SPECIFICATION
FOR
APPROVAL

(   )   Preliminary Specification

(●)   Final Specification

Title	42.0" WXGA TFT LCD

BUYER	General
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LC420WX6
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. S Baek / G. Manager	
REVIEWED BY	
D. S Kim / Manager	
PREPARED BY	
Y. J Heo / Engineer	

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

CONTENTS

RECORD OF REVISIONS

Revision No.	Revision Date	Page	Description
0.0	Sep,14, 2006	-	Preliminary Specification(First Draft)
	Sep, 22,2006	19	Change surface Luminance(400→360)
	Oct, 27, 2006	17	Change Contrast Ratio Minimum value (800→700)
		4,22	Update mechanical characteristics
		23.24	Change mechanic drawing
		26	Update International Standards for Safety
		7	Update Electrical characteristics
0.1	Nov, 22, 2006	17	Update Optical characteristics and Notes(C/R minimum value, notes, Surface Luminance Minimum value)
		5	Change the operation/storage Temperature
1.0	Dec, 15, 2006	7	Update power consumption
			Final Specification
1.1	Jan, 23, 2007	17	Change the Power sequence(T1 min value 1.0ms→0.5ms)

1. General Description

The LC420WX6 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 type display operating in the normally black mode. It has a 42.0 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.
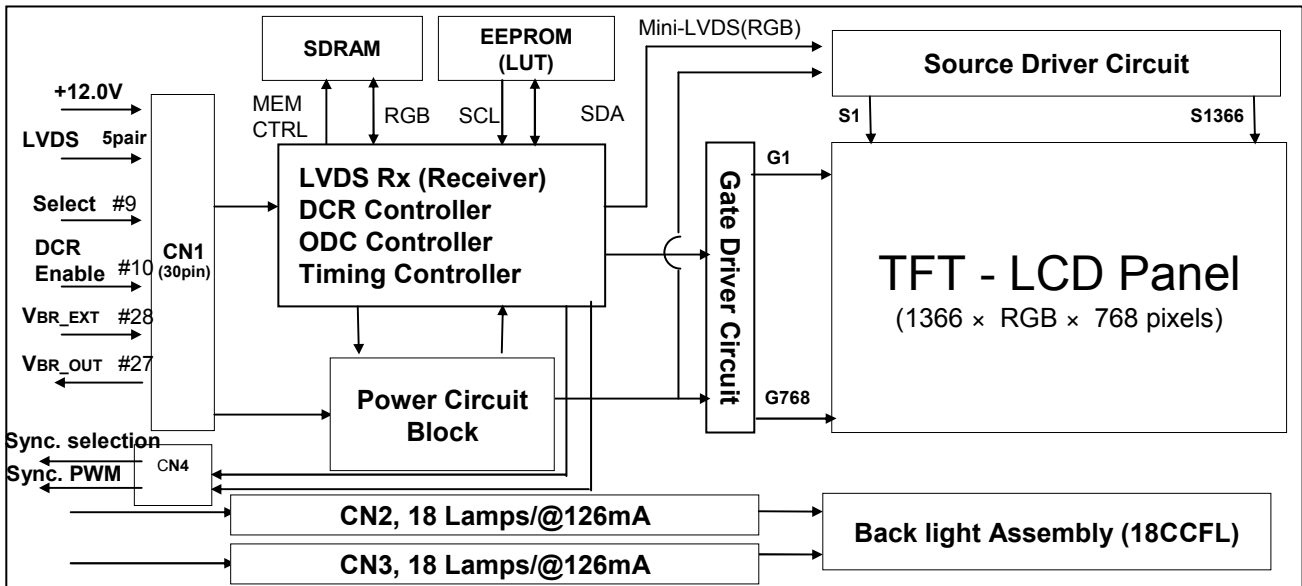
General Features

Active Screen Size	42.02 inches(1067.308mm) diagonal
Outline Dimension	983 mm(H) x 576 mm(V) x 47.3 mm(D) (Typ.)
Pixel Pitch	0.227mm x 0.681mm x RGB
Pixel Format	1366 horiz. by 768 vert. Pixels RGB stripe arrangement
Color Depth	8-bit, 16.7 M colors
Luminance, White	450 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 168.36W (Typ.) (Logic=6.36W, Backlight=162W @ with inverter)
Weight	11.0 Kg (Typ.), 12.0(Max.)
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.

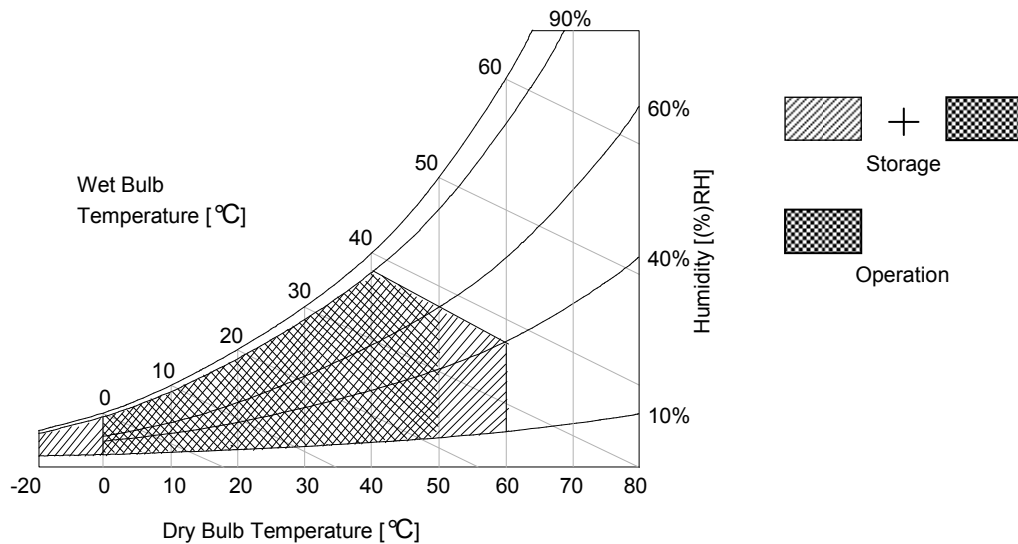**Table 1. ABSOLUTE MAXIMUM RATINGS**

Parameter		Symbol	Value		Unit	Remark
			Min	Max		
Power Input Voltage	LCD circuit	V_{LCD}	-0.3	+14.0	V_{DC}	at 25 ± 2 ℃
Operating Temperature		T_{OP}	0	+50	℃	Note 1,2
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

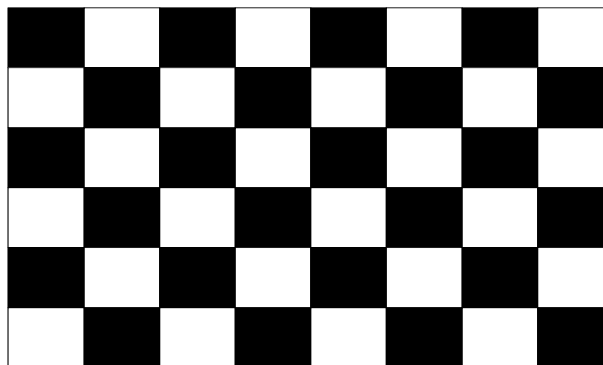### 3-1. Electrical Characteristics

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

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}	-	530	689	mA	1
		-	600	780	mA	2
Power Consumption	P_{LCD}		6.36	8.27	Watt	1
Rush current	I_{RUSH}	-	-	3.0	A	3

