

SPECIFICATION

[☒] Preliminary Specification
[] Final Specification

Description 23.8” 3840xRGBx2160 TFT-LCD Module
Part Number P2380UHF1MA00

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REVISION HISTORY

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1. Summary

1.1 General Description

This is a 23.8 inch a-Si TFT-LCD module with Normal- Black technology. It is composed of a TFT-LCD panel, a driver circuit, a PCB, a backlight unit

1.2 Features

- Ultra-wide viewing angle
- High resolution
- High luminance
- Interface: eDP1.2
- Compliant with the European RoHS Directive

- 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	23.8inches	
	Resolution	3840(RGB)x2160	
	Pixel Pitch	0.13725*0.13725	mm
	TFT Active Area	527.04*296.46	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT, Normally Black	
	Surface Treatment	NA	
	Viewing Direction	ALL	
	Gray Scale Inversion Direction	NA	
Mechanical Characteristics	LCM (W x H x D)	549*323.4*16.52	mm
	Weight	TBD	Kg
Optical Characteristics	Luminance	1300typ	cd/m ²
	Contrast Ratio	1200:1	
	NTSC	70	%
	Viewing Angle	88/88/88/88	degree
Electrical Characteristics	Interface	eDP1.2	
	Color Depth	16.7 Million	color
	Power Consumption	LCD:TBD Backlight: 67200	mW

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	I-PEX 20455-030E-76
Matching connector	I-PEX 20453-2-30T-01

Table 3.1.1 Connector information

No	Symbol	I/O	Description	Comment
1	VDD	P	Power supply (12V)	
2	VDD	P	Power supply (12V)	
3	VDD	P	Power supply (12V)	
4	VDD	P	Power supply (12V)	
5	VDD	P	Power supply (12V)	
6	GND	P	Ground	
7	GND	P	Ground	
8	NC	-	No Connection	
9	NC	-	No Connection	
10	GND	P	Ground	
11	HPD	I/O	Hot Plug Detection Signal	
12	GND	P	Ground	
13	DAUXN	I/O	Complement Signal Auxiliary Channel	
14	DAUXP	I/O	True Signal Auxiliary Channel	
15	GND	P	Ground	
16	DRX0P	I	True Signal Link Lane 0	
17	DRX0N	I	Complement Signal Link Lane 0	
18	GND	P	Ground	
19	DRX1P	I	True Signal Link Lane 1	
20	DRX1N	I	Complement Signal Link Lane 1	
21	GND	P	Ground	
22	DRX2P	I	True Signal Link Lane 2	
23	DRX2N	I	Complement Signal Link Lane 2	
24	GND	P	Ground	
25	DRX3P	I	True Signal Link Lane 3	
26	DRX3N	I	Complement Signal Link Lane 3	
27	GND	P	Ground	
28	GND	P	Ground	
29	NC	-	No Connection	
30	BIST	I	BIST enable input, active high, internal pull-down at 4.7kΩ.	

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.

3.2 CN2/CN3/CN4/CN5 Pin assignment (Back Light)

Connector Information	
LCD Module connector	Molex 5015680607
Matching connector	Molex 5013300600

Table 3.2.1 Connector information

No	Symbol	I/O	Description	Wire Color
1	LEDA	P	LED driving anode (high voltage)	/
2	LEDK	P	LED driving cathode (low voltage)	/
3	LEDK	P	LED driving cathode (low voltage)	/
4	LEDK	P	LED driving cathode (low voltage)	/
5	LEDK	P	LED driving cathode (low voltage)	/
6	LEDK	P	LED driving cathode (low voltage)	/

Table 3.2.2 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 supply (12V)	VDD	-0.3	15	V	
BIST enable input	BIST	-0.3	4.0	V	
eDP signals	HPD, DAUXN, DAUXP, DRX0~3P, DRX0~3N	-0.3	4.0	V	
Power supply voltage for LED	LEDA	-0.3	52.8	V	
Operating Temperature	T _{OPR}	-20	70	°C	
Storage Temperature	T _{STG}	-30	80	°C	

