SPECIFICATION
FOR
APPROVAL

( ) Preliminary Specification
(●) Final Specification

This Product must be used for a TV Application
This is not designed for the public display.

Title	32.0” WXGA TFT LCD

BUYER	General
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LC320WX6
SUFFIX	SLA3(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
J.H. Lee / Senior Manager	
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D.W. Lee / Engineer	

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

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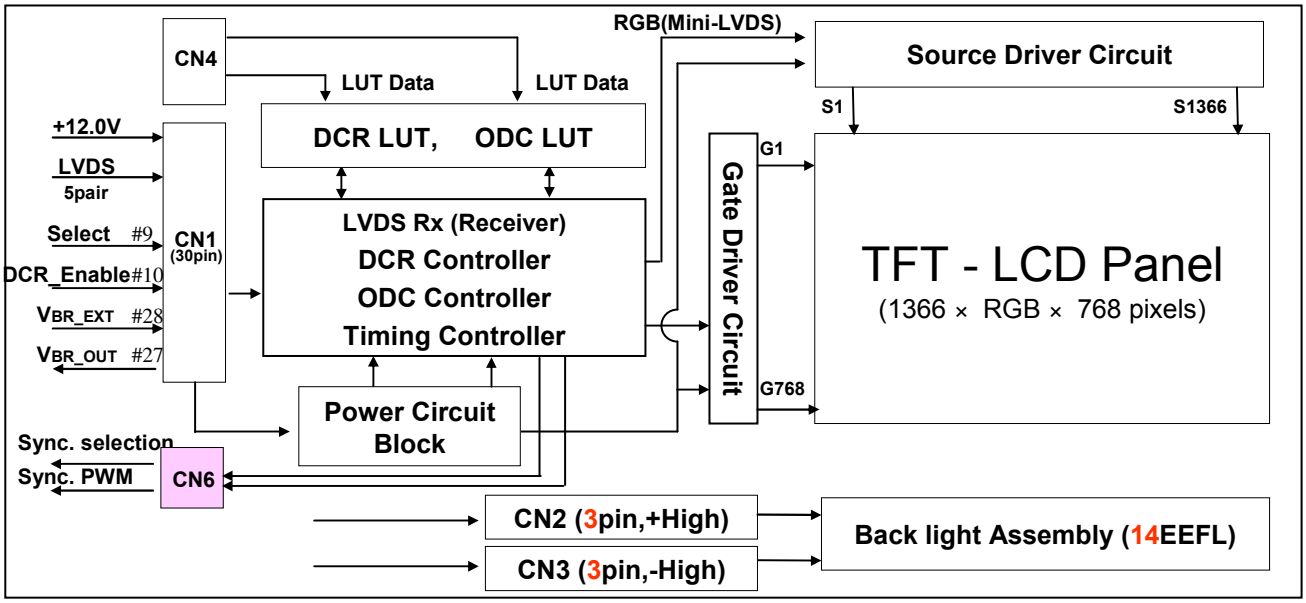
RECORD OF REVISIONS

Revision No	Revision Date	Page	Description
1.0	**Sep. 20. 2007**	**-**	**Final specification**

1. General Description

The LC320WX6 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 31.51 inch diagonally measured active display area with WXGA resolution (768 vertical by 1366 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 8-bit gray scale signal for each dot, thus presenting a palette of more than 16.7M(true) colors.
It has been designed to apply the 8-bit 1-port LVDS interface.
It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.



General Features

Active Screen Size	31.51 inches(800.4mm) diagonal
Outline Dimension	760.0 mm(H) x 450.0 mm(V) x 43.0 mm(D) (Typ.)
Pixel Pitch	170.25㎛ x 510.75㎛ x RGB
Pixel Format	1366 horiz. by 768 vert. pixels RGB stripe arrangement
Color Depth	8bit, 16,7 M colors
Luminance, White	500 cd/m^2 (Center 1 point) (Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178(Min.), U/D 178(Min.))
Power Consumption	Total 87.92 Watt (Typ.) (Logic=3.92W, Lamp=84W [VBR-A=1.65V]
Weight	5,900 g (Typ.)
Display Operating Mode	Transmissive mode, normally black
Surface Treatment	Hard coating(3H), anti-glare treatment of the front polarizer (Haze 13%)

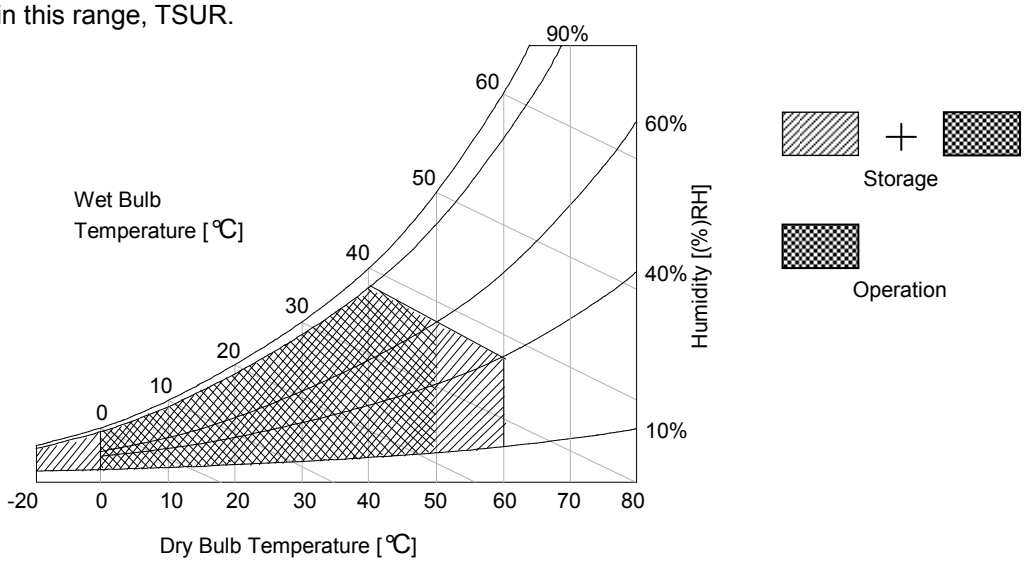
2. Absolute Maximum Ratings

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	1000	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.
3. Abnormal visual problems by panel front side surface temperature can be occurred in specific range (60 ℃ ~ 65 ℃), But materials (exp : polarizer) are not damaged permanently in this range, TSUR.



3. Electrical Specifications

3-1. Electrical Characteristics

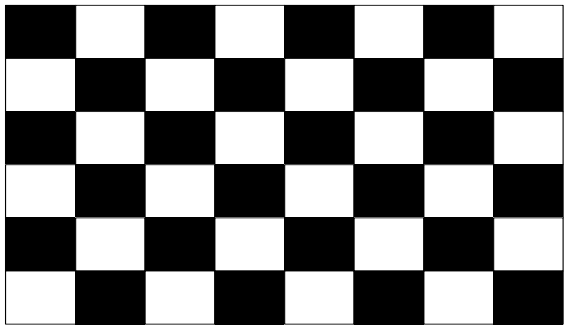
It requires two power inputs. One is employed to power for the LCD circuit. The other input power for the EEFL/Backlight is to power inverter.

