LG.PHILIPS LCD PHILIPS

Product Specification

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	HISENSE
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LC320W01
SUFFIX	SLA1

*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.I. Jang / Senior Manager	
REVIEWED BY	
PREPARED BY	
D.W. Lee / Engineer	

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

CONTENTS

RECORD OF REVISIONS

| Revision No	Revision Date	Page	Description
0.0	Jan. 23. 2007	-	Preliminary specification
1.0	**Apr. 16. 2007**	**-**	**Final specification**

1. General Description

The LC320W01 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.
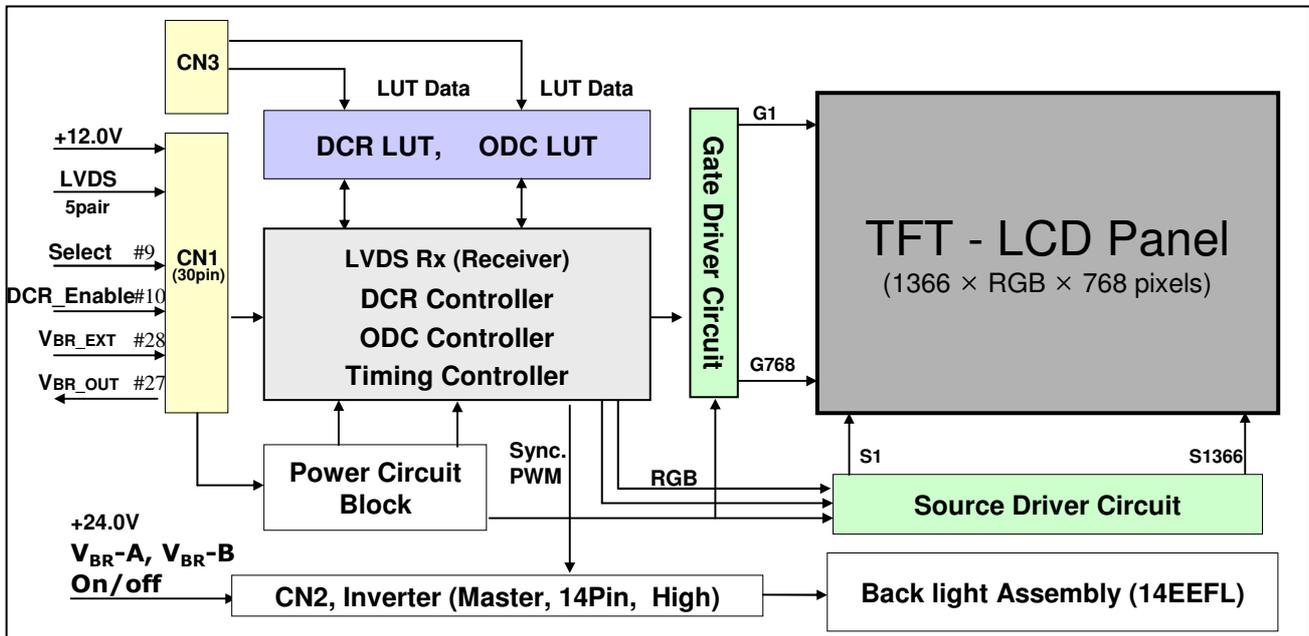
General Features

|	
Active Screen Size	31.51 inches(800.4mm) diagonal
Outline Dimension	760.0 mm(H) x 450.0 mm(V) x 48.0 mm(D) (Typ.)
Pixel Pitch	170.25μm x 510.75μm 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(Typ.), U/D 178(Typ.)) (0RT polarizer applied)
Power Consumption	Total 87.70Watt (Typ.) (Logic=3.70 W, Lamp=84W [I_{BL}=87mA])
Weight	6,150g (Typ.)
Display Operating 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 °C
	Backlight inverter	V_{BL}	-0.3	+27.0	V_{DC}	When Operating
ON/OFF Control Voltage		VON/OFF	-0.3	+5.5	V_{DC}	
Brightness Control Voltage		V_{Br}	-0.3	+5.0	V_{DC}	
Operating Temperature		T_{OP}	0	50	°C	
Storage Temperature		T_{ST}	-20	60	°C	Note 1,2
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 °C Max, and no condensation of water.
2. Abnormal visual problems by the surface temperature of front panel side can be occurred in specific range (higher than 55 °C). But materials (ex : polarize stuff) are not damaged permanently in this range.

Temperature and relative humidity

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 :						
Power Input Voltage	V_{LCD}	11.4	12.0	12.6	V_{DC}	
Power Input Current	I_{LCD}	-	310	403	mA	1
		-	415	540	mA	2
Power Consumption	P_{LCD}	-	3.7	4.8	Watt	1
Rush current	I_{RUSH}	-	-	3.0	A	3

Notes : 1. The specified current and power consumption are under the V_{LCD}=12.0V, 25 ± 2°C, 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 : 255Gray
Black : 0Gray

Mosaic Pattern(8 x 6)

Product Specification

Table 2_2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	Value			Unit	Note
			Min.	Typ.	Max.		
Inverter :							
Input Voltage	V_{BL}		22.8	24.0	25.2	V_{DC}	
Permissible Input Ripple Voltage	V_{RP}		-	-	400	mVp-p	
Input Current	I_{BL}	V_{BR}-A(max) = 3.3V	-	4.0	4.5	A	1, 3
		V_{BR}-A(Typ) = 1.65V	-	3.5	4.0	A	1, 3
Power Consumption	P_{BL}	V_{BL}=24V, V_{BR}-A=3.3V		96	108	Watt	1, 3
		V_{BL}=24V, V_{BR}–A=1.65V	-	84	96		
B/L on/off control	$V_{ON/OFF}$	Lamp ON = High	2.8	-	5.25	V_{DC}	
		Lamp OFF =Low	-0.3		0.5	V_{DC}	
Brightness Adj (Analog mode)	V_{BR}-A	V_{BL}=24V V_{BR}-B = 3.3V	0	1.65	3.3	V_{DC}	
Brightness Adj (Burst mode)	V_{BR}-B	V_{BL}=24V V_{BR}-A = 1.65V	0	-	3.3	V_{DC}	2
Lamp							
Life Time		V_{BR}-A=1.65V	50,000	60,000	-	Hrs	3

Note : 1. The specified current and power consumption are under the typical supply Input voltage, 24.0V.

after 2hr aging with VBR-A =1.65V & VBR-B=3.3V.

2. Brightness Control.

This VBR-B Voltage control brightness.

VBR-B Voltage	Function
3.3V	Maximum Brightness (100%)
0V	Minimum Brightness.(20%)

3. Specified values are for a single lamp which is aligned horizontally.

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 (V_{BR}–A =1.65V) on condition of continuous operating at 25 $\pm$ 2°C.

3-2. Interface Connections

This LCD module employs two kinds of interface connection, a 30-pin connector is used for the module electronics and one 14-pin connectors are used for the integral backlight system.

