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SPECIFICATION

[☒] Preliminary Specification
 [☐] Final Specification

Description **10.1” 1024xRGBx600 TFT-LCD Module**
Part Number **P1010WSF1MB01**

Customer		Industrial Product Dept, PDBU Tianma Microelectronics Co., Ltd.	
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* This cover page is for your Comments and Signatures back to TIANMA

REVISION HISTORY

[illegible]

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1. Summary

1.1 General Description

This is a 10.1 inch a-Si TFT-LCD module with normally-black technology. It is composed of a TFT-LCD panel, a driver circuit, PCBA, and a LED backlight unit.

1.2 Features

- Interface: 1 port LVDS(6/8bit selectable)
- Ultra-wide viewing angle
- LED driver integrated
- Surface treatment AG
- This product will comply with the European RoHS directive (2011/65/EU) and Delegated Directive (2015/863/EU, Amending Annex II of 2011/65/EU)

2. General Specification

Feature		Spec	Unit
Display Spec.	Size	10.1 inch	
	Resolution	1024(RGB)x600	
	Pixel Pitch (mm)	0.2175x0.2088	mm
	TFT Active Area	222.72 x 125.28	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT, Normally Black	
	Surface Treatment	Anti-Glare	
	Viewing Direction	All viewing angle	
	Gray Scale Inversion Direction	No gray scale inversion	
Mechanical Characteristics	LCM (W x H x D)	235.0 x 143.0 x 4.9	mm
	Weight	TBD	g
Optical Characteristics	Luminance	450	cd/m ²
	Contrast ratio	1000	
	NTSC	50	%
	Viewing angle(R/L/U/D)	88/88/88/88	degree
Electrical Characteristics	Interface	1 port LVDS(6/8bit selectable)	
	Color Depth	262k/16.7M	color
	Power consumption	LCD: TBD Backlight: TBD	W

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	IPEX 20455-040E-66
Matching connector	IPEX 20453-040T-01 or compatible

Table 3.1.1 Connector information

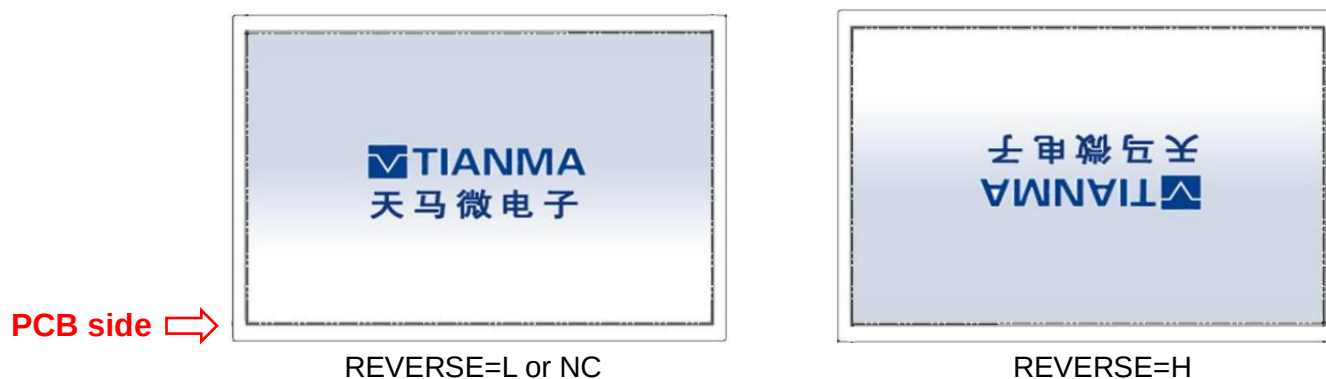
No	Symbol	I/O	Description	Comment
1	NC	N	No connection	
2	VCCS	P	Power supply(3.3V typ)	
3	VCCS	P	Power supply(3.3V typ)	
4	NC	N	No connection	
5	NC	N	No connection	
6	NC	N	No connection	
7	NC	N	No connection	
8	Rxin0-	I	LVDS Data Lane 0-(R0~R5,G0)	
9	Rxin0+	I	LVDS Data Lane 0+(R0~R5,G0)	
10	VSS	P	Ground	
11	Rxin1-	I	LVDS Data Lane 1-(G1~G5,B0~B1)	
12	Rxin1+	I	LVDS Data Lane 1+(G1~G5,B0~B1)	
13	VSS	P	Ground	
14	Rxin2-	I	LVDS Data Lane 2-(B2~B5,HS,VS,DE)	
15	Rxin2+	I	LVDS Data Lane 2+(B2~B5,HS,VS,DE)	
16	VSS	P	Ground	
17	RxCLK-	I	LVDS clock Lane -	
18	RxCLK+	I	LVDS clock Lane +	
19	VSS	P	Ground	
20	Rxin3-	I	LVDS Data Lane 3-(R6~R7,G6~G7,B6~B7)	
21	Rxin3+	I	LVDS Data Lane 3+(R6~R7,G6~G7,B6~B7)	
22	VSS	P	Ground	
23	NC	N	No connection(Tianma internal use)	
24	NC	N	No connection(Tianma internal use)	
25	VSS	P	Ground	