Table 4.1 Absolute Maximum Ratings

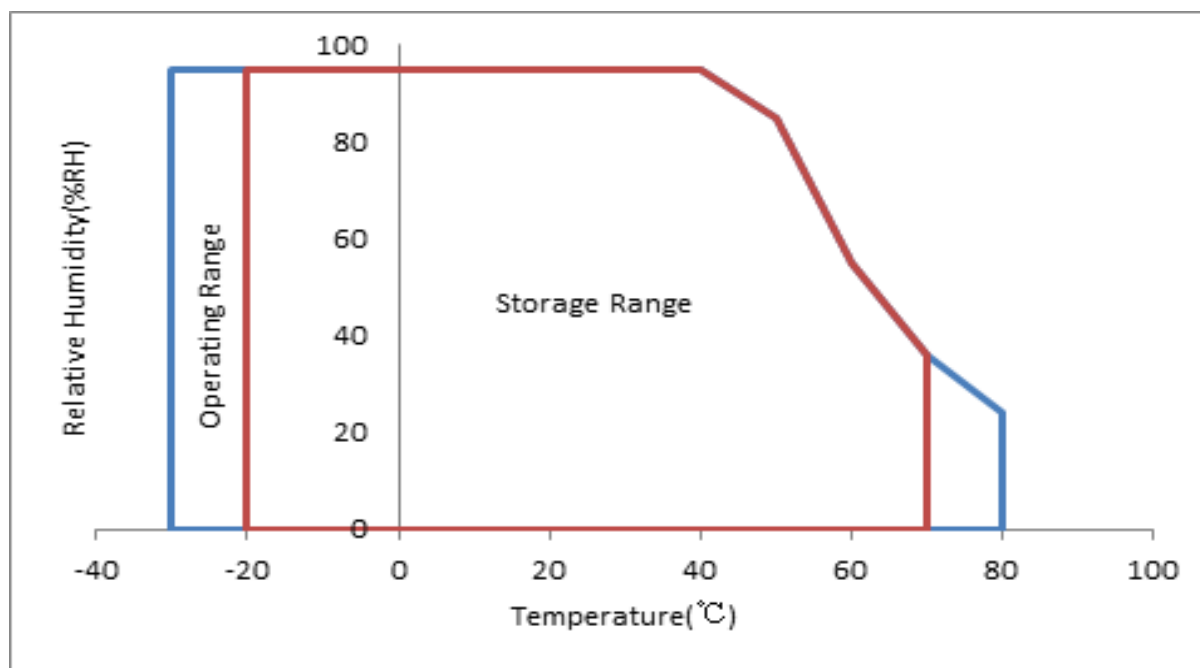


Table 4.2 Absolute Maximum Ratings chart

Note1: Input voltage include all in put 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

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VDD	11.7	12.0	12.3	V	Reliability tested at VDD=12V
Input voltage for BIST	High-level	VIH	2.7	-	3.6	V	The high-level input of BIST must be greater than 2.7V
	Low-level	VIL	0	-	0.4	V	The low-level input of BIST must be less than 0.4V
HPD		VOH_HPDP	3.135	3.3	3.465	V	Note4
Power supply current		IDD	-	360 Note1	TBD Note2	mA	at VDD=12V
Permissible ripple voltage		VRPC	-	-	100	mVp-p	for VDD
Inrush Current		Inrush_VDD	-	-	2.5	A	Note3

Table 5.1.1 Operating Voltages

Note1: Checkered flag pattern [by IEC 61747-6]

Note2: Pattern for maximum current

Note3: Inrush current should be tested under VDD rising time 470us.

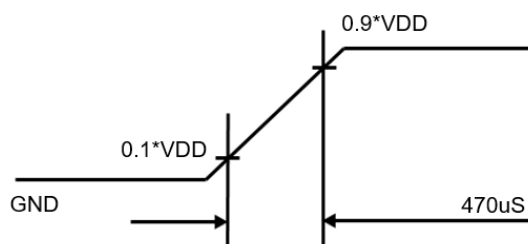
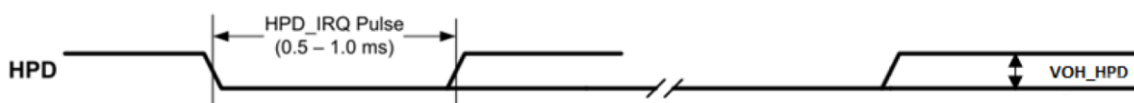


