SPECIFICATION
FOR
APPROVAL

( ) **Preliminary Specification**

(●) **Final Specification**

Title	47.0" WUXGA TFT LCD

BUYER	LGE
MODEL	-

SUPPLIER	LG Display Co., Ltd.
*MODEL	LC470DUH
SUFFIX	PGF1

APPROVED BY	SIGNATURE / DATE
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Please return 1 copy for your confirmation with your signature and comments.

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LG Display Co., Ltd.

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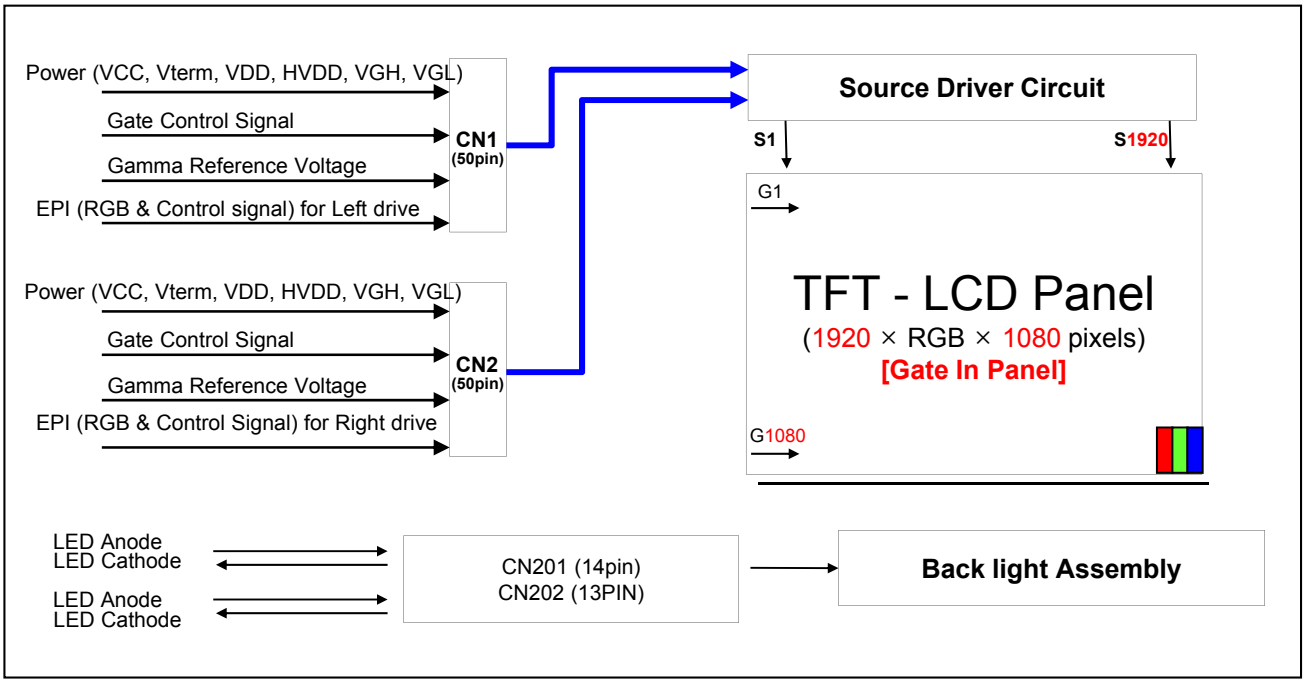
RECORD OF REVISIONS

Revision No.	Revision Date	Page	Description
0.1	Jul, 28, 2013	-	Preliminary Specification(First Draft)
0.2	Oct, 28, 2013	4,11	LCM Weight characteristic update
		21,22,23	Mechanical drawing update
1.0	Dec, 16, 2013	4	Updated General features.
		8	Updated Table 3 & Notes
		9,10	Updated CNT Specification.
		15	Updated Table 10.
		22,23	Updated 2D drawing.
		24	Updated Table 13.
		29	Updated APPENDIX-I
		32	Updated APPENDIX-III
		-	Final specification

1. General Description

The LC470DUH is a Color Active Matrix Liquid Crystal Display with an integral Light Emitting Diode (LED) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive display type which is operating in the normally black mode. It has a 46.96 inch diagonally measured active display area with WUXGA resolution (1080 vertical by 1920 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arrayed in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 8-bit gray scale signal for each dot. Therefore, it can present a palette of more than 1.06 Billion colors.
It has been designed to apply the 10-bit 4-port LVDS interface.
It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.



General Features

Active Screen Size	46.96 inches(1192.78mm) diagonal
Outline Dimension	1056.1(H) X 605.5(V) X 25.0(B) mm (Typ.)
Pixel Pitch	0.5415 mm x 0.5415 mm
Pixel Format	1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement
Color Depth	10bit, 1.06 Billion colors(@ 10bit(D) System output)
Luminance, White	400 cd/m^2 (Center 1point ,Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178 (Min.), U/D 178 (Min.))
Power Consumption	Total 41.29W (Typ.) [Logic = 3.84W, LED Backlight=36.2W)
Weight	8.5 (Typ.) 9.0 (Max.)
Display Mode	Transmissive mode, Normally black
Surface Treatment	Hard coating(2H), Anti-glare treatment of the front polarizer (Haze 1%)

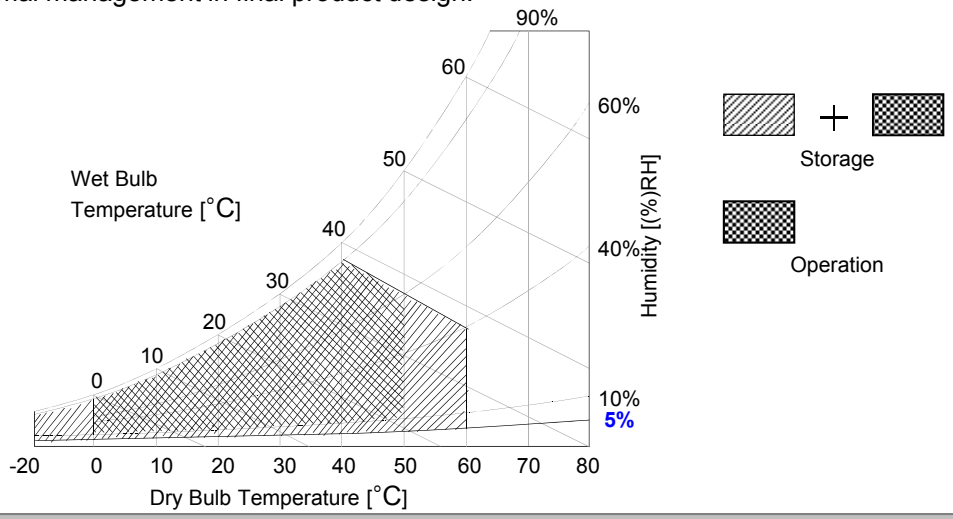
2. Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or permanent damage to the LCD module.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value		Unit	Note
		Min	Max		
Logic & EPI Power Voltage	VCC	-0.5	+2.2	VDC	1
Gate High Voltage	VGH	+18.0	+30.0	VDC	
Gate Low Voltage	VGL	-8.0	-4.0	VDC	
Source D-IC Analog Voltage	VDD	-0.3	+18.0	VDC	
Gamma Ref. Voltage (Upper)	VGMH	7.4	8.4	VDC	
Gamma Ref. Voltage (Low)	VGML	-0.3	16.3	VDC	
LED Input Voltage	VF	-	+28	VDC	
Panel Front Temperature	TSUR	-	+68	°C	4
Operating Temperature	TOP	0	+50	°C	2,3
Storage Temperature	TST	-20	+60	°C	
Operating Ambient Humidity	HOP	10	90	%RH	
Storage Humidity	HST	5	90	%RH	

1. Ambient temperature condition (Ta = 25 ± 2 °C)
2. Temperature and relative humidity range are shown in the figure below.
   Wet bulb temperature should be Max 39°C, and no condensation of water.
3. Gravity mura can be guaranteed below 40°C condition.
4. The maximum operating temperatures is based on the test condition that the surface temperature of display area is less than or equal to 68°C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 68℃. The range of operating temperature may be degraded in case of improper thermal management in final product design.



3. Electrical Specifications

3-1. Electrical Characteristics

It requires two power inputs. One is employed to power for the LCD circuit. The other Is used for the LED backlight and LED Driver circuit.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit	notes
Logic & EPI Power Voltage	VCC	-	1.62	1.8	1.98	VDC	
Logic High Level Input Voltage	VIH	-	1.26	-	1.98	VDC	
Logic Low Level Input Voltage	VIL	-	0	-	0.54	VDC	
Source D-IC Analog Voltage	VDD	-	15.6	15.8	16.0	VDC	
Half Source D-IC Analog Voltage	H_VDD	-	7.7	7.9	8.1	VDC	6
Gamma Reference Voltage	V_{GMH}	(GMA1 ~ GMA9)	8.1	-	15.8	VDC	
	V_{GML}	(GMA10 ~ GMA18)	0.2	-	7.7	VDC	
Common Voltage	Vcom	Reverse	6.6	6.9	7.2	V	
Vterm	Vterm	CML Type Vcore_tx=1.0V,1.2V	1.08	1.2	1.32	V	
EPI input common voltage	VCM	LVDS Type	0.65	-	1.3	V	5
EPI input differential voltage	Vdiff	-	150	-	500	mV	
EPI Input eye diagram	Veye	-	90	-	-	mV	
Gate High Voltage	VGH	@ 25℃	27.7	28	28.3	VDC	
		@ 0℃	29.7	30	30.3	VDC	
Gate Low Voltage	VGL	–	-5.2	-5.0	-4.8	VDC	
GIP Bi-Scan Voltage	VGI_P	-	-5.2	-	-	VDC	
	VGI_N	-	-	-	28.3	VDC	
GIP Refresh Voltage	VGH even/odd	-	-5.2	-	28.3		
GIP Start Pulse Voltage	VST	-	-5.2	-	28.3	V	
GIP Operating Clock	GCLK	-	-5.2	-	28.3	V	
Total Power Current	ILCD	-	-	320	415	mA	1
Total Power Consumption	PLCD	-	-	3.84	4.80	Watt	1

Note:
1. The specified current and power consumption are under the VLCD=12V., 25 ± 2°C, f_V=120Hz condition whereas mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.
2. The current is specified at the maximum current pattern.
3. The above spec is based on the basic model.
4. All of the typical gate voltage should be controlled within 1% voltage level
5. Ripple voltage level is recommended under ±5% of typical voltage
6. In case of EPI signal spec, refer to Fig 2 for the more detail.
7. HVDD Voltage level is half of VDD and it should be between Gamma9 and Gamma10.