Table 2-1. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
MODULE : Magnachip Source D-IC						
Power Input Voltage	V_{LCD}	11.4	12.0	12.6	V_{DC}	
Permissible Input Ripple Voltage	V_{RP}	-	-	200	mV_{P-P}	
Power Input Current	I_{LCD}	-	327	425	mA	1
		-	430	559	mA	2
Power Consumption	P_{LCD}	-	3.92	5.09	Watt	1
Rush current	I_{RUSH}	-	-	3.0	A	3

Notes : 1. The specified current and power consumption are under the VLCD=12.0V, 25 ± 2℃, fV=60Hz condition whereas mosaic pattern(8 x 6) is displayed and fV is the frame frequency.
2. The current is specified at the maximum current pattern.
3. The duration of rush current is about 2ms and rising time of power input is 1ms (min.).
4. At beginning, the power consumed around 20mA more than the normal status causing from the Blue LED applied.

White : 255Gray
Black : 0Gray



Mosaic Pattern(8 x 6)

Table 2-2. ELECTRICAL CHARACTERISTICS

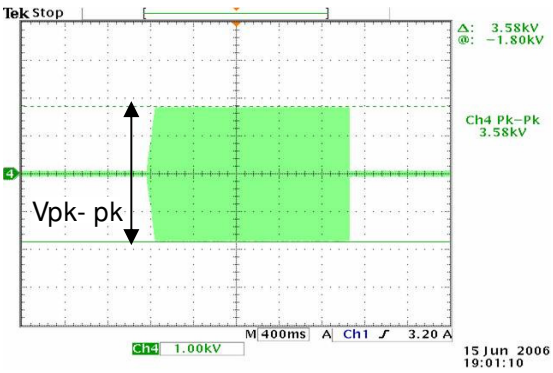
Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Backlight Assembly :							
Operating Voltage (one side,fBL=54.5KHz, IBL= 84mArms))		VBL	-	950	-	V_{RMS}	1, 2
Operating Current (one side)		IBL	-	84	-	mA_{RMS}	1
Established Starting Voltage (one side)	0℃	VS	-	-	1165	V_{RMS}	1, 3
	25℃		-	-	970		
Operating Frequency		fBL	53	54.5	56	kHz	4
Striking Time		S TIME	-	-	1.5	sec	3
Power Consumption		PBL	-	84	96	Watt	6
Burst Dimming Duty		a	20	-	100	%	9
Burst Dimming Frequency		1/T	150	-	180	Hz	9

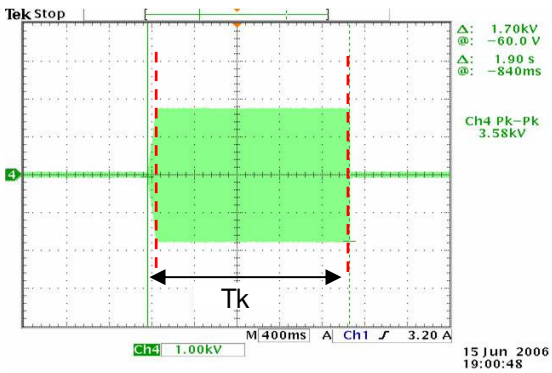
Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Lamp :							
Lamp Voltage (one side)		VLAMP	750	950	990	V_{RMS}	1, 2
Lamp Current (one side)		ILAMP	3	6	7	mA_{RMS}	1
Discharge Stabilization Time		TS	-	-	3	Min	1, 5
Lamp Frequency		f LAMP	50	55	60	KHz	
Lamp Temperature		TLAMP	-	-	145	℃	
Established Starting Voltage (one side)	0℃	VS	-	-	1165	V_{RMS}	1, 3
	25℃	VS	-	-	970		
Life Time			50,000	60,000		Hrs	7

Notes : 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.

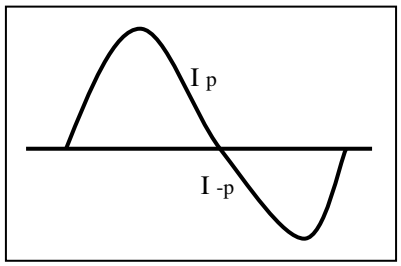
※ Do not attach a conductive tape to lamp connecting wire.
If you attach conductive tape to the lamp wire, not only luminance level can be lower than typical one but also inverter operate abnormally on account of leakage current which is generated between lamp wire and conductive tape.

1. Specified values are defined for a Backlight Assembly.(IBL : 14 lamp, 6.0mA/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.





4. Lamp frequency may produce interface 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 from its harmonics 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%.
   The screen of LCD module may be partially dark by the time the brightness of lamp is stable after turn on.
6. Max of power consumption is measured at initial turn on.
   Typical of power consumption is measured after 2hrs aging at 25 ± 2℃.
7. The life 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 waveform and symmetrical current waveform (Unsymmetrical ratio is less than 10%). Please do not use the inverter which has unsymmetrical voltage and unsymmetrical current and spike wave.
   Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp, are following.
   It shall 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.



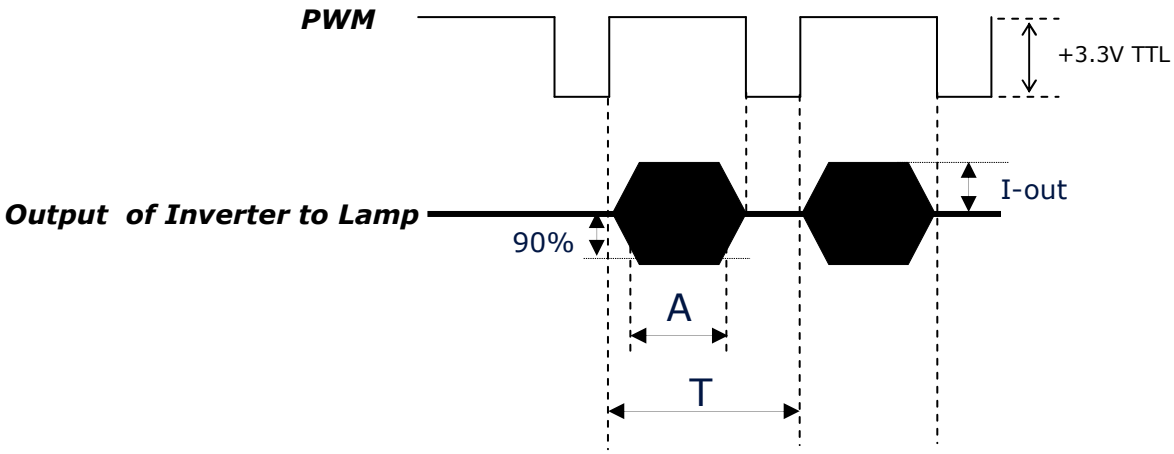
* Asymmetry rate:

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

* Distortion rate

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

9. The reference method of burst dimming duty ratio.
   a. Need the Synchronous Vsync frequency for prevent waterfall (Vsync x 3 =Burst Frequency)
   b. The variance of the burst dimming minimum is ± 5%.



