

PRODUCT SPECIFICATION **FOR LCD MODULE**

Revision: 1.0

Model No: LS1010I11-E-V1

Module Type: COG+FPC+B/L

APPROVED SIGNATURE

- ☒ Approved Product Specification only
- ☐ Approved Product Specification and Samples

<u>Prepared By</u>	<u>Checked By</u>	<u>Approved By</u>

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1. General Description

LS1010I11-E-V1 is a Color Active Matrix Liquid Crystal Display composed of a TFT LCD panel, a driver circuit, and LED backlight system. The screen format is intended to support the 16:10 WUXGA, 1,920(H) x1,200(V) screen and 16.7M colors (RGB 6bits + Hi-FRC) with LED backlight driving circuit. All input signals are eDP interface compatible.

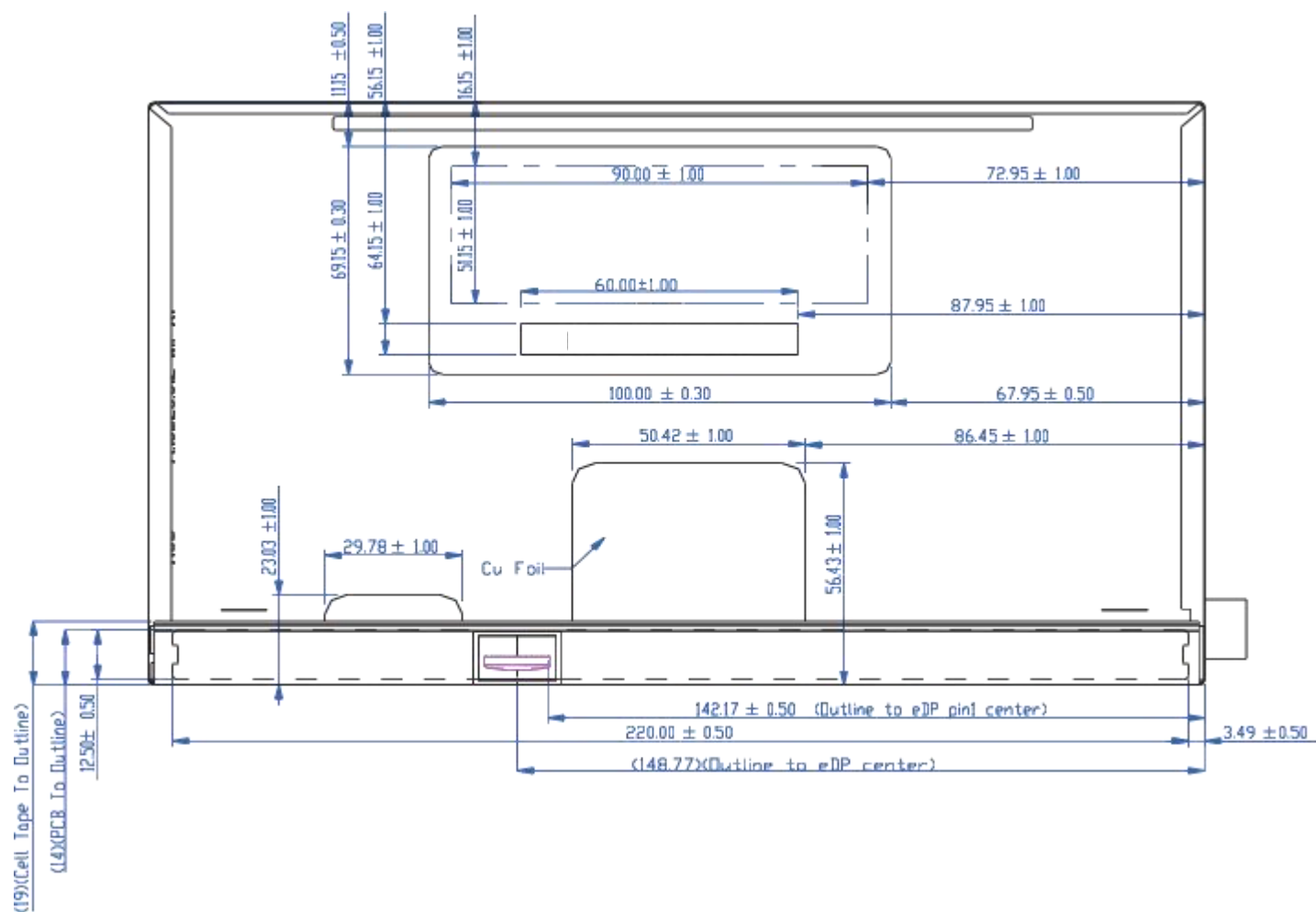
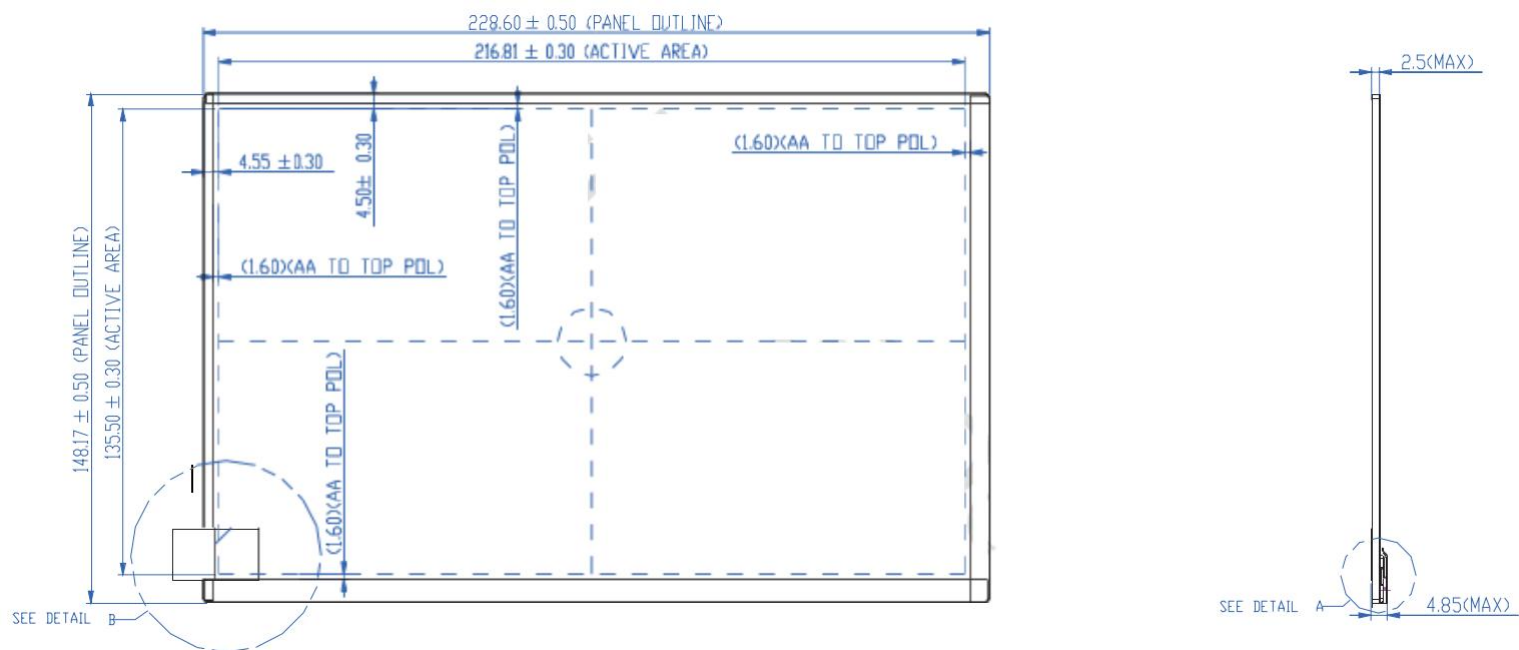
2. Physical Features

Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 1920(RGB)×1200 Dot-matrix
Input Data	EDP
Viewing Direction (Grayscale Inversion)	Free (IPS)

3. Mechanical Specification

Item	Specification	Unit
Module size (H×V×D)	228.6 ×148.17 ×4.85	mm
Number of dots	1920(RGB) ×1200	pixel
Active area (H×V)	216.81×135.5	mm

4. Outline Dimension

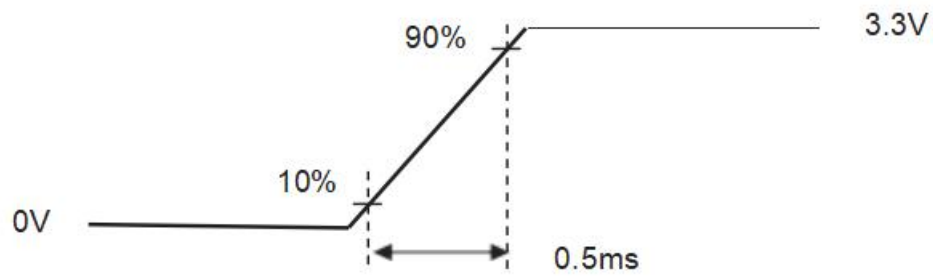
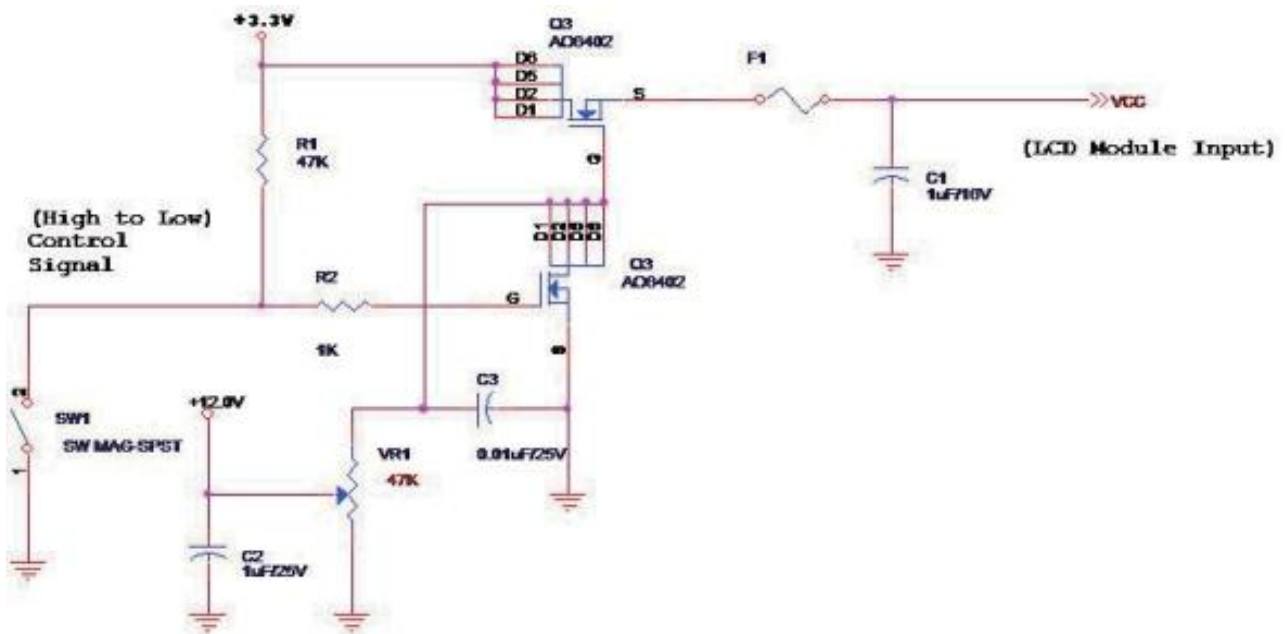


5. Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Remark
Logic/LCD Drive Voltage	Vin	-0.3	4.0	V	Note1 Note2
Operating Temperature	TOP	-0	+50	°C	
Operation Humidity	HOP	5	95	%RH	
Storage Temperature	TST	-20	+60	°C	
Storage Humidity	HST	5	95	%RH	

6. Electrical Characteristics

Symble	Parameter	Min	Typ	Max	Units	Note
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	Note3
PDD	VDD Power	--	-	1.15	[Watt]	
IDD	IDD Current	-	318	350	[mA]	
I Rush	Inrush Current	-	-	2000	[mA]	
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	