26	NC	I	No connection(Tianma internal use)	
27	SEL68	I	LVDS 6/8 bit selection control. SEL68="H":8bit SEL68="L" or NC:6bit	
28	VSS	P	Ground	
29	NC	N	No connection	
30	REVERSE	I	Scanning direction select H: inversion ;L or NC: normal	Note2
31	LED_GND	P	LED ground	
32	LED_GND	P	LED ground	
33	LED_GND	P	LED ground	
34	NC	N	No connection	
35	LED_PWM	I	PWM control signal of LED converter	
36	LED_EN	I	Enable control signal of LED converter	
37	NC	N	No connection	
38	LED_VCC	P	LED power supply(12V typ)	
39	LED_VCC	P	LED power supply(12V typ)	
40	LED_VCC	P	LED power supply(12V typ)	

Table 3.1.2 Pin Assignment for LCD Interface

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

Note2: Scan direction is shown as below (PCB at lower side):



4. Absolute Maximum Ratings

GND=0V

Item	Symbol	Min	Max	Unit	Remark
Power Voltage for LCD	VCC	-0.3	3.96	V	
Input voltage for LCD	V _{IN}	-0.3	3.96	V	Note 1
LED power supply Voltage	LED_VCC	-0.3	27	V	
LED Control Signal Voltage 1	LED_PWM	-0.3	27	V	
LED Control Signal Voltage 2	LED_EN	-0.3	27	V	
Operating Temperature	TOPR	-20	70	°C	Note2、 Note3
Storage Temperature	TSTG	-30	80	°C	
Relative Humidity Note1	RH	--	≤95	%	Ta≤40°C
		--	≤85	%	40°C < Ta≤50°C
		--	≤55	%	50°C < Ta≤60°C
		--	≤36	%	60°C < Ta≤70°C
Absolute Humidity	AH	--	≤70	g/m ³	Ta>70°C

Table 4.1 Absolute Maximum Ratings

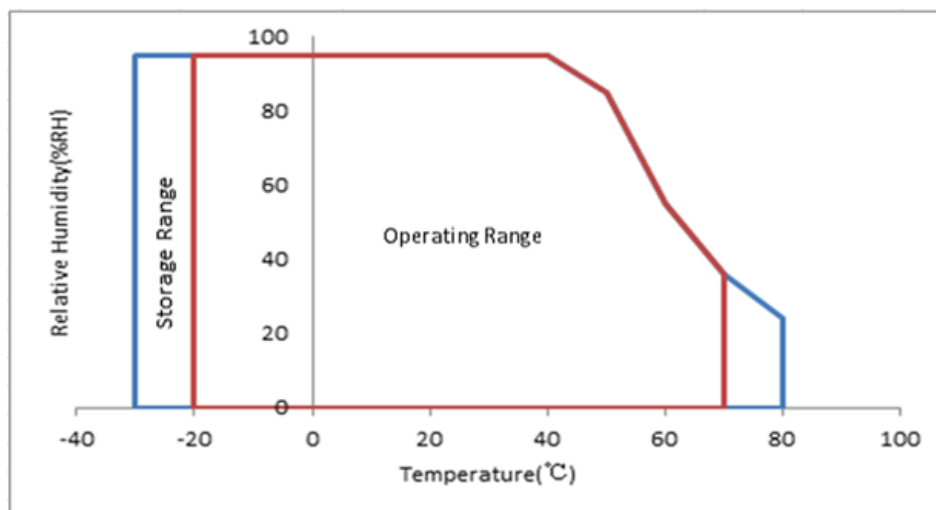


Table 4.2 Absolute Maximum Ratings chart

Note1: Input voltage include REVERSE

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.
When exceeded the maximum ratings, 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
Power supply voltage	VCC	3.0	3.3	3.6	V	
Input Signal Voltage	Low Level	VIL	0	--	0.2×VCC	V
	High Level	VIH	0.7×VCC	--	VCC	V
Power supply current	I _{VCC}	--	TBD		mA	
Power Consumption	60Hz	P	--	TBD	mW	

Note 1: Input Signal Voltage include REVERSE

Table 5.1.1 Operating Voltages

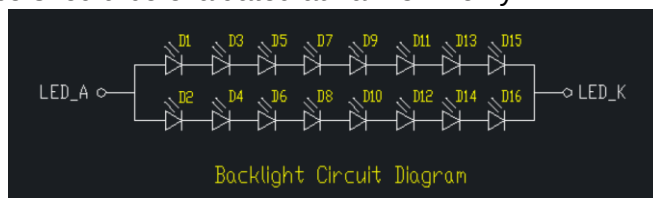
5.2 DC Characteristics for Backlight Driving