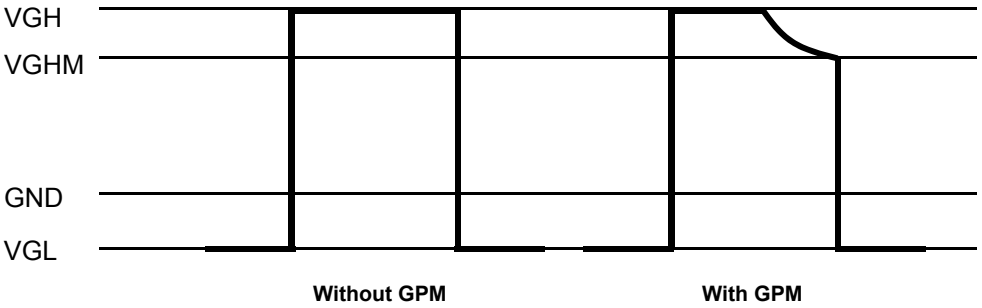


FIG. 1 Gate Output Wave form without GPM and with GPM

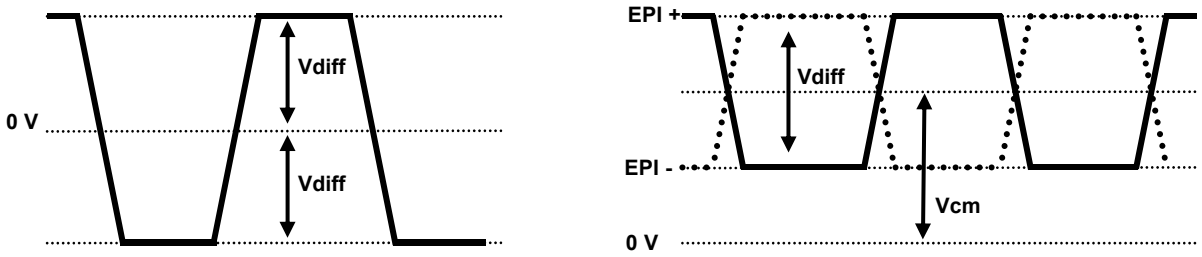


FIG. 2-1 EPI Differential signal characteristics

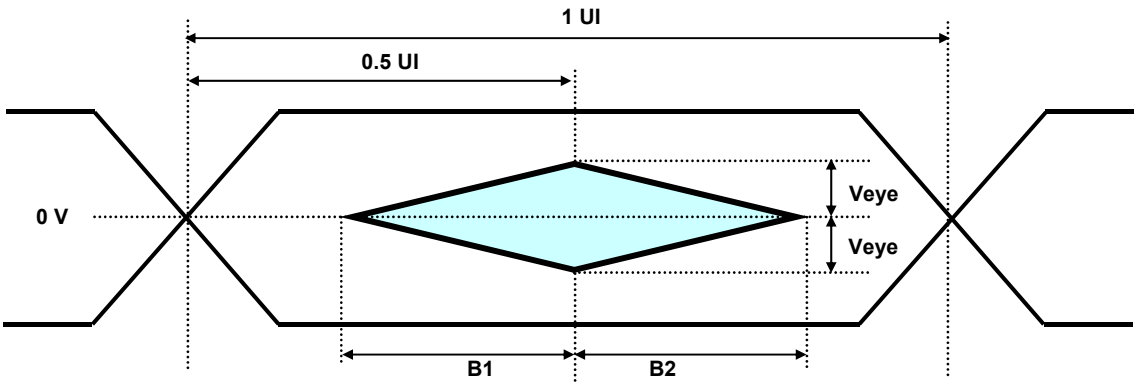


FIG. 2-2 Eye Pattern of EPI Input

*Source PCB

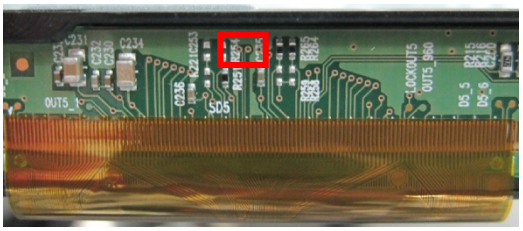


FIG. 3 Measure point

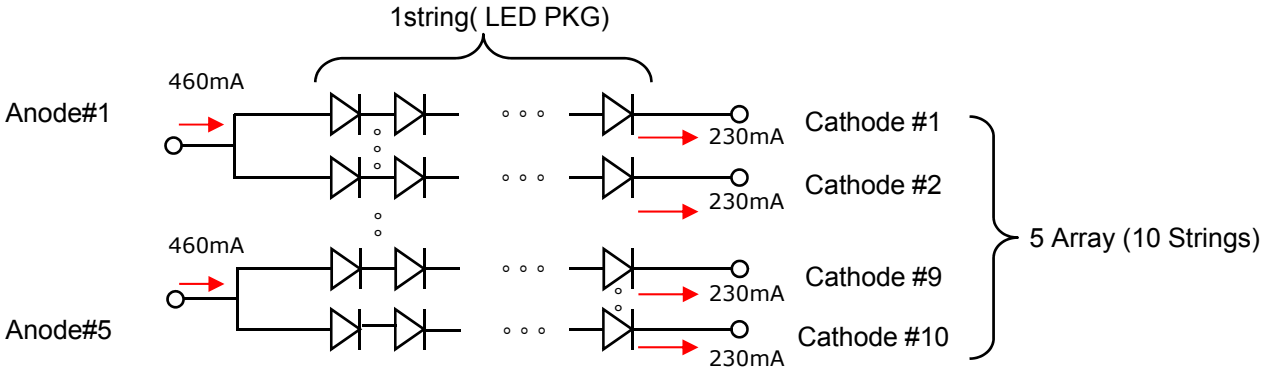
Table 3. ELECTRICAL CHARACTERISTICS (Continue)

Parameter		Symbol	Values			Unit	Note
			Min	Typ	Max		
Backlight Assembly :							
Forward Current (one array)	Anode	$I_{F\ (anode)}$		460		mAdc	±5%
	Cathode	$I_{F\ (cathode)}$		230		mAdc	2, 3
Forward Voltage		V_F	14	15.75	18	Vdc	4
Forward Voltage Variation		$\triangle V_F$			1.7	Vdc	5
Power Consumption (LED only)		P_{BL}	-	36.2	41.4	W	6
Burst Dimming Duty		On duty	1		100	%	
Burst Dimming Frequency		1/T	95		182	Hz	8
LED Array : (APPENDIX-III)							
Life Time			30,000			Hrs	7

Notes :

The design of the LED driver must have specifications for the LED array in LCD Assembly.
The electrical characteristics of LED driver are based on Constant Current driving type.
The performance of the LED in LCM, for example life time or brightness, is extremely influenced by the characteristics of the LED Driver. So, all the parameters of an LED driver should be carefully designed.
When you design or order the LED driver, please make sure unwanted lighting caused by the mismatch of the LED and the driver (no lighting, flicker, etc) has never been occurred. When you confirm it, the LCD–Assembly should be operated in the same condition as installed in your instrument.

1. Electrical characteristics are based on LED Array specification.
2. Specified values are defined for a Backlight Assembly. (IBL 10 LED array /LCM)
3. Each LED array has one anode terminal and two cathode terminals.
   The forward current(I_F) of the anode terminal is 460mA and it supplies 230mA into one strings, respectively



4. The forward voltage(V_F) of LED array depends on ambient temperature (Appendix-III)
5. ΔV_F means Max V_F-Min V_F in one Backlight. So V_F variation in a Backlight isn't over Max. 1.7V
6. Maximum level of power consumption is measured at initial turn on.
   Typical level of power consumption is measured after 1hrs aging at 25 ± 2°C.
7. The life time(MTTF) is determined as the time at which brightness of the LED is 50% compared to that of initial value at the typical LED current on condition of continuous operating at 25 ± 2°C, based on duty 100%.
8. The reference method of burst dimming duty ratio.
   It is recommended to use synchronous V-sync frequency to prevent waterfall
   (Vsync * 1 =Burst Frequency)
   Though PWM frequency is over 182Hz (max252Hz), function of backlight is not affected.

3-2. Interface Connections

This LCD module employs two kinds of interface connection, 50-pin connector is used for the module electronics and 14-pin connector is used for the integral backlight system.

3-2-1. LCD Module

-LCD Connector (CN1): TF06L-50S-0.5SH (Manufactured by HRS) or PF050-L50B-C21
- (Manufactured by UJU) or GF05G-50S-MB(Manufactured by LS)

Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description		No	Symbol	Description
1	NC	No Connection		26	EPI3+	EPI Receiver Signal(3+)
2	GCLK1	GIP GATE Clock 1		27	GND	Ground
3	GCLK2	GIP GATE Clock 2		28	EPI2-	EPI Receiver Signal(2-)
4	GCLK3	GIP GATE Clock 3		29	EPI2+	EPI Receiver Signal(2+)
5	GCLK4	GIP GATE Clock 4		30	GND	Ground
6	GCLK5	GIP GATE Clock 5		31	EPI1-	EPI Receiver Signal(1-)
7	GCLK6	GIP GATE Clock 6		32	EPI1+	EPI Receiver Signal(1+)
8	VGI_N	GIP Bi-Scan (VGI_N = VGH)		33	GND	Ground
9	VGH_ODD	GIP Panel VDD for Odd GATE TFT		34	VCC18	Logic & EPI Power Voltage
10	VGH_EVEN	GIP Panel VDD for Even GATE TFT		35	VCC12	EPI termination voltage
11	VGL	GATE Low Voltage		36	LOCKOUT4	LOCKOUT4
12	VST	VERTICAL START PULSE		37	NC	No Connection
13	GIP_Reset	No Connection		38	GND	Ground
14	VCOM_L_B	VCOM Left Input Bottom		39	GMA 18	GAMMA VOLTAGE 18
15	VCOM_L_FB	VCOM Left Feed-Back Output		40	NC	No Connection
16	VCOM_L_T	VCOM Left Input Top		41	GMA 15	GAMMA VOLTAGE 15 (Output From LCD)
17	GND	Ground		42	GMA 14	GAMMA VOLTAGE 14
18	VDD	Driver Power Supply Voltage		43	GMA 12	GAMMA VOLTAGE 12 (Output From LCD)
19	VDD	Driver Power Supply Voltage		44	GMA 10	GAMMA VOLTAGE 10
20	H_VDD	Half Driver Power Supply Voltage		45	GMA 9	GAMMA VOLTAGE 9
21	GND	Ground		46	GMA 7	GAMMA VOLTAGE 7 (Output From LCD)
22	EPI4-	EPI Receiver Signal(4-)		47	GMA 5	GAMMA VOLTAGE 5
23	EPI4+	EPI Receiver Signal(4+)		48	GMA 4	GAMMA VOLTAGE 4 (Output From LCD)
24	GND	Ground		49	NC	No Connection
25	EPI3-	EPI Receiver Signal(3-)		50	GMA 1	GAMMA VOLTAGE 1

