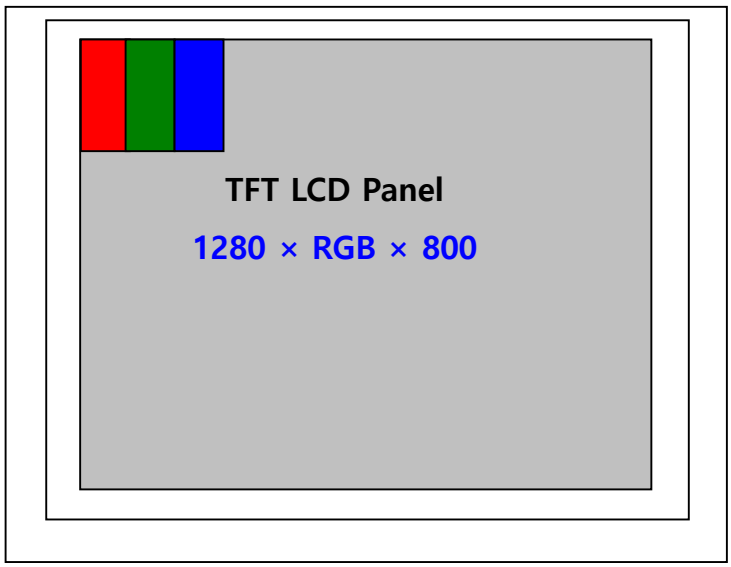
1.0 GENERAL DESCRIPTION

1.1 Introduction

GV121WXM-N80 is a color active matrix TFT LCD using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 12.1 inch diagonally measured active area with WXGA resolutions (1280 horizontal by 800 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors.



1.2 Features

- GOA + dual Gate Design

1.3 Application

- HMI

1.4 General Specification

<Table 1. LCD Module Specifications>

Parameter	Specification	Unit	Remarks
LCD Size	12.1	inch	-
Active area	262.656(H)x164.16(V)	mm	-
Number of pixels	1280(H)x800(V)	pixels	-
Pixel pitch	0.2052(H)x0.2052(V)	mm	-
Pixel arrangement	RGB	-	-
Display colors	16.7M	colors	-
Display mode	Normal black	-	-
LCM Outline Dimension	278.00±0.5(W)×184.00±0.5(V) × 6.76(Max)	mm	9.91(Max)@PCB
Transmittance	6.0%	-	W/o APF
Color Gamut	Typ. 50% Min.45%	-	-
Inversion Type	2 dot inversion	-	Dual Gate
Response Time	Typ. 30ms, Max. 35ms	ms	
Power Consumption (TYP) @White pattern	Panel Power: 5.9W(含BLU) BLU Power: 5.1 W(Typ.)	W	
CR	Typ:1000 Min:800		
Brightness	Typ:450 Min:360	nits	9P
Brightness Uniformity	Typ:75% Min:70%	-	L255 @9P
Viewing angle (CR≧10)	Typ:85/85/85/85	-	Min：75
LCM Weight	535±5%	gram	
Driver IC	HX8245-E04*2	-	
Upper pol size	267.256×168.01（±0.2）	mm	HC
Lower pol size	267.256×168.11（±0.2）	mm	AG25
Interface	LVDS	-	
Crosstalk	<=2%	-	

2.0 ELECTRICAL SPECIFICATIONS

2.1 TFT LCD Module

< Table 1 . LCD Module Electrical Specifications > [Ta =25±2 ℃]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	Note 1
Power Supply Current	I_{DD}	-	350	450	mA	Note 1
Positive-going Input Thresh old Voltage	V_{IT+}	-	-	100	mV	V_{cm} = 1.2V typ.
Negative-going Input Thresh old Voltage	V_{IT-}	-100	-	-	mV	
Differential Input Voltage	V_{ID}	380	-	1200	mV	
Power Consumption	P_D	-	0.8	1	W	@white pattern
	P_{BL}	-	5.1	5.6	W	W/O Driver
	P_{total}	-	5.9	6.6	W	@white pattern

Notes :
1. The supply voltage is measured and specified at the interface connector of LCM. The current draw and power consumption specified is for 3.2V at 25 ℃ Max value at White Pattern
2. Calculated value for reference (VLED X ILED)

