

CUSTOMER APPROVE

SPECIFICATION
FOR
TFT-LCD MODULE
LED55E

Edition : Preliminary spec 1.0

Date of issue : 2017-03-21

Product No. : LC550EQY-SJA3_V1.0_160222

APPROVED	CHECKED	PREPARED

Revision History

Date	Rev.	Page	Old Description	New Description	Remark
2016-12-15	1.0	All	The specification was first issued		

CONTENTS

Introduction	
Revision history	
1. Scope	3
1.1 Feature	
1.2 Application	
1.3 General Specifications	
1.4 Mechanical Specifications	
2. Absolute Maximum Ratings	4
2.1 Absolute Ratings of Environment	
2.2 Electrical Absolute Ratings	
2.2.1 TFT LCD Module	
2.2.2 Backlight unit	
3. Electrical Specifications	6
3.1 TFT LCD Module	
3.2 Backlight system	
4. Block Diagram	8
4.1 TFT LCD Module	
4.2 Backlight unit	
5. Input Terminal Pin Assignment	9
5.1 TFT LCD Module	
5.2 LVDS Interface	
5.3 Colors Data Input Assignment	
6. Interface Timing	12
6.1 Input Signal Timing Specification	
6.2 Power on/off Sequence	
7. Optical Characteristics	15
7.1 Test Condition	
7.2 Optical Characteristics	
7.3 Flicker Adjustment	
8. Labels	19
8.1 Panel Label	
8.2 Caution Labels	
9. Packaging	20
9.1 Carton(internal package)	
9.2 Pakaging Mark	
10. Precaution	21
10.1 Assembly and handling precaution	
10.2 Safety precaution	
11. Outline dimension	22

1.Scope

This specifications is applicable to 55E" diagonal module : "LED55E" designed for TFT LCD TV.

1.1 Features

- Super Wide viewing angle
- Super High contrast ratio
- Super Fast response time
- High color saturation
- DE(Data Enable) only mode
- LVDS Interface
- RoHS compliance

1.2 Application

TFT LCD TV
Multi-Media Display

1.3 General Specifications

Item	Specifications	Unit	Note
Driving Method	a-Si TFT active matrix		Note 1
Active Screen Size	1387.8	mm	
Bezel opening area	1225.2 (W) x 696.7(H) x 1.3(D) Typ	mm	
Number of Pixels	3840×2160	pixel	
Pixel Pitch	0.315(H) x 0.315(V)	mm	
Pixel Arrangement	RGB Vertical Stripe		
Transmissive Mode	Normally Black		
Surface Treatment	Anti-Glare coating Hardness (3H)		Haze=1%
Display Colors	16.7M	color	

1.4 Mechanical Specification

Item		Min	Typ	Max	Unit	Note
Weight		-0.5	TBD	0.5	Kg	-
Module Size	Horizontal(H)	(TYP)-0.5	1238	(TYP)+0.5	mm	1
	Vertical (V)		716.9		mm	
	Depth(D)		26.0		mm	

Note 1: Please refer to the "outline dimension" for more information of back and front outline dimensions.

2. Absolute Maximum Ratings

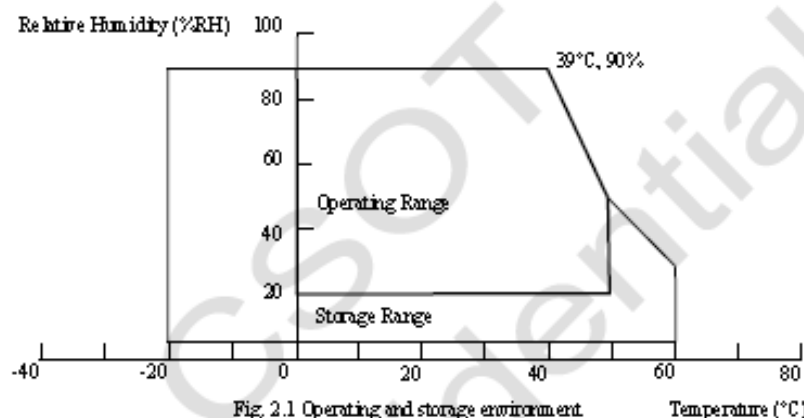
2.1 Absolute Ratings of Environment

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

Item	Symbol	Value		Unit
		Min.	Max.	
Power Supply Voltage	V_{CC}	-0.3	13.8	V
Input Signal Voltage	V_{IN}	-0.3	3.6	V

2.2 Environment Requirement (Based on C SOT's BLU)

(1) Temperature and relative humidity range are shown as below.



(a) 90%RH maximum ($T_a \leq 39^\circ\text{C}$).

(b) Wet-bulb temperature should be 39°C maximum ($T_a > 39^\circ\text{C}$).

(c) No condensation.

(2) The storage temperature is between -20°C to 60°C , and the operating ambient temperature is between 0°C to 50°C

The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65°C with LCD module in a temperature controlled chamber alone. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65°C . The range of operating temperature may degrade in case of improper thermal management in the end product design.

(3) The rating of environment is based on LCD module. Leave LCD cell alone, this environment condition can't be guaranteed. Except LCD cell, the customer has to consider the ability of other parts of LCD module and LCD module process.

2.3 Absolute Ratings of Environment (Open Cell)

When storing open cell as spares for a long time, please follow the precaution instructions:

- (1) Do not store the module in high temperature and high humidity for a long time. It is highly recommended to store the module with temperature from 20°C to 30°C in normal humidity ($50 \pm 10\%$ RH) with shipping package.
- (2) The open cell should be kept within one month shelf life.

