SPECIFICATION
FOR
APPROVAL

(   ) **Preliminary Specification**

(●) **Final Specification**

Title	42.0" WUXGA TFT LCD

BUYER	General
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LC420WUE
SUFFIX	SAA1(RoHS Verified)

*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.

APPROVED BY	SIGNATURE DATE
H.S. Baek/Senior Manager	
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PREPARED BY	
J.B. Chun / Engineer	

TV Product Development Dept.
**LG. Philips LCD Co., Ltd**

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Ver. 1.0

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RECORD OF REVISIONS

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Product Specification

1. General Description

LC420WUE is a Color Active Matrix Liquid Crystal Display with an integral External Electrode Fluorescent Lamp(EEFL) 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 42 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 8bit or 10-bit gray scale signal for each dot, thus presenting a palette of more than 1.06Billion of colors.
It has been designed to apply the 10-bit 2 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.
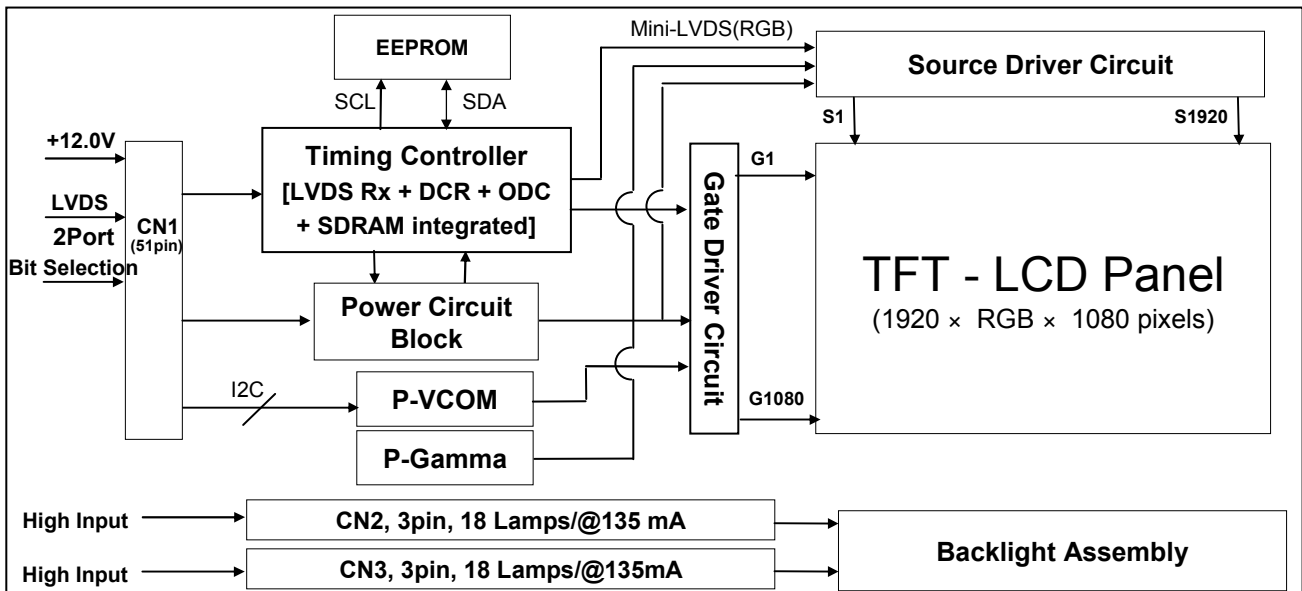
General Features

| Active Screen Size	42.02 inches(1067.31mm) diagonal
Outline Dimension	983.0(H) x 576.0 (V) x 47.3 mm(D) (Typ. Without inverter)
Pixel Pitch	0.4845 mm x 0.4845 mm
Pixel Format	1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement
Color Depth	10bit (D) , 1.06Billon colors
Luminance, White	500 cd/m^2 (Center 1point ,Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178 (Typ.), U/D 178 (Typ.))
Power Consumption	Total 167.5 W (Typ.) (Logic = 6.7 W, Inverter = 160.8 W [VBR-A=1.65V])
Weight	11.0Kg (Typ.)
Display Mode	Transmissive mode, Normally black
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer (Haze 13%)

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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	LCD circuit	V_{LCD}	-0.3	+14.0	V [DC]	at 25 ± 2 ℃
B/L Input voltage	Operating Voltage (one side)	V_{OP}	700	1100	V[RMS]	at 25 ± 2 ℃ Burst Dimming Duty 100%
Operating Temperature		T_{OP}	0	+50	℃	Note 1
Storage Temperature		T_{ST}	-20	+60	℃	
Operating Ambient Humidity		H_{OP}	10	90	%RH	
Storage Humidity		H_{ST}	10	90	%RH	

Notes : 1. Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ℃ Max, and no condensation.
2. Gravity mura can be guaranteed under 40℃ condition.
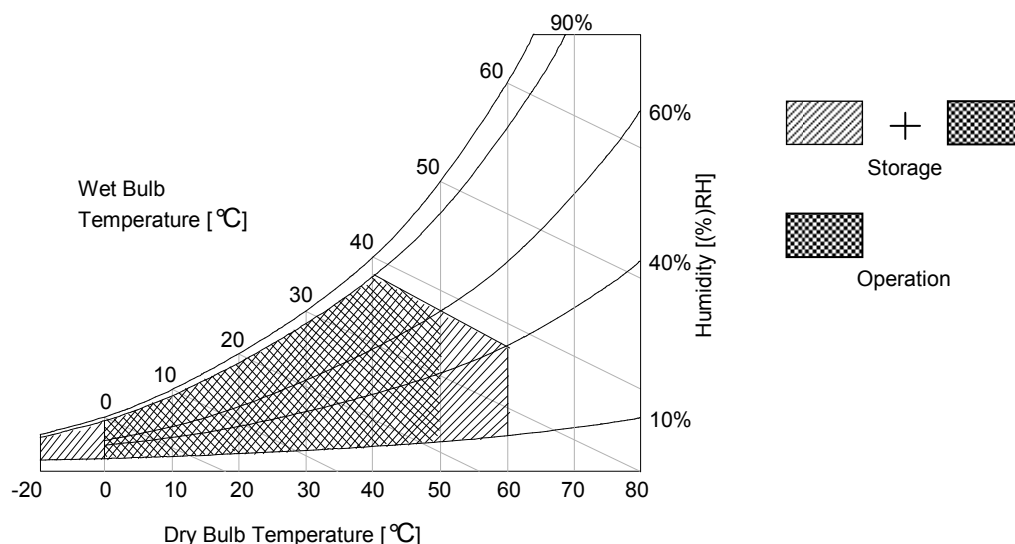
| Product Specification |

3. Electrical Specifications
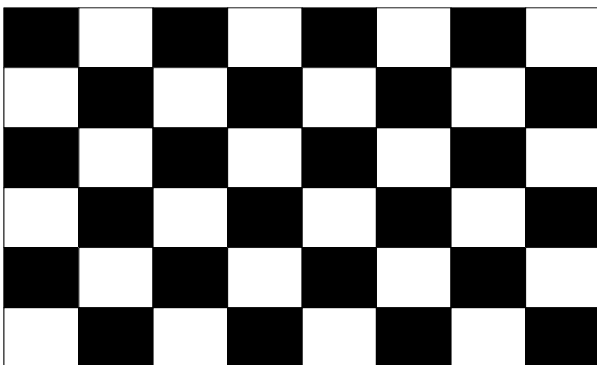
3-1. Electrical Characteristics

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

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V_{LCD}	11.4	12.0	12.6	V_{DC}	
Power Input Current	I_{LCD}	-	560	728	mA	1
		-	800	1040	mA	2
Power Consumption	P_{LCD}	-	6.7	8.8	Watt	1
Rush current	I_{RUSH}	-	-	3	A	3

Notes : 1. The specified current and power consumption are under the V_{LCD}=12.0V, 25 ± 2℃, f_V=60Hz condition whereas mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.
    2. The current is specified at full white pattern.
    3. The duration of rush current is about 2ms and rising time of power input is 1ms (min)

White : 1023Gray
Black : 0Gray

White : 1023 Gray

Mosaic Pattern(8 x 6)

Full White pattern

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Table 3. ELECTRICAL CHARACTERISTICS

Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Backlight Assembly :							
Operating Voltage (one side,fBL=45KHz, IBL= 135mArms))		V_{BL}	800	950	1100	V_{RMS}	1, 2, 13
Operating Current (one side)		I_{BL}	130	135	140	mA_{RMS}	1, 13
Established Starting Voltage (one side)	0℃	V_S	-	-	1200	V_{RMS}	1, 3
	25℃		-	-	1000		
Operating Frequency		f_{BL}	43	45	47	kHz	4
Striking Time		S TIME	-	-	1.5	sec	3
Power Consumption		P_{BL}		160.8		Watt	6
Burst Dimming Duty		PWM duty	20		100	%	9
Burst Dimming Frequency		1/T	98		182	Hz	9

Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Lamp : (APPENDIX-V)							
Lamp Voltage (one side)		V_{LAMP}	945	1050	1155	V_{RMS}	1, 2
Lamp Current (one side)		I_{LAMP}	-	7.5	-	mA_{RMS}	1
Discharge Stabilization Time		T_S	-	-	3	Min	1, 5
Lamp Frequency		f LAMP	40	45	80	KHz	
Lamp Temperature		T_{LAMP}			130	℃	
Established Starting Voltage	0℃	V_S			2370	V_{RMS}	1, 3
	25℃	V_S			1980		
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 : 18 lamp, 7.5mA/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.