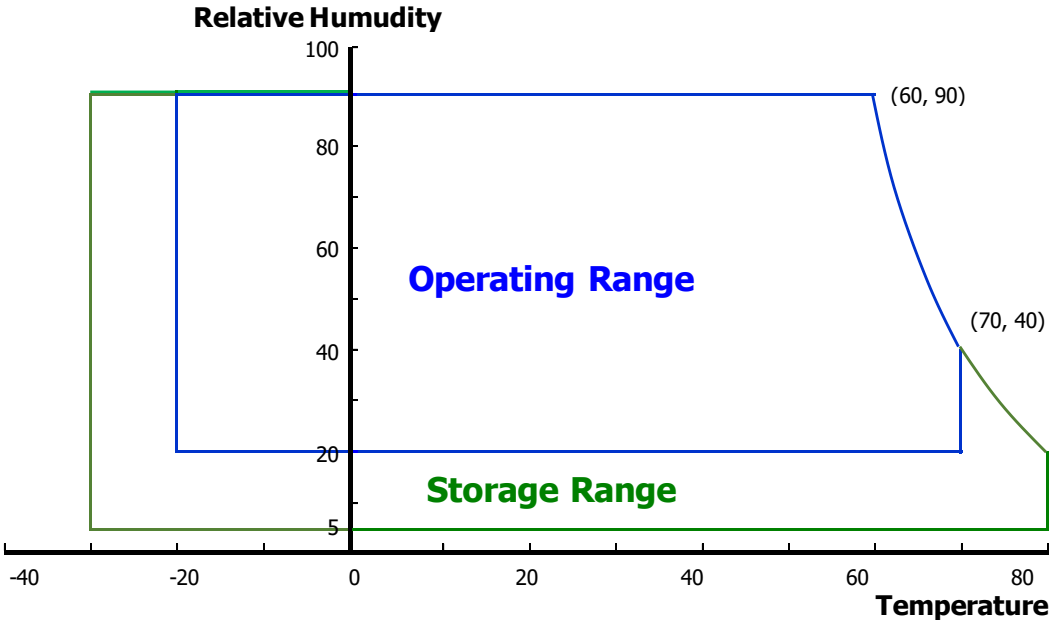
2.2 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2 . LCD Module Electrical Specifications > [Ta =25±2 ℃]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-0.3	4.2	V	Note 1
Logic Supply Voltage	V_{IN}	V_{ss}-0.3	V_{DD}+0.3	V	
BLU Supply Voltage	Vled	-0.3	12+1	V	
Operating Temperature	T_{OP}	-20	+70	℃	Note 1
Storage Temperature	T_{ST}	-30	+80	℃	

Note : 1 Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ℃ max. and no condensation of water.



2.3 Power Consumption of Backlight

Test Condition : ILED=60mA LED 24PCS
Warning: LCM Brightness must match Optical Spec requirement when ILED=60mA
Backlight Unit Schematic:

Item	Symbol	Value			Unit	Remark
		Min	Typ	Max		
Forward current	IBL	-	180	-	mA	Note 1
Power Consumption	PBL	-	5100	5600	mW	
LED Quantity		24			pcs	
LED Rank		Luminous Flux: 2800			mcd	

Note 1 : When ILED=60mA, the VBL must be in the range of above table specified.
The FPC wire resistance between LED+ and LED- must be less than 0.15ohm
PBL= ILED X VBL

2.4 INTERFACE CONNECTION

2.4.1 Module Input Signal & Power

- WTB interface : 30 Pin.(LS100-L30B-C23)

<Table 3. 1Display Interface>

Pin No.	Symbol	Description
1	VLED	LED Power supply(12V)
2	VLED	LED Power supply(12V)
3	VLED	LED Power supply(12V)
4	NC	Not connect
5	ENLED	Backlight enable
6	Dimming	LED PWM control
7	GND	Ground
8	NC	Not connect
9	VCC	LCM power supply (3.3V)
10	VCC	LCM power supply (3.3V)
11	NC	NC
12	GND	Ground
13	RX0-	LVDS signal
14	RX0+	LVDS signal
15	GND	Ground
16	RX1-	LVDS signal
17	RX1+	LVDS signal
18	GND	Ground
19	RX2-	LVDS signal
20	RX2+	LVDS signal
21	GND	Ground
22	RXCLK-	LVDS signal
23	RXCLK+	LVDS signal
24	GND	Ground
25	RX3-	LVDS signal
26	RX3+	LVDS signal
27	GND	Ground
28	NC	Not connect
29	GND	Ground
30	GND	Ground

