SPECIFICATION
FOR
APPROVAL

(●) **Preliminary Specification**

( ) **Final Specification**

Title	47.0” WUXGA TFT LCD

BUYER	LGE
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LC470WUF
SUFFIX	SBF1

*When you obtain standard approval,
please use the above model name without suffix

APPROVED BY	SIGNATURE / DATE
/	
/	
/	

Please return 1 copy for your confirmation with your signature and comments.

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Public Display Development
LG Display Co., Ltd

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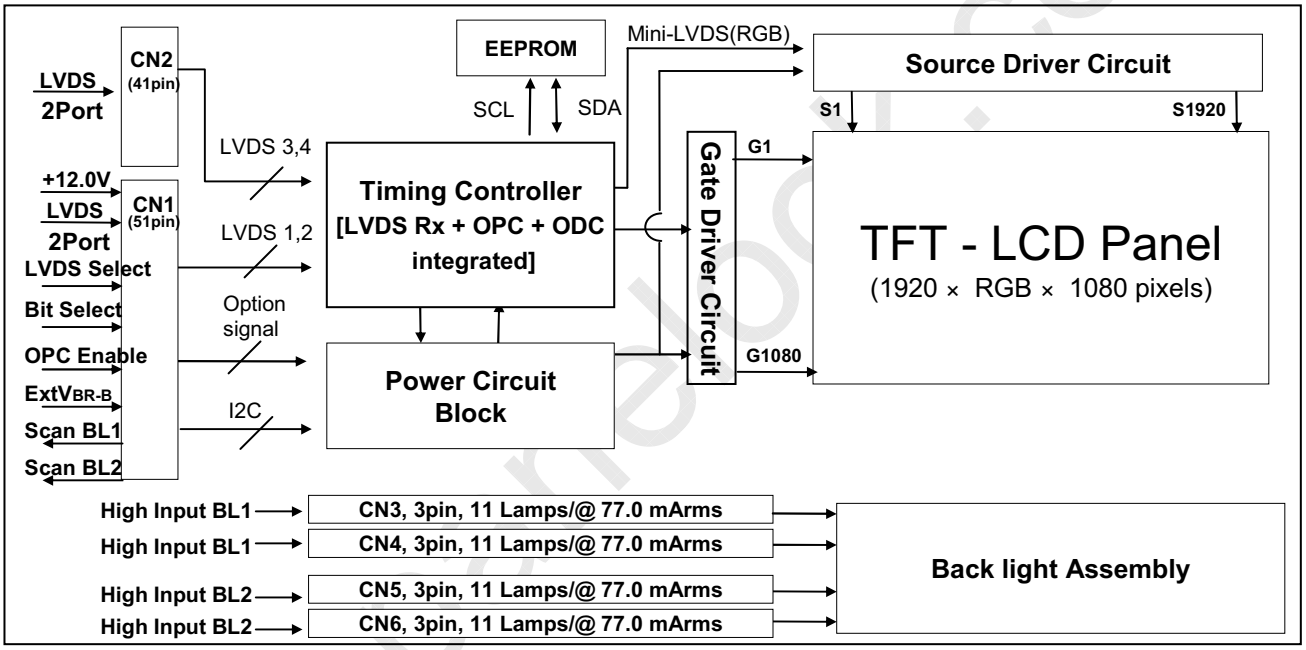
RECORD OF REVISIONS

Revision No.	Revision Date	Page	Description
0.1	Sep 02, 2008	-	Preliminary Specification
0.2	Oct 24. 2008	6,7	Update power Consumption
		10	Change notes of Connector (CN1) pin configuration (about pin #8)
		36	Change Pull Up/Down Structure of OPC_EN pin (Pull Up→ Pull-Down)
0.3	Nov 05.2008	23, 24	Front View / Rear View
		40	Add Appendix _ Inverter input current
		42	Add Appendix _ Humming Noise Level
0.4	Nov 12.2008	18, 19	Contrast Ratio Value (Typ.) is changed : 1400 → 1300(Center 1 point)
0.5	Dec 04, 2008	7,8	Update electrical characteristics of back light assembly & lamp
		23,24	Mechanical Drawing changed
		43,44	Add Appendix XII, XIII
0.51	Dec 18, 2008	18	Update Color Coordinates
0.52	Jan 07. 2009	8	Update ELECTRICAL CHARACTERISTICS for IPB& Lamp
0.53	May 26, 2009	4	General features changed
		18	Optical characteristics changed
		19	Add notes relating to 3D specification
		22,23	Add measurement of 3D performance
		24	Mechanical specifications changed
		25	Mechanical Drawing, Front View, changed

1. General Description

LC470WUF is a Color Active Matrix Liquid Crystal Display with an Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display 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 arranged in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 10-bit gray scale signal for each dot, thus presenting a palette of more than 1.06Billion(FRC) of 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 moving picture response time are important.



General Features

Active Screen Size	46.96 inch (1192.78mm) diagonal
Outline Dimension	1096.0(H) x 640.0 (V) x 47.0(D) mm (D) (Typ.)
Pixel Pitch	0.5415 mm x 0.5415 mm x RGB
Pixel Format	1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement
Color Depth	10Bit(D), 1.06 Billion colors
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 220W(Typ.) [Logic= 7.08W, Backlight=213W (V_{BR-A}=1.65V)]
Weight	14.5 Kg
Display Mode	Transmissive mode, Normally black
Surface Treatment	Anti-Reflection coating(2H)

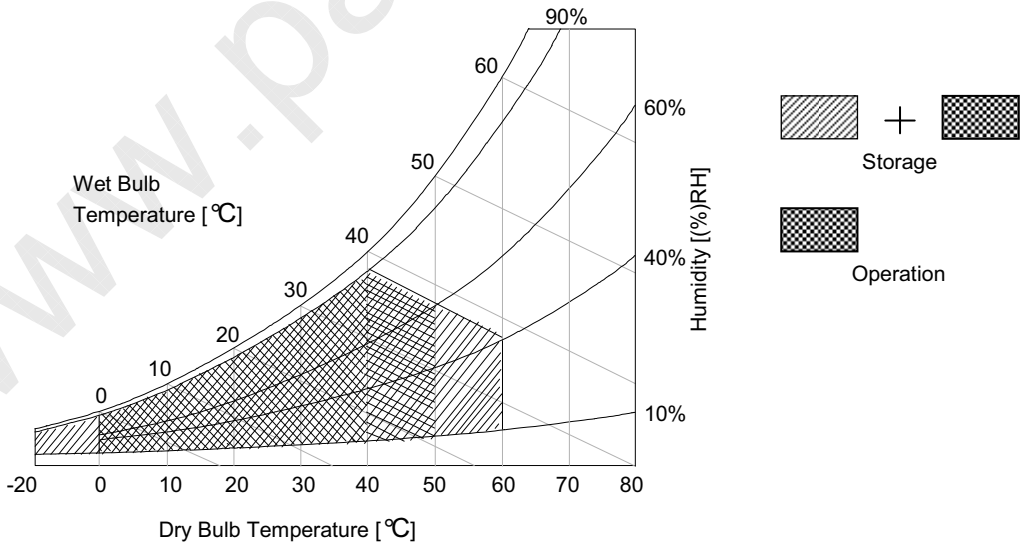
2. Absolute Maximum Ratings

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

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Value		Unit	Remark
			Min	Max		
Power Input Voltage	LCM	V_{LCD}	-0.3	+14.0	V_{DC}	at 25 ± 2 ℃
B/L Input voltage	Operating Voltage (1Block / Side)	VOP	1000	2000	V[RMS]	at 25 ± 2 ℃ ExtVBR-B 100%
Operating Temperature		T_{OP}	0	+50	℃	Note 1,2
Storage Temperature		T_{ST}	-20	+60	℃	
Operating Ambient Humidity		H_{OP}	10	90	%RH	
Storage Humidity		H_{ST}	10	90	%RH	

Note : 1. Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be Max 39 ℃. and no condensation of water.
2. Gravity mura can be guaranteed below 40℃ condition.



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 CCFL backlight circuit.

Table 2. ELECTRICAL CHARACTERISTICS

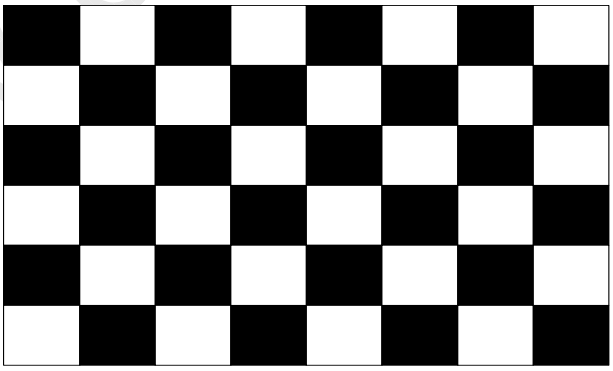
Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V_{LCD}	10.8	12.0	13.2	V_{DC}	
Power Input Current	I_{LCD}	413	590	767	mA	1
		572	817	1062	mA	2
Power Consumption	P_{LCD}	-	7.08	9.20	Watt	1
Rush current	I_{RUSH}	-	-	3	A	3

Note : 1. The specified current and power consumption are under the V_{LCD}=12.0V, 25 ± 2℃, f_V=120Hz condition whereas mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.

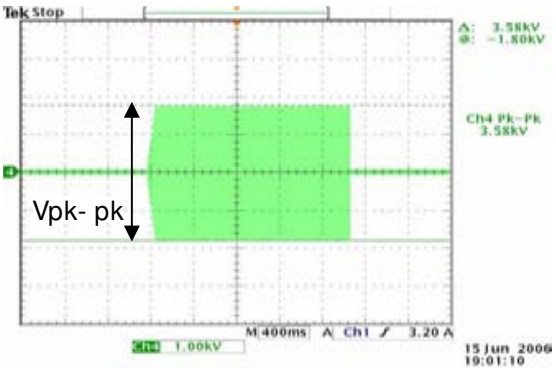
2. The current is specified at maximum current pattern.

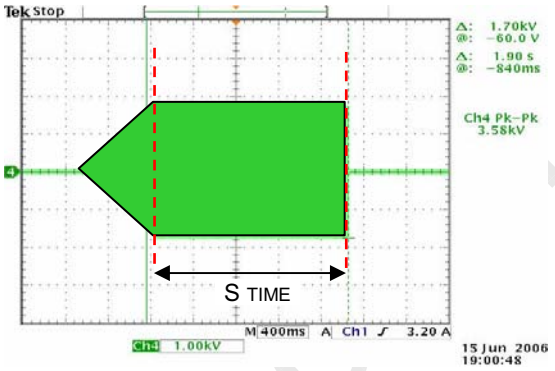
3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).

White : 1023 Gray
Black : 0 Gray



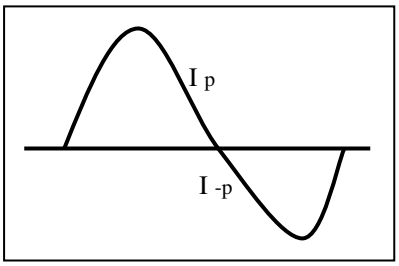
Mosaic Pattern(8 x 6)





Vs = (Vpk-pk) / [2*root(2)]

4. Lamp frequency may produce interference with horizontal synchronous frequency. As a result this may cause beat on the display. Therefore, lamp frequency shall be away as much as possible from the horizontal synchronous frequency and its harmonics range in order to prevent interference.
   There is no reliability problem of lamp, if use out of range of operation frequency (61 kHz~ 65 kHz) on CAS
5. The brightness of the lamp after lighted for 5minutes is defined as 100%.
   T_S is the time required for the brightness of the center of the lamp to be not less than 95% at typical current.
   The screen of LCD module may be partially dark by the time the brightness of lamp is stable after turn on.
6. Maximum level of power consumption is measured at initial turn on.
   Typical level of power consumption is measured after 2hrs aging at 25 ± 2℃.
7. The life time is determined as the time at which brightness of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25 ± 2℃, based on duty 100%.
8. The output of the inverter must have symmetrical(negative and positive) voltage and current waveform (Unsymmetrical ratio is less than 10%). Please do not use the inverter which has not only unsymmetrical voltage and current but also spike wave.
   Requirements for a system inverter design, which is intended to achieve better display performance, power efficiency and more reliable lamp characteristics.
   It can help increase the lamp lifetime and reduce leakage current.
   a. The asymmetry rate of the inverter waveform should be less than 10%.
   b. The distortion rate of the waveform should be within √2 ±10%.
   * Inverter output waveform had better be more similar to ideal sine wave.