GND=0V, Ta = 25℃

Item	Symbol	Min	TYP	MAX	Unit	Remark
Power supply voltage	LED_VCC	-	12	-	V	LED driver
Forward Current Voltage	I _{LED_VCC}	-	TBD	-	mA	
Power Consumption	P _{LED_VCC}	-	TD	-	W	
Input voltage for LED_EN、LED_PWM signal	High	VDFH1	1.6	-	LED_VCC	V
	Low	VDFL1	0	-	0.7	V
PWM frequency	Fpwm	100	-	30K	Hz	
PWM duty cycle	-	0.5	-	100	%	Dim setting must be more than minimum always
LED lifetime	--	-	50000	-	Hrs	

Table 5.2.1 LED Backlight Characteristics

Note 1: Optical performance should be evaluated at Ta=25℃ only.



5.3 Recommended Power ON/OFF Sequence

Description	Parameter	Min	Typ	Max	Unit
Rise time 0.1*VCC to 0.9*VCC	T1	0.2	-	5	ms
0.9VCC to LVDS active	T2	0	-	50	ms
LVDS ON to 0.9BLK on	T3	180	-	-	ms
Rise time 0.1*BLK to 0.9*BLK	T4	0.5	-	10	ms
0.9BLK to LED_PWM on	T5	10	-	-	ms
LED_PWM on to LED_EN on	T6	10	-	-	ms
LED_EN off to LED_PWM off	T7	10	-	-	ms
LED_PWM off to BLK off	T8	10	-	-	ms
Fall time 0.9*BLK to 0.1*BLK	T9	0	-	10	ms
0.1*BLK to LVDS off	T10	180	-	-	ms
LVDS off to VCC off	T11	0	-	50	ms
Fall time 0.9*VCC to 0.1*VCC	T12	0.5	-	10	ms
FALL TIME 0.1 VCC TO RISE TIME 0.1 VCC	T13	1000	-	-	ms

Table 5.4.1 Power ON/OFF Sequence

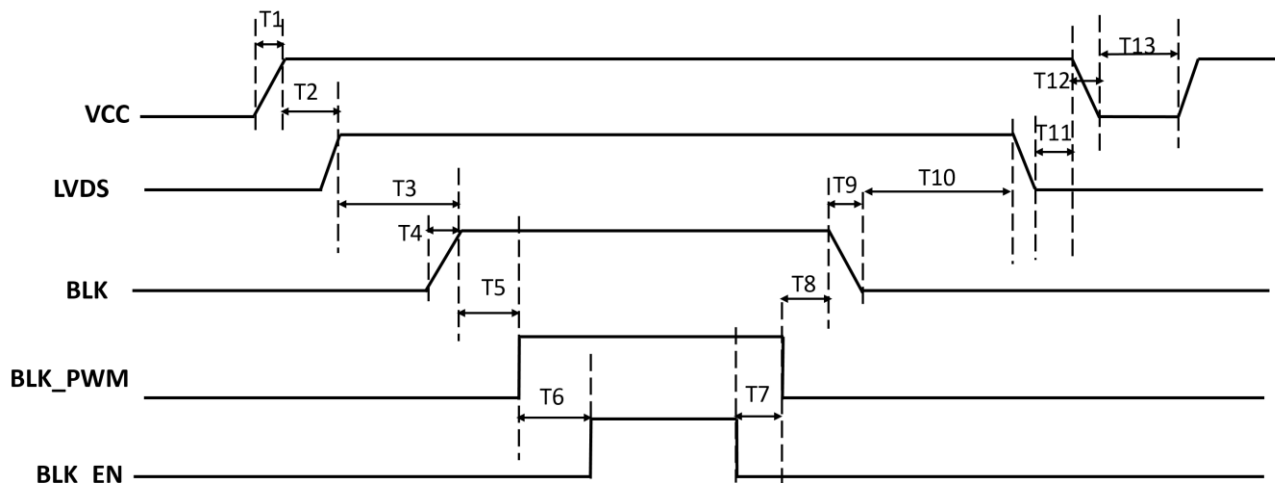


Figure 5.3.1 Power ON/OFF Sequence

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: Keep backlight turned off until the display has stabilized.

Note4: BLK_PWM and LED_PWM are the same; BLK_EN and LED_EN are the same.

