SPECIFICATION
FOR
APPROVAL

(●) Preliminary Specification
(   ) Final Specification

Title	47.0" WUXGA TFT LCD

BUYER	General
MODEL	-

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LC470WU2
SUFFIX	SLA1 (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. Yoon / Senior Manager	
REVIEWED BY	
P.Y. Kim / Manager	
PREPARED BY	
S.S. Lee / Engineer	

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

Contents

Product Specification

Record of Revisions

| Revision No.	Revision Date	Page	Description
0.0	May. 16, 2007	-	First draft.

Product Specification

1. General Description

LC470WU2 is a Color Active Matrix Liquid Crystal Display with an Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. It has a 47 inch diagonally measured active display area with WUXGA resolution (1080 vertical by 1920 horizontal pixel array) Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 8bit or 10-bit gray scale signal for each dot, thus presenting a palette of more than 1.07Billion(10bit) of colors.
It has been designed to apply the 10-bit 4 port LVDS interface.
It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast moving picture response time are important.
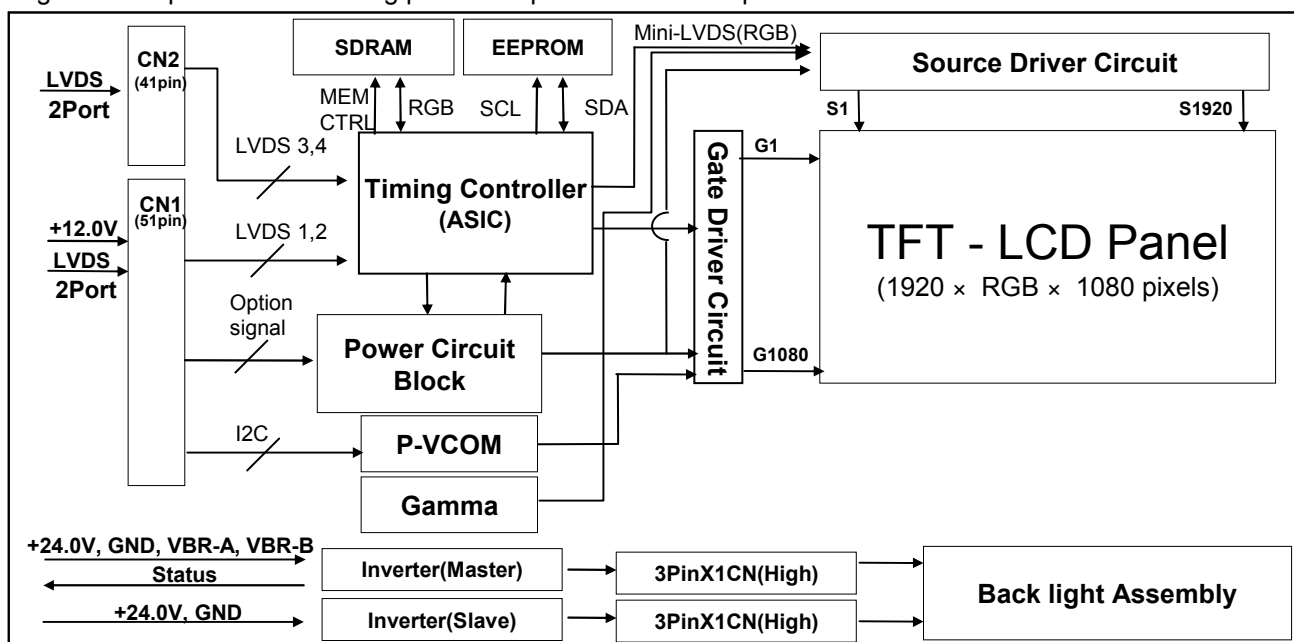
General Features

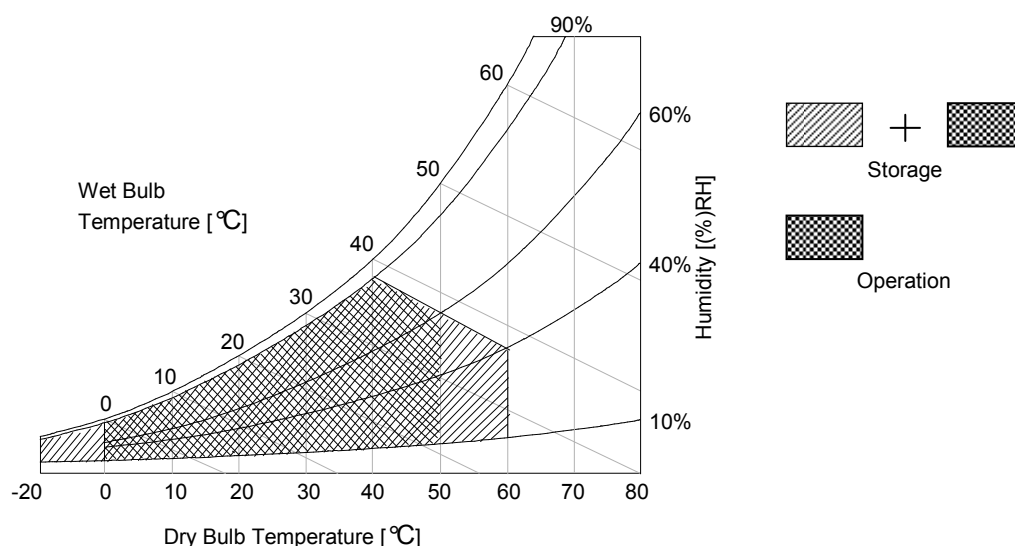|	
Active Screen Size	46.96 inches(1192.78mm) diagonal
Outline Dimension	1096.0 mm(H) x 640.0 mm(V) x 55.0 mm(D) (Typ.)
Pixel Pitch	541.5μm x 541.5μm x RGB
Pixel Format	1920 horiz. by 1080 vert. pixels RGB stripe arrangement
Color Depth	10-bit, 1.07Billon colors
Luminance, White	500 cd/m^2 (Center 1 point Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178(Typ.), U/D 178(Typ.))
Power Consumption	Total 250.2 Watt (Typ.) (Logic= 10.2W, Inverter=240W[VBR-A = 1.65V])
Weight	16.5 Kg (Typ.)
Display Operating Mode	Transmissive mode, normally black
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer

Product Specification

2. Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Value		Unit	Remark
			Min	Max		
Power Input Voltage	LCM	V_{LCD}	+8.0	14.0	V_{DC}	at 25 ± 2 ℃
	Backlight inverter	V_{BL}	21.6	27.0	V_{DC}	When operating
Option input voltage(select)		V_I	-0.3	3.6	V_{DC}	#7 Pin
ON/OFF Control Voltage		$V_{ON/OFF}$	-0.3	+5.5	V_{DC}	
Brightness Control Voltage		V_{BR}-A/V_{BR}-B	0.0	+5.0	V_{DC}	
Operating Temperature		T_{OP}	0	+50	℃	
Storage Temperature		T_{ST}	-20	+60	℃	Note 1,2
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 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 the LCD electronics and to drive the TFT array and liquid crystal. The other input power for the CCFL/Backlight is to power inverter.
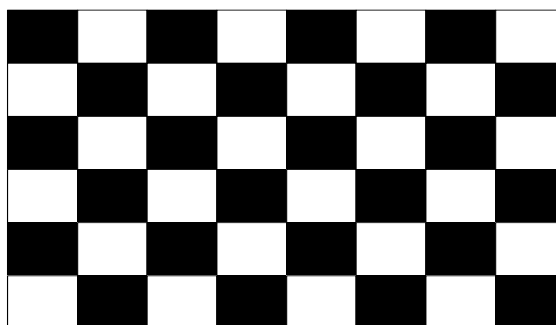
Table 2-1. ELECTRICAL CHARACTERISTICS

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}	-	850	1105	mA	1
		-	1205	1567	mA	2
Power Consumption	P_{LCD}	-	10.2	13.26	Watt	1
Rush current	I_{RUSH}	-	-	5.0	A	3

Note :
1. The specified current and power consumption are under the V_{LCD}=12.0V, 25 ± 2℃, f_V=120Hz condition whereas mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.
2. The current is specified at the maximum current pattern.
3. The duration of rush current is about 2~3ms and rising time of power Input is 1ms(min.).