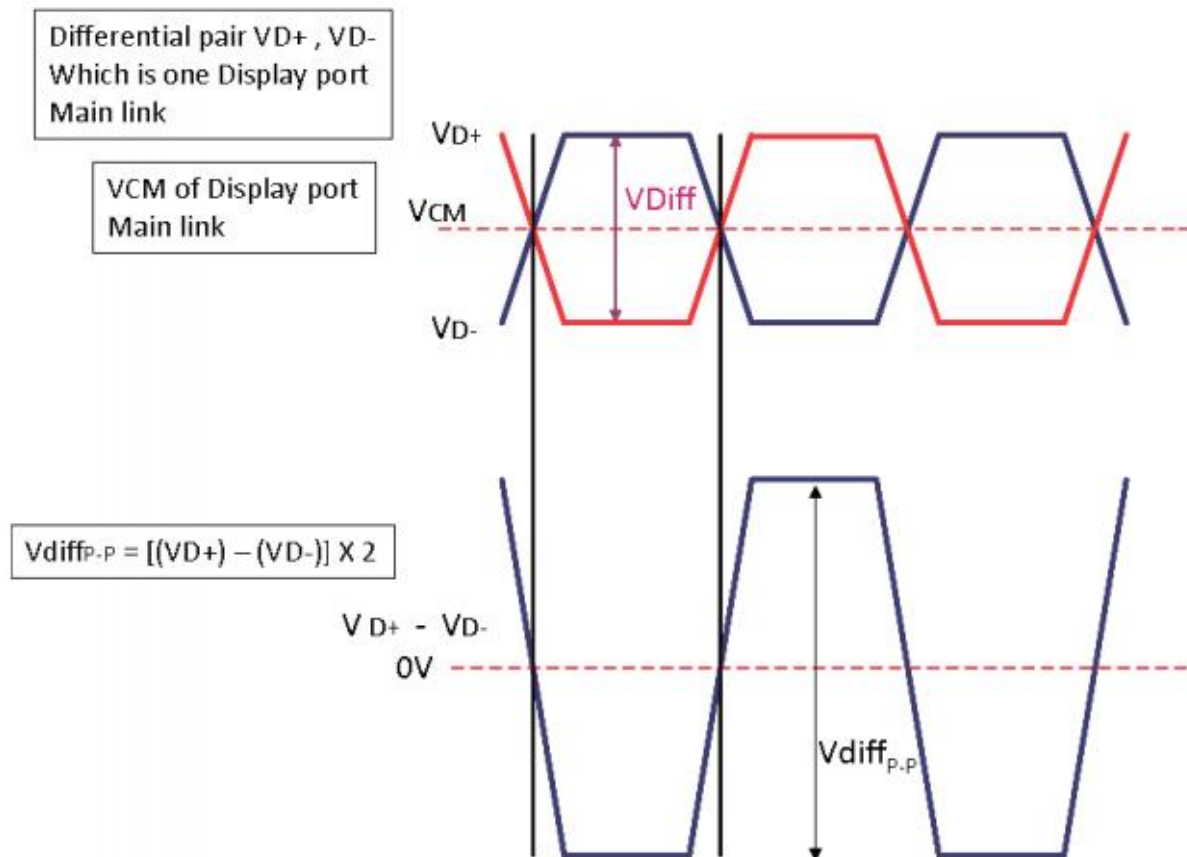
V_{in} rising time

6.1 Signal Electrical Characteristics

Input signals shall be low or High-impedance state when VDD is off.

Signal electrical characteristics are as follows;

Display Port main link signal:

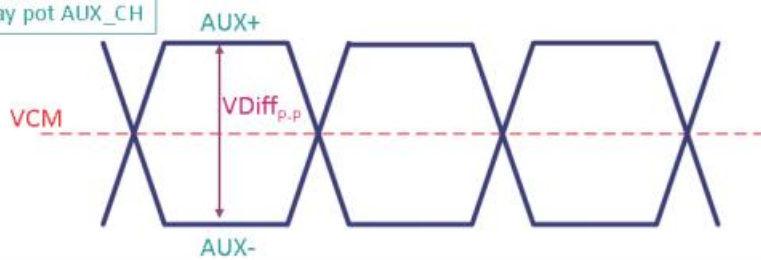


Display port main link					
		Min	Typ	Max	unit
VCM	RX input DC Common Mode Voltage		0		V
VDiff _{p-p}	Peak-to-peak Voltage at a receiving Device	100		1320	mV

Follow as VESA display port standard V1.3

Display Port AUX_CH signal:

Differential AUX+ , AUX-
Which is Display port AUX_CH



Display port AUX_CH					
		Min	Typ	Max	unit
VCM	AUX DC Common Mode Voltage		0		V
VDiff _{p-p}	AUX Peak-to-peak Voltage at a receiving Device	0.4	0.6	0.8	V

Follow as VESA display port standard V1.3.

Display Port VHPD signal:

Display port VHPD					
		Min	Typ	Max	unit
VHPD	HPD Voltage	2.25		3.6	V

Follow as VESA display port standard V1.3.

6.2 Backlight Unit

Parameter	Symbol	Min	Typ	Max	Units	Condition
Backlight Power Consumption	PLED	–	–	2.45	[Watt]	(Ta=25℃), Note 1
LED Life-Time	N/A	15,000		–	Hour	(Ta=25℃), Note 2 IF=20.5 mA

Note 1: Calculator value for reference $P_{LED} = V_F$ (Normal Distribution) * I_F (Normal Distribution) / Efficiency and depends on system LED driver design.