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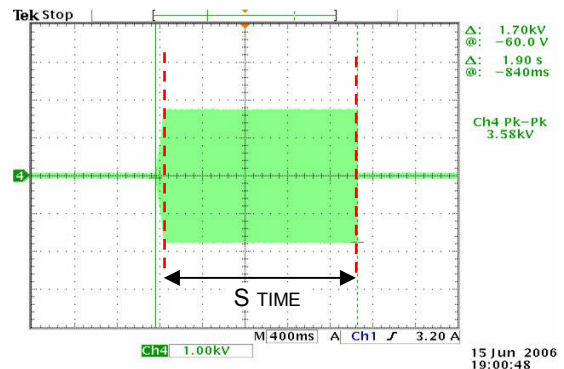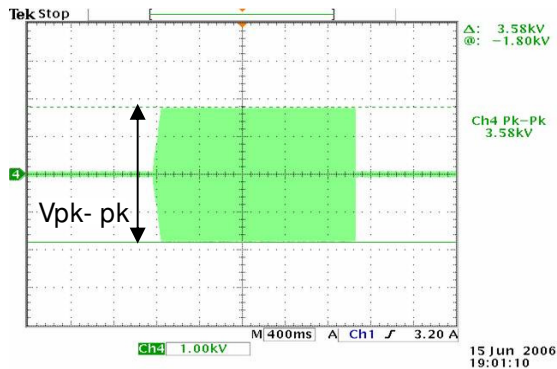

Vs = (Vpk-pk) / [2*root(2)]

4. Lamp frequency may produce interference with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore, lamp frequency shall be as away possible from the horizontal synchronous frequency and its harmonics range in order to prevent interference.

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 $25 \pm 2°C$.

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 $25 \pm 2°C$, 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 $\sqrt{2} \pm 10\%$.

     * Inverter output waveform had better be more similar to ideal sine wave.
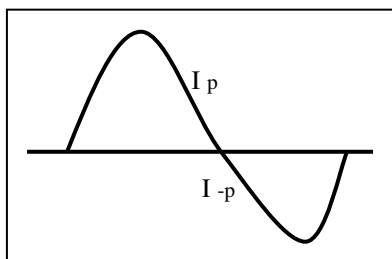
* Asymmetry rate:

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

* Distortion rate

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

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9. The reference method of burst dimming duty ratio.
   It is recommended to use synchronous V-sync frequency for prevent waterfall(Vsync x 2 =Burst Frequency)
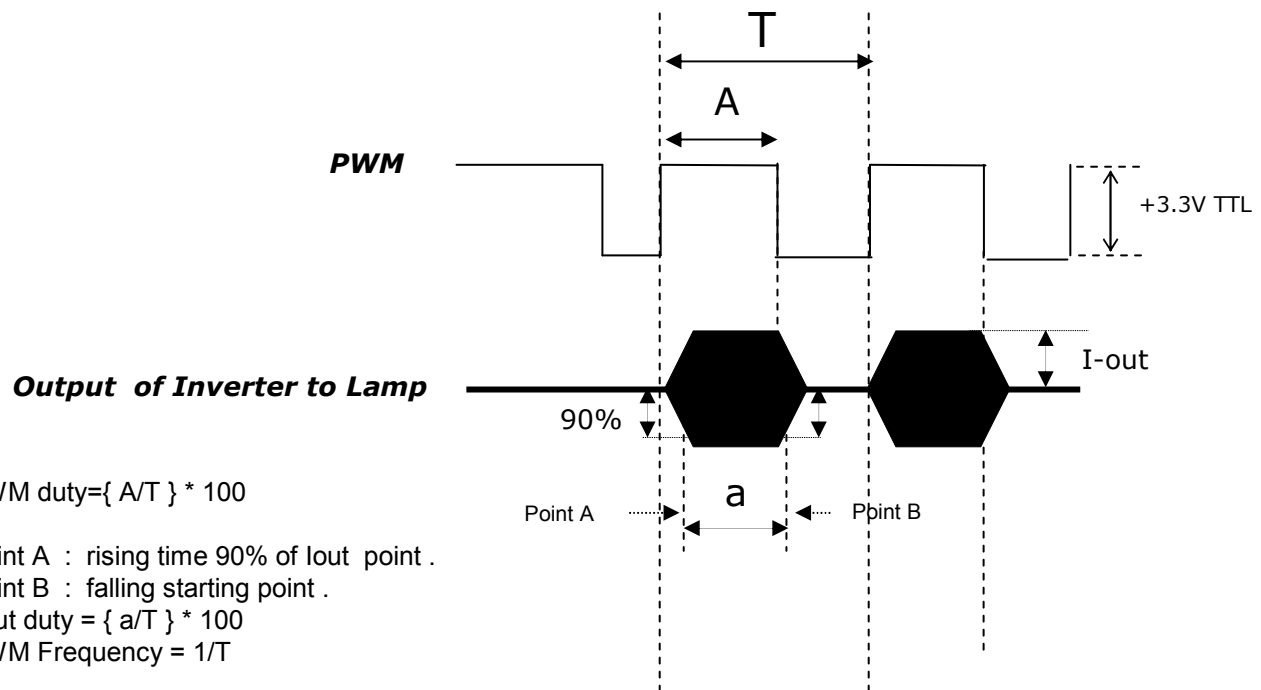
PWM duty={ A/T } * 100

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 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 typ ± 10%.

13. The measurement method of V_{BL} & I_{BL} refer to appendix X.

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3-2. Interface Connections

This LCD module employs two kinds of interface connection, a 51-pin connector is used for the module electronics and two 3-pin Balance PCB connectors are used for the integral backlight system.

3-2-1. LCD Module

- LCD Connector(CN1): FI-R51S-HF(manufactured by JAE) or KN25-51P-0.5SH(manufactured by Hirose)
- Mating Connector : FI-R51HL(JAE) or compatible

Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	GND	Ground	27	Bit Selection	Logic 'H' or NC : 10Bit (D), 'L' : 8bit
2	NC	No Connection	28	RE0N	SECOND CHANNEL 0-
3	NC	No Connection	29	RE0P	SECOND CHANNEL 0+
4	NC	No Connection	30	RE1N	SECOND CHANNEL 1-
5	NC	No Connection	31	RE1P	SECOND CHANNEL 1+
6	NC	No Connection	32	RE2N	SECOND CHANNEL 2-
7	LVDS Select	Logic 'L' or NC : VESA, 'H':JEIDA	33	RE2P	SECOND CHANNEL 2+
8	NC	No Connection	34	GND	Ground
9	NC	No Connection	35	RECLKN	SECOND CLOCK CHANNEL C-
10	NC	No Connection	36	RECLKP	SECOND CLOCK CHANNEL C+
11	GND	Ground	37	GND	Ground
12	RO0N	FIRST CHANNEL 0-	38	RE3N	SECOND CHANNEL 3-
13	RO0P	FIRST CHANNEL 0+	39	RE3P	SECOND CHANNEL 3+
14	RO1N	FIRST CHANNEL 1-	40	RE4N	SECOND CHANNEL 4- (For 10bit D)
15	RO1P	FIRST CHANNEL 1+	41	RE4P	SECOND CHANNEL 4+ (For 10bit D)
16	RO2N	FIRST CHANNEL 2-	42	Reserved	No connection or GND
17	RO2P	FIRST CHANNEL 2+	43	Reserved	No connection or GND
18	GND	Ground	44	GND	Ground
19	ROCLKN	FIRST CLOCK CHANNEL C-	45	GND	Ground
20	ROCLKP	FIRST CLOCK CHANNEL C+	46	GND	Ground
21	GND	Ground	47	NC	No connection
22	RO3N	FIRST CHANNEL 3-	48	VLCD	Power Supply +12.0V
23	RO3P	FIRST CHANNEL 3+	49	VLCD	Power Supply +12.0V
24	RO4N	FIRST CHANNEL 4- (For 10bit D)	50	VLCD	Power Supply +12.0V
25	RO4P	FIRST CHANNEL 4+ (For 10bit D)	51	VLCD	Power Supply +12.0V
26	Reserved	No connection or GND	-	-	-

Notes :
1. The pin no 44 is LCD Test option. "AGP" (Auto Generation LCM operates Pattern) or "NSB" (No Signal Black) is case that LVDS signals are out of frequency or abnormal condition in spite of 12 volt power supply. LPL recommends "NSB". (AGP : "VCC" or "OPEN" / NSB : "GND")
2. All GND(ground) pins should be connected together to the LCD module's metal frame.
3. All VLCD (power input) pins should be connected together.
4. All Input levels of LVDS signals are based on the IEA 664 Standard.
5. Specific pins(pin No. #1~#10) are used for internal data process of the LCD module.
   If not used, these pins are no connection.

