深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT080ENPFSA

LCD Module User Manual

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CONTENTS

1. FEATURES 1

2. GENERAL SPECIFICATIONS 1

3. INPUT / OUTPUT TERMINALS 2

3.1 CN1 Pin assignment (LCD Interface) 2

3.2 CN2 Pin assignment (Back Light) 3

4. ABSOLUTE MAXIMUM RATINGS 4

5. ELECTRICAL CHARACTERISTICS 5

5.1 DC Characteristics for Panel Driving 5

5.2 DC Characteristics for Backlight Driving 6

5.3 Recommended Power ON/OFF Sequence 7

5.4 LCD Module Block Diagram 8

6. INTERFACE TIMING CHARACTERISTICS 9

6.1 LVDS AC characteristics 9

6.2 DE Mode Data Input Timing Parameter Setting 11

6.3 LVDS signal format 12

7. OPTICAL CHARACTERISTICS 13

8. MECHANICAL DRAWING 16

1. Features

1.1 General Description

This is an 8.0 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) Normally Black technology module, which is composed of a TFT-LCD panel, LCD Driver IC ， FPC and a LED backlight unit. It is designed for Automotive and other high reliability electronic products and complies with the *RoHS* environmental protection directive.

1.2 Features

- Ultra-wide viewing angle (Super Fine TFT (SFT)
- High luminance typ：1200nits
- Interface: LVDS
- 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 inch	
	Resolution	1280(RGB)x720	
	Pixel Pitch	0.138 x 0.138	mm
	TFT Active Area	176.64 x 99.36	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	Normally Black SFT technology	
	Surface Treatment	HC	
	Viewing Direction	All	
	Gray Scale Inversion Direction	No gray inversion.	
Mechanical Characteristics	LCM (W x H x D)	192.8x116.9x6.4	mm
	Weight	186±5%	g
Optical Characteristics	Luminance	Min：850 Typ：1200	cd/m^2
	Contrast Ratio	Min: 900:1 Typ:1300:1	
	NTSC	Typ:73	%
	Viewing Angle	88/88/88/88	degree
Electrical Characteristics	Interface	LVDS	
	Color Depth	16.7 Million	color
	Power Consumption	LCD:1.0725 Backlinght:6.588	W

Table 2.1 General TFT Specifications

Note 1: Requirements on Environmental Protection: Q/S0002.
Note 2: The height dimension does not include the length of FPC.
Note 3: LCM weight tolerance: ±5%.

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
Matching connector	FH28D-30S-0.5SH (Hirose)

Table 3.1.1 Connector information

No	Symbol	I/O	Description	Remark
1	NC	N	Keep this pin open.	
2	VDD	P	Power supply 3.3V(Typ)	
3	VDD	P	Power supply 3.3V(Typ)	
4	GND	P	Power Ground	
5	RESET	I	Reset signal	
6	STBYB	I	Standby mode control signal	
7	GND	P	Power Ground	
8	SDA	N	Only for Tianma OTP use, Keep this pin open	
9	SCL	N	Only for Tianma OTP use, Keep this pin open	
10	CSB	N	Only for Tianma OTP use, Keep this pin open	
11	GND	P	Power Ground	
12	UD	I	Vertical shift direction selection	
13	RL	I	Horizontal shift direction selection	
14	GND	P	Power Ground	
15	LV0N	I	Negative LVDS Differential data input(0)	
16	LV0P	I	Positive LVDS Differential data input(0)	
17	GND	P	Power Ground	
18	LV1N	I	Negative LVDS Differential data input(1)	
19	LV1P	I	Negative LVDS Differential data input(1)	
20	GND	P	Power Ground	
21	LV2N	I	Negative LVDS Differential data input(2)	
22	LV2P	I	Positive LVDS Differential data input(2)	
23	GND	P	Power Ground	
24	CLKN	I	Negative LVDS Differential clock input	
25	CLKP	I	Positive LVDS Differential clock input	
26	GND	P	Power Ground	
27	LV3N	I	Negative LVDS Differential data input(3)	
28	LV3P	I	Positive LVDS Differential data input(3)	
29	GND	P	Power Ground	
30	VDDOTP	N	Power input for OTP programming, Keep this pin	

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: Description of Scan Direction.

