SPECIFICATION
FOR
APPROVAL

( ) **Preliminary Specification**

(●) **Final Specification**

Title	47.0” WUXGA TFT LCD

BUYER	
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LC470WU4
SUFFIX	SLC1 (RoHS Verified)

*When you obtain standard approval,
please use the above model name without suffix
** Appendix 10,000:1

APPROVED BY	SIGNATURE DATE
/	
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/	

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

APPROVED BY	SIGNATURE DATE
J.H. Yoon /Senior Manager	
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Y.N. Lee / Engineer	

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

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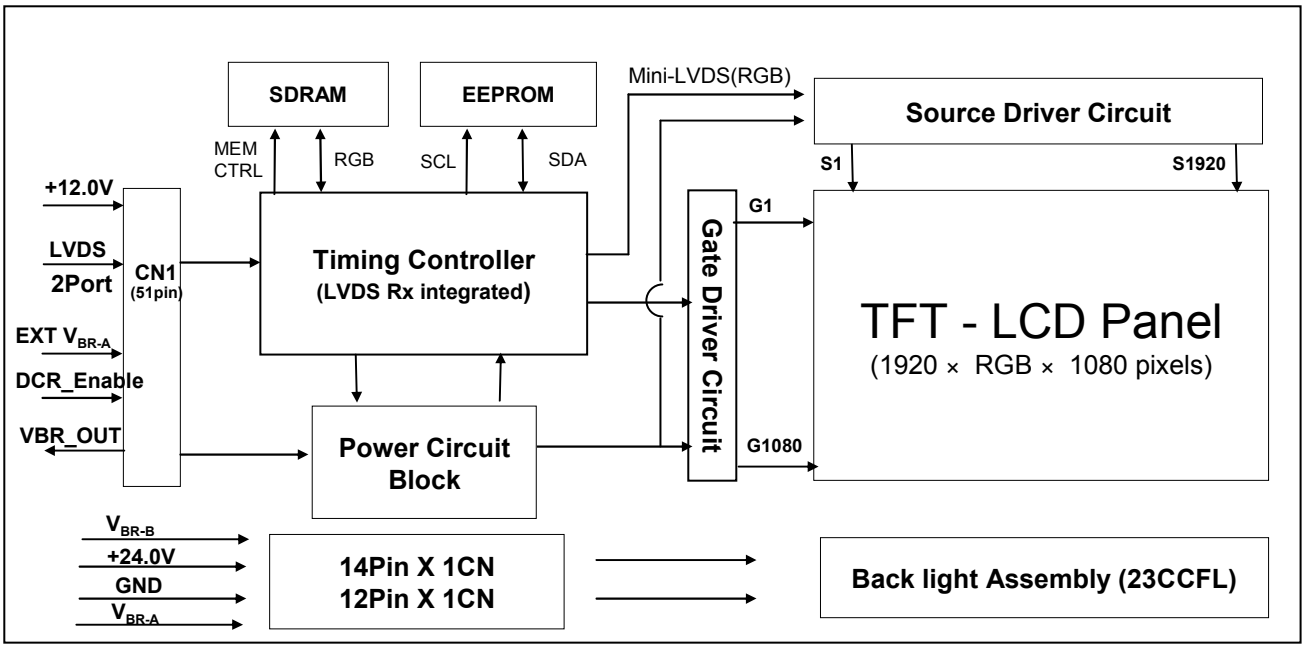
RECORD OF REVISIONS

Revision No.	Revision Date	Page	Description
1.0	Aug. 13, 2007	-	Final Specification

1. General Description

The LC470WU4 is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive display type which is operating in the normally black mode. It has a 46.96 inch diagonally measured active display area with WUXGA resolution (1080 vertical by 1920 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arrayed in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 10-bit gray scale signal for each dot. Therefore, it can present a palette of more than 1.07Billion(true) 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 response time are important.



General Features

Active Screen Size	46.96 inch (1192.87mm) diagonal
Outline Dimension	1096.0(H) x 640.0 (V) x 51 mm(D) (Typ.)
Pixel Pitch	0.5415 mm x 0.5415 mm
Pixel Format	1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement
Color Depth	10-bit, 1.07 Billion 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 248.52 W (Typ.) (Logic=8.52 W, Inverter= 240 W [V_{BR-A}=1.65V])
Weight	16.5 Kg (Typ.)
Display Mode	Transmissive mode, Normally black
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer

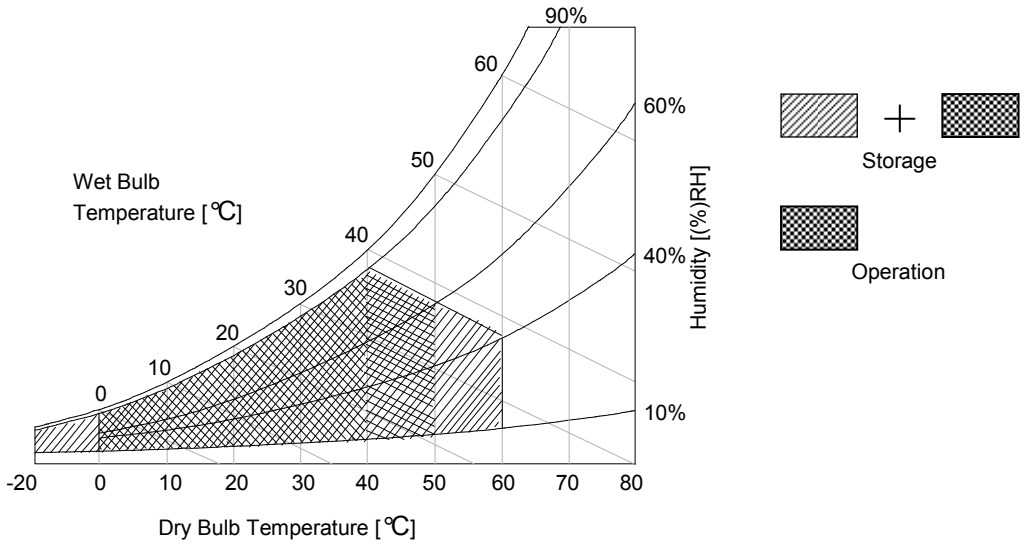
2. Absolute Maximum Ratings

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 ℃
	Backlight inverter	V_{BL}	+21.6	+27.0	V_{DC}	
ON/OFF Control Voltage		$V_{ON/OFF}$	-0.3	+5.25	V_{DC}	
Brightness Control Voltage		V_{BR-B}	0	+5.0	V_{DC}	
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	

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

Table 2. ELECTRICAL CHARACTERISTICS

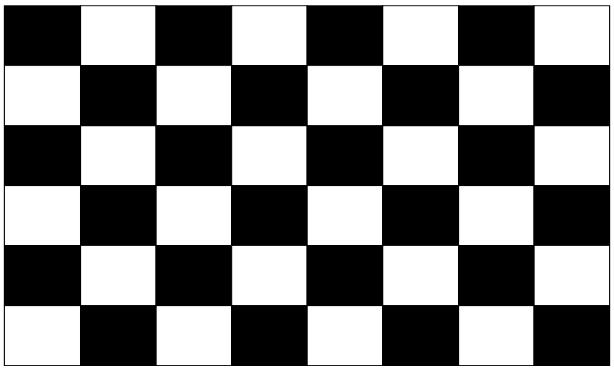
Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V_{LCD}	11.4	12.0	12.6	V_{DC}	
Power Input Current	I_{LCD}	-	710	930	mA	1
		-	930	1210	mA	2
Power Consumption	P_{LCD}	-	8.52	11.1	Watt	1
Rush current	I_{RUSH}	-	-	5	A	3

Note : 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 the maximum current pattern.