2.2 Electrical Absolute Ratings

2.2.1 TFT LCD MODULE

Item	Symbol	Min	Max	Unit	Note 1
Power Supply Module	VCC	10.8	13.2	V	Note 1

Note 1: Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

2.2.2 Backlight Unit

Item	Symbol	Value		Unit	Note
		Min	Max		
Single LightBar Voltage	VL	—	125.4	V	Note 1,2
Single LightBar Current	IL	—	960	mA	

Note 1: Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under normal operating conditions.

Note 2: Specified values are for input of LED lightbar at $T_a=25 \pm 2 \text{ }^\circ\text{C}$
(Refer to 3.2 for further Information).

3. Electrical Specifications

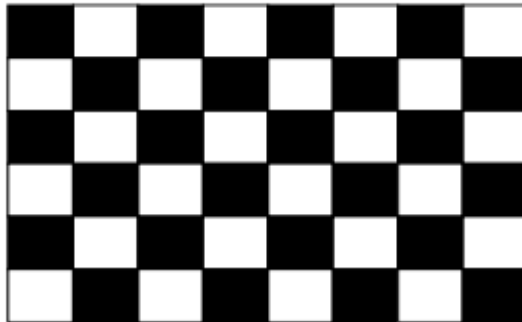
3-1. Electrical Characteristics

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V _{LCD}	10.8	12.0	13.2	V _{DC}	
Power Input Current	I _{LCD}	-	1380	1795	mA	1
		-	1850	2405	mA	2
T-CON Option	Input High Voltage	V _{IH}	2.7	-	3.6	V _{DC}
Selection Voltage	Input Low Voltage	V _{IL}	0	-	0.7	V _{DC}
Power Consumption	P _{LCD}	-	16.6	21.5	Watt	1
Rush current	I _{RUSH}	-	-	10	A	3

- Note
1. The specified current and power consumption are under the V_{LCD}=12.0V, Ta=25 ± 2°C, f_v=60Hz condition, and 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 0.5ms (min.).
 4. Ripple voltage level is recommended under ±5% of typical voltage

White : 1023 Gray
 Black : 0 Gray



Mosaic Pattern(8 x 6)

3.2 Backlight system

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	Remark
LightBar Voltage	V_L	114	117.8	125.4	V	Note 1
LightBar Current	I_L	—	960	1056	mA	
Power Consumption	P_{BL}	—	113	—	W	LightBar
LED Life Time	L_{BL}	30000	—	—		

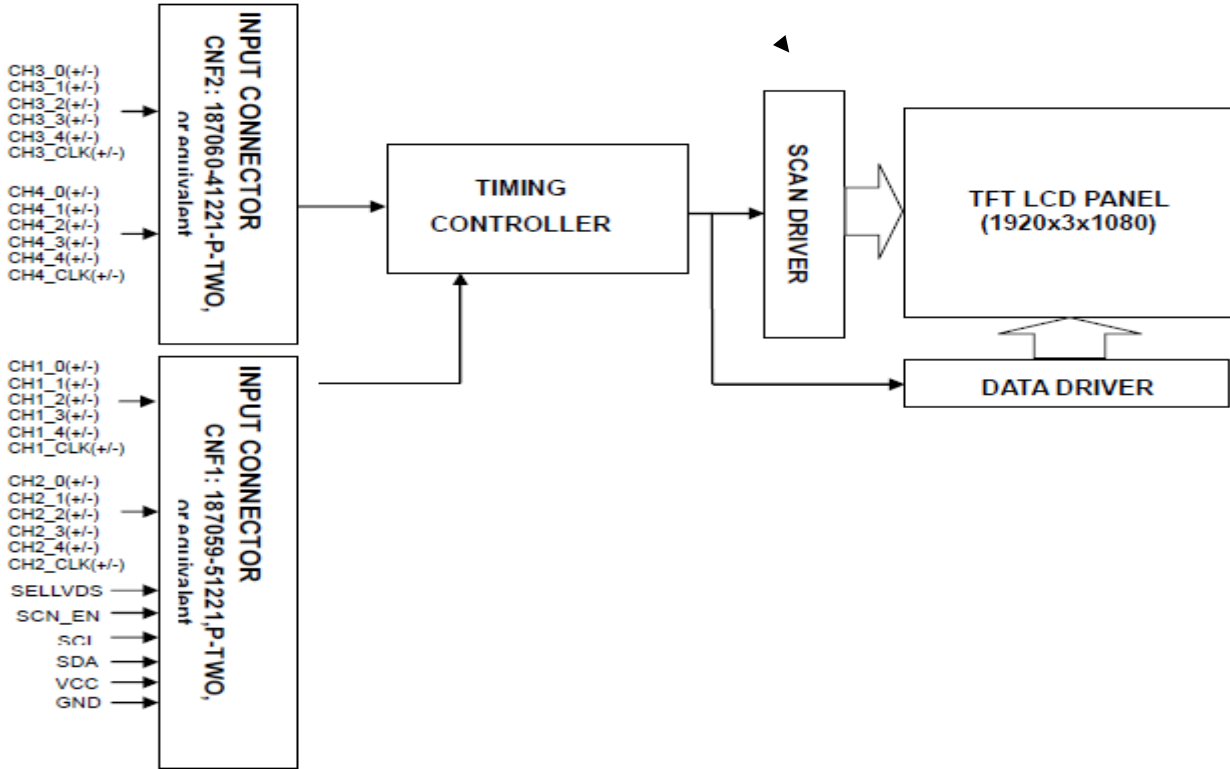
Note 1 The LED LightBar connector part No: PHR-6 (JST) or equivalent, as shown next page.

Note 2: $P_{BL} = I_L \times V_L$, The LED LightBar circuit is 19 Series,8 Parallel.

Note 3: The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ and $I = (960)\text{mA}$ (per chip) until the brightness becomes $\cong 50\%$ of its original value.