White : 255Gray(1023Gray)
Black : 0Gray

Mosaic Pattern(8 x 6)

Product Specification

Table 2-2. ELECTRICAL CHARACTERISTICS

Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Inverter :							
Power Supply Input Voltage		VBL	22.8	24.0	25.2	Vdc	1
Power Supply Input Voltage Ripple			-	-	0.5	Vp-p	1
Power Supply Input Current	After Aging	IBL_A	-	10	11	A	V_{BR-A} = 1.65V … 1
			-	11	12	A	V_{BR-A} = 3.3V … 1
	Before Aging	IBL_B	-	11	12	A	V_{BR-A} = 1.65V … 2
			-	12	13	A	V_{BR-A} = 3.3V … 2
Power Supply Input Current (In-Rush)		Irush	-	-	14	A	V_{BL} = 22.8V V_{BR-B} = 3.3V V_{BR-A} = 1.65V
Power Consumption		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	
	On/Off Off	V off	-0.3	0.0	0.8	Vdc	
	Brightness Adjust	V_{BR-B}	0	-	3.3	V	3
Lamp:							
Discharge Stabilization Time		Ts			3	min	4
Life Time			30,000			Hrs	5

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 24Vand VBR (VBR-A : 1.65V & VBR-B :3.3V), it is total power consumption.
   The ripple voltage of the power supply input voltage is under 0.5 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. Brightness Control.
   This VBR-B Voltage control brightness.

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

4. 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.
5. 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 (VBR-A : 1.65V & VBR-B :3.3V), on condition of continuous operating at 25 ± 2℃
6. The duration of rush current is about 10ms.

Product Specification

3-2. Interface Connections

This LCD module employs two kinds of interface connection, 51pin(CN1) and 41pin(CN2) connectors are used for the module electronics and 14-pin connector and 12 pin connector are used for the integral backlight system.

3-2-1. LCD Module

- LCD Connector(CN1): FI-RE51S-HF, Refer to below table.
- Mating Connector : FI-RE51HL

Table 3-1. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	GND	Ground	27	GND	Ground(Reserved)
2	NC	Reserved	28	RA2N	SECOND CHANNEL A-
3	NC	Reserved	29	RA2P	SECOND CHANNEL A+
4	NC	Reserved	30	RB2N	SECOND CHANNEL B-
5	NC	Reserved	31	RB2P	SECOND CHANNEL B+
6	NC	Reserved	32	RC2N	SECOND CHANNEL C-
7	LVDS Select	'H' =JEIDA , 'L' = VESA	33	RC2P	SECOND CHANNEL C+
8	NC	Reserved	34	GND	Ground
9	NC	Reserved	35	RCLK2N	SECOND CLOCK CHANNEL Clk-
10	NC	Reserved	36	RCLK2P	SECOND CLOCK CHANNEL Clk+
11	GND	Ground	37	GND	Ground
12	RA1N	FIRST CHANNEL A-	38	RD2N	SECOND CHANNEL D-
13	RA1P	FIRST CHANNEL A+	39	RD2P	SECOND CHANNEL D+
14	RB1N	FIRST CHANNEL B-	40	RE2N	SECOND CHANNEL E-
15	RB1P	FIRST CHANNEL B+	41	RE2P	SECOND CHANNEL E+
16	RC1N	FIRST CHANNEL C-	42	GND	Ground
17	RC1P	FIRST CHANNEL C+	43	GND	Ground
18	GND	Ground	44	GND	Ground (NSB)
19	RCLK1N	FIRST CLOCK CHANNEL Clk-	45	GND	Ground
20	RCLK1P	FIRST CLOCK CHANNEL Clk+	46	GND	Ground
21	GND	Ground	47	NC	No connection
22	RD1N	FIRST CHANNEL D-	48	V_{LCD}	Power Supply +12.0V
23	RD1P	FIRST CHANNEL D+	49	V_{LCD}	Power Supply +12.0V
24	RE1N	FIRST CHANNEL E-	50	V_{LCD}	Power Supply +12.0V
25	RE1P	FIRST CHANNEL E+	51	V_{LCD}	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) are used for internal data process of the LCD module.
   If not used, these pins are no connection.
5. Specific pins(pin No. #8~#9) are used for Inverter test of the LCD module.
   If not used, these pins are no connection.
6. Specific pin No. #44 is used for "No signal detection" of system signal interface.
   It should be GND for NSB(No Signal Black) during the system interface signal is not.
   If this pin is "H", LCD Module displays AGP(Auto Generation Pattern).

Product Specification

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

Table 3-2. MODULE CONNECTOR(CN2) PIN CONFIGURATION

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

Note : 1. All GND(ground) pins should be connected together to the LCD module's metal frame.
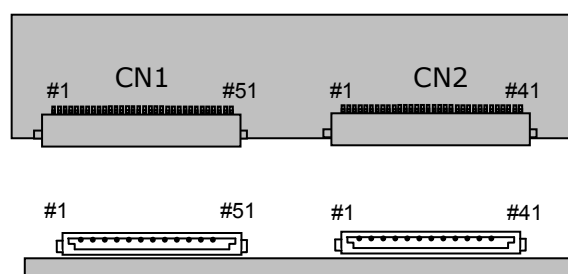
[CN1]
- Part/No. : FI-RE51S-HF(JAE)
- Mating connector : FI-RE51HL
      (Manufactured by JAE)
[CN2]
- Part/No. : FI-RE41S-HF(JAE)
- Mating connector : FI-RE41HL
      (Manufactured by JAE)

Rear view of LCM

Product Specification

3-2-2. Backlight Inverter

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

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

Table 5. INVERTER CONNECTOR PIN CONFIGURATION

Pin No	Symbol	Description	Master	Slave	Note
1	V_{BL}	Power Supply +24.0V	V_{BL}	V_{BL}	
2	V_{BL}	Power Supply +24.0V	V_{BL}	V_{BL}	
3	V_{BL}	Power Supply +24.0V	V_{BL}	V_{BL}	
4	V_{BL}	Power Supply +24.0V	V_{BL}	V_{BL}	
5	V_{BL}	Power Supply +24.0V	V_{BL}	V_{BL}	
6	GND	Backlight Ground	GND	GND	
7	GND	Backlight Ground	GND	GND	
8	GND	Backlight Ground	GND	GND	1
9	GND	Backlight Ground	GND	GND	
10	GND	Backlight Ground	GND	GND	
11	V_{BR-A}	Analog dimming voltage DC 0.0V ~ 3.3V (Typ : 1.65V)	V_{BR-A}	Don't care	2, 3
12	$V_{ON/OFF}$	0.0V ~ 5.0V	On/Off	Don't care	
13	V_{BR-B}	Burst dimming voltage DC 0.0V ~ 3.3V	V_{BR-B}	-	3
14	Status	Normal : Upper 3.0V Abnormal : Under 0.7V	Status	-	4

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 127[kΩ], 84.7[kΩ], 208.8[kΩ]

◆ **Rear view of LCM**

<Master>   <Slave>
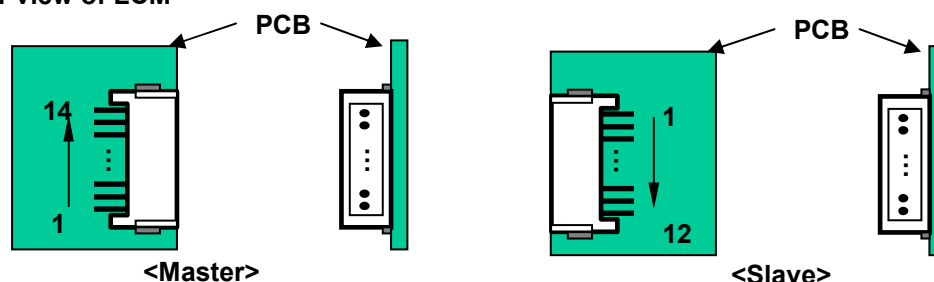
Product Specification

3-3. Signal Timing Specifications

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

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

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	t_{HV}	480	480	480	t_{CLK}	1920/4
	Blank	t_{HB}	40	70	200	t_{CLK}	1
	Total	t_{HP}	520	550	680	t_{CLK}	
Vertical	Display Period	t_{VV}	1080	1080	1080	Lines	
	Blank	t_{VB}	10	45	86	Lines	1
	Total	t_{VP}	1090	1125	1166	Lines	

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

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.