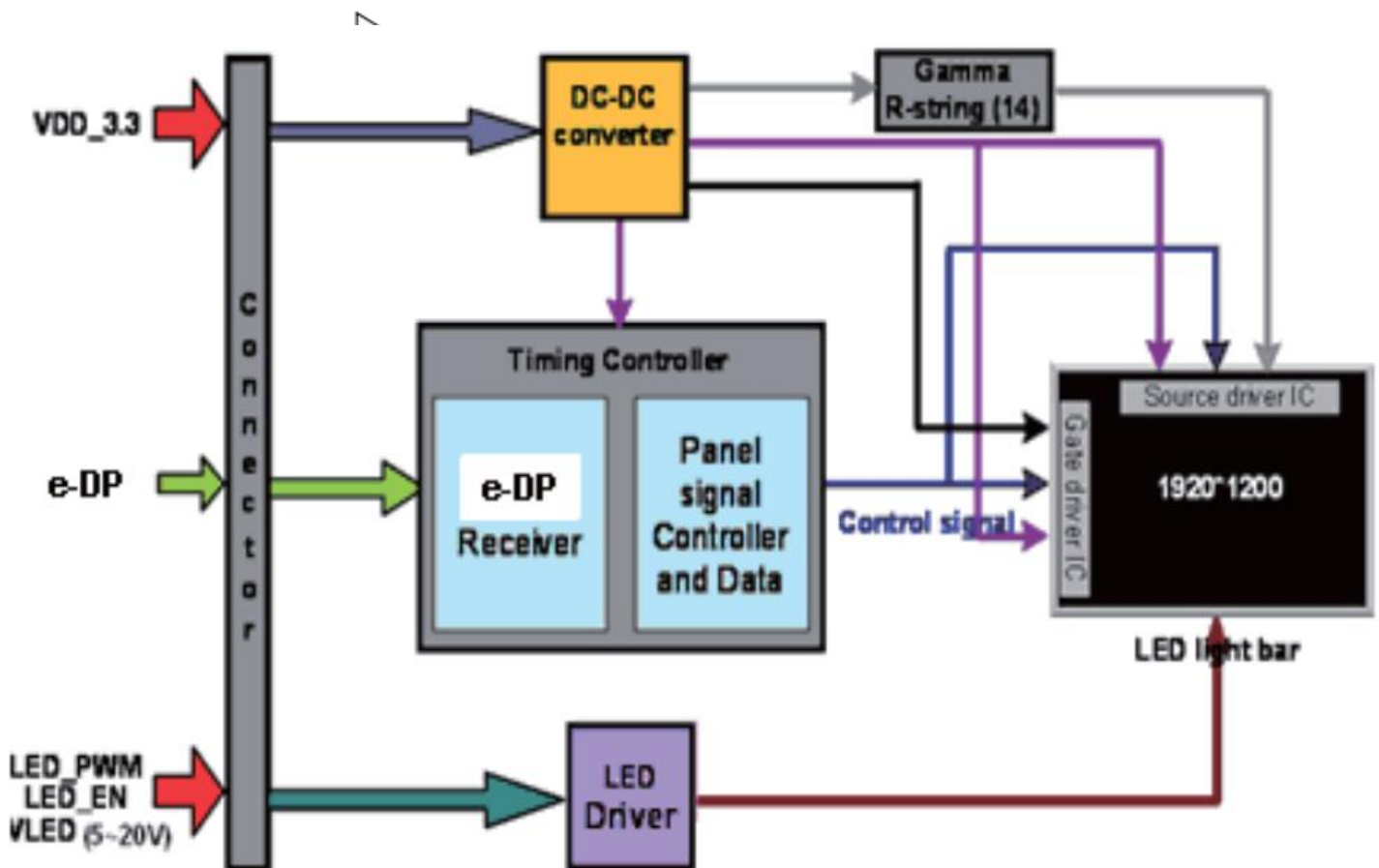
Note 2: The LED life-time define as the estimated time to 50% degradton of initial luminous.

Backlight input signal characteristics

Parameter	Symbol	Min	Typ	Max	Units	Remark
LED Power Supply	VLED (Note 1)	5		20	[Volt]	Define as Connector Interface (Ta=25℃)
LED Enable Input High Level	VLED_EN	2.5	-	5.5	[Volt]	
LED Enable Input Low Level		-	-	0.8	[Volt]	
PWM Logic Input High Level	VPWM_EN	2.5	-	5.5	[Volt]	
Low Level		-	-	0.8	[Volt]	
PWM Input Frequency	FPWM	200		20K	Hz	
PWM Duty Ratio	Duty	5		100	%	