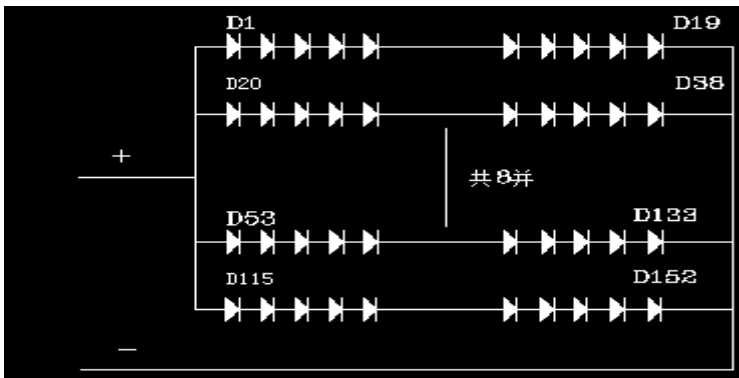
4. Block Diagram

4.1 TFT LCD Module



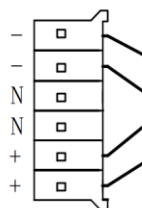
4.2 Backlight Unit

The LED LightBar Series and Parallel circuit, interface type as shown below:



19 Series, 8 Parallel

4.3 Backlight wire



5. Input Terminal Pin Assignment

5.1 TFT LCD OPEN CELL

CNF1 Connector Pin Assignment: (187059-51221,P-Two)

No	Symbol	Description	No	Symbol	Description
1	VLCD	Power Supply +12.0V	27	GND	Ground
2	VLCD	Power Supply +12.0V	28	Rx0n	V-by-One HS Data Lane 0
3	VLCD	Power Supply +12.0V	29	Rx0p	V-by-One HS Data Lane 0
4	VLCD	Power Supply +12.0V	30	GND	Ground
5	VLCD	Power Supply +12.0V	31	Rx1n	V-by-One HS Data Lane 1
6	VLCD	Power Supply +12.0V	32	Rx1p	V-by-One HS Data Lane 1
7	VLCD	Power Supply +12.0V	33	GND	Ground
8	VLCD	Power Supply +12.0V	34	Rx2n	V-by-One HS Data Lane 2
9	NC	NO CONNECTION	35	Rx2p	V-by-One HS Data Lane 2
10	GND	Ground	36	GND	Ground
11	GND	Ground	37	Rx3n	V-by-One HS Data Lane 3
12	GND	Ground	38	Rx3p	V-by-One HS Data Lane 3
13	GND	Ground	39	GND	Ground
14	SPI_EN	SPI_WP Enable	40	Rx4n	V-by-One HS Data Lane 4
15	NC	NO CONNECTION	41	Rx4p	V-by-One HS Data Lane 4
16	SPI_DI	SPI Data In for Flash	42	GND	Ground
17	SPI_DO	SPI Data Out for Flash	43	Rx5n	V-by-One HS Data Lane 5
18	SDA	SDA for I2C	44	Rx5p	V-by-One HS Data Lane 5
19	SCL	SCL for I2C	45	GND	Ground
20	nWIP	WP(Write Protection)	46	Rx6n	V-by-One HS Data Lane 6
21	SPI_CLK	SPI_CLK for Flash	47	Rx6p	V-by-One HS Data Lane 6
22	SPI_CS	SPI_CS for Flash	48	GND	Ground
23	Aging Mode	H: or NC : AGP or Flicker PTN L: NSB (No signal Black)	49	Rx7n	V-by-One HS Data Lane 7
24	GND	Ground	50	Rx7p	V-by-One HS Data Lane 7
25	HTPDN	Hot plug detect	51	GND	Ground
26	LOCKN	Lock detect	.	.	.

- Note
1. All GND (ground) pins should be connected together to the LCD module's metal frame.
 2. All Input levels of V-by-One signals are based on the V-by-One-HS Standard Version 1.4
 3. Specific pin No. #23 is used for "No signal detection" of system signal interface.
It should be GND for NSB (No Signal Black) while the system interface signal is not.
If this pin is "H", LCD Module displays AGP (Auto Generation Pattern).
 4. Specific Pin No. #20 & #23 is used for "Vcom Adjustment", (Please see the Appendix V-2