3-2-1. LCD Module

- LCD Connector(CN1) : FI-X30SSL-HF or Equivalent (Manufactured by JAE)
- Mating Connector : FI-X30C2L or Equivalent (Manufactured by JAE)

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 or NC'= Disable , 'H' = Enable)	2, Page 29
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

Note: 1. If the pin no. 9 is Ground, Interface format is "LG", and if the pin no. 9 is Vcc(3.3V), Interface format is "DISM". See page 9 and 10.
2. When #10 pin is no connection, DCR is disabled.
3. The pin no. 30 is necessary for LCD test.
   When LVDS signals are abnormal operation more than 3-Vsync times and power 12V is supplied,
   'Open' or 'Vcc' : LCD operate itself some test patterns.(AGP – Auto Generation Pattern)
   'Ground' : LCD operate itself a black pattern. (NSB – No Signal Black)
   LPL recommend 'Ground' for NSB.
4. All GND (ground) pins should be connected together, which should be also connected to the LCD module's metal frame.
5. All VLCD (power input) pins should be connected together.
6. Input Levels of LVDS signals are based on the IEA 664 Standard.

Table 4. REQUIRED SIGNAL ASSIGNMENT FOR LVDS TRANSMITTER (Pin9="L" or "Open")
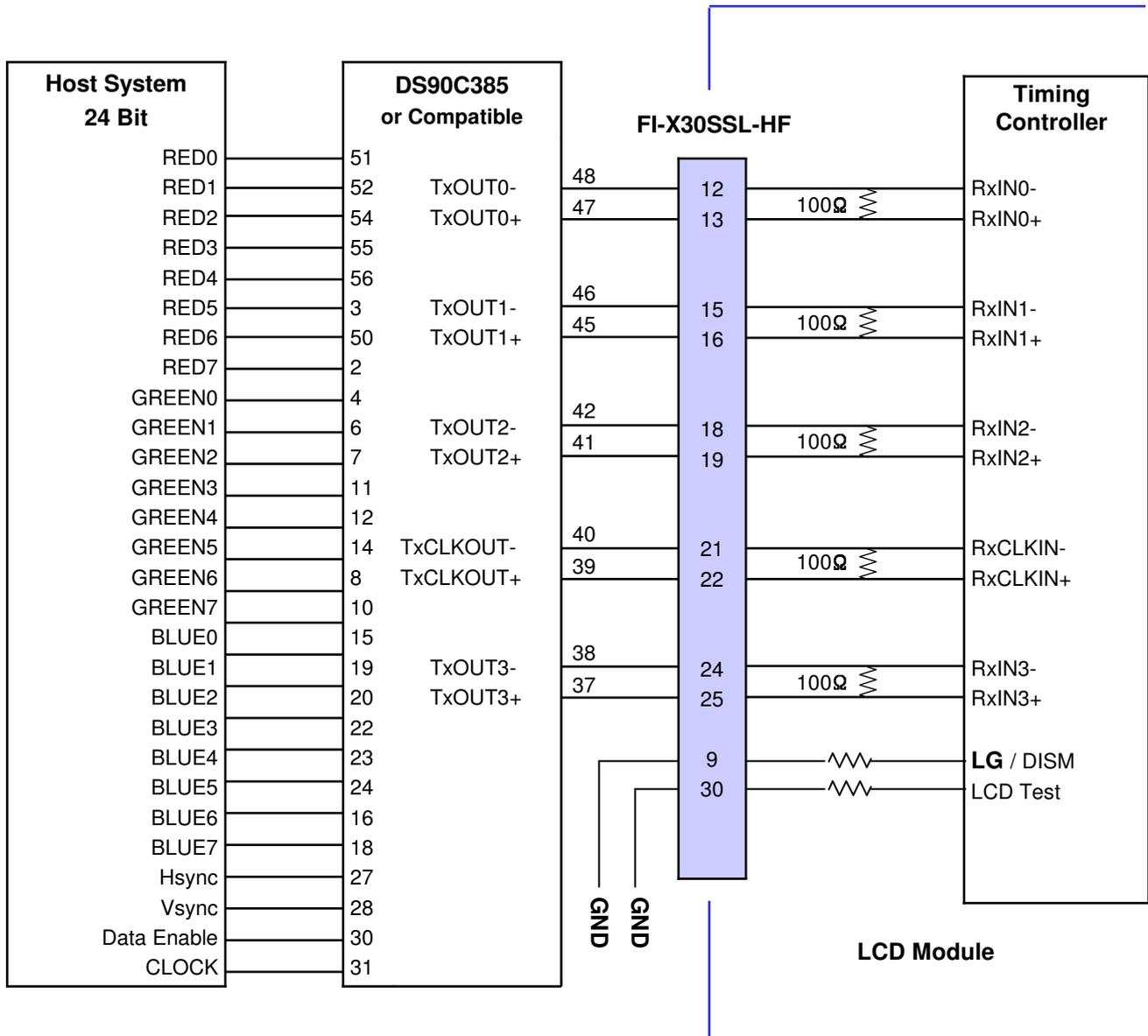
| Host System 24 Bit		DS90C385 or Compatible	FI-X30SSL-HF		Timing Controller
RED0	51				
RED1	52	TxOUT0-	48	12	RxIN0-
RED2	54	TxOUT0+	47	13	100Ω RxIN0+
RED3	55				
RED4	56				
RED5	3	TxOUT1-	46	15	RxIN1-
RED6	50	TxOUT1+	45	16	100Ω RxIN1+
RED7	2				
GREEN0	4				
GREEN1	6	TxOUT2-	42	18	RxIN2-
GREEN2	7	TxOUT2+	41	19	100Ω RxIN2+
GREEN3	11				
GREEN4	12				
GREEN5	14	TxCLKOUT-	40	21	RxCLKIN-
GREEN6	8	TxCLKOUT+	39	22	100Ω RxCLKIN+
GREEN7	10				
BLUE0	15				
BLUE1	19	TxOUT3-	38	24	RxIN3-
BLUE2	20	TxOUT3+	37	25	100Ω RxIN3+
BLUE3	22				
BLUE4	23			9	LG / DISM
BLUE5	24			30	LCD Test
BLUE6	16				
BLUE7	18				
Hsync	27				
Vsync	28		GND	GND	
Data Enable	30				LCD Module
CLOCK	31				

Note: 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. (DS90C385 or Compatible)
3. '7' means MSB and '0' means LSB at R,G,B pixel data.