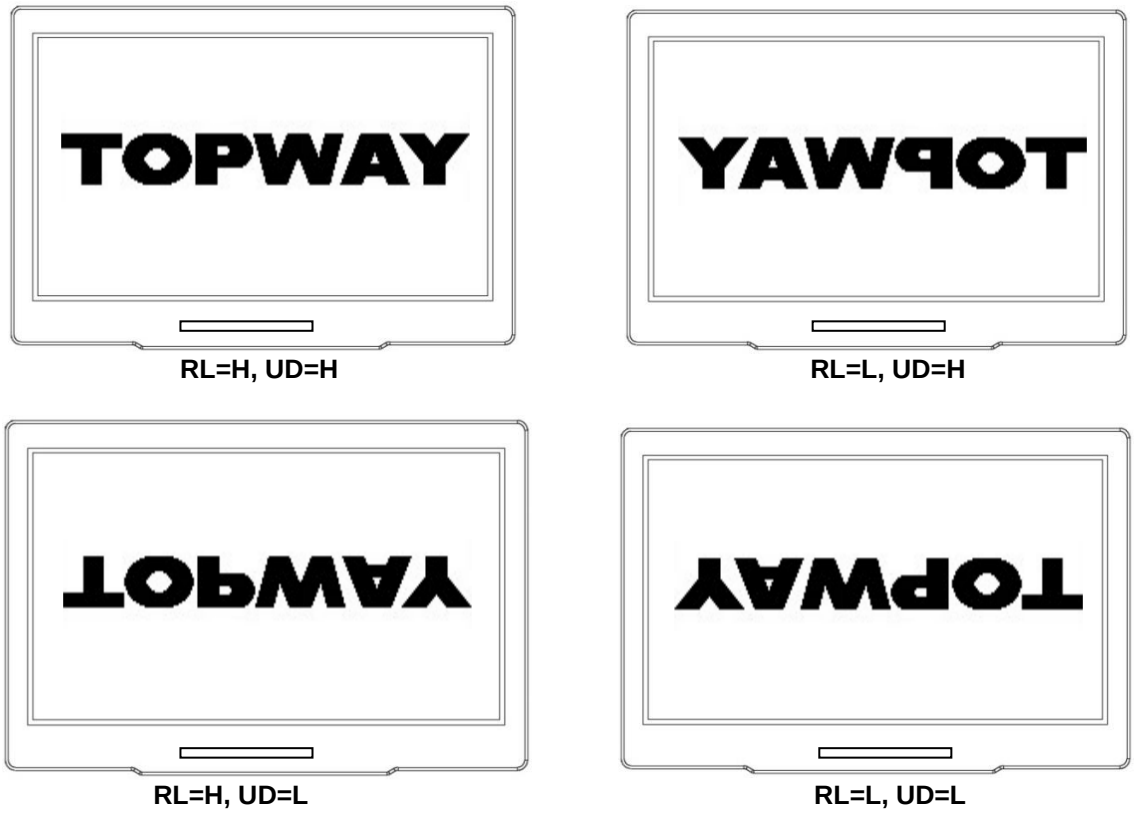


Figure 3.1.1 Description of Scan Direction

3.2 CN2 Pin assignment (Back Light)

Connector Information	
Matching connector	FH28-10S-0.5SH Hirose

Table 3.2.1 Connector information

No	Symbol	I/O	Description	Remark
1	A1	P	LED Anode	
2	A2	P	LED Anode	
3	A3	P	LED Anode	
4	NC	N	Keep this pin open	
5	THER+	I/O	Thermistor +	
6	THER-	I/O	Thermistor -	
7	NC	N	Keep this pin open	
8	C3	P	LED Cathode	
9	C2	P	LED Cathode	
10	C1	P	LED Cathode	

Table 3.2.1 Pin Assignment for Back Light 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.

4. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VDD	-0.3	5.0	V	Note1
Operating Temperature	Top	-30	85	℃	
Storage Temperature	Tst	-40	85	℃	
Relative Humidity Note2	RH	--	≤95	%	Ta≤40℃
		--	≤85	%	40℃＜Ta≤50℃
		--	≤55	%	50℃＜Ta≤60℃
		--	≤36	%	60℃＜Ta≤70℃
		--	≤24	%	70℃＜Ta≤80℃
Absolute Humidity	AH	--	≤70	g/m³	Ta＞70℃

Table 4.1 Absolute Maximum Rating

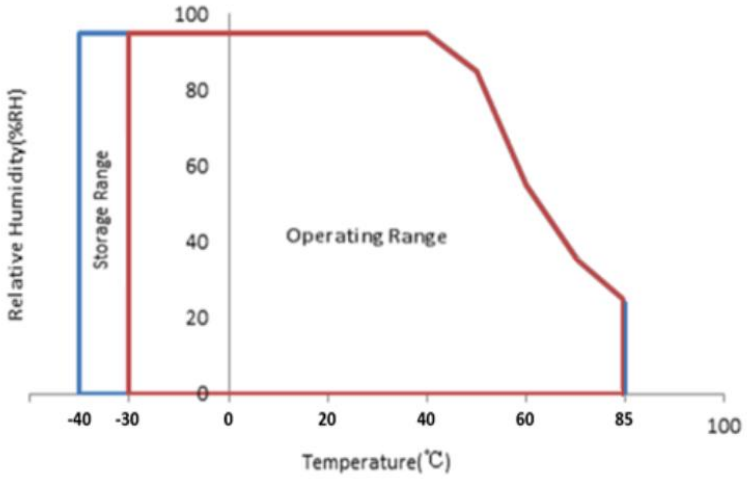


Figure 4.1 Absolute Maximum Ratings chart

Note1: 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.

Note2: 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

GND=0V, Ta = 25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Logic supply voltage	VDD	3.0	3.3	3.6	V	
VDD Current	Ivdd	-	325	-	mA	
Permissible Ripple Voltage of VDD	Vr			100	mV	
Input High Voltage	V_{IH}	0.7*VDD		VDD	V	Note 1
Input Low Voltage	V_{IL}	GND		0.3*VDD	V	
Differential Input common Mode voltage	RXVCM	1	1.2	1.4	V	Note 2
Differential Input voltage	|VID|	0.1	-	(1.5-RxVCM)*2	V	
Differential Input leakage Current	RVXliz	-10	-	10	uA	
VDD Inrush current	Irush	-	-	1.5	A	Note3

Table 5.1.1 Operating Voltages

Note1: RESET, STBYB, RL, UD.
Note2: LVDS input signal electrical characteristics
Note3: Test condition of VDD Inrush current: The rise time of 10%VDD to 90%VDD is 470us.