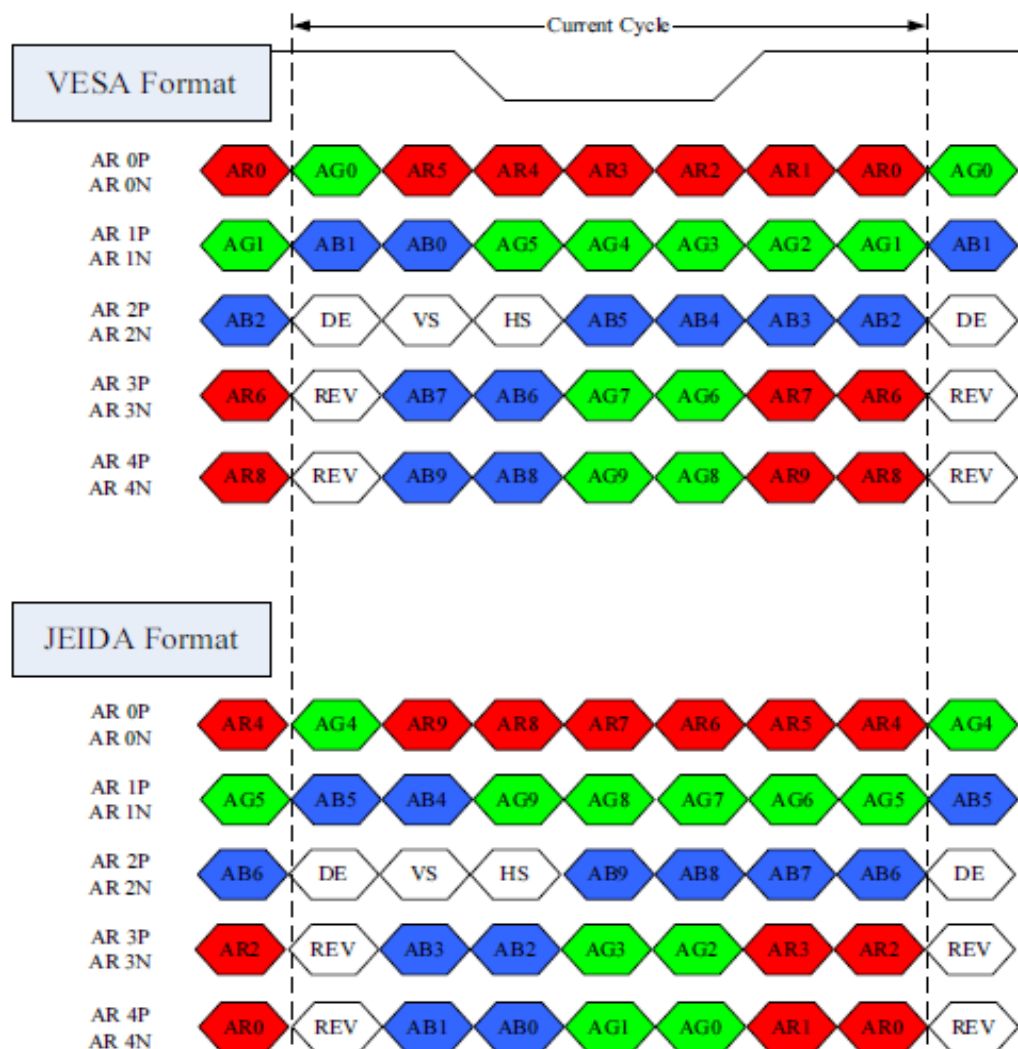
5.2 LVDS Interface

JEIDA Format : SELLVDS = L

VESA Format : SELLVDS = H or Open

JEIDA Format : SELLVDS = L

VESA Format : SELLVDS = H or Open



AR0~AR9: First Pixel R Data (9; MSB, 0; LSB)

AG0~AG9: First Pixel G Data (9; MSB, 0; LSB)

AB0~AB9: First Pixel B Data (9; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

RSV: Reserved

6. INTERFACE TIMING

6.1 Input Signal Timing Specifications

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frequency	Data Clock	F_{clk} (=1/TC)	73	74.25	75.8	MHz	(1)
Vby1	Spread spectrum modulation range	F_{clk_mod}	-0.5%	-	0.5%	%	(4)
	Spread spectrum modulation frequency	FSSM	-	-	30	KHz	

6.2 Timing spec for Frame Rate = 100Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame rate	Mode	F_{ns}		60		Hz	(8),(9)
Vertical Section	Total	T_v		2250		Line	$T_v=T_{vd}+T_{vb}$
	Display	T_{vd}		2160		Line	—
	Blank	T_{vb}		90		Line	—
Horizontal Section	Total	T_h		4400		Pixel	$T_h=T_{hd}+T_{hb}$
	Display	T_{hd}		3840		Pixel	—
	Blank	T_{hb}		560		Pixel	—
Clock	Frequency			594		MHz	—
Vertical Freq.	Frequency			60		Hz	—
Horizontal Freq.	Frequency			135		KHz	—

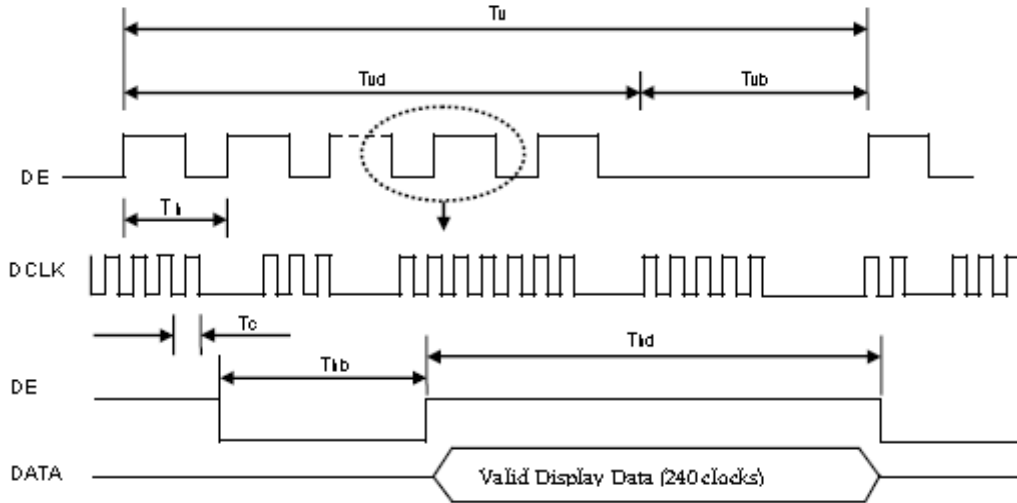
6.3 Timing spec for Frame Rate = 120Hz

Frame rate	2D mode		F_{rs}	114	120	126	Hz	
	3D mode		F_{rs}	(228)	240	(252)	Hz	(6)
Vertical Active Display Term (4 Lan,960X2160 Active Area)	2D Mode	Total	T_v	2200	2250	2790	T_h	$T_v=T_{vd}+T_{vb}$
		Display	T_{vd}	2160	2160	2160	T_h	—
		Blank	T_{vb}	40	90	630	T_h	—
	3D Mode	Total	T_v	(1116)	1125	(1200)	T_h	(6),(7)
		Display	T_{vd}	1080	1080	1080	T_h	
		Blank	T_{vb}	(36)	45	(120)	T_h	
Horizontal Active Display Term (4 Lan,960X2160 Active Area)	2D Mode	Total	T_h	270	285	300	T_c	$T_h=T_{hd}+T_{hb}$
		Display	T_{hd}	240	240	240	T_c	—
		Blank	T_{hb}	30	45	60	T_c	—
	3D Mode	Total	T_h	(270)	285	(300)	T_c	$T_h=T_{hd}+T_{hb}$
		Display	T_{hd}	240	240	240	T_c	—
		Blank	T_{hb}	(30)	45	(60)	T_c	—