Figure 5.1.1 VDD rising time

Note4:



5.2 DC Characteristics for Backlight Driving

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF	-	1400	-	mA	160 LEDs (8S5P*4) 70mA/LED
Forward Current Voltage	VF	-	48.0	49.6	V	
Backlight Power Consumption	WBL	-	67.2	-	W	
LED life time	--	50000	70000	-	Hrs	

Table 5.2.1 LED Backlight Characteristics

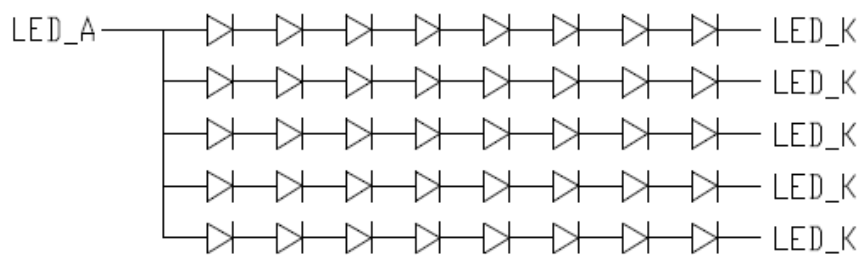
Note1: I_F is defined for total.

Note2: Optical performance should be evaluated at $T_a=25^{\circ}\text{C}$ 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*8PCS*2*2(双侧)
1400mA; 48.8V TYP
LED CIRCUIT