Note : 1. The specified current and power consumption are under the V_{LCD}=12.0V, $25 \pm 2°C$, 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)

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Table 3. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
Backlight Assembly						
Operating Voltage	Vop	1070	1360	1510	V_{RMS}	1, 2
	Iop	90	126	135	mA_{RMS}	1
Established Starting Voltage	Vs			1950	V_{RMS}	1, 3
Operating Frequency	fBL	60	65	70	kHz	4
Discharge Stabilization Time	Ts			3	Min	1, 5
Striking Time	Tk	1			sec	3
Power Consumption	PBL		162		Watt	6
C ballaster	Cb	14.25	15	15.75	pF	9
Burst Dimming Duty	Duty	20		100	%	10
Life Time		50,000			Hrs	7

Note : The design of the inverter must have specifications for the lamp in LCD Assembly.
   The electrical characteristic of inverter is based on High-High Driving type
   The performance of the Lamp in LCM, for example life time or brightness, is extremely influenced by
   the characteristics of the DC-AC inverter. So all the parameters of an inverter should be carefully
   designed so as not to produce too much leakage current from high-voltage output of the inverter.
   When you design or order the inverter, please make sure unwanted lighting caused by the mismatch
   of the lamp and the inverter (no lighting, flicker, etc) never occurs. When you confirm it, the LCD–
   Assembly should be operated in the same condition as installed in you instrument.
※ Do not attach a conducting tape to lamp connecting wire.
   If the lamp wire attach to a conducting tape, TFT-LCD Module has a low luminance and the inverter
   has abnormal action.Because leakage current is occurred between lamp wire and conducting tape.

1. Specified values are for a Backlight Assembly.
2. Operating voltage is measured at $25 \pm 2°C$. The variance of the voltage is $\pm$ 10%.
3. The voltage above V_S should be applied to the lamps for more than 1 second for start-up.
   (Inverter open voltage must be more than established starting voltage.
   Otherwise, the lamps may not be turned on. The used lamp current is typical value.
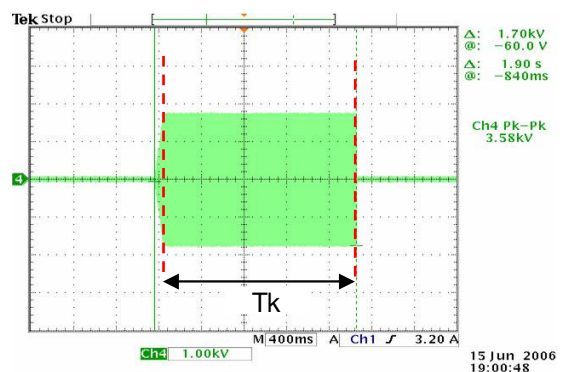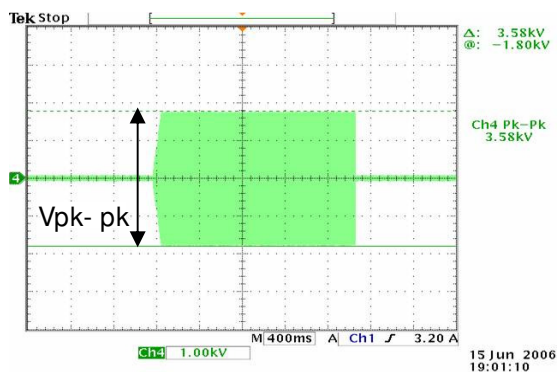
$$Vs = (Vpk\text{-}pk) / [2*root(2)]$$

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

5. The brightness of the lamp after lighted for 5minutes is defined as 100%.
 T_S is the time required for the brightness of the center of the lamp to be not less than 95% at typical current
 The screen of LCD module may be partially dark by the time the brightness of lamp is stable after turn on.

6. Max of power consumption is measured at initial turn on.
 Typical of power consumption is measured after 2hrs aging at 25 ± 2℃.

7. The life is determined as the time at which brightness of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25 ± 2℃, based on duty 100%

8. The output of the inverter must have symmetrical(negative and positive) voltage waveform and symmetrical current waveform (Unsymmetrical ratio is less than 10%). Please do not use the inverter which has unsymmetrical voltage and unsymmetrical current and spike wave.
 Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp, are following.
 It shall help increase the lamp lifetime and reduce leakage current.
 a. The asymmetry rate of the inverter waveform should be less than 10%.
 b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$.
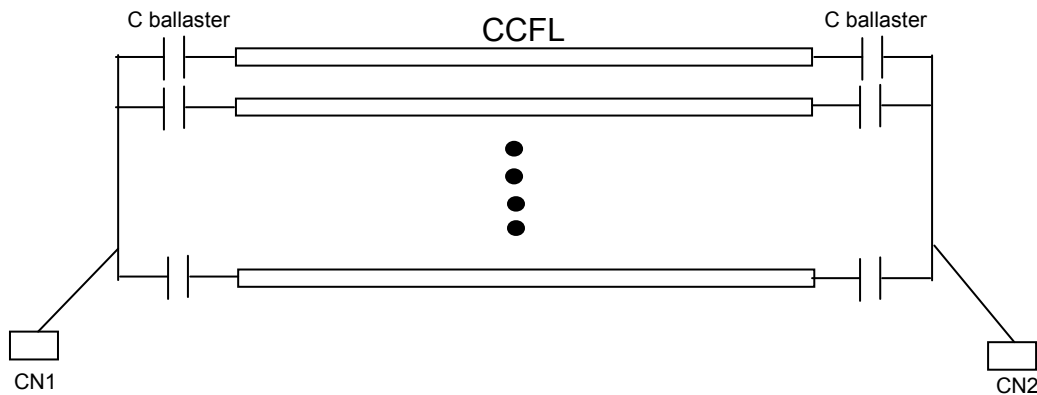 * Inverter output waveform had better be more similar to ideal sine wave.
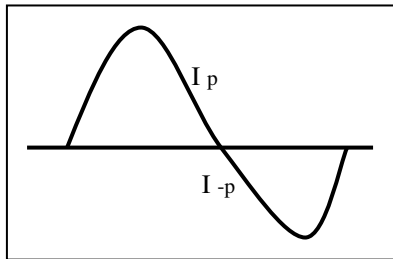
* Asymmetry rate:

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

* Distortion rate
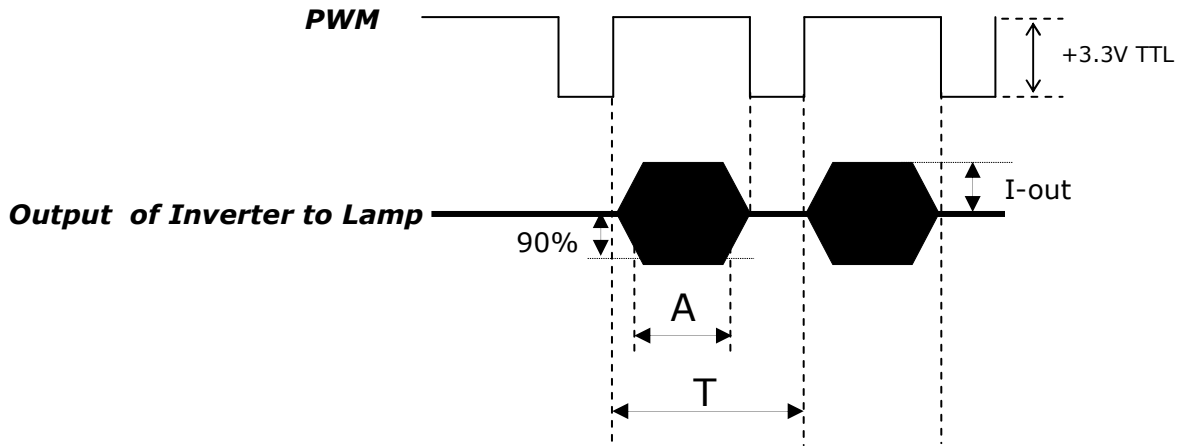
$$I_p \ (or \ I_{-p}) / I_{op}$$

9.C ballaster is as following.

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10. The reference method of burst dimming duty ratio.
   Need the Synchronous V-sync frequency for prevent waterfall(Vsync x 3 =Burst Frequency)

PWM

+3.3V TTL

Output of Inverter to Lamp

I-out

90%

A

T

Point A : rising time 90% of Iout point .

Point B : falling starting point .

I out duty = { A/T } * 100

PWM Frequency = 1/T

※ Dimming current output rising and falling time may produce humming and inverter trans sound noise.
※ Burst dimming duty should be 100% for 1second after turn on
※ **Equipment**
   Oscilloscope :TDS3054B(Tektronix)
   Current Probe : P6022 AC (Tektronix)
   High Voltage Probe: P5100(Tektronix)

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3-2. Interface Connections

This LCD module employs two kinds of interface connection, a 30-pin connector is used for the module electronics and two 3-pin Balance PCB connectors are used for the integral backlight system.
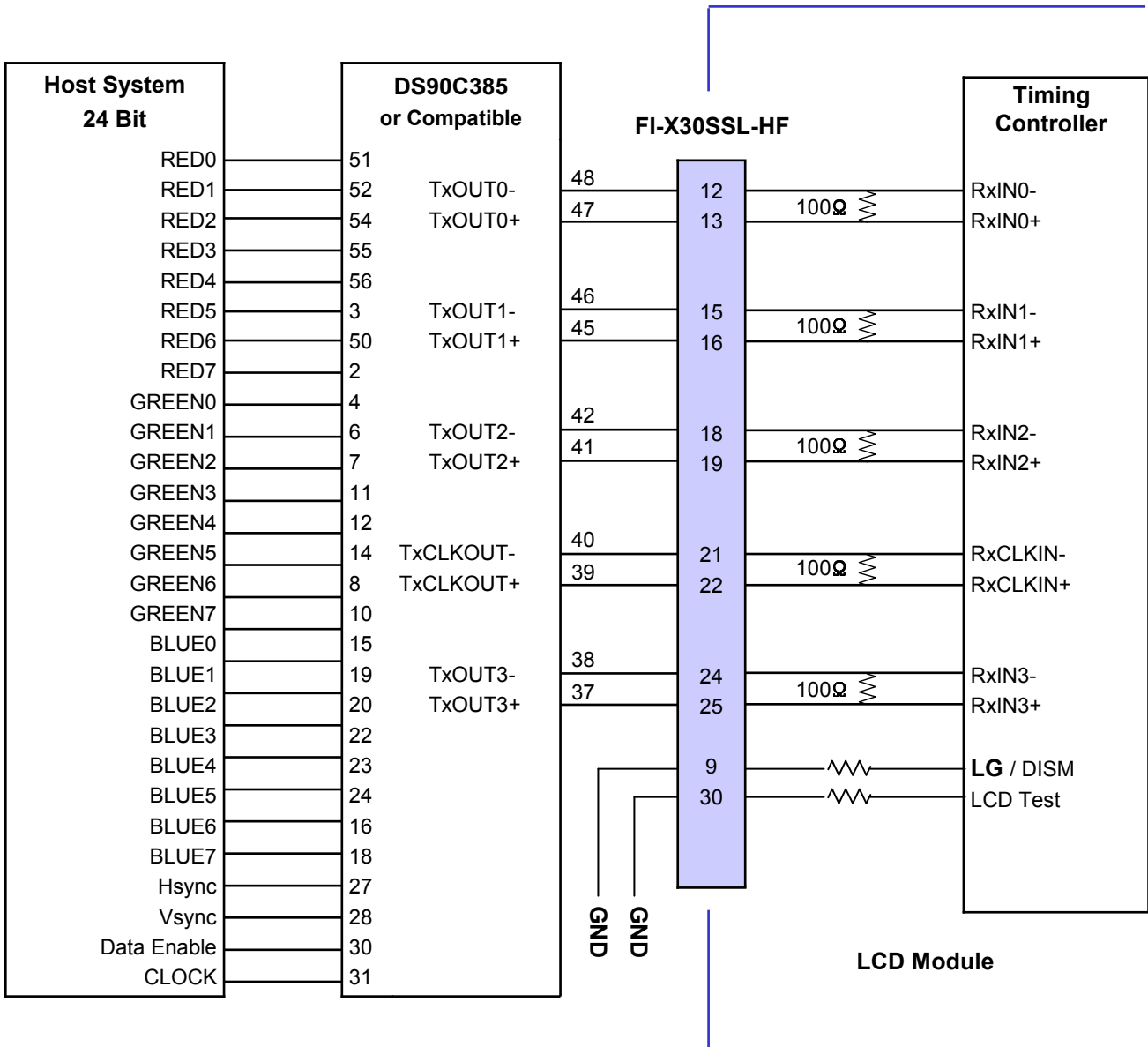
3-2-1. LCD Module