3. The duration of rush current is about 2ms and rising time of power input is 1ms (min.).

White : 1023 Gray
Black : 0 Gray



Mosaic Pattern(8 x 6)

Table 3. ELECTRICAL CHARACTERISTICS (Continue)

Parameter			Symbol	Values			Unit	Notes
				Min	Typ	Max		
Inverter : 6632L-0392C,0393C(Rev0.3)								
Power Supply Input Voltage			VBL	22.8	24.0	25.2	Vdc	1
Unloading Input Voltage						28	Vdc	
Power Supply Input Voltage Ripple				-0.2		0.2	Vp-p	1
Power Supply Input Current	**After Aging**		IBL_A	-	10.0	11.0	A	V_{BR-A} = 1.65V ,1
				-	11.0	12.0	A	V_{BR-A} = 3.3V, 1
	Before Aging		IBL_B	-	11.0	12.0	A	V_{BR-A} = 1.65V ,2
				-	12.1	13.0	A	V_{BR-A} = 3.3V , 2
Power Supply Input Current (In-Rush)			Irush	-	-	14	A	V_{BL} = 24V V_{BR-B} =3.3V V_{BR-A} = 1.65V
Power Consumption			PBL	-	216	240	W	V_{BR-A} = 0V , 1
			PBL	-	240	264	W	V_{BR-A} = 1.65V ,1
Input Voltage for Control System Signals	**Brightness Adjust**		V_{BR-A}	0.0	1.65	3.3	Vdc	
	On/Off	**On**	V on	2.5	-	5.0	Vdc	
		Off	V off	-0.3	0.0	0.8	Vdc	
Brightness Adjust (Burst mode)			V_{BR-B}	0		3.3	V	
Lamp								
Discharge Stabilization Time			Ts			3	min	3
Lamp Life Time				30,000	40,000	-	Hrs	4

Notes :

1. Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 120 minutes at 25± 2℃. The specified current and power consumption are under the typical supply Input voltage 24V, it is total power consumption.
   The ripple voltage of the power supply input voltage is under 0.4 Vp-p. LPL recommend Input Voltage is 24.0V ± 5%.
2. Electrical characteristics are determined within 30 minutes at 25± 2℃.
   The specified currents are under the typical supply Input voltage 24V.
3. 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.
4. Specified Values are for a single lamp which is aligned horizontally.
   The life time is determined as the time which luminance of the lamp is 50% compared to that of initial value at the typical lamp current (V_{BR-A} : 1.65V & V_{BR-B} :3.3V), on condition of continuous operating at 25 ± 2℃
5. The duration of rush current is about 10ms.

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 connectors(14-pin / 12-pin) are used for the integral backlight system.

3-2-1. LCD Module

- LCD Connector(CN1): KN25-51P-0.5SH(manufactured by HIROSE) or Equivalent
- Mating Connector : FI-RE51HL(manufactured by JAE)

Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	Reserved(NC)	No connection	27	GND	Ground
2	Reserved (NC)	No connection(Reserved for I²C)	28	RE0N	SECOND CHANNEL 0-
3	Reserved (NC)	No connection(Reserved for I²C)	29	RE0P	SECOND CHANNEL 0+
4	Reserved (NC)	No connection	30	RE1N	SECOND CHANNEL 1-
5	Reserved (NC)	No connection	31	RE1P	SECOND CHANNEL 1+
6	Reserved (NC)	No connection	32	RE2N	SECOND CHANNEL 2-
7	LVDS Select	Logic 'L or NC':LG format,'H':DISM	33	RE2P	SECOND CHANNEL 2+
8	EXT V_{BR-B}	EXT V_{BR-B} Input	34	GND	Ground
9	VBR-OUT	DCR V_{BR-B} Output	35	RECLKN	SECOND CLOCK CHANNEL C-
10	DCR Enable	Logic 'L' Level : Disable	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-
15	RO1P	FIRST CHANNEL 1+	41	RE4P	SECOND CHANNEL 4+
16	RO2N	FIRST CHANNEL 2-	42	GND	Ground
17	RO2N	FIRST CHANNEL 2+	43	GND	Ground
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	NC
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-	50	VLCD	Power Supply +12.0V
25	RO4P	FIRST CHANNEL 4+	51	VLCD	Power Supply +12.0V
26	GND	Ground	-	-	-

Note : 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 IEA 664 Standard.
4. Specific pins(pin No. #2~#6, #8~#10) are used for internal data process of the LCD module. If not used, these pins are no connection.

3-2-2. Backlight Inverter

Master (A board)

- Inverter Connector : S14B-PH-SMC(manufactured by JST) or Equivalent
- Mating Connector : PHR-14 or Equivalent

Slave(B,board)

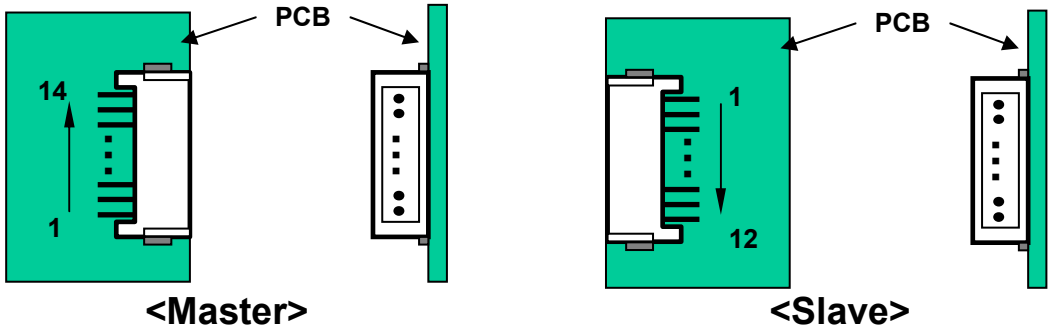
- Inverter Connector : S12B-PH-SMC(manufactured by JST) or Equivalent
- Mating Connector : PHR-12 or Equivalent

Table 5. INVERTER CONNECTOR PIN CONFIGURATION

Pin No	Symbol	Description	Master	Slave	Note
1	VBL	Power Supply +24.0V	VBL	VBL	
2	VBL	Power Supply +24.0V	VBL	VBL	
3	VBL	Power Supply +24.0V	VBL	VBL	
4	VBL	Power Supply +24.0V	VBL	VBL	
5	VBL	Power Supply +24.0V	VBL	VBL	
6	GND	Power GND	GND	GND	
7	GND	Power GND	GND	GND	
8	GND	Power GND	GND	GND	2
9	GND	Power GND	GND	GND	
10	GND	Power GND	GND	GND	
11	V_{BR-A}	0.0V ~ 3.3V	V_{BR-A}	Don't care	3
12	$V_{ON/OFF}$	0.0V ~ 5.0V	On/Off	Don't care	
13	V_{BR-B}	0.0V ~ 3.3V	V_{BR-B}	-	4
14	Status	2.5V~5.0V : ON 0.0V~0.7V : OFF	Status	-	

Notes : 1. GND should be connected to the LCD module's metal frame.
2. If Pin #11 is open, V_{BR-A} = 1.65V. When apply over 1.65V(~ 3.3V) continuously, its luminance is increasing however lamp's life time is decreasing. It could be usable for boost up luminance when using DCR (=Dynamic contrast ratio) function only.
3. Minimum Brightness : V_{BR-B} =0V Maximum Brightness : V_{BR-B} = 3.3V
4. Even though Pin #14 is open, there is no effect on inverter operating, The output terminal of inverter.
5. Each impedance of pin #11,12 and 13 is 0.33[MΩ], 0.05[MΩ], 1.5[MΩ]

◆ Rear view of LCM



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 (DE Only Mode)

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Period	t_{CLK}	12.99	13.47	14.29	ns	
	Frequency	-	70	74.25	77	MHz	=148.5/2
Hsync	Period	t_{HP}	1060	1100	1280	t_{CLK}	1
	Horizontal Valid	t_{HV}	-	960	-	t_{CLK}	
	Horizontal Blank	t_{HB}	100	140	320		
	Frequency	f_H	65.5	67.5	68.9	KHz	
	Width	t_{WH}	12	30	60	t_{CLK}	
	Horizontal Back Porch	t_{HBP}	12	78	120		
	Horizontal Front Porch	t_{HFP}	12	32	120		
Vsync	Period	t_{VP}	1091	1125	1149	t_{HP}	1
	Vertical Valid	t_{VV}	-	1080	-	t_{HP}	
	Vertical Blank	t_{VB}	11	45	69	t_{HP}	
	Frequency	f_V	57	60	63	Hz	
	Width	t_{WV}	4	5	10	t_{HP}	
	Vertical Back Porch	t_{VBP}	6	36	48		
	Vertical Front Porch	t_{VFP}	2	4	10		

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.