Point A : rising time 90% of Iout point .

Point B : falling starting point .

I out duty = { A/T } * 100

PWM Frequency = 1/T

※ 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: P6015(Tektronix)

10. The cable between the back light connector and its inverter power supply should be connected directly with a minimized length. A longer cable between the back light and the inverter may cause lower luminance of lamp and may require more higher starting voltage(Vs).
11. The operating current must be measured as near as back light assembly input.
12. The Operating current unbalance between left and right must be under typ±10%.

3-2. Interface Connections

This LCD module employs two kinds of interface connection, a 30-pin connector is used for the module electronics and two 2-pin connectors are used for the integral backlight system.

3-2-1. LCD Module

- LCD Connector(CN1) : FI-X30SSL-HF (Manufactured by JAE) or Equivalent
- Mating Connector : FI-30C2L (Manufactured by JAE) or Equivalent

Table 3. MODULE CONNECTOR(CN1) PIN CONFIGURATION

Pin No.	Symbol	Description	Note
1	VLCD	Power Supply +12.0V	
2	VLCD	Power Supply +12.0V	
3	VLCD	Power Supply +12.0V	
4	VLCD	Power Supply +12.0V	
5	GND	Ground	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	Select	Select LVDS Data format	1
10	DCR Enable	Dynamic CR Enable ('L'= Disable , 'H' = Enable)	2
11	GND	Ground	
12	RA-	LVDS Receiver Signal(-)	
13	RA+	LVDS Receiver Signal(+)	
14	GND	Ground	
15	RB-	LVDS Receiver Signal(-)	
16	RB+	LVDS Receiver Signal(+)	
17	GND	Ground	
18	RC-	LVDS Receiver Signal(-)	
19	RC+	LVDS Receiver Signal(+)	
20	GND	Ground	
21	RCLK-	LVDS Receiver Clock Signal(-)	
22	RCLK+	LVDS Receiver Clock Signal(+)	
23	GND	Ground	
24	RD-	LVDS Receiver Signal(-)	
25	RD+	LVDS Receiver Signal(+)	
26	GND	Ground	
27	VBR_OUT	VBR output form LCD module	
28	VBR_EXT	External VBR input from System to LCD module	
29	GND	Ground	
30	GND	Ground	3

Notes: 1. The pin no 9 is an option pin for DISM or LG format. (VESA Format = "GND" / JEIDA Format ="VCC")
2. The pin no 10 is an option pin for DCR Function. (Enable = "VCC" / Disable ="GND")
For more information, see the FIG. 5. (P.28)
3. The pin no 30 is LCD Test option.
LCM operates "AGP" (Auto Generation 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")
4. All GND (ground) pins should be connected together, which should be also connected to the LCD module's metal frame.
5. All V_{LCD} (power input) pins should be connected together.
6. Input Levels of LVDS signals are based on the IEA 664 Standard.

3-2-2. Backlight Module

[Master]

1) Balance Connector

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

2) Mating Connector

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

[Slave]

1) Balance Connector

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

2) Mating Connector

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

Table 4. 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

3-2-3. Sync connection between LCD Module and System

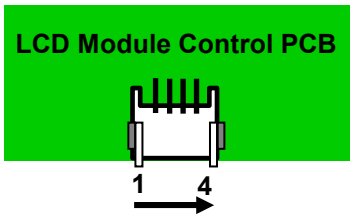
There are 4 pins sync connector in the LCD module control PCB . The No.1 pin is for REFMODE which is selected of Vsync frequency signal. The No.2 pin is for WPWM which s generated for PWM frequency synchronically between control & inverter. The rest pins are for Ground and NC.

1) Inverter Sync Connector

: DF14-4S-1.25C (manufactured by Hirose)or equivalent

Table 5. INVERTER SYNC. CONNECTOR PIN CONFIGURATION(CN4)

Pin No.	Symbol	Description	Note
1	REFMODE	Vsync. Frequency select signal	
2	WPWM	PWM Frequency output	
3	GND	Ground	
4	NC	No connection	



Notes:
1. LPL recommends that Inverter Burst dimming frequency (PWM Frequency) should be synchronized with Sync signal.
2. LPL recommends that Inverter Burst dimming frequency (PWM Frequency) should be 150Hz or 180Hz.

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 (DE only Mode)

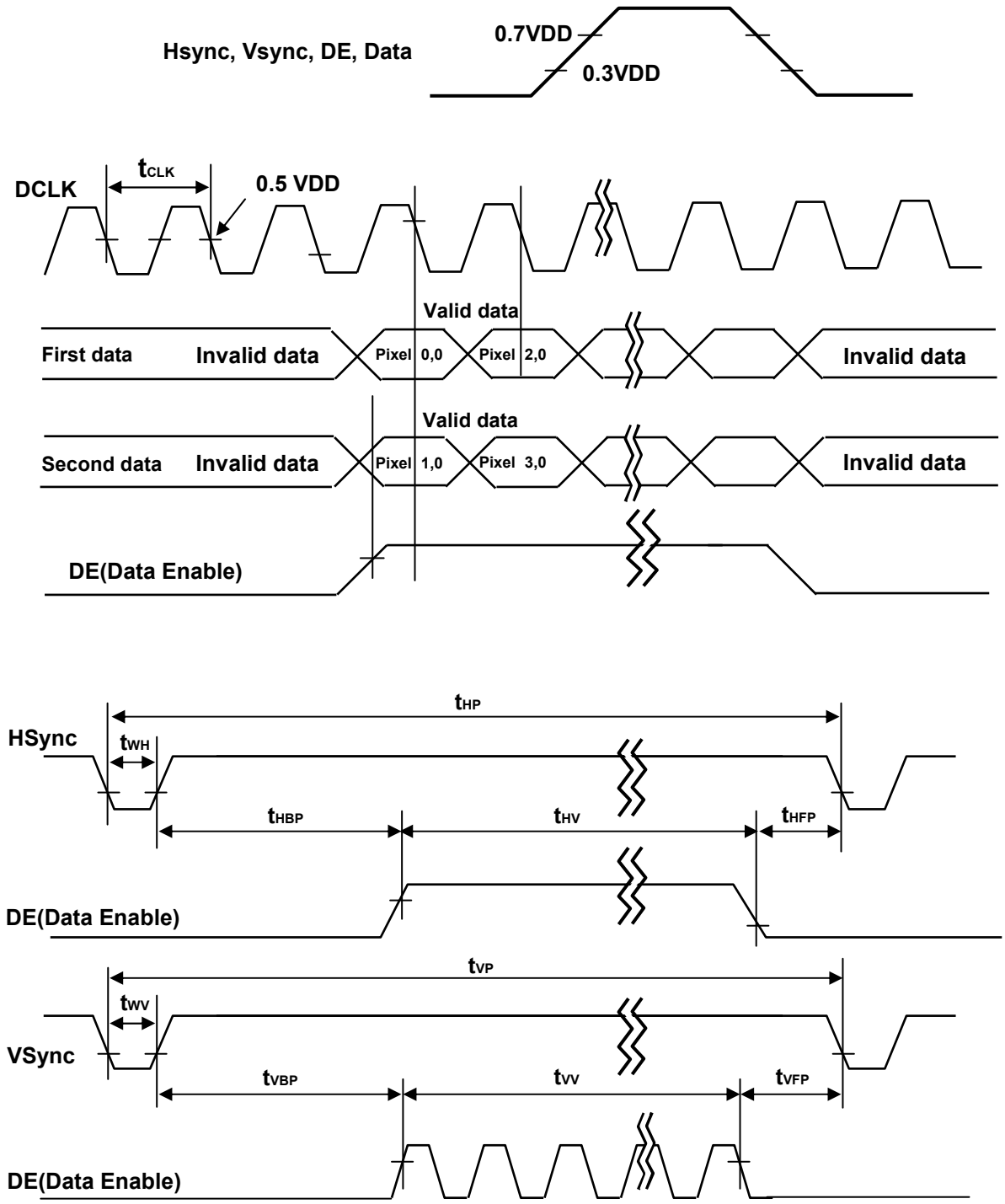
ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Period	t_{CLK}	12.5	13.8	15.8	ns	
	Frequency	-	63	72.4	82	MHz	
Hsync	Period	t_{HP}	1456	1528	1920	t_{CLK}	
	Horizontal Valid	t_{HV}	1366	1366	1366	t_{CLK}	
	Horizontal Blank	t_{HB}	tHP- tHV	162	tHP- tHV		
	Frequency	f_H	45	47.4	50	KHz	
	Width	t_{WH}	-	32	-	t_{CLK}	
	Horizontal Back Porch	t_{HBP}	24	48	-		
	Horizontal Front Porch	t_{HFP}	40	80	-		
Vsync	Period	t_{VP}	776	790	1063	t_{HP}	PAL : 47~53Hz, NTSC : 57~63Hz
	Vertical Valid	t_{VV}	768	768	768	t_{HP}	
	Vertical Blank	t_{VB}	tVP- tVV	22	tVP- tVV	t_{HP}	
	Frequency	f_V	47	60	63	Hz	
	Width	t_{WV}	-	5	-	t_{HP}	
	Vertical Back Porch	t_{VBP}	4	15		Hz	
	Vertical Front Porch	t_{VFP}	1	2	-	t_{HP}	

