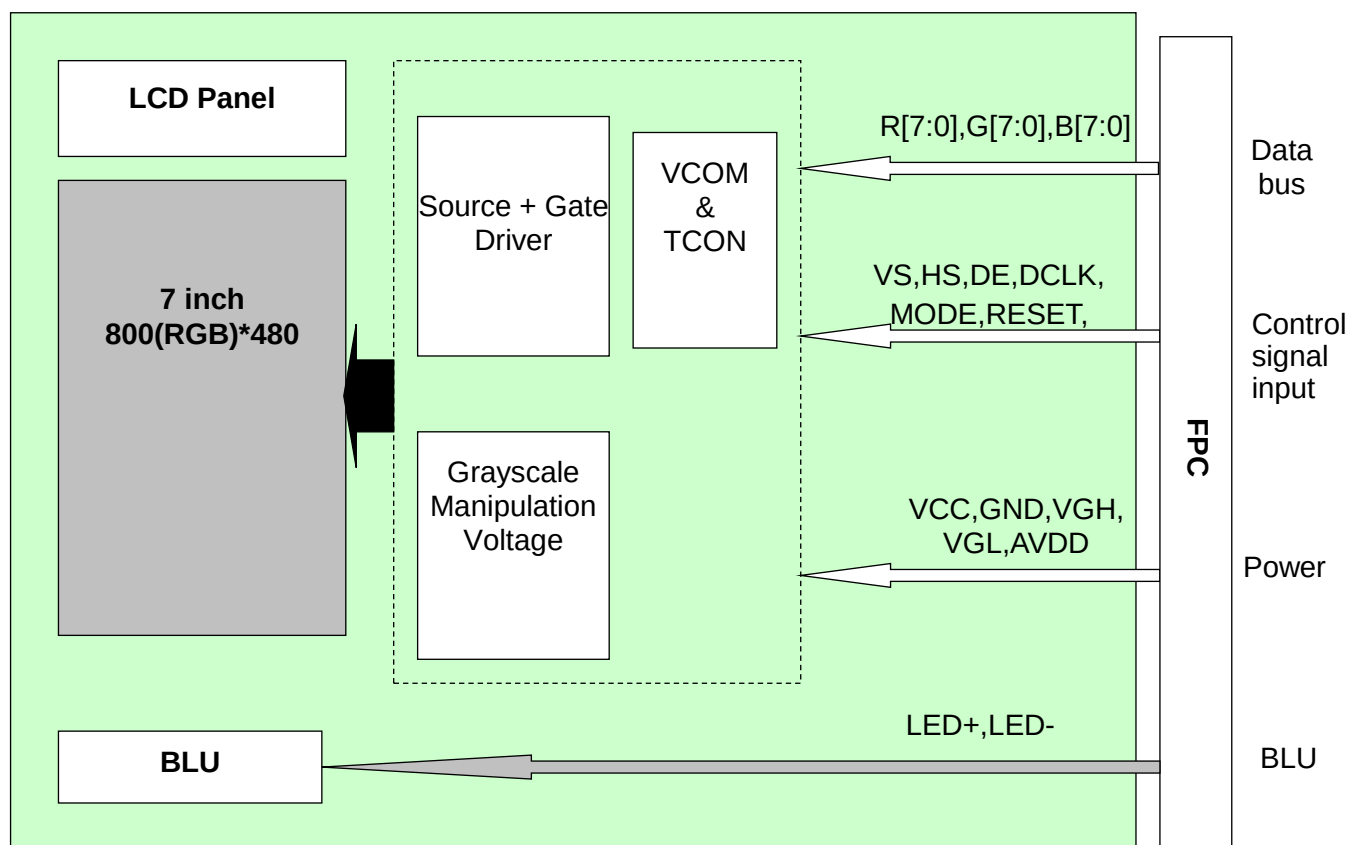


Figure 5.4.1 LCD Module Block Diagram

6. Timing Characteristics

6.1 AC characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
DCLK Cycle Time	Tcph	14	-	-	ns	
DCLK Pulse Duty	Tcwh	40	50	60	%	
VSD Setup Time	Tvst	5	-	-	ns	
VSD Hold Time	Tvhd	5	-	-	ns	
HSD Setup Time	Thst	5	-	-	ns	
HSD Hold Time	Thhd	5	-	-	ns	
Data Setup Time	Tdsu	5	-	-	ns	D0[7:0],D1[7:0],D2[7:0] to DCLK
Data Hold Time	Tdhd	5	-	-	ns	D0[7:0],D1[7:0],D2[7:0] to DCLK
DE Setup Time	Tesu	5	-	-	ns	
DE Hold Time	Tehd	5	-	-	ns	