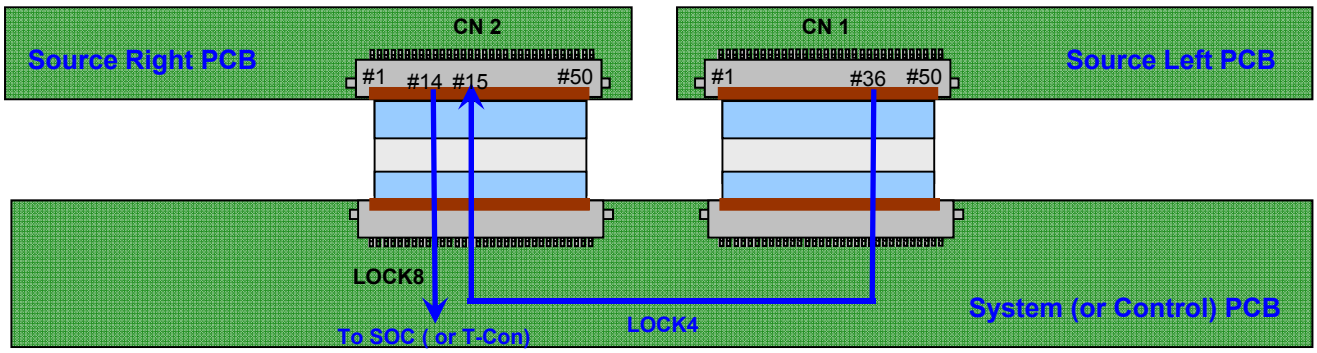
Note : 1. Please refer to application note for details.
(**GIP** & **Half VDD & Gamma Voltage setting**)

-LCD Connector (CN2): TF06L-50S-0.5SH (Manufactured by HRS) or PF050-L50B-C21
- (Manufactured by UJU) or GF05G-50S-MB(Manufactured by LS)

Table 3-2. MODULE CONNECTOR(CN2) PIN CONFIGURATION

No	Symbol	Description		No	Symbol	Description
1	GMA 1	GAMMA VOLTAGE 1		26	EPI6+	EPI Receiver Signal(6+)
2	NC	No Connection		27	GND	Ground
3	GMA 4	GAMMA VOLTAGE 4 (Output From LCD)		28	EPI5-	EPI Receiver Signal(5-)
4	GMA 5	GAMMA VOLTAGE 5		29	EPI5+	EPI Receiver Signal(5+)
5	GMA 7	GAMMA VOLTAGE 7 (Output From LCD)		30	GND	Ground
6	GMA 9	GAMMA VOLTAGE 9		31	H_VDD	Half Driver Power Supply Voltage
7	GMA 10	GAMMA VOLTAGE 10		32	VDD	Driver Power Supply Voltage
8	GMA 12	GAMMA VOLTAGE 12 (Output From LCD)		33	VDD	Driver Power Supply Voltage
9	GMA 14	GAMMA VOLTAGE 14		34	GND	Ground
10	GMA 15	GAMMA VOLTAGE 15 (Output From LCD)		35	VCOM_R_Top	VCOM Right Input Top
11	NC	No Connection		36	VCOM_R_FB	VCOM Right Feed-Back Output
12	GMA 18	GAMMA VOLTAGE 18		37	VCOM_R_Bottom	VCOM Right Input Bottom
13	GND	Ground		38	GIP_Reset	No Connection
14	LOCKOUT8	LOCKOUT8		39	VST	VERTICAL START PULSE
15	LOCKIN4	LOCKIN4		40	VGI_P	GIP Bi-Scan (VGI_P = VGL)
16	VCC12	EPI termination voltage		41	VGH_EVEN	GIP Panel VDD for Even GATE TFT
17	VCC18	Logic & EPI Power Voltage		42	VGH_ODD	GIP Panel VDD for Odd GATE TFT
18	GND	Ground		43	VGH	Gate High Voltage
19	EPI8-	EPI Receiver Signal(8-)		44	GCLK6	GIP GATE Clock 6
20	EPI8+	EPI Receiver Signal(8+)		45	GCLK5	GIP GATE Clock 5
21	GND	Ground		46	GCLK4	GIP GATE Clock 4
22	EPI7-	EPI Receiver Signal(7-)		47	GCLK3	GIP GATE Clock 3
23	EPI7+	EPI Receiver Signal(7+)		48	GCLK2	GIP GATE Clock 2
24	GND	Ground		49	GCLK1	GIP GATE Clock 1
25	EPI6-	EPI Receiver Signal(6-)		50	NC	No Connection

Note : 1. Please refer to application note for details.
(**GIP** & **Half VDD & Gamma Voltage setting**)



3-2-2. Backlight Module

[CN201]

1) LED Array ass`y Connector (Plug)

: 20022WR-H14BD2, 20022WR-H13BD2(BK) (Manufactured by Yeonho)

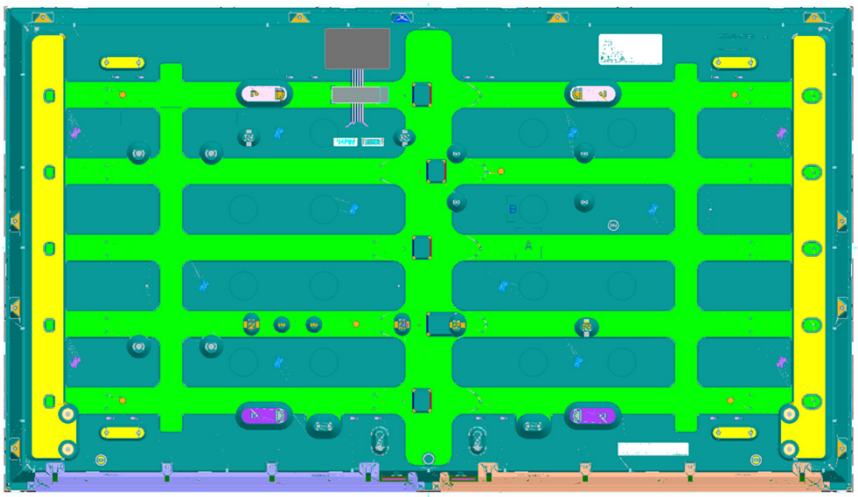
2) Mating Connector (Receptacle)

: 20022HS-14B2, 20022HS-13B2(BK) (Manufactured by Yeonho)

Table 5. BACKLIGHT CONNECTOR PIN CONFIGURATION(CN1,CN2)

No	Symbol(CN1)	Description
1	5,6BLK_Anode_	LED Input Current
2	5BLK_Cathode	LED Output Current
3	6BLK_Cathode	LED Output Current
4	NC	No Connection
5	NC	No Connection
6	NC	No Connection
7	3,4BLK_Anode_	LED Input Current
8	3BLK_Cathode	LED Output Current
9	4BLK_Cathode	LED Output Current
10	NC	No Connection
11	1,2BLK_Anode_	LED Input Current
12	1BLK_Cathode	LED Output Current
13	2BLK_Cathode	LED Output Current
14	NC	No Connection

No	Symbol(CN2)	Description
1	NC	No Connection
2	NC	No Connection
3	NC	No Connection
4	9,10BLK_Anode_	LED Input Current
5	9BLK_Cathode	LED Output Current
6	10BLK_Cathode	LED Output Current
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection
10	7,8BLK_Anode_	LED Input Current
11	7BLK_Cathode	LED Output Current
12	8BLK_Cathode	LED Output Current
13	NC	No Connection



Rear

3-3. Signal Timing Specifications

Table 5. Timing Requirements

Parameter	Symbol	Condition	Min	Typ	Max	Unit	notes
Unit Interval	UI	-	0.916	-	1.190	ns	
Effective Veye width time	B1&B2	-	0.25	-	-	UI	Fig. 2
Modulation Ratio of SSC	Vspread	@100KHz	-	-	2	%	1
1st data to SOE rising time	Ts1	-	3	-	-	Packet	Fig.4
SOE rising to last data	Ts4		0	-	-	Packet	Fig.4
Last data to SOE falling	Ts5	-	10	-	-	Packet	Fig.4
EPI Bandwidth	BW	-	0.84	-	1.092	GBPS	

notes : 1. VModulation Ratio of SSC for 20KHz ~ 100kHz Modulation Frequency is calculated by (7 – 0.05*Fmod), where Fmod unit is KHz.