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.

Table 7. TIMING TABLE for PAL (DE Only Mode)

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Period	t_{CLK}	14.81	16.16	16.77	ns	
	Frequency	-	59.63	61.88	67.5	MHz	=148.5/2
Hsync	Period	t_{HP}	1060	1100	1200	t_{CLK}	1
	Horizontal Valid	t_{HV}	-	960	-	t_{CLK}	
	Horizontal Blank	t_{HB}	100	140	240		
	Frequency	f_H	55.25	56.25	57.25	KHz	
	Width	t_{WH}	12	30	60	t_{CLK}	
	Horizontal Back Porch	t_{HBP}	12	78	120		
	Horizontal Front Porch	t_{HFP}	12	32	120		
Vsync	Period	t_{VP}	1105	1125	1145	t_{HP}	1
	Vertical Valid	t_{VV}	-	1080	-	t_{HP}	
	Vertical Blank	t_{VB}	25	45	65	t_{HP}	
	Frequency	f_V	47	50	53	Hz	
	Width	t_{WV}	4	5	10	t_{HP}	
	Vertical Back Porch	t_{VBP}	6	36	45		
	Vertical Front Porch	t_{VFP}	2	4	10		

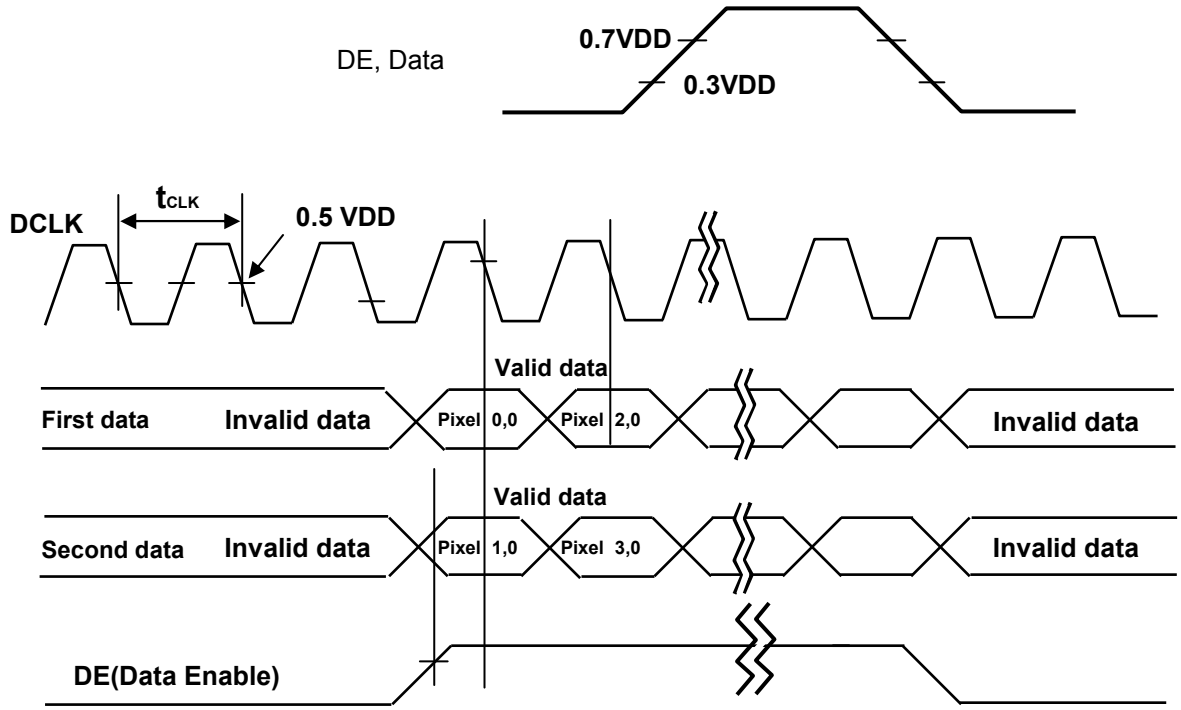
Note : 1. $t_{HB} = t_{HFP} + t_{WH} + t_{HBP}$

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

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

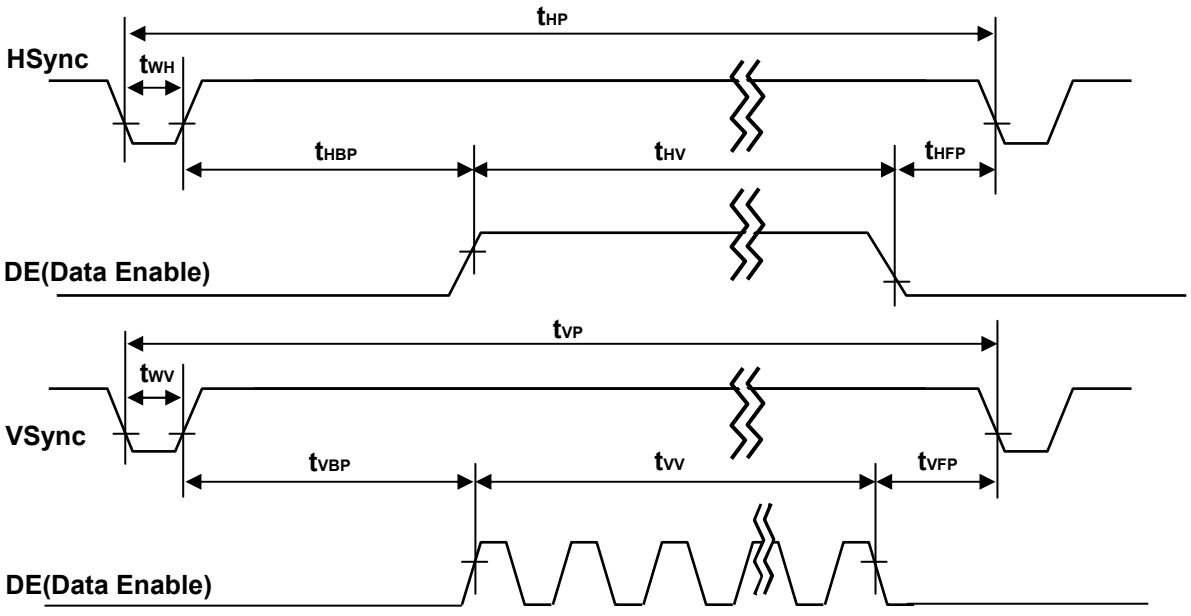
The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate.