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3-2-2. Backlight Module

[Master]   **[Slave]**

1) Balance Connector   **1) Balance Connector**

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

2) Mating Connector   **2) Mating Connector**

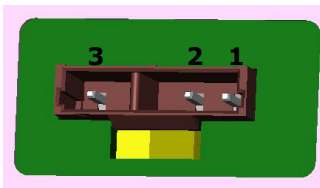: 65002HS-03 (manufactured by YEONHO) or equivalent.   : 65002HS-03 (manufactured by YEONHO) or equivalent.

Table 5. BACKLIGHT CONNECTOR PIN CONFIGURATION(CN2,CN3)

No	Symbol	Master	Slave	Note
1	**H_Input**	High_Input	High_Input	
2	**H_Input**	High_Input	High_Input	
3	**FB**	NC	NC	

◆ Rear view of LCM

Master   **Slave**
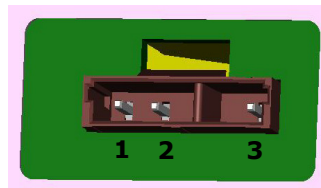
3-3. Signal Timing Specifications

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 & PAL (DE Only Mode)

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Period	t_{CLK}	12.8	13.5	15.9	ns	
	Frequency	-	63	74.25	78	MHz	=148.5/2
Hsync	Period	t_{HP}	1060	1100	1280	t_{CLK}	
	Horizontal Valid	t_{HV}	-	960	-	t_{CLK}	
	Horizontal Blank	t_{HB}	100	140	320		
	Frequency	f_H	57.3	67.5	70.9	KHz	1
	Width	t_{WH}	4	30	60	t_{CLK}	
	Horizontal Back Porch	t_{HBP}	72	78			
	Horizontal Front Porch	t_{HFP}	24	32			
Vsync	Period	t_{VP}	1092	1125	1380	t_{HP}	1
	Vertical Valid	t_{VV}	-	1080	-	t_{HP}	
	Vertical Blank	t_{VB}	12	45	-	t_{HP}	
	Frequency	f_V	47	60	63	Hz	Note 1) PAL : 47~53Hz NTSC : 57~63Hz
	Width	t_{WV}	4	5	10	t_{HP}	
	Vertical Back Porch	t_{VBP}	6	36	-		
	Vertical Front Porch	t_{VFP}	2	4	-		

Note : 1. $t_{HB} = t_{HFP} + t_{WH} + t_{HBP}$

$t_{VB} = t_{VFP} + t_{WV} + t_{VBP}$

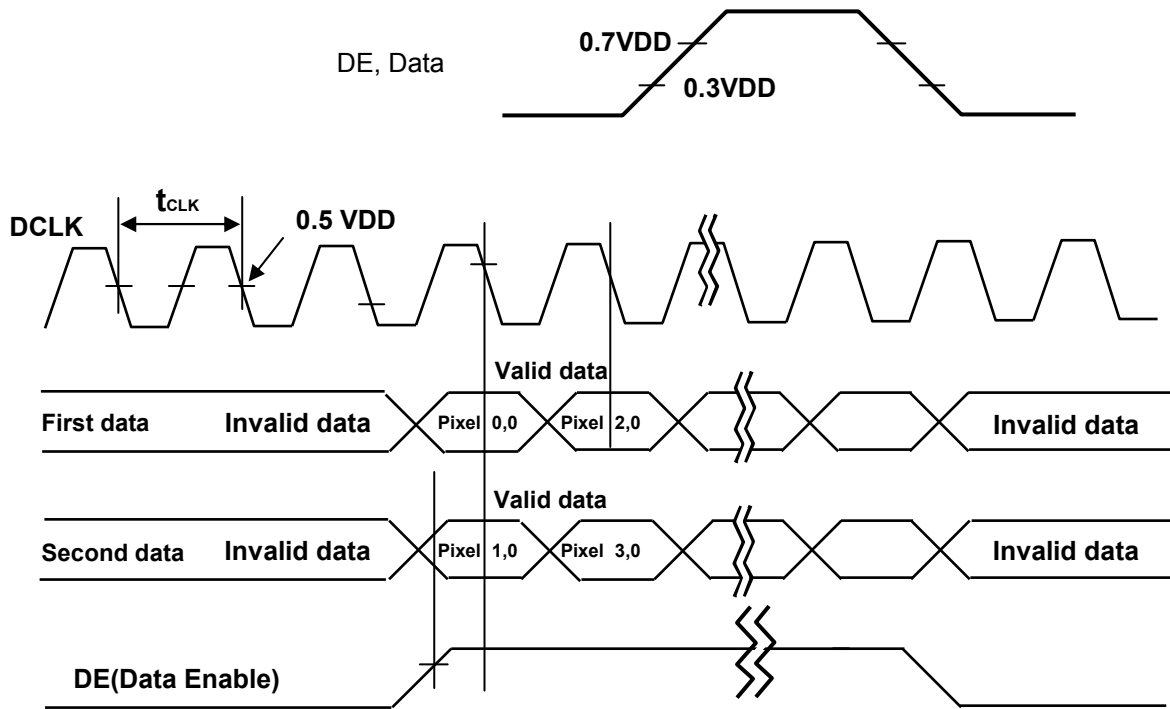The Input of HSYNC & VSYNC signal does not have an effect on normal operation(DE Only Mode).

The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate.
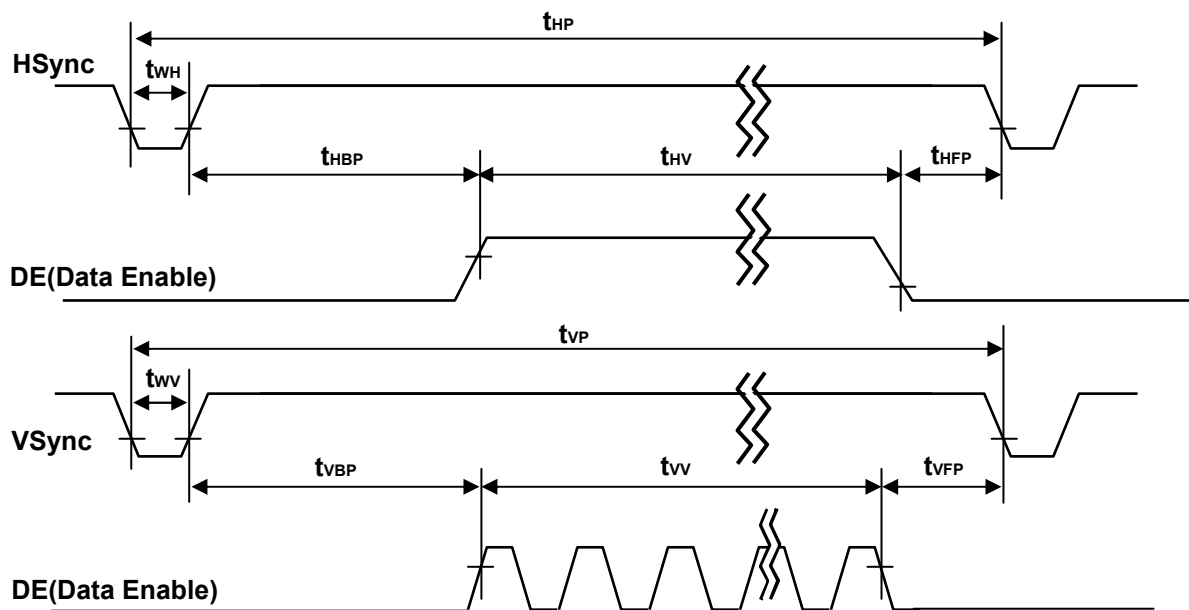
3-4. Signal Timing Waveforms

* **Reference : Sync. Relation**

* $t_{HB} = t_{HFP} + t_{WH} + t_{HBP}$

* $t_{VB} = t_{VFP} + t_{WV} + t_{VBP}$

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3-5. Color Data Reference

The brightness of each primary color(red,green,blue) is based on the 8-bit gray scale data input for the color. The higher binary input, the brighter the color. Table 7 provides a reference for color versus data input.