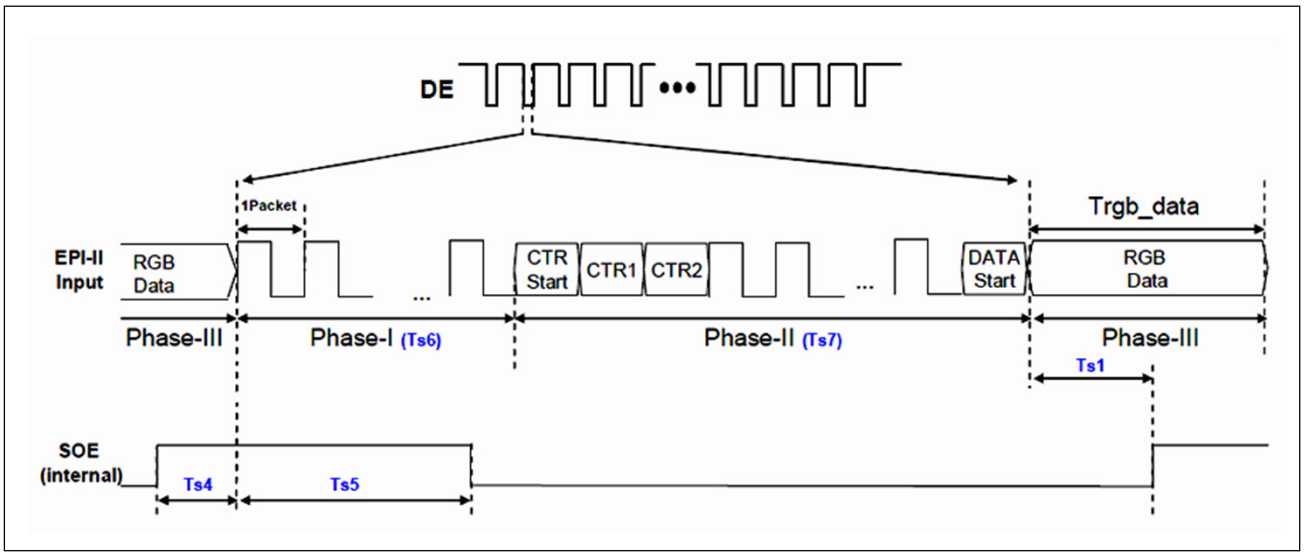


FIG 4. SOE Width & Timing

3-4. Panel Pixel Structure

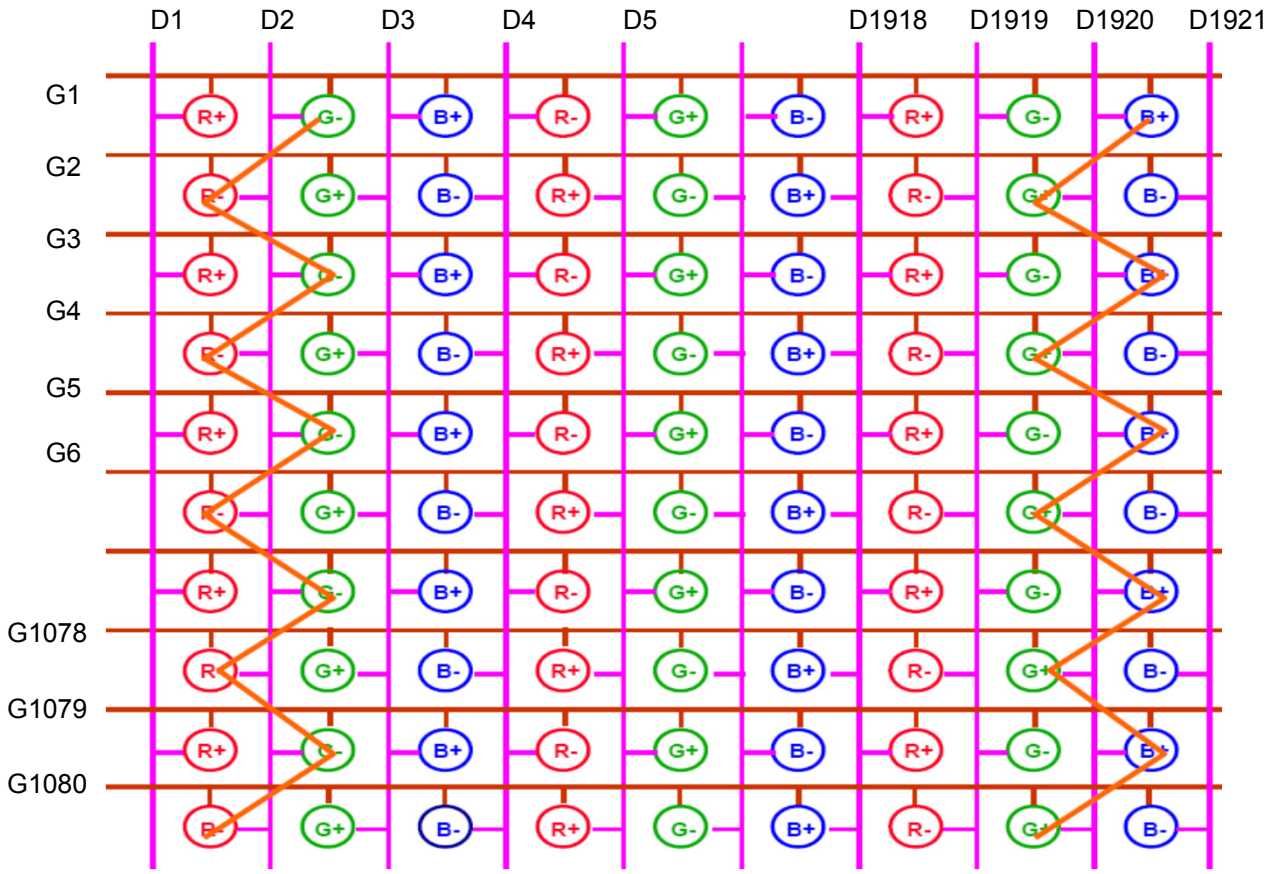


FIG. 5 Panel Pixel Structure

3-5. Power Sequence

3-5-1. LCD Driving circuit

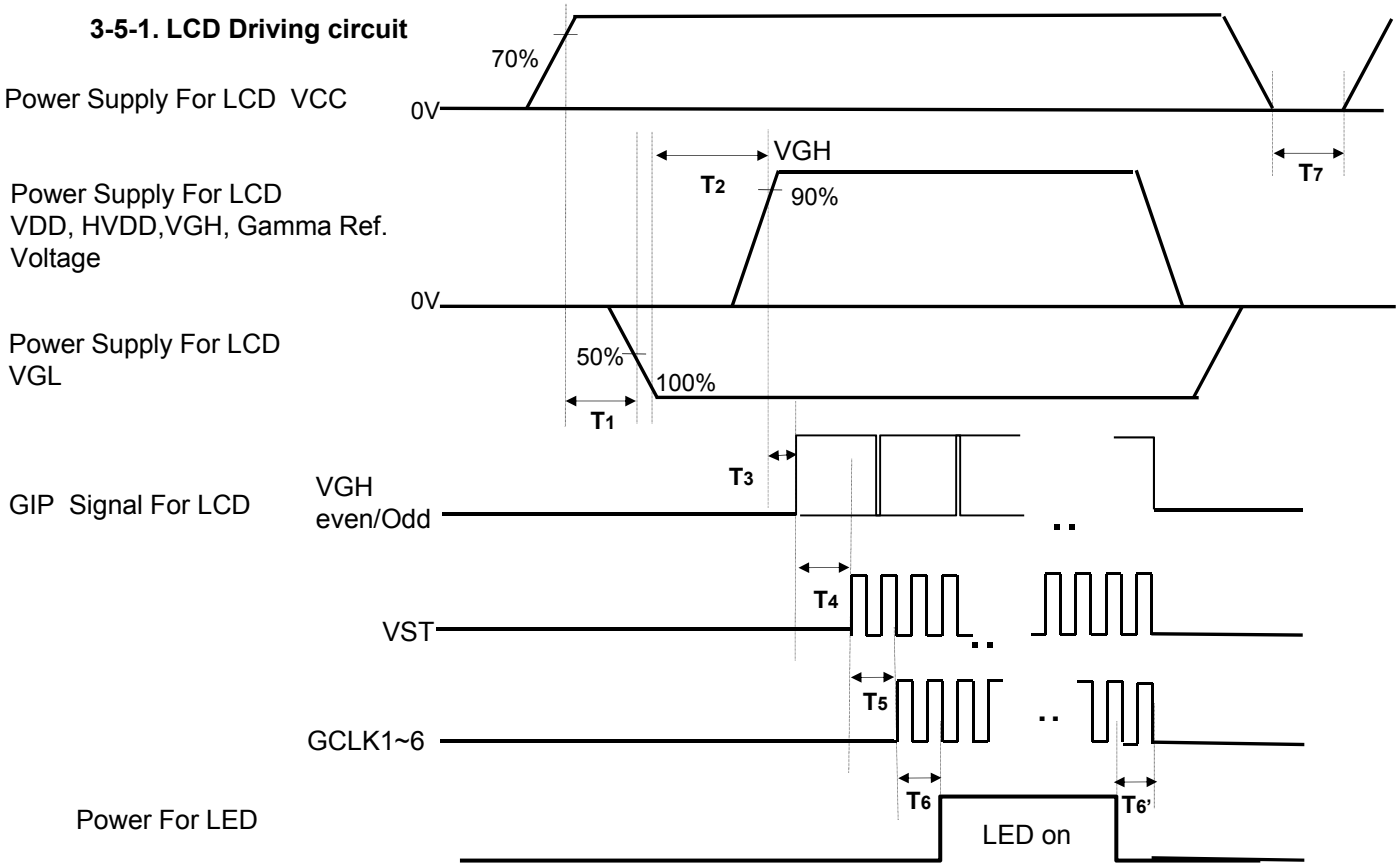


Table 6. POWER SEQUENCE

Ta= 25±2°C, fv=120Hz,

Parameter	Value			Unit	Notes
	Min	Typ	Max		
T_1	0.5	-	-	ms	
T_2	0.5	-	-	ms	
T_3	0	-	-	ms	
T_4	10	-	-	ms	2
T_5	0	-	-	ms	
T_6 / $T_{6'}$	20	-	-	ms	6
T_7	2	-	-	s	

Note : 1. Power sequence for Source D-IC must follow the Case1 & 2.
※ Please refer to Appendix IV for more details.
2. VGH even & odd can not be “High at the same time.
3. Power Off Sequence order is reverse of Power On Condition including Source D-IC.
4. GCLK On/Off Sequence
:GCLK3 → GCLK2 →GCLK1 → GCLK6 → GCLK5 → GCLK4.
5. VDD_odd/even transition time should be within V_blank
6. In case of T6’, If there is no abnormal display, no problem

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at 25±2°C. The values are specified at 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0 °.
FIG. 1 shows additional information concerning the measurement equipment and method.

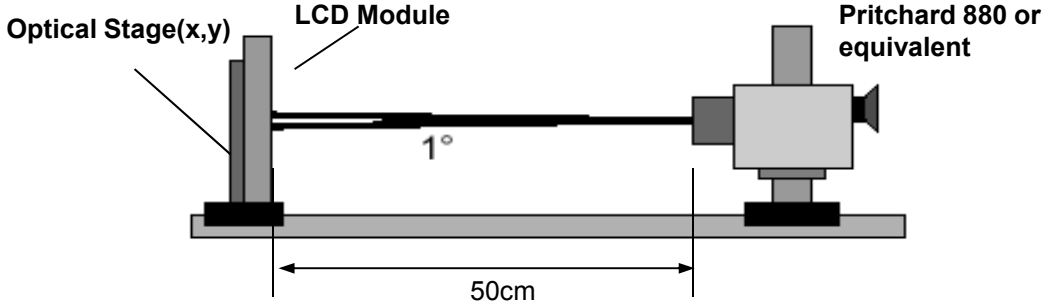


FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 10. OPTICAL CHARACTERISTICS

Ta= 25±2°C, V_{LCD}=12.0V, fv=120Hz, Dclk=74.25MHz, **EXTV**BR-B =100%

Parameter			Symbol		Value Min	Value Typ	Value Max	Unit	Note
Contrast Ratio			CR		1000	1400	-		1
Surface Luminance, white			L_{WH}	2D	320	400		cd/m²	2
				3D		150			7
Luminance Variation			δ_{WHITE}	9P	65			%	3
Response Time		Rising	Tr		-	8	12	ms	4
		Falling	Tf		-	10	14		
Color Coordinates [CIE1931]		RED	Rx		Typ -0.03	0.650	Typ +0.03		
			Ry			0.332			
		GREEN	Gx			0.306			
			Gy			0.601			
		BLUE	Bx			0.151			
			By			0.060			
		WHITE	Wx			0.281			
			Wy			0.288			
Color Temperature						10,000		K	
Color Gamut						72		%	
Viewing Angle	2D (CR>10)	right(ϕ=0°)	θr (x axis)		89	-	-	degree	6
		left (ϕ=180°)	θl (x axis)		89	-	-		
		up (ϕ=90°)	θu (y axis)		89	-	-		
		down (ϕ=270°)	θd (y axis)		89	-	-		
	3D (CT≤10%)	up + down	θu (y axis) +θd (y axis)		11	-	-	degree	8
3D Crosstalk			3D C/T			3	5	%	
Gray Scale					-	-	-		7

Note : 1. . Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

It is measured at center 1-point.