3-4. Signal Timing Waveforms



* tHB = tHFP + tWH +tHBP
* tVB = tVFP + tWV +tVBP

* Reference : Sync. Relation



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
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	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
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	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
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	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

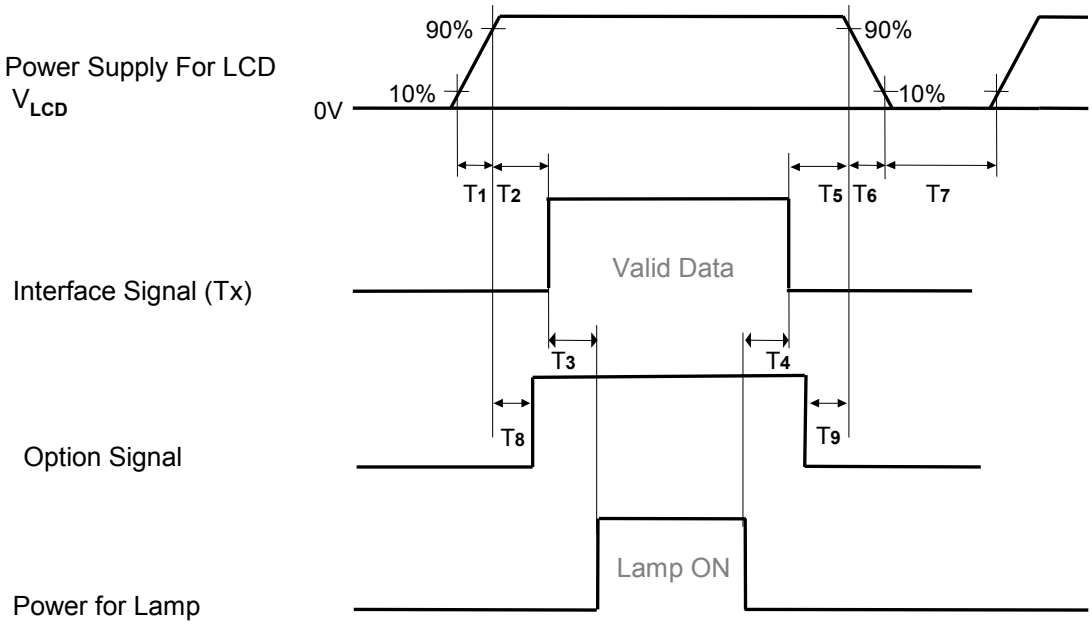
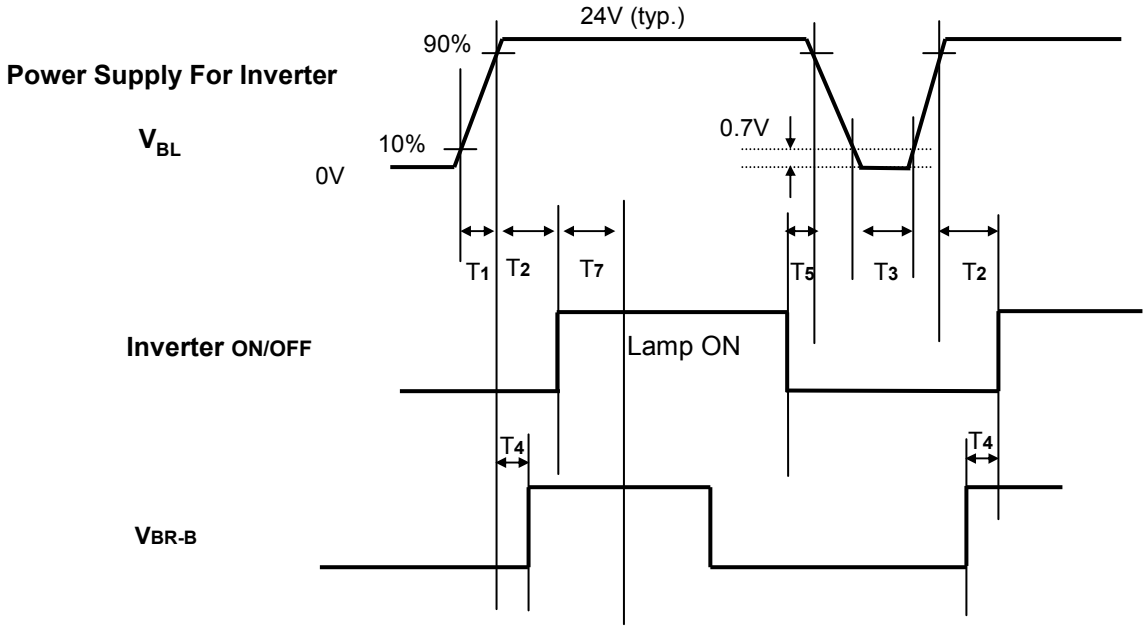


Table 9. POWER SEQUENCE

Parameter	Value			Unit
	Min	Typ	Max	
T1	0.5	-	20	ms
T2	0.5	-	50	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0.5	-	50	ms
T6	0.01	-	300	ms
T7	1.0	-	-	s
T8	0 < T8 < T2			ms
T9	0 < T9 < 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. Flicker would come out when power on-off(T7=under 2s) is tested over several ten-times.
4. The case when the T2/T5 exceed maximum specification, it operates protection pattern(Black pattern) till valid signal inputted. There is no reliability problem.
5. 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.

3-6-2. Sequence for Inverter



3-6-3. Deep condition for Inverter

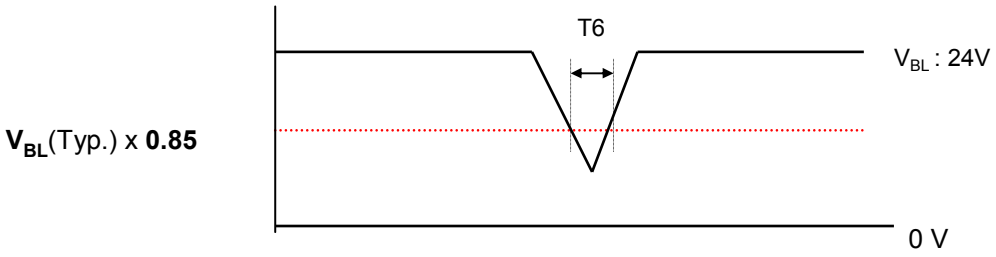


Table 10. Power Sequence for Inverter

Parameter	Values			Units	Remarks
	Min	Typ	Max		
T1	20	-	-	ms	1
T2	500	-	-	ms	
T3	200	-	-	ms	
T4	0		-	ms	2
T5	10	-	-	ms	
T6	-	-	10	ms	V_{BL}(Typ) x 0.85
T7	1000	-	-	ms	3

Notes : 1. T1 describes rising time of 0V to 24V and is not applied at restarting time.
2. T4(max) is less than T2.
3. In T7 section, VBR-B is recommended 3.3V.
4. When V_{BL}[24V] is supplied always, there is no reliability problem.