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

Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION

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

Note: 1. The pin no 9 is an option pin for DISM or LG format. (LG Format = "GND" / DISM Format ="VCC")
Please refer to page 9 and 10 for further details
2. The pin no 10 is an option pin for DCR Function (Enable = "VCC" / Disable ="GND")
3. The pin no 30 is LCD Test option.
LCM operates "AGP" (Auto Generation Pattern) or "NSB" (No Signal Black) is case that LVDS signals are out of frequency or abnormal condition in spite of 12 volt power supply.
LPL recommends "NSB". (AGP : "VCC" or "OPEN" / NSB : "GND")
4. All GND (ground) pins should be connected together, which should be also connected to the LCD module's metal frame.
5. All VLCD (power input) pins should be connected together.
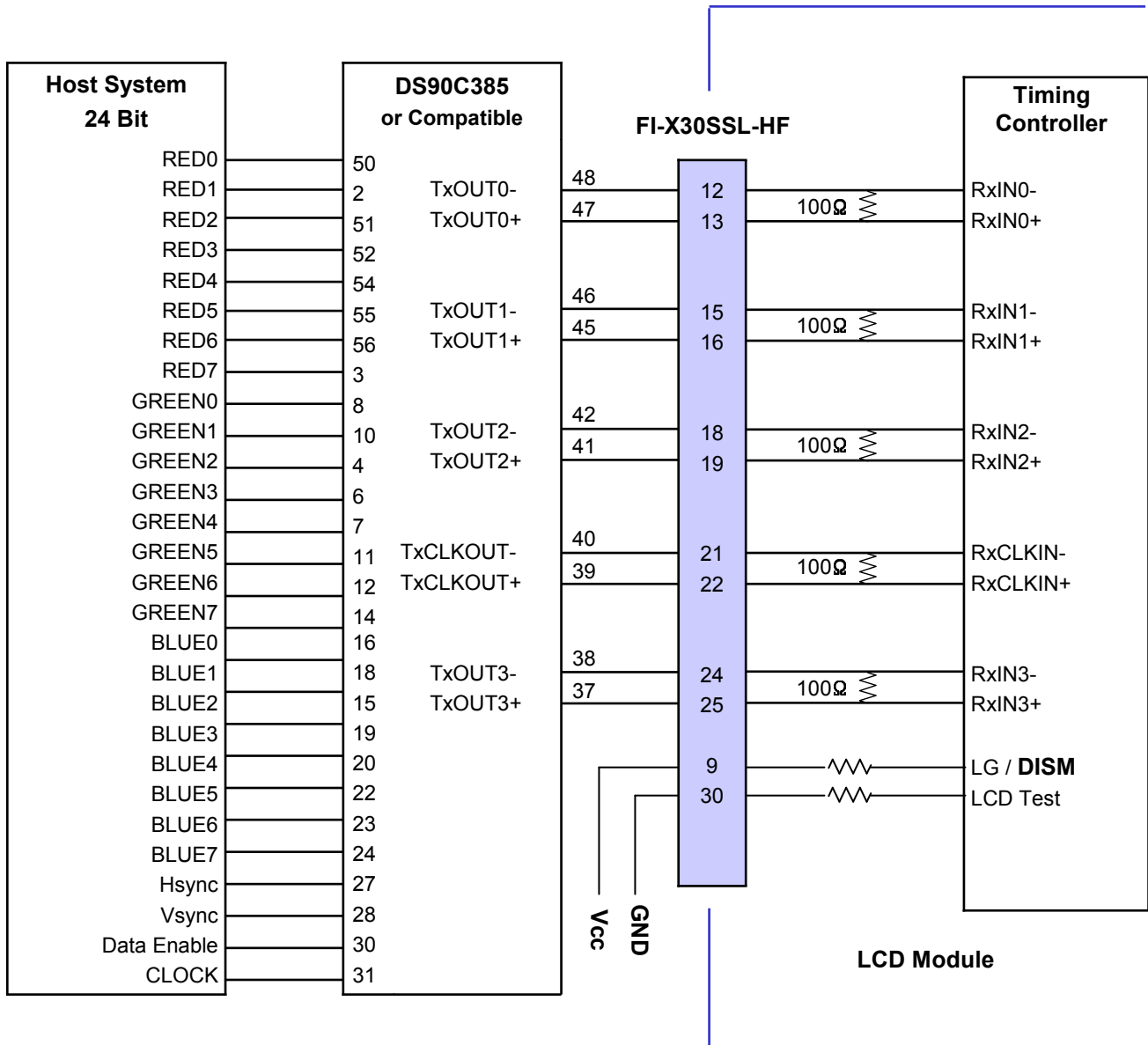6. Input Levels of LVDS signals are based on the IEA 664 Standard.

Table 5. REQUIRED SIGNAL ASSIGNMENT FOR LVDS TRANSMITTER (Pin9="L")

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

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Table 7. BACKLIGHT CONNECTOR PIN CONFIGURATION(CN2,CN3)

The backlight interface connector is a model 65002WS-03(CN2/CN3) manufactured by YEONHO.
The mating connector part number are 65002HS-03(3 pin) or equivalent. The pin configuration for the
connector is shown in the table below.

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

◆ Rear view of LCM

Master   **Slave**
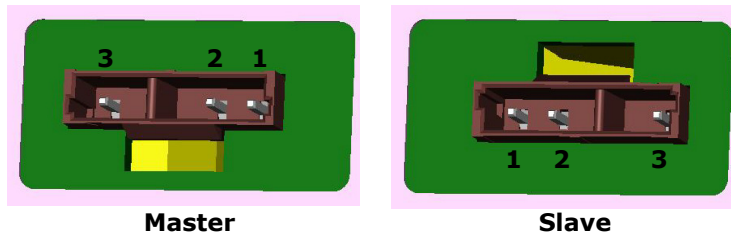
1. Connector
   1) Balance Connector
      : 65002WS-03 (YEONHO)
   2) Mating Connector
      : 65002HS-03 (YEONHO) or equivalant.

Table 8. INVERTER SYNC. CONNECTOR PIN CONFIGURATION(CN4)

There are 4 pins in the inverter for sync_connector. The No.1 pin is for REFMODE which is selected of
Vsync frequency signal. The No.2 pin is for WPWM which s generated for PWM frequency synchronically
between control & inverter. The rest pins are for Ground and NC.
The pin configuration for the connector is show in the table below.

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

LCD Module Control PCB

1   4
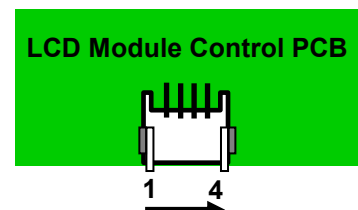
Notes:
1. LPL recommends that Inverter Burst dimming frequency (PWM Frequency) should be synchronized
   with Sync signal.
2. LPL recommends that Inverter Burst dimming frequency (PWM Frequency) should be 150Hz or
   180Hz.

3-3. Signal Timing Specifications

Table 9 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.