2. Surface luminance are determined after the unit has been 'ON' and 1 Hour after lighting the backlight in a dark environment at 25±2°C. Surface luminance is the luminance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see the FIG. 2.
3. The variation in surface luminance , δ WHITE is defined as :
   δ WHITE(9P) = Minimum (Lon1,Lon2~ Lon8, Lon9) / Maximum (Lon1,Lon2~ Lon8, Lon9)*100
   Where Lon1 to Lon9 are the luminance with all pixels displaying white at 9 locations
   For more information, see the FIG. 2.
4. Response time is the time required for the display to transit from G(0) to G(255) (Rising Time, Tr) and from G(255) to G(0) (Falling Time, Tf). For additional information, see the FIG. 8.
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.
6. Gray scale specification
   Gamma Value is approximately 2.2. For more information, see the Table 10
7. 3D performance specification is expressed by 3D luminance, 3D Crosstalk and 3D viewing angle
   3D luminance and 3D crosstalk is measured at center 1-point.
   For more information, see the FIG 10~13.

Table 8. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ)
L0	0.07
L15	0.28
L31	1.05
L47	2.50
L63	4.69
L79	7.67
L95	11.47
L111	16.11
L127	21.64
L143	28.07
L159	35.43
L175	43.73
L191	52.99
L207	63.23
L223	74.47
L239	86.72
L255	100

	Gray Level	Gamma Ref.
Positive Voltage	L0	Gamma9
	L127	Gamma5
	L255	Gamma1
Negative Voltage	L255	Gamma18
	L127	Gamma14
	L0	Gamma10

Measuring point for surface luminance & measuring point for luminance variation.

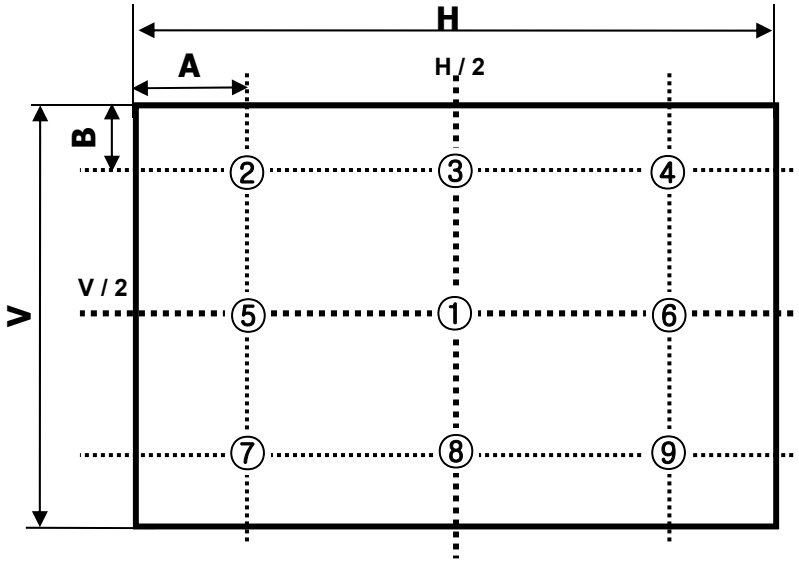


FIG. 2 9 Points for Luminance Measure

Response time is defined as the following figure and shall be measured by switching the input signal for "Black" ~ "White" and "White" ~ "Black".

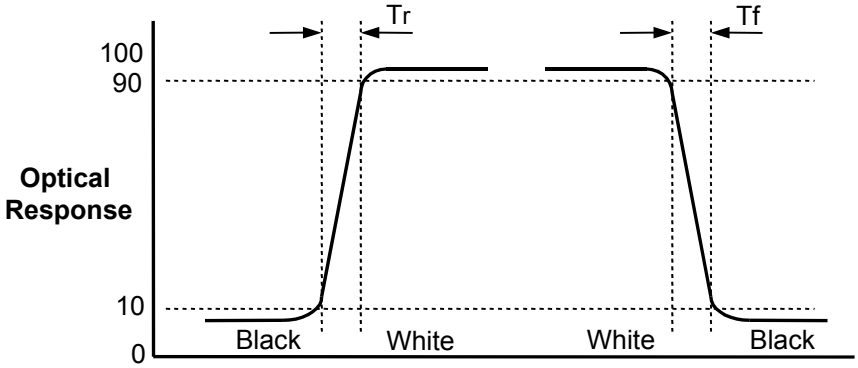


FIG. 8 Response Time

Dimension of viewing angle range

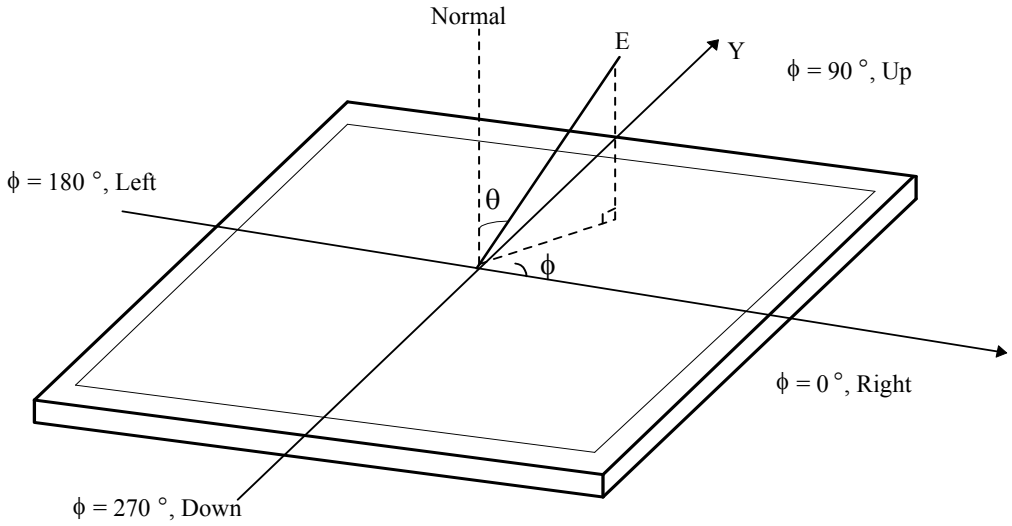
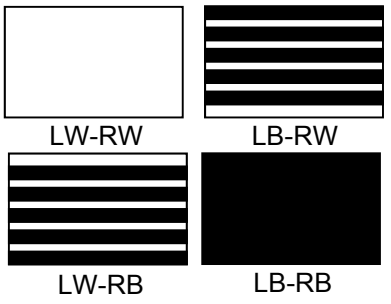
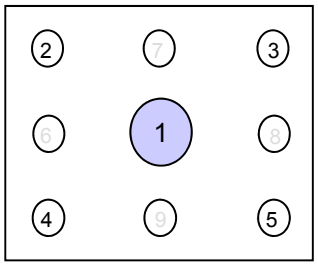


FIG. 9 Viewing Angle

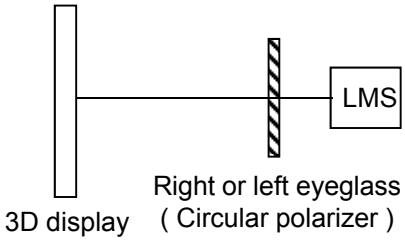
Measuring point for Contrast Ratio



(a) Test pattern image

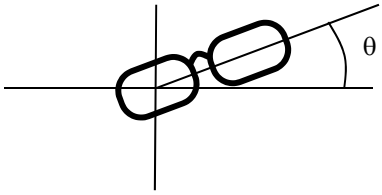


(b) Measurement position

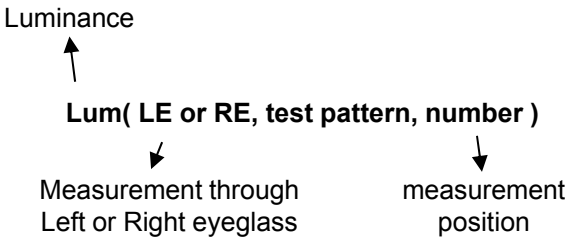


(c) Setup

< FIG. 6. Measurement configuration>



< FIG. 7. Positioning eyeglass >



< FIG. 8. notation of luminance measurement >

In order to measure 3D luminance, 3D crosstalk and 3D viewing angle, it need to be prepared as below;

1) Measurement configuration

4-Test pattern images. Refer to FIG 6.

-. LW-RW : White for left and right eye

-. LW-RB : White for left eye and Black for right eye

-. LB-RW : Black for left eye and white for right eye

-. LB-RB : Black for left eye and right eye

Image files where black and white lines are displayed on even or odd lines.

Luminance measurement system (LMS) with narrow FOV (field of view) is used. Refer to FIG 1.

2) Positioning Eyeglass (refer to appendix-VII for standard specification of eyeglass)

Find angle of minimum transmittance.

This value would be provided beforehand or measured by the following steps;

(i) Test image (LB-RW) is displayed.

(ii) Left eyeglass are placed in front of LMS and luminance is measured, rotating right eyeglass such as FIG 7. The notation for luminance measurement is “Lum(LE, LB-RW,1)”.

(iii) Find the angle where luminance is minimum.

* Following measurements should be performed at the angle of minimum transmittance of eyeglass.

3) Measurement of 3D luminance
(i) Test image (LW-RW) is displayed.
(ii) Left or right eyeglass are placed in front of LMS successively and luminance is measured at center 1 point where the notation for luminance measurement is "Lum(LE, LW-RW,1)" or "Lum(RE, LW-RW,1).

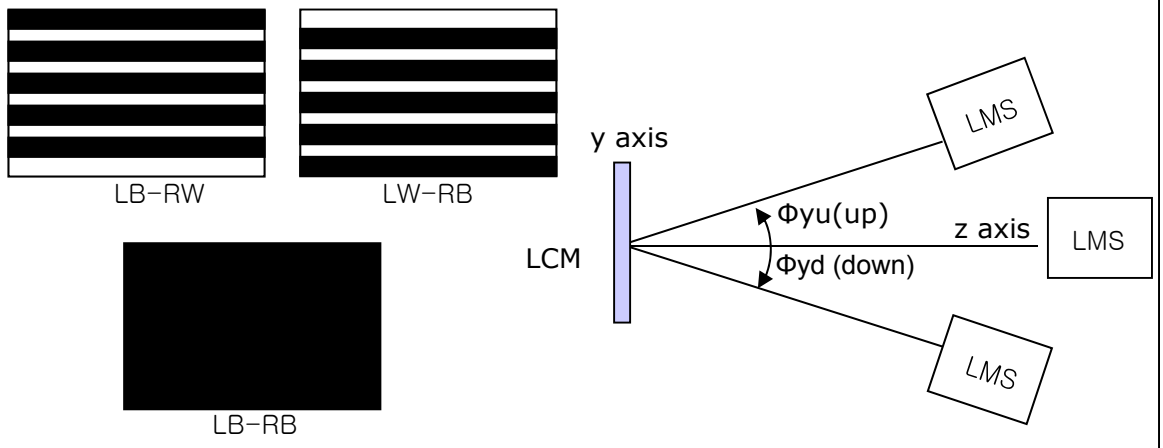
4) Measurement of 3D crosstalk
(i) Test image (LB-RW, LW-RB and LB-RB) is displayed.
(ii) Right or left eyeglass are placed in front of LMS successively and luminance is measured for position 1.
with rotating LMS or sample vertically.

$$\frac{\text{Lum(LE, LB-RW,1) - Lum(LE, LB-RB,1)}}{\text{Lum(LE, LW-RB,1) - Lum(LE, LB-RB,1)}}$$

or

$$\frac{\text{Lum(RE, LW-RB,1) - Lum(RE, LB-RB,1)}}{\text{Lum(RE, LB-RW,1) - Lum(RE, LB-RB,1)}}$$

5) Measurement of 3D Viewing Angle
3D viewing angle is the angle at which the 3D crosstalk is under 10%. The angles are determined for the vertical or y axis with respect to the z axis which is normal to the LCD module surface and measured for position 1. For more information , see the Fig 9



(a) Test pattern image (b) Measurement of 3D viewing angle (up/down)

< FIG. 9. Measurement of 3D crosstalk and 3D viewing angle >

5. Mechanical Characteristics

Table 12 provides general mechanical characteristics.