4. Optical Specification

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

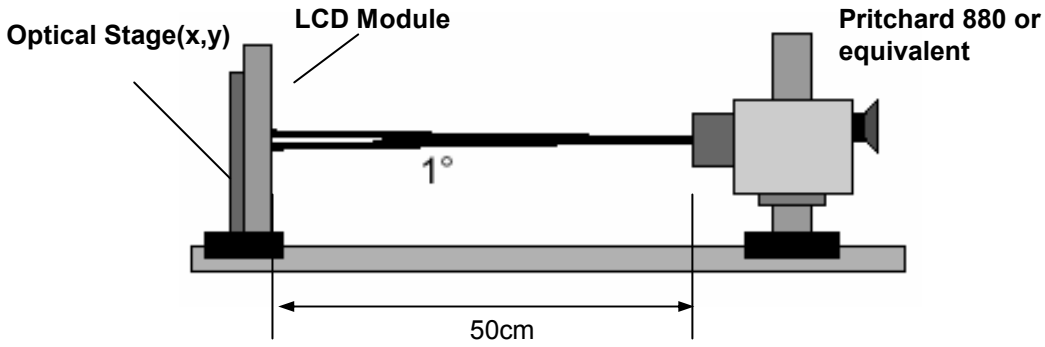


FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 11. OPTICAL CHARACTERISTICS

Ta= 25± 2℃, V_{LCD}=12.0V, fv=60Hz, Dclk=148.5MHz, V_{BR-B}=3.3V, V_{BR-A}=1.65V

Parameter		Symbol	Value			Unit	Note
			Min	Typ	Max		
Contrast Ratio		CR	600	800			1
Surface Luminance, white		L_{WH}	400	500		cd/m^2	2
Luminance Variation		δ_{WHITE} 5P			1.3		3
Response Time (Gray to Gray)		Tr_R, Tr_D		8	16	ms	4
Color Coordinates [CIE1931]	RED	Rx	Typ -0.03	0.663	Typ +0.03		
		Ry		0.324			
	GREEN	Gx		0.194			
		Gy		0.659			
	BLUE	Bx		0.141			
		By		0.082			
	WHITE	Wx		0.279			
		Wy		0.292			
Viewing Angle (CR>10)							
	x axis, right(ϕ=0°)	θr	85	89	-	degree	5
	x axis, left (ϕ=180°)	θl	85	89	-		
	y axis, up (ϕ=90°)	θu	85	89	-		
	y axis, down (ϕ=270°)	θd	85	89	-		
Gray Scale				2.2			6

Note :

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

   CR = The Maximum Value of CRn

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

   Measure Position : 5-point. See FIG. 2 for more information

2. Surface Luminance(L_{WH}) is the luminance value measured at an approximate 50cm distance from the center 1-point of LCD surface as all pixels displaying white. See FIG. 2 for more information.

3. The variation of 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 defined as the required time for the 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)

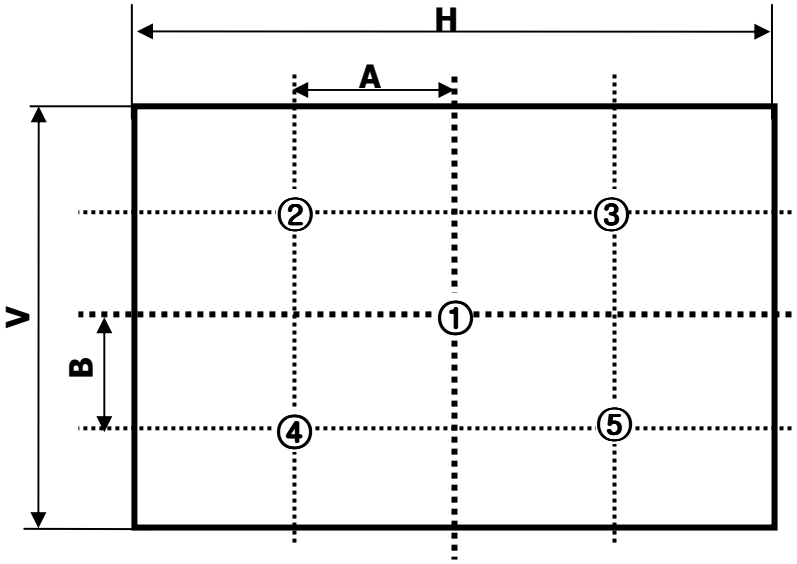
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.

6. See Table 12 for gray scale specification

Table 12. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ.)
L0	0.16
L63	0.33
L127	0.96
L191	2.36
L255	4.67
L319	7.95
L383	12.21
L447	17.19
L511	22.5
L575	28.86
L639	36.48
L703	44.1
L767	54.26
L831	64.42
L895	75.32
L959	87.3
L1023	100

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



A : H / 4 mm
B : V / 4 mm
H : 1039.68 mm
V : 584.82 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)".