Table 5. REQUIRED SIGNAL ASSIGNMENT FOR LVDS TRANSMITTER (Pin9="H")
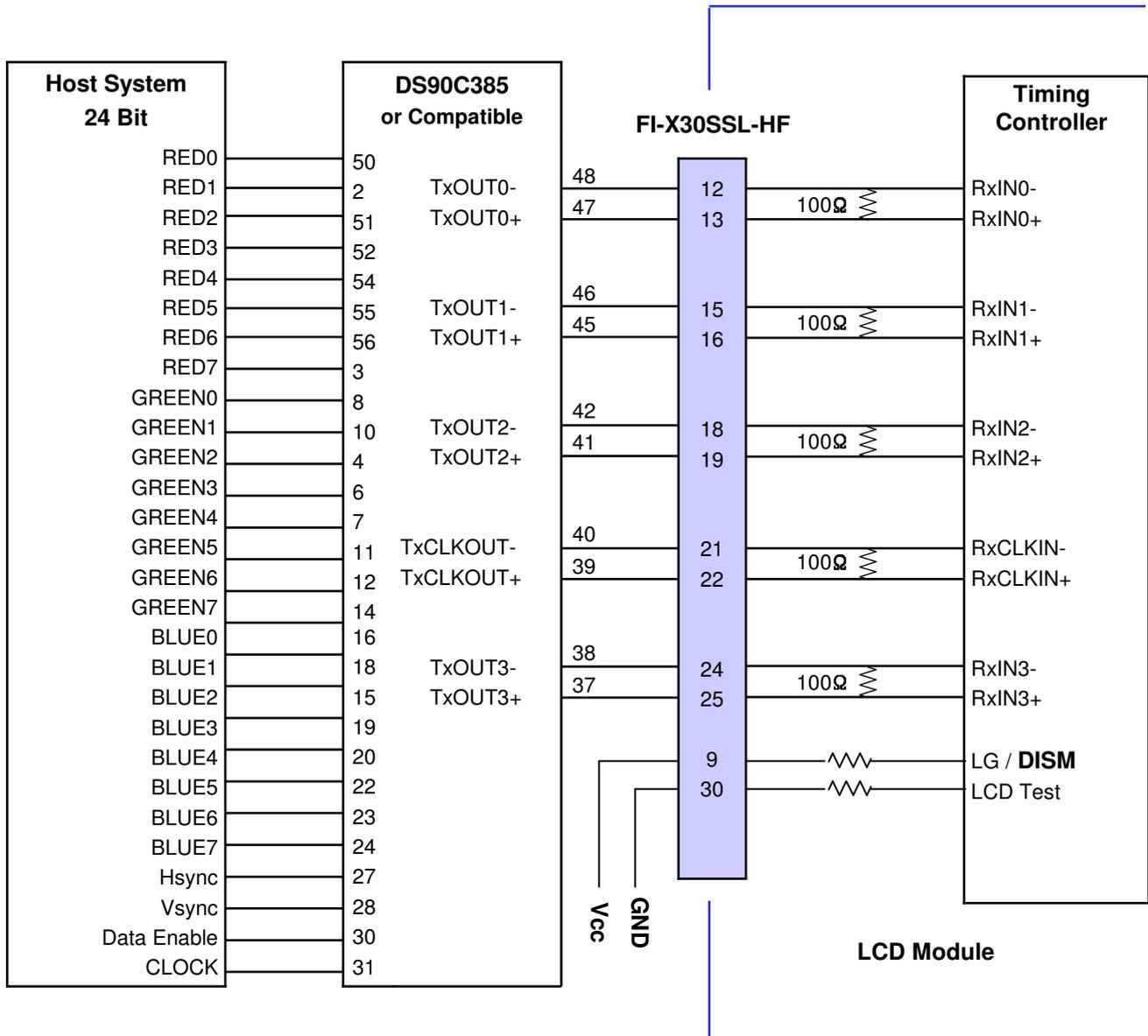
Host System 24 Bit		DS90C385 or Compatible		FI-X30SSL-HF		Timing Controller
RED0	50		48	12		RxIN0-
RED1	2	TxOUT0-	47	13	100Ω	RxIN0+
RED2	51	TxOUT0+				
RED3	52					
RED4	54		46	15		RxIN1-
RED5	55	TxOUT1-	45	16	100Ω	RxIN1+
RED6	56	TxOUT1+				
RED7	3					
GREEN0	8		42	18		RxIN2-
GREEN1	10	TxOUT2-	41	19	100Ω	RxIN2+
GREEN2	4	TxOUT2+				
GREEN3	6					
GREEN4	7		40	21		RxCLKIN-
GREEN5	11	TxCLKOUT-	39	22	100Ω	RxCLKIN+
GREEN6	12	TxCLKOUT+				
GREEN7	14					
BLUE0	16		38	24		RxIN3-
BLUE1	18	TxOUT3-	37	25	100Ω	RxIN3+
BLUE2	15	TxOUT3+				
BLUE3	19					
BLUE4	20			9		LG / **DISM**
BLUE5	22			30		LCD Test
BLUE6	23					
BLUE7	24					
Hsync	27					
Vsync	28					
Data Enable	30		Vcc GND			
CLOCK	31					**LCD Module**

Note: 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. (DS90C385 or Compatible)
     3. '7' means MSB and '0' means LSB at R,G,B pixel data.

3-2-2. Backlight Inverter

The inverter connector is 20022WR-14B1 side entry type (manufactured by YeonHo) or equivalent
The pin configuration for the 14 pin connector is shown in the table below.

Table 5. INVERTER CONNECTOR PIN CONFIGULATION

| Pin	Symbol	Signal assignment		Note
		Master(CN2)	Slave(CN3)	
1	V_{BL}	24V Power Input	24V Power Input	
2	V_{BL}	24V Power Input	24V Power Input	
3	V_{BL}	24V Power Input	24V Power Input	
4	V_{BL}	24V Power Input	24V Power Input	
5	V_{BL}	24V Power Input	24V Power Input	
6	GND	GROUND	GROUND	
7	GND	GROUND	GROUND	
8	GND	GROUND	GROUND	
9	GND	GROUND	GROUND	
10	GND	GROUND	GROUND	
11	V_{BR}-A	Analog dimming voltage for PWM amplitude control	Don't care	0V : 90% (min) 1.65V : 100% (Typ) 3.3V : 110% (max) Open(NC) : 1.65V
12	$V_{ON/OFF}$	Backlight ON/OFF control	Don't care	ON : 2.8~ 5.25V OFF : 0.0 ~ 0.8V
13	V_{BR}-B	Burst dimming Voltage for PWM duty control	No Pin	0V : 20% (min) 3.3V : 100% (max)
14	Status	Using Status output	No pin	3.0V to 5.0V output (Normal), 0V to 0.7V output (Abnormal)

1. Connector
   1) Connector(Receptacle)
      : 20022WR-14B1 (YeonHo)

   2) Mating Connector(Plug)
      : PHR14 (JST)
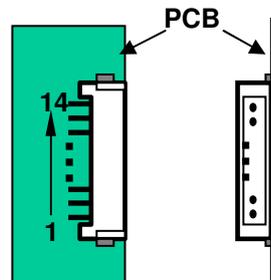
3-3. Signal Timing Specifications

This is 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 it's proper operation.