5.4 LCD Module Block Diagram

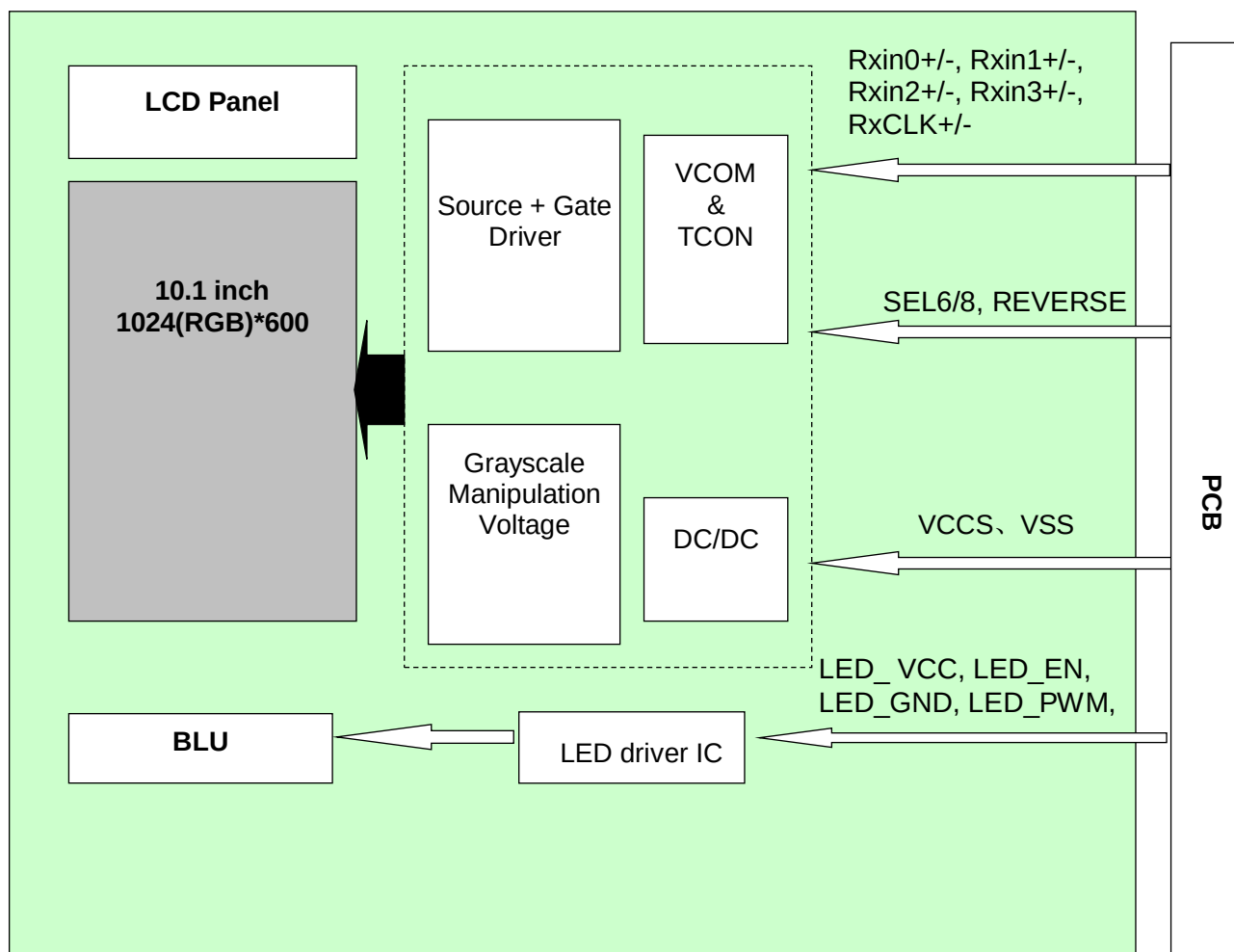


Figure 5.4.1 LCD Module Block Diagram

6. Timing Characteristics

6.1 Data input timing table

VCC=3.3V, GND=0V, Ta=25°C

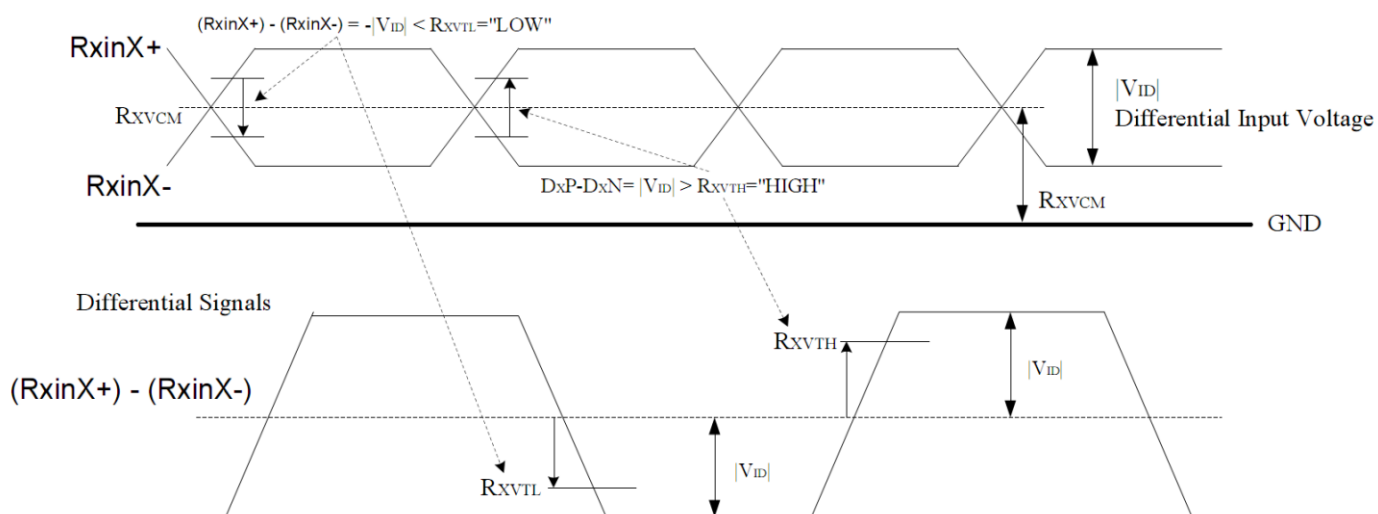
	Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
	Dclk frequency	Fclk	46.3	51.2	59.1	MHz	Tclk=1/Fclk
Horizontal section	Horizontal total	th	1229	1344	1372	Tclk	
	Horizontal blanking	thb	205	320	348	Tclk	
	Valid Data Width	thd	1024			Tclk	
Vertical section	Vertical total	tv	628	635	718	TH	
	Vertical blanking	tvb	28	35	118	TH	
	Valid Data Width	tvd	600			TH	
	Frame rate		60			Hz	

Table 6.1.1 Input timing (DE mode)

6.2 LVDS DC characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Differential input high threshold voltage	R_{XVTH}		-	100	mV	
Differential input low threshold voltage	R_{XVTL}	-100	-		mV	
Input voltage range (singled-end)	R_{XVIN}	400		1650	mV	1. $R_{XVCM} + 1/2 V_{ID} \leq 1650\text{mV}$. 2. $R_{XVCM} - 1/2 V_{ID} \geq 400\text{mV}$.
Differential input common mode voltage	R_{XVCM}	600	1200	1375	mV	
Differential input voltage	$ V_{ID} $	200	-	400	mV	