Table 7. COLOR DATA REFERENCE

Color		Input Color Data		
		RED MSB LSB R9 R8 R7 R6 R5 R4 R3 R2 R1 R0	GREEN MSB LSB G9 G8 G7 G6 G5 G4 G3 G2 G1 G0	BLUE MSB LSB 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
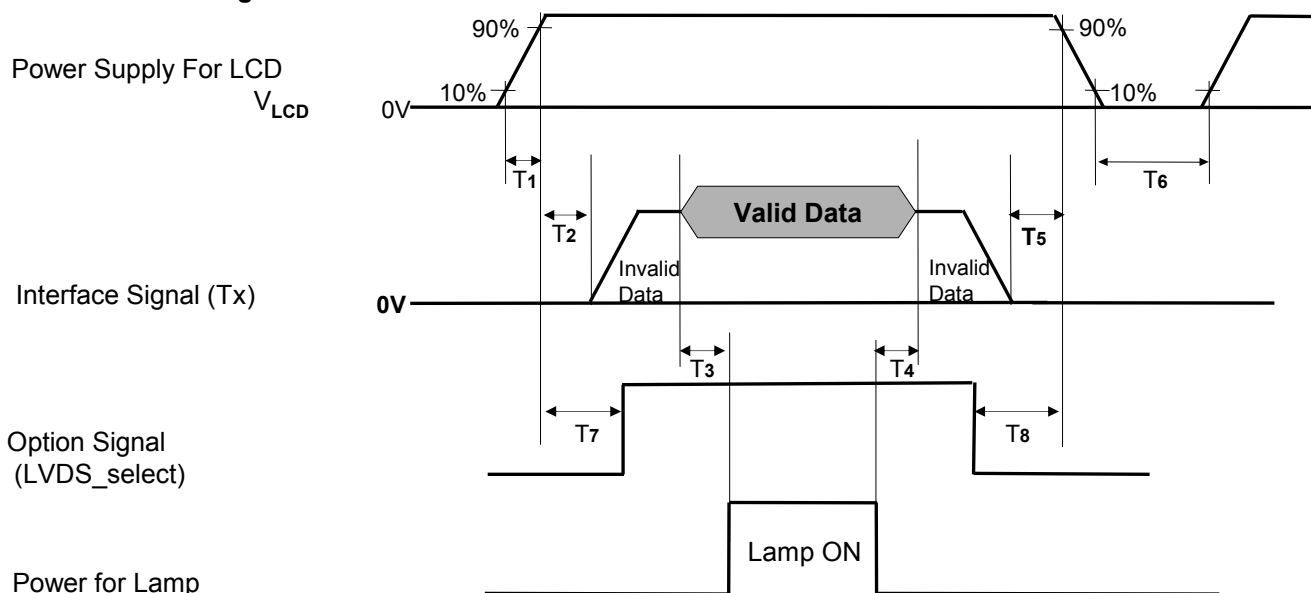
Table 8. POWER SEQUENCE

Parameter	Value			Unit	Notes
	Min	Typ	Max		
T1	0.5	-	20	ms	
T2	0	-	-	ms	3,5
T3	200	-	-	ms	4
T4	200	-	-	ms	4
T5	0	-	-	ms	3,5
T6	2.0	-	-	s	2,6
T7	0	-	T2	ms	5
T8	0	-	-	ms	5

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 case when the T2/T5 exceed 3x(1/fv), it operates protection pattern (Black pattern) till valid signal inputted. There is no reliability problem. (ex. 60Hz : 3x(1/60Hz) = 50ms)
4. 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.
5. If the on time of signals(Interface signal and Option signals) precedes the on time of Power(V_{LCD}), check the LCD logic Power(Vcc) is under 0.8V, otherwise it will be happened abnormal display.
6. T6 should be measured after the Module has been fully discharged between power off and on period.

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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.
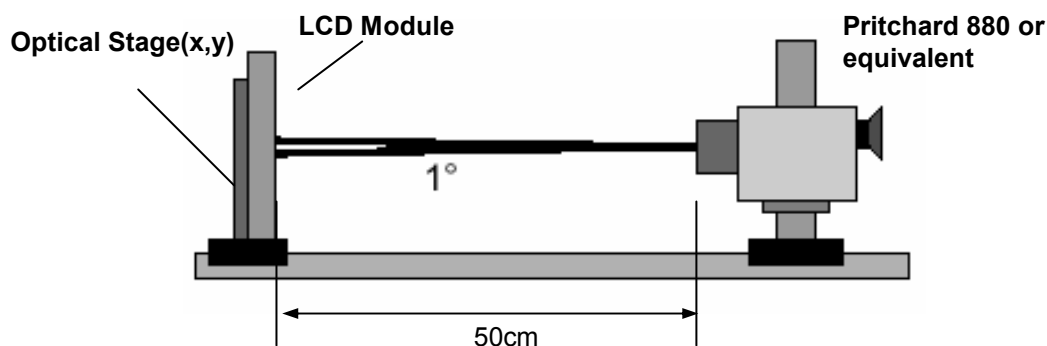
FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 9. OPTICAL CHARACTERISTICS

Parameter		Symbol		Value			Unit	Note
				Min	Typ	Max		
Contrast Ratio		CR		900	1300	-		1
Surface Luminance, white		L_{WH}		400	500	-	cd/m^2	2
Luminance Variation		δ_{WHITE}	5P	-	-	1.3		3
		δ_{BLACK}	5P	-	-	1.7		
Response Time	Gray-to-Gray	G to G		-	5	8	ms	4
Color Coordinates [CIE1931]	RED	Rx			0.640			
		Ry			0.335			
	GREEN	Gx			0.289			
		Gy		Typ -0.03	0.610	Typ +0.03		
	BLUE	Bx			0.144			
		By			0.066			
	WHITE	Wx			0.279			
		Wy			0.292			
Viewing Angle (CR>10)								
	x axis, right(φ=0°)	θr		89	-	-	degree	5
	x axis, left (φ=180°)	θl		89	-	-		
	y axis, up (φ=90°)	θu		89	-	-		
	y axis, down (φ=270°)	θd		89	-	-		
Gray Scale				-	-	-		6
Cross Talk						1.8	%	7

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

CR(Contrast Ratio) = Maximum CRn (n=1, 2, 3, 4, 5)

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

It is measured at center 1-point.

2. Surface luminance are determined after the unit has been 'ON' and 30min 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 and δ BLACK are 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})

δ BLACK(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 transition 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 is average of measured time.

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.

Table 10. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ.)
L0	0.08
L15	0.21
L31	0.86
L47	2.32
L63	4.71
L79	7.70
L95	11.52
L111	16.18
L127	21.72
L143	28.15
L159	35.51
L175	43.81
L191	53.07
L207	63.30
L223	74.52
L239	86.75
L255	100