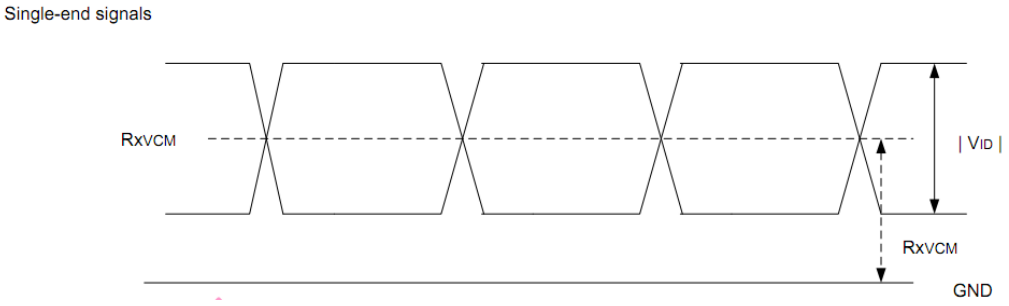


Fig 5.1.1 LVDS mode DC electrical characteristics

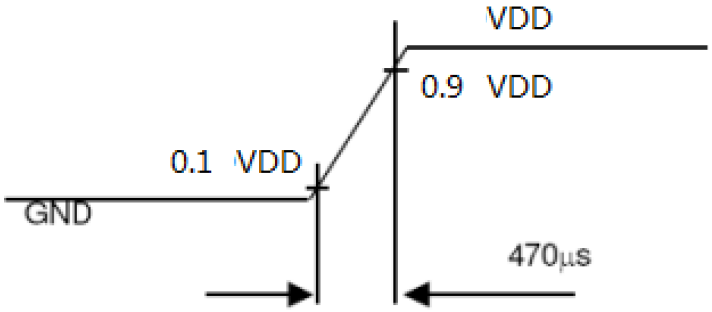


Figure 5.1.2 VDD Inrush current

5.2 DC Characteristics for Backlight Driving

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_{BL}	-	120	-	mA	Note1
Forward Voltage	V_{BL}	16.8	18.3	20.4	V	Note2
Backlight Power Consumption	V_{BL}	-	6.588	-	W	Note2
Lifetime	-	30000	50000	-	Hrs	Note3

Table 5.2.1 LED Backlight Characteristics

Note1: I_F is defined for each 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.

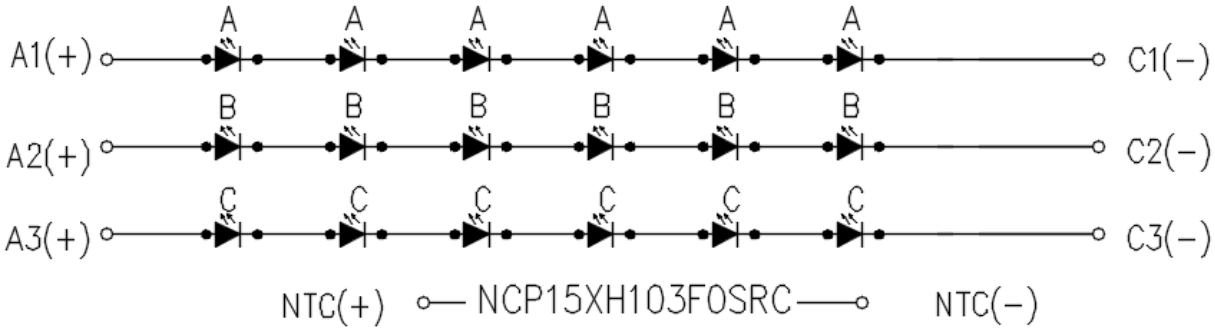


Figure 5.2.1 LED connection of backlight

Item	Value	Remarks
Part Number	NCP15XH103F0SRC	Murata
Resistance / Tolerance	10kΩ±1%	Ta=25℃
Permissive Operating Current	0.31mA	Ta=25°C Note5

Table 5.2.2 Thermistor Description

Note1: I_F is defined for one channel LEDs. There are a total of 3 LED channels in the backlight unit. While the LCM is operating, a stable forward current should be supplied. The PWM value is only for inrush current.

Note2: I_F =120mA.

Note3: Optical performance should be evaluated at Ta=25℃ only. If the LEDs are driven at high current or at high ambient temperature & high humidity environment, the lifetime of the LEDs will be reduced. Operating lifetime means the brightness will decrease to 80% of the original brightness.

Note4: An NTC thermistor is included in the LED circuit. Part number: NCP15XH103F0SRC. It is used for the measuring LED temperature and is located in the LED circuit on the backlight FPC.

Note5: To reduce the influence of NTC self-heating and improve the measurement accuracy. suggest

the operating current of NTC be xx mA
Note6: When operating at high temperature, NTC resistance should not be below xx **kΩ**