Single-end Signals

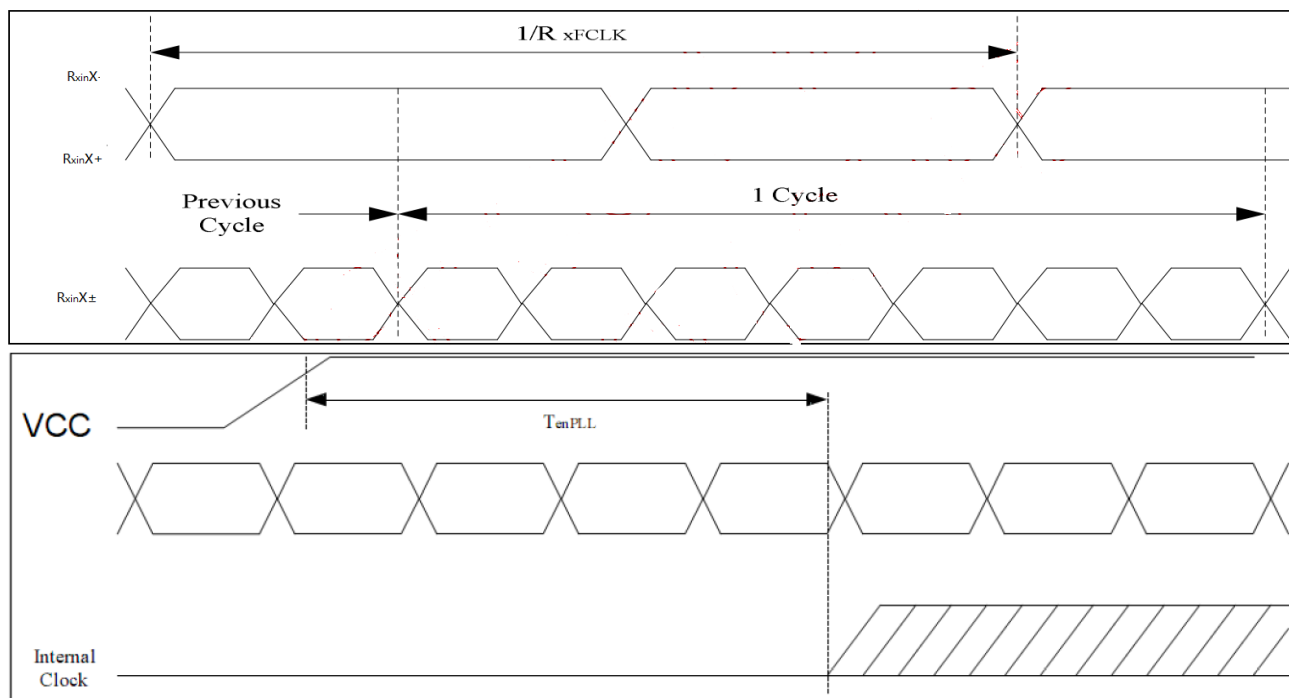


6.3 LVDS AC characteristics

VCC=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Dclk Frequency	RxFCLK	46.3	51.2	59.1	MHZ	
Input Data Skew Margin	T _{RSKM}	-0.2	-	0.2	UI	V _{IO} =200mV R _{XVCM} =1.2V 1UI=1/(RxFCLKx7)
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	
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	