Product Specification

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

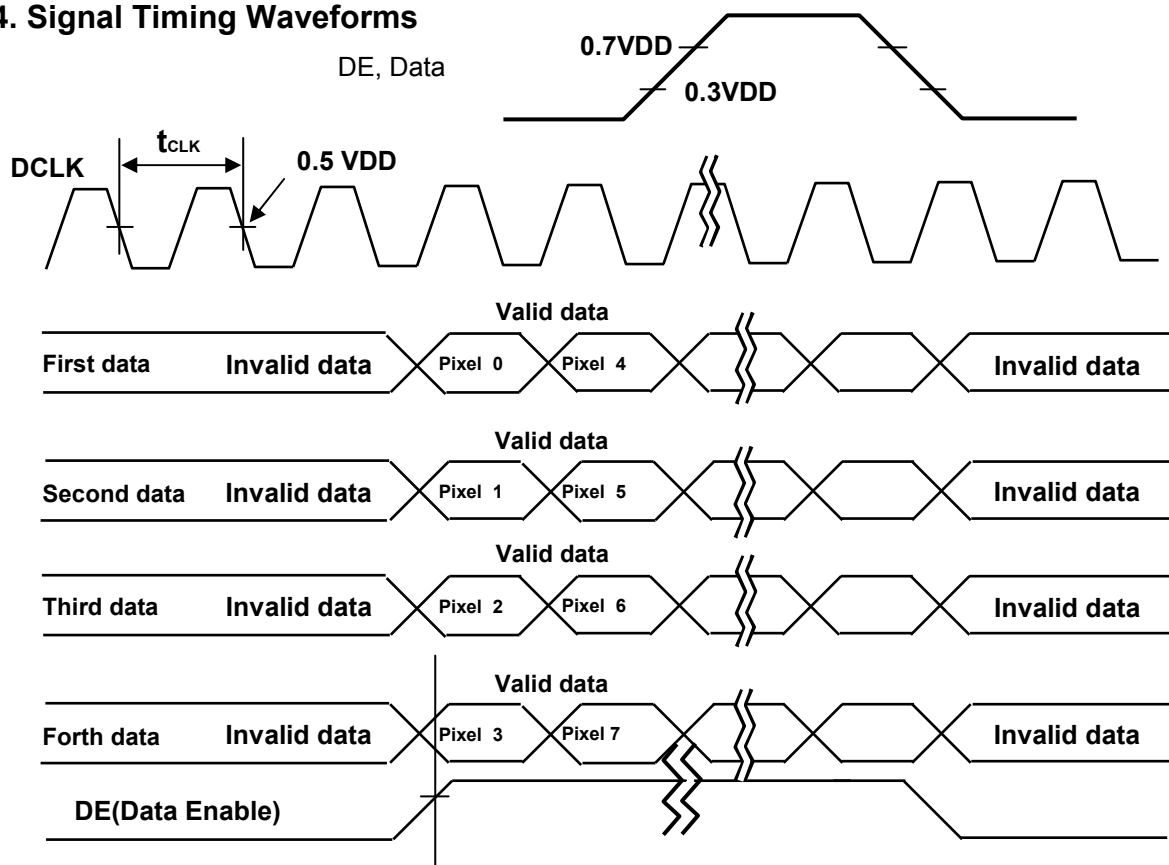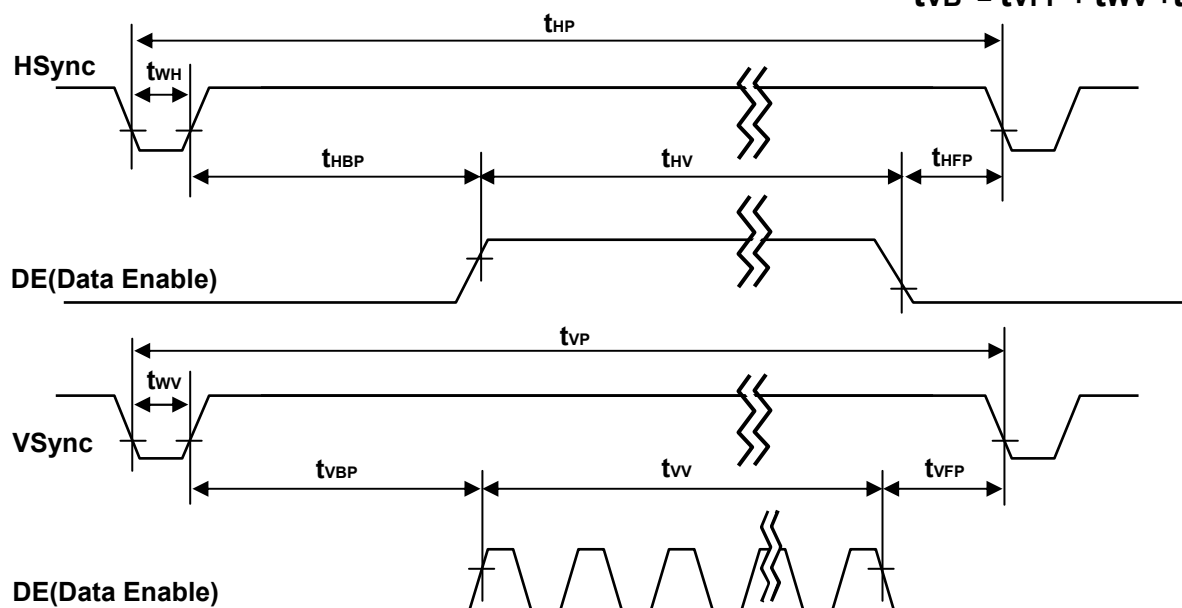### Table7. TIMING TABLE for DVB/PAL (DE Only Mode)

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	t_{HV}	480	480	480	t_{CLK}	1920/4
	Blank	t_{HB}	40	70	200	t_{CLK}	1
	Total	t_{HP}	520	550	680	t_{CLK}	
Vertical	Display Period	t_{VV}	1080	1080	1080	Lines	
	Blank	t_{VB}	228	270	300	Lines	1
	Total	t_{VP}	1308	1350	1380	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	f_{CLK}	66.97	74.25	75.00	MHz	
	Horizontal	f_H	121.8	135	140	KHz	2
	Vertical	f_V	90.2	100	103.7	Hz	2

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.