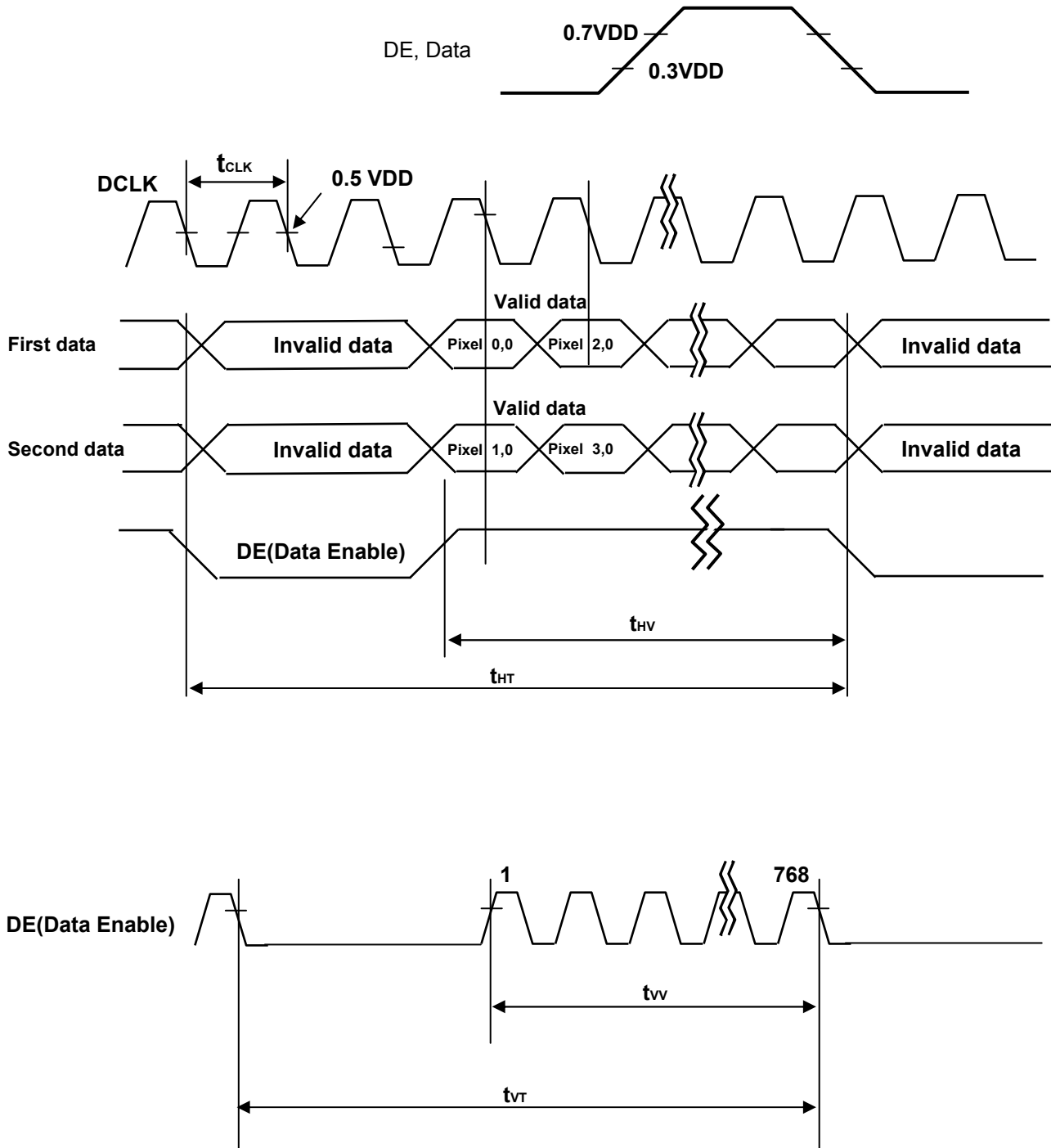**Table 9. TIMING TABLE for NTSC &PAL**

[DE (Data Enable) Only]

ITEM	Symbol		Min	Typ	Max	Unit	Note
	Frequency	f_{CLK}	63	72.3	82	MHz	
Hsync	Frequency	f_H	39	47.4	53	KHz	
	Display Valid	t_{HV}	1366	1366	1366	Clks	
	Blank	tHT- tHV	80	162	474	Clks	
	Total	tHT	1446	1528	1840	Clks	
Vsync	Frequency	f_H	47	60	63	Hz	
	Display Valid	t_{HV}	768	768	768	Clks	Note 1)
	Blank	tHT- tHV	7	22	295	Clks	PAL : 47~53Hz
	Total	tHT	775	790	1063	Clks	NTSC : 57~63Hz

Note :
1. The input of HSYNC & VSYNC signal does not have an effect on normal operation(DE Only Mode). If you use spread spectrum of 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

DE, Data

0.7VDD

0.3VDD

DCLK

t_{CLK}

0.5 VDD

First data

Invalid data   **Pixel 0,0** **Pixel 2,0**   **Valid data**   **Invalid data**

Second data

Invalid data   **Pixel 1,0** **Pixel 3,0**   **Valid data**   **Invalid data**

DE(Data Enable)

t_{HV}

t_{HT}

DE(Data Enable)

1   768

t_{VV}

t_{VT}

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3-5. Color Data Reference

The brightness of each primary color(red,green,blue) is based on the 8-bit gray scale data input for the color. The higher binary input, the brighter the color. Table 10 provides a reference for color versus data input.

Table 10. 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

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3-6. Power Sequence

3-6-1. LCD Driving circuit
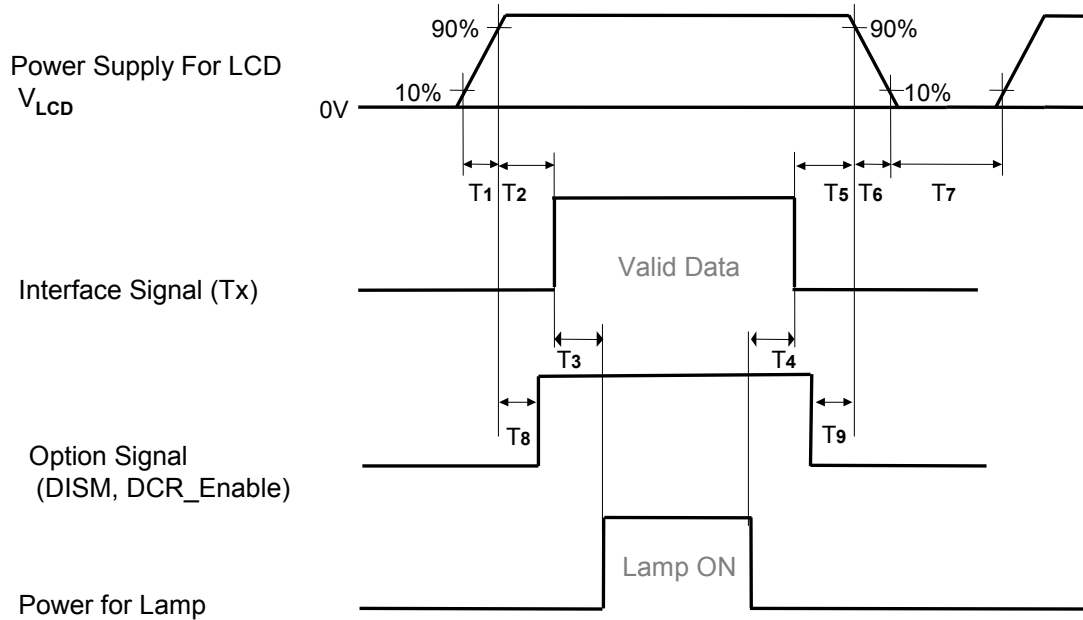
Table 11. POWER SEQUENCE

Parameter	Value			Unit
	Min	Typ	Max	
T1	0.5	-	20	ms
T2	5.0	-	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 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.