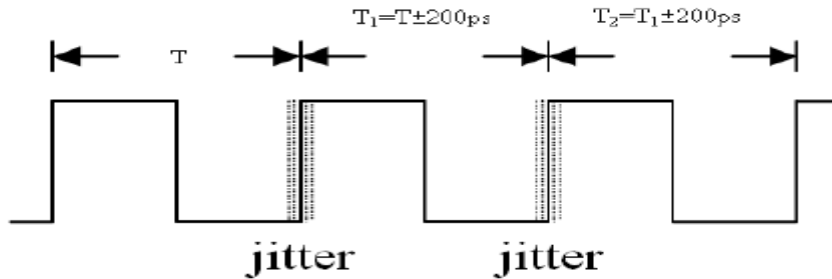
(Note (1) Since the module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

Note (2) Please make sure the range of pixel clock has follow the below equation:

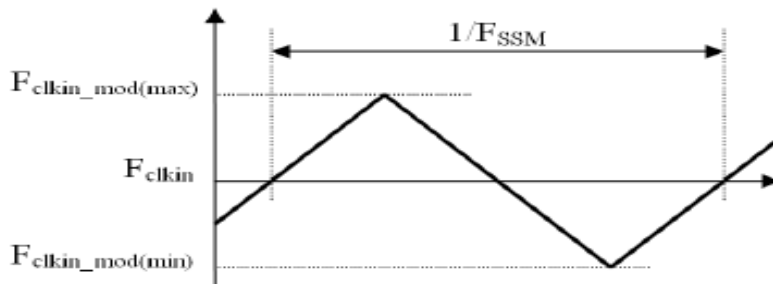
$$F_{clk_{in}}(\max) \cong Fr6 \times Tv \times Th \qquad Fr5 \times Tv \times Th \cong F_{clk_{in}}(\min)$$



Note (3) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = |T_1 - T_2|$

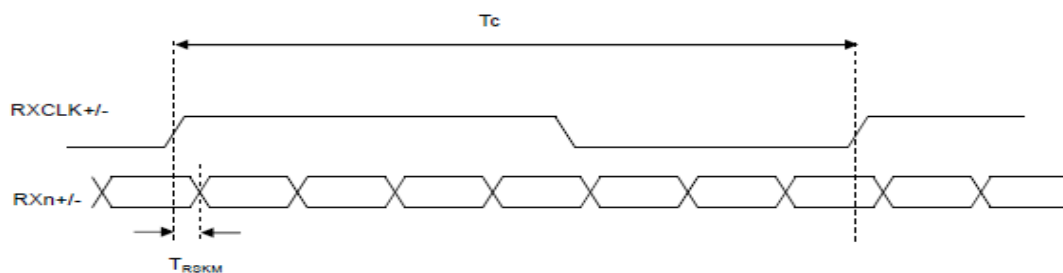


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



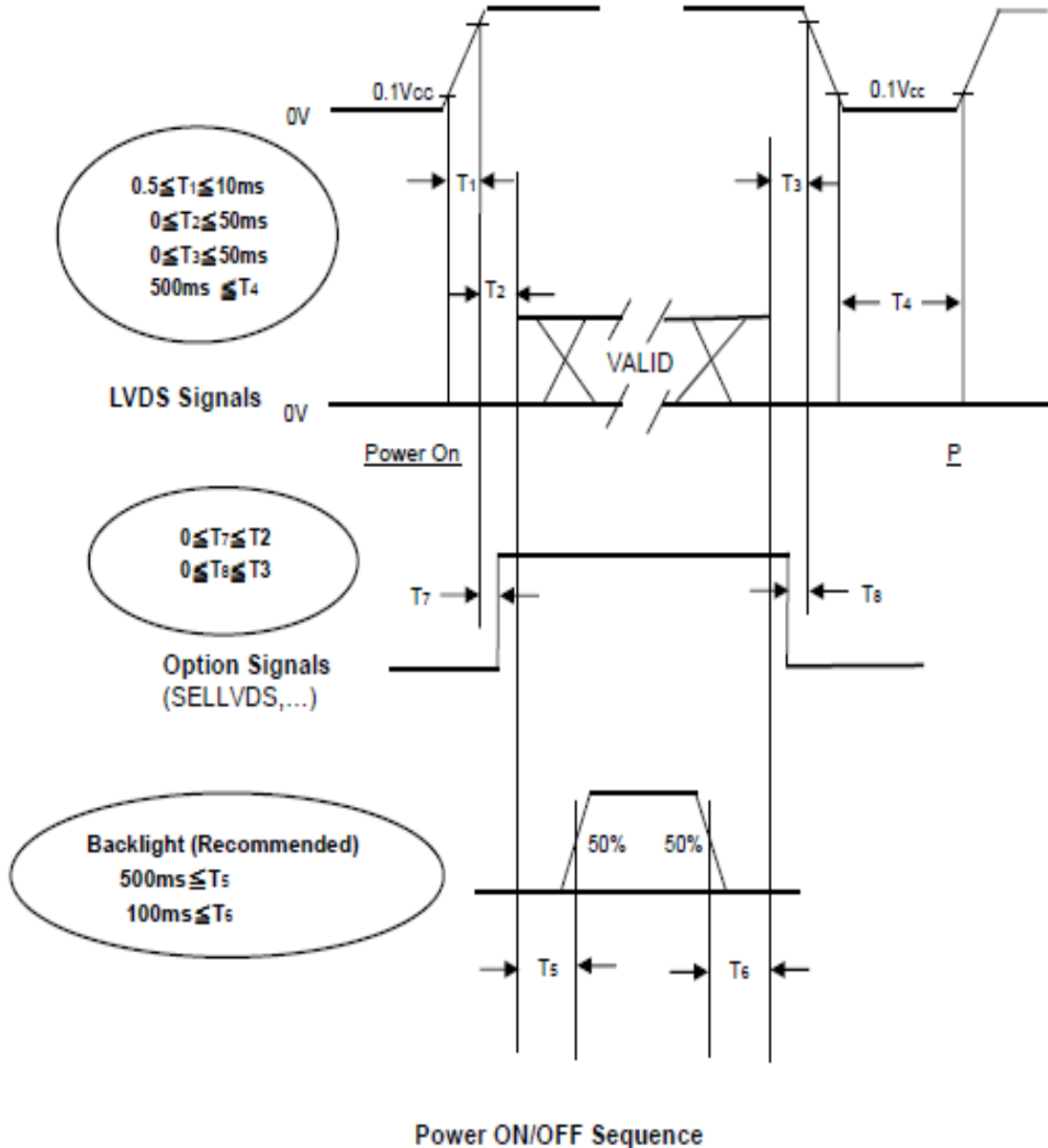
Note (5) LVDS receiver skew margin is defined and shown as below.