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



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								GREEN								BLUE							
		MSB							LSB	MSB							LSB	MSB							LSB
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	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
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	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	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
RED	RED (000) Dark	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	...					...								...								...			
	RED (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (000) Dark	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	1	0	0	0	0	0	0	0	0
	...					...								...								...			
	GREEN (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE (000) Dark	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	1
	...					...								...								...			
	BLUE (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

3-6. Power Sequence

3-6-1. LCD Driving circuit

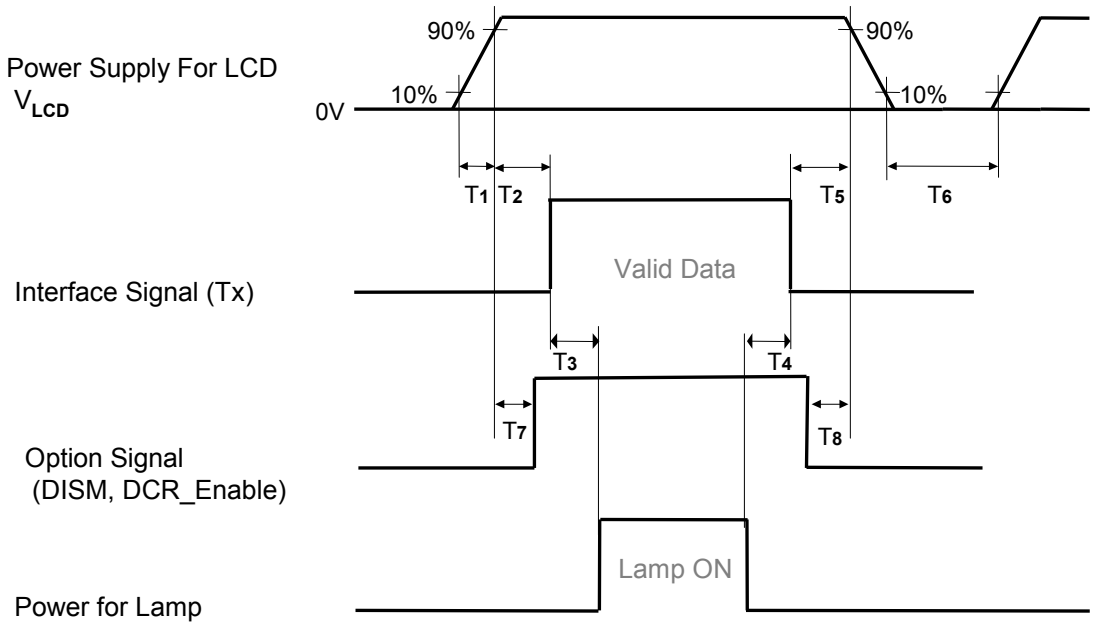


Table 8. POWER SEQUENCE

Parameter	Value			Unit
	Min	Typ	Max	
T1	0.5	-	20	ms
T2	0.5	-	3 x (1/fV)	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0	-	-	ms
T6	2.0	-	-	s
T7	0	-	T2	ms
T8	0	-	T5	ms

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 3× (1/fv), it operates protection pattern(Black pattern) till valid signal inputted. There is no reliability problem(ex. 60Hz : 3× (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 option signal(DISM or DCR_Enable) 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.

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and for 30 minutes in a dark environment at 25± 2℃. The values are specified at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0 °.
It is presented additional information concerning the measurement equipment and method in FIG. 1.

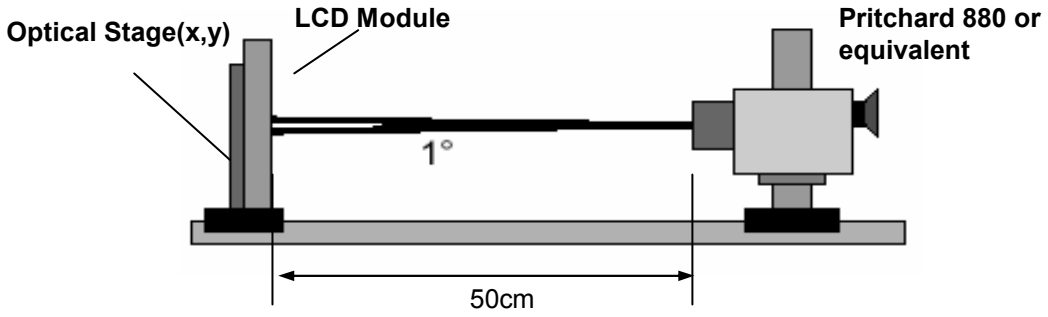


FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 9. OPTICAL CHARACTERISTICS Ta= 25± 2℃, V_{LCD}=12.0V, fv=60Hz, Dclk=72.3MHz, I_{BL}=84mA

Parameter		Symbol	Value			Unit	Note
			Min	Typ	Max		
Contrast Ratio		CR	800	1000			1
Surface Luminance, white		L_{WH}	400	500		cd/m^2	2
Luminance Variation		δ_{WHITE} 5P			1.3		3
Response Time	Rise Time	Tr_R	-	8	12	ms	4
	Decay Time	Tr_D	-	10	14		
	G to G		-	8	12		
Color Coordinates [CIE1931]	RED	Rx	Typ -0.03	0.635	Typ +0.03		
		Ry		0.345			
	GREEN	Gx		0.284			
		Gy		0.612			
	BLUE	Bx		0.146			
		By		0.061			
	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

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

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

$$CRn = \frac{\text{Surface Luminance at position n with all white pixels}}{\text{Surface Luminance at position n with all black pixels}}$$

n = the Position number(1, 2, 3, 4, 5). For more information, see FIG 2.