5.3 Recommended Power ON/OFF Sequence

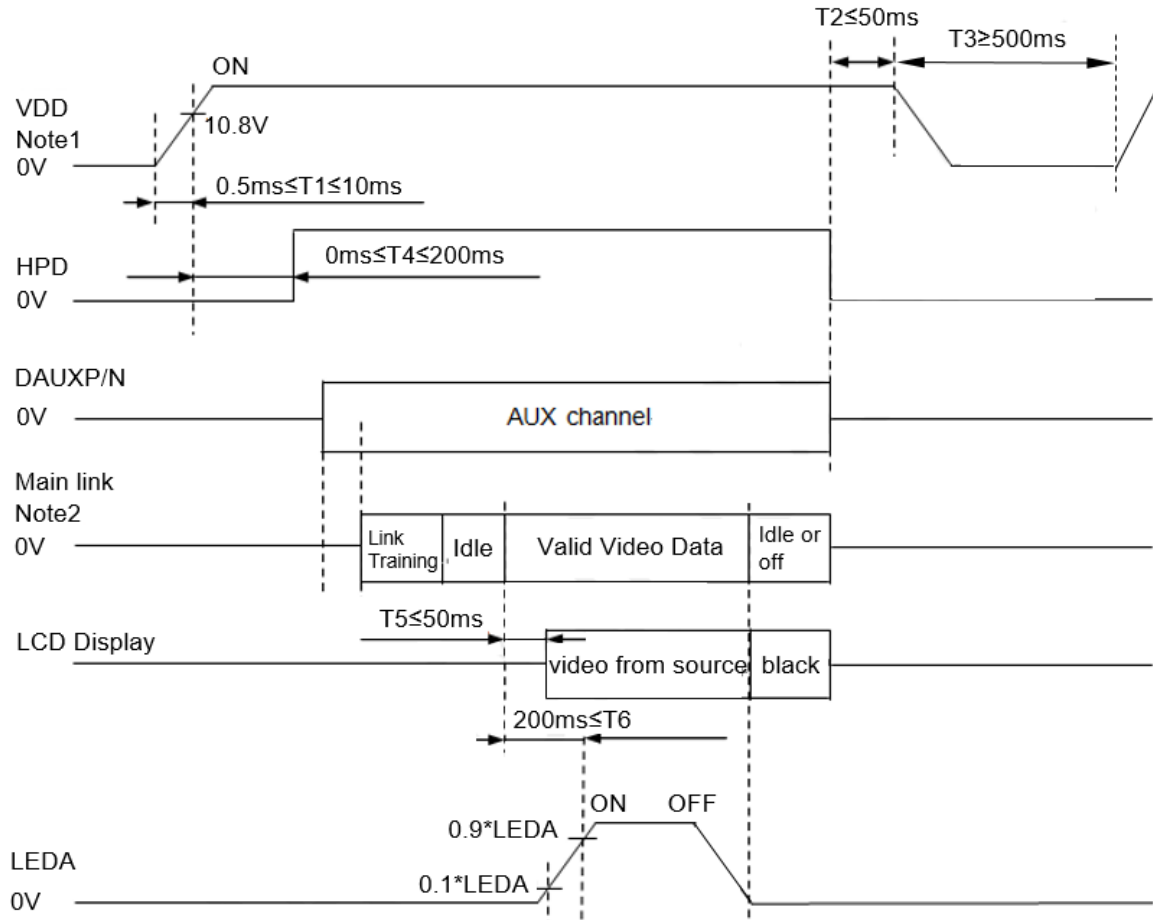


Figure 5.3.1 Power on/off sequence

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: 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