2.5 SIGNAL TIMING SPECIFICATION

2.5.1 Signal timing

ITEM	Symbol		Min	Typ	Max	Unit	Note
CLK	Period	t_{CLK}	-	-	-	ns	
	Frequency	-	-	71.88	-	MHZ	
Hsync	Period	t_{HP}	-	1440	-	t_{CLK}	HBP:12 HFP:16
	Frequency	f_H	-	-	-	KHz	
Vsync	Period	t_{VP}	-	832	-	t_{HP}	VBP:70 VFP:70
	Frequency	f_V	-	60	-	Hz	
Horizontal Active Display Term	Valid	t_{HV}	-	1280	-	t_{CLK}	Hsyn:4
	Total	t_{HP}	-	1440	-	t_{CLK}	
Vertical Active Display Term	Valid	t_{VV}	-	800	-	t_{HP}	Vsyn:20
	Total	t_{VP}	-	832	-	t_{HP}	

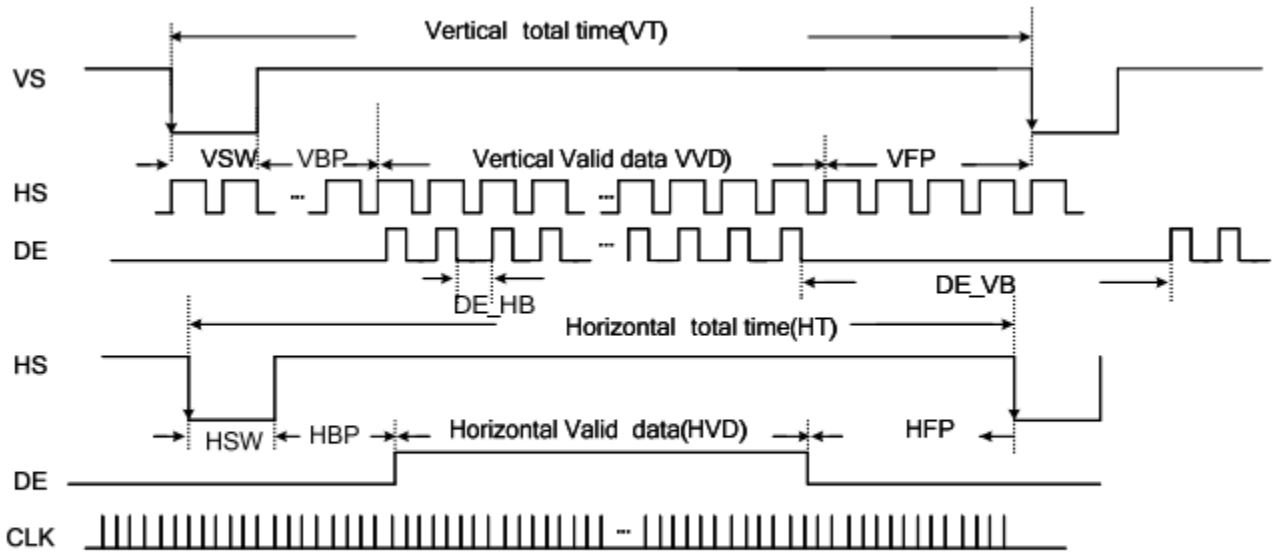
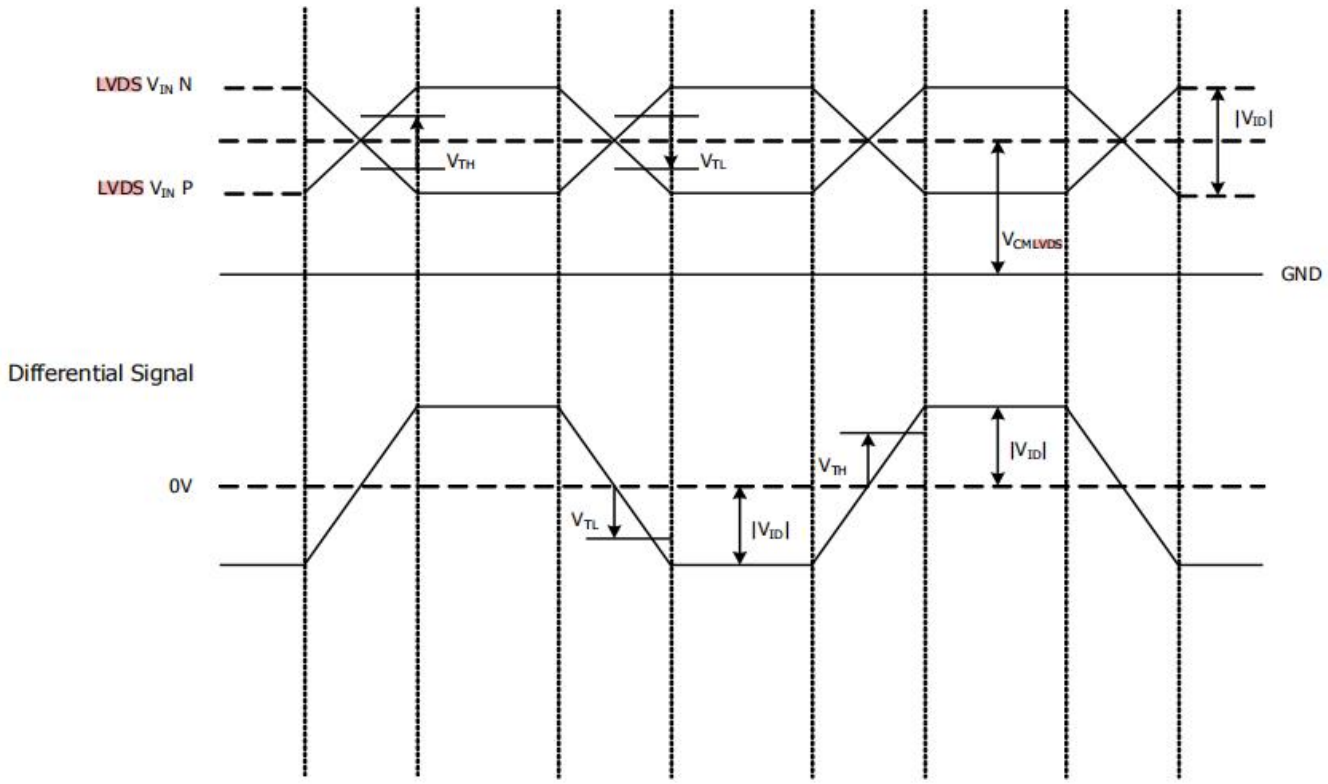