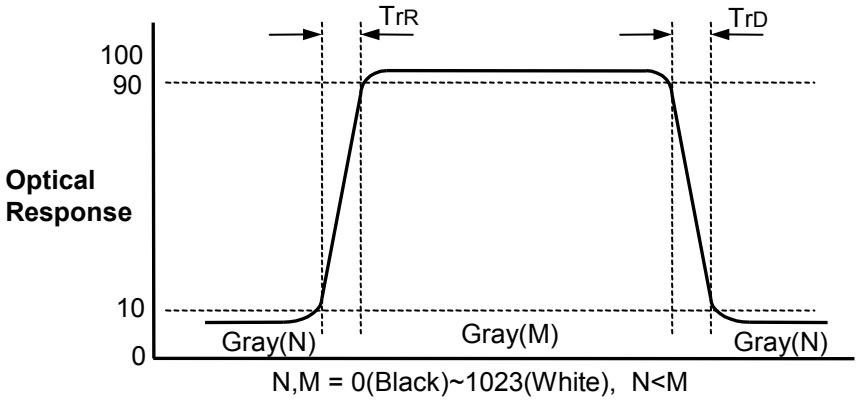


FIG. 3 Response Time

Dimension of viewing angle range

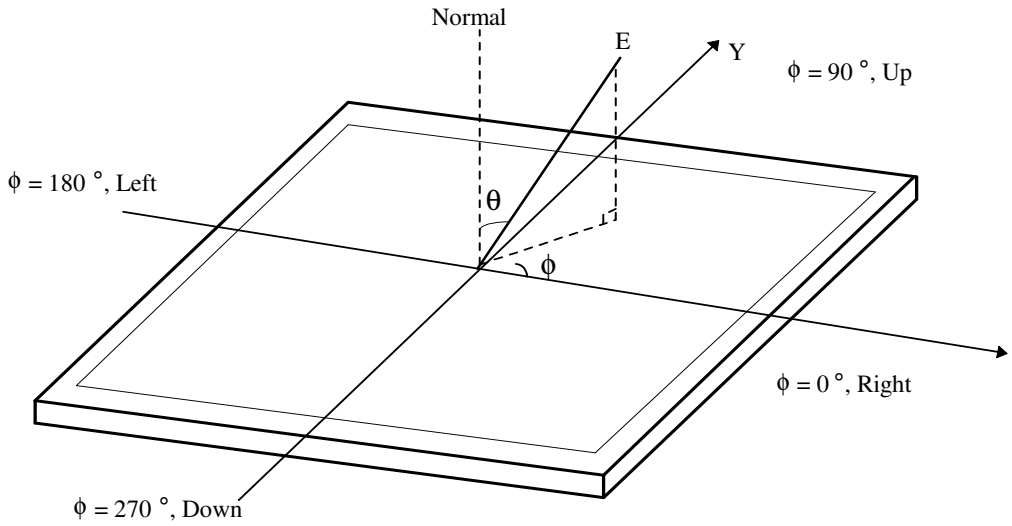


FIG. 4 Viewing Angle

5. Mechanical Characteristics

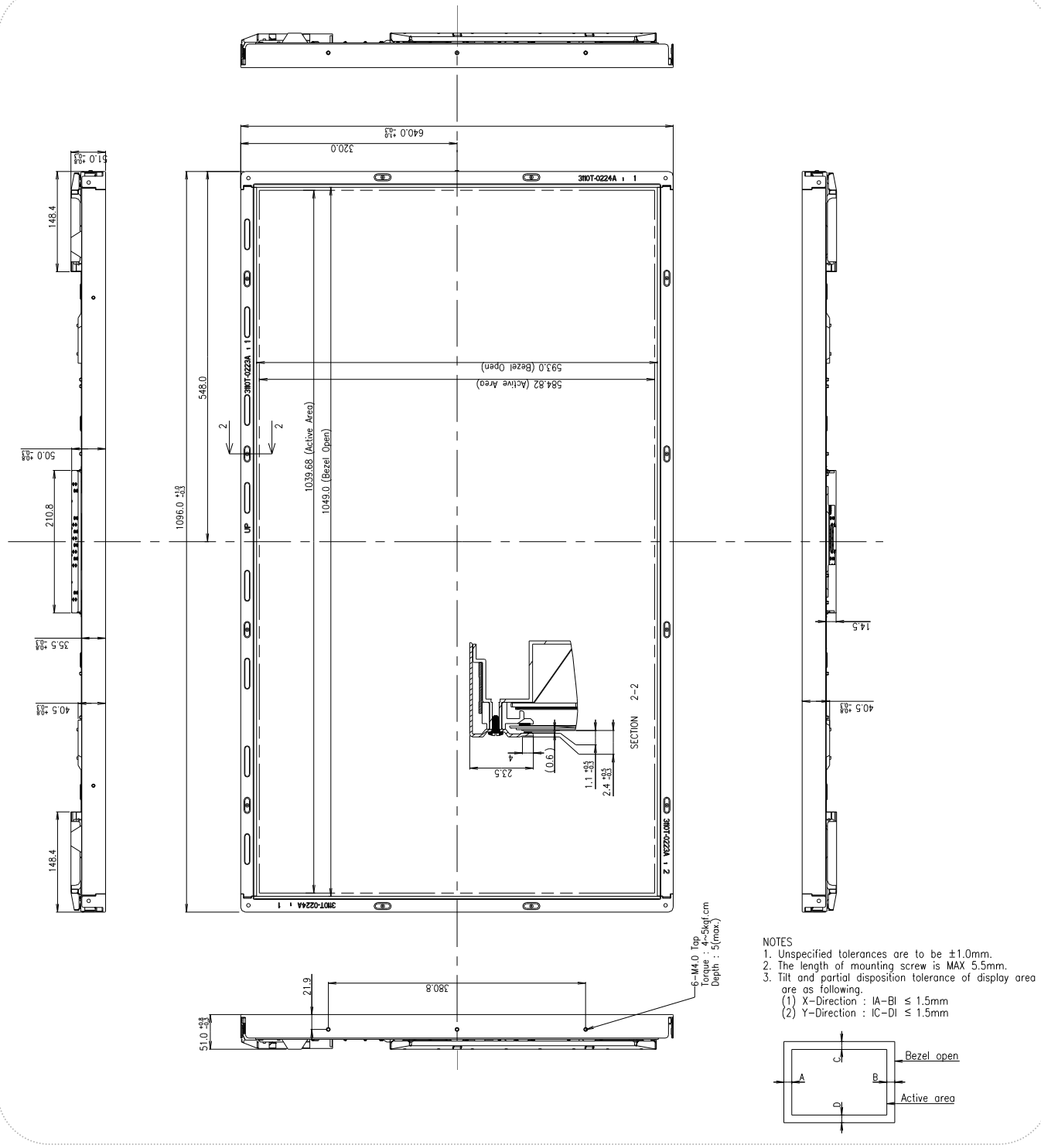
Table 13 provides general mechanical characteristics.

Table 13. MECHANICAL CHARACTERISTICS

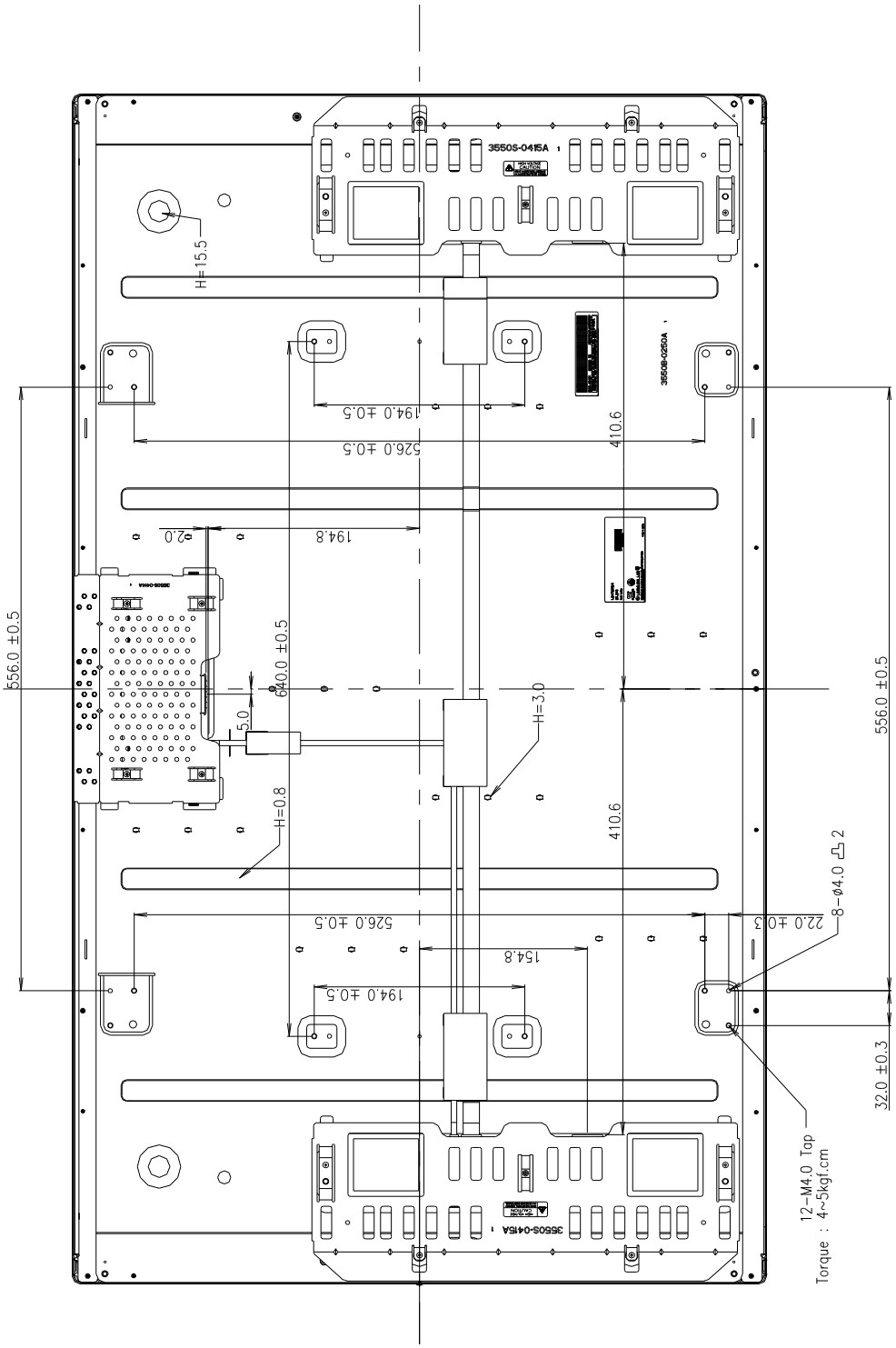
Item	Value	
Outline Dimension	Horizontal	1096.0 mm
	Vertical	640.0 mm
	Depth	51.0 mm
Bezel Area	Horizontal	1049.0 mm
	Vertical	593.0 mm
Active Display Area	Horizontal	1039.68 mm
	Vertical	584.82 mm
Weight	16.5 Kg (Typ.)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer	

Note : Please refer to page21 and 22 for mechanic drawings in terms of tolerance.

<FRONT VIEW>



<REAR VIEW>



6. Reliability

Table 14. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 50℃ 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 : 30 min for X,Y,Z axis One time each direction
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 - 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) C.I.S.P.R. “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)

8-1. 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 ~ 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 pallet : 12 pcs

b) Pallet Size : 1220mm 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.
(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.