Table 7. TIMING TABLE

ITEM		Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	f_{CLK}	63	72.3	80	MHz	
Hsync	Frequency	f_H	39	47.4	53	KHZ	
	Display Valid	t_{HV}	1366	1366	1366	Clks	
	Blank	t_{HT}-t_{HV}	80	162	474	Clks	
	Total	t_{HT}	1446	1528	1840	Clks	
Vsync	Frequency	f_V	47	60	63	HZ	PAL : 47~53Hz, NTSC : 57~63Hz
	Display Valid	t_{VV}	768	768	768	Lines	
	Blank	t_{VT}-t_{VV}	7	22	295	Lines	
	Total	t_{VT}	775	790	1063	Lines	

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

3-4. Signal Timing Waveforms

Hsync, Vsync, DE, Data

0.7VDD

0.3VDD

DCLK

t_{CLK}

0.5 VDD

Valid data

First data   Invalid data   Pixel 0,0   Pixel 2,0   Invalid data

Valid data

Second data   Invalid data   Pixel 1,0   Pixel 3,0   Invalid data

DE(Data Enable)

t_{HP}

HSync

t_{WH}

t_{HBP} t_{HV} t_{HFP}

DE(Data Enable)

t_{VP}

t_{WV}

VSync

t_{VBP} t_{VV} t_{VFP}

DE(Data Enable)
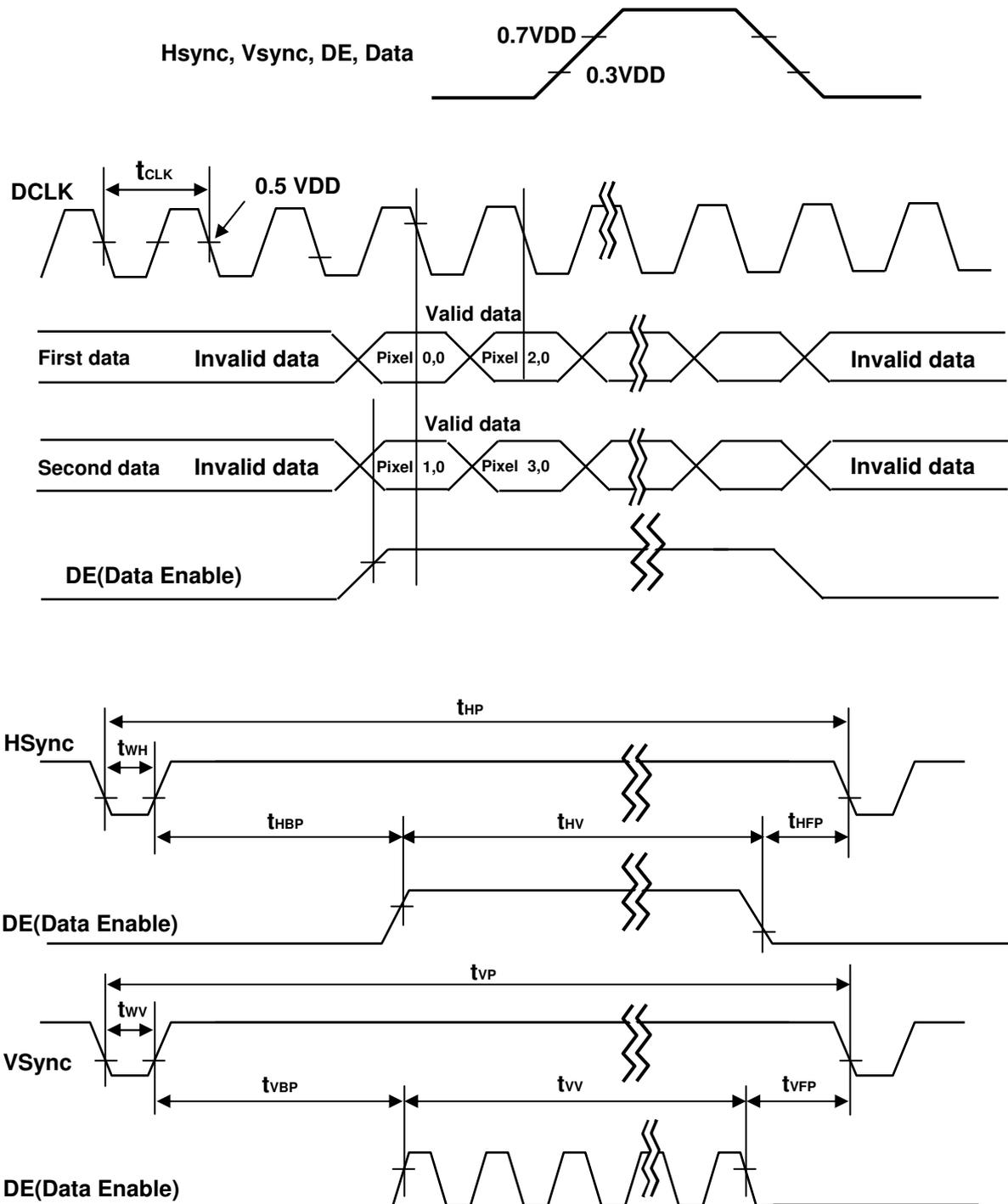
3-5. Color Data Reference

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

Table 8. COLOR DATA REFERENCE

Color		Input Color Data																								
		RED MSB							LSB	GREEN MSB							LSB	BLUE 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

Note : Users should be input true 8 Bit data streams via LVDS transmitter.

3-6. Power Sequence

3-6-1. LCD Driving circuit
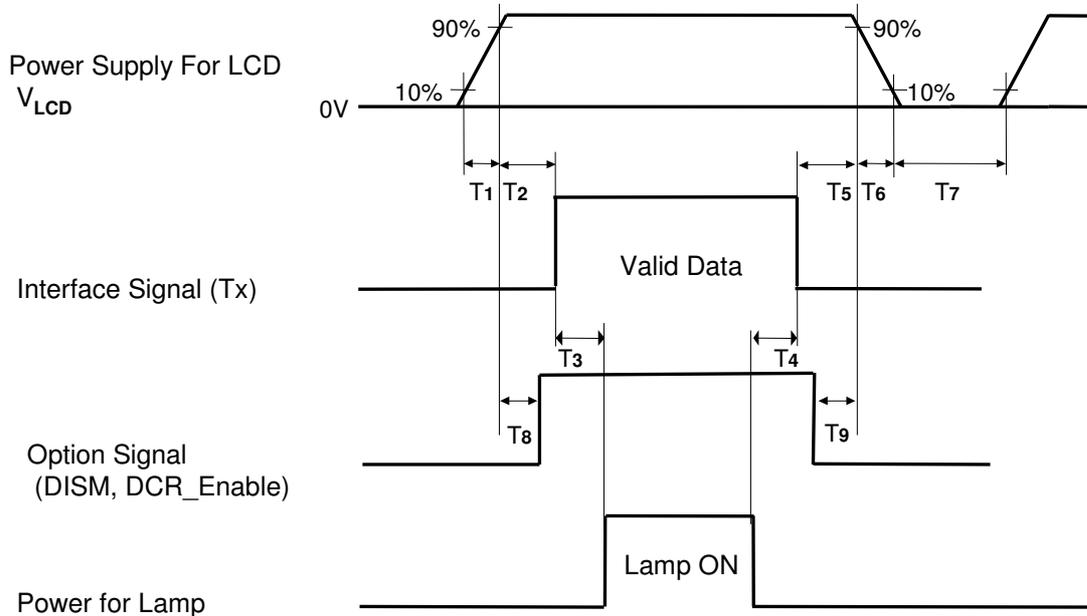

Table 9. POWER SEQUENCE

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	-	-	300	ms
T7	1.0	-	-	s
T8	0 < T8 < T2			ms
T9	0 < T9 < T5			ms

Note :　1. Please avoid the 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=1s) 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.

6. 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.