Figure 6.5: Input video signal format

2.5.2 LVDS Interface Timing Parameter

The specification of the LVDS interface timing parameter



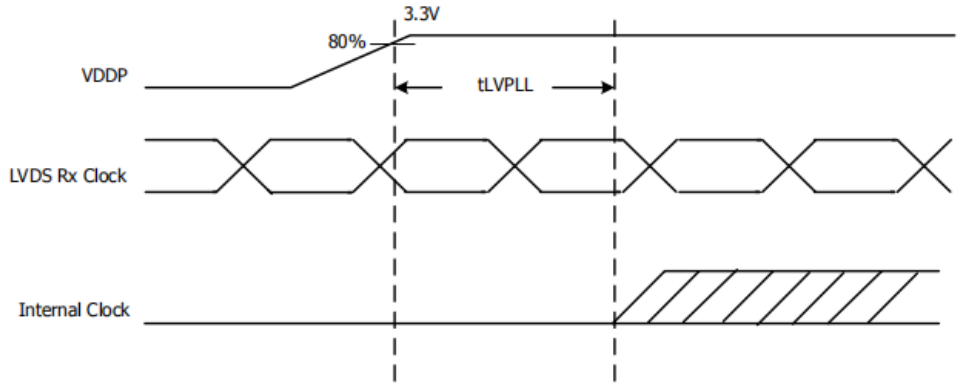
2.5.3 DC electrical character

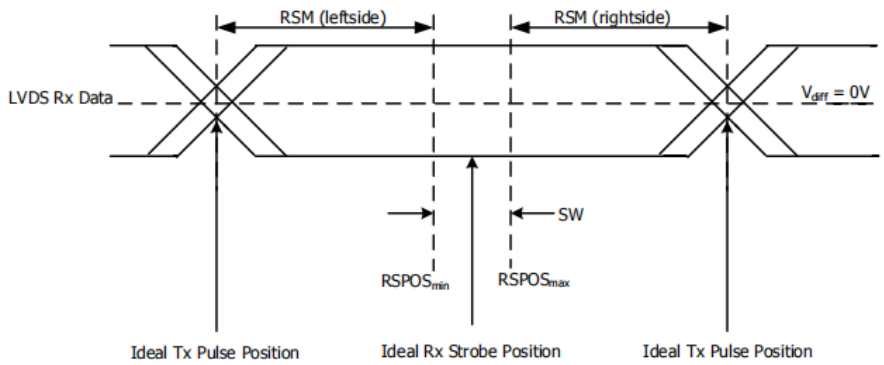
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
LVDS Input High Threshold	V_{TH}	V_{CMLVDS} = 1.2V			+100	mV
LVDS Input Low Threshold	V_{TL}	V_{CMLVDS} = 1.2V	-100			mV
Single-End Input Voltage Range	V_{IN}		0		VCC_LVDS	V
LVDS Input Common Mode Voltage	V_{CMLVDS}			1.2	VCC_LVDS-0.4-|VID|/2	V
Differential Input Voltage	$\|V_{ID}\|$		100		600	mV
Input Leakage Current	IN		-10		+10	μA

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Differential Output Voltage	VOD_MINI-LVDS Note	RL = 100 Ω		350		mV
Offset Voltage	VOS_MINI-LVDS Note			0.8/1.2		V
Output Current	|ID|			2.0		mA
Termination	RL			100		Ω

2.5.4 AC electrical character

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Clock Period	tLVCP		9.5	T	25	ns
Clock Frequency	1/tLVCP		40		105	MHz
Clock High Time	tLVCH			4T/7		ns
Clock Low Time	tLVCL			3T/7		ns
PLL Wake-Up Time	tLVPLL				1	ms
Strobe Width	tSW	V_{CMLVDS} =1.2V |VID|=400mV @65MHz	200			ps
Receiver Strobe Margin	tRSM		400			ps

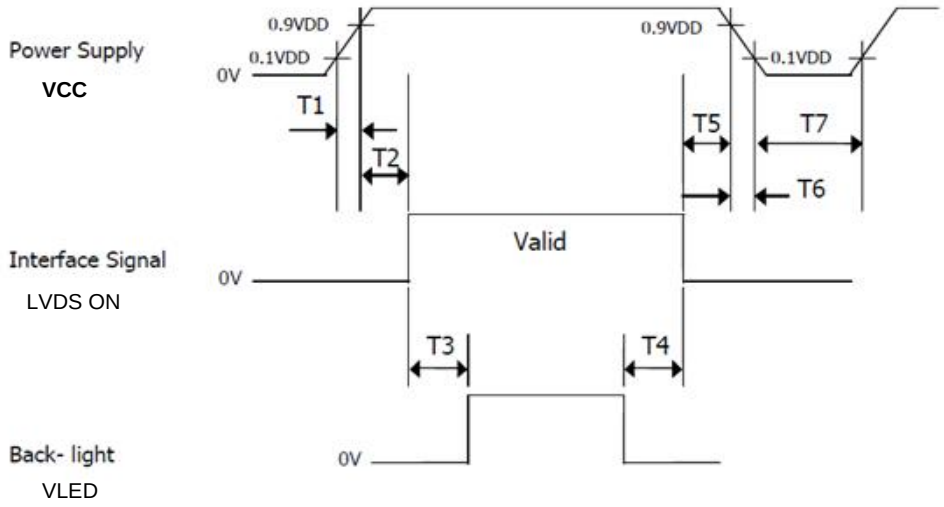




2.5.5 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below

Power-On/Off Timing Sequence:



Parameter	Values			Units
	Min	Typ	Max	
T1	0	-	10	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0.5	-	50	ms
T6	0	-	10	ms
T7	500	-	-	ms

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

3.0 Optical Specifications

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (CA-310、BM-5A) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to $\theta_{Ø=0}$ (=θ_3) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (= θ_{12}) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (= θ_9) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$(= θ_6) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 3.3V +/-10% at 25°C. Optimum viewing angle direction is 6 'clock.