Table 6.3.1 LVDS AC characteristics



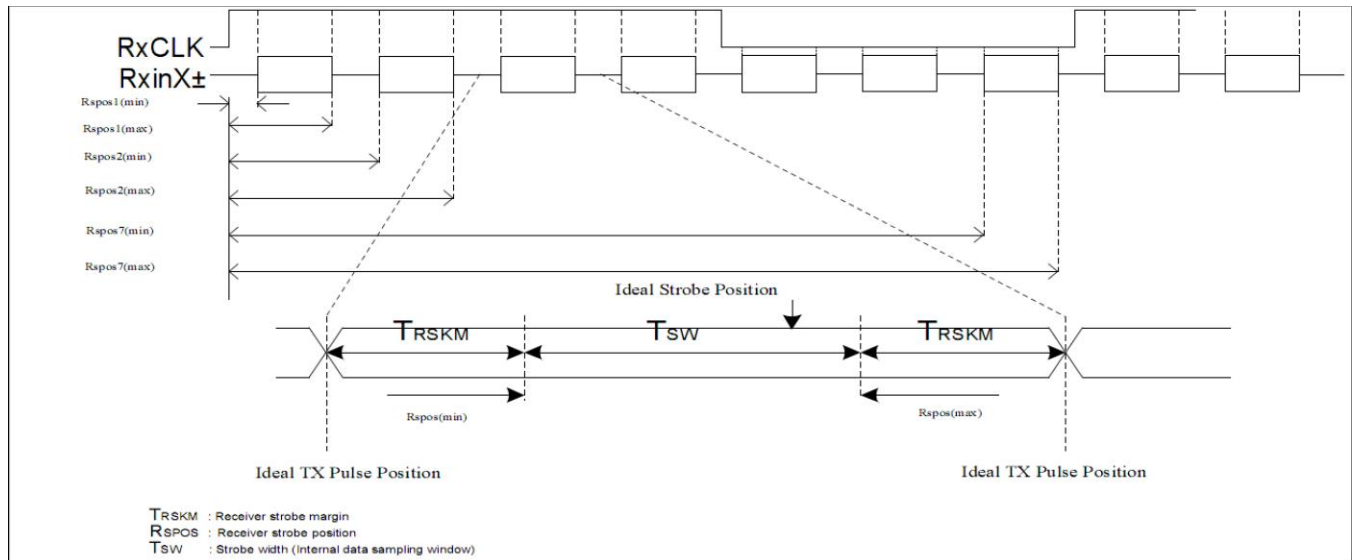


Figure 6.3.2 LVDS AC characteristics

6.4 LVDS data mapping

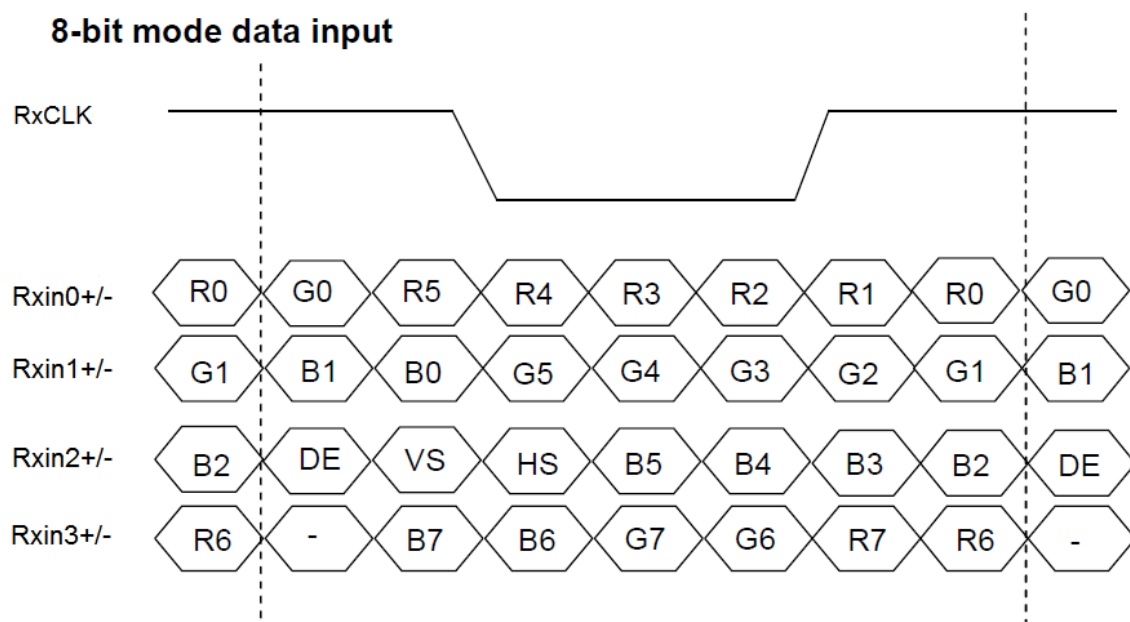


Figure 6.4.1 LVDS 8bit data mapping

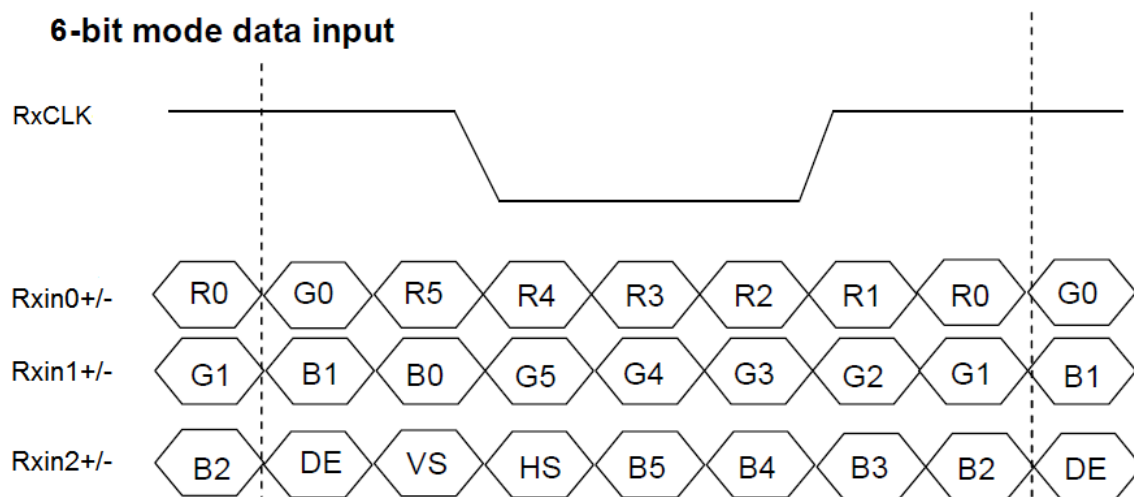


Figure 6.4.2 LVDS 6bit data mapping

7. Optical Characteristics

Ta=25℃

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	75	88	-	Degree	Note2,3
		θB		75	88	-		
		θL		75	88	-		
		θR		75	88	-		
Contrast Ratio		CR	θ=0°	800	1000			Note 3
Response Time		T _{ON}	25℃	-	30	40	ms	Note 4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.275	0.325	0.375		Note 1,5