3-4. Signal Timing Waveforms

DE, Data

0.7VDD

0.3VDD

t_{CLK}

DCLK   0.5 VDD

Valid data

First data   Invalid data   Pixel 0   Pixel 4   Invalid data

Valid data

Second data   Invalid data   Pixel 1   Pixel 5   Invalid data

Valid data

Third data   Invalid data   Pixel 2   Pixel 6   Invalid data

Valid data

Forth data   Invalid data   Pixel 3   Pixel 7   Invalid data

DE(Data Enable)

* Reference : Sync. Relation

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

t_{HP}

HSync t_{WH}

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

DE(Data Enable)

t_{VP}

VSync t_{WV}

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

DE(Data Enable)

Product Specification

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

Product Specification

3-6. Power Sequence

3-6-1. Sequence for LCM
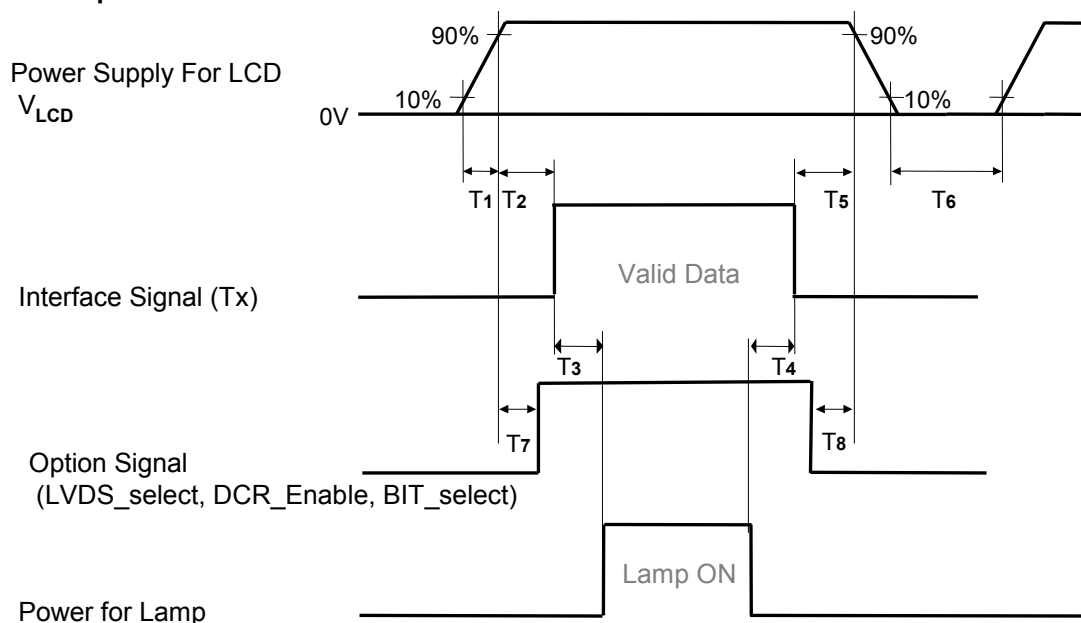
Table 9. POWER SEQUENCE

Parameter	Value			Unit	Notes
	Min	Typ	Max		
T1	0.5	-	20	ms	
T2	0.5	-	$3 \times (1/f_V)$	ms	3,5
T3	200	-	-	ms	4
T4	200	-	-	ms	4
T5	0	-	-	ms	3,5
T6	2.0	-	-	s	2,6
T7	0	-	T2	ms	5
T8	0	-	-	ms	5

Note :
1. Please avoid floating state of interface signal at invalid period.
2. When the interface signal is invalid, be sure to pull down the power supply V_{LCD} to 0V.
3. The case when the T2/T5 exceed maximum specification, it operates protection
   pattern(Black pattern) till valid signal inputted. There is no reliability problem.
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

3-6-2. Sequence for Inverter

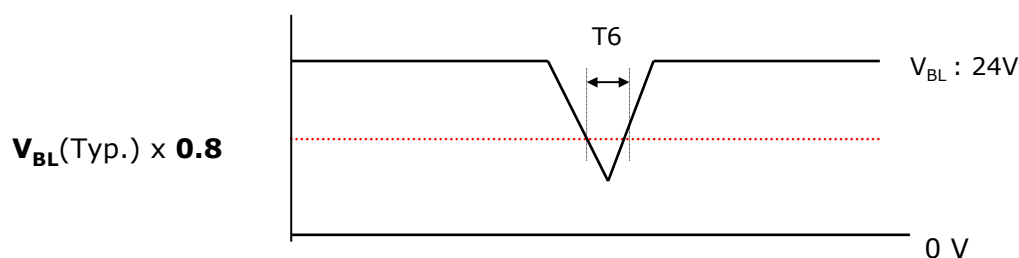**Power Supply For Inverter**
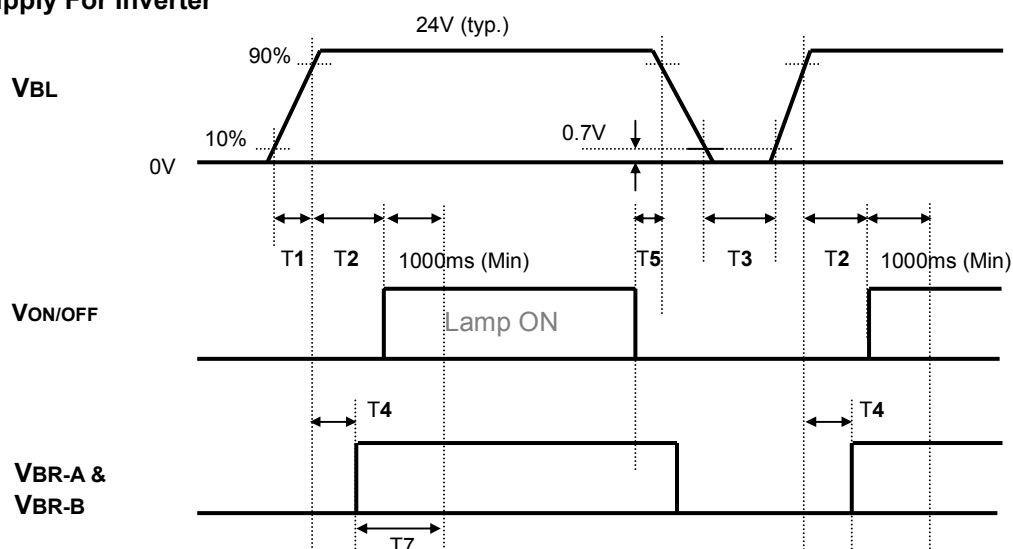
3-6-3. Deep condition for Inverter

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 **0.8**
T7	**1000**	-	-	ms	3

Notes : 1. T1 describes rising time of 0V to 24V and this parameter does not applied at restarting time.
2. T4(max) is less than T2.
3. In T7 section, VBR-B is recommended 3.3V.

4. Optical Specification

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

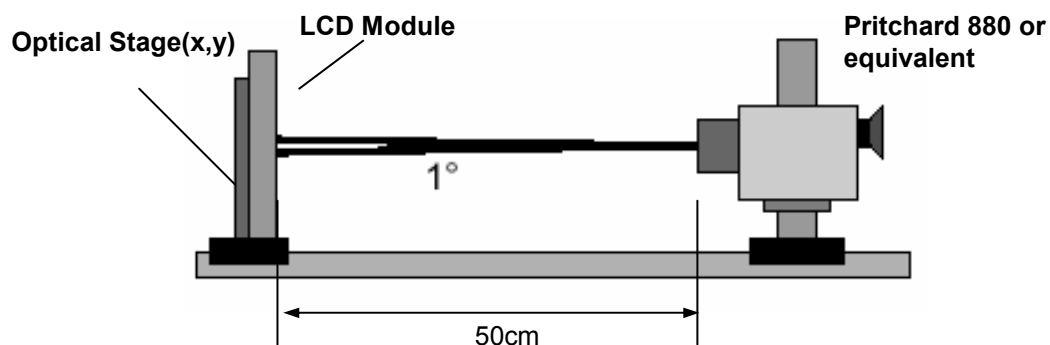**FIG. 1 Optical Characteristic Measurement Equipment and Method**