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

A : H / 4 mm
B : V / 4 mm
@ H,V : Active Area
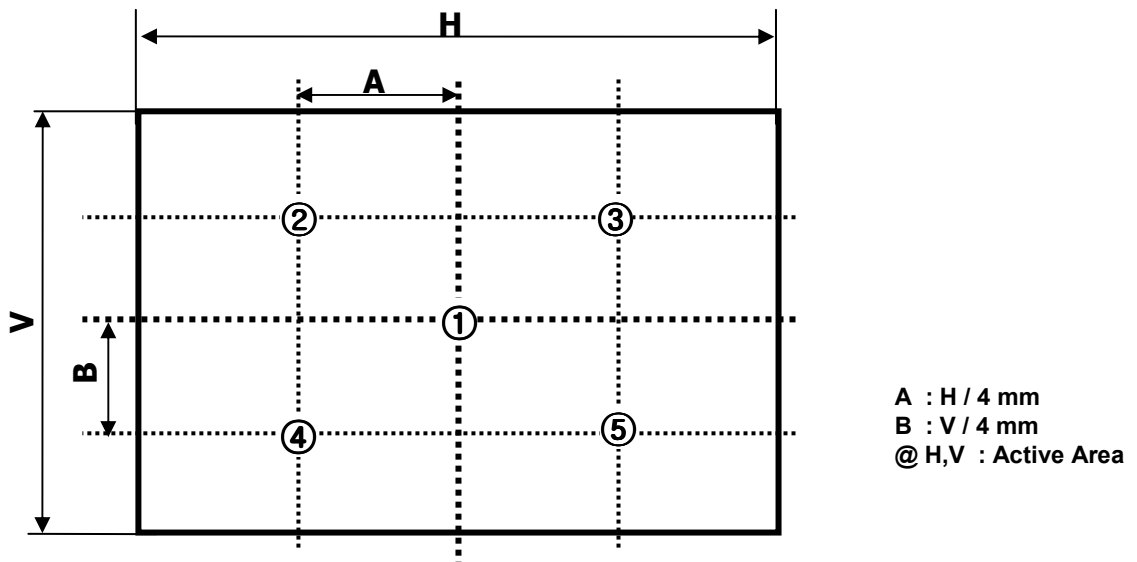
FIG. 2 5 Points for Luminance Measure

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Gray(M)".
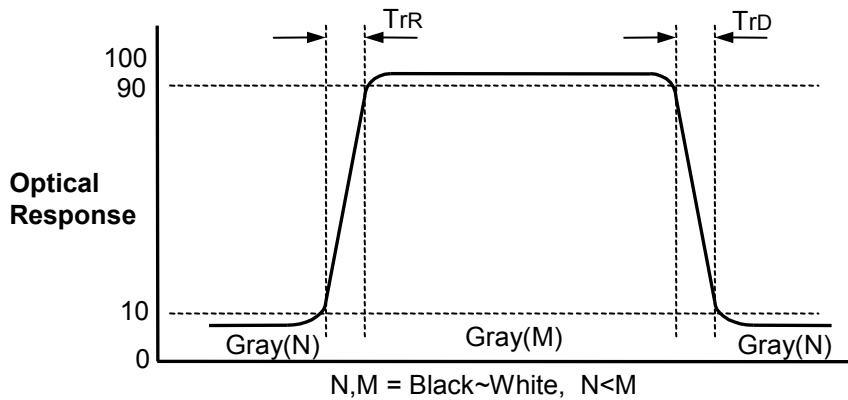
FIG. 3 Response Time

Dimension of viewing angle range
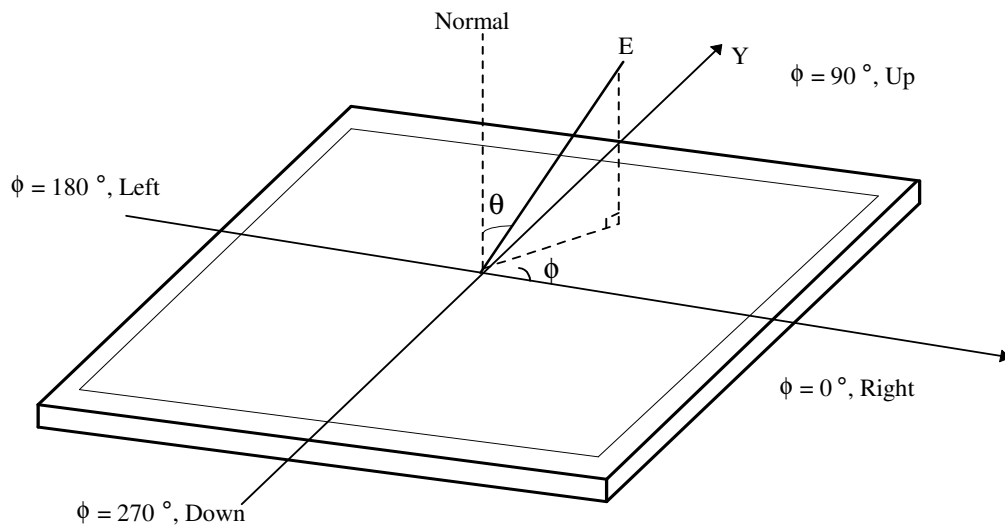
FIG. 4 Viewing Angle

5. Mechanical Characteristics

Table 11 provides general mechanical characteristics.

Table 11. MECHANICAL CHARACTERISTICS

Item	Value	
Outline Dimension	Horizontal	983.0 mm
	Vertical	576.0 mm
	Depth	47.3 mm
Bezel Area	Horizontal	939.0 mm
	Vertical	531.0 mm
Active Display Area	Horizontal	930.24 mm
	Vertical	523.26 mm
Weight	11.0 Kg (Typ.) , 12.0 Kg (Max.)	

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

Product Specification

<FRONT VIEW>

3-M4.0
Torque : 4~5kgf.cm
Depth : 5mm (Max.)

470.0

470.0

35.5 +0.8/−0.3

Ø4.0

40.5 +0.8/−0.3

47.3 +0.8/−0.3

26.9

983.0 +0.8/−0.3

(491.5)

486.5

486.5

12-Ø5 Hole

10.0

(22.5)

UP

390T-0307A

30.0

10.0

(22.0)

26.9

5-M4.0
Torque : 4~5kgf.cm
Depth : 3.5mm (Max.)

20.0

9.0

220.0

140.0

283.0

12.0

16.0

939.0 (Bezel Open)

930.240 (Active Area)

(288.0)

100.0

100.0

523.260 (Active Area)

531.0 (Bezel Open)

576.0 +0.8/−0.3

A

A

220.0

140.0

283.0

(22.0)

DOWN

390T-0308A

100.0

100.0

486.5

300.0

300.0

486.5

(22.5)

8-M4.0
Torque : 4~5kgf.cm
Depth : 5mm (Max.)

30.0

16.0

26.9

115.0

115.0

220.0

220.0

335.0

335.0

450.0

450.0

2.7 +0.5/−0.5

1.6 +0.5/−0.5

(0.7)

22.0

5.0

SECTION A-A

Bezel open

A

B

C

D

Active area

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

Product Specification

<REAR VIEW>

SECTION   B-B

Product Specification

6. Reliability

Table 12. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 60℃, 75%RH, 240h
2	Low temperature storage test	Ta= -20℃ 240h
3	High temperature operation test	Ta= 50℃ 60%RH 240h
4	Low temperature operation test	Ta= 0℃ 240h
5	Vibration test (non-operating)	Wave form : random Vibration level : 1.0Grms Bandwidth : 10-300Hz Duration : X,Y,Z, 30 min 　　　　　One time each direction
6	Shock test (non-operating)	Shock level : 50G Waveform : half sine wave, 11ms Direction : ± X, ± Y, ± Z 　　　　　One time each direction
7	ESD test	Condition : 150pF, 330 ohm 　　　　　Case , air Evaluation : ± 15kV
8	Humidity condition Operation	Ta= 40 ℃ ,90%RH
9	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) CISPR22 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electro technical Standardization.(CENELEC), 1998 (Including A1: 2000)

8. Packing

8-1. Designation of Lot Mark

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 : PANEL CODE   G : FACTORY CODE
H : ASSEMBLY CODE   I,J,K,L,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 : 13 pcs

b) Pallet Size : 1140 mm X 990 mm X 810 mm.

Product Specification

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 causes metallic foreign material and deal LCM a fatal blow)

(9) Please do not set LCD on its edge.

(10) 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.

Product Specification

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.

| Product Specification |

APPENDIX- I-1

■ **Required signal assignment for Flat Link (Thine : THC63LVD103) Transmitter(Pin7="L")**

Host System 30 Bit	THC63LVD103 or Compatible
RED0	33
RED1	34
RED2	35
RED3	36
RED4	37
RED5	38
RED6	59
RED7	61
RED8	4
RED9	5
GREEN0	40
GREEN1	41
GREEN2	42
GREEN3	44
GREEN4	45
GREEN5	46
GREEN6	62
GREEN7	63
GREEN8	6
GREEN9	8
BLUE0	48
BLUE1	49
BLUE2	50
BLUE3	52
BLUE4	53
BLUE5	54
BLUE6	64
BLUE7	1
BLUE8	9
BLUE9	11
Hsync	55
Vsync	57
Data Enable	58
CLOCK	12

FI-RE51S-HF

Timing Controller

TA-	31	12	
TA+	30	13	RO0N / RO0P (100Ω)
TB-	29	14	
TB+	28	15	RO1N / RO1P (100Ω)
TC-	25	16	
TC+	24	17	RO2N / RO2P (100Ω)
TCLK-	23	19	
TCLK+	22	20	ROCLKN / ROCLKP (100Ω)
TD-	21	22	
TD+	20	23	RO3N / RO3P (100Ω)
TE-	19	24	
TE+	18	25	RO4N / RO4P (100Ω)
		7	**VESA** / JEIDA

GND

LCM Module

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. (THC63LVD823 or Compatible)
3. '7' means MSB and '0' means LSB at R,G,B pixel data.