LVDS RECEIVER INTERFACE TIMING DIAGRAM



6.2 Power On/Off Sequence

To prevent a latch-up or DC operation of LCD module ,the power on/off sequence should follow be as the diagram below.



Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance. If T2<0, that maybe cause electrical overstress failure.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

7 Optical Characteristics

7.1 Test Condition

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25 ±2	°C
Ambient Humidity	Ha	50 ±10	%RH
Supply Voltage	Vcc	12	V
Input Signal	According to typical value in "3. Electrical characteristics"		
LED LightBar Current	I _L	3	mA

7.2 Optical Characteristics

The relative measurement methods of optical characteristics are shown in the 7.2. The following items should be measured under the test condition in 7.1 and the stable environment shown in the in 7.1.

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio	CR	T	800	1100	—	—	—	
Response Time	Gray to gray average		—	8	12	ms	Note 3	
Transmittance			—	5.34	—	%		
Brightness uniformity	BU		—	1.33	1.42	—	Note 2	
Center Luminance of White	Lc		300	350	—	cd/m2	—	
The color chromaticity	Red		Rx	-0.03	0.636	+0.03	—	Note 0
			Ry		0.334		—	
	Green		Gx		0.293		—	
			Gy		0.633		—	
	Blue		Bx		0.153		—	
		By	0.064		—			
	White	Wx	0.268		—			
		Wy	0.306		—			
Viewing Angle	Horizontal	θx+	CR ≥ 10	89	—	Deg	Note 1、2	
		θx-		89	—			
	Vertical	θy+		89	—			
		θy-		89	—			

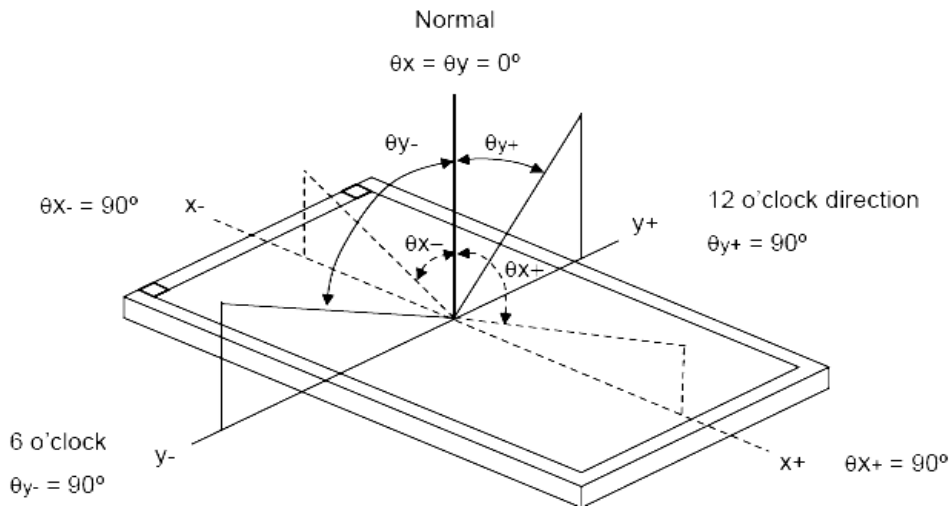
Note 0: Light source is the standard light source "C" which is defined by CIE and driving voltage are based on suitable gamma voltages. The calculating method is as following:

1. Measure Module's and BLU's spectrum at center point. White and R,G,B are with signal input. BLU (for V500HK3-L01) is supplied by CMI.
2. Calculate cell's spectrum.
3. Calculate cell's chromaticity by using the spectrum of standard light source "C".

Note 1: Light source is the BLU which supplied by CMI and driving voltage are based on suitable gamma voltages.