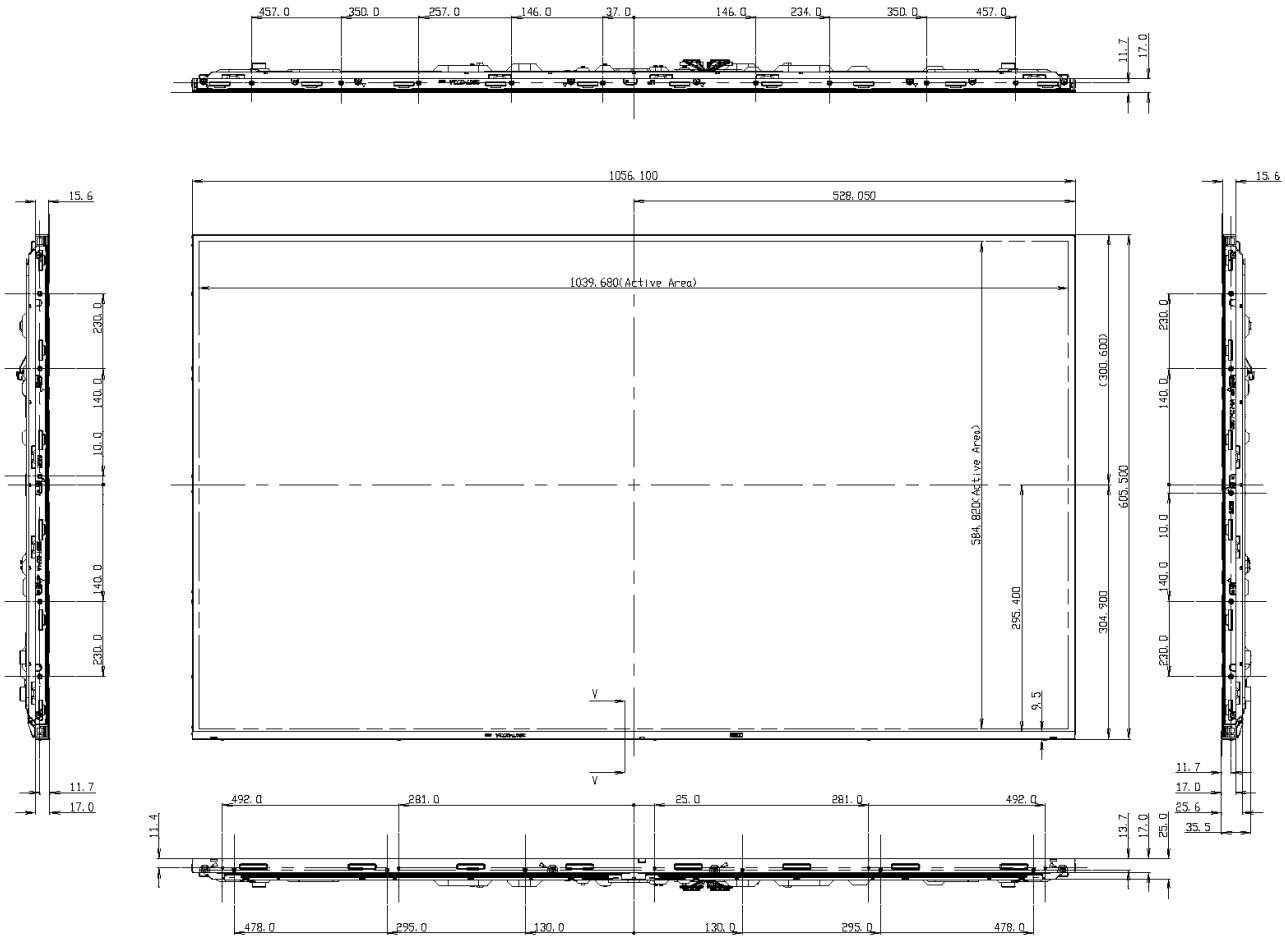
Table 12. MECHANICAL CHARACTERISTICS

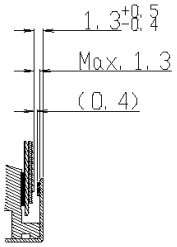
Item	Value	
Outline Dimension	Horizontal	1056.1 mm
	Vertical	605.5 mm
	Depth	25.0 mm
Active Display Area	Horizontal	1039.68 mm
	Vertical	584.82 mm
Weight	8.5 (Typ.) 9.0 (Max.)	

Note1 : Please refer to a mechanical drawing in terms of tolerance at the next page.

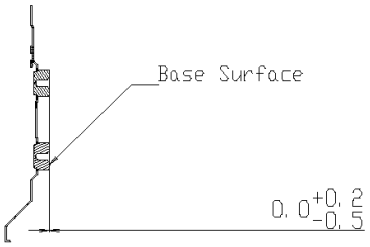
Note2 : LGD Manage Stand Pem-nut height as inspection spec of Cover Bottom suppliers.

[FRONT VIEW]



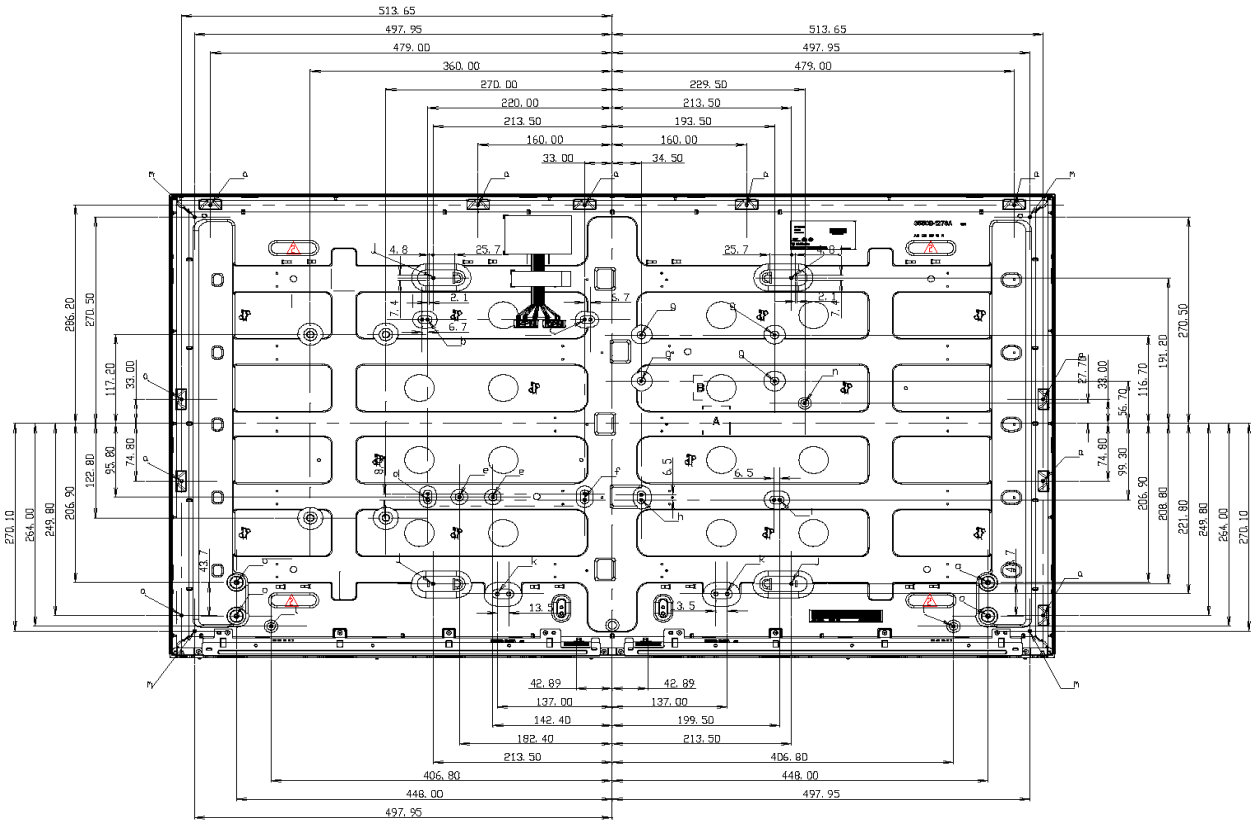


SECTION V-V



*. Note
1. Unspecifed tolerance is ±1.0mm.
2. LPB CNT Specification is
   - Left(Black Color): HS100-L08N-N62(UJU ELEC.)
     Right(White Color): HS100 L08N NG2 A(UJU ELEC.)
3. Max. torque : refer to table.
4. Max. depth(screw) : refer to table.
5. The same feature means the same dimension.
6. Cover Bottom supplier's inspection result represents PEMNUT height.