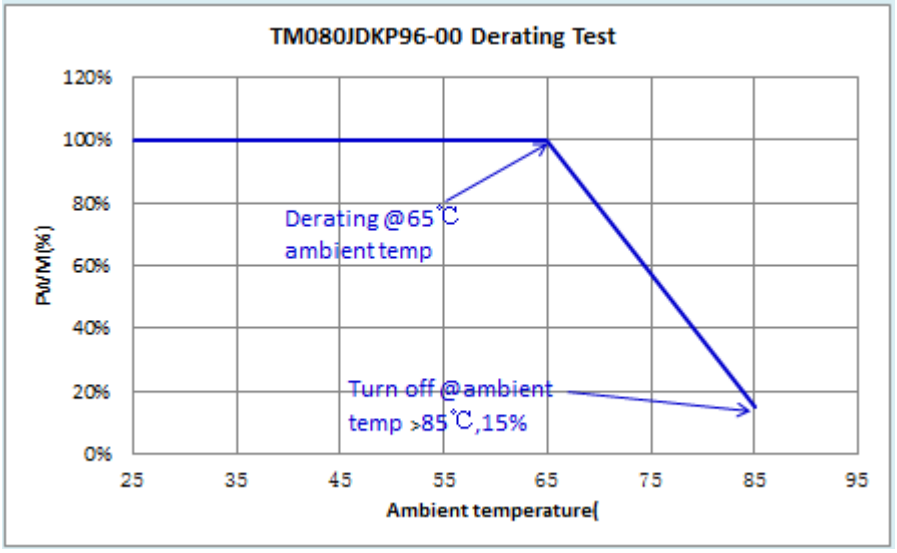


Figure 5.2.2 PWM vs Ambient Temperature

5.3 Recommended Power ON/OFF Sequence

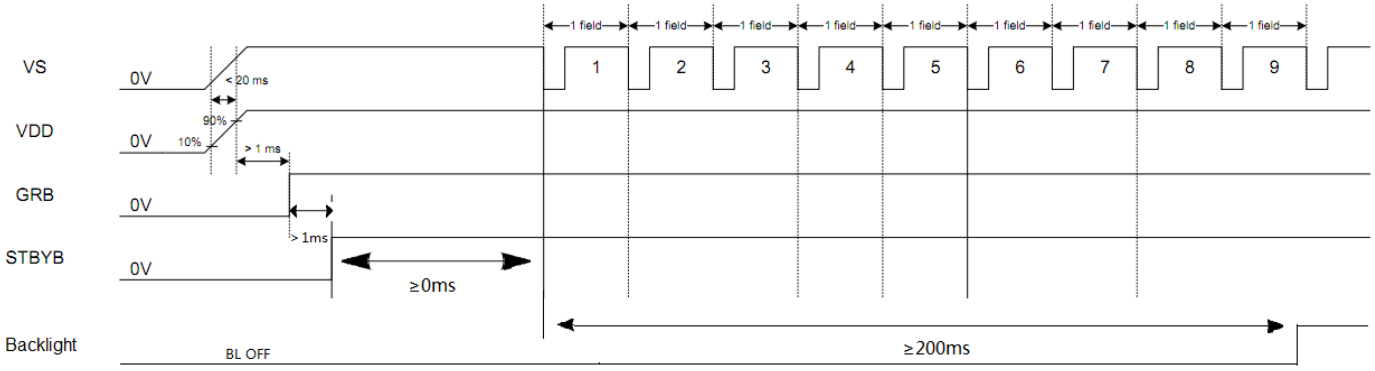


Figure 5.3.1 Power on Sequence

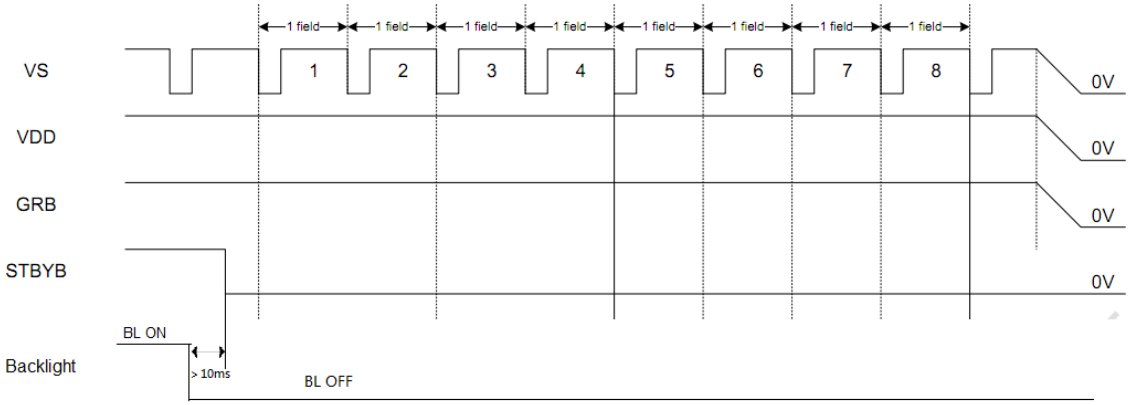


Figure 5.3.2 Power off Sequence

Note1: GRB=RESET.
Note2: Power on/off of UD(RL) is at the same time as VDD.