		y		0.296	0.346	0.396		
	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		-		45	50	-	%	Note 5
Luminance		L		380	450	-	cd/m ²	Note 7

Table 7.1 Optical characteristics

Test Conditions:

- PWM duty=100%. Ambient temperature is 25℃.
- The test systems refer to Note 1 and Note 2.

Note 1: 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.

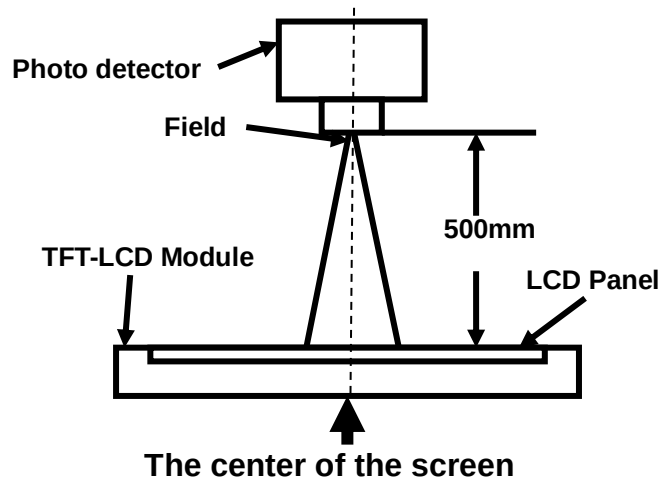


Fig1. Measurement Set Up

Note 2: Definition of viewing angle range and measurement system. viewing angle is measured at the center point of the LCD .