[REAR VIEW]



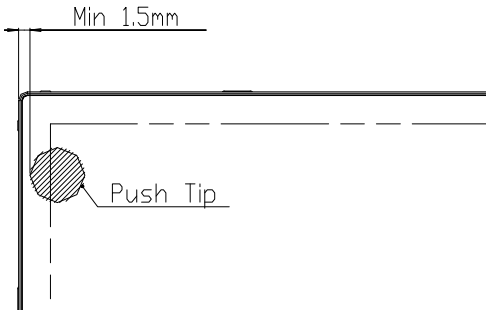
Item	Tap	UDM Height (mm)	Max. Depth (mm)	Max Torque (kgf. cm)	Notes
a	M3.0	12.1	5.0	8.0	THM
b	M3.0	6.1	6.1	8.0	PSU
c	M3.0	6.1	6.1	8.0	PSU
d	M4.0	6.1	5.0	8.0	PSU
e	M3.0	6.1	5.0	8.0	PSU
f	M3.0	6.1	5.0	8.0	PSU
g	M3.0	7.9	7.9	8.0	MAIN
h	M3.0	7.9	6.8	8.0	MAIN
i	M3.0	7.9	6.8	8.0	MAIN
j	M3.0	8.0	6.9	8.0	VESA
k	M4.0	10.0	8.9	8.0	DECO-1
l	M3.0	3.0	3.0	8.0	DECO-2
m	M3.0	0.0	3.0	8.0	B-COVER
n	M3.0	2.7	2.0	8.0	SIDE_BRK
o	M4.0	10.5	6.5	10.0	STAND

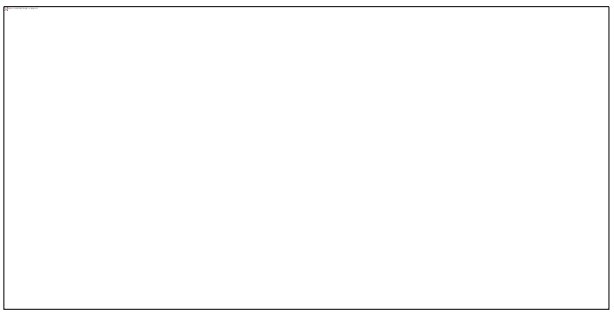
6. Reliability

Table 13. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 60°C, 90% 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 50°C 50%RH 500h
4	Low temperature operation test	Ta= 0°C 500h
5	Panel Push Test (Module Condition)	Max 6kgf (Test Method : Note 2)
6	Vibration test (non-operation)	No Guarantee
7	Shock test (non-operation)	No Guarantee
8	Humidity condition Operation	Ta= 40 °C ,90%RH
9	Altitude operating storage / shipment	0 - 16,400 ft 0 - 40,000 ft

Note : 1. Before and after Reliability test, LCM should be operated with normal function.
2. Panel Push Test Method





7. International Standards

7-1. Safety

a) UL 60065, Underwriters Laboratories Inc.
Audio, Video and Similar Electronic Apparatus - Safety Requirements.

b) CAN/CSA C22.2 No.60065:03, Canadian Standards Association.
Audio, Video and Similar Electronic Apparatus - Safety Requirements.

c) EN 60065, European Committee for Electrotechnical Standardization (CENELEC).
Audio, Video and Similar Electronic Apparatus - Safety Requirements.

d) IEC 60065, The International Electrotechnical Commission (IEC).
Audio, Video and Similar Electronic Apparatus - Safety Requirements.
(Including report of IEC60825-1:2001 clause 8 and clause 9)

Notes

1. Laser (LED Backlight) Information

Class 1M LED Product IEC60825-1 : 2001 Embedded LED Power (Class1M)

2. Caution
: LED inside.
Class 1M laser (LEDs) radiation when open.
Do not open while operating.

7-2. EMC

a) ANSI C63.4 "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz." American National Standards Institute (ANSI), 2003.

b) CISPR 22 "Information technology equipment – Radio disturbance characteristics – Limit and methods of measurement." International Special Committee on Radio Interference (CISPR), 2005.

c) CISPR 13 "Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and method of measurement." International Special Committee on Radio Interference (CISPR), 2006.

7-3. Environment

a) RoHS, Directive 2002/95/EC of the European Parliament and of the council of 27 January 2003

8. Packing

8-1. Information of LCM Label

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M

A,B,C : SIZE(INCH)
D : YEAR
E : MONTH
F ~ M : SERIAL NO.

Note

1. YEAR

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mark	A	B	C	D	E	F	G	H	J	K

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

Serial NO. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one Pallet : 18 pcs

b) Pallet Size : 1300 mm(W) X 1140 mm(D) X 840 mm(H)

9. Precautions

Please pay attention to the followings when you use this TFT LCD module.

9-1. Mounting Precautions

(1) You must mount a module using specified mounting holes (Details refer to the drawings).
(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)
(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(9) Do not open the case because inside circuits do not have sufficient strength.

9-2. Operating Precautions

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=±200mV(Over and under shoot voltage)
(2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer
(4) Be careful for condensation at sudden temperature change.Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
(7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can't be operated its full characteristics perfectly.
(8) A screw which is fastened up the steels should be a machine screw.
(if not, it can causes conductive particles and deal LCM a fatal blow)
(9) Please do not set LCD on its edge.
(10) The conductive material and signal cables are kept away from LED driver inductor to prevent abnormal display, sound noise and temperature rising.

9-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.
(3) Storage condition is guaranteed under packing conditions.
(4) The phase transition of Liquid Crystal in the condition of the low or high storage temperature will be recovered when the LCD module returns to the normal condition.

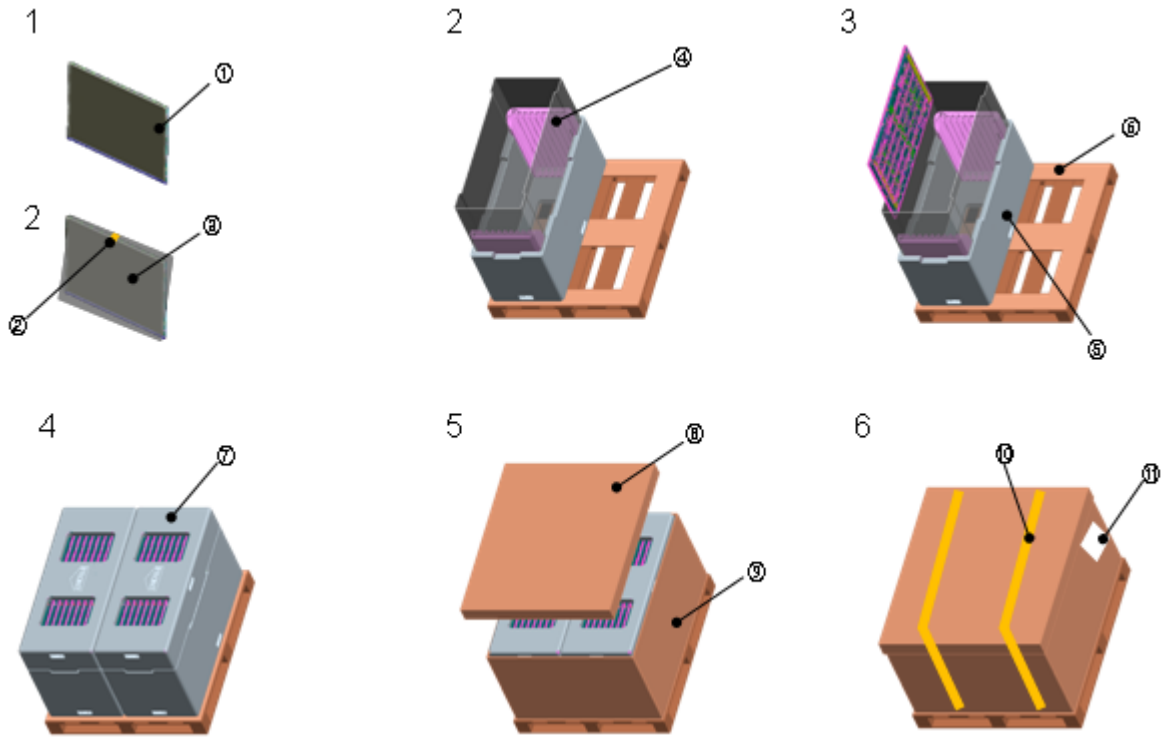
9-6. Operating condition guide

(1) The LCD product should be operated under normal conditions. Normal condition is defined as below;
- Temperature : 5 ~ 40 ℃, normal humidity
- Display pattern : continually changing pattern (Not stationary)

(2) If the product will be used in extreme conditions such as high temperature, display patterns or operation time etc..,
It is strongly recommended to contact LGD for Qualification engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems. The LCD product should be applied by global standard environment. (refer ETSI EN 300, IEC 60721)

APPENDIX-I

■ Pallet Ass'y



NO.	DESCRIPTION	MATERIAL
①	LCD Module	47INCH
②	TAPE	MASKING 20MMX50M
③	PE BAG	LLDPE
④	AL BAG	AL
⑤	PACKING,BOTTOM	EPS
⑥	PALLET	Plywood 1300X1140X125.5mm
⑦	PACKING,TOP	EPS
⑧	ANGLE,COVER	PAPER
⑨	ANGLE,PACKING	PAPER
⑩	BAND,CLIP	STEEL or PP
⑪	LABEL	YUPO 80G 100X70

 # APPENDIX- II-1

■ LCM Label

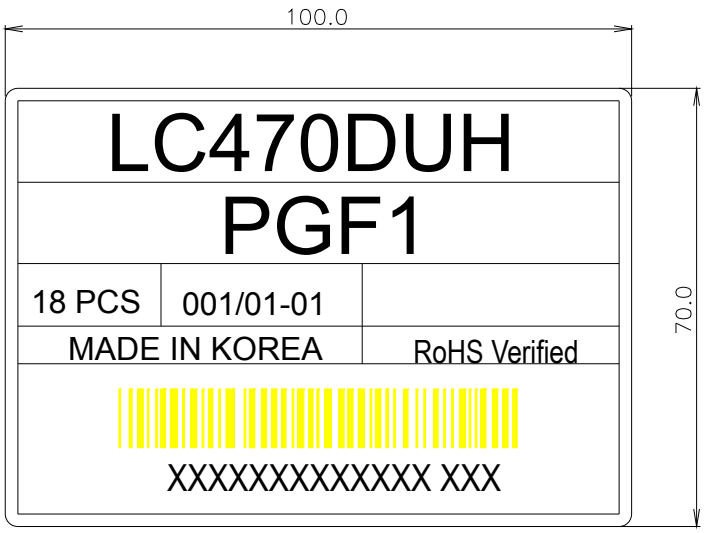
■ Production site

- LG Display (Paju) Co., LTD
- LG Display (Guangzhou) Co., LTD

Note 1.The origin of LCM Label will be changed according to the production site.