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 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 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)

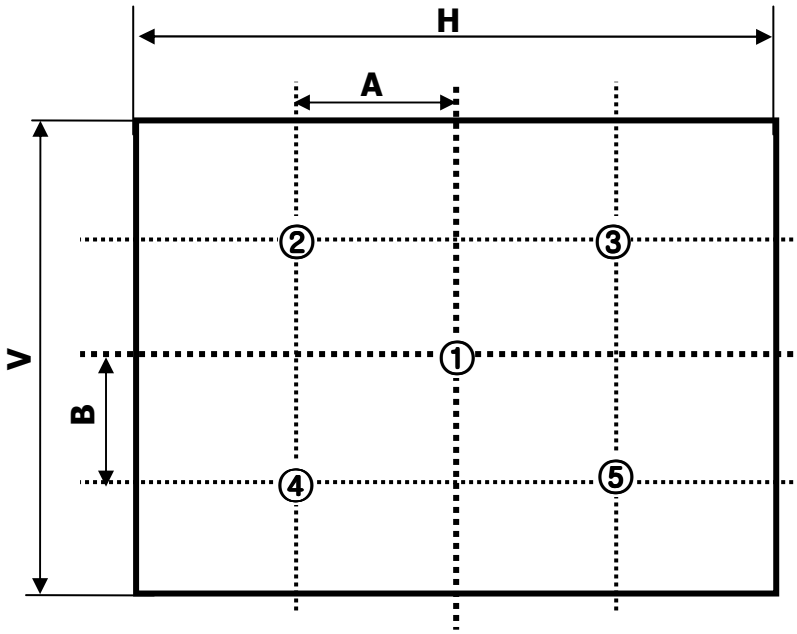
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.

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	0.13
L15	0.27
L31	1.00
L47	2.40
L63	4.60
L79	7.60
L95	11.40
L111	16.00
L127	21.60
L143	28.00
L159	35.40
L175	43.70
L191	53.00
L207	63.20
L223	74.50
L239	88.00
L255	100.00

Measuring point for surface luminance & measuring point for luminance variation



A : H / 4 mm
B : V / 4 mm
H : 697.685 mm
V : 392.256 mm
@ H,V : Active Area

FIG. 2 The Position of 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)".

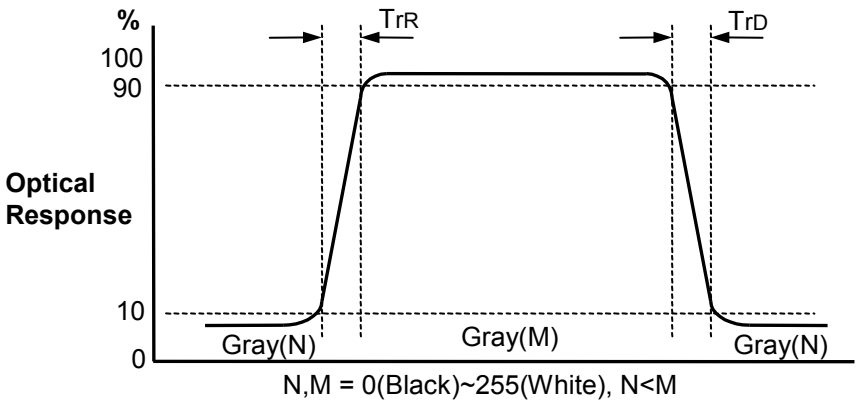


FIG. 3 Response Time

Dimension of viewing angle range

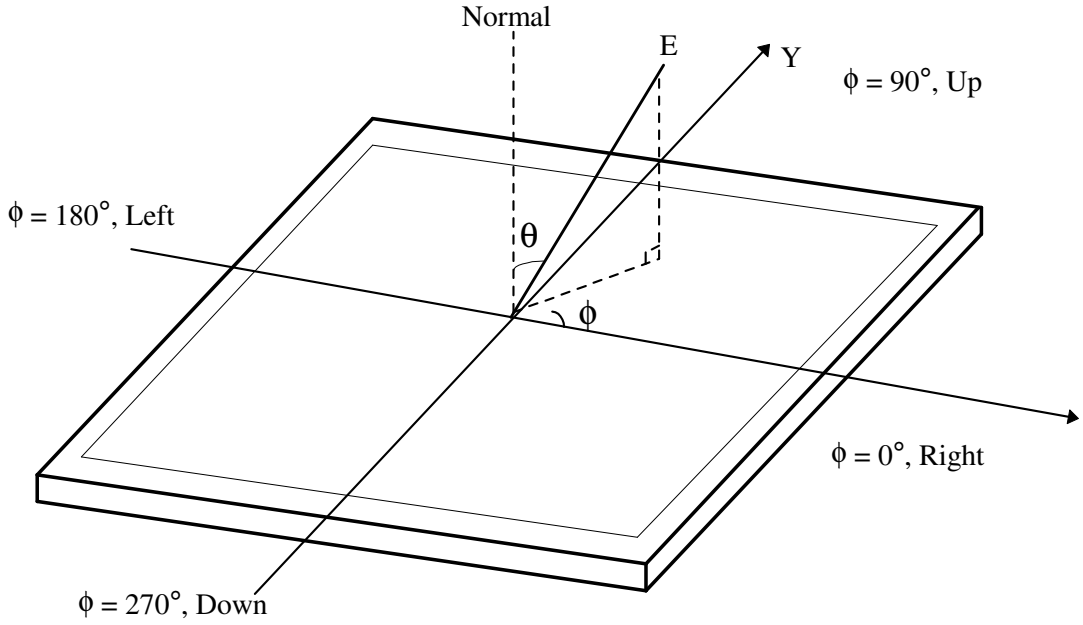


FIG. 4 Viewing Angle

Optical characteristics are determined after the unit has been 'ON' for 30min in a dark environment at 25± 2℃. The values specified are at an approximate distance 1.2mm from the LCD surface at a viewing angle of Φ and θ equal to 0 °.
It is presented additional information concerning the measurement equipment and method in FIG. 1.