Table 6.1.1 Input Setup Timing Parameters Requirement

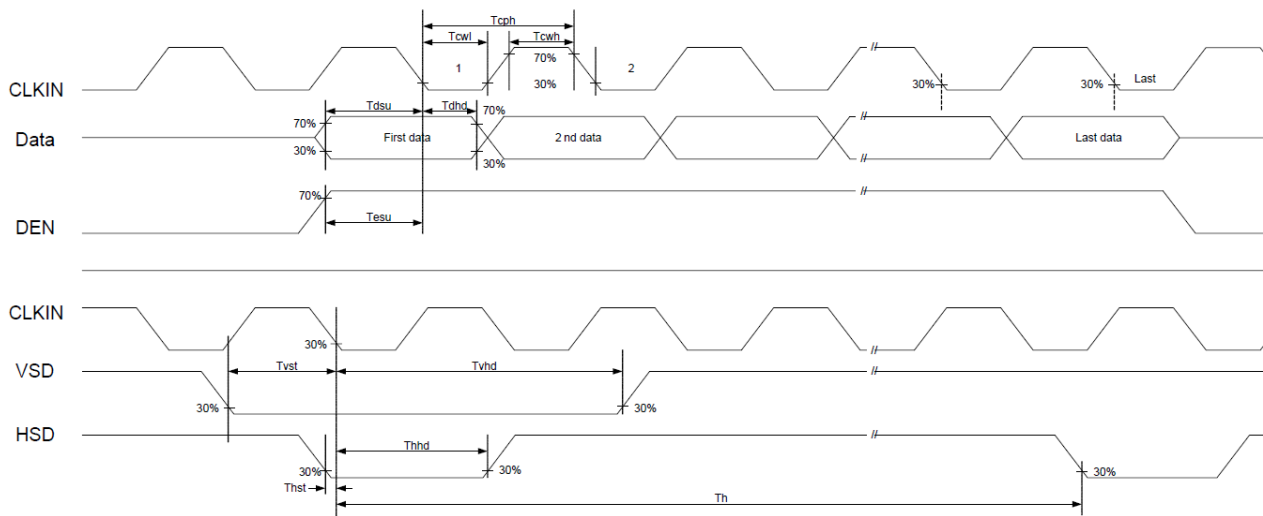


Figure 6.1.1 Clock and Data Input Timing Diagram

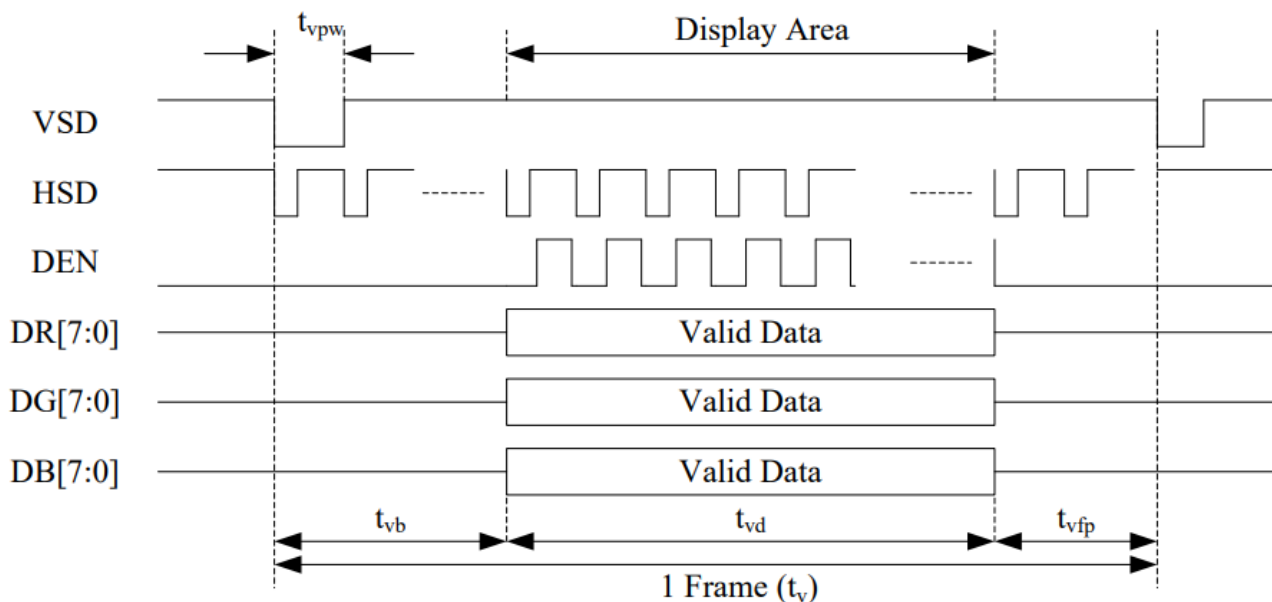
6.2 Data Input Timing Parameter Setting

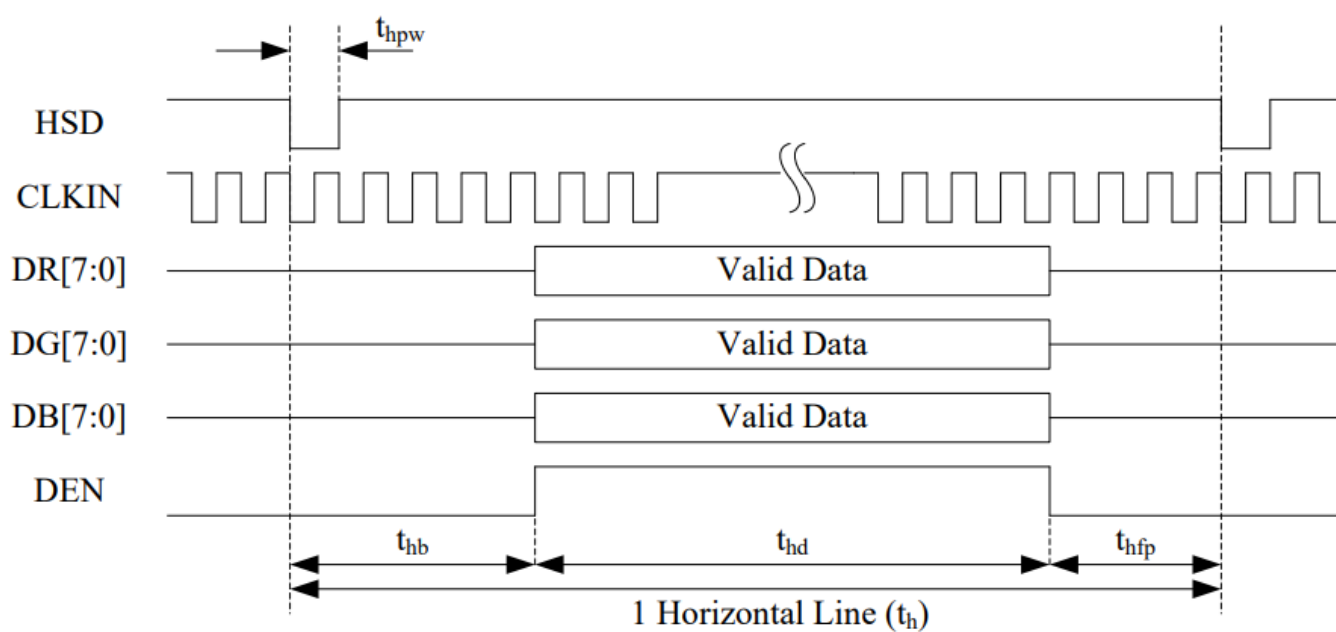
TCON (Embedded In Source IC) Input Timing (DCLK, HSD, VSD, DE)

Parameter	Symbol	Min	Typ	Max	Unit	Remark
DCLK	Fclk	32.6	39.6	62.4	MHZ	
HSD	Th	890	1000	1300	DCLK	
	Thd	800			DCLK	
	Blanking	90	200	500	DCLK	
	Pulse width	1	24	HBP-1	DCLK	
	Thbp	60	88	250	DCLK	
	Thfp	30	112	250	DCLK	
VSD	Tvd	600			Th	
	Tv	610	660	800	Th	
	Blanking	20	60	200	Th	
	Pulse width	1	2	VBP-1	Th	
	Tvbp	8	39	100	Th	
	Tvfp	2	21	100	Th	

