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1. Summary

1.1 General Description

This is a 17.3 inch LTPS TFT-LCD module with Normal-black technology. It is composed of a TFT-LCD panel, driver IC, PCB, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle
- High resolution
- High luminance
- High contrast ratio
- Wide temperature range
- Interface: eDP 1.2
- Without LED driver
- 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	17.3 inch	
	Resolution	1920(RGB)*1080	
	Pixel Pitch	0.1995*0.1995	mm
	TFT Active Area	381.888*214.812	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT, Normally Black	
	Surface Treatment	AG	
	Viewing Direction	ALL	
Mechanical Characteristics	LCM (W x H x D)	397.1*234*11.4	mm
	Weight	TBD	g
Optical Characteristics	Luminance	1200	cd/m ²
	Contrast Ratio	1700	
	NTSC	75	%
	Viewing Angle	88/88/88/88	degree
Electrical Characteristics	Interface	EDP 1.2	
	Color Depth	16.7 Million	color
	Power Consumption	LCD: TBD Backlight: TBD	mW

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	STM MSAK24025P30D
Matching connector	I-PEX: 20454-230T or equivalent

Table 3.1.1 Connector information

No	Symbol	I/O	Description	Comment
1	NC	-	No connection	
2	H_GND	P	Ground	
3	LANE1_N	I	Complement Signal Link Line 1	
4	LANE1_P	I	Ture Signal Link Line 1	
5	H_GND	P	Ground	
6	LANE0_N	I	Complement Signal Link Line 0	
7	LANE0_P	I	Ture Signal Link Line 0	
8	H_GND	P	Ground	
9	AUX_CH_P	I	Ture Signal Auxiliary Channel	
10	AUX_CH_N	I/O	Complement Signal Auxiliary Channel	
11	H_GND	P	Ground	
12	LCD_VCC	P	LCD power supply(+3.3V)	
13	LCD_VCC	P	LCD power supply(+3.3V)	
14	NC	-	No connection	
15	H_GND	P	Ground	
16	H_GND	P	Ground	
17	HPD	I	Hot plug detect	
18	H_GND	P	Ground	
19	NC	-	No connection	
20	NC	-	No connection	
21	NC	-	No connection	
22	NC	-	No connection	
23	NC	-	No connection	
24	NC	-	No connection	
25	NC	-	No connection	
26	NC	-	No connection	
27	NC	-	No connection	
28	NC	-	No connection	
29	NC	-	No connection	
30	NC	-	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: A stronger wire should be used for VCC power lines.

Note4: Default display direction.



3.2 CN2 Pin assignment (Backlight)

Connector Information	
Backlight connector	Molex51021-0300
Matching connector	

Table 3.2.1 Connector for backlight

No	Symbol	I/O	Description	Comment
1	LED_K	P	LED driving cathode (-)	
2	NC	N	No connection	
3	LED_A	P	LED driving anode (+)	

Table 3.2.2 Backlight pin assignment

4. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	LCD_VCC	-0.3	4	V	Note1
Input voltage	V _{IN}	-0.3	4	V	
Operating Temperature	Top	-30	80	°C	
Storage Temperature	Tst	-40	85	°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 damaged.

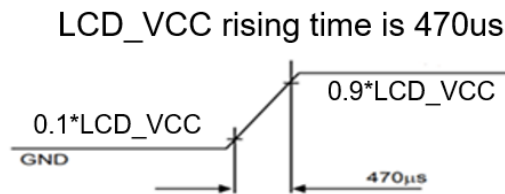
5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage	LCD_VCC	3.2	3.3	3.4	V	Without ripple
Supply Current	I _{LCD_VCC}	-	TBD	-	mA	All white pattern
Power Consumption	W _{LCD_VCC}	-	TBD	-	mW	
Output Signal Voltage	Low Level	VOL	-	-	0.15* LCD_VCC	HPD
	High Level	VOH	0.8* LCD_VCC	-	VCC	
Inrush Current	Inrush_ LCD_VCC	-	-	1.5	A	Note1
Permissible ripple voltage	VRPC	-	-	100	mVp-p	Note2

Table 5.1.1 Operating Voltages

Note1: Inrush current should be tested under LCD_VCC rising time 470us.