Table 11. OPTICAL CHARACTERISTICS

Ta= 25± 2℃, V_{LCD}=12.0V, f$_V$=120Hz, Dclk=297MHz, V_{BR}-A =1.65V, V_{BR}-B =3.3V

Parameter		Symbol		Value			Unit	Note
				Min	Typ	Max		
Contrast Ratio		CR		700	1000			1
Surface Luminance, white		L_{WH}		400	500		cd/m²	2
Luminance Variation		δ_{WHITE}	5P			1.3		3
Response Time	MPRT	-		-	8	10	ms	4
Color Coordinates [CIE1931]	RED	Rx			0.663			
		Ry			0.324			
	GREEN	Gx			0.199			
		Gy		Typ -0.03	0.659	Typ +0.03		
	BLUE	Bx			0.141			
		By			0.082			
	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

Product Specification

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 $25\pm 2°C$. 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_{on5}) / Minimum(L_{on1},L_{on2}, L_{on3}, ... , L_{on5})
    Where L_{on1} to L_{on5} are the luminance with all pixels displaying white at 5 locations .
    For more information, see FIG 2.

4. MPRT is defined as the 10% to 90% blur-edge width Bij(pixels) and scroll speed U(pixels/frame)at the moving picture. For more information, see FIG 3.

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 surface. For more information, see FIG 4.

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

Table 12. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ)
10bit	[Normal]
L0	0.10
L63	0.29
L127	1.06
L191	2.50
L255	4.69
L319	7.66
L383	11.5
L447	16.1
L511	21.6
L575	28.1
L639	35.4
L703	43.7
L767	53.0
L831	63.2
L895	74.5
L959	86.7
L1023	100

Measuring point for surface luminance & measuring point for luminance variation
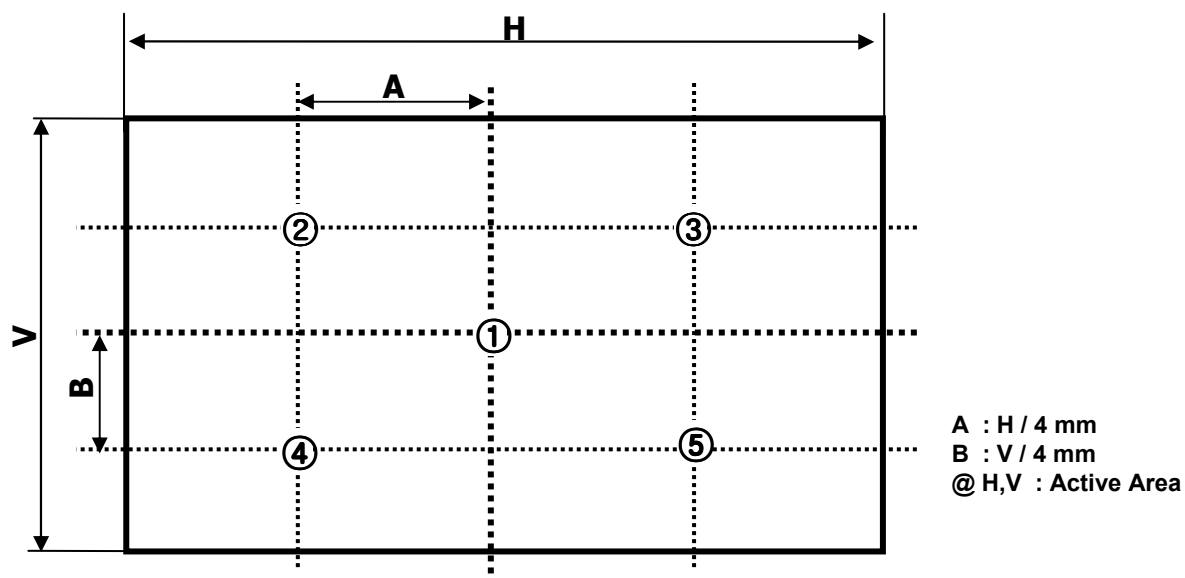

A : H / 4 mm
B : V / 4 mm
@ H,V : Active Area

FIG. 2 Measure Point for Luminance

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

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

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

   M = 12pixels / (10pixels / 120Hz)