Product Specification

4. Optical Specification

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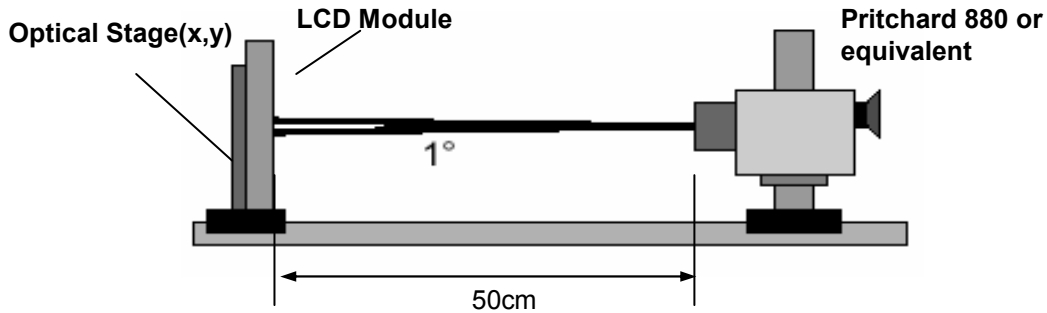
FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 13. OPTICAL CHARACTERISTICS   Ta= 25± 2 ℃, V$_{LCD}$=12.0V, fv=60Hz, Dclk=72.4MHz, I$_{BL}$=126mA$_{rms}$

Parameter		Symbol		Value			Unit	Note
				Min	Typ	Max		
Contrast Ratio		CR		800	1000			1
		CR with DCR						
Surface Luminance, white		L$_{WH}$		400	450		cd/m^2	2
Luminance Variation		δ$_{WHITE}$	5P			1.3		3
Response Time (Gray to Gray)	Gray to Gray	G-to-G		-	5	8		
	Rise + decay	Tr$_{R +}$Tr$_D$			10	14		
Color Coordinates [CIE1931]	RED	Rx			0.635			
		Ry			0.344			
	GREEN	Gx			0.286			
		Gy		Typ -0.03	0.614	Typ +0.03		
	BLUE	Bx			0.146			
		By			0.061			
	WHITE	Wx			0.279			
		Wy			0.292			
Viewing Angle (CR>10)								
	x axis, right(φ=0°)	θr		85	89	-		
	x axis, left (φ=180°)	θl		85	89	-	degree	5
	y axis, up (φ=90°)	θu		85	89	-		
	y axis, down (φ=270°)	θd		85	89	-		
Gray Scale		Without DCR			2.2	-		6
		With DCR						

Product Specification

Note : 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 are determined after the unit has been 'ON' and 30min after lighting the backlight in a dark environment at 25± 2℃. Surface luminance is the luminance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see the FIG. 2.

3. The variation in surface luminance , δ WHITE is defined as :

δ WHITE(5P) = Maximum($L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}$) / Minimum($L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}$)

Where L_{on1} to L_{on5} are the luminance with all pixels displaying white at 5 locations . For more information, see the FIG. 2.

4. Response time is the time required for the display to transition from G(N) to G(M) (Rise Time, Tr_R) and from G(M) to G(N) (Decay Time, Tr_D). For additional information see the FIG. 3. (N<M)

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

6. Gray scale specification
Gamma Value is approximately 2.2. For more information, see the Table 13.

Table 13. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ)
L0	0.11
L15	0.19
L31	1.08
L47	2.07
L63	4.51
L79	7.75
L95	12.05
L111	17.06
L127	22.36
L143	28.21
L159	35.56
L175	43.96
L191	53.00
L207	63.37
L223	74.66
L239	88.17
L255	100

Measuring point for surface luminance & measuring point for luminance variation

A : H / 4 mm
B : V / 4 mm
H : 930.25 mm
V : 523.01 mm
@ H,V : Active Area
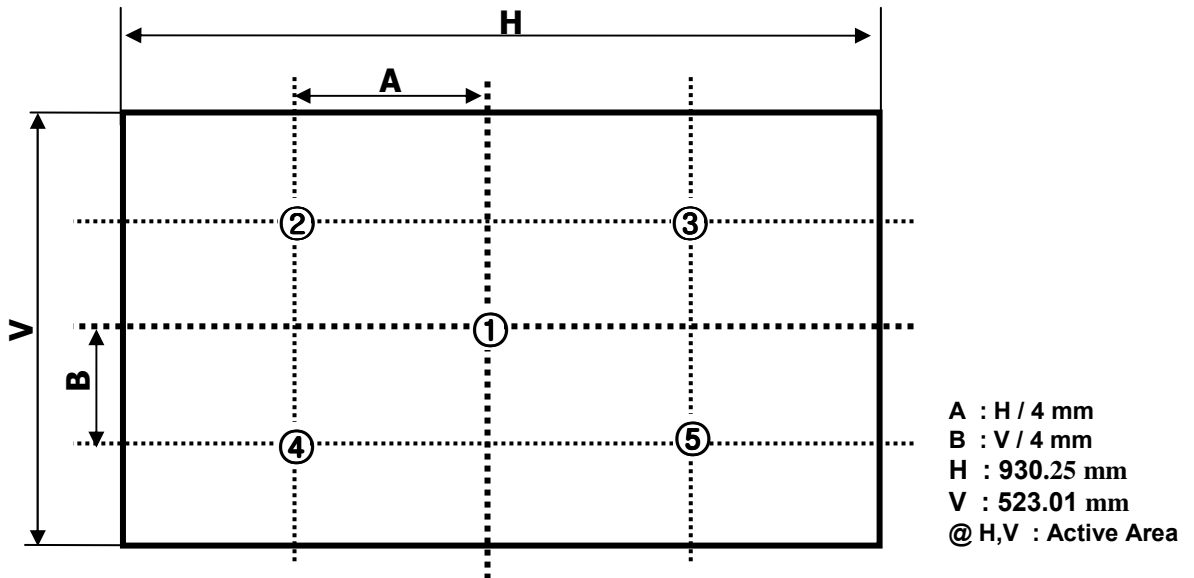
FIG.2 Measure Point for Luminance

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Gray(M)".
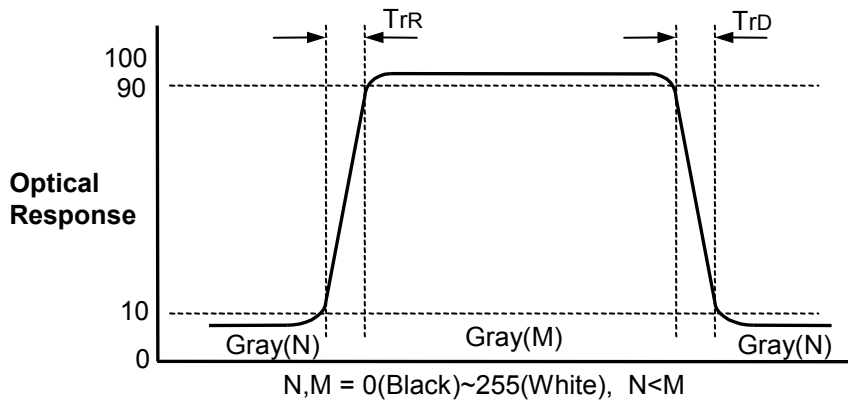
N,M = 0(Black)~255(White), N<M