5.4 LCD Module Block Diagram

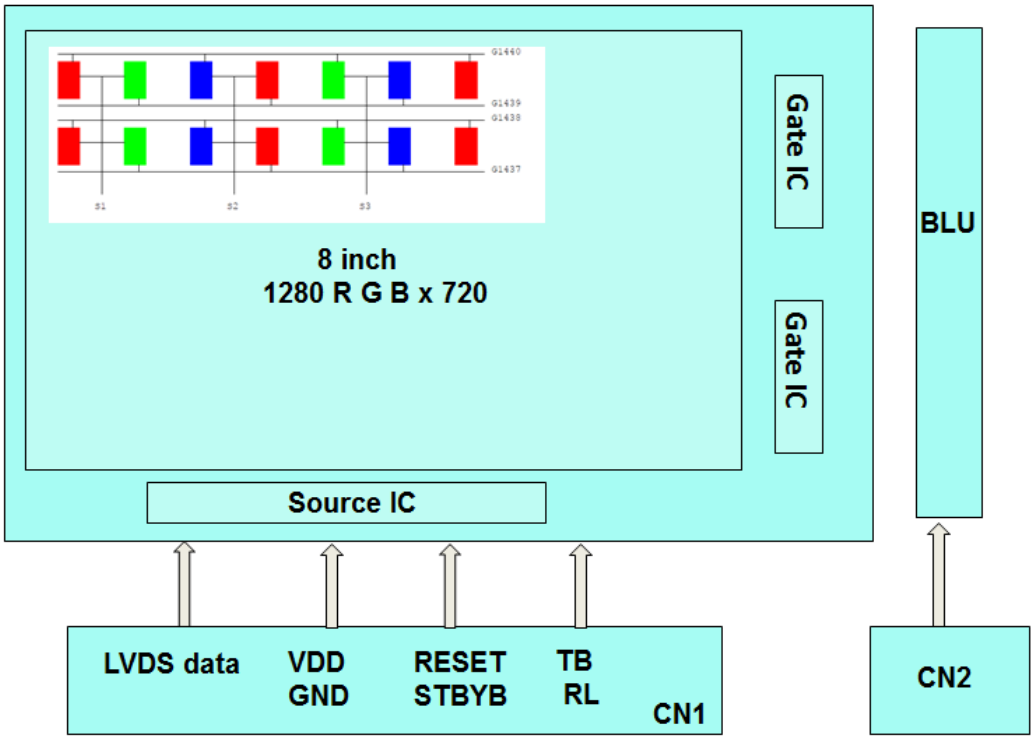


Figure 5.4.1 LCD Module Block Diagram

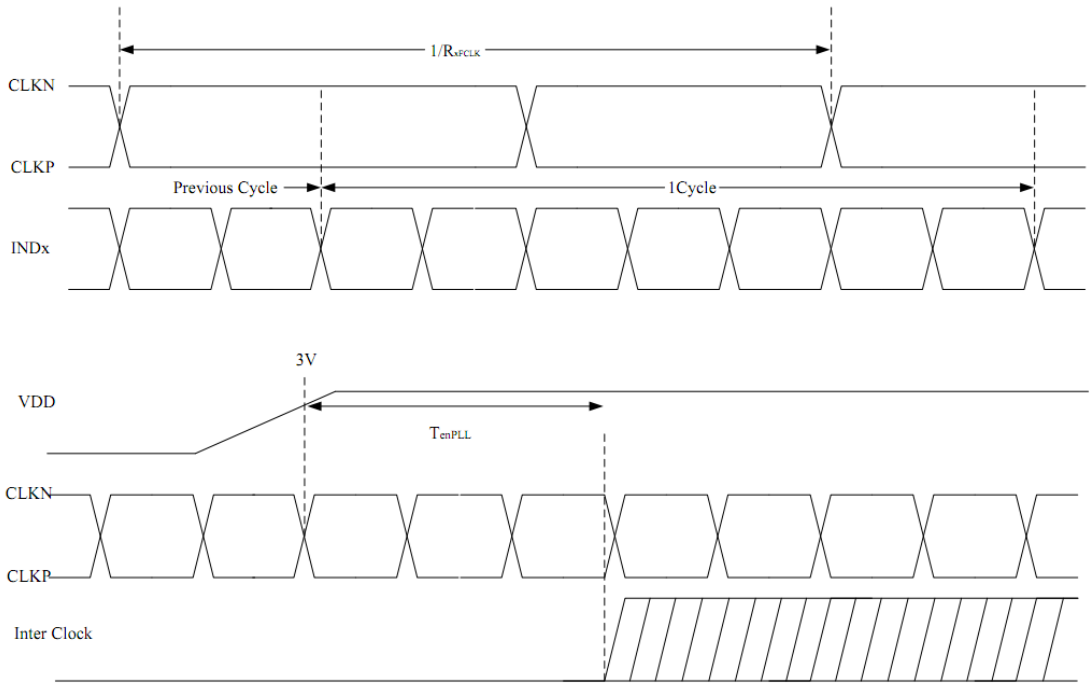
6. Interface Timing Characteristics

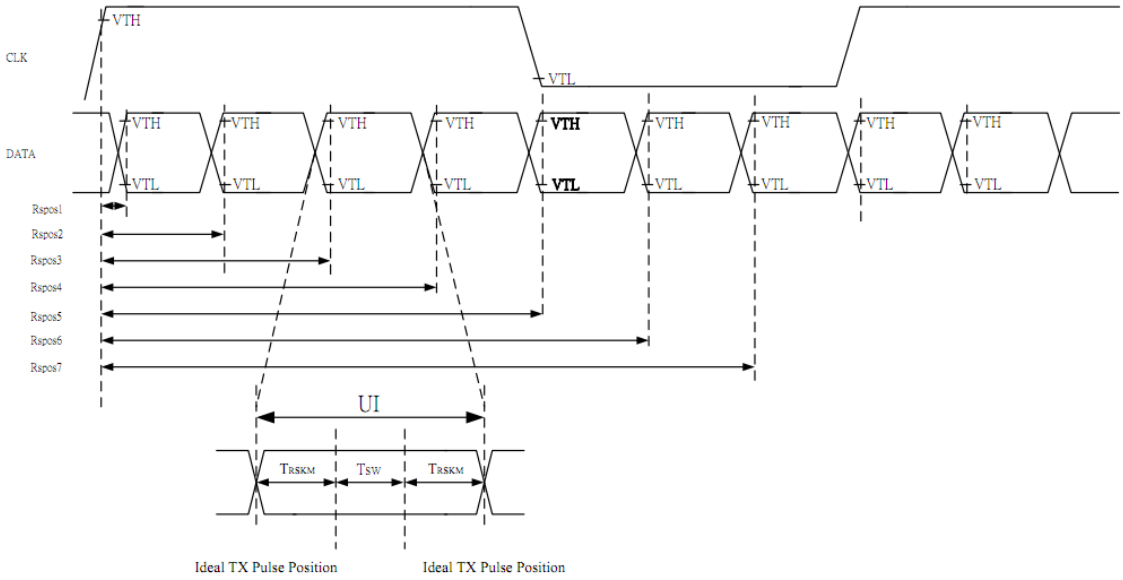
6.1 LVDS AC characteristics

(DVDD=DVDD_IF=1.7 to 1.9V, VDD= 2.7 to 3.6V, AVDD= 10 to 13.5V, VSS_IF=VSS=AGND=0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency	RXFCLK	10	-	110	MHz	
1 data bit time	UI		1/7		1/RXFCLK	
Position 1	Rspos1	-0.2	0	0.2	UI	
Position 2	Rspos2	0.8	1	1.2	UI	
Position 3	Rspos3	1.8	2	2.2	UI	
Position 4	Rspos4	2.8	3	3.2	UI	
Position 5	Rspos5	3.8	4	4.2	UI	
Position 6	Rspos6	4.8	5	5.2	UI	
Position 7	Rspos7	5.8	6	6.2	UI	
Input data skew margin	T_{RSKM}	-	-	0.2	UI	|VID|=100mV RXVCM=1.2V RXFCLK=75MHz
Clock high time	T_{LVCH}	-	4/(7*RXFCLK)	-	ns	
Clock low time	T_{LVCL}	-	3/(7*RXFCLK)	-	ns	