Item		Symbol	Condition	Value			Unit	Note
				Min	Typ	Max		
luminance		Bp	θ=0 Φ=0	360	450	--	cd/m2	Note 3
Maximum Brightness of Black Pattern		Bblk		---	---	0.65	cd/m2	
Uniformity		△Bp		70	75	--	%	Note 4
Color Uniformity		△u'△ v'-A				TBD		
		△u'△ v'-B				TBD		
		△E*ab				TBD		
Viewing Angle	Left	θ_L	Cr≥10	75	85	--	deg	Note 1
	Right	θ_R		75	85	--		
	Top	ψ_T		75	85	--		
	Bottom	ψ_B		75	85	--		
Contrast Ratio		Cr	θ=0 Φ=0	8000	1000	--	-	Note 2
Response Time		Tr+Tf		--	30	35	ms	Note 6
		Tgray		-	45	55	ms	
Color Coordinate of CIE1931	Red	**x**	θ=0 Φ=0	0.561	0.591	0.621	-	Note 5
		y		0.324	0.354	0.384		
	Green	**x**		0.312	0.342	0.372		
		y		0.570	0.600	0.630		
	Blue	**x**		0.125	0.155	0.185		
		y		0.099	0.129	0.159		
	White	**x**		0.273	0.303	0.333		
		y		0.303	0.333	0.363		
NTSC Ratio		NTSC	CEI1931	45	50	55	%	

Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as luminance values of 1point average across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display. The luminance is measured by CA310 when the LED current is set at 16.8mA.

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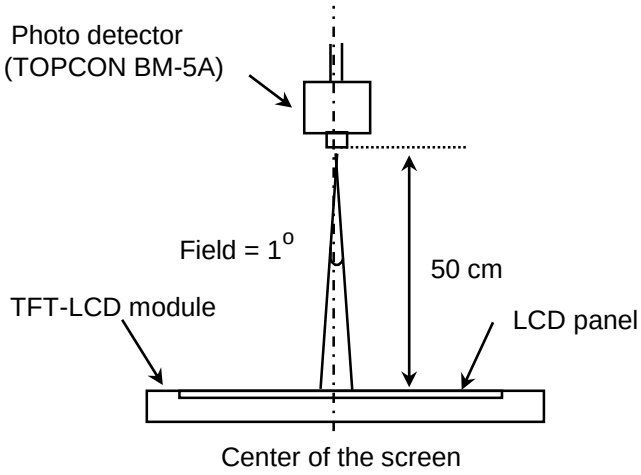
4. The White luminance uniformity on LCD surface is then expressed as : ΔY = Minimum Luminance of 13points / Maximum Luminance of 13points (see FIGURE 3).

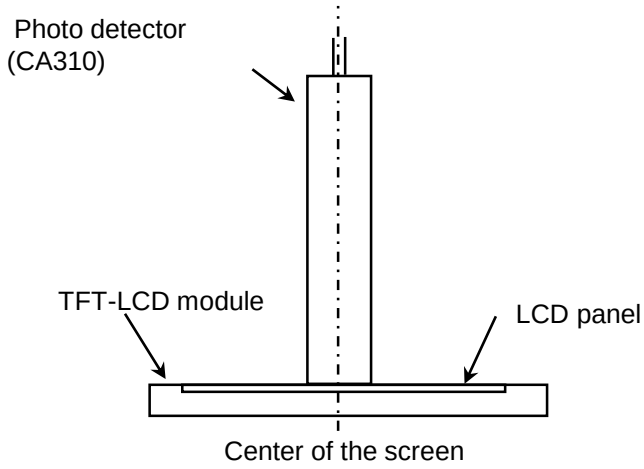
5. The color chromaticity coordinates specified shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

6. The color chromaticity coordinates specified shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

7. The electro-optical response time measurements shall be made as FIGURE 4 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