* Asymmetry rate:

$| I_p - I_{-p} | / I_{op} \times 100\%$

* Distortion rate

I_p (or I_{-p}) / I_{op}

Table 3. ELECTRICAL CHARACTERISTICS for IPB& Lamp (Continue)

Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Backlight Assembly : APPENDIX-XIII							
Operating Voltage (1Block/side,fBL=63KHz, IBL=77.0mArms))		VBL	-	1335	-	V_{RMS}	1, 2
Operating Current (1 Block/side)		IBL	-	77.0	-	mA_{RMS}	1
Established Starting Voltage (1 Block/side)	0℃	Vs	-	-	1325	V_{RMS}	1, 3
	25℃		-	-	1125		
Operating Frequency		fBL	61	63	65	kHz	4
Striking Time		S TIME	-	-	1.5	sec	3
Balance Cap.		Cb	-	15	-	pF	1,3
Power Consumption		PBL	-	211	232	Watt	6
Burst Dimming Duty		a/T * 100	20		100	%	9
Burst Dimming Frequency		1/T	98	-	182	Hz	9

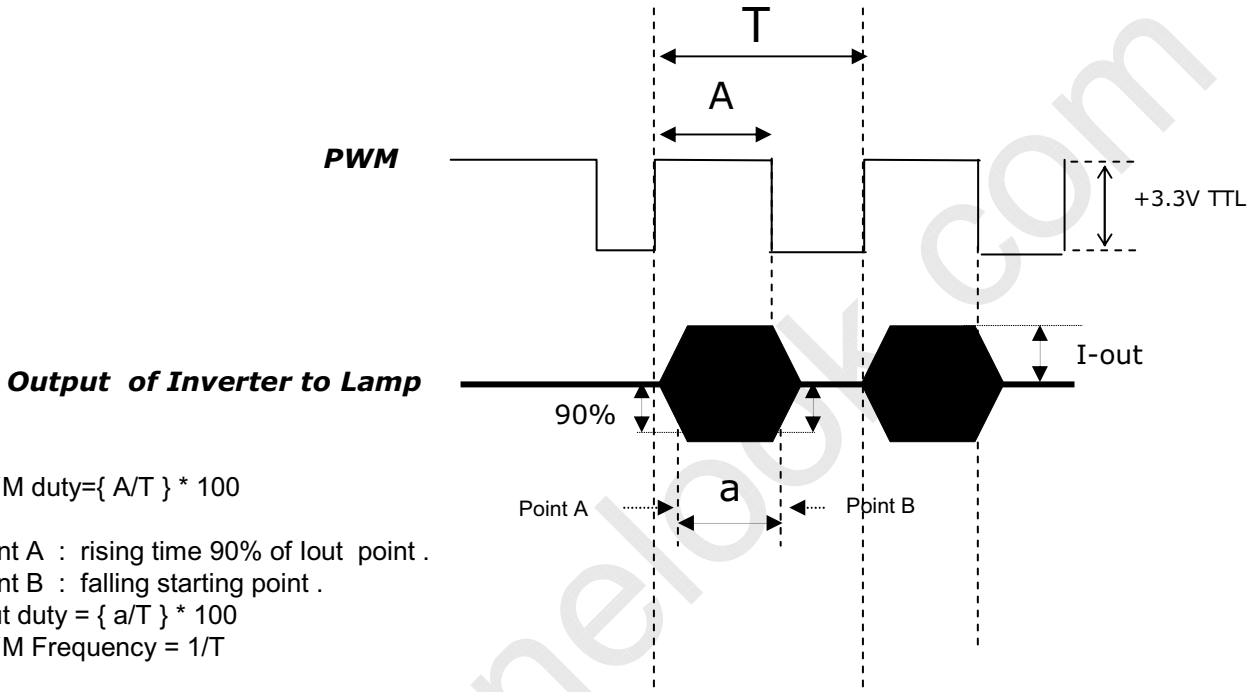
Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Lamp : APPENDIX-XII							
Lamp Voltage (1 Block/side)		VLAMP	725	755	880	V_{RMS}	2
Lamp Current (1 Block/side)		ILAMP	3	7.0	8	mA_{RMS}	
Discharge Stabilization Time		Ts	-	-	3	Min	5
Lamp Frequency		f LAMP	40	63	80	KHz	
Lamp Temperature		TLAMP			170	℃	
Established Starting Voltage (1 Block/side)	0℃	Vs			1325	V_{RMS}	3
	25℃	Vs			1125		
Life Time			50,000			Hrs	7

Note : The design of the inverter must have specifications for the lamp in LCD Assembly.
The electrical characteristics of inverter are based on High-High Driving type.
The performance of the lamps in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC inverter. So, all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.
When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter (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.

※ Do not attach a conductive tape to lamp connecting wire.
If you attach conductive tape to the lamp wire, not only luminance level can be lower than typical one but also inverter operate abnormally on account of leakage current which is generated between lamp wire and conductive tape.

1. Specified values are defined for a Backlight Assembly.(IBL : 22 lamp, 7.0mA/Lamp)
2. Operating voltage is measured at 25 ± 2℃(after 2hr.aging). The variance range for operating voltage is ± 10%.
3. The established starting voltage [Vs] should be applied to the lamps for more than Striking time (S TIME) for start-up. Inverter open voltage must be more than established starting voltage. Otherwise, the lamps may not be turned on. The used lamp current is typical value.

9. The reference method of burst dimming duty ratio.
   It is recommended to use synchronous V-sync frequency to prevent waterfall
   (Vsync x 1 =Burst Frequency)



PWM duty={ A/T } * 100

Point A : rising time 90% of Iout point .
Point B : falling starting point .
I out duty = { a/T } * 100
PWM Frequency = 1/T

※ We recommend not to be much different between PWM duty and Iout duty .
※ Minimum PWM duty ratio should be defined based on the minimum luminance.
※ Dimming current output rising and falling time may produce humming and inverter trans' sound noise.
※ Burst dimming duty should be 100% for more than 1second after turn on
※ Equipment
Oscilloscope :TDS3054B(Tektronix)
Current Probe : P6022 AC (Tektronix)
High Voltage Probe: P5100(Tektronix)

10. The Cable between the backlight connector and its inverter power supply should be connected directly with a minimized length. The longer cable between the backlight and the inverter may cause the lower luminance of lamp and may require more higher starting voltage (Vs).

11. The operating current must be measured as near as backlight assembly input.

12. The operating current unbalance between left and right must be under 10% of Typical current
   | Left(Master) current – Right(Slave) Current | 〈 10% of typical current

3-2. Interface Connections

This LCD module employs two kinds of interface connection, 51-pin and 41-pin connector are used for the module electronics and Master 3-pin and Slave 3-pin connectors are used for the integral backlight system

3-2-1. LCD Module

- LCD Connector(CN1): FI-RE51S-HF(manufactured by JAE) Refer to below and next Page table
- Mating Connector : FI-RE51HL(JAE) or compatible

Table 4-1. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	GND	Ground	27	BIT Selection	'H' or NC: 10Bit (D), 'L' : 8Bit
2	NC	No connection	28	R2AN	SECOND LVDS Receiver Signal (A-)
3	NC	No connection	29	R2AP	SECOND LVDS Receiver Signal (A+)
4	NC	No connection	30	R2BN	SECOND LVDS Receiver Signal (B-)
5	NC	No connection	31	R2BP	SECOND LVDS Receiver Signal (B+)
6	NC	No connection	32	R2CN	SECOND LVDS Receiver Signal (C-)
7	LVDS Select	'H' =JEIDA , 'L' = VESA	33	R2CP	SECOND LVDS Receiver Signal (C+)
8	VBR EXT	External VBR (Input)	34	GND	Ground
9	OPC OUT	SCAN_BLK1 (output,)	35	R2CLKN	SECOND LVDS Receiver Clock Signal(-)
10	OPC Enable	'H' = Enable , 'L' or NC = Disable	36	R2CLKP	SECOND LVDS Receiver Clock Signal(+)
11	SCAN_BLK2	SCAN_BLK2 (output)	37	GND	Ground
12	R1AN	FIRST LVDS Receiver Signal (A-)	38	R2DN	SECOND LVDS Receiver Signal (D-)
13	R1AP	FIRST LVDS Receiver Signal (A+)	39	R2DP	SECOND LVDS Receiver Signal (D+)
14	R1AN	FIRST LVDS Receiver Signal (B-)	40	R2EN	SECOND LVDS Receiver Signal (E-)
15	R1BP	FIRST LVDS Receiver Signal (B+)	41	R2EP	SECONDLVDS Receiver Signal (E+)
16	R1CN	FIRST LVDS Receiver Signal (C-)	42	GND	Ground
17	R1CN	FIRST LVDS Receiver Signal (C+)	43	GND	Ground
18	GND	Ground	44	GND	Ground
19	R1CLKN	FIRST LVDS Receiver Clock Signal(-)	45	GND	Ground
20	R1CLKP	FIRST LVDS Receiver Clock Signal(+)	46	GND	Ground
21	GND	Ground	47	Reserved (NC)	No connection
22	R1DN	FIRST LVDS Receiver Signal (D-)	48	VLCD	Power Supply +12.0V
23	R1DP	FIRST LVDS Receiver Signal (D+)	49	VLCD	Power Supply +12.0V
24	R1EN	FIRST LVDS Receiver Signal (E-)	50	VLCD	Power Supply +12.0V
25	R1EP	FIRST LVDS Receiver Signal (E+)	51	VLCD	Power Supply +12.0V
26	Reserved	No connection or GND	-	-	-

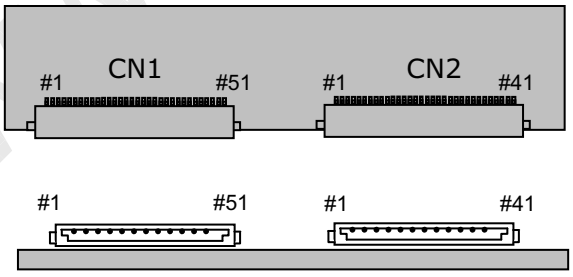
Notes : 1. All GND(ground) pins should be connected together to the LCD module's metal frame.
2. All V_{LCD} (power input) pins should be connected together.
3. All Input levels of LVDS signals are based on the EIA 644 Standard.
4. Specific pins(pin No. #2~#6) are used for internal data process of the LCD module. If not used, these pins are no connection.
5. Specific pins(pin No. #8~#11) are used for OPC & Scanning function of the LCD module. If not used, #9~#11pins are no connection and #8 pin must be fixed VCC(3.3V).
6. LVDS pin (pin No. #24,25,40,41) are used for 10Bit(D) of the LCD module. If used for 8Bit(R), these pins are no connection.
7. Specific pin No. #44 is used for "No signal detection" of system signal interface. It should be GND for NSB(No Signal Black) during the system interface signal is not. If this pin is "H", LCD Module displays AGP(Auto Generation Pattern).

- LCD Connector(CN2): FI-RE41S-HF, Refer to below table
- Mating Connector : FI-RE41HL

Table 4-2. MODULE CONNECTOR(CN2) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	NC	No connection(Reserved)	22	RE3N	THIRD LVDS Receiver Signal (E-)
2	NC	No connection	23	RE3P	THIRD LVDS Receiver Signal (E+)
3	NC	No connection	24	GND	Ground
4	NC	No connection	25	GND	Ground
5	NC	No connection	26	RA4N	FOURTH LVDS Receiver Signal (A-)
6	NC	No connection	27	RA4P	FOURTH LVDS Receiver Signal (A+)
7	NC	No connection	28	RB4N	FOURTH LVDS Receiver Signal (B-)
8	NC	No connection	29	RB4P	FOURTH LVDS Receiver Signal (B+)
9	GND	Ground	30	RC4N	FOURTH LVDS Receiver Signal (C-)
10	RA3N	THIRD LVDS Receiver Signal (A-)	31	RC4P	FOURTH LVDS Receiver Signal (C+)
11	RA3P	THIRD LVDS Receiver Signal (A+)	32	GND	Ground
12	RB3N	THIRD LVDS Receiver Signal (B-)	33	RCLK4N	FOURTH LVDS Receiver Clock Signal(-)
13	RB3P	THIRD LVDS Receiver Signal (B+)	34	RCLK4P	FOURTH LVDS Receiver Clock Signal(+)
14	RC3N	THIRD LVDS Receiver Signal (C-)	35	GND	Ground
15	RC3P	THIRD LVDS Receiver Signal (C+)	36	RD4N	FOURTH LVDS Receiver Signal (D-)
16	GND	Ground	37	RD4P	FOURTH LVDS Receiver Signal (D+)
17	RCLK3N	THIRD LVDS Receiver Clock Signal(-)	38	RE4N	FOURTH LVDS Receiver Signal (E-)
18	RCLK3P	THIRD LVDS Receiver Clock Signal(+)	39	RE4P	FOURTH LVDS Receiver Signal (E+)
19	GND	Ground	40	GND	Ground
20	RD3N	THIRD LVDS Receiver Signal (D-)	41	GND	Ground
21	RD3P	THIRD LVDS Receiver Signal (D+)	-		

Notes : 1. All GND(ground) pins should be connected together to the LCD module's metal frame.
2. LVDS pin (pin No. #22,23,38,39) are used for 10Bit(D) of the LCD module.
If used for 8Bit(R), these pins are no connection.



Rear view of LCM

[CN1]
-Part/No. : FI-RE51S-HF(JAE)
KN25-51P-0.5SH(Hirose)
- Mating connector : FI-RE51HL
(Manufactured by JAE)
[CN2]
- Part/No. : FI-RE41S-HF(JAE)
- Mating connector : FI-RE41HL
(Manufactured by JAE)

3-2-2. Backlight Module

[Master (Block #1, #2)]

1) Balance Connector

: 65002WS-03 (manufactured by YEONHO)or equivalent

2) Mating Connector

: 65002HS-03 (manufactured by YEONHO) or equivalent.

[Slave (Block #1, #2)]

1) Balance Connector

: 65002WS-03 (manufactured by YEONHO)or equivalent

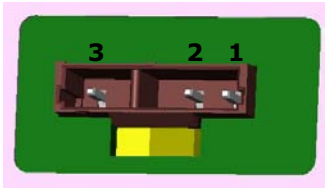
2) Mating Connector

: 65002HS-03 (manufactured by YEONHO) or equivalent.

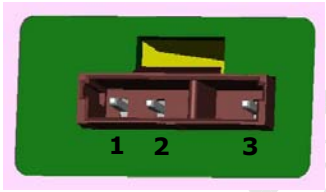
Table 5. BACKLIGHT CONNECTOR PIN CONFIGURATION(CN3,CN4,CN5,CN6)

No	Symbol	Master (Block #1, #2)	Slave (Block #1, #2)	Note
1	**H_Input**	High_Input	High_Input	
2	**H_Input**	High_Input	High_Input	
3	**FB**	NC	NC	

◆ Rear view of LCM



Master
Block(#1, #2)



Slave
Block(#1, #2)

Table 7 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timing should be satisfied with the following specification for normal operation.

Table7. TIMING TABLE for DVB/PAL (DE Only Mode)

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	t_{HV}	480	480	480	t_{CLK}	1920/4
	Blank	t_{HB}	44	70	200	t_{CLK}	1
	Total	t_{HP}	524	550	680	t_{CLK}	
Vertical	Display Period	t_{VV}	1080	1080	1080	Lines	
	Blank	t_{VB}	228	270	300	Lines	1
	Total	t_{VP}	1308	1350	1380	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	f_{CLK}	66.97	74.25	75.00	MHz	
	Horizontal	f_H	121.8	135	136.4	KHz	2
	Vertical	f_V	95	100	103.7	Hz	2

Notes : 1. The Input of HSYNC & VSYNC signal does not have an effect on normal operation(DE Only Mode). If you use spread spectrum for EMI, add some additional clock to minimum value for clock margin.
2. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency.

3-3. Signal Timing Specifications

Table 6 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timing should be satisfied with the following specification for normal operation.