Note3: The permissible ripple voltage includes spike noise.

5.2 DC Characteristics for Backlight Driving

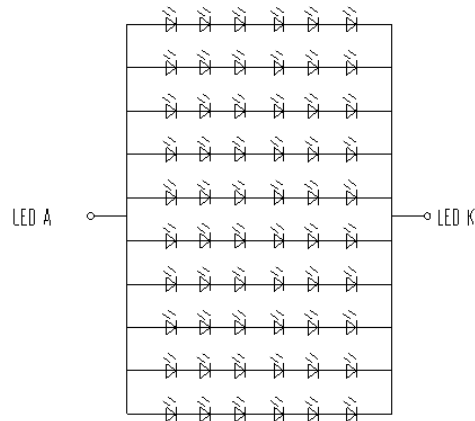
Item	Symbol	Min	Typ	Max	Unit	Remark
Backlight power supply voltage	VLED	-	18	-	V	Note1
Backlight power supply current	I_LED	-	1000	-	mA	
Backlight power consumption	P_LED	-	18	-	W	
Operating Life Time	--	50000	-	-	hrs	Note3

Table 5.2.1 LED Backlight Characteristics

Note1: Optical performance should be evaluated at Ta=25°C only.

Note2: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced.

Note3: Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is estimated data.



Backlight Circuit Diagram
6S-10P; If=100mA/LED

Figure 5.2.1 LED circuit

5.3 Recommended Power ON/OFF Sequence

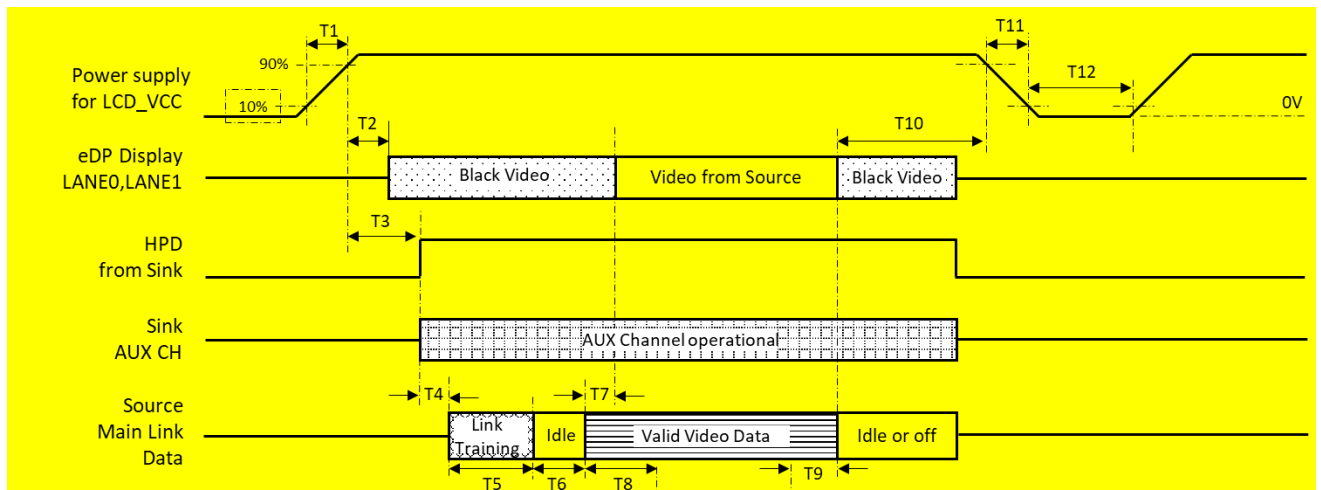


Figure 5.3.1 Power on sequence

Parameters	Description	Reqd. by	Value		Unit	Notes
			Min	Max		
T1	Power tail rise time, 10% to 90%	Source	0.5	10	ms	-
T2	Delay from LCD_VCC to black video generation	Sink	0	200	ms	Automatic Black Video generation prevents display noise until valid video data is received from the Source
T3	Delay from LCD_VCC to HPD high	Sink	0	200	ms	Sink AUX Channel must be operational upon HPD high
T4	Delay from HPD high to link training initialization	Source	-	-	ms	Allows for source to read Link capacity and initialize
T5	Link training duration	Source	-	-	ms	Dependent on Source link training Protocol
T6	Link Idle	Source	-	-	ms	Min Accounts for required BS-Idle pattern. Max allows for Source frame synchronization
T7	Delay from valid video Data from Source to video on display	Sink	0	50	ms	Max value allows for Sink to valid video Data and Timing. At the end of T7, Sink will indicate the detection of valid video data by setting SINK_STATUS bit to logic 1(DPCD 00205h, bit 0), and Sink will no longer generate automatic Black video
T8	Delay from valid video Data from Source to Backlight on	Source	0	-	ms	Source must assure display video is stable
T9	Delay from Backlight off to end of valid video Data	Source	0	-	ms	Source must assure backlight is no longer illuminated. At the end of T9, Sink will indicate the detection of no valid video data by setting the SINK_STATUS bit to logic 0 (DPCD 00205h, bit 0), and Sink will automatically display Black Video.
T10	Delay from end of valid video data from Source to Power off	Source	0	500	ms	Black video will be displayed after receiving idle or off signals from Source
T11	LCD_VCC power rail fall time, 90% to 10%	Source	-	10	ms	-
T12	LCD_VCC Power off time	Source	1000	-	ms	-

Table 5.3.2 Power on/off sequence Table

Note1: If there is a voltage variation (voltage drop) at the rising edge of LCD_VCC below 3.0V, there is a possibility that a product does not work due to a protection circuit.

Note2: Display signals (LANE0_P/N, LANE1_P/N) must be set to Low or High-impedance, except the VALID period (See above sequence diagram), in order to avoid the circuitry damage.

If some of display and function signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If a customer stops the display and function signals, LCD_VCC also must be shut down.