PLL wake-up time	T_{enPLL}	-	-	150	us	

Table 6.1.1 LVDS mode AC electrical characteristics





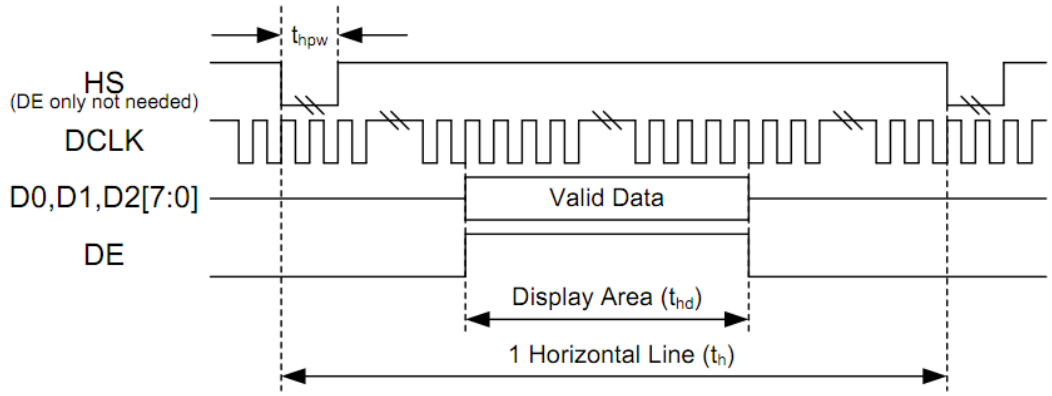
TRSKM: Receiver strobe margin
Tsw : Strobe width (internal data sampling window)
VTH=Rxvcm+|VID|/2, VTL=Rxvcm-|VID|/2

6.2 DE Mode Data Input Timing Parameter Setting

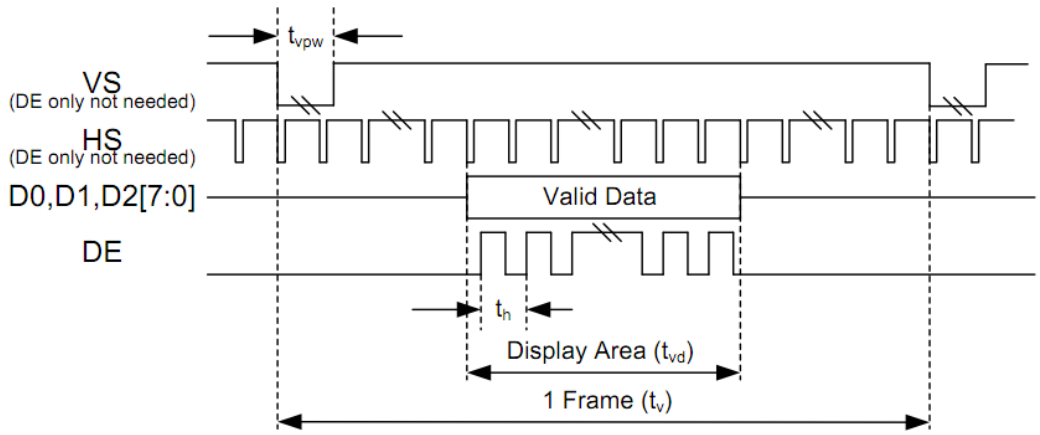
Parameter	Symbol	1280RGBx720 (One Port)		
		Min.	Typ.	Max.
DCLK Frequency	F_{DCLK}	58.37	58.71	74.88
Horizontal valid data	t_{hd}	1280		
1 Horizontal Line	t_h	1340	1344	1470
Vertical valid data	t_{vd}	720		
1 Vertical field	t_v	726	728	849
Frame rate	FR	60		

Table 6.2.1 Data Input Timing Parameters

Horizontal



Vertical



Note：Above of all these information is just for reference，the final information should be based on the test result of module and be set for module in initial code.