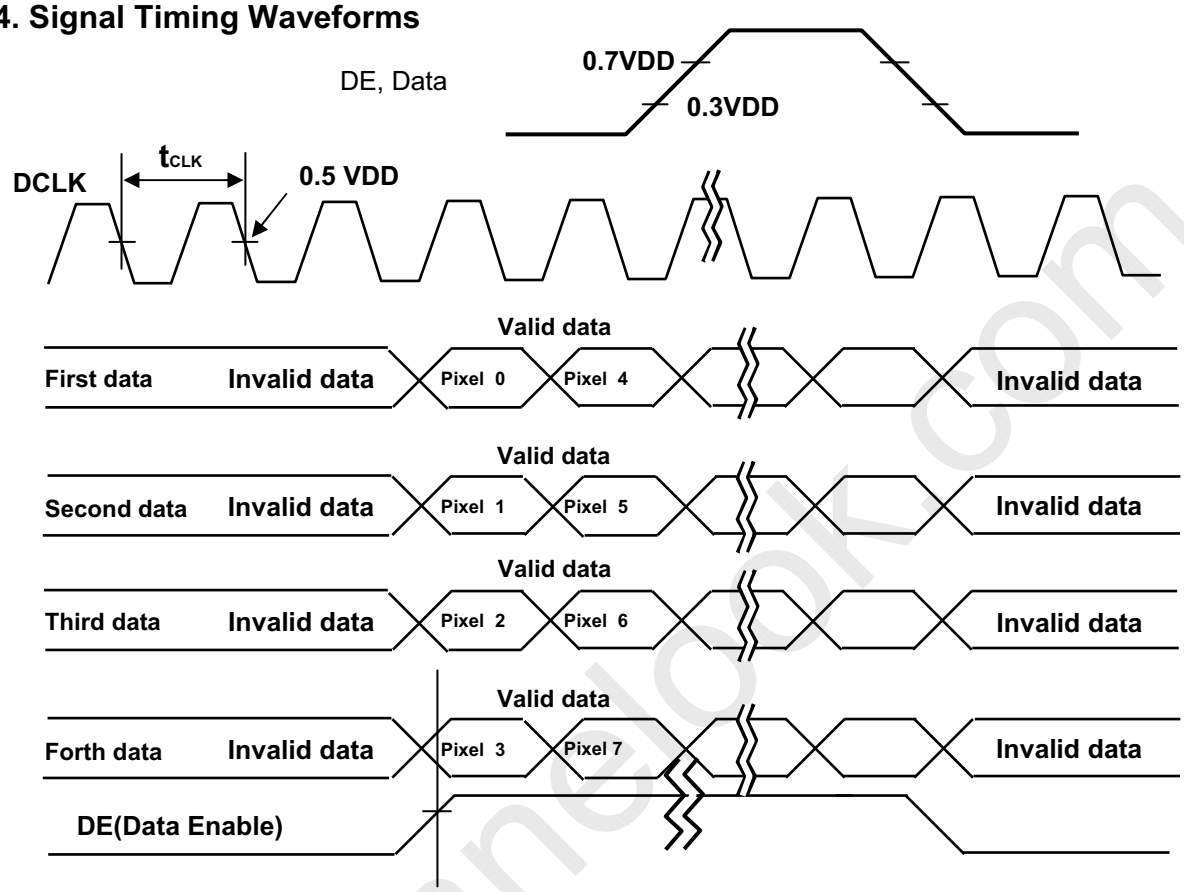
Table 6. TIMING TABLE for NTSC/ATSC (DE Only Mode)

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	t_{HV}	480	480	480	t_{CLK}	1920/4
	Blank	t_{HB}	44	70	200	t_{CLK}	1
	Total	t_{HP}	524	550	680	t_{CLK}	
Vertical	Display Period	t_{VV}	1080	1080	1080	Lines	
	Blank	t_{VB}	10	45	86	Lines	1
	Total	t_{VP}	1090	1125	1166	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	f_{CLK}	66.97	74.25	75.00	MHz	
	Horizontal	f_H	121.8	135	136.4	KHz	2
	Vertical	f_V	108.2	120	121.2	Hz	2

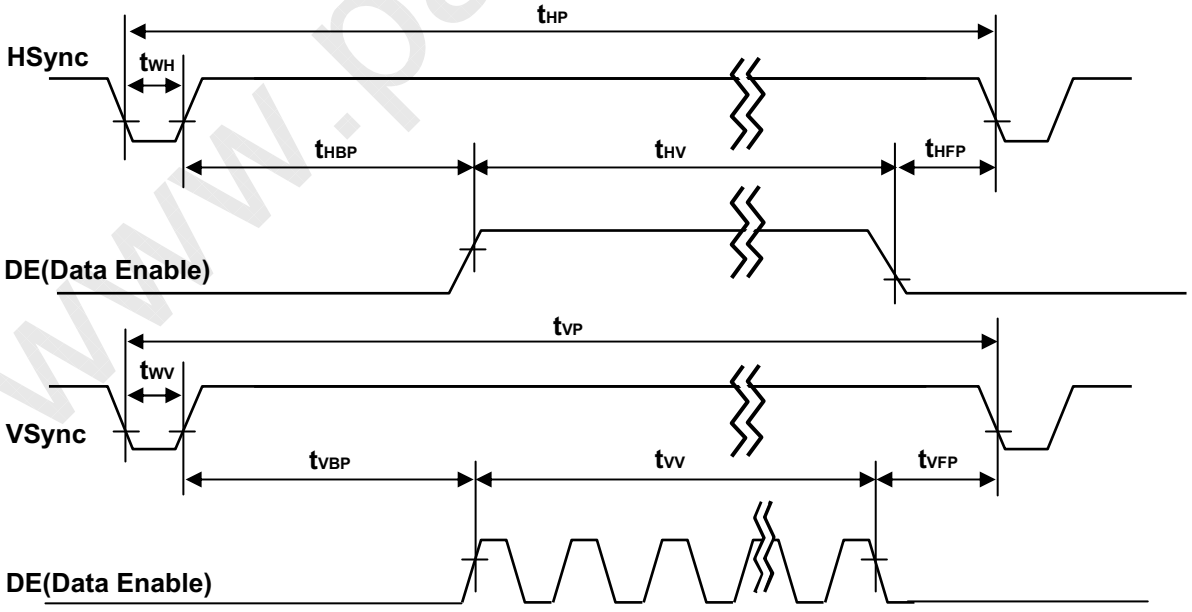
Notes : 1. The Input of HSYNC & VSYNC signal does not have an effect on normal operation(DE Only Mode). If you use spread spectrum for EMI, add some additional clock to minimum value for clock margin.
2. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency.

3-4. Signal Timing Waveforms



* Reference : Sync. Relation

* $t_{HB} = t_{HFP} + t_{WH} + t_{HBP}$
* $t_{VB} = t_{VFP} + t_{WV} + t_{VBP}$



3-5. Color Data Reference

The brightness of each primary color(red,green,blue) is based on the 10-bit gray scale data input for the color. The higher binary input, the brighter the color. Table 8 provides a reference for color versus data input.

Table 8. COLOR DATA REFERENCE

Color		Input Color Data																													
		RED										GREEN										BLUE									
		MSB									LSB	MSB									LSB	MSB									LSB
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Blue (1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED (000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (001)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	. . .					. . .										. . .										. . .					
	RED (1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	. . .					. . .										. . .										. . .					
	GREEN (1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	GREEN (1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
BLUE	BLUE (000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	. . .					. . .										. . .										. . .					
	BLUE (1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
	BLUE (1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

3-6. Power Sequence

3-6-1. LCD Driving circuit

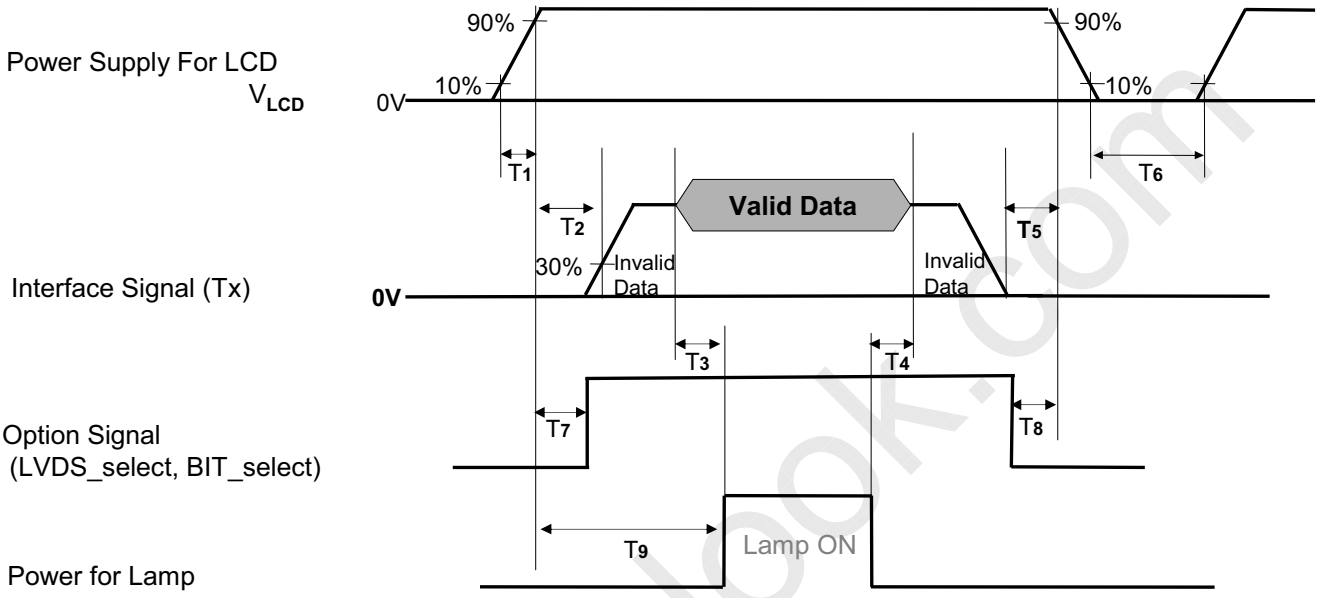


Table 9. POWER SEQUENCE

Parameter	Value			Unit	Notes
	Min	Typ	Max		
T1	0.5	-	20	ms	
T2	0.5	-	-	ms	4, 5
T3	200	-	-	ms	3
T4	200	-	-	ms	3
T5	0	-	-	ms	
T6	2.0	-	-	s	6
T7	0.5	-	T2	ms	4
T8	0	-	-	ms	4
T9	T2 + T3	-	12	s	

Note : 1. Please avoid floating state of interface signal at invalid period.
2. When the interface signal is invalid, be sure to pull down the power supply V_{LCD} to 0V.
3. The T3/T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.
4. If the On time of signals(Interface signal and Option signals) precedes the On time of Power(V_{LCD}), it will be happened abnormal display.
5. The case when failed to meet a minimum specification (T2) because of the Tcon, Please check system output sequence after unplug the user cable.
6. T6 should be measured after the Module has been fully discharged between power off and on period.

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at 25± 2℃. The values specified are at an approximate distance 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.

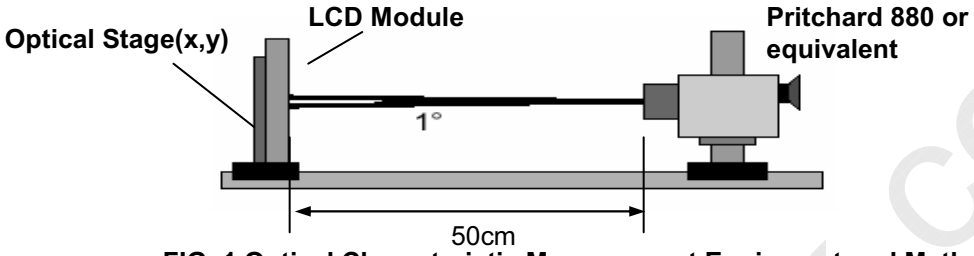


FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 11. OPTICAL CHARACTERISTICS

Ta= 25± 2℃, V_{LCD}=12.0V, f_V=120Hz, Dclk =297MHz
V_{BR_A}=1.65V, $EXTV_{BR-B}$=100%

Parameter			Symbol		Value Min	Value Typ	Value Max	Unit	Note
Contrast Ratio			CR		830	1200	-		1
Surface Luminance, white			L_{WH}	2D	320	400		cd/m²	2
				3D	120	150			8
Luminance Variation			δ_{WHITE}	5P			1.3		3
Response Time		Gray-to-Gray	G to G		-	4	6	ms	4
		MPRT	MPRT		-	6	9		5
		Uniformity	δ_{MPRT}		-	-	1		6
		Uniformity	$\delta_{G\ TO\ G}$		-	-	1		6
Color Coordinates [CIE1931]		RED	Rx		Typ -0.03	0.636	Typ +0.03		
			Ry			0.334			
		GREEN	Gx			0.290			
			Gy			0.606			
		BLUE	Bx			0.145			
			By			0.064			
		WHITE	Wx			0.279			
			Wy			0.292			
Viewing Angle	2D (CR>10)	right(ϕ=0°)	θr (x axis)		89	-	-	degree	7
		left (ϕ=180°)	θl (x axis)		89	-	-		
		up (ϕ=90°)	θu (y axis)		89	-	-		
		down (ϕ=270°)	θd (y axis)		89	-	-		
	3D (CT<7%)	right(ϕ=0°)	θr (x axis)		89	-	-	degree	8
		left (ϕ=180°)	θl (x axis)		89	-	-		
		up (ϕ=90°)	θu (y axis)		10	-	-		
		down (ϕ=270°)	θd (y axis)		10	-	-		
3D Crosstalk			3D C/T			1	3	%	8
Gray Scale						2.2			9

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

$$CR = \frac{\text{Surface Luminance at all white pixels}}{\text{Surface Luminance at all black pixels}}$$

It is measured at center 1-point.

2. Surface luminance is determined after the unit has been 'ON' and 1Hour after lighting the backlight in a dark environment at 25± 2℃. 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(5P) = Maximum(L_{on1},L_{on2}, L_{on3}, L_{on4}, L_{on5}) / Minimum(L_{on1},L_{on2}, L_{on3}, L_{on4}, L_{on5})
Where L_{on1} to L_{on5} are the luminance with all pixels displaying white at 5 locations .
For more information, see the FIG. 2.

4. Response time is the time required for the display to transit from G(N) to G(M) (Rise Time, Tr_R) and from G(M) to G(N) (Decay Time, Tr_D). For additional information see the FIG. 3. (N<M)
※ G to G Spec stands for average value of all measured points.
Photo Detector : RD-80S / Field : 2 °

5. MPRT is defined as 10% to 90% blur-edge width Bij(pixels) and scroll speed U(pixels/frame)at the moving picture. For more information, see FIG 4

6. Gray to Gray and MPRT Response time uniformity is Reference data. Please see Appendix X.

7. 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. 5.