5. Mechanical Characteristics

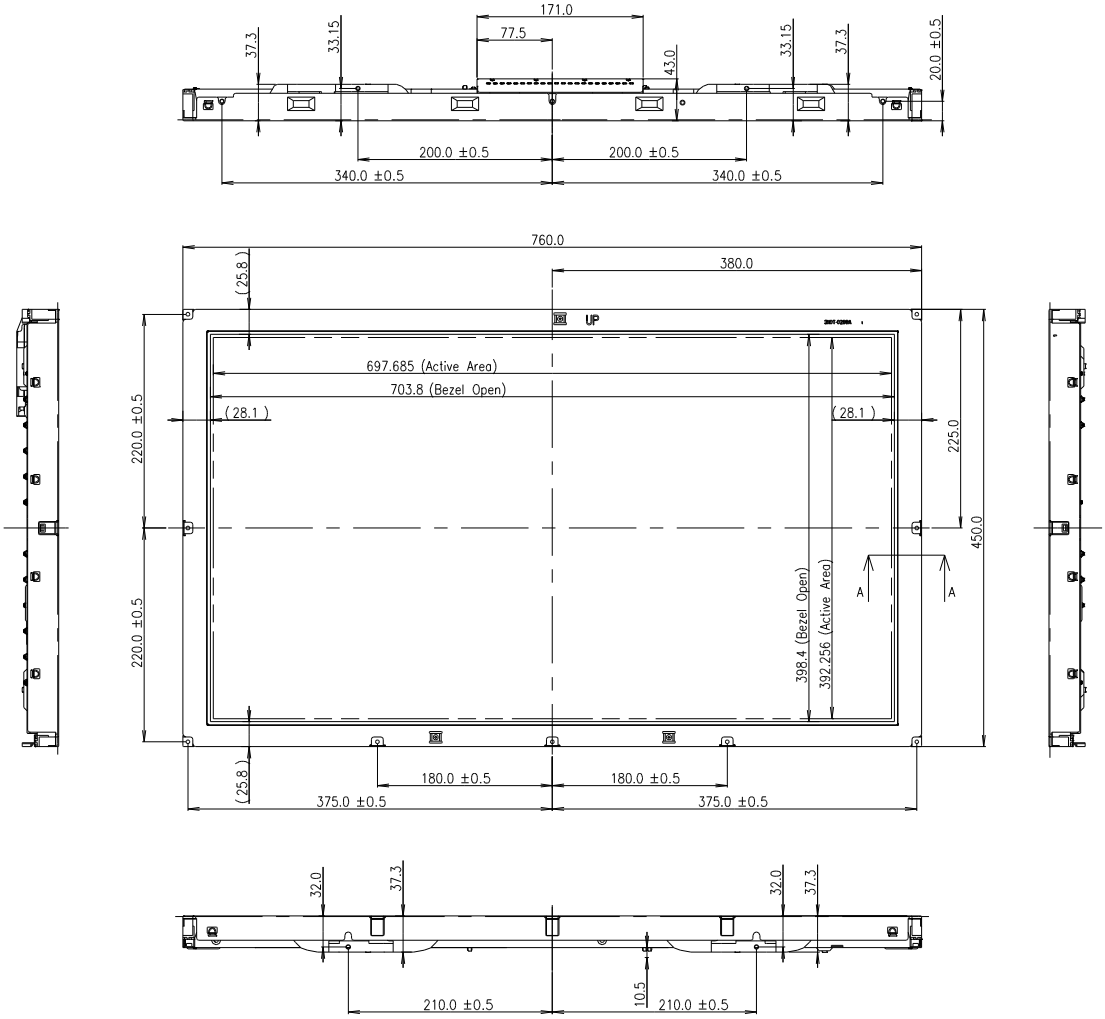
The following items provide general mechanical characteristics. In addition, the figures in the next page show the detail information of mechanical drawing for LCD module.

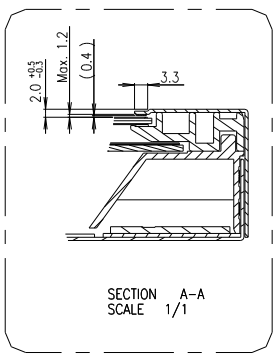
Table 11. MECHANICAL CHARACTERISTICS

Outline Dimension	Horizontal	760.0mm
	Vertical	450.0 mm
	Depth	43.0 mm
Bezel Area	Horizontal	703.8mm
	Vertical	398.4mm
Active Display Area	Horizontal	697.685mm
	Vertical	392.256mm
Weight	5,900 g(Typ.), 6,200 g(Max)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer	

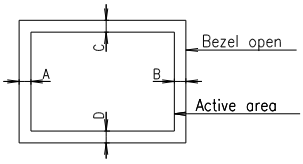
Notes : Please refer to a mechanic drawing in terms of tolerance at the next page.

<FRONT VIEW>

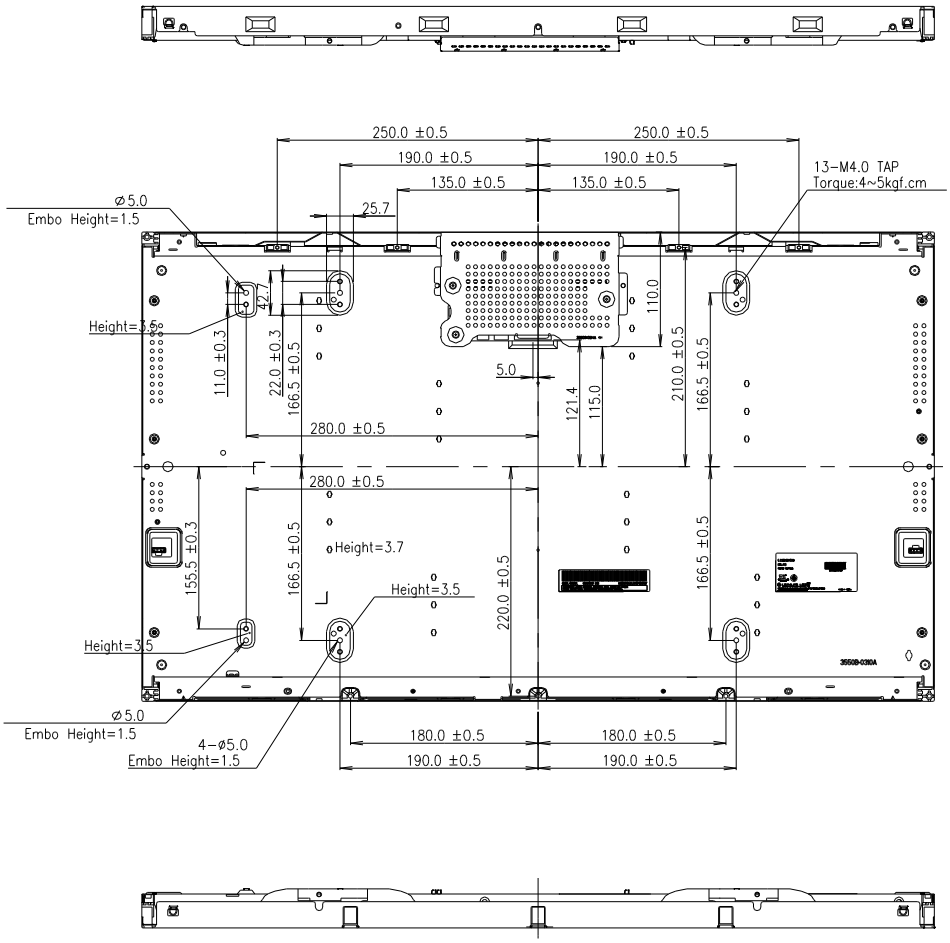




NOTES
1. Unspecified tolerances are to be ±1.0mm.
2. Tilt and partial disposition tolerance of display area are as following.
   (1) X-Direction : IA−BI ≤ 1.5mm
   (2) Y-Direction : IC−DI ≤ 1.5mm