6.3 LVDS signal format

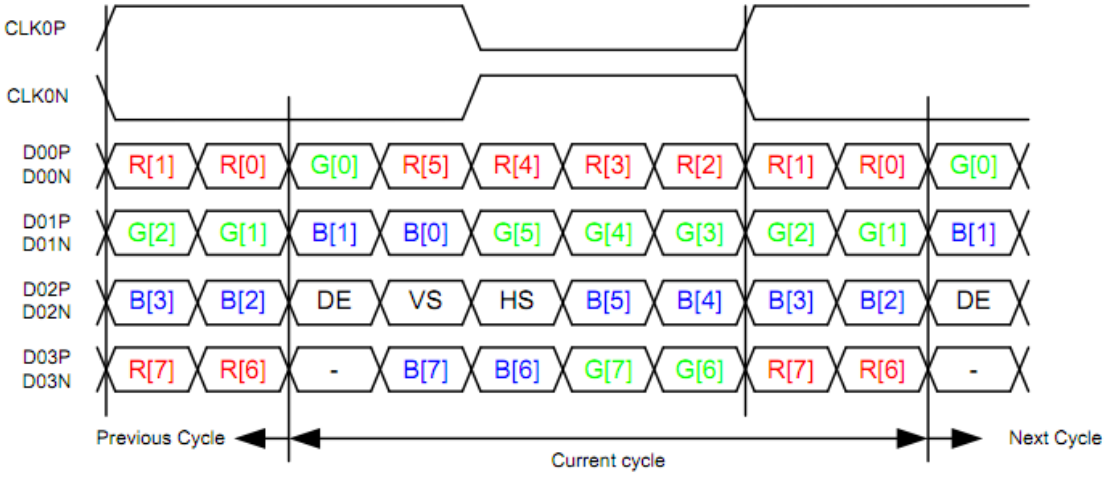


Figure 6.3.1 LVDS signals, VESA format

Note: CLK0P/N=CLKP/N, D00P/N=LV0P/N, D01P/N=LV1P/N, D02P/N=LV2P/N, D03P/N=LV3P/N

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θU	CR≥10	80	88	--	Degree	Note1 Note2
		θD		80	88	--		
		θL		80	88	--		
		θR		80	88	--		
Contrast Ratio		CR	Vertical,25℃	900:1	1300:1	--	--	Note3 Note6
			Vertical,85℃	50% value of 25℃	--	--	--	
Response Time		$T_{ON}+T_{OFF}$	25℃	--	--	25	ms	Note4
			-20℃	--	--	200		
			-30℃	--	--	350		
Chromaticity	White	x	Backlight is on	0.250	0.300	0.350		Note5
		y		0.265	0.315	0.365		
	Red	x		0.586	0.636	0.686		
		y		0.286	0.336	0.386		
	Green	x		0.256	0.306	0.356		
		y		0.579	0.629	0.679		
	Blue	x		0.095	0.148	0.195		
		y		0.013	0.063	0.113		
Uniformity		White	--	75	80	--	%	Note7
NTSC			CIE1931-XYZ	70	73	--	%	Note5
Luminance		L	--	850	1200	--	cd/m^2	Note8

Table 7.1 Optical Parameters

Test Conditions:

1. I_F= 120 mA, and the ambient temperature is 25℃.
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.

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

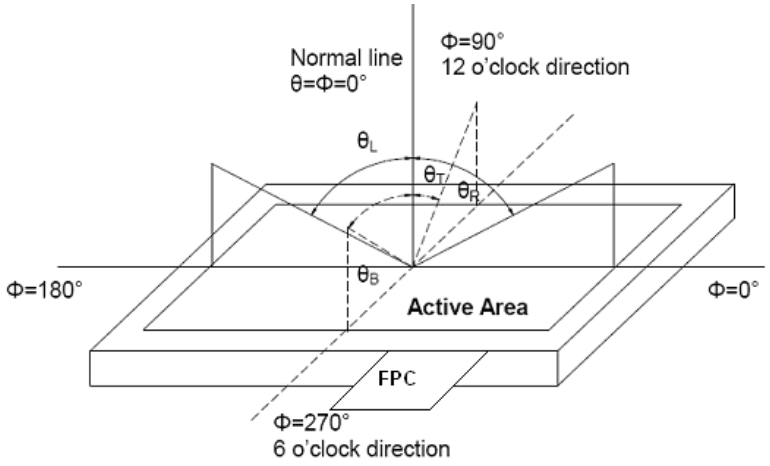


Fig1. Measurement viewing angle

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%.

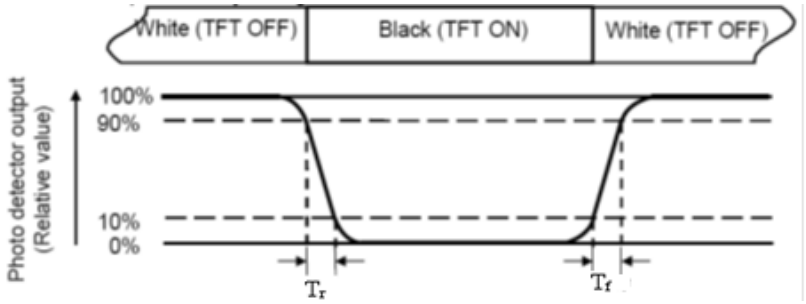


Fig2. Response Time Testing(TN)