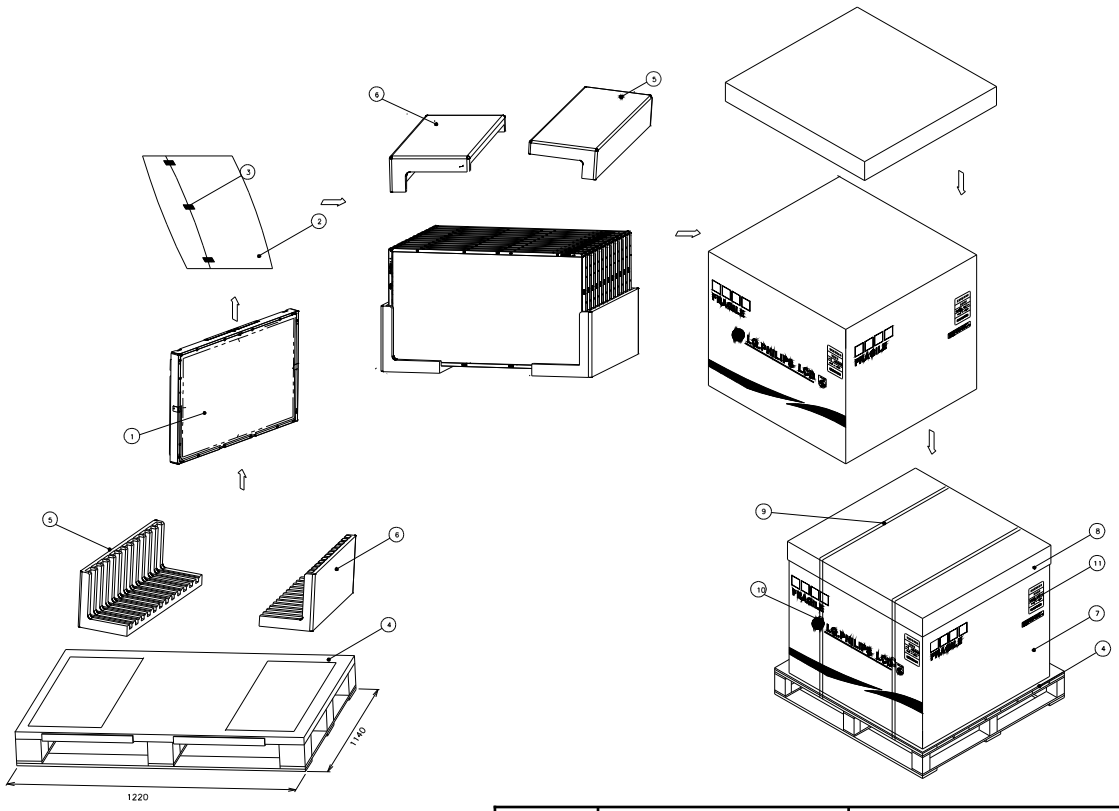
(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were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

APPENDIX- I

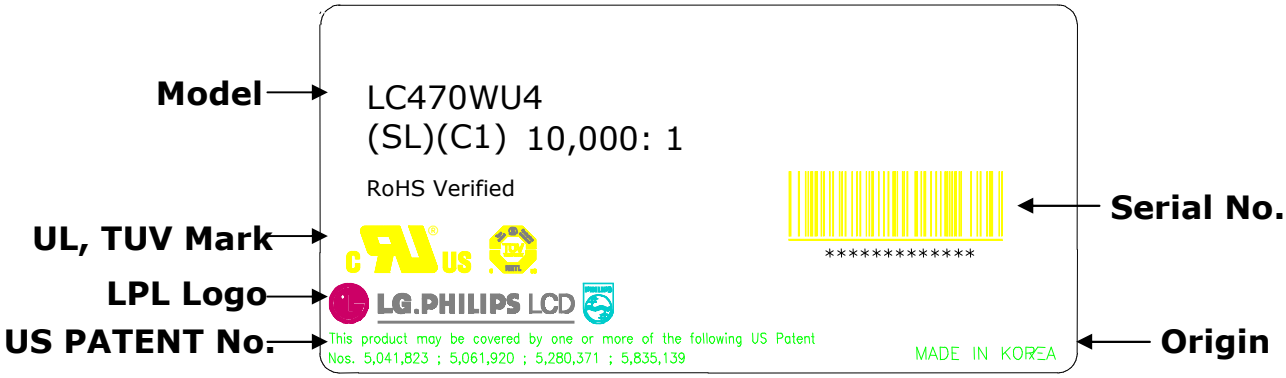
■LC470WU4-SLC1 Packing Ass'y



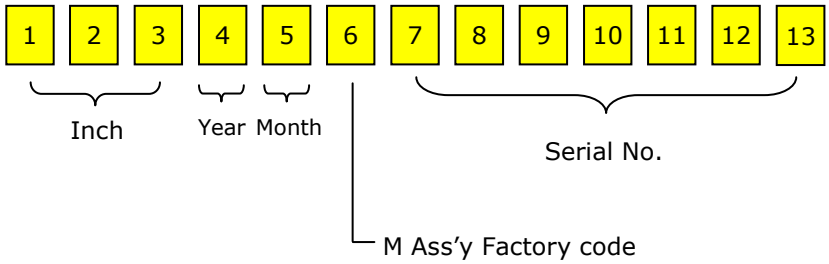
NO.	DESCRIPTION	MATERIAL
1	LCD Module	
2	BAG	47INCH
3	TAPE	MASKING 20MM X 50M
4	PALLET	PAPER 1220X1140X138MM
5	PACKING	EPS
6	PACKING	EPS
7	ANGLE PACKING	PAPER
8	ANGLE COVER	PAPER
9	BAND,CLIP	STEEL
10	BAND	PP
11	LABEL	YUPO PAPER 80G 100X100