<REAR VIEW>


250.0 ±0.5
250.0 ±0.5
190.0 ±0.5
190.0 ±0.5
135.0 ±0.5
135.0 ±0.5
25.7
13-M4.0 TAP
Torque:4~5kgf.cm
ø5.0
Embo Height=1.5
Height=3.5
11.0 ±0.3
22.0 ±0.3
166.5 ±0.5
4.7
110.0
5.0
121.4
115.0
210.0 ±0.5
166.5 ±0.5
280.0 ±0.5
280.0 ±0.5
155.5 ±0.3
166.5 ±0.5
Height=3.7
Height=3.5
220.0 ±0.5
166.5 ±0.5
Height=3.5
ø5.0
Embo Height=1.5
4-ø5.0
Embo Height=1.5
180.0 ±0.5
180.0 ±0.5
190.0 ±0.5
190.0 ±0.5

6. Reliability

Table 12. 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 : 1.0Grms Bandwidth : 10-500Hz Duration : X,Y,Z, 10 min One time each direction
6	Shock test (non-operating)	Shock level : 100Grms Waveform : half sine wave, 2ms Direction : ±X, ±Y, ±Z One time each direction
7	Humidity condition Operation	Ta= 40 ℃ 90%RH 240h
8	Altitude operating storage / shipment	0 - 14,000 feet(4267.2m) 0 - 40,000 feet(12192m)

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)
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	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

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

8-2. Packing Form

a) Package quantity in one box : 6 pcs

b) Box size : 848mm(W) X 494mm(D) X 539mm(H)

9. Precautions

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

9-1. Mounting Precautions

(1) You must mount a module using 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.
(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.

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.

*** The attached figure of the DCR_ENABLE Circuit Block Diagram**

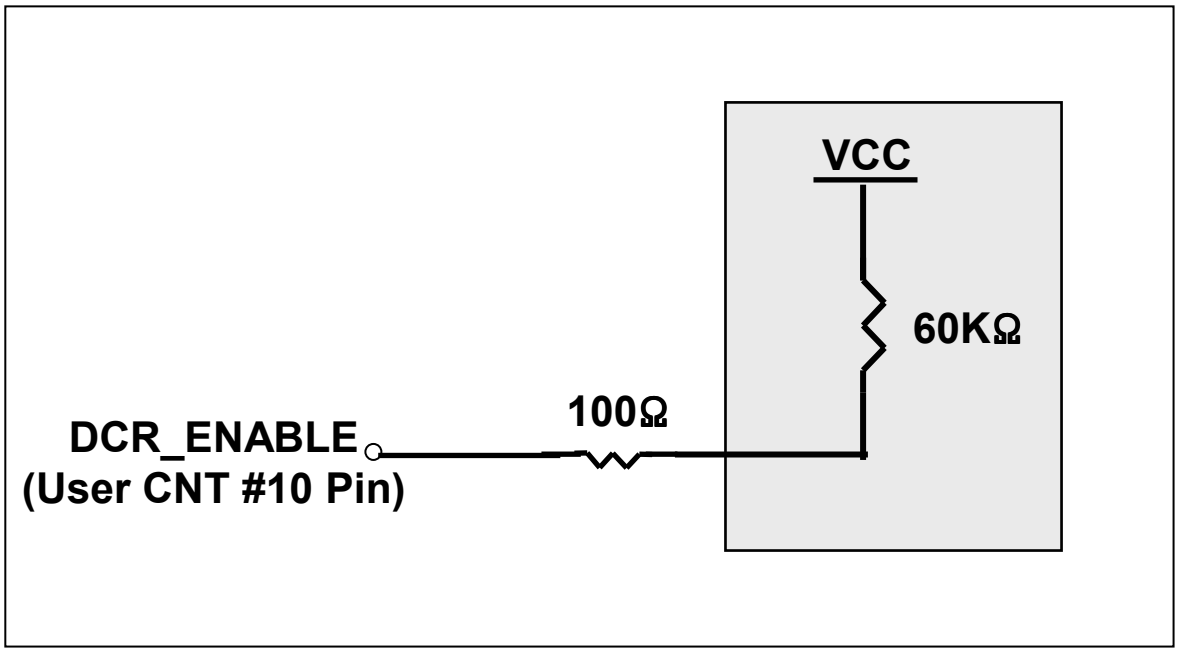
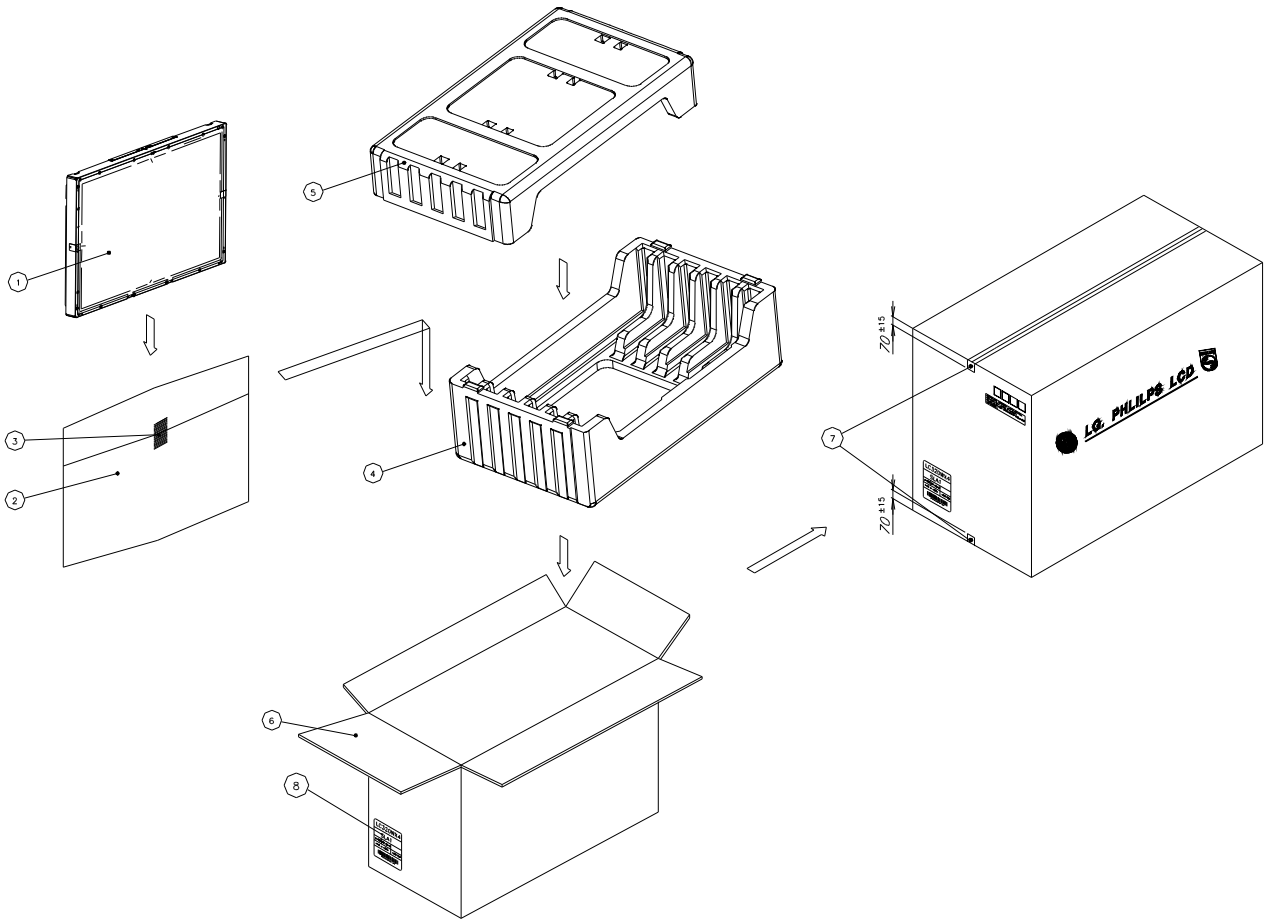