3-6-2. On/Off for Inverter

Power Supply For Inverter
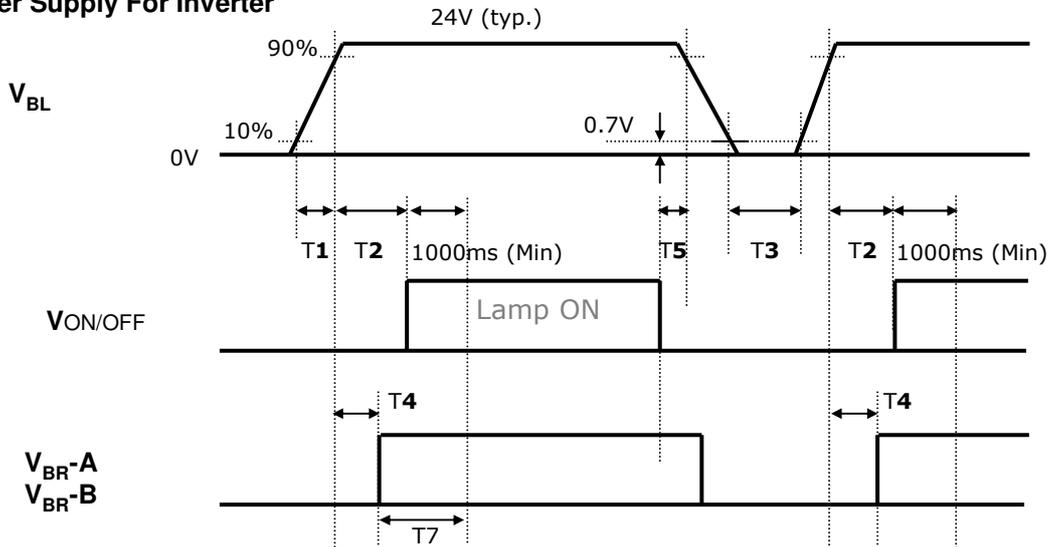
V_{BR}-**B** : V_{BR}-**B** has the same sequence with V_{BR}-A.

3-6-3. Deep condition for Inverter
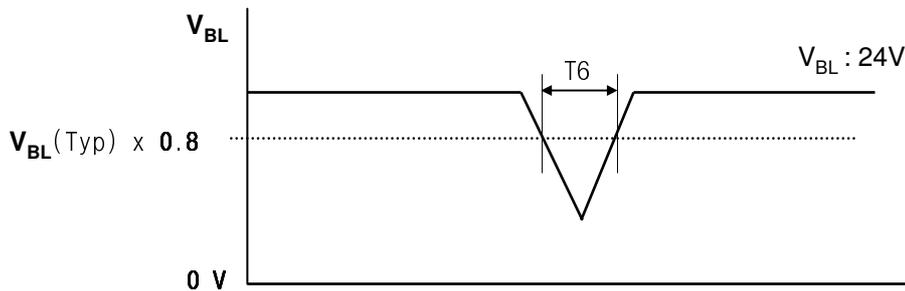
Table 10. Power Sequence for Inverter

Parameter	Values			Units	Remarks
	Min	Typ	Max		
T1	20	-	-	ms	1
T2	500	-	-	ms	
T3	200	-	-	ms	2
T4	0		-	ms	3
T5	10	-	-	ms	
T6	-	-	10	ms	V_{BL}(Typ) x **0.8**
T7	1000	-	-	ms	

Note : 1. T1 describes rising time of 0V to 24V and is not applied at restarting time.
     2. When V_{BL} (24V) is supplied always, there is no reliability problem.
     3. T3(max) is less than T2.
     4. For 1 second after lamp on, V_{BR}-**B** should be max level(3.3V) and V_{BR}-A is recommended 1.65V.

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4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and for 30 minutes in a dark environment at 25±2°C. 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.
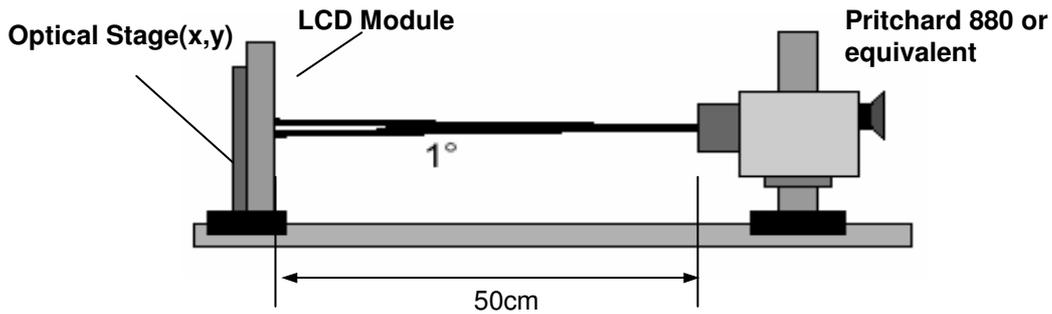
FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 11. OPTICAL CHARACTERISTICS Ta= 25±2°C, V_{LCD}=12.0V, fv=60Hz, Dclk=72.3MHz, V_{BR-A}=1.65V, V_{BR-B}=3.3V

Parameter		Symbol		Value			Unit	Note
				Min	Typ	Max		
Contrast Ratio		CR		750	1000			1
		DCR (With AI)		3750	5000			
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	14		
Color Coordinates [CIE1931]	RED	Rx			0.638			
		Ry			0.343			
	GREEN	Gx			0.290			
		Gy		Typ -0.03	0.612	Typ +0.03		
	BLUE	Bx			0.146			
		By			0.060			
	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								6

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

CR (Contrast Ratio) = Maximum CRn (n=1, 2, 3, 4, 5)
DCR (Dynamic CR) = 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(L_{WH}) 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 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 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 12.

Table 12. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ) [Normal]	Luminance [%] (Typ) [DCR]
L0	0.10	0.02 (V_{BR}-A = 0V, V_{BR}-B = 0V)
L15	0.32	
L31	1.10	
L47	2.60	
L63	4.90	
L79	8.10	
L95	12.1	
L111	16.7	
L127	21.6	DCR gray scale is according to inverter dimming voltages.
L143	28.0	
L159	35.4	
L175	43.9	
L191	53.3	
L207	64.1	
L223	75.8	
L239	88.0	
L255	100	100 (V_{BR}-A = 3.3V, V_{BR}-B = 3.3V)