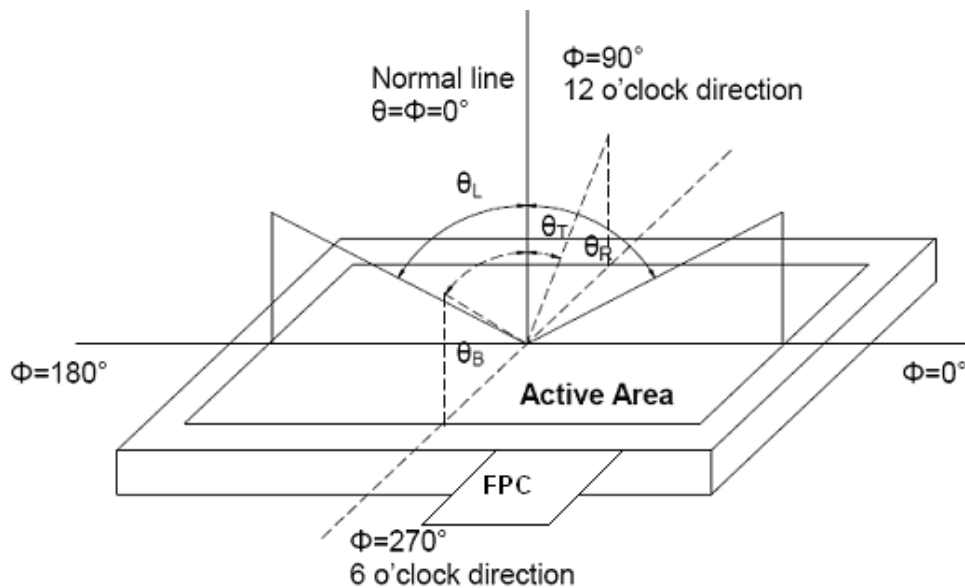


Fig2. Measurement viewing angle

Note 3: 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%.

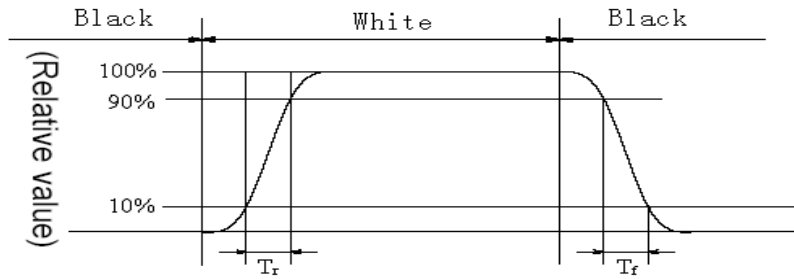


Fig4. Response Time Testing

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: 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

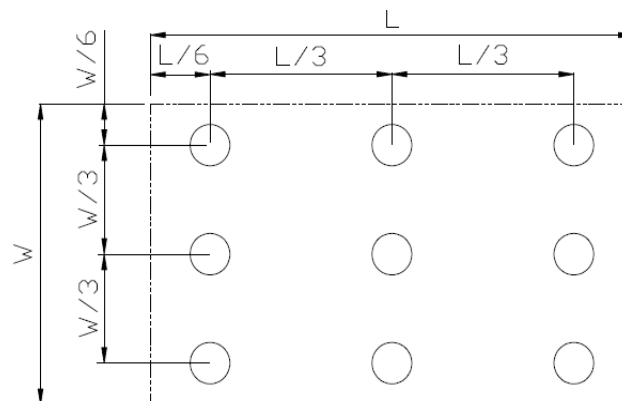


Fig5. Luminance Uniformity Measurement Locations(9 points)

Note 7: 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°C,240hrs	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	-20°C,240hrs	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	+80°C,240hrs	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-30°C,240hrs	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity	+60°C, 90% RH 240 hours	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30°C 30 min~+80°C 30 min, Change time:5min,100 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,G B2423.22-2002
7	ESD	C=150pF, R=330Ω, 5points/panel Air:± 15KV, 5times, Contact:± 8KV, 5 times, (Environment:15°C~35°C, 30%~60%.86Kpa~106Kpa) 4 corners and center	IEC61000-4-2:2001 GB/T17626.2-2006
8	Vibration Test (Non-operation)	Stroke:1.5G Sweep:10Hz~100Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total)	IEC60068-2-6:1982 GB/T2423.10—1995
9	Mechanical Shock (Non-operation)	peak acceleration: 60G; durations for half-sine pulse: 6ms ± X,± Y,± Z 3times, for each direction	IEC60068-2-27:1987 GB/T2423.5—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 4857.23-2012
11	Package Drop	Height: 60 cm, 1corner,3edges,6surfaces	GB/T 4857.5-1992

Table 8.1 Reliability test condition

Note1: Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

Note 2: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.



10. Packing Instruction

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.