Table 6.2.1 Data Input Timing Parameters

Vertical input timing Diagram:



Horizontal input timing Diagram:**Figure 6.2.1 Input timing Diagram**

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥10	80	89	-	Degree	Note 2,3
		θB		80	89	-		
		θL		80	89	-		
		θR		80	89	-		
Contrast Ratio		CR	θ=0°	800	1000	-		Note3
Response Time		T _{ON}	25℃	-	25	35	ms	Note4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.249	0.299	0.349		Note1 Note5
		y		0.275	0.325	0.375		
	Red	x		0.519	0.569	0.619		
		y		0.290	0.340	0.390		
	Green	x		0.288	0.338	0.388		
		y		0.543	0.593	0.643		
	Blue	x		0.099	0.149	0.199		
		y		0.038	0.088	0.138		
Uniformity		U		70	75	-	%	Note6
NTSC				45	50	-	%	Note 5
Luminance		L		300	350	-	cd/m ²	Note7

Table 7.1 Optical Parameters

Test Conditions:

1. $I_F = 20 \text{ mA}$, and the ambient temperature is $25^\circ C$.
2. The test systems refer to Note1 and Note2.

Note1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical characteristics are measured at the center point of the LCD screen.

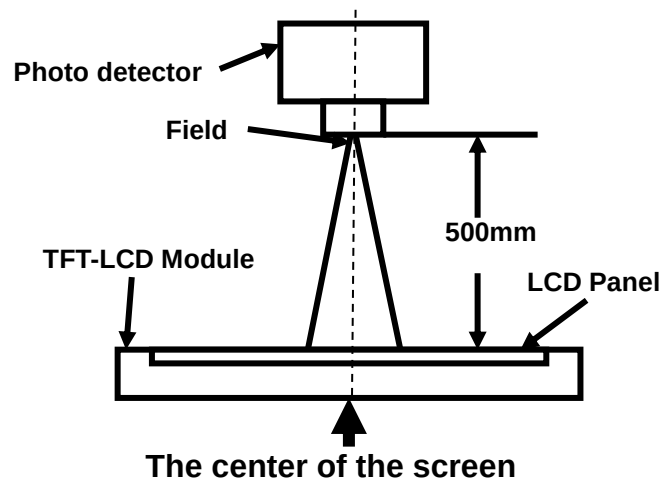


Fig1. Measurement Set Up

Note2: Definition of viewing angle range and measurement system. Viewing angle is measured at the center point of the LCD .

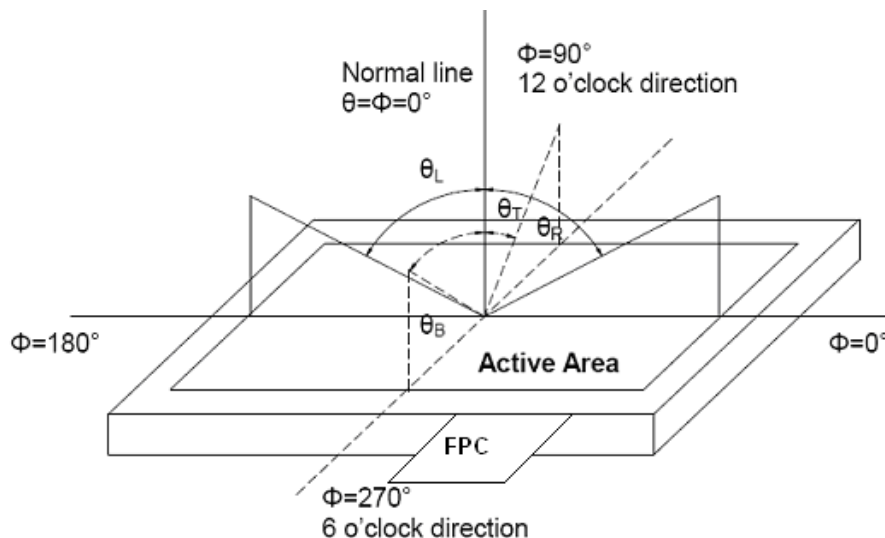


Fig2. Measurement viewing angle

Note3: Definition of contrast ratio

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

Note4: Definition of Response time

For TN LCM, 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%.