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
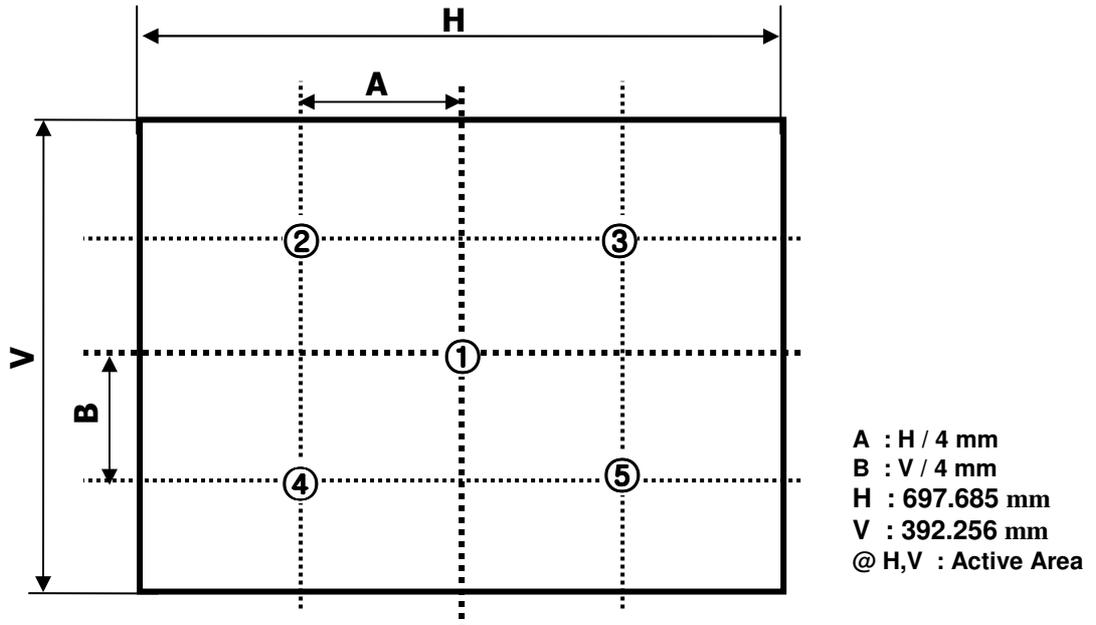
FIG. 2 The Position of Points for Luminance Measure

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


N,M = 0(Black)~255(White), N<M
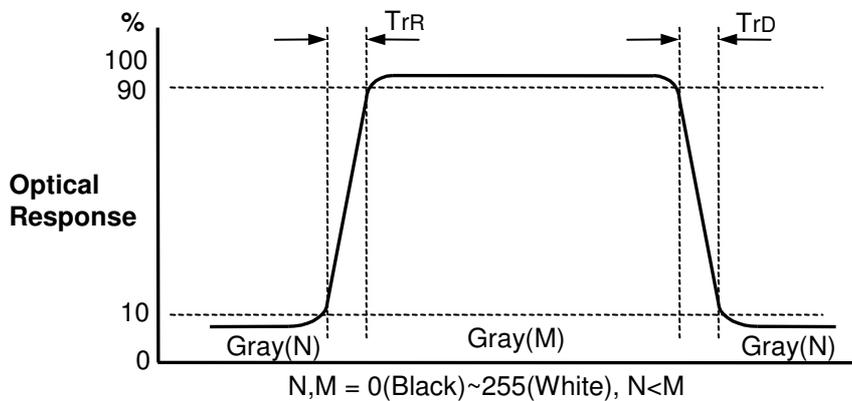
FIG. 3 Response Time

Dimension of viewing angle range
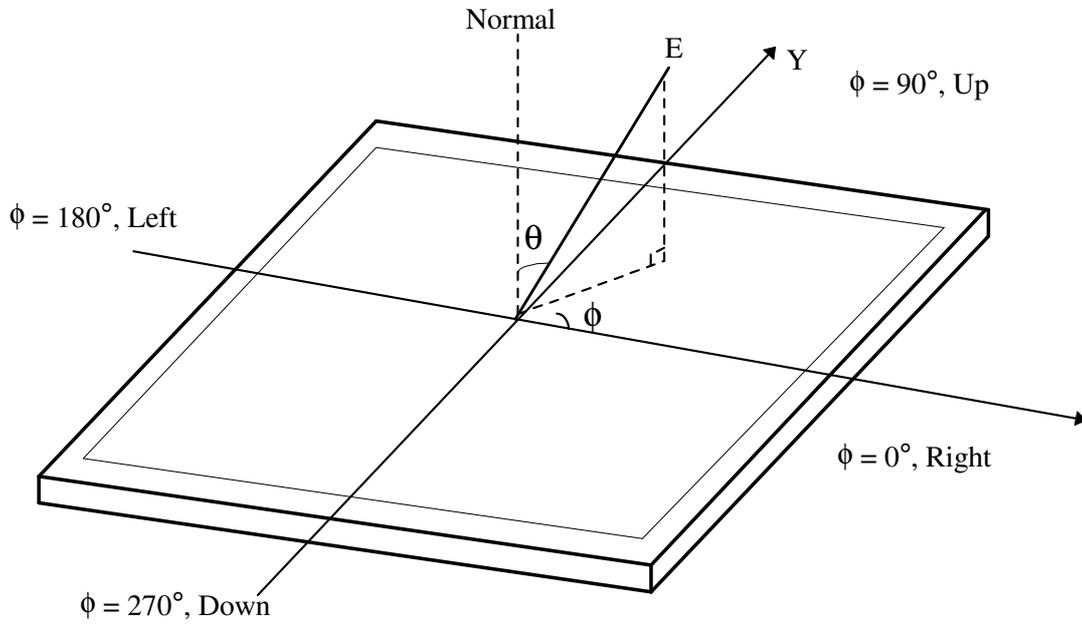
FIG. 4 Viewing Angle

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 13. MECHANICAL CHARACTERISTICS

Outline Dimension	Horizontal	760.0mm	
	Vertical	450.0 mm	
	Depth	48.0 mm	
Bezel Area	Horizontal	703.8mm	
	Vertical	398.4mm	
Active Display Area	Horizontal	697.685mm	
	Vertical	392.256mm	
Weight	6,150 g(Typ.), 6,770g(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>