8. 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 6~9.

9. Gray scale specification
Gamma Value is approximately 2.2. For more information, see the Table 12.

Table 12. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ.)
L0	0.07
L63	0.27
L127	1.04
L191	2.49
L255	4.68
L319	7.66
L383	11.5
L447	16.1
L511	21.6
L575	28.1
L639	35.4
L703	43.7
L767	53.0
L831	63.2
L895	74.5
L959	86.7
L1023	100

Measuring point for surface luminance & measuring point for luminance variation

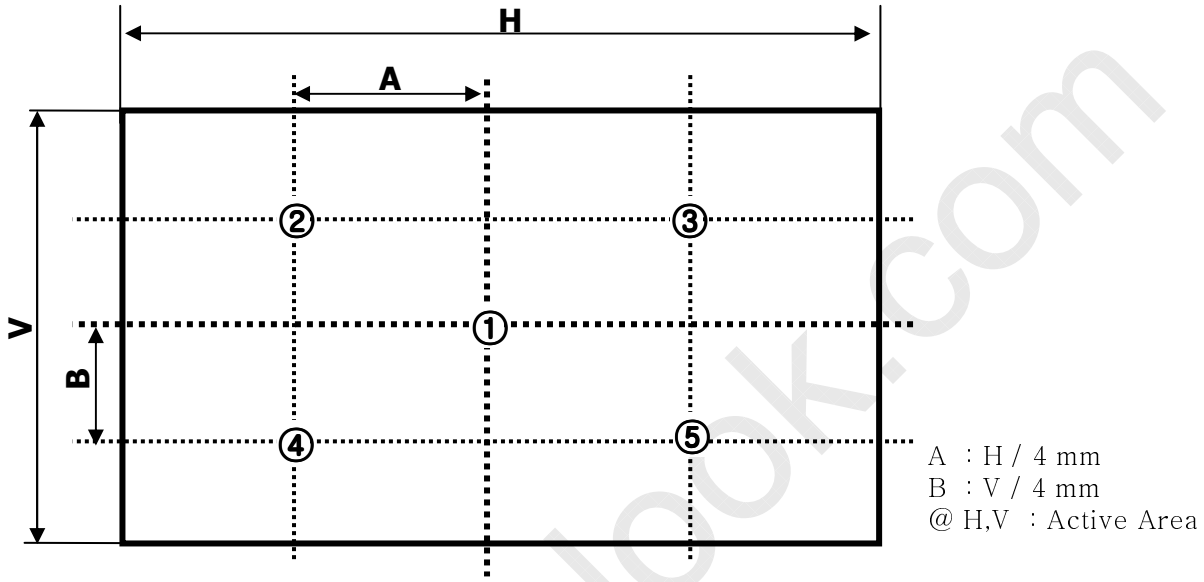


FIG. 2 Measure Point for Luminance

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Gray(M)".

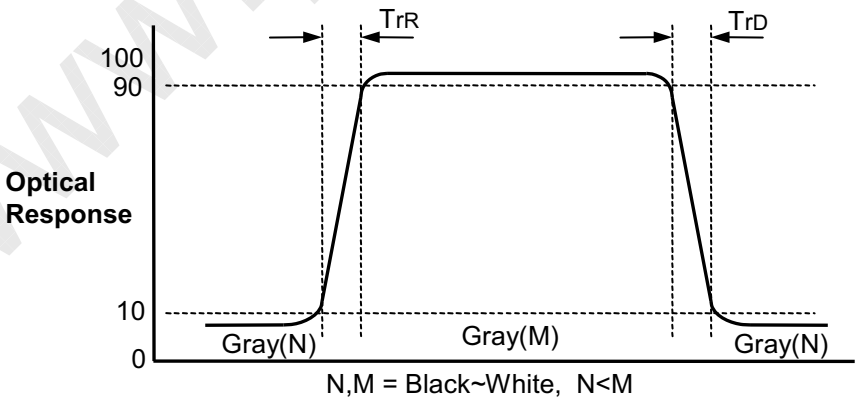
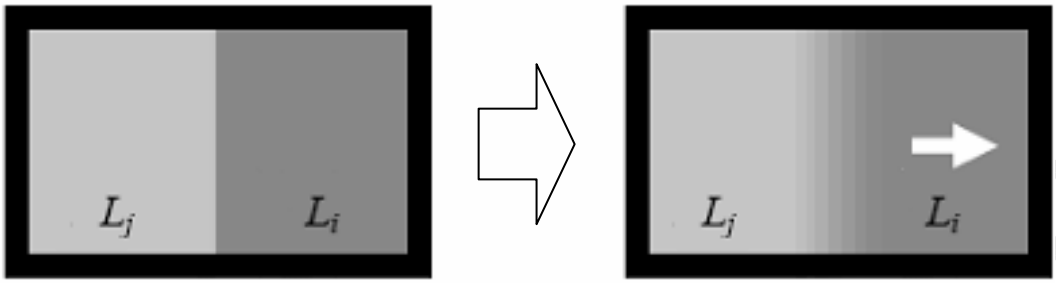
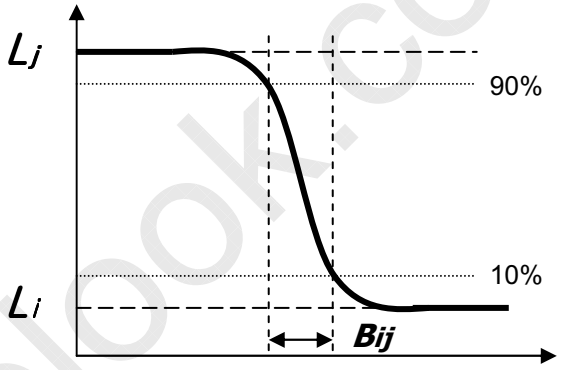


FIG.3 Response Time(G to G)

MPRT is defined as 10% to 90% blur-edge with Bij(pixels) and scroll speed U(pixels/frame)at the moving picture.



$$M = \frac{1}{U} Bij \ (i \neq j)$$



Example) Bij = 12pixels, U = 10pixels / 120Hz

M = 12pixels / (10pixels / 120Hz)
= 12pixels / {10pixels / (1/120)s}
= 12 / 1,200 s
= 10 ms

FIG. 4 MPRT

Dimension of viewing angle range

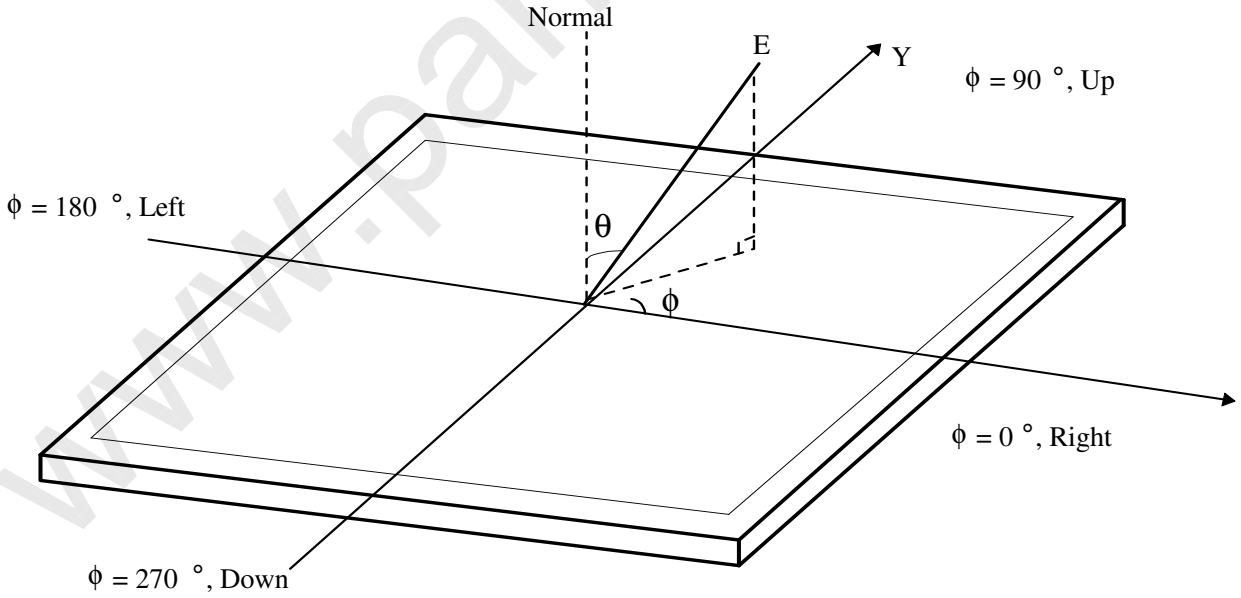
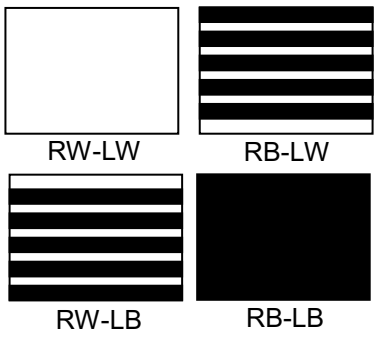
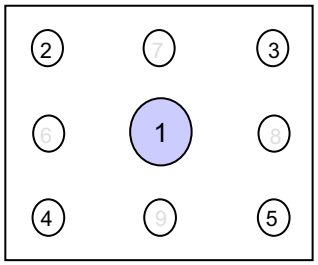


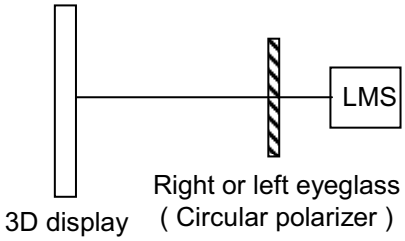
FIG. 5 Viewing angle



(a) Test pattern image

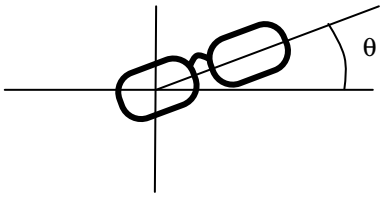


(b) Measurement position

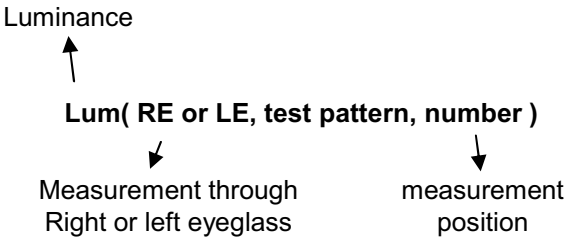


(c) Setup

< Figure 6. Measurement configuration>



< Figure 7. Positioning eyeglass >



< Figure 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 8.

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

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

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

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

Find angle of minimum transmittance.

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

(i) Test image (RB-LW) is displayed.

(ii) Right 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(RE, RB-LW,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 (RW-LB or RB-LW) is displayed.
(ii) Right or left eyeglass are placed in front of LMS successively and luminance is measured at center 1 point where the notation for luminance measurement is "Lum(RE, RW-LB,1)" or "Lum(LE, RB_LW,1).

4) Measurement of 3D crosstalk and 3D viewing angle
(i) Test image (RB-LW, RW-LB and RB-LB) is displayed.
(ii) Right or left eyeglass are placed in front of LMS successively and luminance is measured for position 1 (position 2,3 : optional) with rotating LMS or sample vertically. (horizontal: optional)

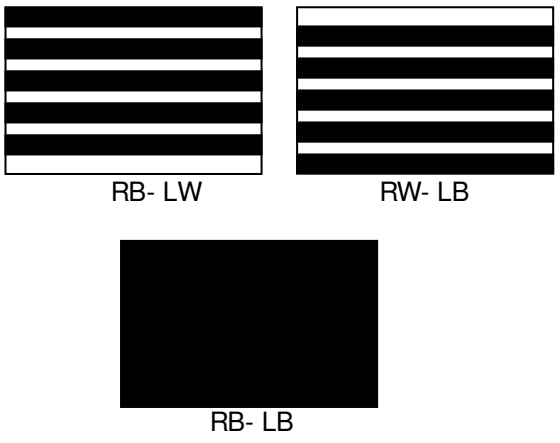
Average of

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

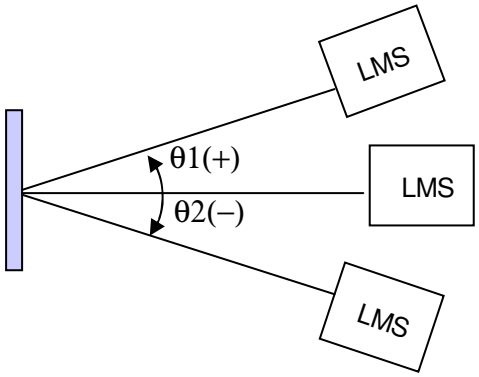
and

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

3D perceiving angular range, or 3D viewing angle, is defined as angular range that 3D crosstalk is below 7%.