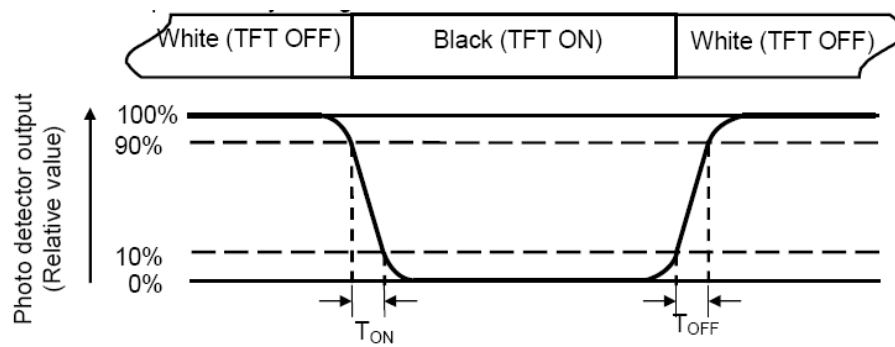


Fig3. Response Time Testing(TN)

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig.5). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = L_{min} / L_{max}

L_{max} : The measured Maximum luminance of all measurement position.

L_{min} : The measured Minimum luminance of all measurement position.

L-----Active area length; W----- Active area width

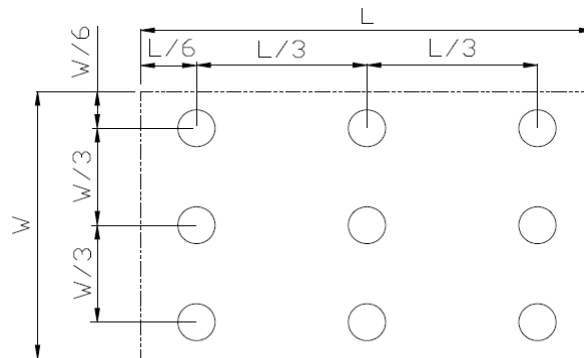


Fig5. Luminance Uniformity Measurement Locations(9 points)

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

8. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	+70℃ , 240H	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	-20℃ , 240H	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	+80℃ , 240H	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-30℃ , 240H	IEC60068-2-1:2007 GB2423.1-2008
5	Operation at High Temperature and Humidity	+60℃ , 90%RH , 240H	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃ , 30min~80℃ , 30min , change time : 5min , 100cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
7	ESD	C=150pF , R=330Ω , 5point/panel Air : ±8kv , 5times ; Contact : ±4kv , 5times ; (Environment : 15℃~35℃ , 30%~60% , 86Kpa~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006
8	Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total)	IEC60068-2-6:1982 GB/T2423.10—1995
9	Package Vibration	5-20-200HZ , PSD : 0.01-0.01-0.001 Total:0.781g ² /HZ, x/y/z 30min)	GB/T 4857.23-2012
10	Package Drop Test	Height: 60cm,1 corner, 3edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