     = 12pixels / {10pixels / (1/120)s}

     = 12 / 1,200 s

     = 10 ms
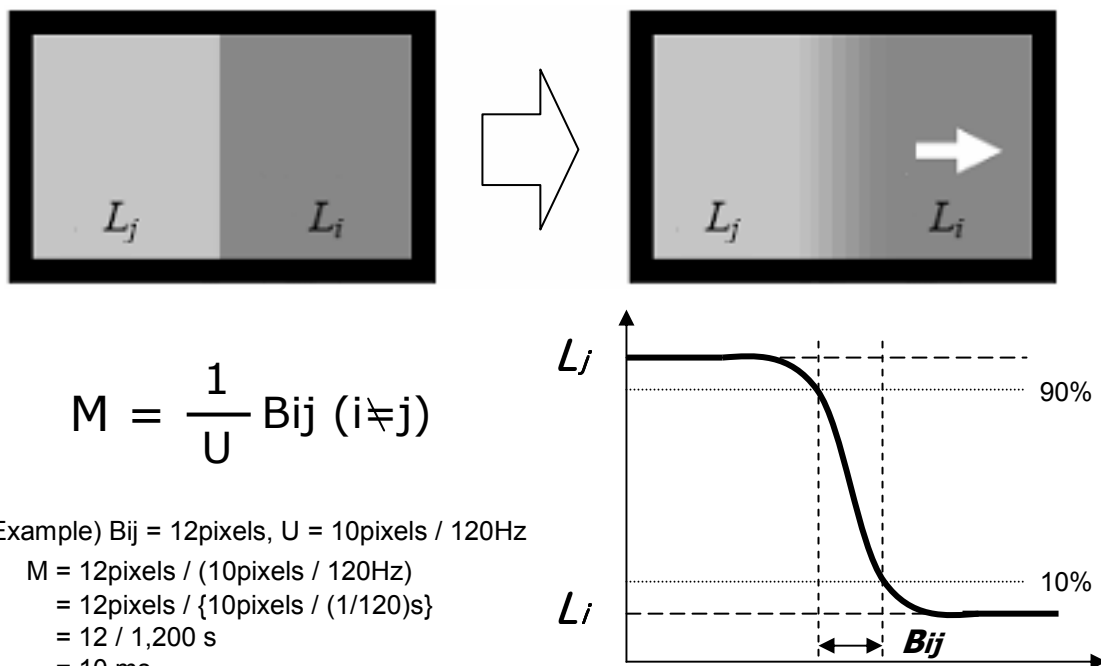
FIG. 3 MPRT

Product Specification

Dimension of viewing angle range

Normal
E
Y
φ = 90 °, Up
φ = 180 °, Left
θ
φ
φ = 0 °, Right
φ = 270 °, Down

FIG. 4 Viewing angle

Product Specification

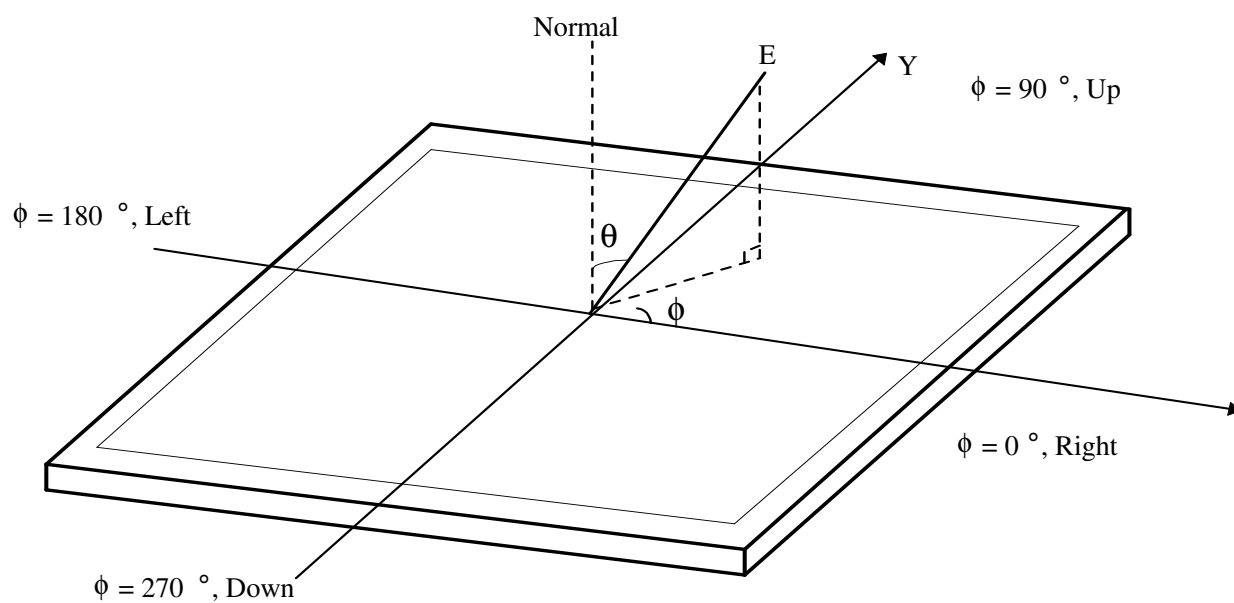## 5. Mechanical Characteristics

The following items provide general mechanical characteristics. In addition the figures in the next page are detailed mechanical drawing of the LCD module.

Table 13. MECHANICAL CHARACTERISTICS

Outline Dimension	Horizontal	1096.0 mm
	Vertical	640.0 mm
	Depth	55.0 mm
Bezel Area	Horizontal	1049.0mm
	Vertical	593.0mm
Active Display Area	Horizontal	1039.68mm
	Vertical	584.82mm
Weight	16.5Kg (Typ.) , 17.5Kg(max)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer	

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

Product Specification

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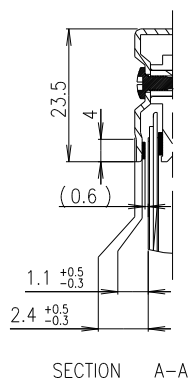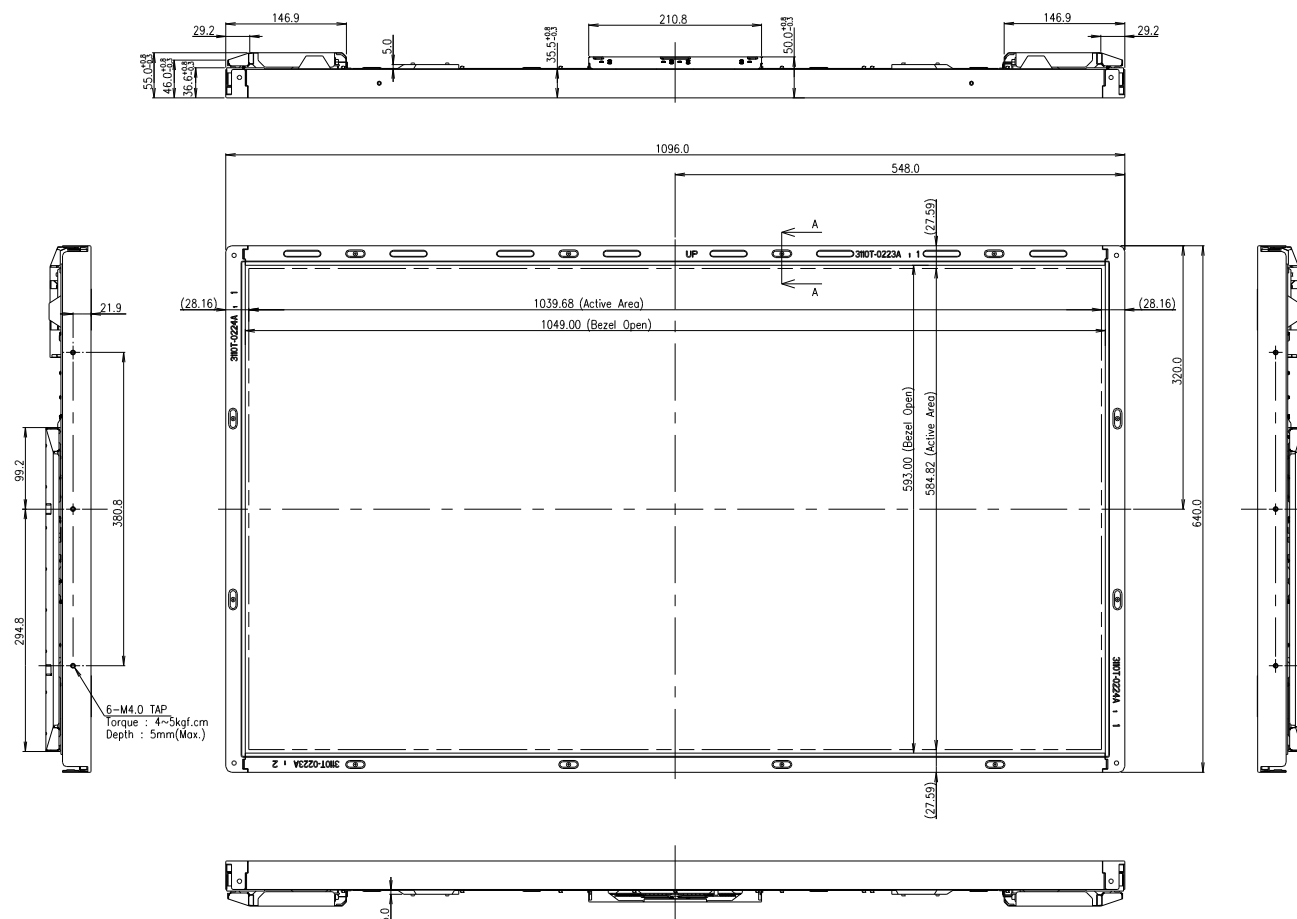
NOTES
1. Unspecified tolerances are to be ±1.0mm.
2. Tilt and partial disposition tolerance of display area are as following.
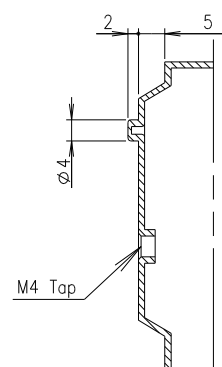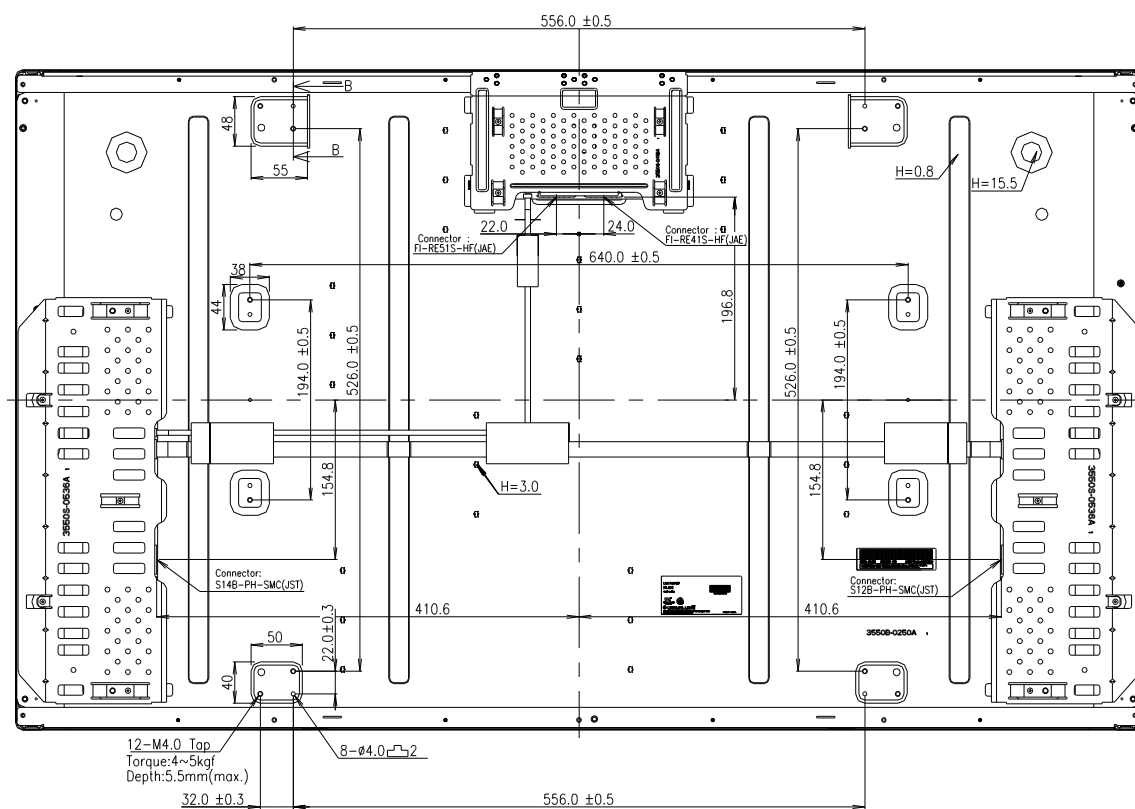   (1) X-Direction : IA-BI ≤ 1.5mm
   (2) Y-Direction : IC-DI ≤ 1.5mm
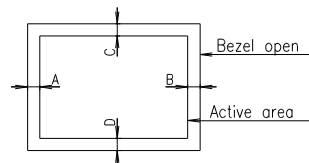
SECTION   A-A