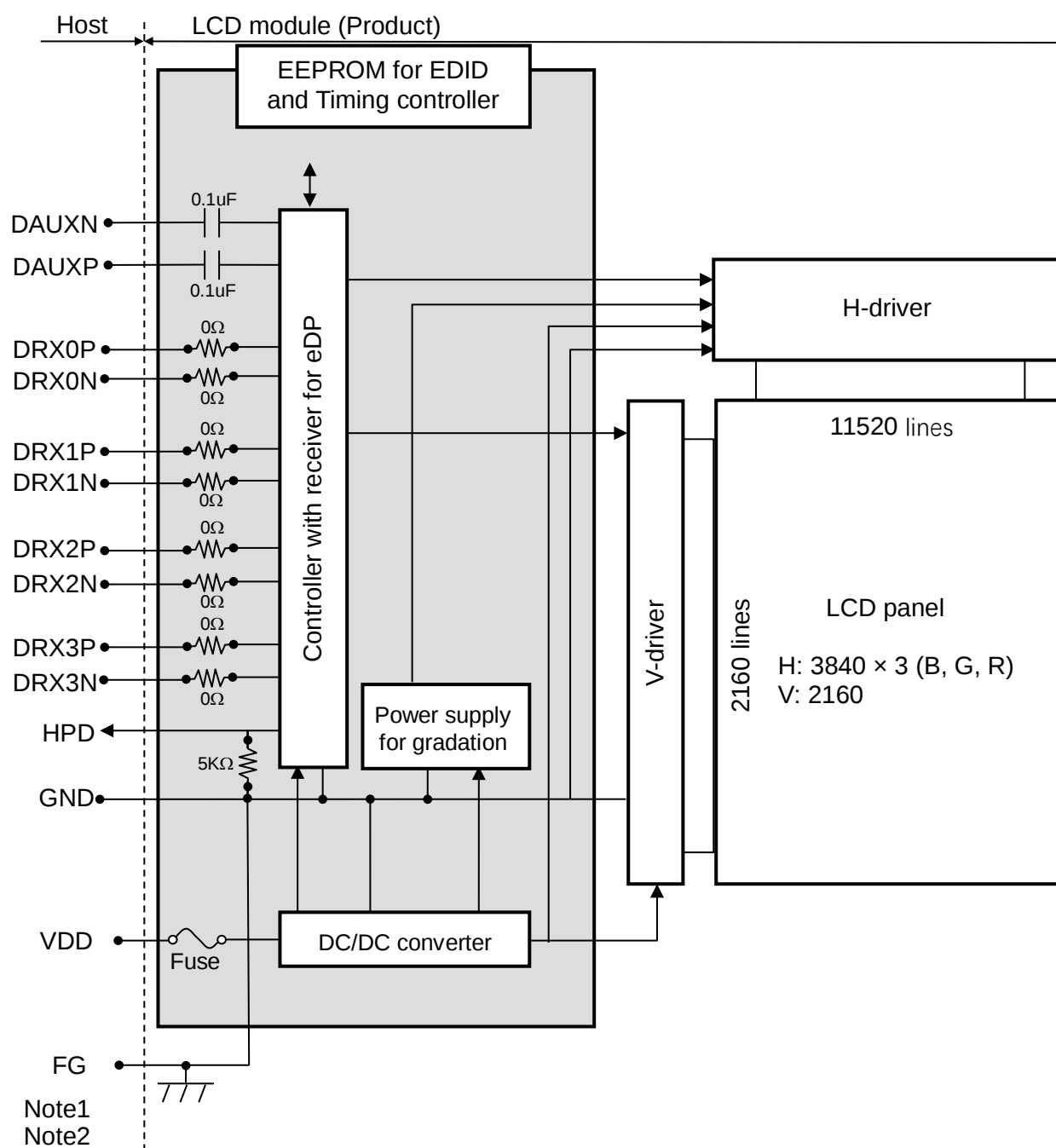


Figure 5.4.1 LCD Module Block Diagram

6. LCM Timing Characteristics

6.1 Display port main link Receiver Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock (down spreading)	-	0	-	0.5	%	
SSC modulation frequency	-	30	-	33	KHz	
Differential peak-to-peak input voltage at package pins	$V_{RX-DIFFP-P}$	100	-	1320	mV	
Rx input DC common mode voltage	V_{CM}	0	-	2	V	
Differential termination resistance	-	80	-	120	Ohm	
Single-ended termination resistance	-	40	-	60	Ohm	
Rx short circuit current limit	-	-	-	50	mA	
RX intra-pair skew tolerance at HBR	-	-	-	60	ps	

Table 6.1.1 DisplayPort™ Main Link Receiver Characteristics

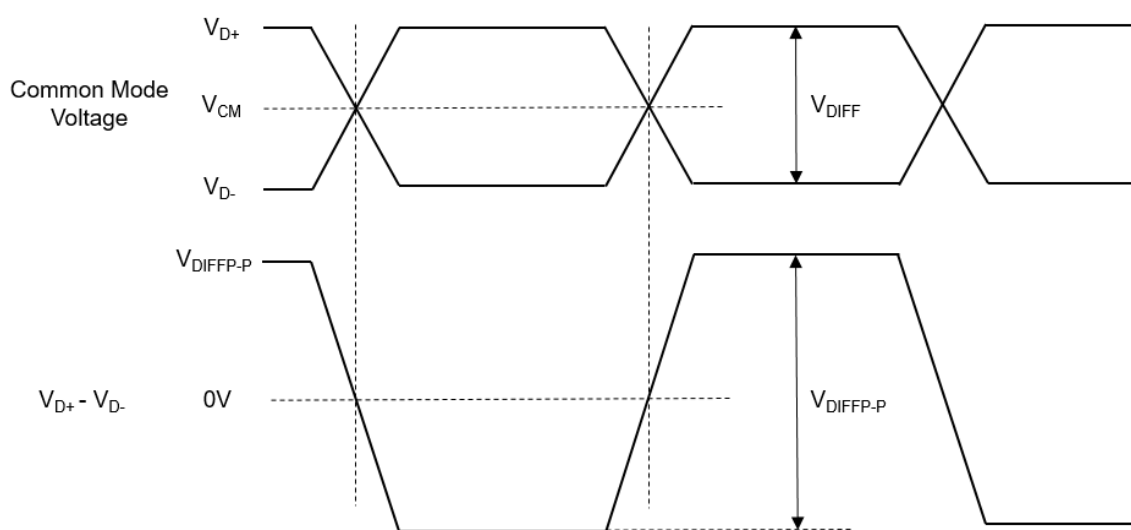


Figure 6.1.1 Definition of Differential Voltage and Differential Voltage Peak-to-Peak