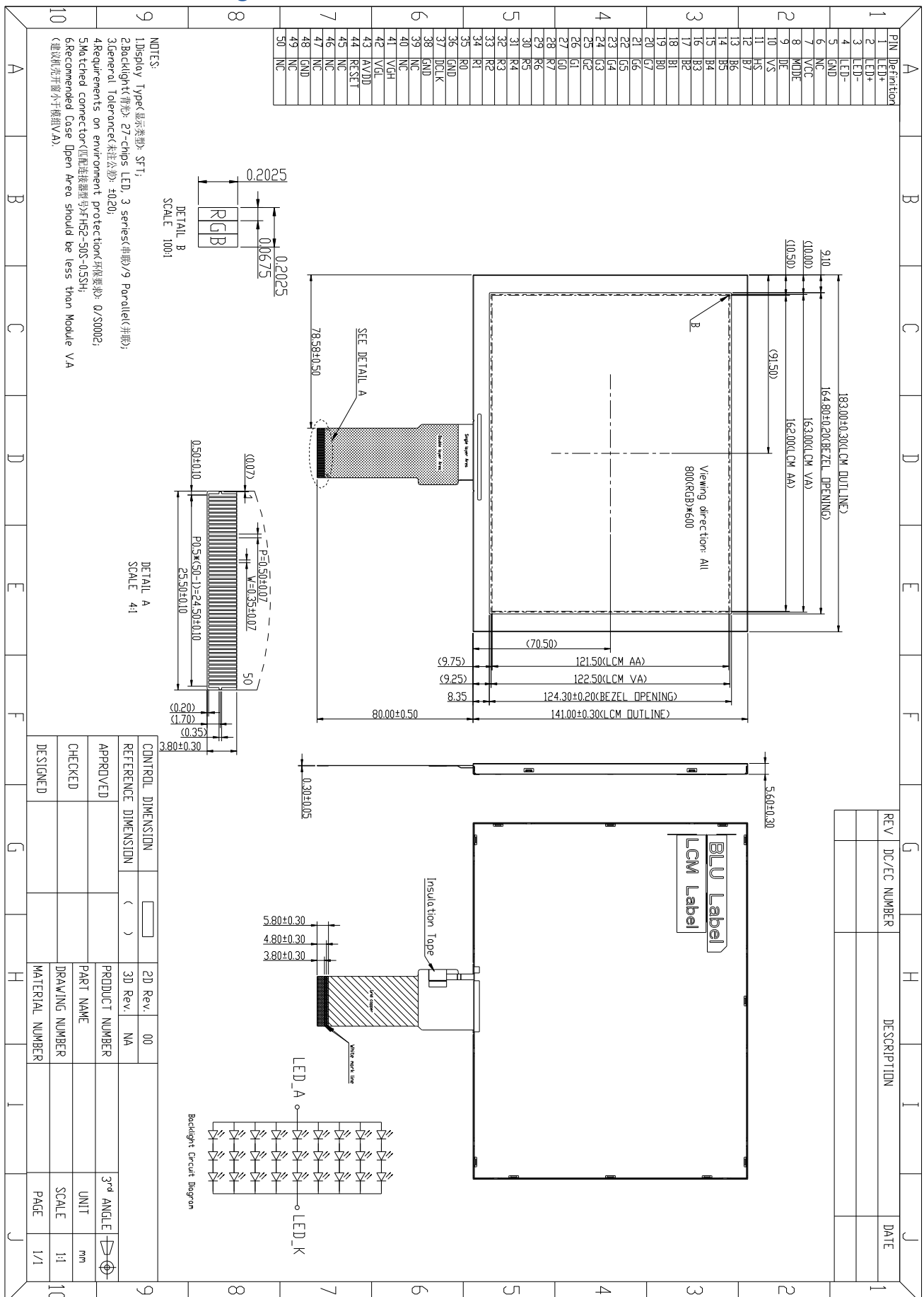
Table 8.1 RA test condition

Note1: Temperature is the ambient temperature of sample

Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product's function only be guaranteed, but not for all of the cosmetic specification.

9. Mechanical Drawing



10. Precautions for Use of LCD Modules

10.1 Handling Precautions

- (1) The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.
- (2) If the display panel is damaged and the liquid crystal fluid inside it leaks out be sure not to get any in your mouth. If the fluid comes into contact with your skin or clothes promptly wash it off using soap and water.
- (3) Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.
- (4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
- (5) If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear use a moist cloth with one of the following solvents:
 - Isopropyl alcohol
 - Ethyl alcoholSolvents other than those mentioned above may damage the polarizer. Specifically, do not use the following:
 - Water
 - Ketone
 - Aromatic solvents
- (6) Do not disassemble the LCD Module.
- (7) If powered off, do not apply the input signals.
- (8) To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.
- (9) Be sure to ground your body when handling the LCD Modules.
- (10) Tools used for assembly, must be properly grounded.
- (11) To reduce the amount of static electricity generated, do not conduct assembly or other work under very low humidity conditions.
- (12) The LCD Module is covered with a film to protect the display surface, remove film slowly under the ionizer.

10.2 Storage precautions

- (1) When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.
- (2) The LCD modules should be stored within the rated storage temperature range. The recommend condition is: Temperature: 0 ~ 35 °C at normal humidity.
- (3) The LCD modules should be stored in a room without acid, alkali or other harmful gas.

10.3 Transportation Precautions

The LCD modules should not be dropped or subject to violent mechanical shock during transportation. Also they should avoid excessive pressure, water, high humidity and direct sunlight.

10.4 Screen saver Precautions

Not display the fixed pattern for a long time. Use a screen saver, if the fixed pattern is displayed on the screen

10.5 Safety Precautions

- (1) When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned
- (2) Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.
- (3) LED driver should be designed to limit or stop its function when over current is detected on the LED.