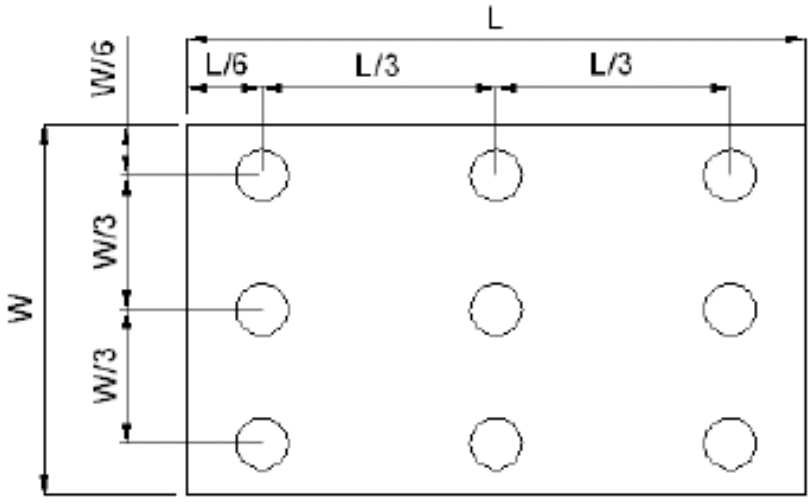
Figure 1. Measurement Set Up





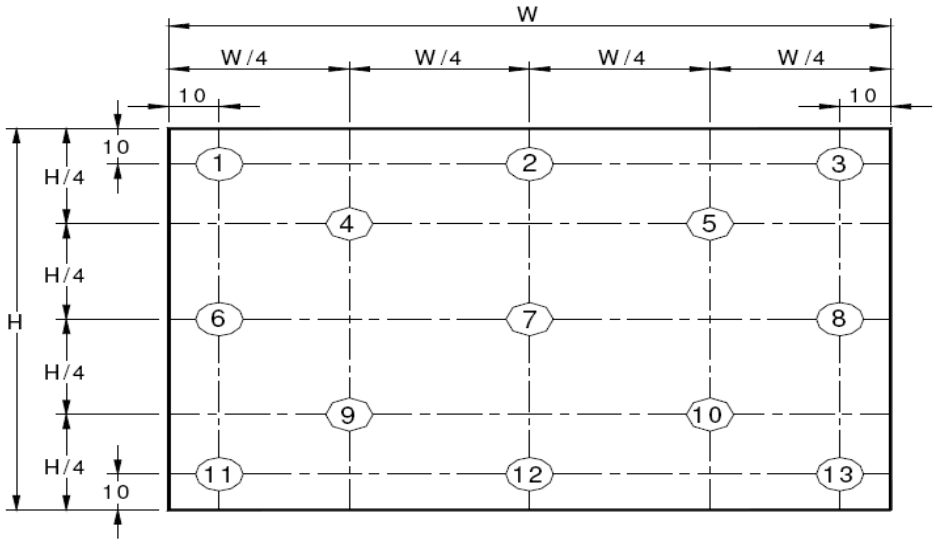
View angel range measurement setup Luminance , uniformity and color measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



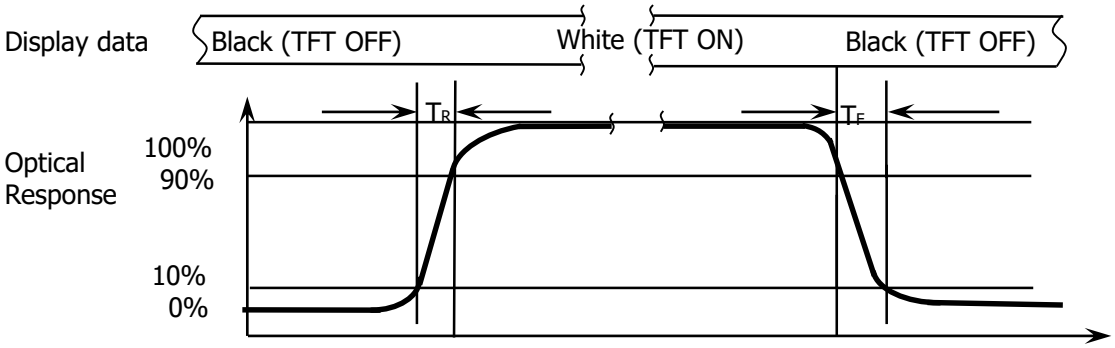
Center Luminance of white is defined as luminance values of center 5 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
The White luminance uniformity on LCD surface is then expressed as : ΔY9 = Minimum Luminance of 9points / Maximum Luminance of 9points (see FIGURE 2).

Figure 3. Uniformity Measurement Locations (13 points)



The White luminance uniformity on LCD surface is then expressed as : ΔY13 = Minimum Luminance of 13 points /Maximum Luminance of 13 points (see FIGURE 3).
The White luminance uniformity of 5 point is the same test method as 13 point u sing FIGURE 3.

Figure 4. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 3 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Td.