(a) Test pattern image



(b) Measurement of 3D viewing angle (up/down)

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

5. Mechanical Characteristics

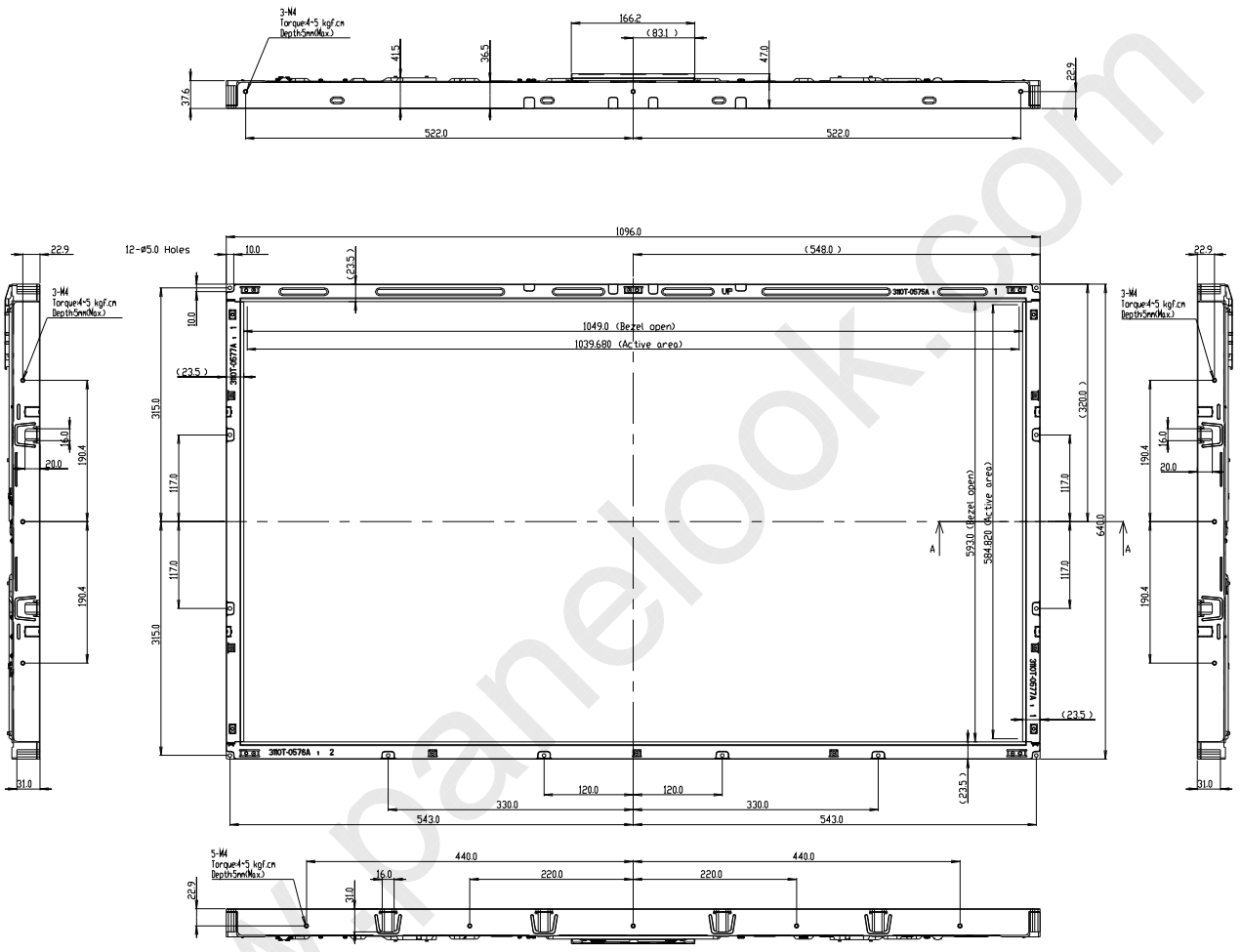
Table 13 provides general mechanical characteristics.

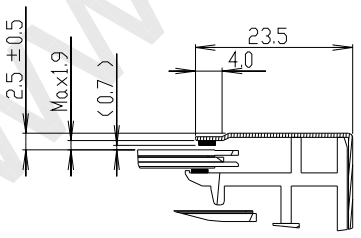
Table 13. MECHANICAL CHARACTERISTICS

Item	Value	
Outline Dimension	Horizontal	1096.0 mm
	Vertical	640.0 mm
	Depth	47.0 mm
Bezel Area	Horizontal	1049.0 mm
	Vertical	593.0 mm
Active Display Area	Horizontal	1039.68 mm
	Vertical	584.82 mm
Weight	Typ. 14.5㎏	

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

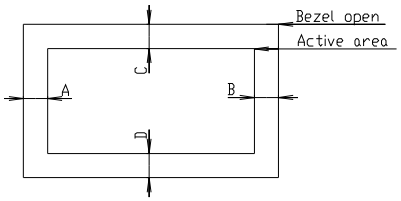
<FRONT VIEW>



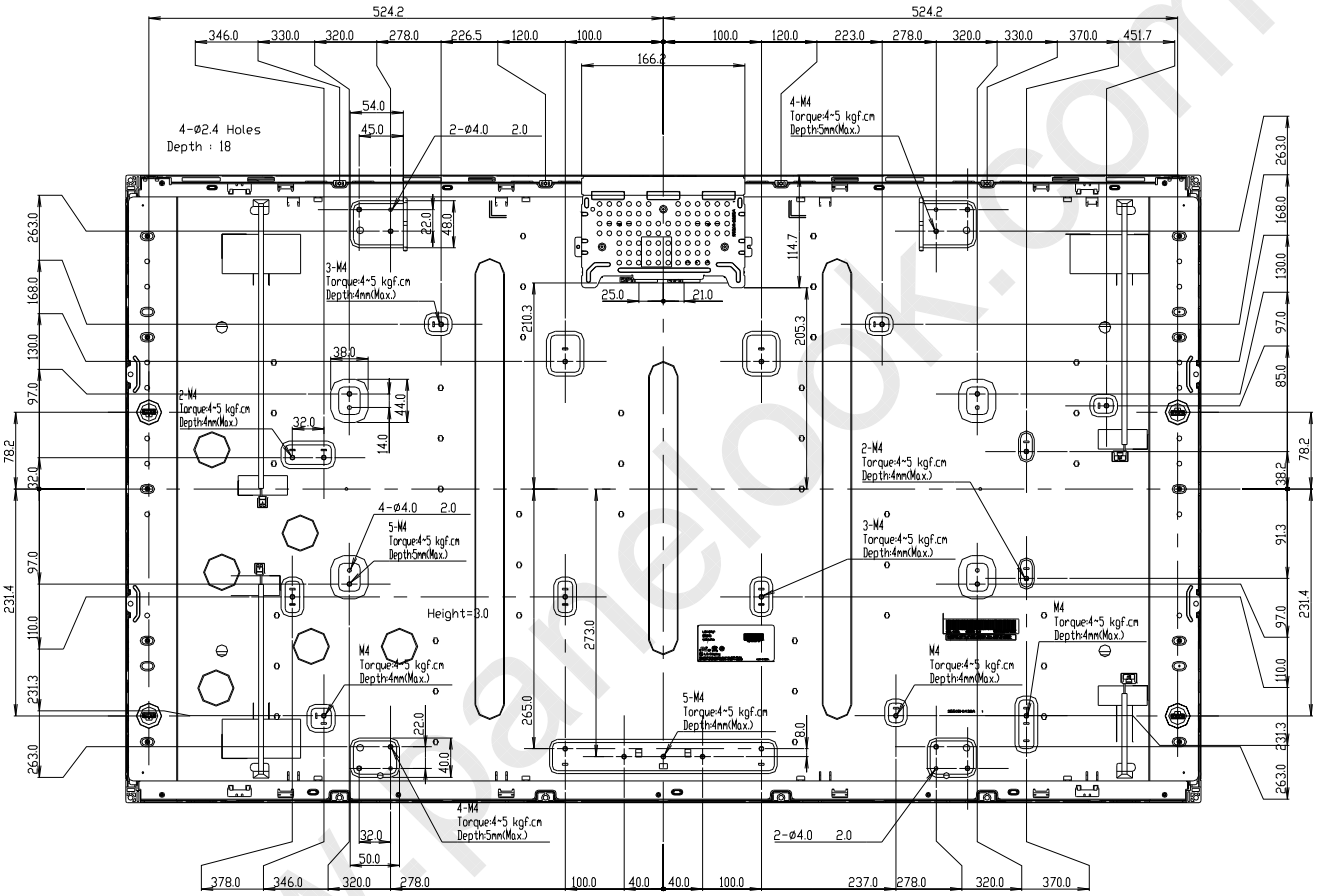


SECTION A-A
SCALE 1/1

Notes
1. Unspecified tolerances are to be ±1.0mm.
2. Tilt and partial disposition tolerance of display area are as following.
(1) X-Direction : IA-BI 1.5mm
(2) Y-Direction : IC-DI 1.5mm



<REAR VIEW>



6. Reliability

Table 14. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 60℃ 240h
2	Low temperature storage test	Ta= -20℃ 240h
3	High temperature operation test	Ta= 50℃ 50%RH 240h
4	Low temperature operation test	Ta= 0℃ 240h
5	Vibration test (non-operating)	Wave form : random Vibration level : 1.0G RMS Bandwidth : 10-300Hz Duration : X,Y,Z axis Each direction Per 10min
6	Shock test (non-operating)	Shock level :50G(X,Y axis) , 35G(Z axis) Waveform : half sine wave, 11ms Direction : ±X, ±Y, ±Z One time each direction
7	Humidity condition Operation	Ta= 40 ℃ ,90%RH
8	Altitude operating storage / shipment	0 - 15,000 ft 0 - 40,000 ft

Note : Before and after Reliability test, LCM should be operated with normal function.

7. International Standards

7-1. Safety

a) UL 60065, 7th Edition, dated June 30, 2003, Underwriters Laboratories, Inc., Standard for Audio, Video and Similar Electronic Apparatus.
b) CAN/CSA C22.2, No. 60065:03, Canadian Standards Association, Standard for Audio, Video and Similar Electronic Apparatus.
c) IEC60065:2001, 7th Edition CB-scheme and EN 60065:2002, Safety requirements for Audio, Video and Similar Electronic Apparatus..

7-2. EMC

a) ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHZ to 40GHz. “American National Standards Institute(ANSI), 1992
b) CISPR13 "Limits and Methods of Measurement of Radio interference characteristics of Sound and Television broadcast receivers and associated equipment"
CISPR22 "Limits and Methods of Measurement of Radio interference characteristics of Information Technology Equipment" International Special Committee on Radio Interference.
c) EN55013 "Limits and Methods of Measurement of Radio interference characteristics of Sound and Television broadcast receivers and associated equipment"
EN55022 "Limits and Methods of Measurement of Radio interference characteristics of Information Technology Equipment" European Committee for Electro Technical Standardization. (CENELEC), 1988(Including A1:2000)

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)
E : MONTH

D : YEAR
F~M : SERIAL NO.

Note

1. YEAR

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	4	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 : 14 pcs

b) Pallet Size : 1300mm X 1140mm X 860mm

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 holes arranged in four corners or four sides.
(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. * There is no problem of Panel crack under 5kgf / ϕ10mm
(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) It is recommended to avoid the signal cable and conductive material over the inverter transformer for it can cause the abnormal display and temperature rising.
(11) Partial darkness may happen during 3~5 minutes when LCM is operated initially in condition that luminance is under 40% at low temperature (under 5℃). This phenomenon which disappears naturally after 3~5 minutes is not a problem about reliability but LCD characteristic

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.

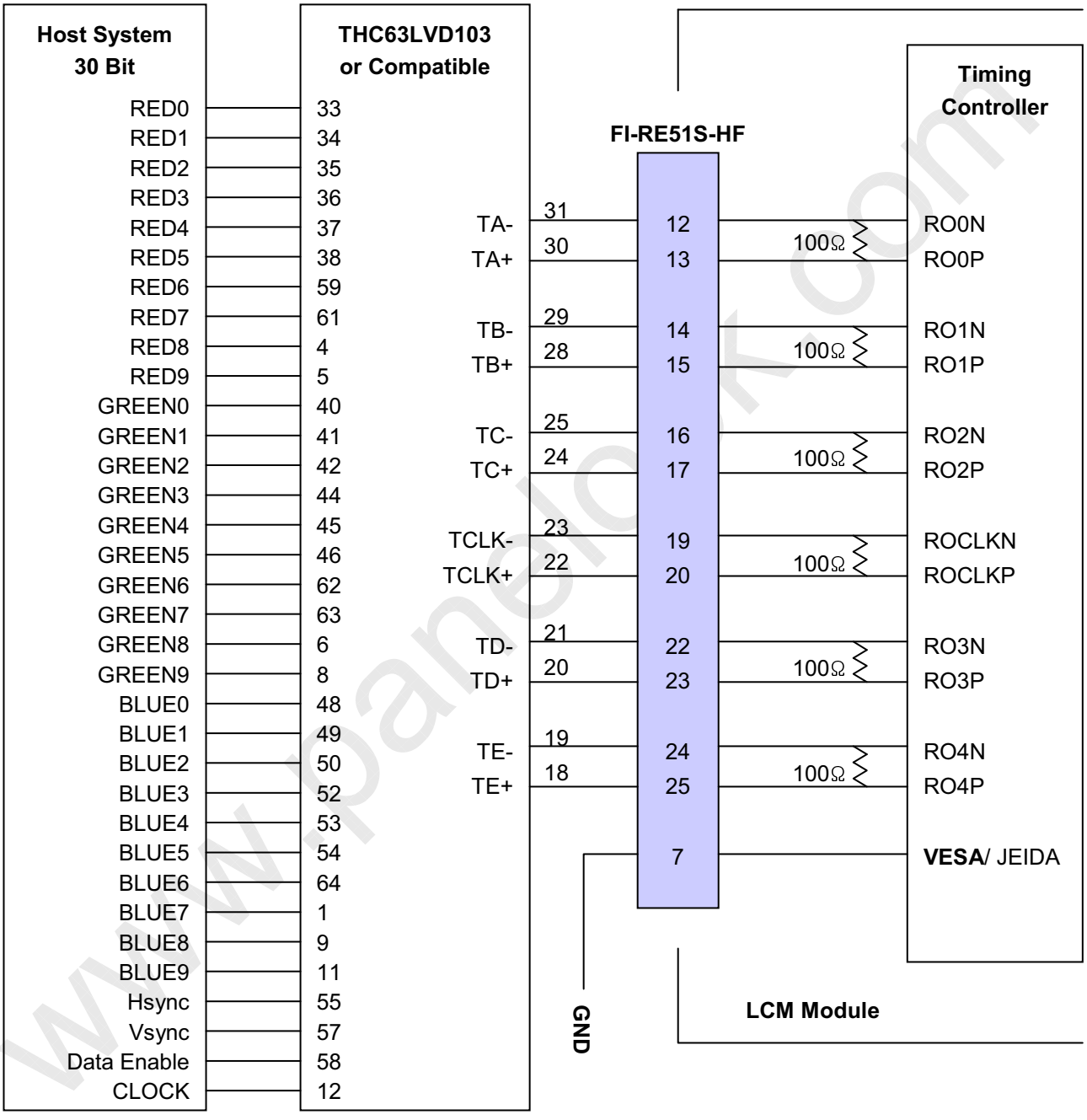
(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

9-6. Handling Precautions for Protection Film

(1) The protection film is attached to the bezel with a small masking tape.
When the protection film is peeled off, static electricity is generated between the film and polarizer.
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
(2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
(3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