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

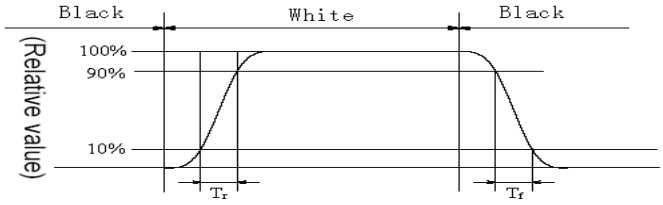


Fig3.Response Time Testing(SFT)

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Contrast ratio against temperature

CR defines the allowed contrast reduction at the defined temperature based on the CR at room temperature. For example: CR = (CR@25°C – CR@85°C) / CR@25°C x 100%

Note7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig.4). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/ 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

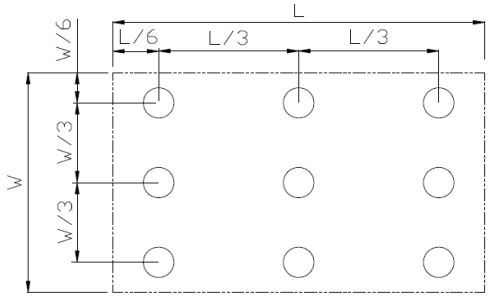
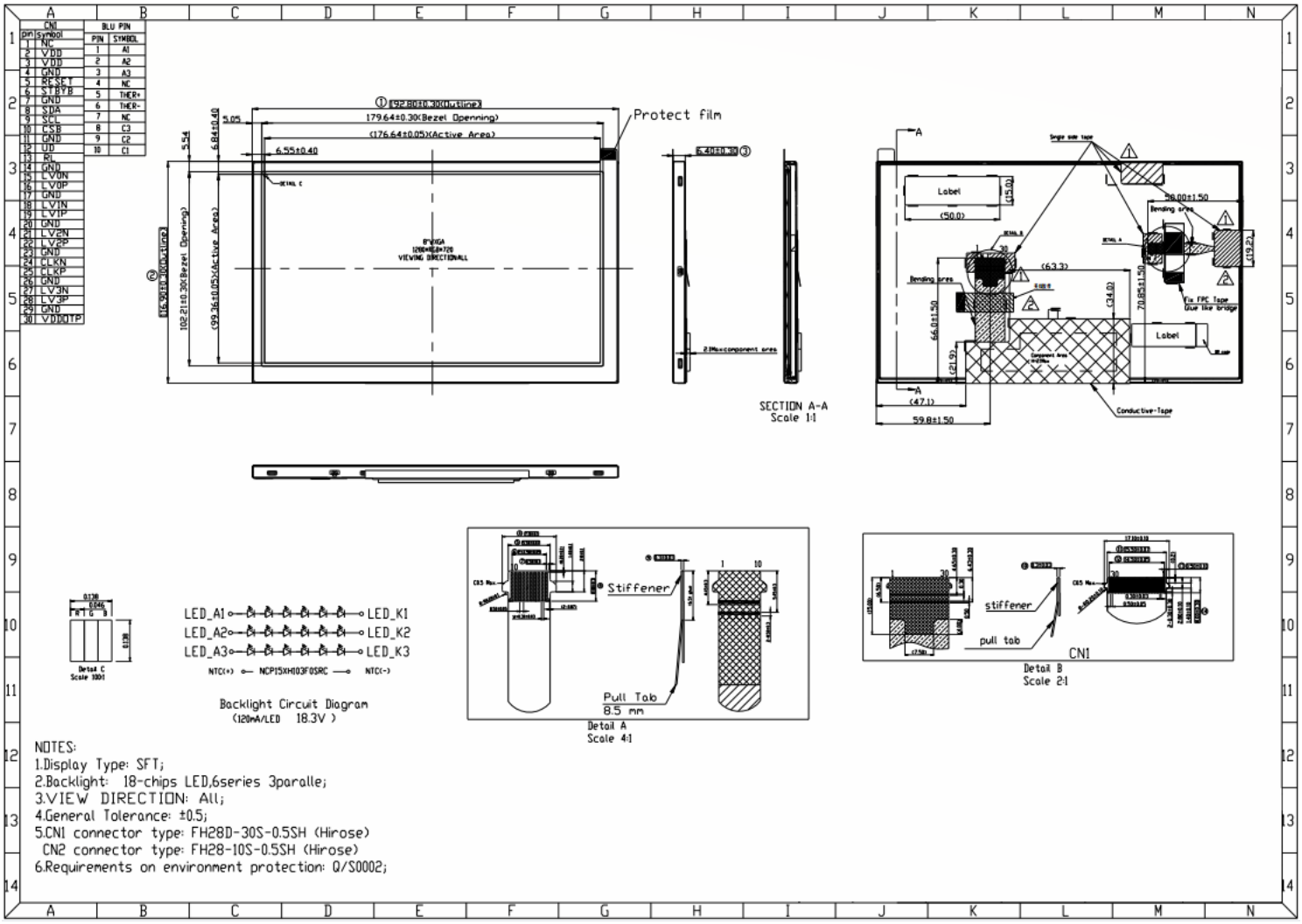


Fig4. Luminance Uniformity Measurement Locations(9 points)

Note8: Definition of Luminance:

Measure the luminance of white state at center point.

8. Mechanical Drawing



NOTES:
1.Display Type: SFT;
2.Backlight: 18-chips LED,6series 3paralle;
3.VIEW DIRECTION: All;
4.General Tolerance: ±0.5;
5.CN1 connector type: FH28D-30S-0.5SH (Hirose)
CN2 connector type: FH28-10S-0.5SH (Hirose)
6.Requirements on environment protection: Q/S0002;