 # APPENDIX- II-2

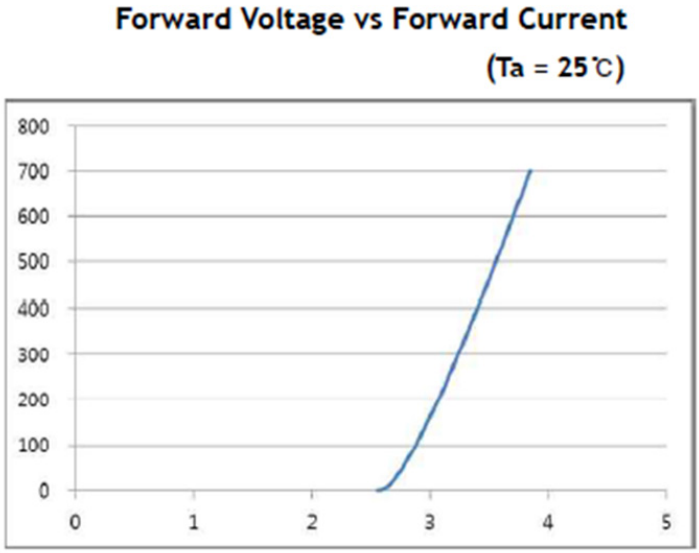
■ Pallet Label

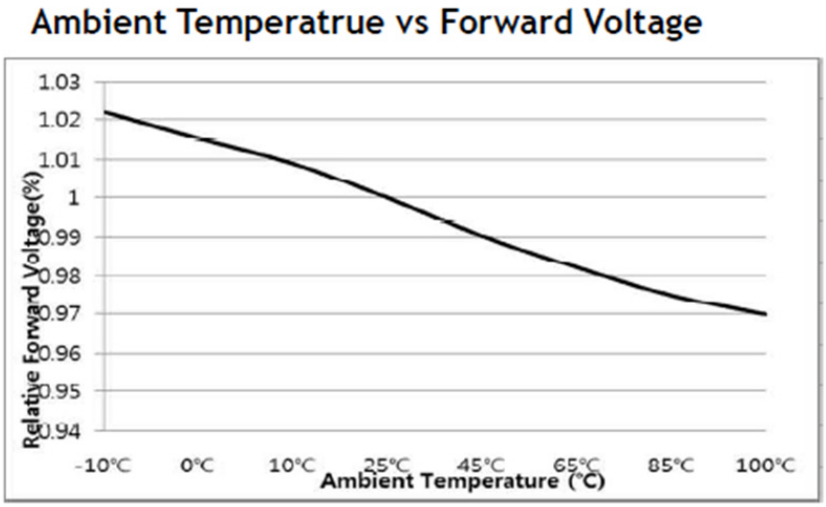


APPENDIX- III

■ LED Array Electrical Spec

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Operating Voltage	Vf	If = 230mA	-	15.75	-	V	Vf : 5 PKG.

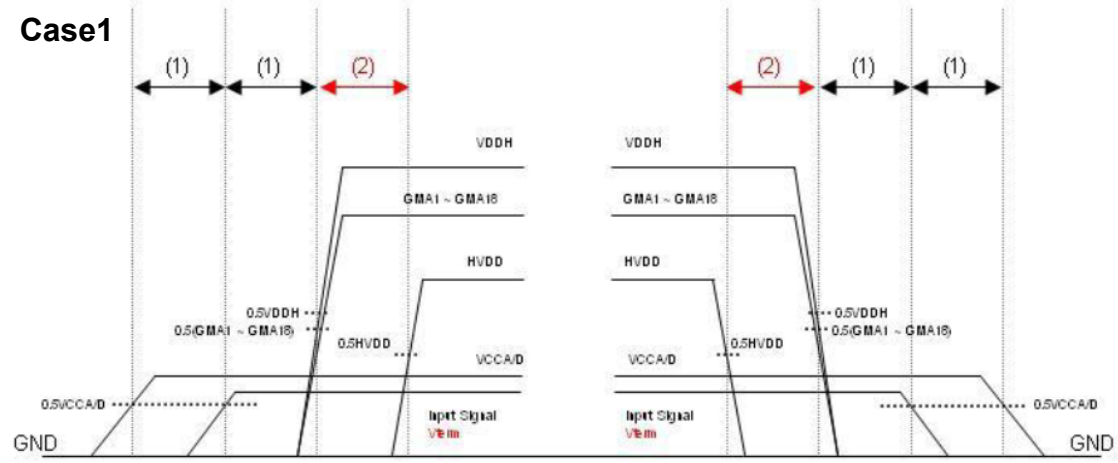




APPENDIX- IV

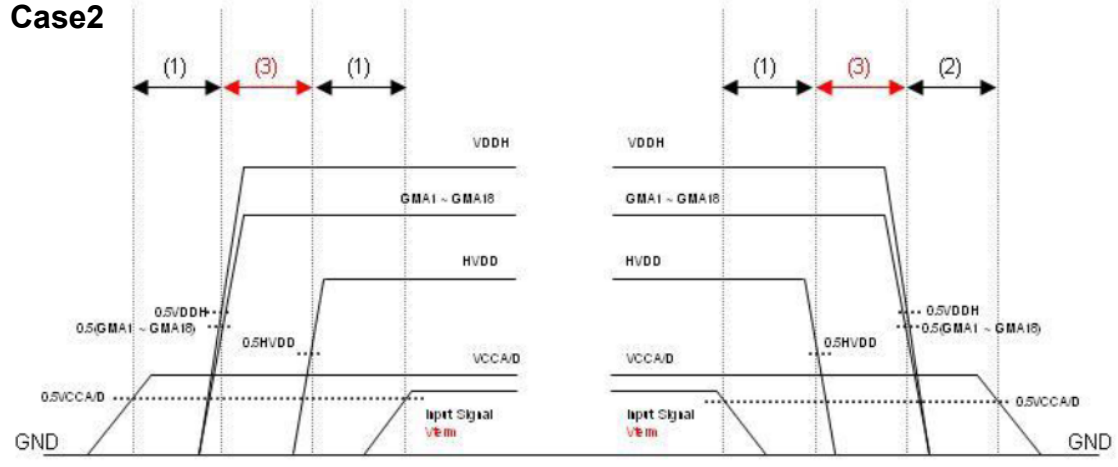
■ Source D-IC Power Sequence

Case1



Note : (1)=0~1s, (2)=-100ms~1s (Always, VDD must be higher than or same width HVDD.)

Case2



Note : (1)=0~1s, (2)=**-40ms**~1s,
(3)=-100ms~1s (Always, VDD must be higher than or same width HVDD.)

- Input Signal : EPI

APPENDIX-V

■ Standard specification of Eyeglasses

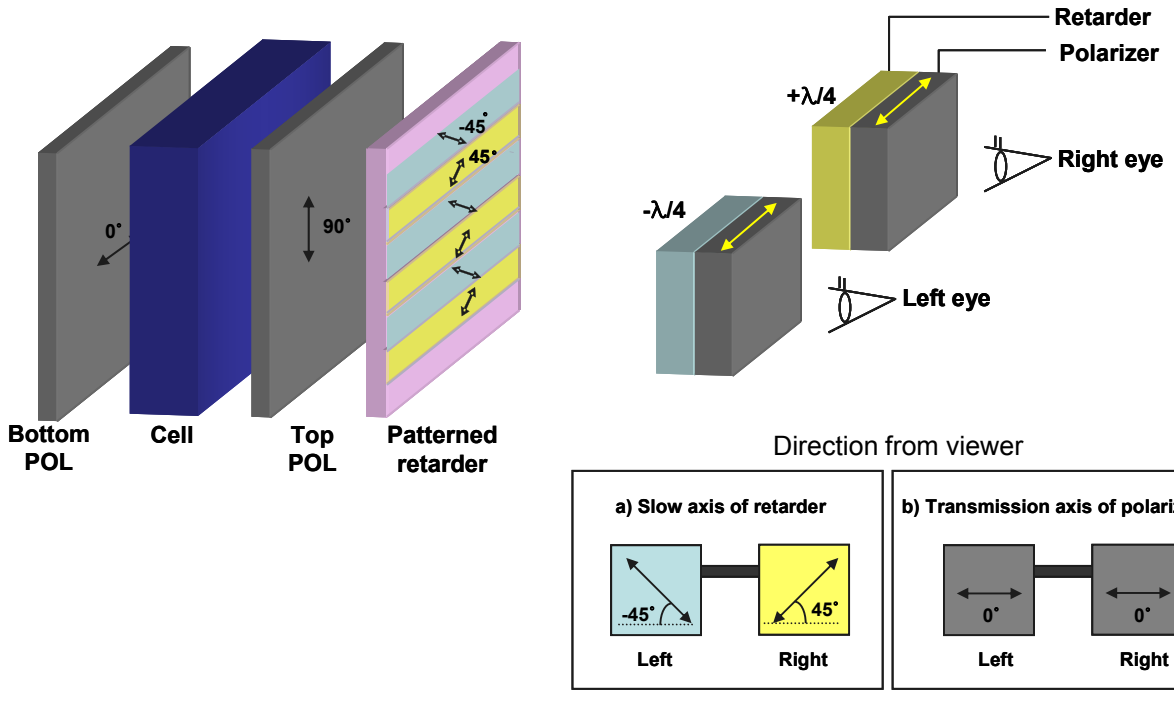
This is recommended data of Eyeglasses for LC470DUH-PGF1 model. (details refer to table)

For each item, depending on the eyeglass manufacturer tolerances may occur, this tolerance can affect 3D performance. (3D Crosstalk, 3D luminance, 3D viewing angle)

<Table. Standard specification of Eyeglasses>

Design item of Eyeglasses		Left	Right	Remark
Optical axis	a) Slow axis of retarder	-45˚	45˚	Refer to drawing
	b) Transmission axis of polarizer	0˚	0˚	
Retardation value	Retarder	125nm		@550nm

※Recommended polarizer
Polarization efficiency: more than 99.90%



(b) Configuration of Eyeglasses

<Drawing. Information of optical axis>

APPENDIX-XII

■ Management for Micro-crack by Laser Cutting

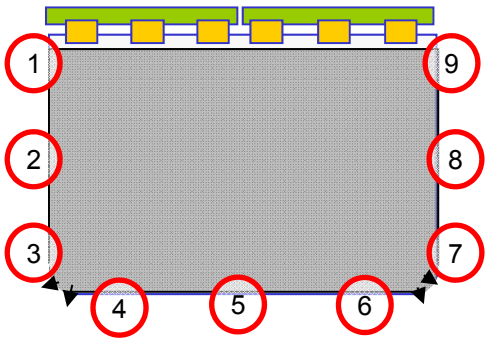
1. Subject of process : Laser cutting

2. Measuring cycle

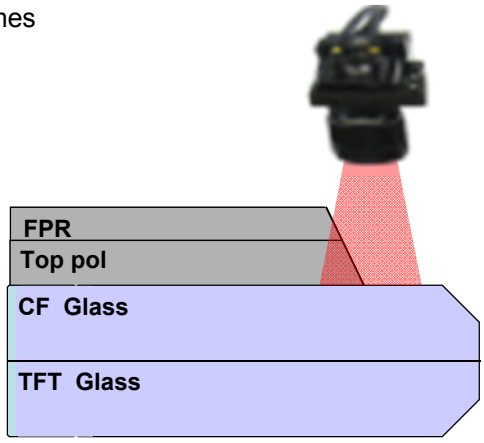
- Regular measuring : One of Fixer Ass'Y is measured in every 8 hours
- Irregular measuring : One of Fixer Ass'Y is measured when a model is changed

3. Measurement Method

- Measuring point : 9 Points



- Measuring Condition
  - Magnification of microscope : 50 times
  - Lighting Mode : Reflection Mode



4. Management standard

- Micro-crack length : Smaller than 50㎛ at Start①/End⑨ point, no micro-crack at the rest of point