7. Module Function Description

7- 1. Block Diagram Of LCM

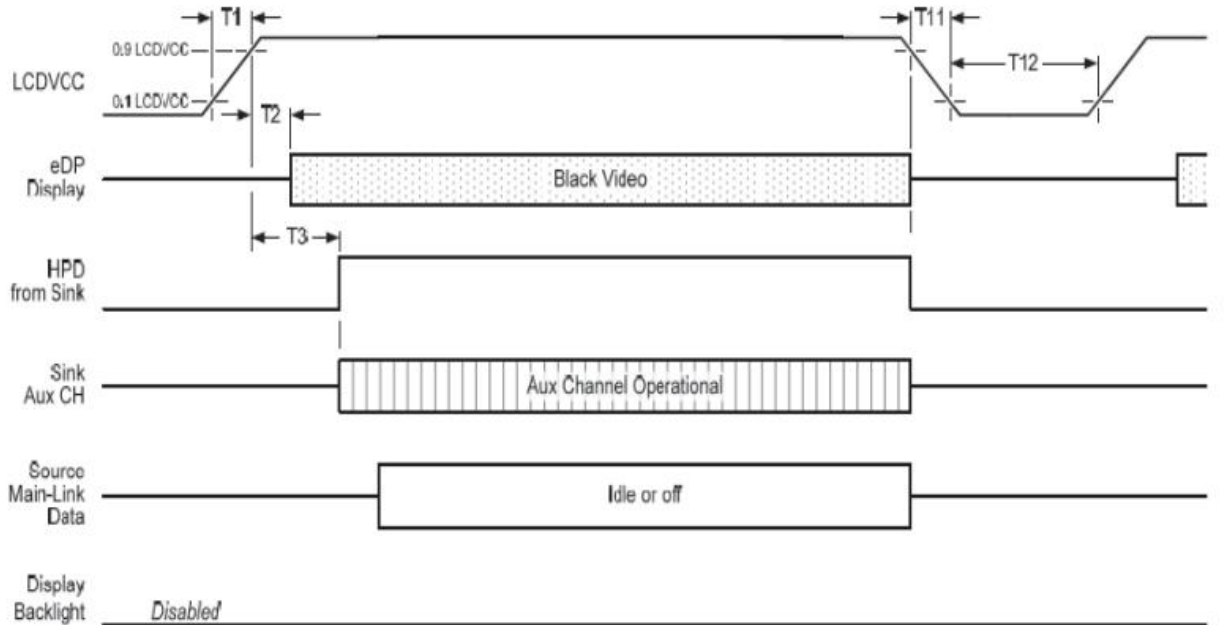


7-2. Pin Description

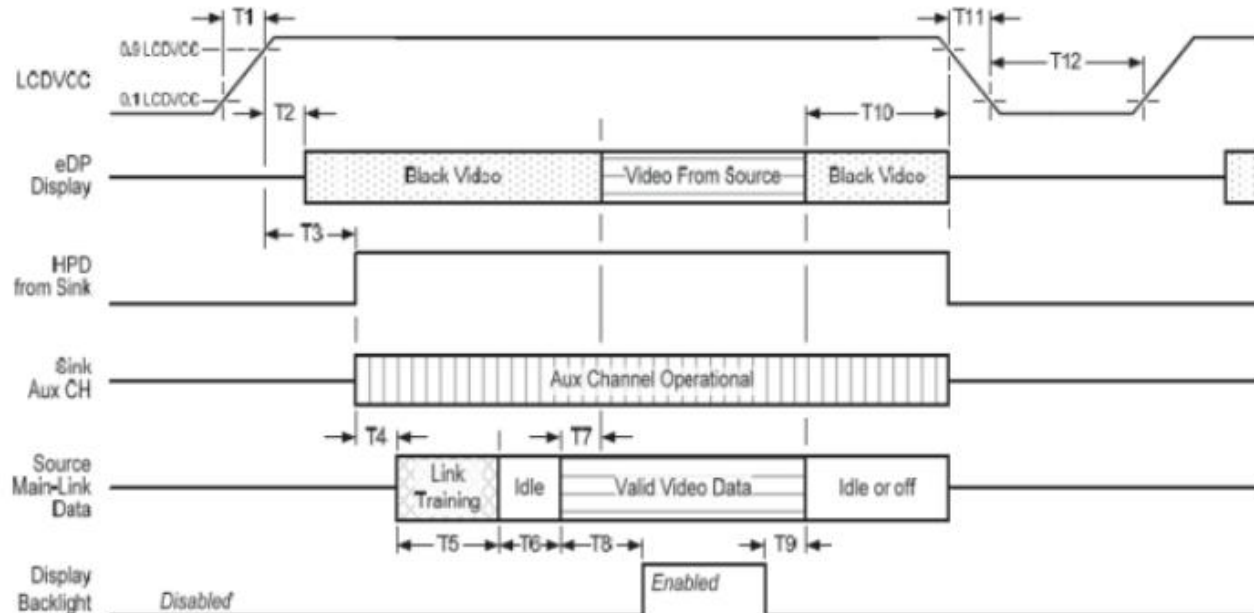
No.	Pin name	Description
1	H_GND	High Speed Ground
2	Lane1_N	Complement Signal Link Lane 1
3	Lane1_P	True Signal Link Lane 1
4	H_GND	High Speed Ground
5	Lane0_N	Complement Signal Link Lane 0
6	Lane0_P	True Signal Link Lane 0
7	H_GND	High Speed Ground
8	AUX_CH_P	True signal Auxiliary Channel
9	AUX_CH_N	Complement Signal Auxiliary Channel
10	H_GND	High Speed Ground
11	NC	No Connection
12	NC	No Connection
13	LCD_VCC	LCD logic and driver power
14	LCD_VCC	LCD logic and driver power
15	LCD_VCC	LCD logic and driver power
16	LCD_VCC	LCD logic and driver power
17	LCD_Self_Test or NC	LCD Panel Self-Test Enable (optional)
18	NC	No Connection
19	NC	No Connection
20	LCD_GND	LCD logic and driver ground
21	LCD_GND	LCD logic and driver ground
22	HPD	HPD signal pin
23	BL_GND	Backlight ground
24	BL_GND	Backlight ground
25	BL_GND	Backlight ground
26	BL_GND	Backlight ground
27	NC	No Connection
28	NC	No Connection
29	BL_ENABLE or NC	Backlight On/Off (optional)
30	BL_PWM_DIM or NC	System PWM signal input for dimming (optional)
31	NC	No Connection
32	NC	No Connection
33	NC-RESERVED	Reserved for LCD manufacturer's use
34	NC-RESERVED	Reserved for LCD manufacturer's use
35	NC	No Connection
36	NC	No Connection
37	BL_PWR	Backlight power
38	BL_PWR	Backlight power
39	BL_PWR	Backlight power
40	BL_PWR	Backlight power