Note 2: Definition of Viewing Angle (x, y):

Viewing angles are measured by Autronic Conoscope Cono-80



Note 3: Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

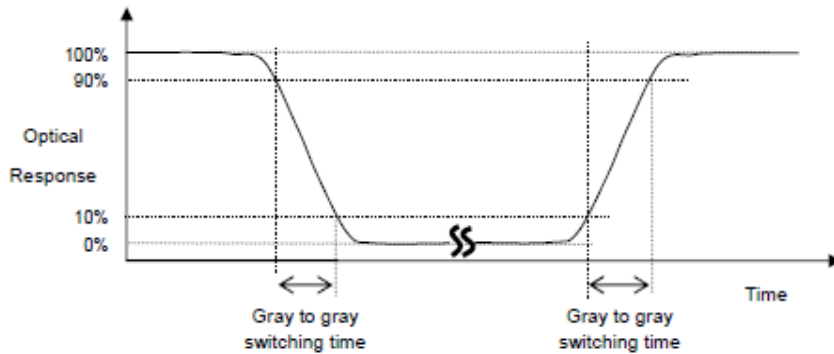
$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance of L255}}{\text{Surface Luminance of L0}}$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (X), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (5).

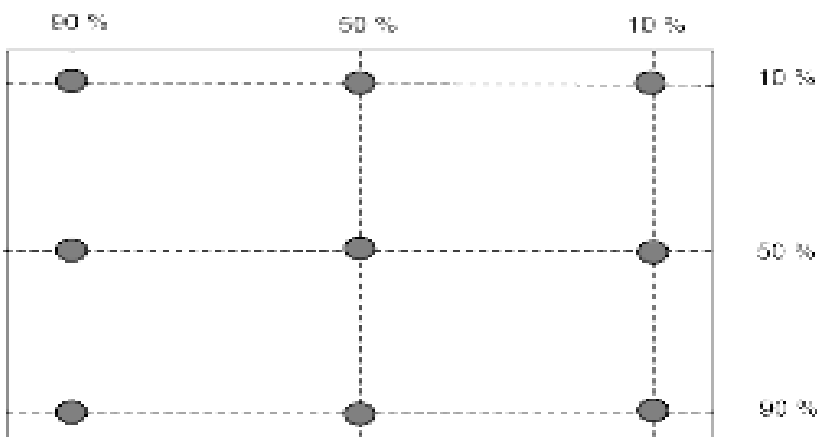
Note 4: Definition of Gray-to-Gray Switching Time:



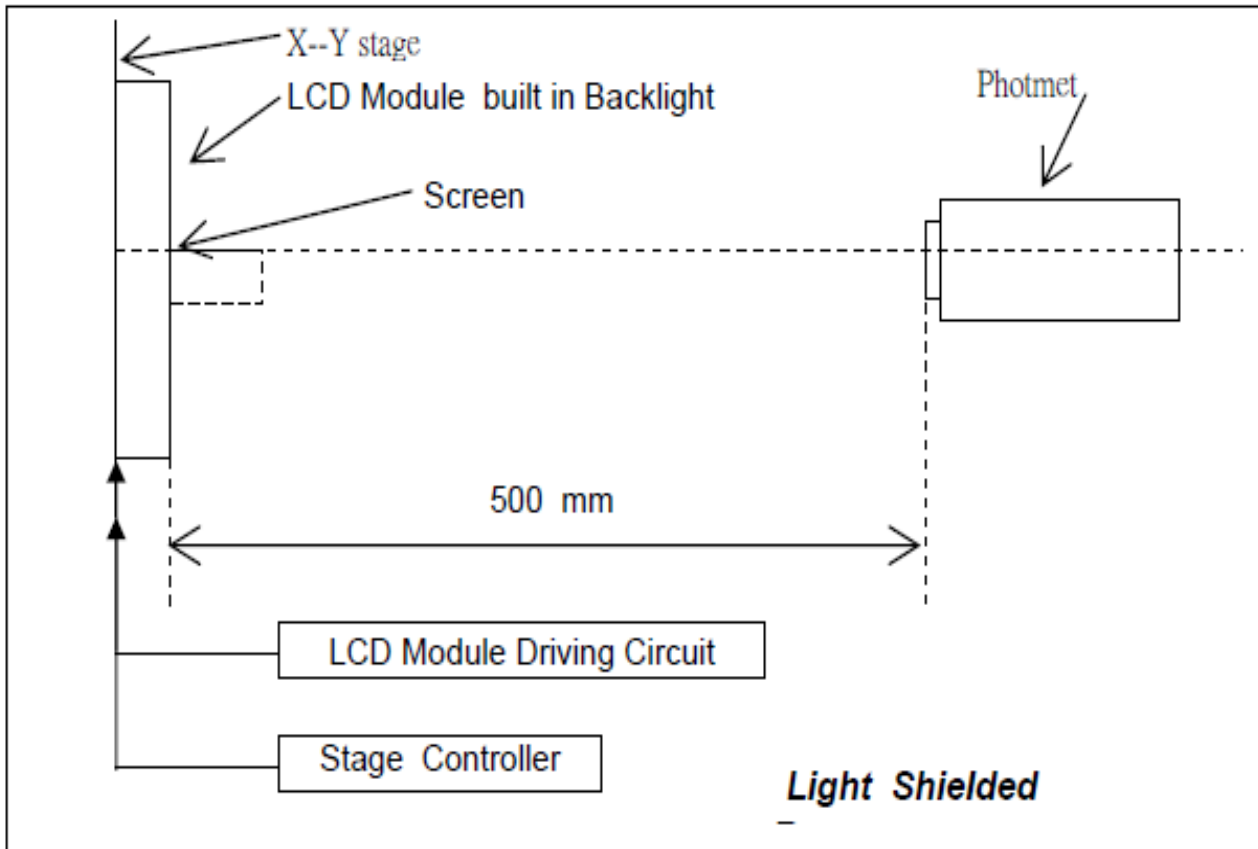
The driving signal means the signal of gray level 0, 124, 252, 380, 508, 636, 764, 892 and 1023.

Gray to gray average time means the average switching time of gray level 0, 124, 252, 380, 508, 636, 764, 892 and 1023 to each other.

Note 5: Definition of White Variation :



Note6: The measure method



Note(1): The measurement point is the center of the active area except for the measurement of Luminance Uniformity

Note (2): Photometer :BM-7 TOPCON (Aperture 2deg.)