FIG.3 Response Time

Dimension of viewing angle range
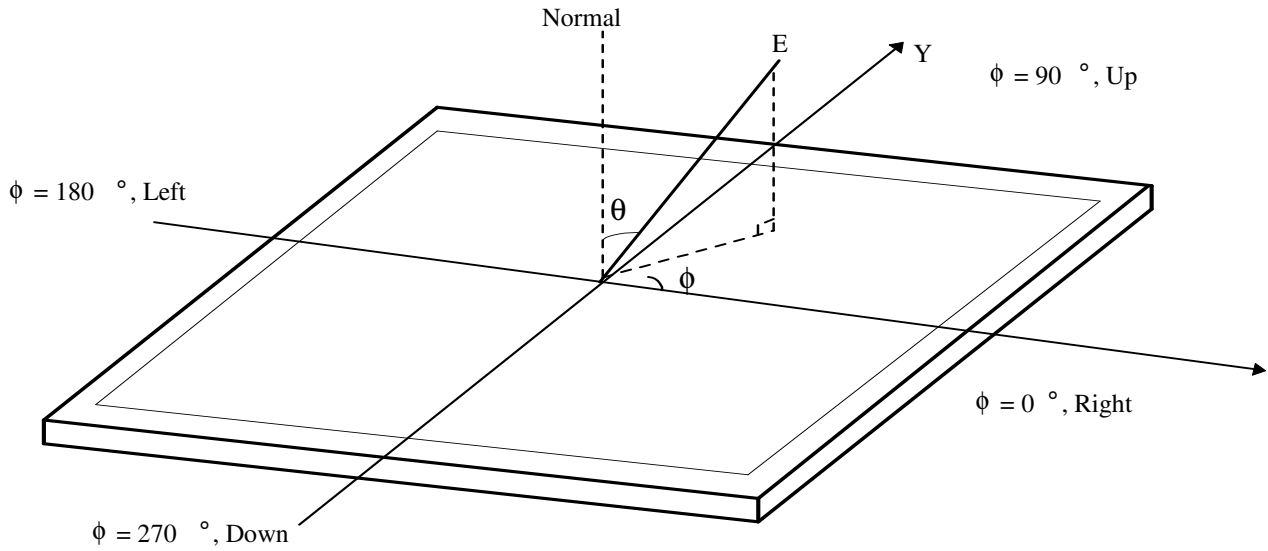
FIG.4 Viewing Angle

5. Mechanical Characteristics

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

Table 15. MECHANICAL CHARACTERISTICS

Item	Value	
Outline Dimension	Horizontal	983.0 mm
	Vertical	576.0 mm
	Depth	47.3 mm
Bezel Area	Horizontal	939.0 mm
	Vertical	531.0 mm
Active Display Area	Horizontal	930.25 mm
	Vertical	523.01 mm
Weight	11.0 Kg (Typ.) , 12.0 Kg (Max.)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer (Haze 13%)	

Note : 1.Please refer to a mechanic drawing in terms of tolerance at the next page.

Product Specification

<FRONT VIEW>
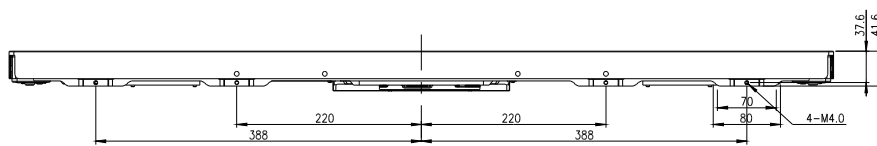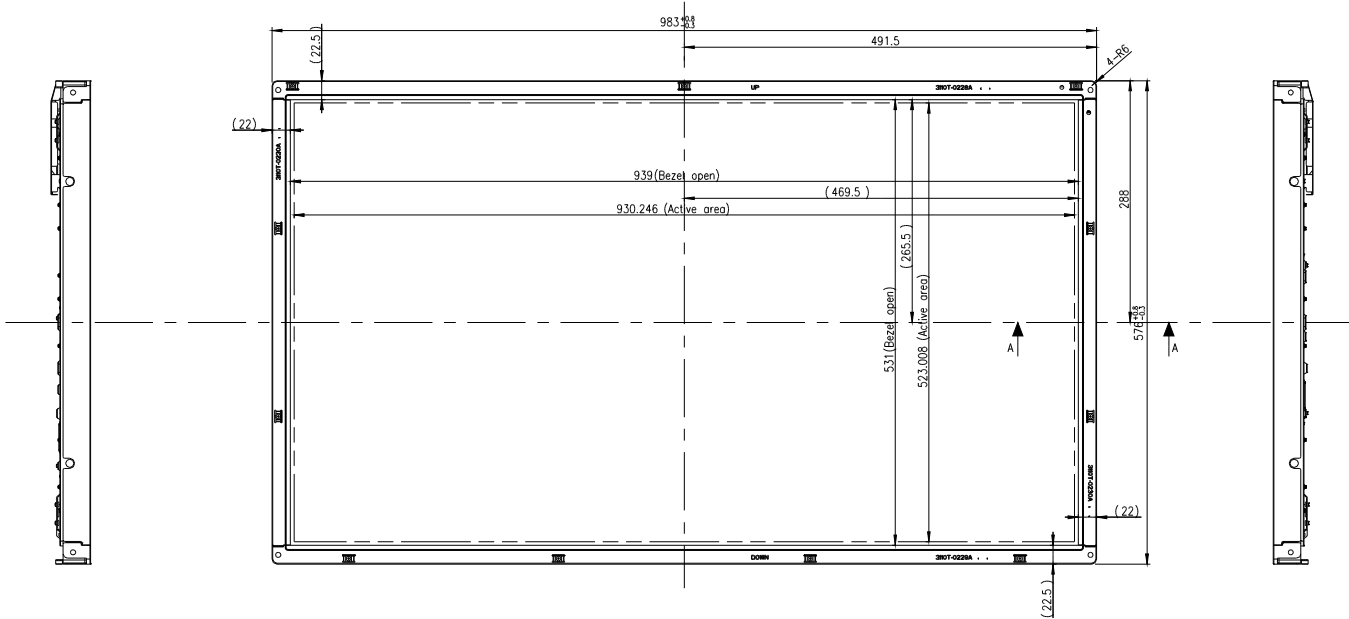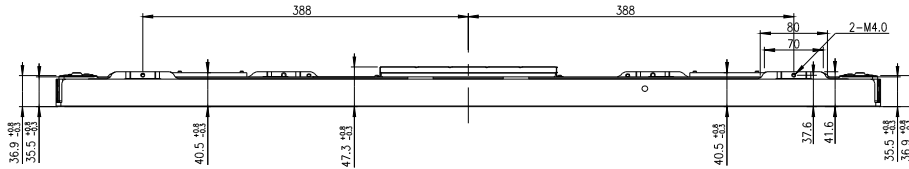
NOTES
1. UNSPECIFIED DIMENSIONAL TOLERANCES TO BE ±0.5mm.
2. TILT AND A PARTIAL DISPOSITION TOLERANCE OF DISPLAY AREA ARE AS FOLLOW.
   1) X-DIRECTION : |A-B| < 1.5mm
   2) Y-DIRECTION : |C-D| < 1.5mm

SECTION A-A
SCALE 1/1
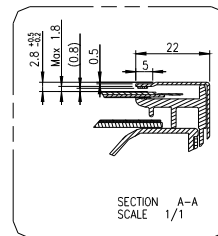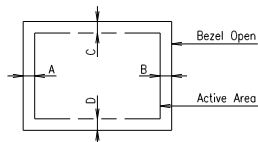
Product Specification

<REAR VIEW>

6. Reliability

Table 16. 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= 40℃　50%RH　240h
4	Low temperature operation test	Ta= 0℃　240h
5	Vibration test (operating)	Wave form : random Vibration level : 1.0Grms Bandwidth : 10-300Hz Duration : X,Y,Z, 30 min 　　　　One time each direction
6	Shock test (operating)	Shock level : 50Grms 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)

Product Specification

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 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 ~ M : SERIAL NO.