Note: D+ are DRX0P、DRX1P、DRX2P、DRX3P ;
D- are DRX0N、DRX1N、DRX2N、DRX3N

6.2 Display port AUX channel characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Remark
AUX unit interval	UIAUX	0.4	-	0.6	us	
Number of pre-charge pulse	Nprecharge	10	-	16	times	
AUX CH bus park time	TAUX-BUS-PARK	10	-	-	ns	
Max cycle-to-cycle output jitter within a single transaction	TAUX-TX-JITTER	-	-	0.04	UI	
Max allowable cycle-to-cycle input jitter within a single transaction	TAUX-RX-JITTER	-	-	0.05	UI	
AUX peak-to-peak output differential voltage	VAUX-TX-DIFF p-p	0.18	-	1.38	V	
AUX peak-to-peak input differential voltage	VAUX-RX-DIFF p-p	0.14	-	1.36	V	
AUX CH termination DC resistance	RAUX-TERM	-	100	-	Ω	differential resistance
AUX DC common mode voltage	VAUX-DC-CM	0	-	2	V	
AUX turn around common mode voltage	VAUX-TURN-CM	-	-	0.4	V	
AUX AC-coupling capacitor	C_AUX	75	-	200	nF	The AUX CH ACcoupling Capacitor placed on both the eDP upstream and downstream devices.
AUX short circuit current limit	IAUX-SHORT	-	-	90	mA	

Table 6.2.1 Displayport™ AUX channel characteristics

6.3 Timing characteristics

(Note1)

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency	1/tc	524.48	533.28	561.69	MHz	(1.875) ns (typ.)
	Duty ratio	-	-				
	Rise time, Fall time	-					
DE	Horizontal	Cycle	th	-	7.50	-	μ s
				3950	4,000	4088	CLK
	Vertical (One frame)	Display period	thd	3840			(133.3) kHz (typ.)
		Cycle	tv	-	16.67	-	ms
				2213	2222	2290	H
		Display period	tvd	2160			-

Table 6.3.1 Timing characteristics

Note1: Definition of parameters is as follows.