APPENDIX- I-2

■ **Required signal assignment for Flat Link (Thine : THC63LVD103) Transmitter(Pin7="H")**

Host System 30 Bit — **THC63LVD103 or Compatible**

Host System Signal	THC63LVD103 Pin
RED0	4
RED1	5
RED2	59
RED3	61
RED4	33
RED5	34
RED6	35
RED7	36
RED8	37
RED9	38
GREEN0	6
GREEN1	8
GREEN2	62
GREEN3	63
GREEN4	40
GREEN5	41
GREEN6	42
GREEN7	44
GREEN8	45
GREEN9	46
BLUE0	9
BLUE1	11
BLUE2	64
BLUE3	1
BLUE4	48
BLUE5	49
BLUE6	50
BLUE7	52
BLUE8	53
BLUE9	54
Hsync	55
Vsync	57
Data Enable	58
CLOCK	12

FI-RE51S-HF — **Timing Controller** (LCM Module)

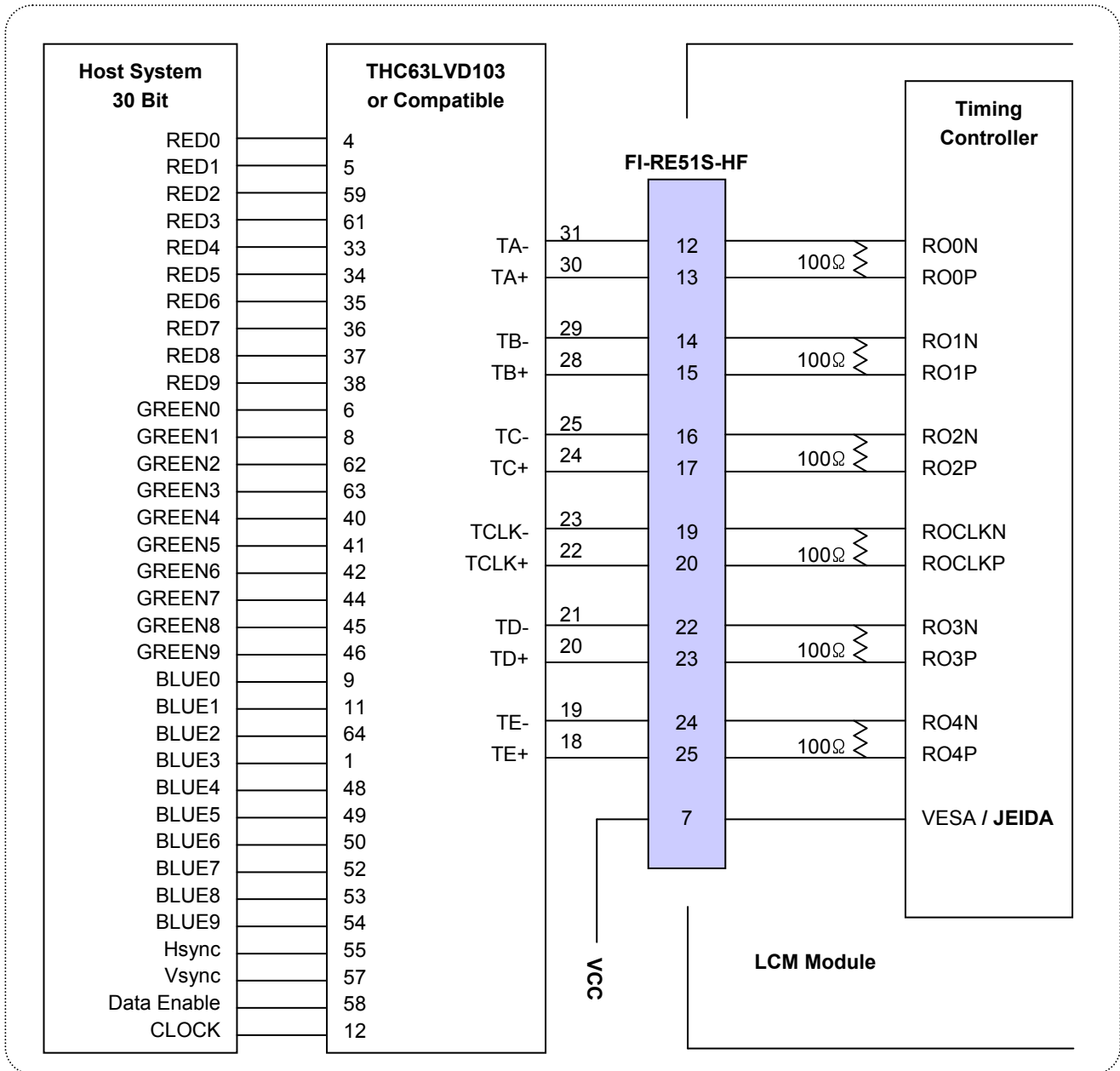| THC63LVD103 Out	Signal	FI-RE51S-HF	Timing Controller
31	TA-	12	RO0N
30	TA+	13	RO0P (100Ω)
29	TB-	14	RO1N
28	TB+	15	RO1P (100Ω)
25	TC-	16	RO2N
24	TC+	17	RO2P (100Ω)
23	TCLK-	19	ROCLKN
22	TCLK+	20	ROCLKP (100Ω)
21	TD-	22	RO3N
20	TD+	23	RO3P (100Ω)
19	TE-	24	RO4N
18	TE+	25	RO4P (100Ω)
	VCC	7	VESA / **JEIDA**

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. (THC63LVD823 or Compatible)
3. '7' means MSB and '0' means LSB at R,G,B pixel data.

Product Specification

APPENDIX-II

■ Pallet Ass'y
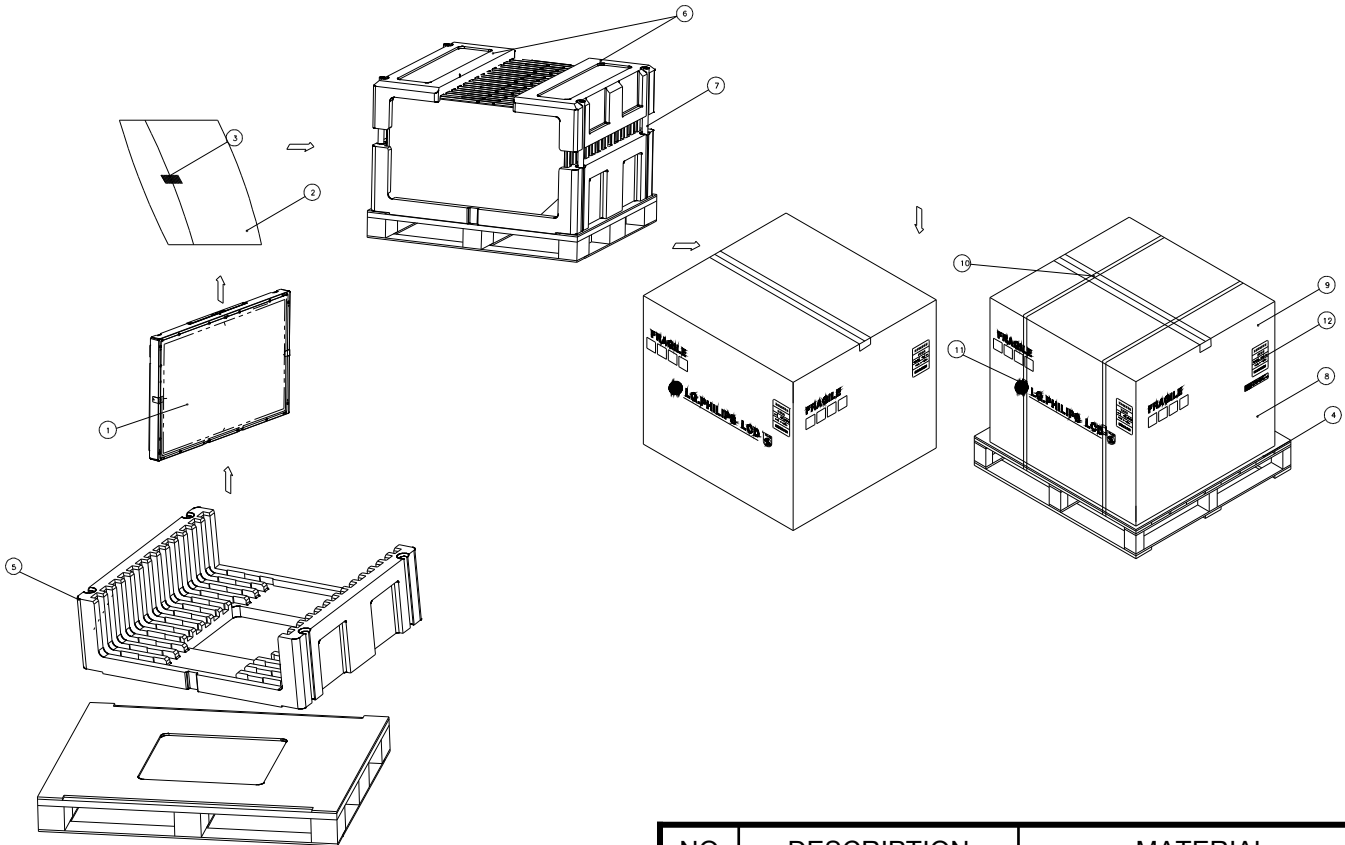
NO.	DESCRIPTION	MATERIAL
1	LCD Module	
2	BAG	42INCH
3	TAPE	MASKING 20MMX50M
4	PALLET	PAPER 1140X990X130MM
5	PACKING,BOTTOM	EPS
6	PACKING,TOP	EPS
7	ANGLE,POST	PAPER
8	ANGLE,PACKING	PAPER
9	BAND,CLIP	STEEL
10	BAND	PP
11	LABEL	YUPO 80G 100X100