APPENDIX-I-1

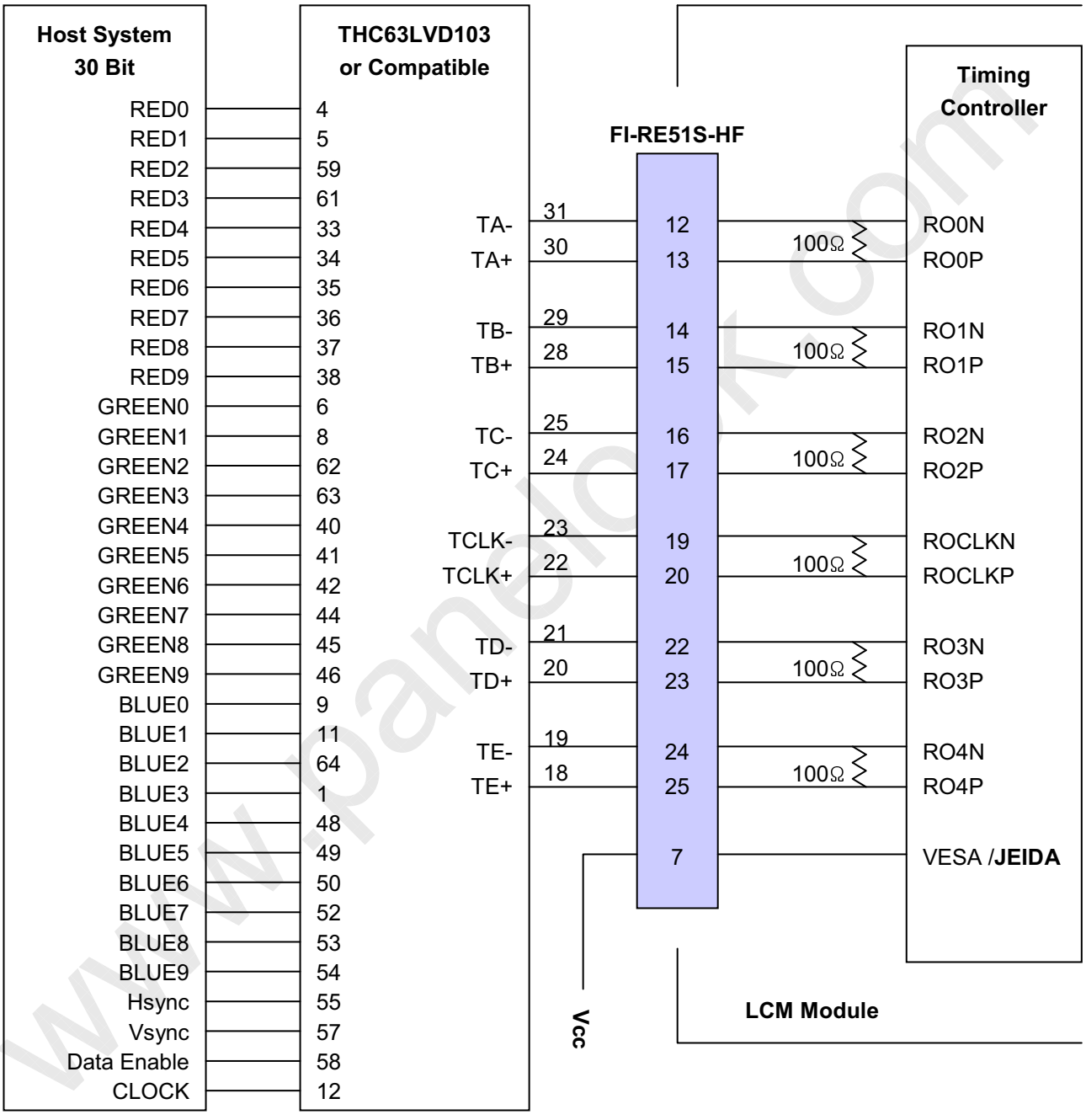
■ **REQUIRED SIGNAL ASSIGNMENT FOR LVDS TRANSMITTER (Pin7="L or NC")**



Notes :1. The LCD module uses a 100 Ohm[Ω] resistor between positive and negative lines of each receiver input.
2. Refer to LVDS Transmitter Data Sheet for detail descriptions. (THC63LVD103 or Compatible)
3. '9' means MSB and '0' means LSB at R,G,B pixel data.

APPENDIX-I-2

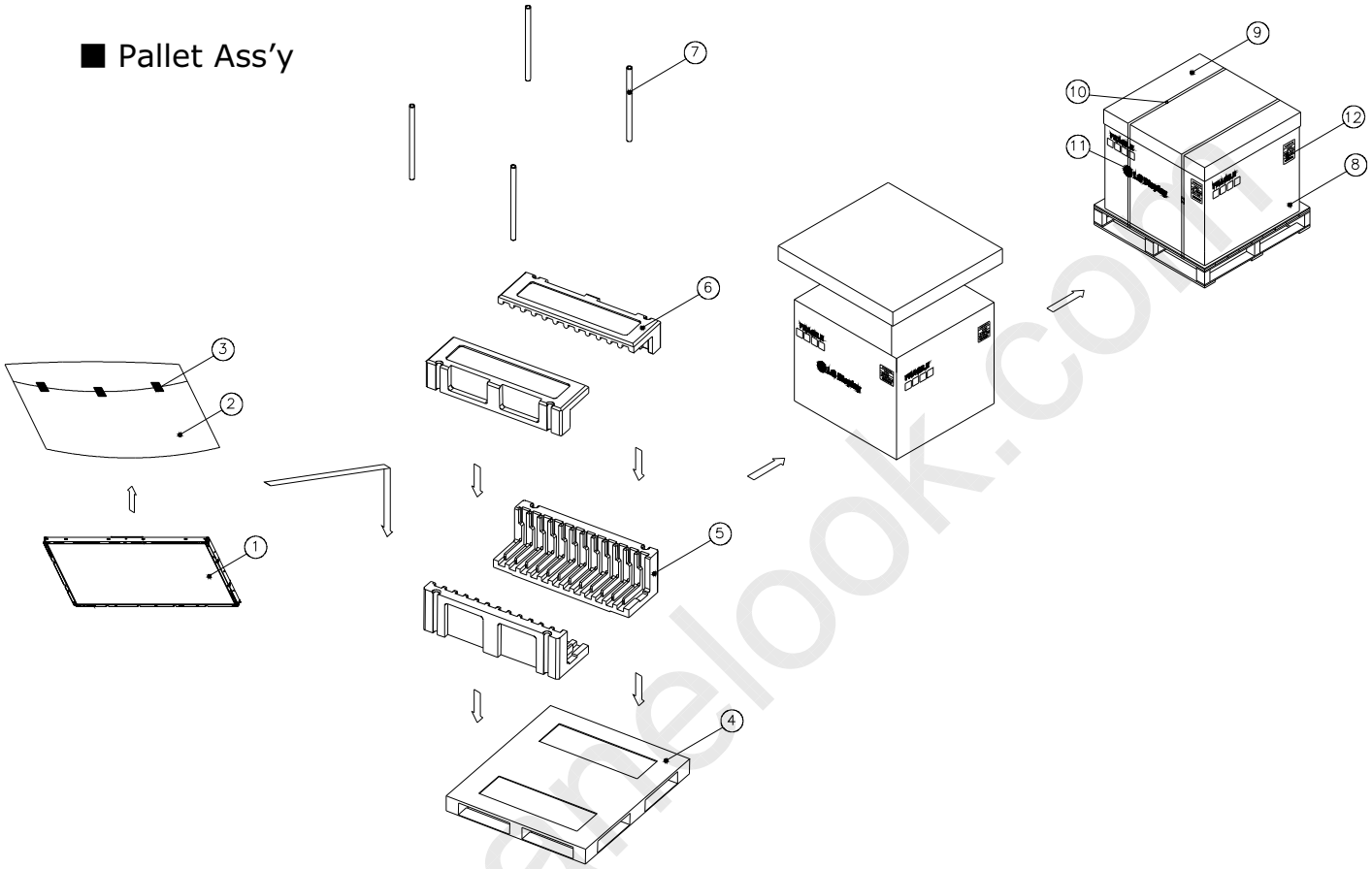
■ **REQUIRED SIGNAL ASSIGNMENT FOR LVDS TRANSMITTER (Pin7="H")**



Notes :1. The LCD module uses a 100 Ohm[Ω] resistor between positive and negative lines of each receiver input.
2. Refer to LVDS Transmitter Data Sheet for detail descriptions. (THC63LVD103 or Compatible)
3. '9' means MSB and '0' means LSB at R,G,B pixel data.

APPENDIX-II

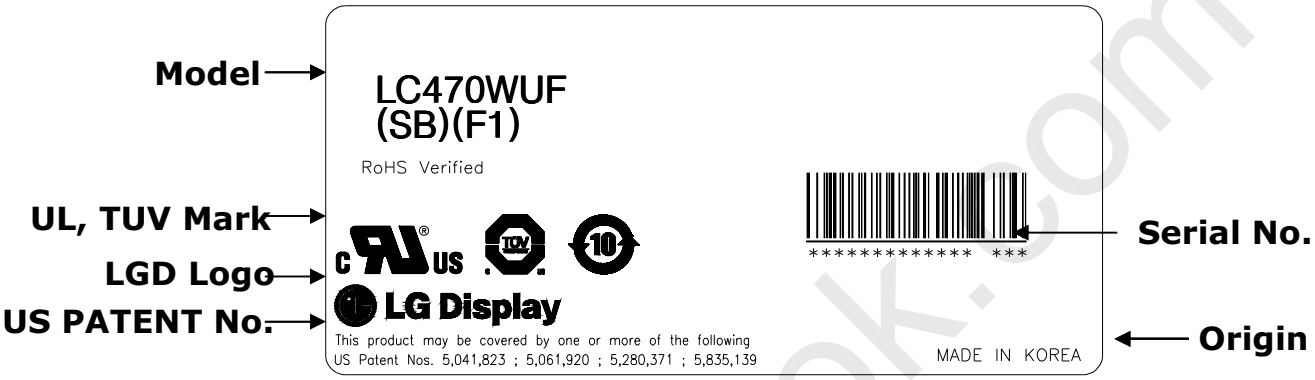
■ Pallet Ass'y



NO.	DESCRIPTION	MATERIAL
1	LCD Module	
2	BAG	47INCH
3	TAPE	MASKING 20MMX50M
4	PALLET	Plywood(1300X1140X125.5)
5	PACKING,BOTTOM	EPS
6	PACKING,TOP	EPS
7	ANGLE,POST	PAPER
8	ANGLE,PACKING	PAPER
9	ANGLE,COVER	PAPER
10	BAND	PP
11	BAND,CLIP	STEEL
12	LABEL	YUPO 80G 100X100

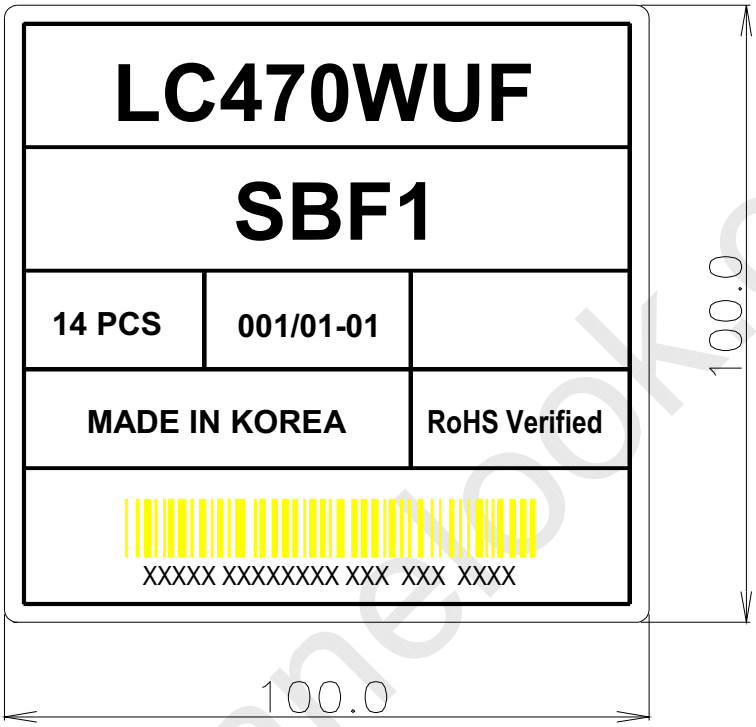
APPENDIX- III

■ LCM Label



APPENDIX- IV

■ Pallet Label



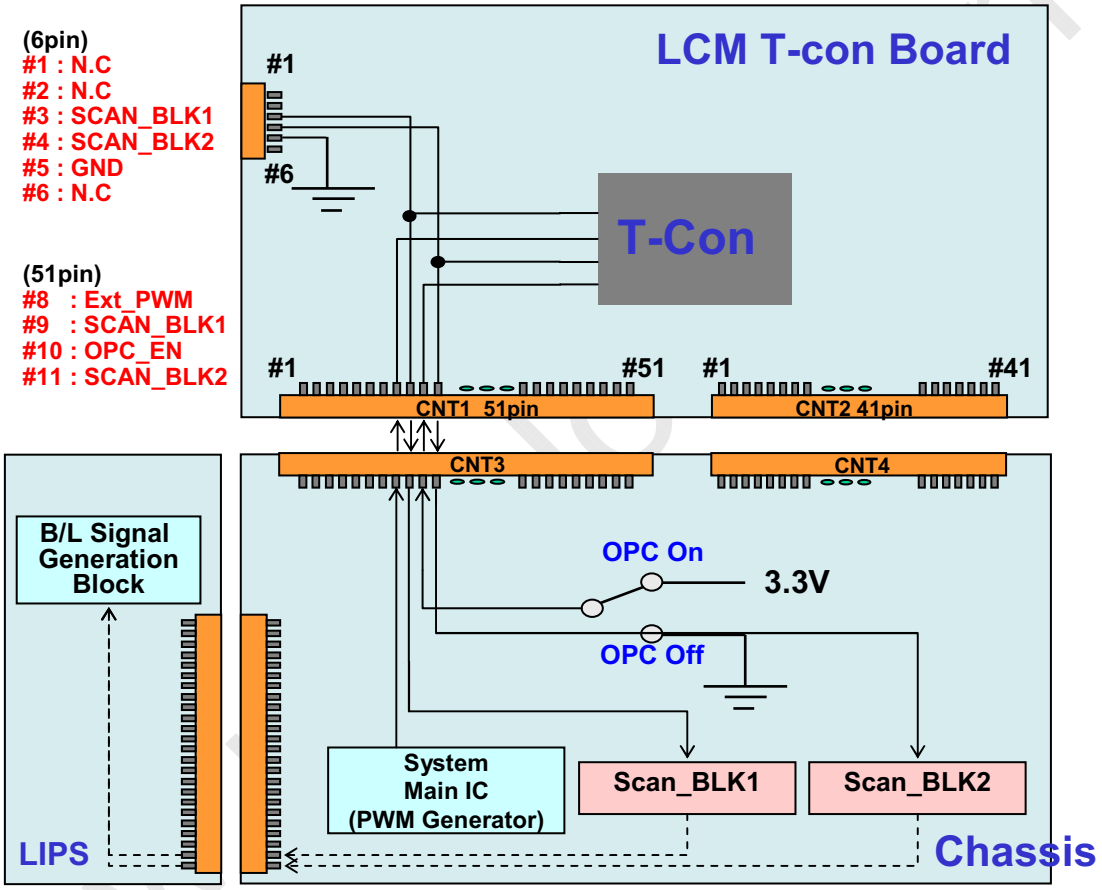
APPENDIX-V

Scanning Pinmap

◇ When OPC_EN (#10pin) is “H", OPC function is enable.