tc= 1CLK, th= 1H

6.4 Input signal timing chart

Horizontal timing

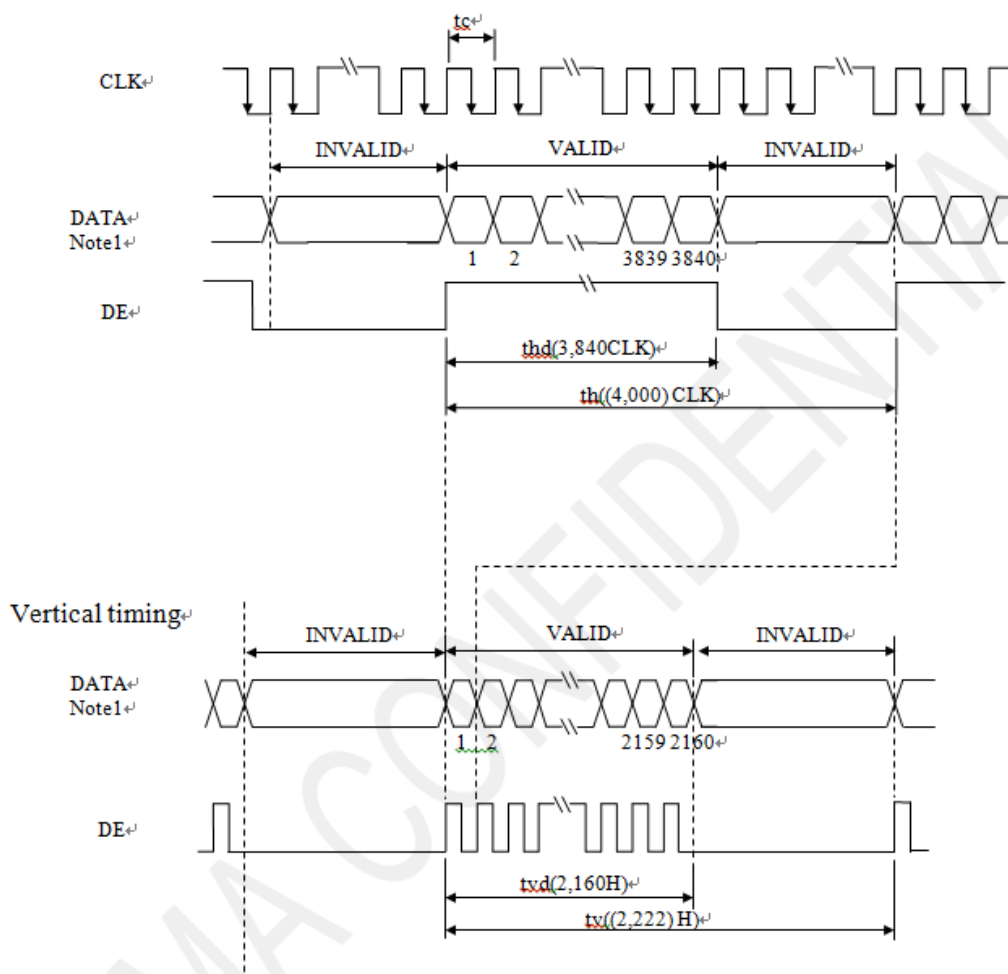


Figure6.4.1 Input signal timing chart

Note1: DATA = RA0-RA7, GA0-GA7, BA0-BA7,
RB0-RB7, GB0-GB7, BB0-BB7,
RC0-RC7, GC0-GC7, BC0-BC7,
RD0-RD7, GD0-GD7, BD0-BD7

7. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	$CR \geq 10$	80	88	-	degree	Note2,3
	θB		80	88	-		
	θL		80	88	-		
	θR		80	88	-		
Contrast Ratio	CR	$\theta=0^{\circ}$	1000	1200	-		Note 3
		$\Phi 45, \theta 45$	300	400			
		$\Phi 135, \theta 45$	300	400			
		$\Phi 225, \theta 45$	300	400			
		$\Phi 315, \theta 45$	300	400			
Response Time	T_{ON}	25°C	-		35	ms	Note 4
	T_{OFF}						
Chromaticity	White	x	Backlight is on	TBD	TBD	TBD	Note 1,5
		y		TBD	TBD	TBD	
	Red	x		TBD	TBD	TBD	Note 1,5
		y		TBD	TBD	TBD	
	Green	x		TBD	TBD	TBD	Note 1,5
		y		TBD	TBD	TBD	
	Blue	x		TBD	TBD	TBD	Note 1,5
		y		TBD	TBD	TBD	
Uniformity	U		70	75	-	%	Note 6
NTSC	-		65	70	-	%	Note 5
Luminance	L			1300		cd/m ²	Note 7

Table 7.1 Optical Parameters

Test Conditions:

1. $I_F = 1400$ mA, and 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.