5.4 LCD Module Block Diagram

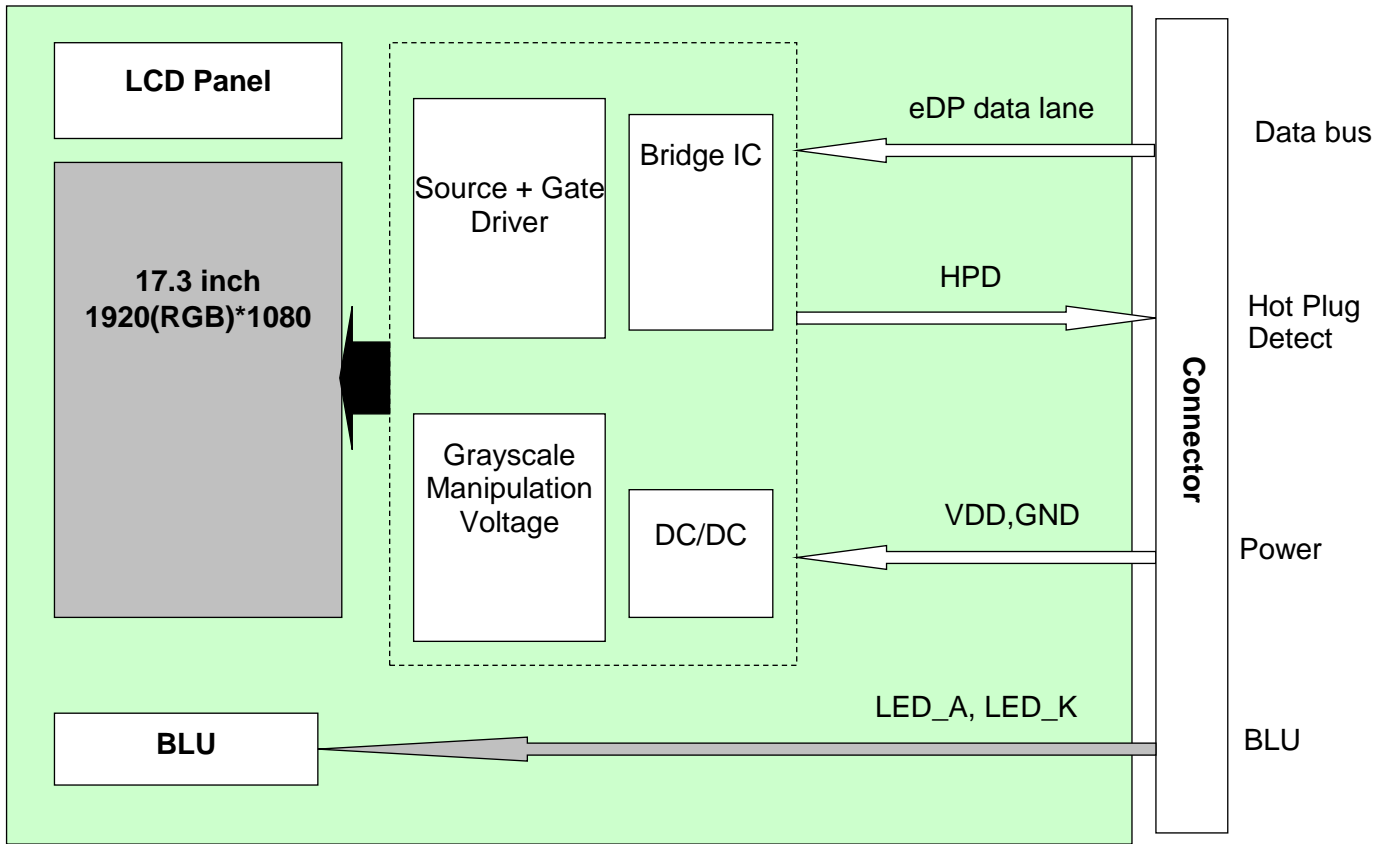


Figure 5.4.1 LCD Module Block Diagram

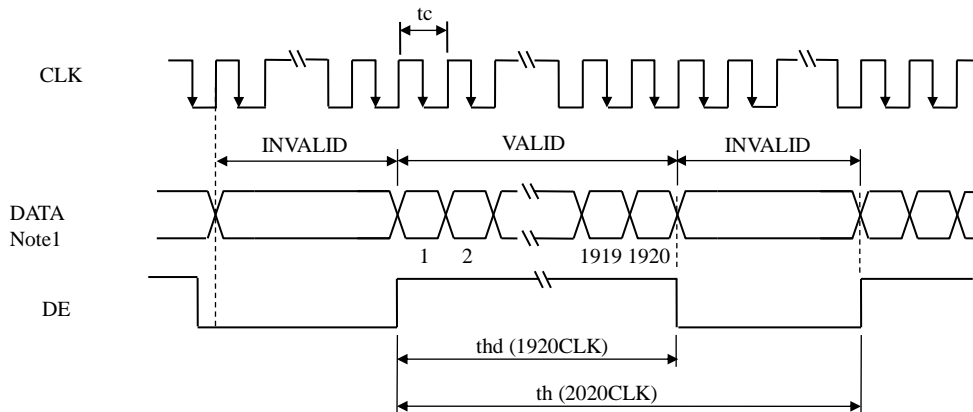
6. Timing Characteristics

6.1 Data Input Timing Parameter Setting

Parameter	Symbol	Min	Typ	Max	Unit	Remark
CLK frequency	$1/t_{clk}$	-	135	-	MHz	Calculated at 60HZ frame rate
Horizontal blanking time	tHBT	-	100	-	tclk	
Horizontal display area	tHD	-	1920	-	tclk	
Horizontal period	tH	-	2020	-	tclk	
Vertical blanking time	tVBT	-	40	-	tH	
Vertical display area	tVD	-	1080	-	tH	
Vertical period	tV	-	1120	-	tH	
Frame Rate	FR	-	60	-	HZ	