7-3 Timing Characteristics

Display Port AUX_CH transaction only:



Display Port panel power sequence:



Display port interface power up/down sequence, normal system operation

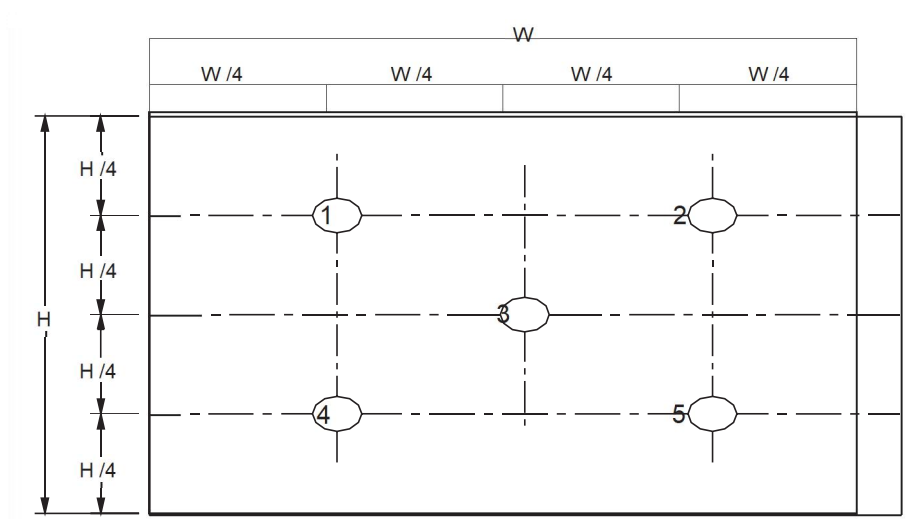
Basically, interface timings should match the 1920x1200 /60Hz manufacturing guide line timing.

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		---	--	60	---	Hz
Clock frequency		1/ T _{Clock}		TBD		MHz
Vertical Section	Period	T _V	1087	TBD	1200	T _{Line} 1000000
	Active	T _{VD}	1200			
	Blanking	T _{VB}	4	TBD	2000	
Horizontal Section	Period	T _H	2040	TBD	2500	T _{Clock}
	Active	T _{HD}	1920			
	Blanking	T _{HB}	80	TBD		

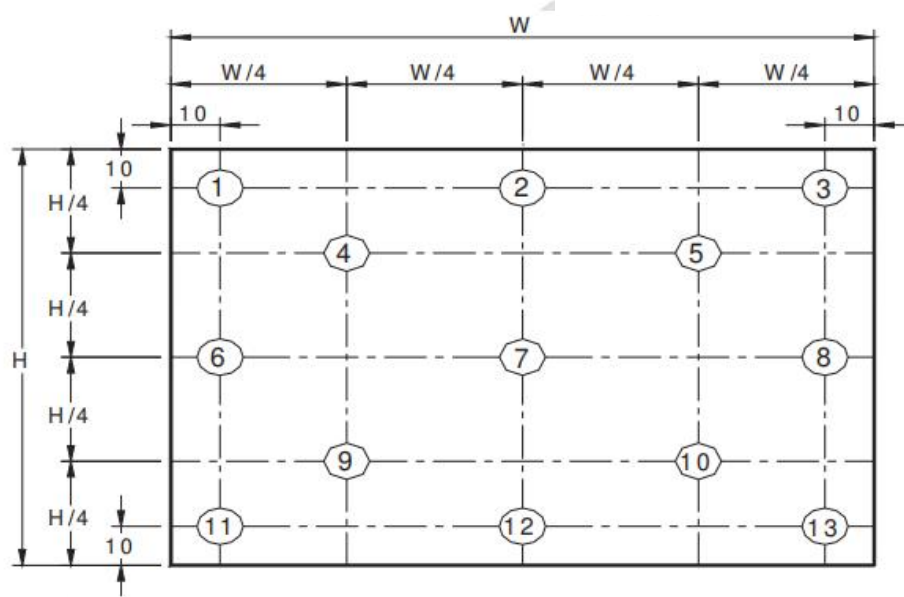
8. Electro-Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time		Tr +Tf	$\theta_x = \theta_y = 0$	---	25	35	ms	Note 1
Contrast Ratio		CR		600	800	---	---	Note 2
Color Chromaticity (CIE1931)	White	W x	$\theta_x = \theta_y = 0$	---	0.313	---	---	
		W y		---	0.329	---	---	
Viewing angle	θ_T		CR > 10	---	85	---	Deg.	Note 3
	θ_B			---	85	---		
	θ_L			---	85	---		
	θ_R			---	85	---		
Luminance ($I_F = 20mA$)		L		340	400	---	cd/m2	Note4