SECTION "A"—"A"
SCALE 1/1

<REAR VIEW>
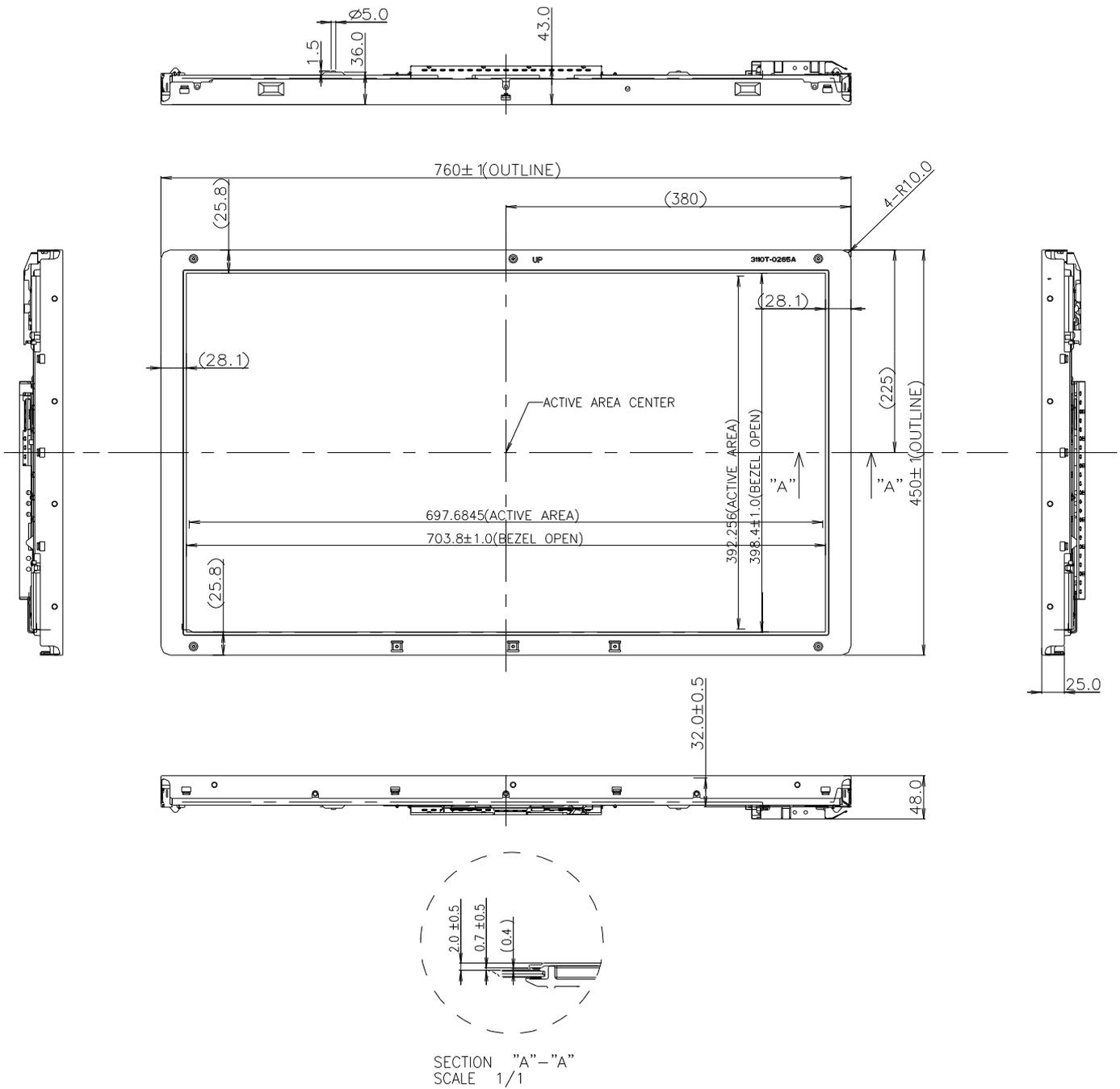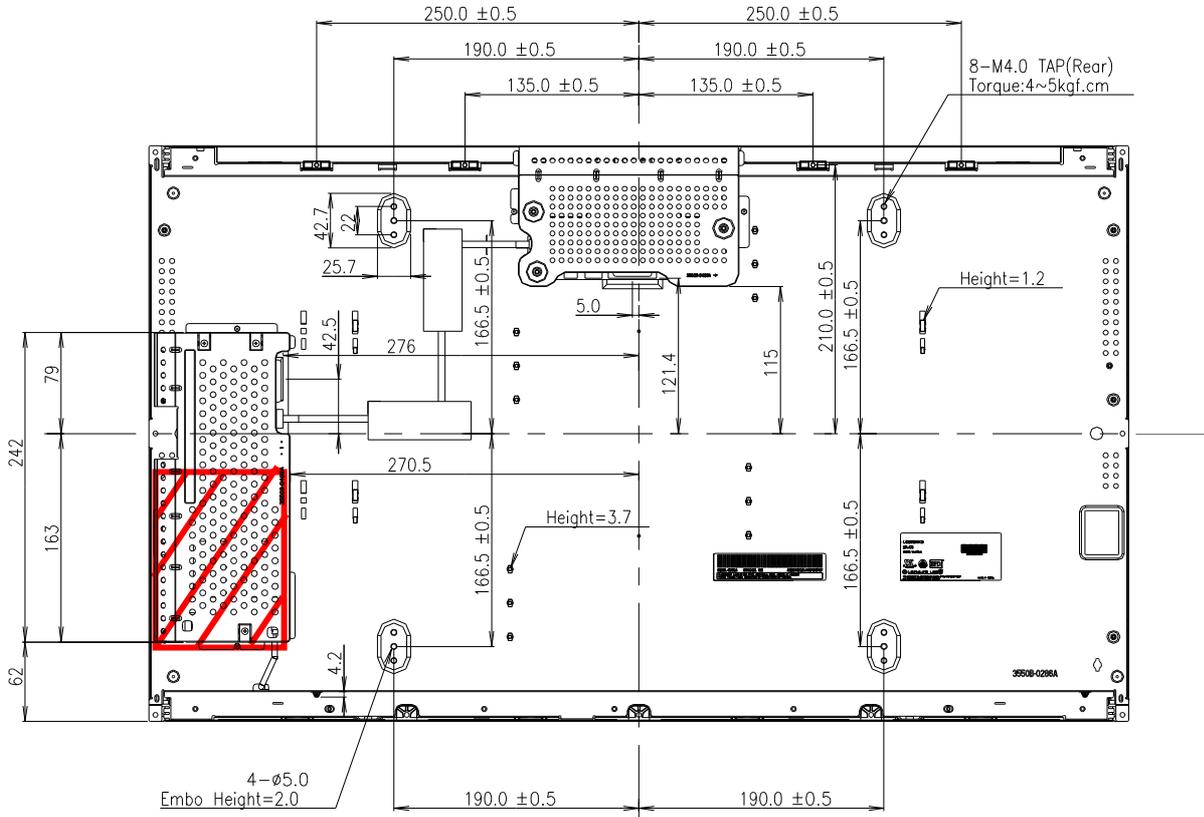
NOTES
1. UNSPECIFIED TOLERANCES TO BE ±0.5MM
2. TILT AND PARTIAL DISPOSITION TOLERANCE OF DISPLAY AREA ARE AS FOLLOWING.
(1) Y-DIRECTION: | A-B | ≤ 1.5
(2) X-DIRECTION: | C-D | ≤ 1.5
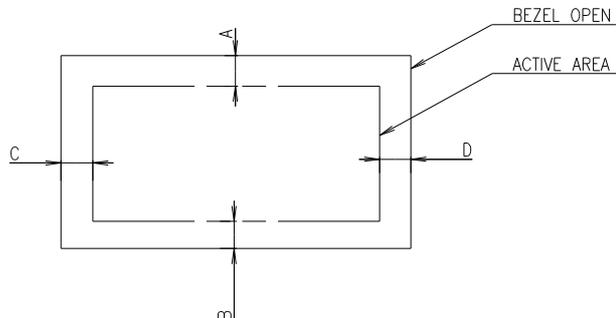
Notes : It should be recommended that any exterior materials do not go passing up the red area slanted. (For example, electrical cable, system board , etc). Otherwise, it could cause that abnormal display happens.