Table 6.1.1 Input Timing Parameters

Horizontal timing



Vertical timing

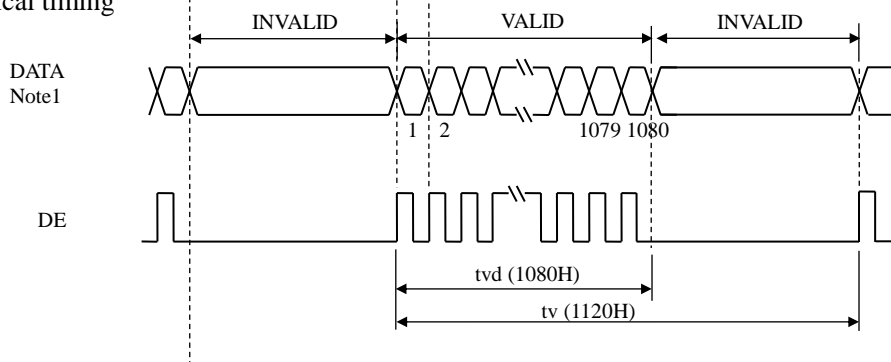


Figure 6.1.1 Input Signal Timings

Note1: DATA = R0-R7, G0-G7, B0-B7

6.2 eDP data format

6.2.1 eDP main link signal characteristics

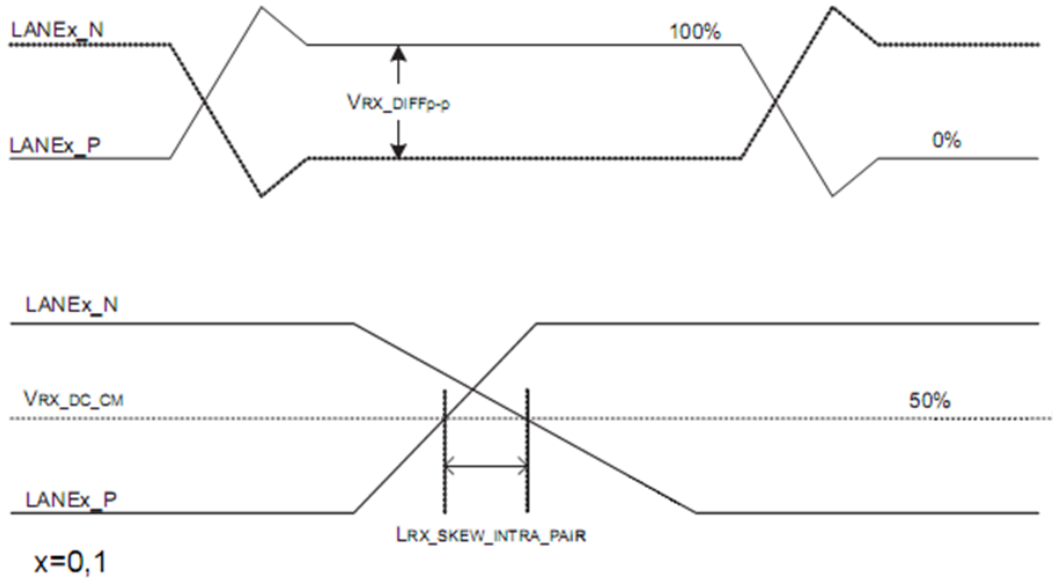


Figure 6.2.1 Timing Specification for Display Port Main Link Signal

Symbol and Parameter	Test Conditions	Min	Typ	Max	Unit
Spread spectrum clock, down-spreading by SOURCE Modulation frequency		30	0.5	33	% kHz
$V_{RX_DIFFp-p}$: Differential peak-to-peak input voltage at package pins		100		1360	mV
Maximum adaptive RX equalization level at 2.7Gbps			16		dB
$V_{RX_DC_CM}$: RX input DC common mode voltage			GND		V
$R_{RX-DIFF}$: Differential termination resistance		80	100	120	Ω
R_{RX-SE} : Single-ended termination resistance		40	50	60	Ω
I_{RX_SHORT} : Rx short circuit current limit				20	mA
$L_{RX_SKEW_INTRA_PAIR}$: Intra-pair skew at Rx package pins (HBR) RX intra-pair skew tolerance at HBR				150	ps
$L_{RX_SKEW_INTRA_PAIR}$: Intra-pair skew at Rx package pins (RBR) RX intra-pair skew tolerance at RBR				300	ps
Receiver Jitter Tolerance for High Bit Rate (HBR) Total jitter tolerance at 2MHz Total jitter tolerance at 10MHz Total jitter tolerance at 20MHz Total jitter tolerance at 100MHz		1227 548 505 491			mUI mUI mUI mUI