7.3 Flicker Adjustment

(1) Adjustment pattern :

Sub pixel on/off Pattern was shown as below. If customer need below pattern, please directly contact with Account FAE. (bright sub-pixel: G128 ; dark sub-pixel: G0)



Fig 9.6Flicker pattern

(2) Adjustment method: (Digital V-com / Gamma)


Programmable memory IC is used for Digital V-com (Gamma) adjustment in this model. CMI provide Auto V-com (Auto Gamma) tools to adjust Digital V-com (Gamma). The detail connection and setting instruction, please directly contact with Account FAE or refer CMI Auto V-com (Auto Gamma) adjustment OI.

Below items is suggested to be ready before Digital V-com (Gamma) adjustment in customer LCM line.

8. Labels

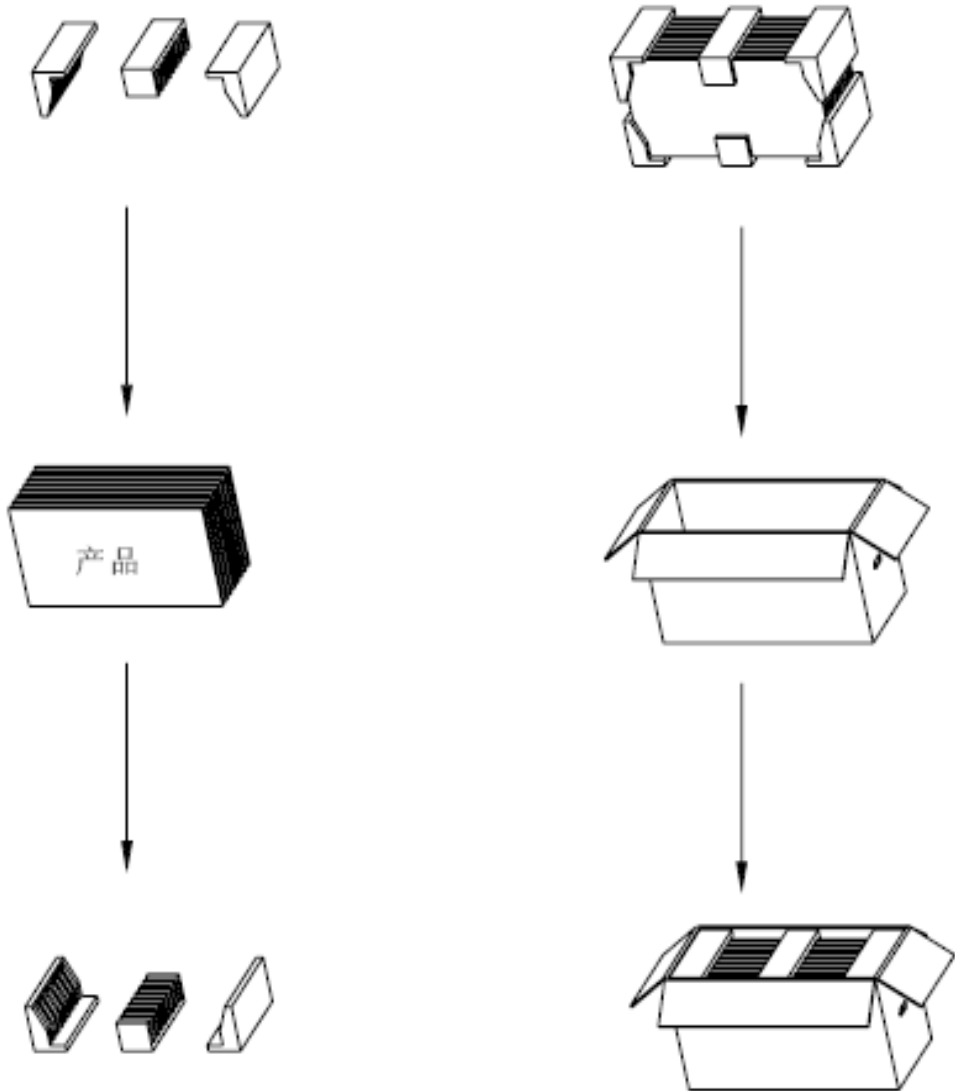
8.1 Panel Label:

8.2 Caution Label:

	CAUTION HIGH VOLTAGE RISK OF ELECTRIC SHOCK. DISCONNECT THE ELECTRIC POWER BEFORE SERVICING
COLD CATHODE FLUORESCENT LAMP IN LCD PANEL CONTAINS A SMALL AMOUNT OF MERCURY. PLEASE FOLLOW LOCAL ORDINANCES OR REGULATIONS FOR DISPOSAL	

9. Packaging

9.1 Carton(internal package)



9.2 Packaging Mark



10. PRECAUTION**10.1 ASSEMBLY AND HANDLING PRECAUTIONS**

- 1 Do not apply rough force such as bending or twisting to the module during assembly.
- 2 To assemble or install module into user's system can be in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- 3 It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- 4 Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- 5 Do not pull the I/F connector in or out while the module is operating .
- 6 Do not disassemble the module.
- 7 Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- 8 It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- 9 High temperature or humidity may reduce the performance of module. Please store LCD module within the specified stored conditions.
- 10 When ambient temperature is lower than 10 °C may reduce the display quality.

10.2 SAFETY PRECAUTIONS

- 1 The LED LightBar voltage of Backlight is can't exceed out Volts Spec, otherwise it may cause electrical shock.. Do not disassemble the module or insert anything into the Backlight unit.
- 2 If the liquid crystal material leaks from the panel,it should be kept away from the eyes or mouth, in case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- 3 After the modlule's end of life, it is not harmful in case of normal operation and storage.

11.Outline dimension