Fig.5 The DCR_ENABLE Circuit Block Diagram

 # APPENDIX- I

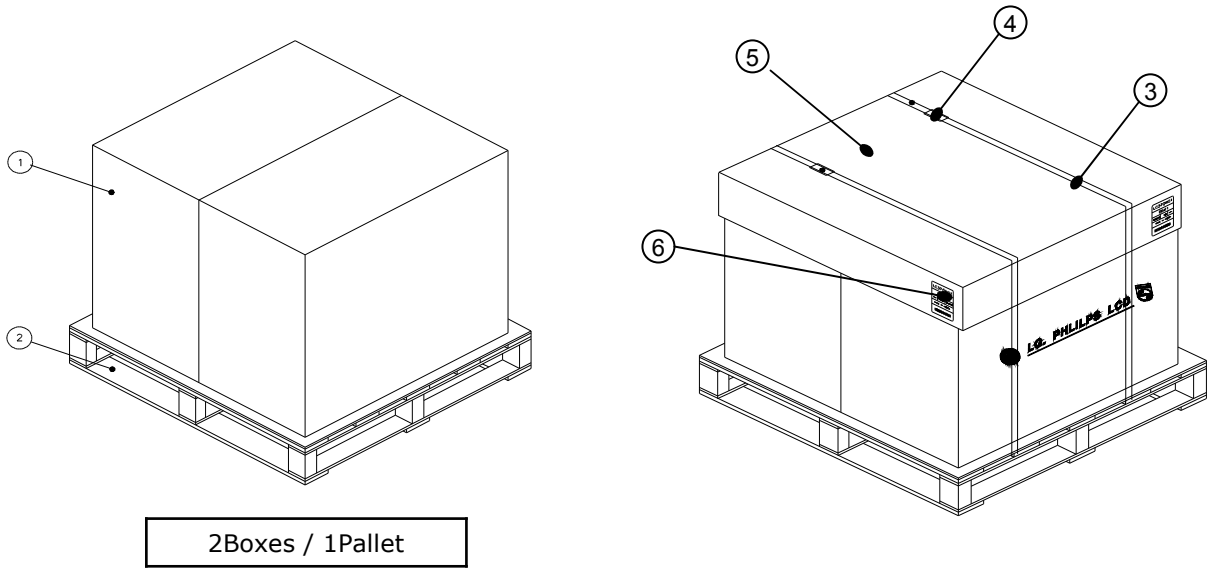
■LC320WX6-SLA3 Packing Ass'y



NO.	DESCRIPTION	MATERIAL
1	LCD Module	
2	BAG	AL
3	TAPE	MASKING 20MM X 50M
4	Packing	EPS_BOTTOM_LC320WX4
5	Packing	EPS_TOP_LC320WX4
6	BOX	DW3 848*494*539
7	TAPE	OPP 70MMX300M
8	LABEL	YUPO PAPER 80G 100X100

APPENDIX- II

■ LC320WX6-SLA3 Pallet Ass'y

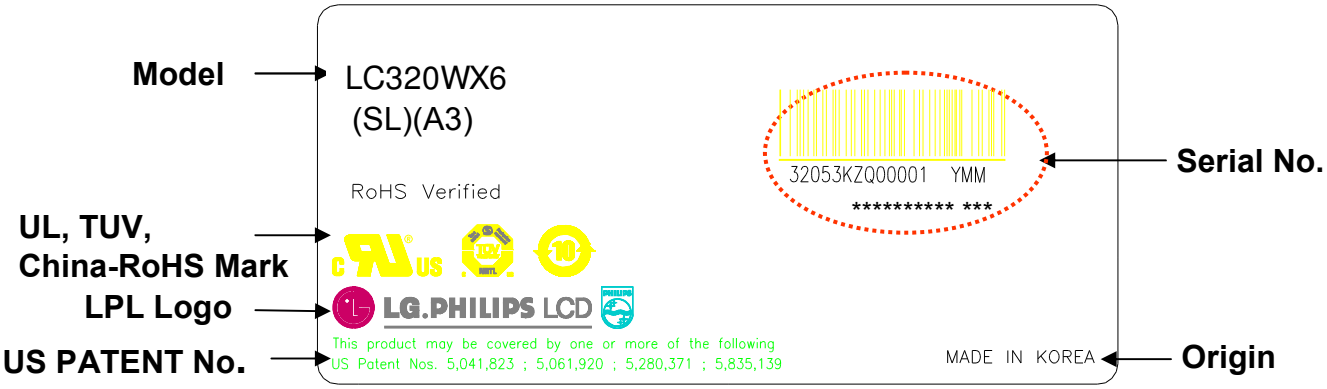


2Boxes / 1Pallet

NO.	DESCRIPTION	MATERIAL
1	PACKING ASS'Y	
2	PALLET	PAPER_1040X870X130
3	BAND, PACKING	P.P 18MMX200MX0.8MM
4	BAND, CLIP	CLIP 18MM
5	ANGLE,Cover	DW3
6	LABEL	PAPER

APPENDIX- III

■ LCM Label



APPENDIX- Ⅳ

■ Box Label

LC320WX6		
SLA3		
6 PCS	LOT/MM-DD	
MADE IN KOREA		RoHS Verified

■ Pallet Label

LC320WX6		
SLA3		
12 PCS	LOT/MM-DD	
MADE IN KOREA		RoHS Verified