APPENDIX- III
■ LCM Label

Model → LC420WUE

(SA) (A1)

RoHS Verified

UL, TUV Mark →

LPL Logo →

US PATENT No. → LG.PHILIPS LCD

This product may be covered by one or more of the following
US Patent Nos. 5,041,823 ; 5,061,920 ; 5,280,371 ; 5,835,139

← Serial No.

****

MADE IN KOREA ← Origin
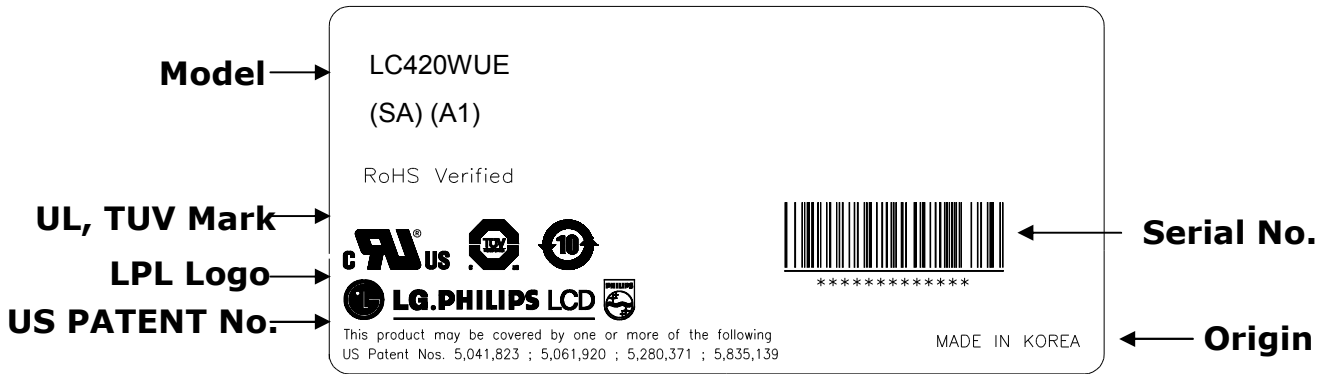
■ **Serial No. (See CAS 25page for more information)**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |

Inch   Year Month

Serial No.

M Ass'y Factory code
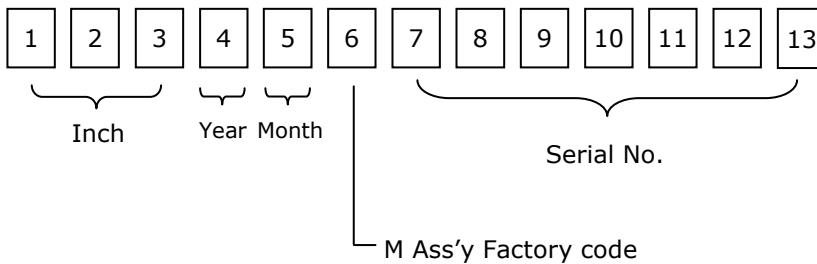
APPENDIX- IV
■ Pallet Label

LC420WUE		
SAA1		
13 PCS	001/01-01	
MADE IN KOREA		RoHS Verified

XXXXX XXXXXXXX XXX XXX XXXX

100.0

100.0
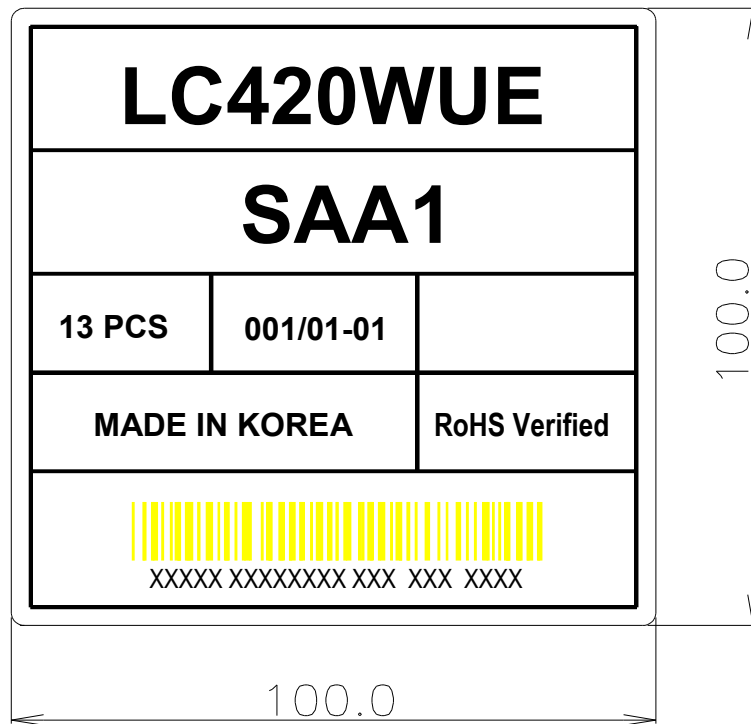
Product Specification

APPENDIX- V

■ Lamp Electrical spec

	Item	Unit	Standards		Notes
			Frequency	Characteristics	
1	Lamp Voltage ＶＬ	V$_{rms}$	45kHz	1,640± 10% IL=3.0mA (25℃) 2,030± 10% IL=7.0mA (25℃) 2,100± 10% IL=7.5mA (25℃) 2,180± 10% IL=8.0mA (25℃)	1, 3
2	Lamp Current ＩＬ	mA$_{rms}$		Min 3.0 Typ 7.0 Max 8.0	1, 3
3	Lamp power VL x IL	W	45kHz	4.5 IL=3.0mA 9.0 IL=7.0mA 9.4 IL=7.5mA 9.8 IL=8.0mA	1, 3
4	Starting Voltage	V$_{rms}$	45kHz	MAX 2,370 (0℃) MAX 1,980 (25℃)	2
5	Discharge Stabilization Time	min		3	3, 4
6	Operating Frequency	kHz		40~45(Typ)~80	5

Note   1) Started at IL=7.0(mA) and measure 3 minutes later.
        2) Voltage at switch on. Inverter output voltage.
        3) Ambient Temperature should be 25± 1℃ under no wind.
        4) The time needed to achieve not less than 95% luminance of the center / center part of lamp. The center
           / center part of lamp shall be measured. The luminance of the lamp after lighted for 5minutes is defined
           as 100%.
        5) The frequency range can be keep within ± 10% range of optical characteristics. (except the
           chromaticity)