Note
  1. YEAR

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

  2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

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

8-2. Packing Form

a) Package quantity in one box : 12 pcs

b) Box Size :1150 mm X 1020 mm X 815 mm.

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 module 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

■LC420WX6-SLA1 – Pallet Ass'y
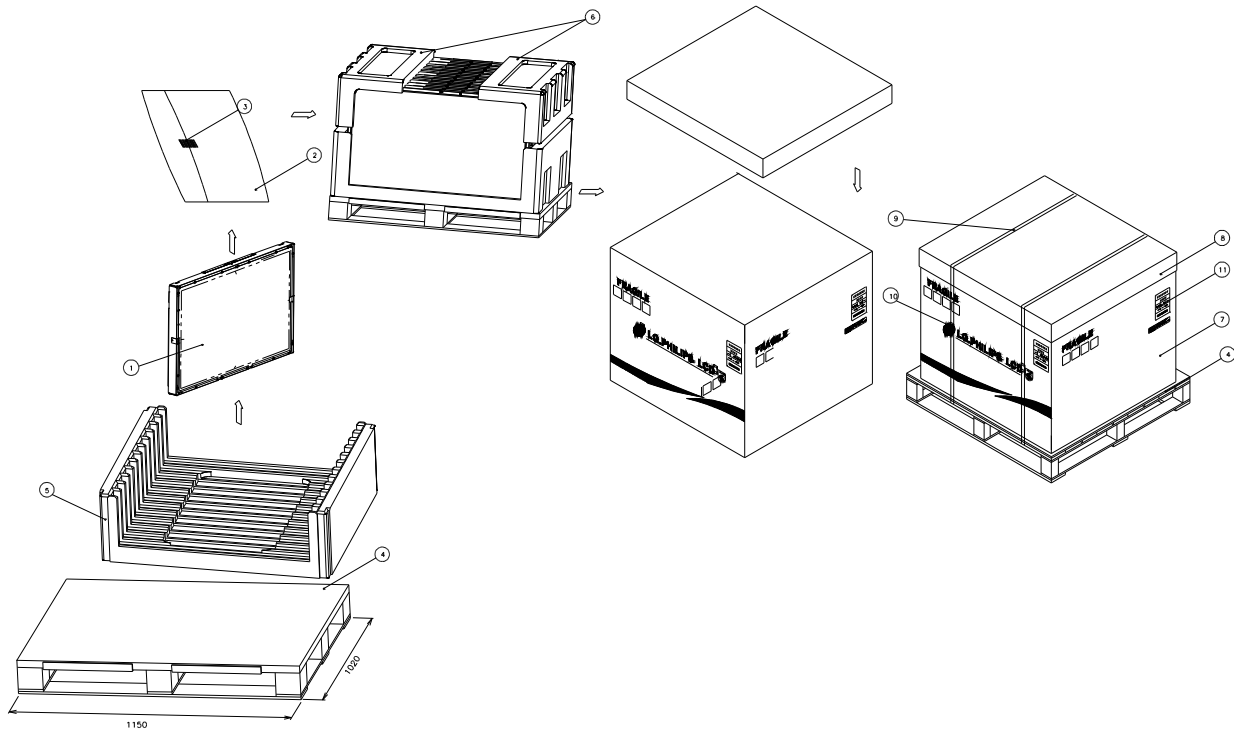
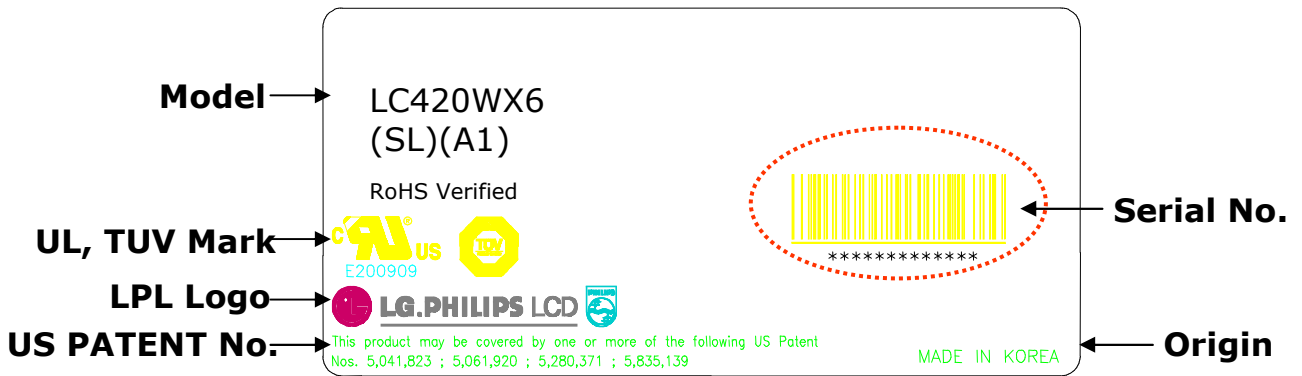| NO.	DESCRIPTION	MATERIAL
1	LCD Module	
2	BAG	42INCH
3	TAPE	MASKING 20MM X 50M
4	PALLET	PAPER 1140X1000X138MM
5	PACKING	EPS
6	PACKING	EPS
7	ANGLE PACKING	PAPER
8	ANGLE COVER	PAPER
9	BAND,CLIP	STEEL
10	BAND	PP
11	LABEL	YUPO PAPER 80G 100X100

APPENDIX- Ⅱ

■ LCM Label

Model → LC420WX6
(SL)(A1)

RoHS Verified

UL, TUV Mark → E200909

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 28page for more information)**

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

Inch — Year Month

M Ass'y Factory code

Serial No.
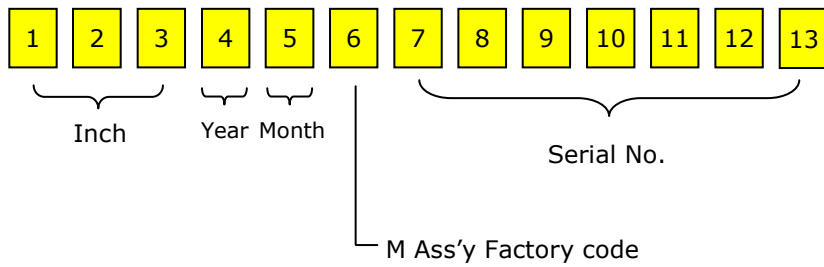
APPENDIX- Ⅲ

■ Pallet Label

LC420WX6
SLA1

12 PCS	001/01-01

REMARK

MADE IN KOREA	RoHS Verified

*************   ***