APPENDIX- II

■ LCM Label

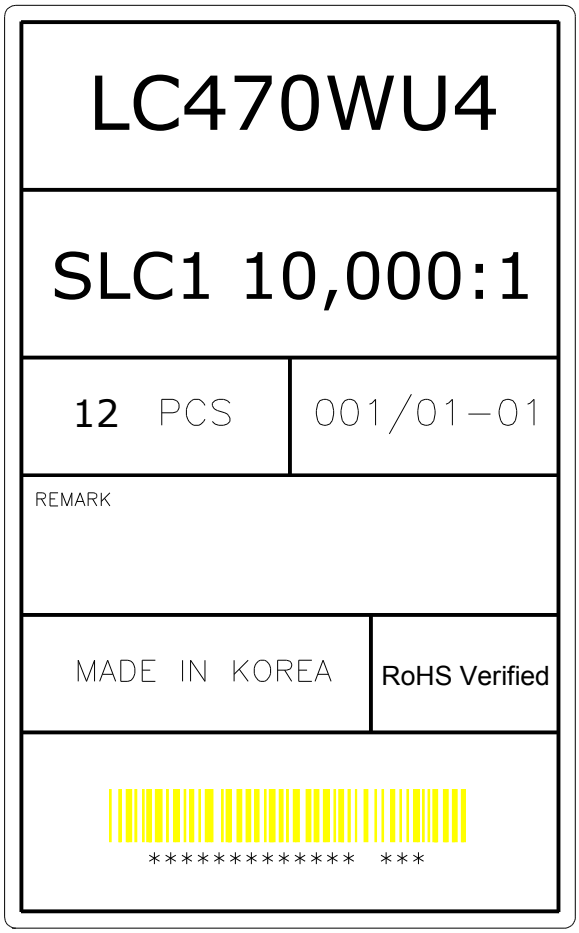


■ **Serial No. (See CAS 25page for more information)**



APPENDIX- III

■ Pallet Label



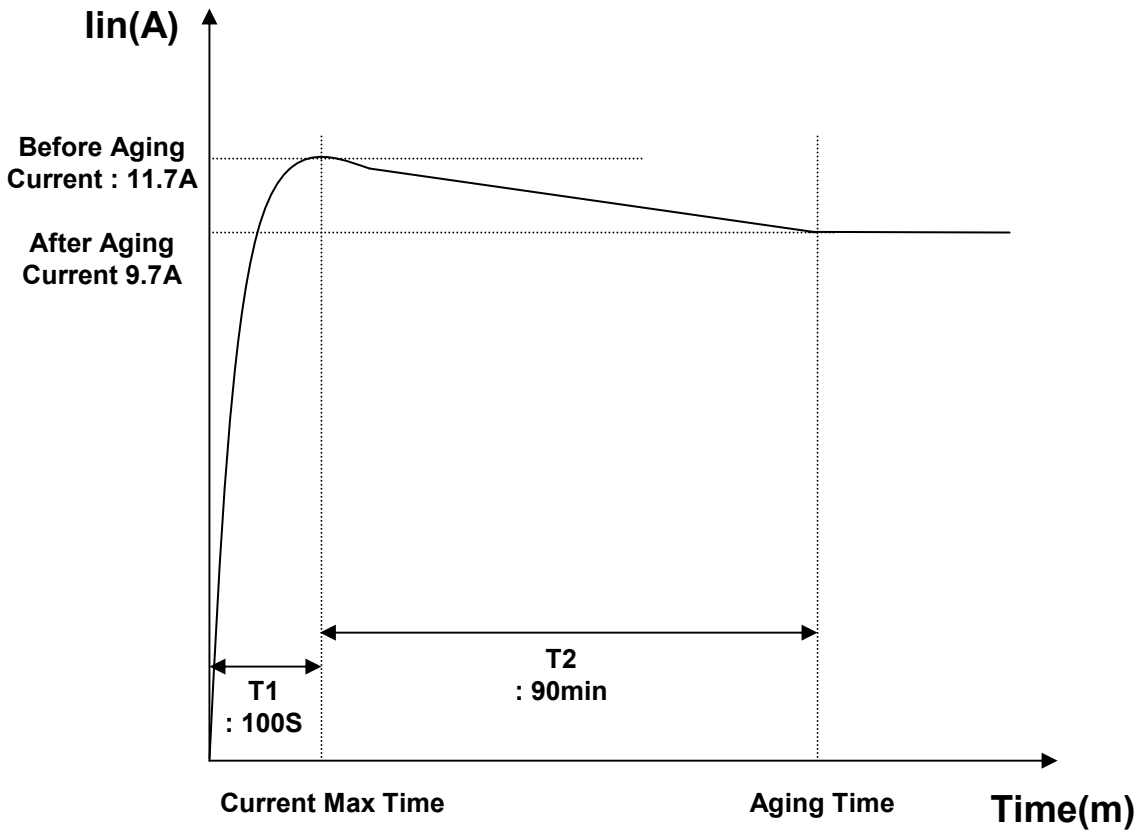
APPENDIX-Ⅳ : Inverter input current (Design for power supply)

This is only the reference data of Inverter input current for LC470WU4-SLC1 model.

1. Model : LC470WU4-SLC1

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

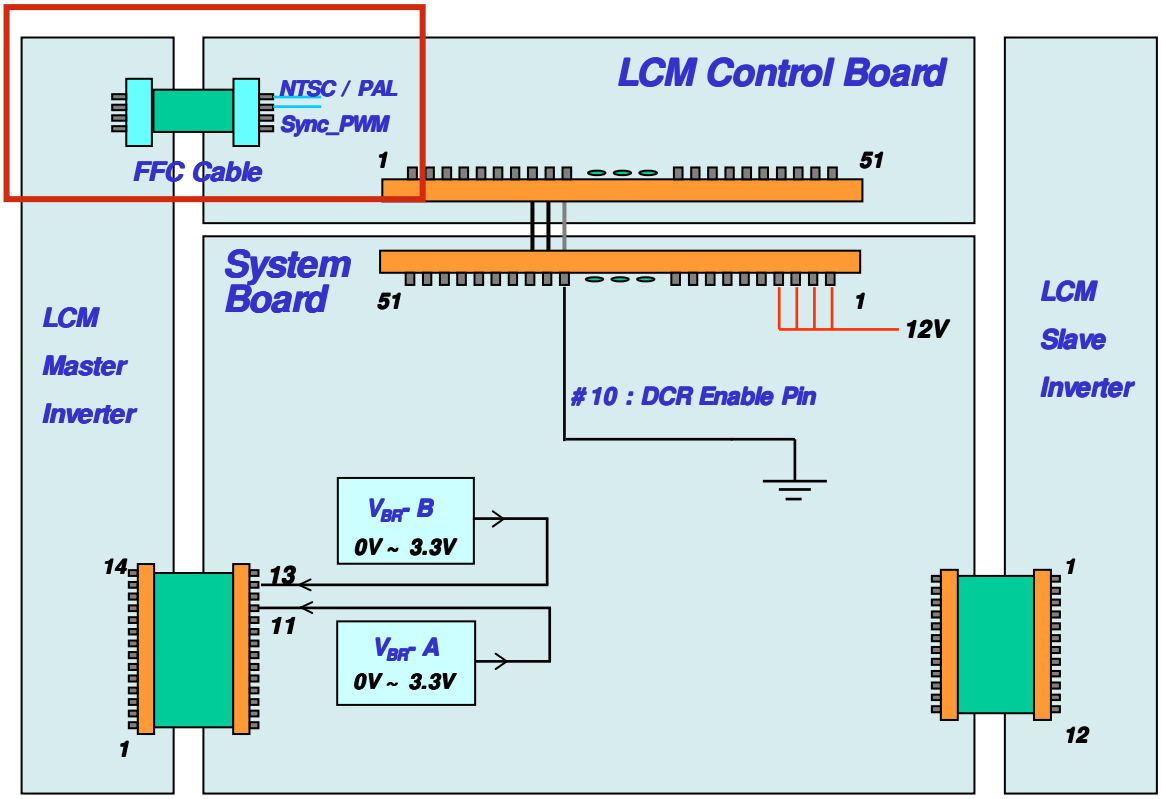
3. Equipment : Oscilloscope (Tektronix : TDS5054) ,
AC/DC Current Probe(TCP312)



※Initial Current Boost Function is not used at LC470WU4-SLC1

APPENDIX-V

■ **System DCR (Dynamic Contrast Ratio)- Max 10000:1 (Reference)**



V_{BR}-B	0V ~ 3.3V	3.3V
V_{BR}-A	0V ~ 3.3V	1.65V
DCR Level	10000 : 1	800 : 1

$V_{BR-A,B}$ Voltage	Function
3.3V	Maximum Brightness (100%)
0V	Minimum Brightness (10%)

Note : 1. To make DCR Max 10000:1, V_{BR}-A and V_{BR}-B must be given by system.

2. DCR Max 10000:1 is defined mathematically as :
DCR = Maximum DCRn (n=1, 2, 3, 4, 5)

$$DCRn = \frac{\text{Surface Luminance at position n with all white pixels (VBR-A=3.3V, VBR-B=3.3V)}}{\text{Surface Luminance at position n with all black pixels (VBR-A=0V, VBR-B=0V)}}$$

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

3. Measurement Sequence (aging time 10 min each pattern) :
① Turn On LCM
② Measure Black Luminance (VBR-A=0V, VBR-B=0V)
③ Measure White Luminance (VBR-A=3.3V, VBR-B=3.3V)

4. In case the lowest minimum brightness is continued,
it can affect the lamp reliability and appear the partial darkness.