APPENDIX- VI

■ **Option Pin Circuit Block Diagram**

Circuit Block Diagram of LVDS Format Selection pin
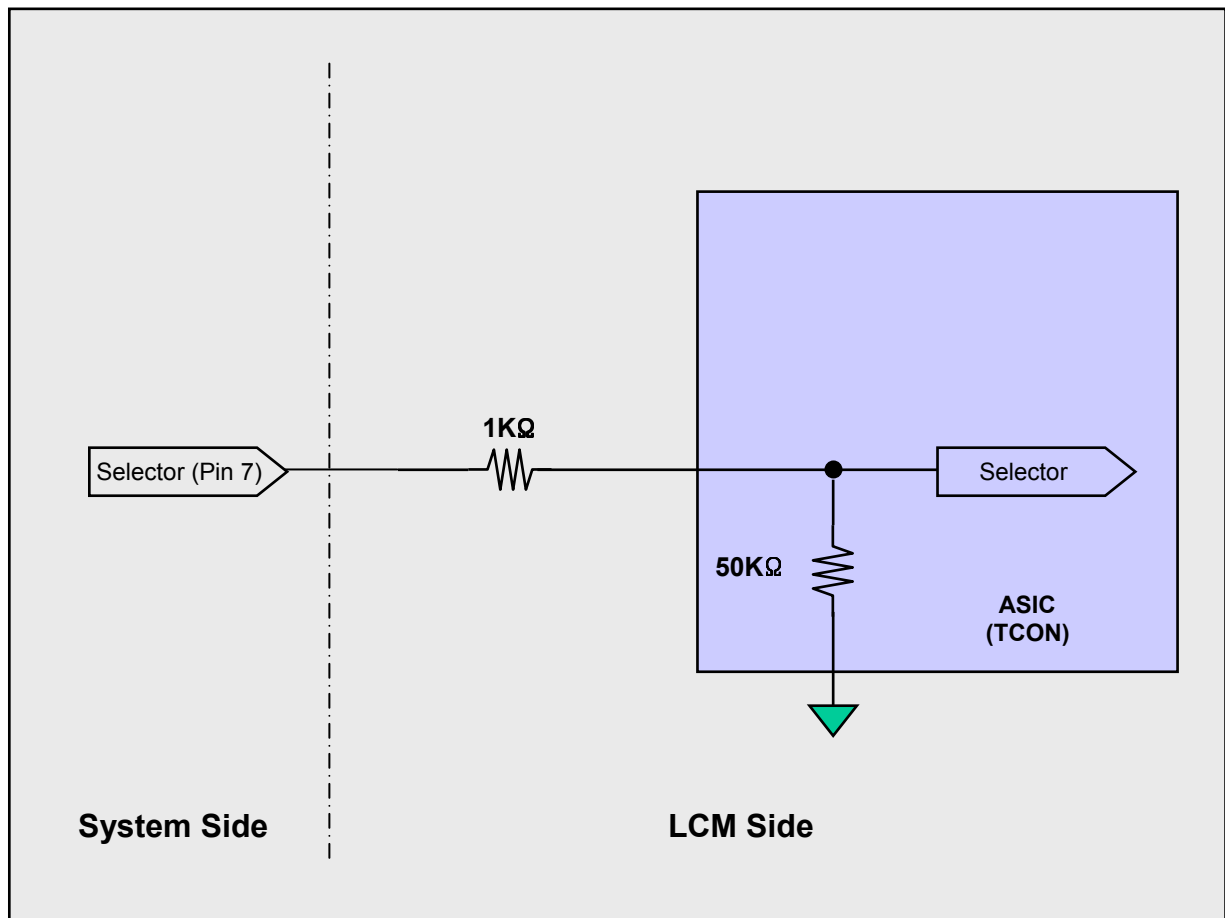
APPENDIX- VII

LVDS Data-Mapping info. (10bit)

■ LVDS Select : "H" Data-Mapping (JEIDA format)
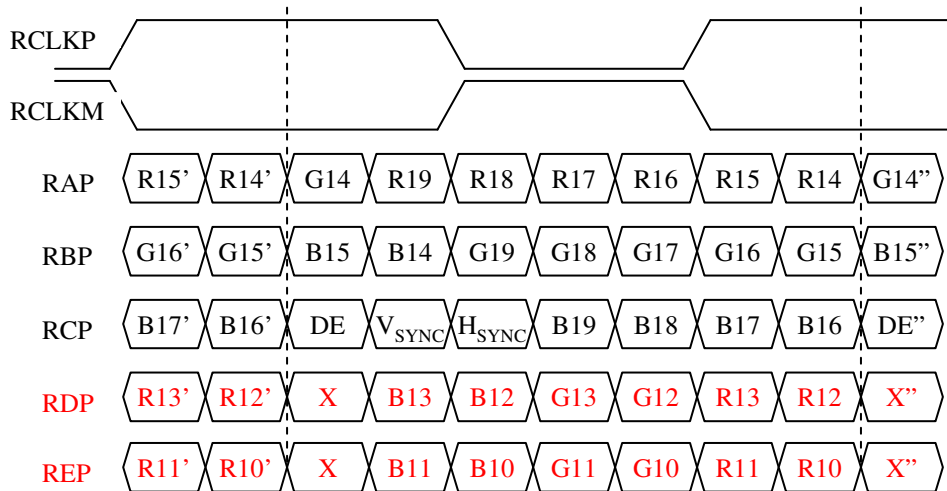
RCLKP / RCLKM									
RAP	R15'	R14'	G14	R19	R18	R17	R16	R15	R14	G14"
RBP	G16'	G15'	B15	B14	G19	G18	G17	G16	G15	B15"
RCP	B17'	B16'	DE	V_{SYNC}	H_{SYNC}	B19	B18	B17	B16	DE"
RDP	R13'	R12'	X	B13	B12	G13	G12	R13	R12	X"
REP	R11'	R10'	X	B11	B10	G11	G10	R11	R10	X"

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

RCLKP / RCLKM									
RAP	R11'	R10'	G10	R15	R14	R13	R12	R11	R10	G10"
RBP	G12'	G11'	B11	B10	G15	G14	G13	G12	G11	B15"
RCP	B13'	B12'	DE	V_{SYNC}	H_{SYNC}	B15	B14	B13	B12	DE"
RDP	R17'	R16'	X	B17	B16	G17	G16	R17	R16	X"
REP	R19'	R18'	X	B19	B18	G19	G18	R19	R18	X"
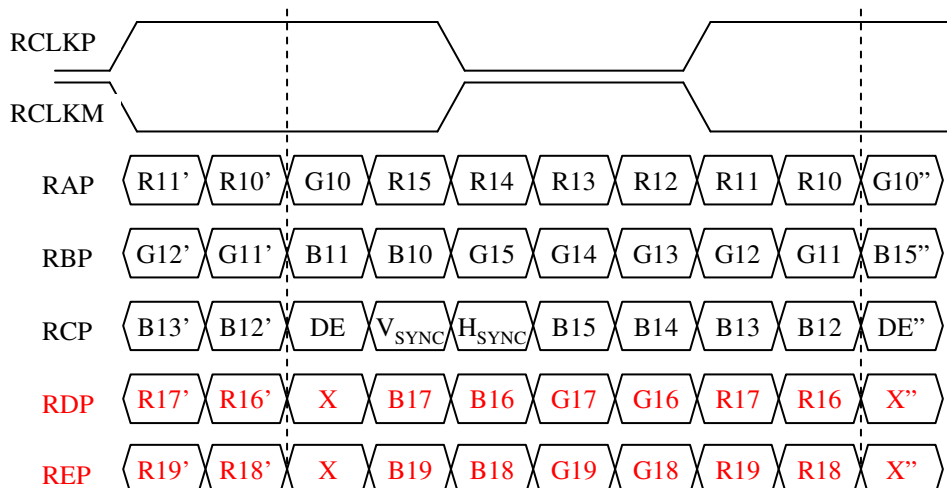
Product Specification

APPENDIX- VIII

LVDS Data-Mapping info. (8bit)

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

RAP	R13'	R12'	G12	R17	R16	R15	R14	R13	R12	G12"
RBP	G14'	G13'	B13	B12	G17	G16	G15	G14	G13	B13"
RCP	B15'	B14'	DE	V_{SYNC}	H_{SYNC}	B17	B16	B15	B14	DE"
RDP	R11'	R10'	X	B11	B10	G11	G10	R11	R10	X"

RCLKP RCLKM

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

RAP	R11'	R10'	G10	R15	R14	R13	R12	R11	R10	G10"
RBP	G12'	G11'	B11	B10	G15	G14	G13	G12	G11	B15"
RCP	B13'	B12'	DE	V_{SYNC}	H_{SYNC}	B15	B14	B13	B12	DE"
RDP	R17'	R16'	X	B17	B16	G17	G16	R17	R16	X"

RCLKP RCLKM

Ver. 1.0