Note 1: 5 points position (Ref: Active area)



Note 2: 13 points position (Ref: Active area)



Note 3: The luminance uniformity of 5 or 13 points is defined by dividing the maximum luminance values by the minimum test point luminance

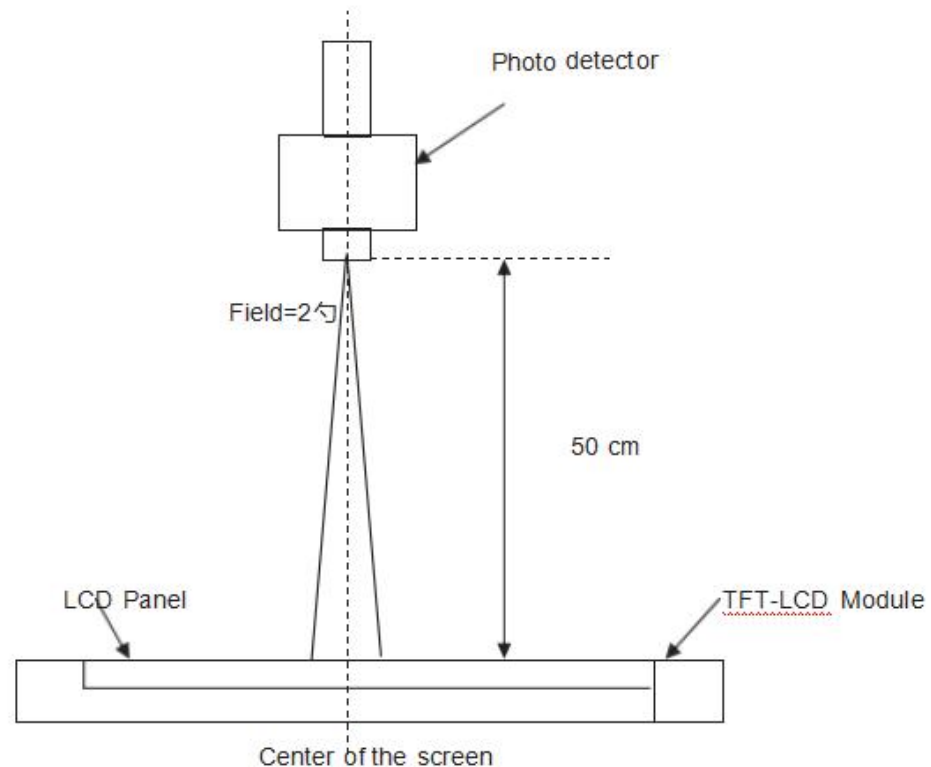
$$\delta_{W5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

$$\delta_{W13} = \frac{\text{Maximum Brightness of thirteen points}}{\text{Minimum Brightness of thirteen points}} - 1$$

Note 4: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting

Backlight for 30 minutes in a stable, windless and dark room, and it should be measured in the center of screen.



Note 5 : Definition of Average Luminance of White (Y_L):

Measure the luminance of gray level 63 at 5 points $\times Y_L = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (1).]

Note 6 : Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness-on-the "White" state}}{\text{Brightness-on-the "Black" state}}$$

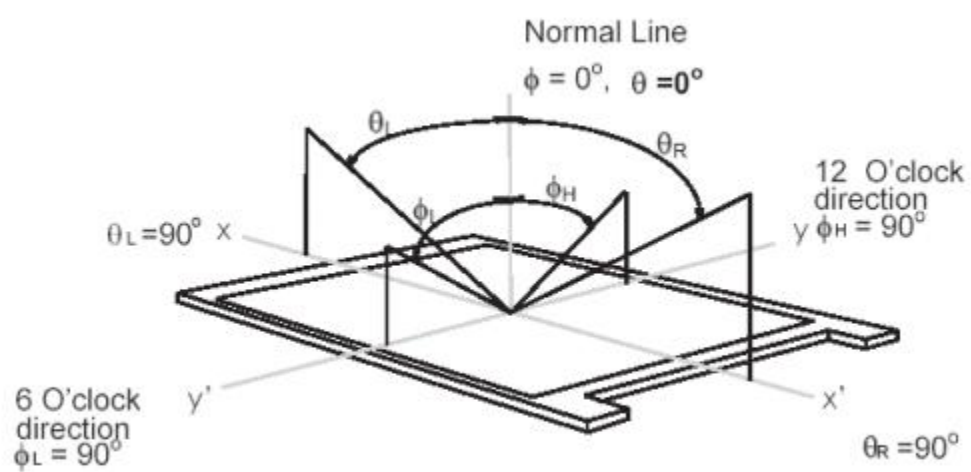
Note 7 : Definition of Cross Talk (CT)

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where

Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



9.Records Of Version

Version	Revise Date	Page	Content
00		ALL	New released