◇ SCAN_BLK1 & 2 (PWM Signal) are synchronized with V-sync frequency of chassis in T-Con.

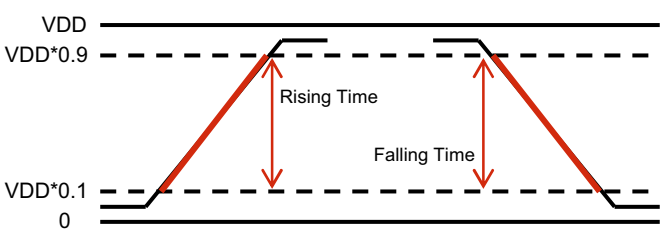
◇ Chassis should always give dimming Signal (EXT PWM) to T-con.



◇ PWM Specification (VDD = 3.3V) @ OPC

1. PWM High Voltage Range : 2.5V~3.6V
2. PWM Low Voltage Range : 0.0V~0.8V

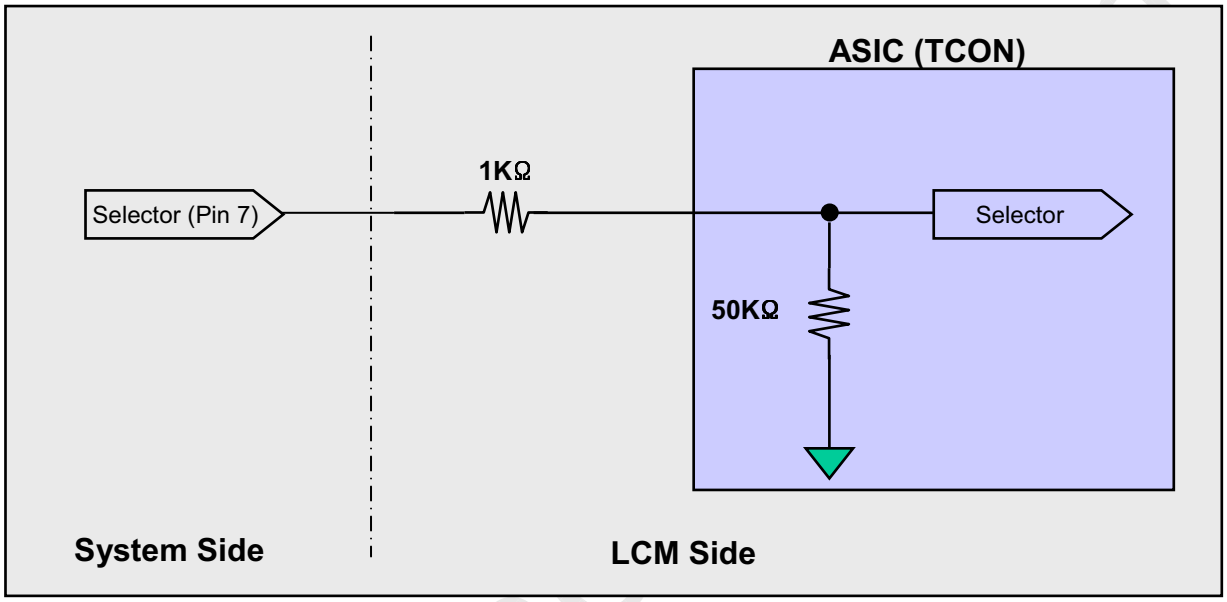
Input Frequency	MAX 1Khz (Recommendation:50~200Hz)
Rising Time	MAX 10.0 μs
Falling Time	MAX 10.0 μs



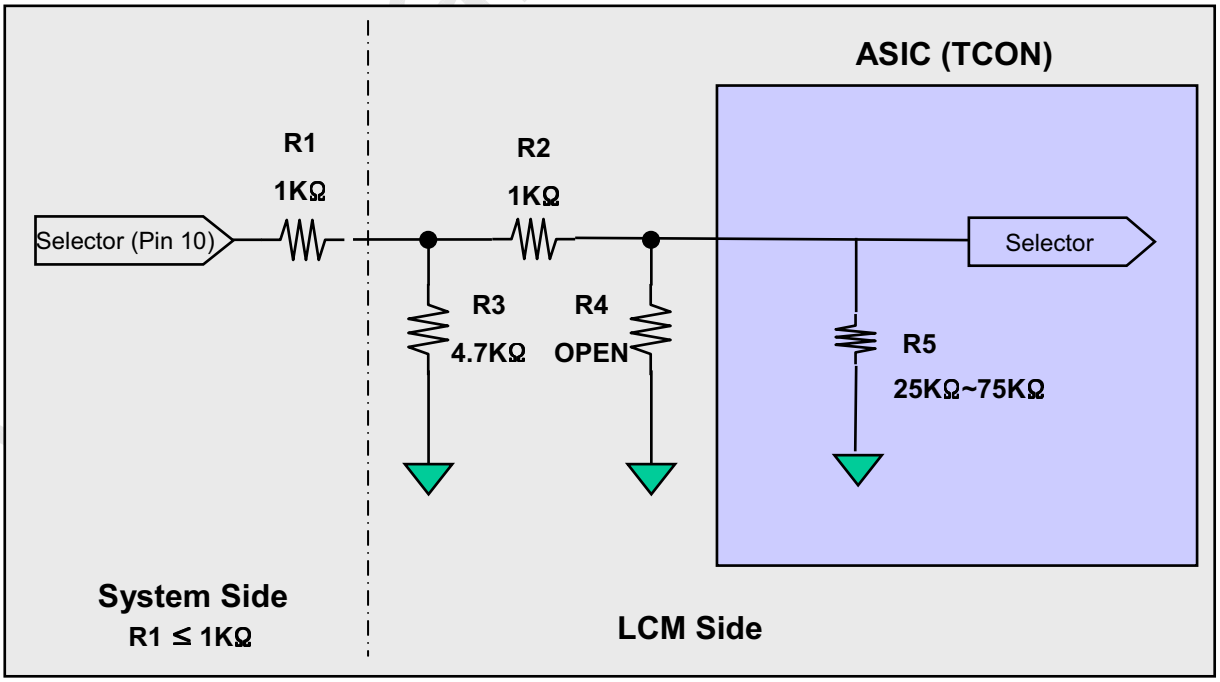
APPENDIX- VI

Option Pin Circuit Block Diagram

Circuit Block Diagram of LVDS Format Selection pin



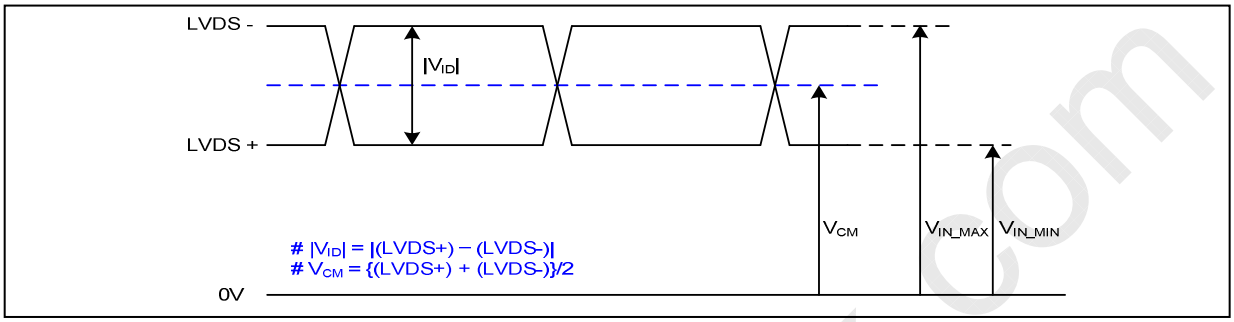
Circuit Block Diagram of OPC Enable Selection pin



APPENDIX- VII

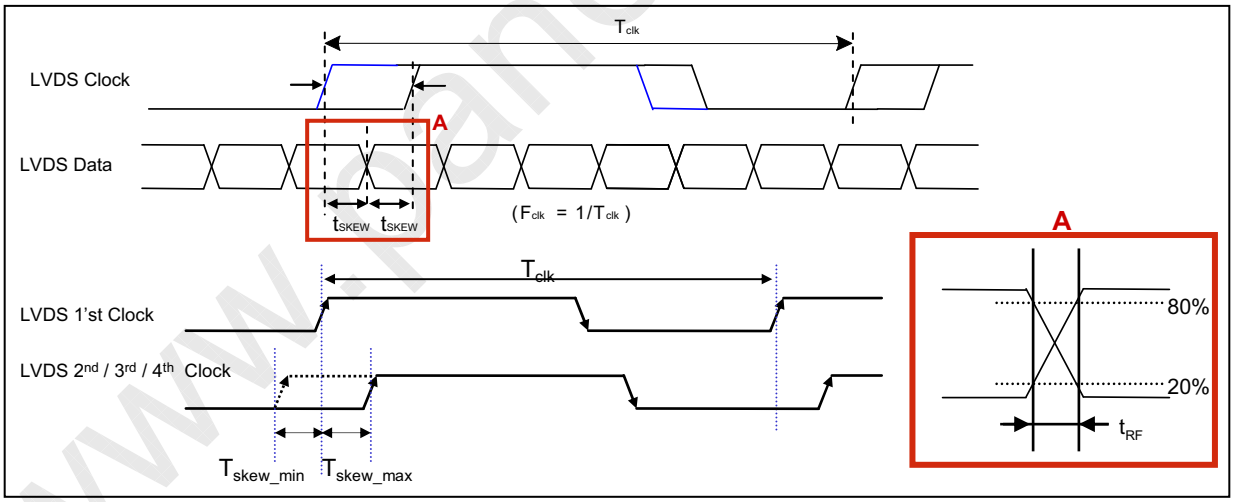
LVDS Input characteristics

1. DC Specification



Description	Symbol	Min	Max	Unit	Notes
LVDS Single end Voltage	$\|V_{ID}\|$	200	600	mV	-
LVDS Common mode Voltage	V_{CM}	1.0	1.5	V	-
LVDS Input Voltage Range	V_{IN}	0.7	1.8	V	-
Change in common mode Voltage	ΔV_{CM}		250	mV	-

2. AC Specification



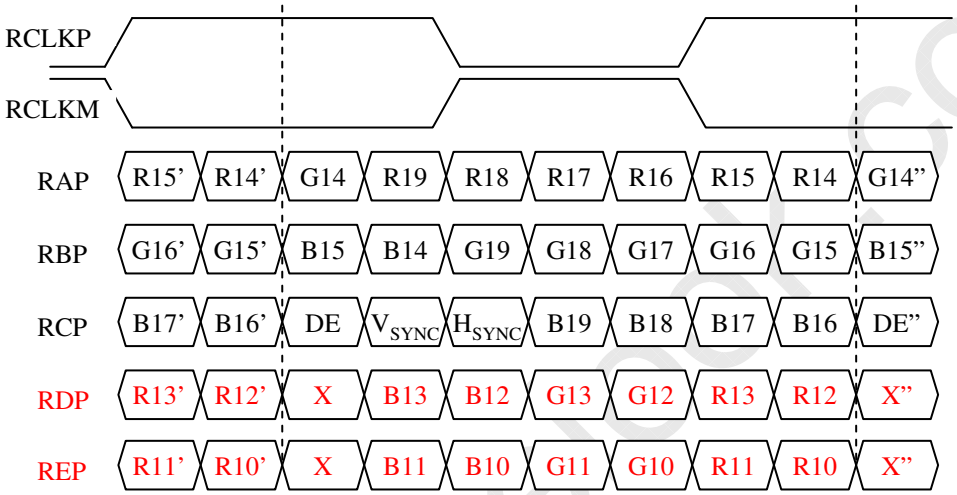
Description	Symbol	Min	Max	Unit	Notes
LVDS Clock to Data Skew Margin	t_{SKEW}		$\|(0.25*T_{clk})/7\|$	ps	-
LVDS Clock/DATA Rising/Falling time	t_{RF}	260	$(0.3*T_{clk})/7$	ps	2
LVDS Clock to Clock Skew Margin (Even to Odd)	t_{SKEW_EO}		$1/7* T_{clk}$	T_{clk}	-

Notes : 1. All Input levels of LVDS signals are based on the EIA 644 Standard.