Product Specification

<REAR VIEW>

SECTION   B—B
SCALE   1/1

6. Reliability

Table 14. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 60℃ 240h
2	Low temperature storage test	Ta= -20℃ 240h
3	High temperature operation test	Ta= 50℃ 50%RH 240h
4	Low temperature operation test	Ta= 0℃ 240h
5	Vibration test (non-operating)	Wave form : random Vibration level : 1.0Grms Bandwidth : 10-300Hz Duration : X,Y,Z, 30 min 　　　　　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, 240h
8	Altitude operating 　　　　　storage / shipment	0 - 14,000 feet(4267.2m) 0 - 40,000 feet(12192m)

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

7. International Standards

7-1. Safety

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

7-2. EMC

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

8. Packing

8-1. 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

Product Specification

9. Precautions

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

9-1. Mounting Precautions

(1) You must mount a module using specified mounting holes (Details refer to the drawings).
(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)
(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(9) Do not open the case because inside circuits do not have sufficient strength.

9-2. Operating Precautions

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=± 200mV(Over and under shoot voltage)
(2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
(7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can't be operated its full characteristics perfectly.
(8) A screw which is fastened up the steels should be a machine screw.
(if not, it causes metallic foreign material and deal LCM a fatal blow)
(9) Please do not set LCD on its edge.

9-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.

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

9-6. Handling Precautions for Protection Film

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

Product Specification

APPENDIX-I-1

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

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

FI-RE51S-HF

Timing Controller

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

GND

LCM 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. (THC63LVD103 or Compatible)
3. '9' means MSB and '0' means LSB at R,G,B pixel data.

Product Specification

APPENDIX-I-2

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

Host System 30 Bit	THC63LVD103 or Compatible		FI-RE41S-HF		Timing Controller
RED0	4				
RED1	5				
RED2	59				
RED3	61	TA- 31	12	100Ω	RO0N
RED4	33	TA+ 30	13		RO0P
RED5	34				
RED6	35				
RED7	36	TB- 29	14	100Ω	RO1N
RED8	37	TB+ 28	15		RO1P
RED9	38				
GREEN0	6				
GREEN1	8	TC- 25	16	100Ω	RO2N
GREEN2	62	TC+ 24	17		RO2P
GREEN3	63				
GREEN4	40				
GREEN5	41	TCLK- 23	19	100Ω	ROCLKN
GREEN6	42	TCLK+ 22	20		ROCLKP
GREEN7	44				
GREEN8	45	TD- 21	22	100Ω	RO3N
GREEN9	46	TD+ 20	23		RO3P
BLUE0	9				
BLUE1	11	TE- 19	24	100Ω	RO4N
BLUE2	64	TE+ 18	25		RO4P
BLUE3	1				
BLUE4	48		7		**JEIDA** / VESA
BLUE5	49				
BLUE6	50				
BLUE7	52				
BLUE8	53				
BLUE9	54				
Hsync	55				
Vsync	57		Vcc		LCM Module
Data Enable	58				
CLOCK	12				