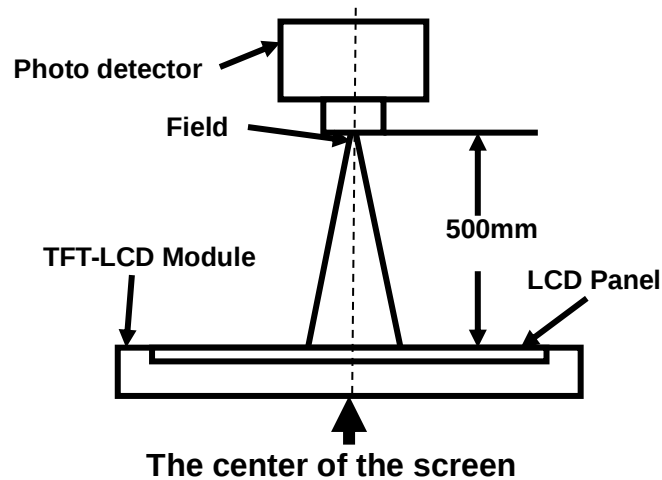


Fig1. Measurement Set Up

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

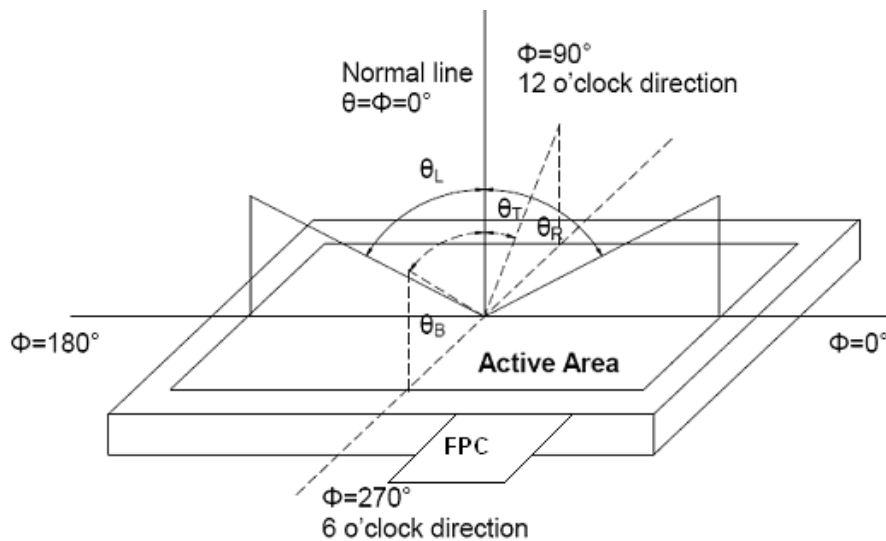


Fig2. Measurement viewing angle

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

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%.

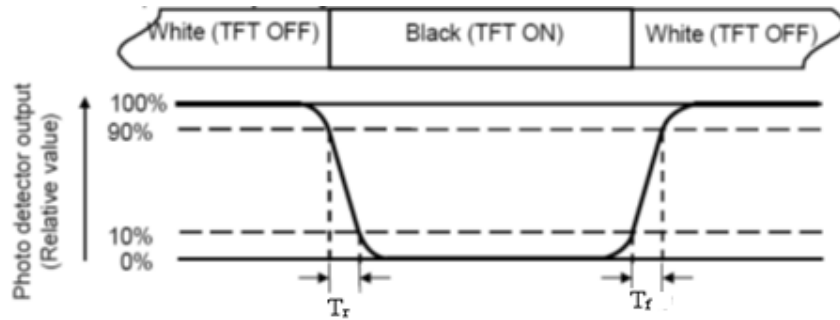


Fig3. Response Time Testing(TN)

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%.

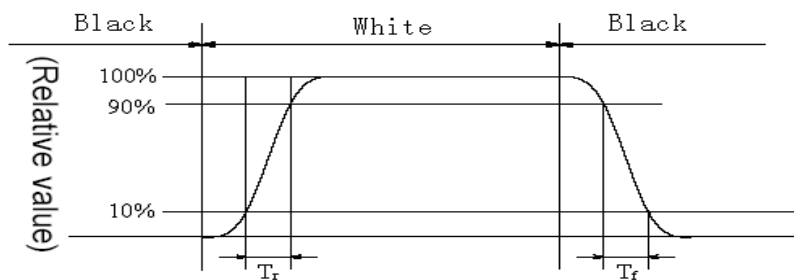


Fig4. Response Time Testing(SFT)

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

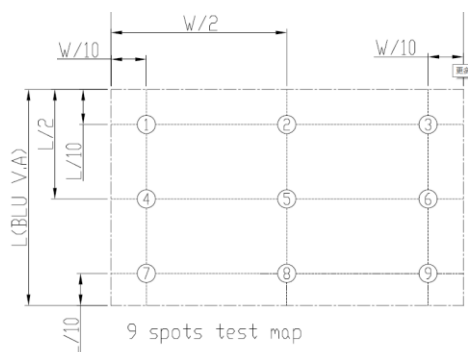


Fig5. Luminance Uniformity Measurement Locations(9 points)

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	Storage at High Temperature and Humidity(non-operation)	+60℃ , 90%RH , 240H	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃ , 30min~80℃ , 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 : ±8kv , 5times ; Contact : ±4kv , 5times ; (Environment : 15℃~35℃ , 30%~60% , 86Kpa~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006
8	Shock Test	Half Sine Wave 100G ,6ms,±X,±Y,±Z 3times for each direction	GB_T2423.5-1995
9	Package Vibration	5-20-200HZ , PSD : 0.01-0.01-0.001 Total:0.781g2/HZ,x/y/z 30min)	
10	Package Drop Test	Height: X cm,1 corner, 3edges, 6 surfaces Note : X > 10Kg:60cm ; ≤10Kg:80cm	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.

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10. Packing Instruction

TBD

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.