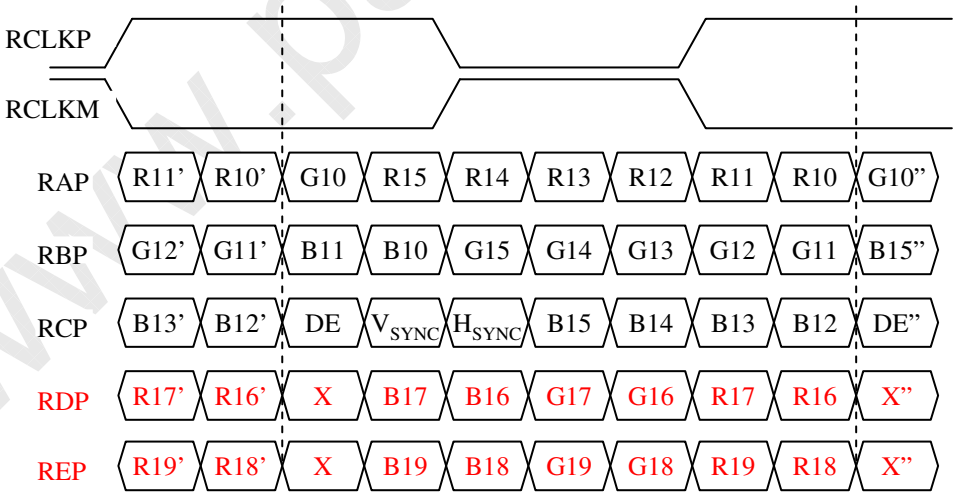
 # APPENDIX- VIII-1

LVDS Data-Mapping info. (10bit)

■ LVDS Select : "H" Data-Mapping (JEIDA format)



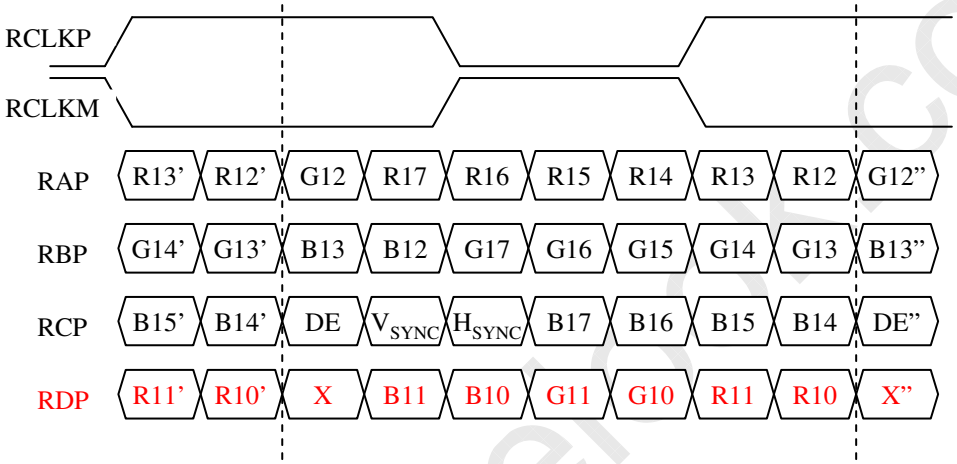
■ LVDS Select : "L" Data-Mapping (VESA format)



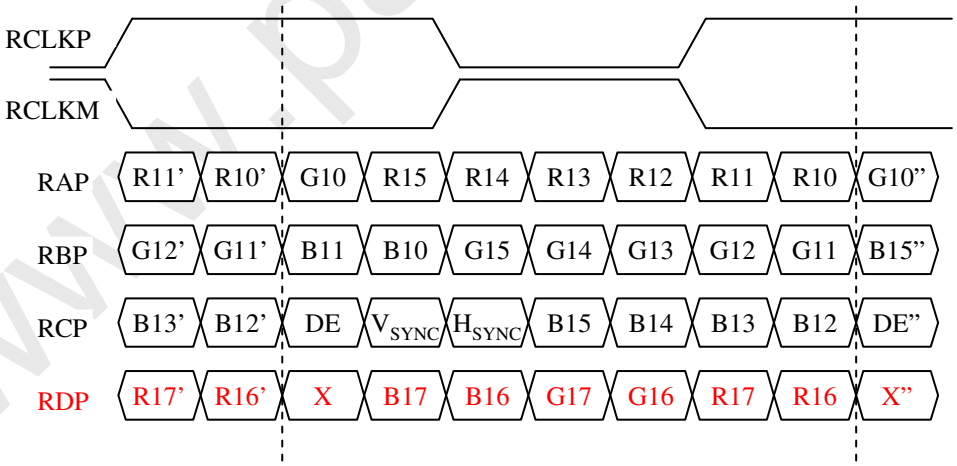
 # APPENDIX- VIII-2

LVDS Data-Mapping info. (8bit)

■ LVDS Select : "H" Data-Mapping (JEIDA format)



■ LVDS Select : "L" Data-Mapping (VESA format)



APPENDIX- IX

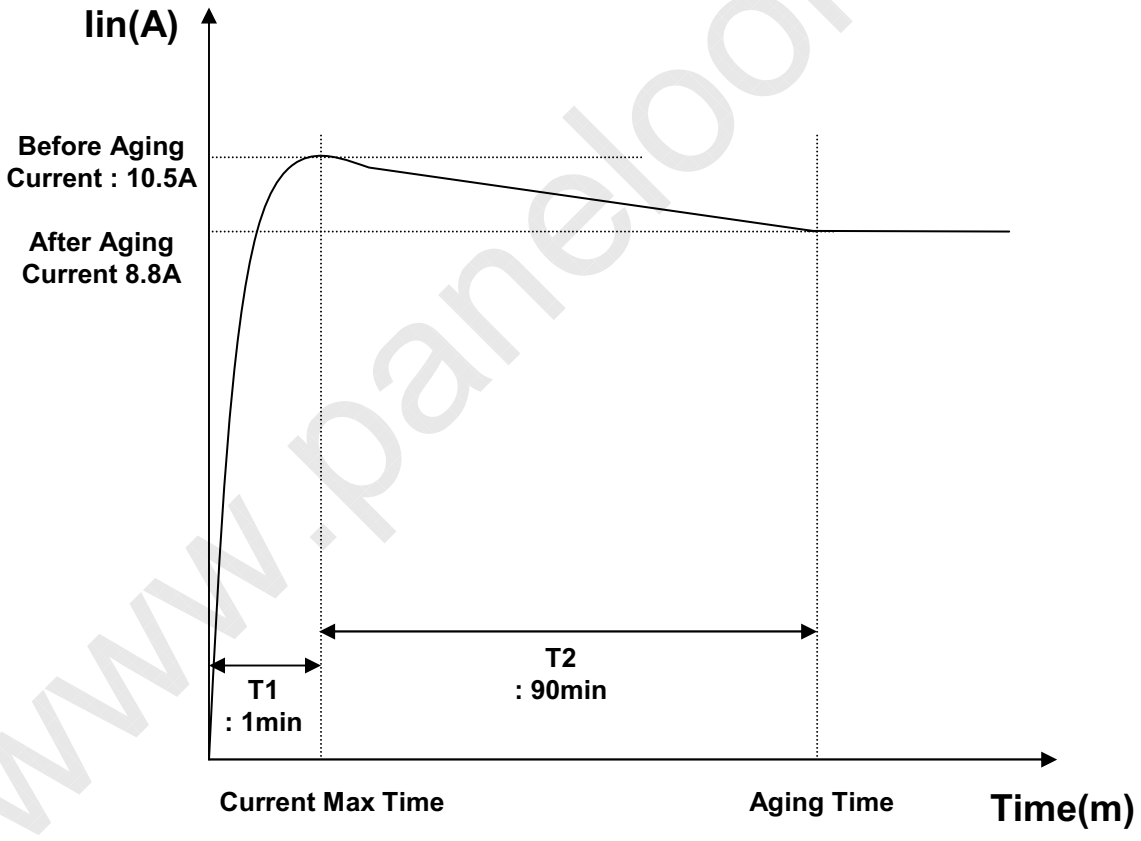
Inverter input current
(Design for power supply)

This is only the reference data of Inverter input current for LC470WUF-SBF1 model.

1. Model : LC470WUF-SBF1 (IPB Scanning Model)

2. Test condition : Vin =24V , V_{BR_B} : 3.3V(100%) , V_{BR_A} : 1.65V, At 25℃ (with LGD Internal Inverter Board)

3. Equipment : Oscilloscope (Tektronix : DPO7254) ,
AC/DC Current Probe(TCP0030)



※Initial Current Boost Function is not used at LC470WUF-SBF1

 # APPENDIX- X

Humming Noise Level

These are measurement method and condition of Humming Noise Level for LC470WUF-SBF1 model of RV sample conditions

Type of room		**Anechoic**
Distance to display		**0.5m (Typical)**
Measurement Point		**@ LCM Center**
Humming Noise Level	**Front**	**Typ 19dBA, Max 20dBA**
	Rear	**Max 25dBA**

APPENDIX-XI

■ Lamp Electrical spec

Item	Unit	Standards	
Lamp Voltage V L	Vrms	64kHz	1760±7% IL=3.0mA 1510±7% IL=7.0mA 1450±7% IL=8.0mA
		50kHz	1770±7% IL=3.0mA 1520±7% IL=7.0mA 1460±7% IL=8.0mA
Lamp Current I L	mArms	Min 3.0 Typ 7.0 Max 8.0	
Lamp power VL x IL	W	64kHz	5.28 IL=3.0mA 10.57 IL=7.0mA 11.60 IL=8.0mA
		50kHz	5.31 IL=3.0mA 10.6 IL=7.0mA 11.7 IL=8.0mA
Starting Voltage V s	Vrms	64kHz	Max 2650 (0°C) Typ 2170 (0°C) Max 2250 (25°C) Typ 1880 (25°C)
		50kHz	Max 2700 (0°C) Typ 2220 (0°C) Max 2300 (25°C) Typ 1920 (25°C)
Discharge Stabilization Time	min	3.0 Max	
Delayed Discharge Time	second	0.3 Max	
Operating Frequency	kHz	40 ~ Typ 64 ~ 80	
Life Time	hours	Min 50,000(at max 8mA) Ave 55,000(at max 8mA)	
Temperature difference of between the electrode	°C	5 Max	
Lamp surface temperature	°C	170 Max(at electrode) 70 Max(at center)	
Content of Mercury	mg	Min 2.5 Max 5.0	

APPENDIX-XII

■ Starting (Striking) Voltage measurement method.

Measure the high voltage point of Balance Ass'y after removing all lamp.

a) CCFL Cap balance Structure

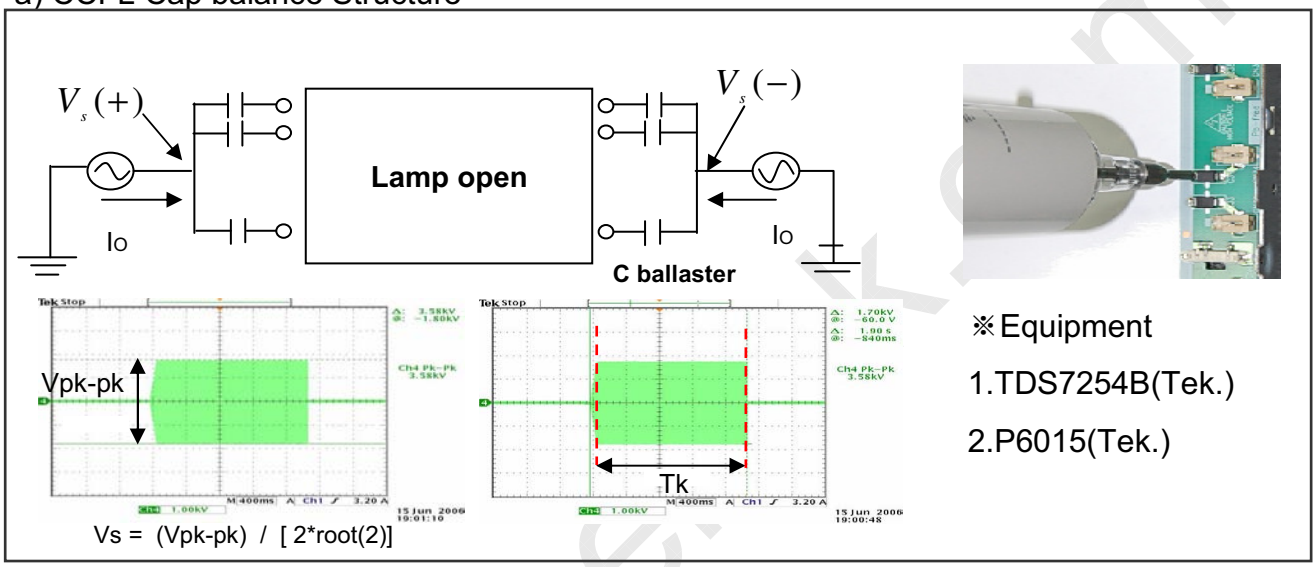


Fig1 . CCFL Vopen

b) EEFL Structure

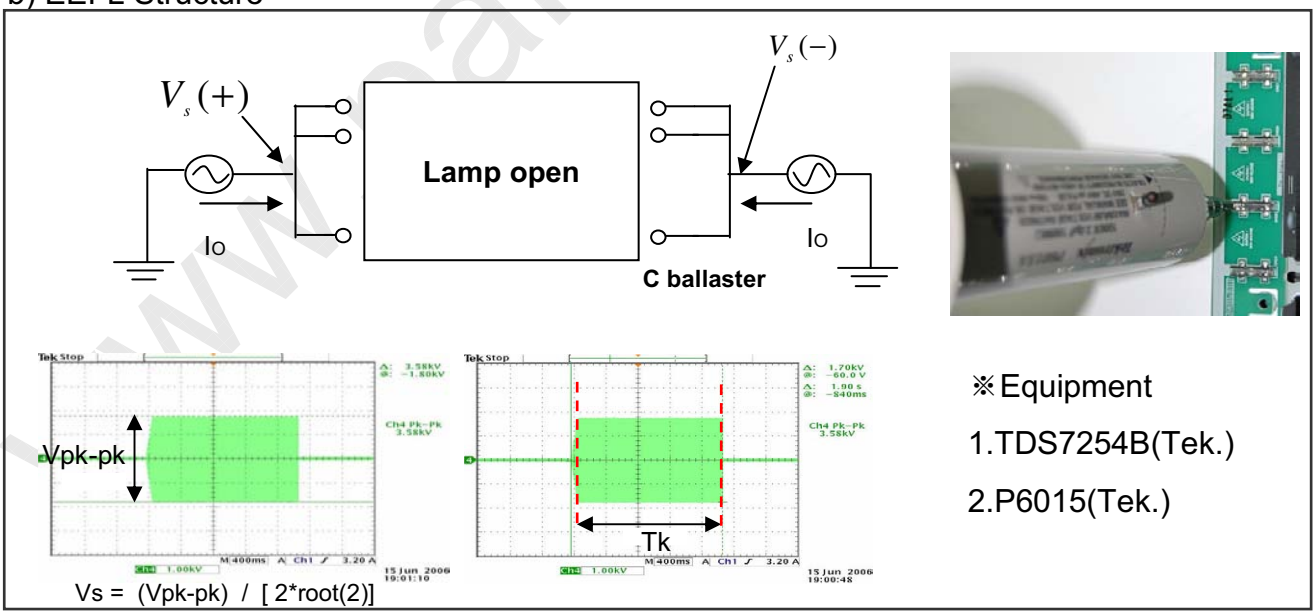


Fig2 . EEFL Vopen