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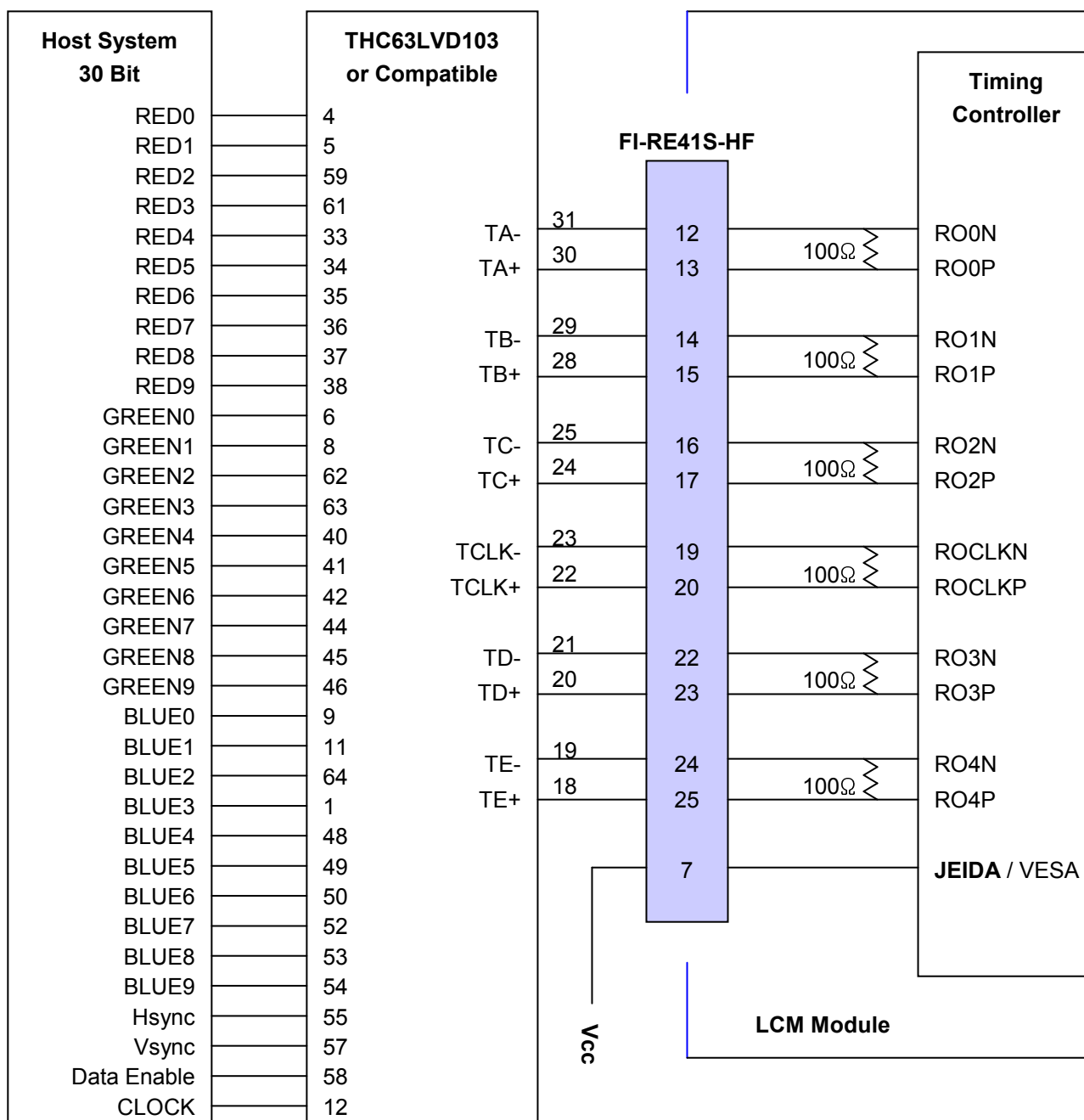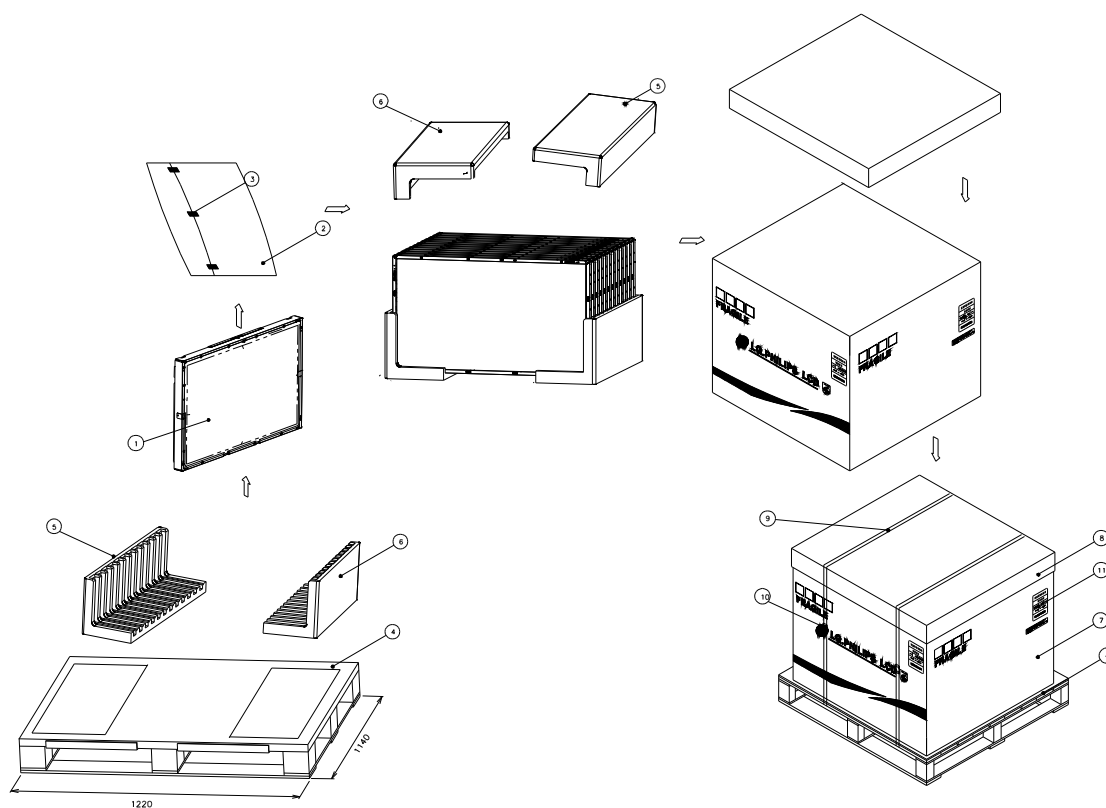   2. Refer to LVDS Transmitter Data Sheet for detail descriptions. (THC63LVD103 or Compatible)
   3. '9' means MSB and '0' means LSB at R,G,B pixel data.

APPENDIX- II

■ Pallet Ass'y

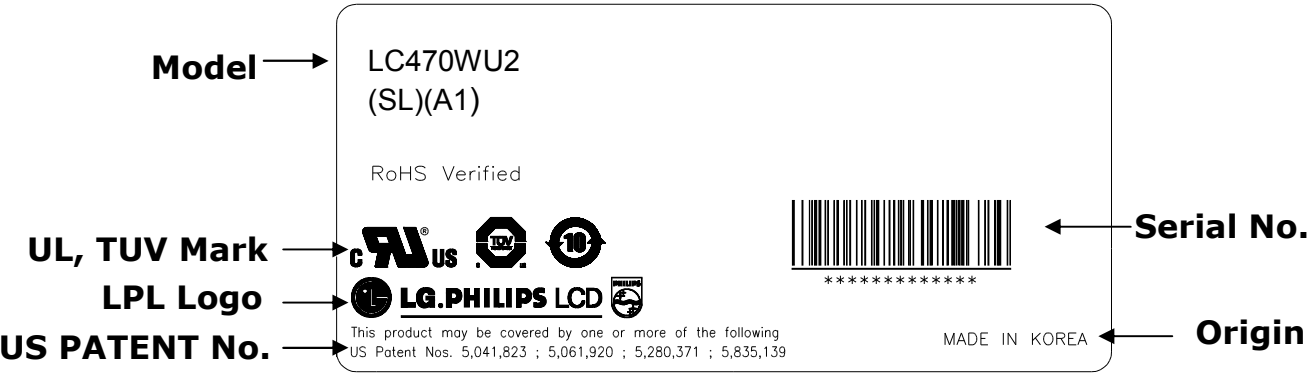| NO.	DESCRIPTION	MATERIAL
1	LCD Module	
2	BAG	47INCH
3	TAPE	MASKING 20MM X 50M
4	PALLET	PAPER 1220X1140X138MM
5	PACKING	EPS
6	PACKING	EPS
7	ANGLE PACKING	PAPER
8	ANGLE COVER	PAPER
9	BAND,CLIP	STEEL
10	BAND	PP
11	LABEL	YUPO PAPER 80G 100X100

Product Specification

APPENDIX- III

■ LCM Label

Model → LC470WU2
(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

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

Product Specification
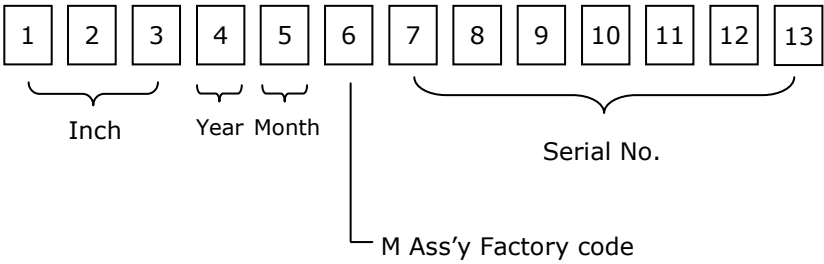
APPENDIX- Ⅳ

■ Pallet Label

LC470WU2

SLA1

| 12 PCS | 001/01−01 |

REMARK

| MADE IN KOREA | RoHS Verified |

| ‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖ |
| ************* *** |