Receiver Jitter Tolerance for Reduced Bit Rate (RBR) Total jitter tolerance at 2MHz Total jitter tolerance at 10MHz Total jitter tolerance at 20MHz		1648 778 747			mUI mUI mUI

Figure 6.2.1 Timing Specification for Display Port Main Link Signal

6.2.2 eDP AUX link signal characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Unit interval	UI	0.4	0.5	0.6	μs	-
AUX differential peak-to-peak voltage When driving	$V_{\text{AUX-DIFF-P-P}}$	400	-	1000	mV	-
AUX differential peak-to-peak voltage When receiving	$V_{\text{AUX-DIFF-P-P}}$	200	-	1360	mV	-
AUX common-mode voltage When transmitting	$V_{\text{AUX-DC-CM-TX}}$	-	200	-	mV	-
AUX common-mode voltage When receiving	$V_{\text{AUX-DC-CM-RX}}$	-	GND	-	mV	-
AUX channel short circuit current	$I_{\text{AUX-SHORT}}$	-	-	20	mA	-
AUX AC coupling capacitor	C_{AUX}	75	-	200	nF	-

Table 6.2.2 AUX link signal characteristics

7. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	$CR \geq 10$	78	88	-	degree	Note2,3
	θB		78	88	-		
	θL		78	88	-		
	θR		78	88	-		
Contrast Ratio	CR	$\theta=0^\circ$	1300	1700	-		Note 3
Response Time	T_{r+f}	25°C	-	25	40	ms	Note 4
Chromaticity	White	x	Backlight is on		TBD		Note 1,5
		y			TBD		
	Red	x			TBD		Note 1,5
		y			TBD		
	Green	x			TBD		Note 1,5
		y			TBD		
	Blue	x			TBD		Note 1,5
		y			TBD		
Uniformity	U		75	80	-	%	Note 6
NTSC	-		70	75	-	%	Note 5
Luminance	L		1000	1200	-	cd/m ²	Note 7

Table 7.1 Optical Parameters

Test Conditions:

1. PWM duty=100%,the ambient temperature is 25°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.

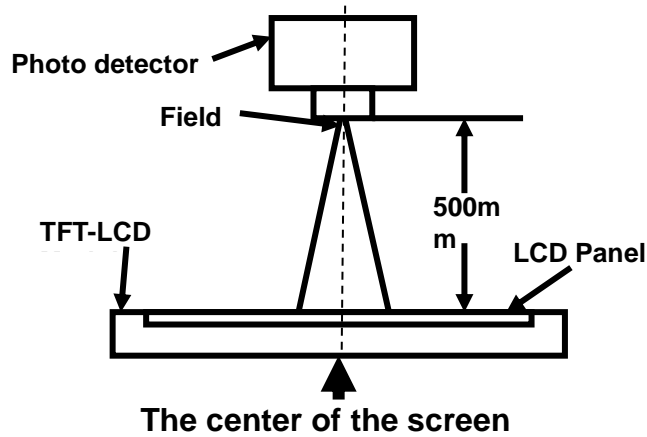


Fig1. Measurement Set Up

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

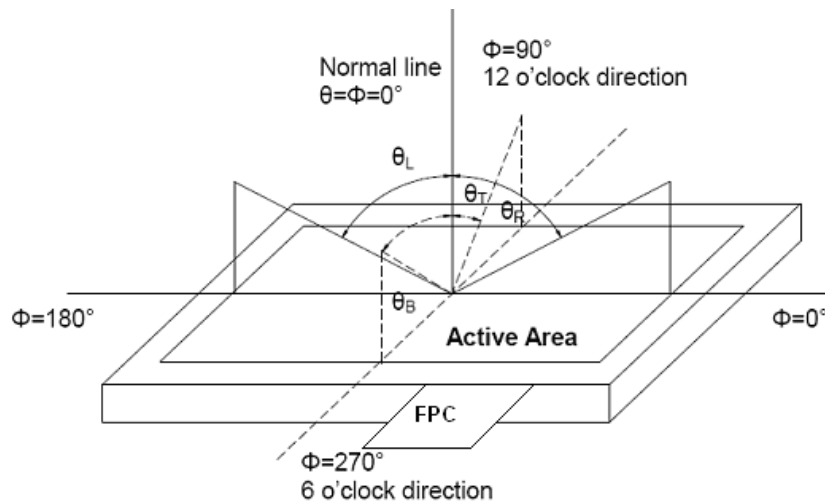


Fig2. Measurement viewing angle

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

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 10% to 90%. And fall time (T_f) is the time between photo detector output intensity changed from 90% to 10%.

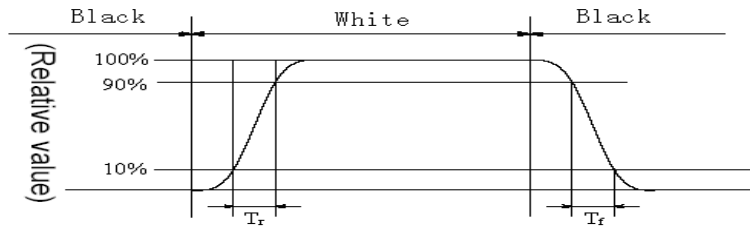


Fig3. Response Time Testing

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.

$$\text{Luminance Uniformity (U)} = \text{Lmin} / \text{Lmax}$$

Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

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



Fig4. 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	+80°C , 240H	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	-30°C , 240H	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	+85°C , 240H	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-40°C , 240H	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity(non-operation)	+60°C , 90%RH , 240H	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30°C , 30min~80°C , 30min , change time : 5min , 100cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
7	ESD	C=150pF , R=330Ω , 5point/panel Air : ±15kv , 5times ; Contact : ±8kv , 5times ; (Environment : 15°C~35°C , 30%~60% , 86Kpa~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006
8	Vibration (Non-operation)	Acceleration:1.5G Wave: Random Fequency:10-200-10Hz Sweep: 30 Minutes each Axis (X,Y,Z)	GB/T 2423.10-2008 ; GB/T 2423.56-2006
9	Shock (Non-operation)	Acceleration:50G Wave: Half-sine Active Time: 10ms Direction: +/-X,+/-Y,+/-Z (one time for each Axis)	GB/T 2423.5-1995
10	Package Vibration	5-20-200HZ , PSD : 0.01-0.01-0.001 Total:0.781g ² /HZ, x/y/z 30min)	GB/T 4857.5-1992
11	Package Drop Test	Height: 60 cm,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.

10. Packing Instruction

No	Item	Model (Material)	Dimensions (mm)	Unit Weight(Kg)	Q'ty	Remark
1	LCM module	P1730FHF1MA00				
2	Tray	PET				
3	BOX	CORRUGATED PAPER				
4	Dust proof bag	LD-PE				
5	Lable	tagboard				
6	Carton	CORRUGATED PAPER				
7	EPE	EPE				
8	Total weight	TBD ± 5%Kg				

Table 10.1 Packing instruction

Packing details:

11. Precautions for Use of LCD Modules

11.1 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 alcohol
 Solvents 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.

11.2 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.

11.3 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.

11.4 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

11.5 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.