6. Reliability

Table 14. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 50°C 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 40°C 50%RH 240h
4	Low temperature operation test	Ta= 0°C 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 °C 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 Electrotechnical 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 : FACTORY CODE
G ~ 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

3. FACTORY CODE

Factory Code	Gumi	Nanjing	Paju
Mark	K	C	P

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°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

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 AI_ENABLE Circuit Block Diagram

on the Control PCB ass'y
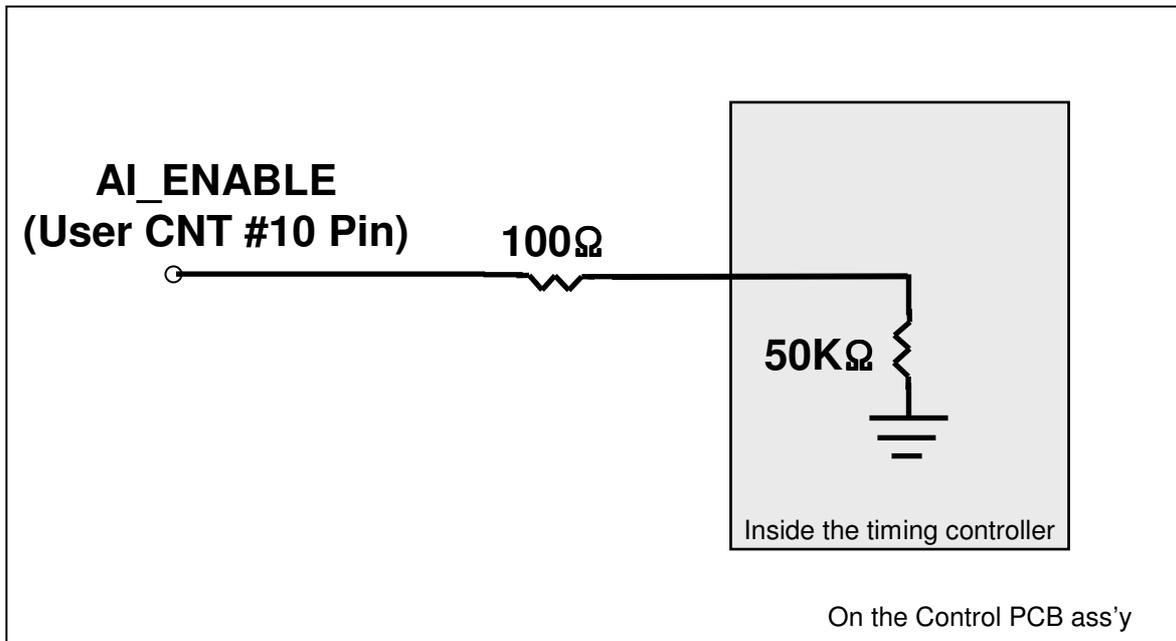
Fig. The AI_ENABLE Circuit Block Diagram

APPENDIX- Ⅰ

■LC320W01─SL22 Packing Ass'y
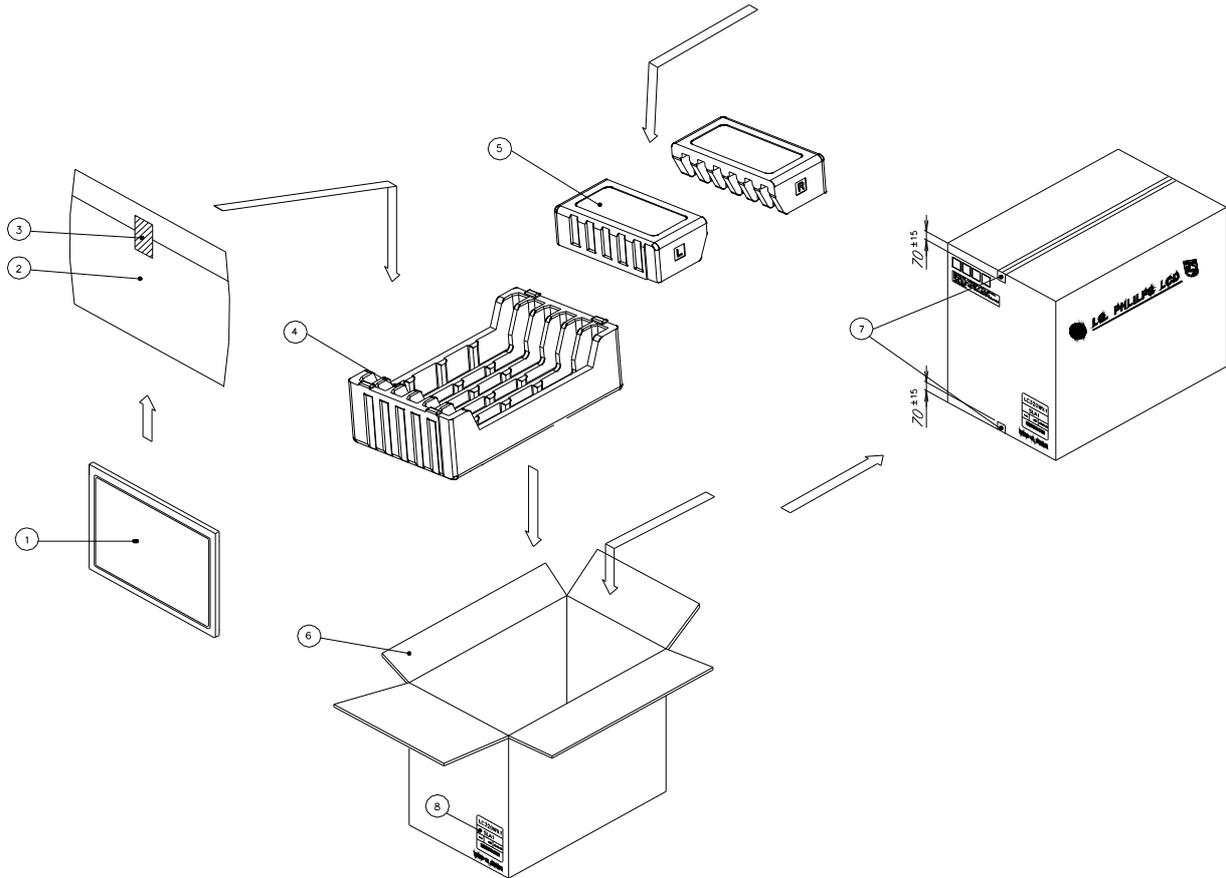
NO.	DESCRIPTION	MATERIAL
1	LCD MODULE	
2	BAG	AL
3	TAPE	MASKING 20MM X 50M
4	PACKING, BOTTOM	EPS
5	PACKING, TOP R_L	EPS
6	BOX	PAPER_DW3
7	TAPE	OPP 70MMX300M
8	LABEL	YUPO PAPER 100X100

LG.PHILIPS LCD

Product Specification

APPENDIX- II

■ LC320W01-SL22 Pallet Ass'y

Box quantity per pallet: 2ea
Pallet size: L1040 x W900 x H740
Pallet gross weight: 113.0kg

NO.	DESCRIPTION	MATERIAL
1	PACKING ASS'Y	
2	PALLET	PAPER
3	AANGLE, PACKING	PAPER (DW3)
4	LABEL	PAPER
5	TAPE	OPP
6	BAND	PP
7	CLIP, BAND	STEEL

APPENDIX- Ⅲ

■ LCM Label

Model → LC320W01
(SL)(A1)
RoHS Verified

UL, TUV Mark →

LPL Logo → LG.PHILIPS LCD

US PATENT No. → 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

32053KZQ00014 F11 ← **Serial No.**

MADE IN KOREA ← **Origin**

■ **Serial No. (See CAS 26page 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

■ Box Label   ■ Pallet Label

LC320W01
SLA1

6 PCS	001/01−01	

MADE IN KOREA	RoHS Verified

| (barcode) |

LC320W01
SLA1

12 PCS	001/01−01

| REMARK |

MADE IN KOREA	RoHS Verified

| (barcode) |
| ************ *** |