SAMSUNG DISPLAY

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Preliminary Spec

DATE : 16. May. 2012

SAMSUNG TFT-LCD

MODEL : **LTA400HL15**

The Information Described in this Specification is Preliminary and can be changed without prior notice

Samsung Display Co . , LTD.

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* Revision History

Date	Rev. No	Page	Summary
16. May. 2012	000	all	First issued

General Description

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Description

LTA400HL15 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit.

The resolution of a 40.0" is 1920 x 1080 and this model can display up to 1.07B (Dithered 10bit) colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV and High Definition TV.

Features

- RoHS compliance (Pb-free)
- High contrast & aperture ratio
- SPVA (Super Patterned Vertical Align) mode
- Wide viewing angle (±178°)
- High speed response (240Hz)
- FHD resolution (16:9)
- Low Power consumption
- White E-LED Backlight
- DE (Data Enable) mode
- 8 lane V-by-one Interface

General Information

Items	Specification	Unit	Note
Module Size	897.4(H_{TYP}) x 511.0(V_{TYP})	mm	±1.0mm
	27(D_{max})		Wall mount Stud
Weight	8300 (Max)	g	
Pixel Pitch	0.12125(H) X 0.36375 (V)	mm	
Active Display Area	885.6(H) X 498.15(V)	mm	
Surface Treatment	Glare, 2H	-	Glare
Display Colors	1.07B - Dithered 10bit	Colors	
Number of Pixels	1920 x 1080	Pixel	
Pixel Arrangement	RGB vertical stripe	-	
Display Mode	Normally Black	-	
Luminance of White	450 (Typ.)	cd/m^2	

1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	GND-0.5	16	V	(1)
Storage temperature	T_{STG}	-20	60	℃	(2)
Operating temperature	T_{OPR}	0	50	℃	
Shock (non - operating)	X,Y	-	30	G	(4)
Vibration (non - operating)	V_{NOP}	-	1.5	G	(5)

1.2 LED Unit Absolute Maximum Ratings

Item	Symbol	Max.	Unit	Note
Operating Temperature Range	T_{op}	*-30~+70*	℃	-
Storage Temperature Range	T_{STG}	*-30~+70*	℃	-
Forward Current	I_f	180	mA	Duty 100% operation @ 1 string (8block/PCB)
	I_{fp}	214	mA	Duty 50% operation @ 1 string (8block/PCB)
Forward Voltage	V_f	42.1	V	I_{fp} = 180mA , Duty100% @ 1block (6LED/block)
	V_{fp}	43.7	V	I_{fp} = 214mA , Duty 50% @ 1block (6LED/block)

Note (1) Ta= 25 ± 2 °C

(2) Temperature and relative humidity range are shown in the figure below.

a. 90 % RH Max. (Ta ≤ 39 °C)

b. Relative Humidity is 90% or less. (Ta > 39 °C)

c. No condensation

(3) Although abnormal visual problems can be occurred in T_{SUR} range, the polarizer is not damaged in this range.

(4) 11ms, sine wave, one time for ±X, ±Y, ±Z axis

(5) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

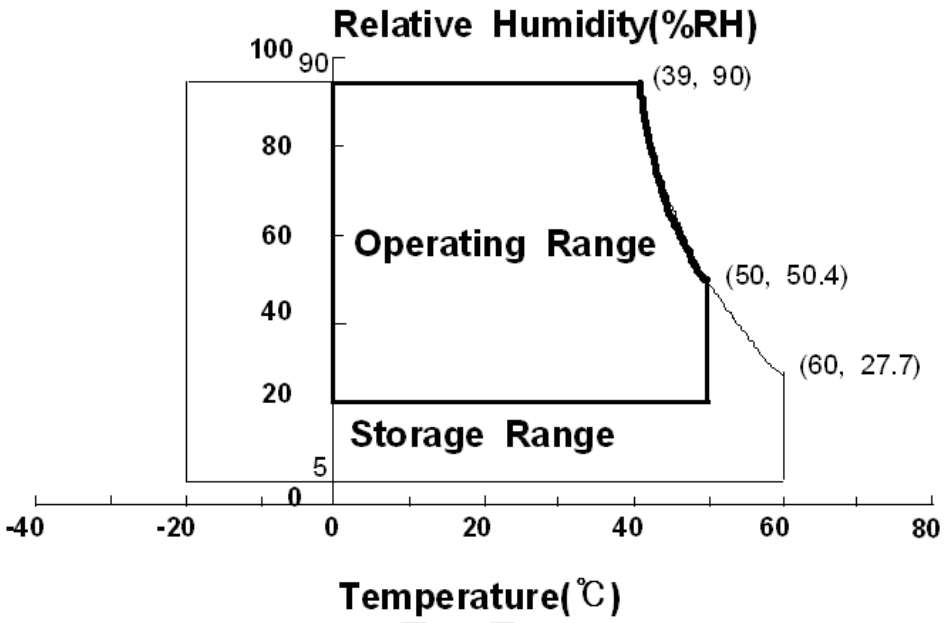

Fig. Temperature and Relative humidity range

2. Optical Characteristics

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The optical characteristics should be measured in a dark room or equivalent.
Measuring equipment : TOPCON RD-80S, TOPCON SR-3 ,ELDIM EZ-Contrast

(Ta = 25 ± 2°C, VDD=12.0V, fv=240Hz, f_{DCLK}=594 MHz, 2D Mode, Duty=100%))

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R	Normal θL,R=0 θU,D=0 Viewing Angle	3,000	5,000	-		(1) SR-3
Response Time	G-to-G	Tg		-	8	-	msec	(3) RD-80S
Luminance of White (Center of screen)		Y_L		350	450	-	cd/m²	(4) SR-3
Color Chromaticity (CIE 1931)	Red	Rx		TYP. -0.03	0.650	TYP. +0.03		(5),(6) SR-3
		Ry			0.333			
	Green	Gx			0.308			
		Gy			0.610			
	Blue	Bx			0.150			
		By			0.061			
	White	Wx			0.280			
		Wy			0.290			
Color Gamut		-		-	70	-	%	(5) SR-3
Color Temperature		-		-	10,000	-	K	
Viewing Angle	Hor.	θ_L	C/R≥10	75	89	-	Degree	(6) EZ-Contrast
		θ_R		75	89	-		
	Ver.	θ_U		75	89	-		
		θ_D		75	89	-		
Brightness Uniformity (9 Points)		B_{uni}		-	-	27	%	(2) SR-3

- Test Equipment Setup

The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

. LED current = 120mA
. Environment condition : Ta = 25 ± 2 °C

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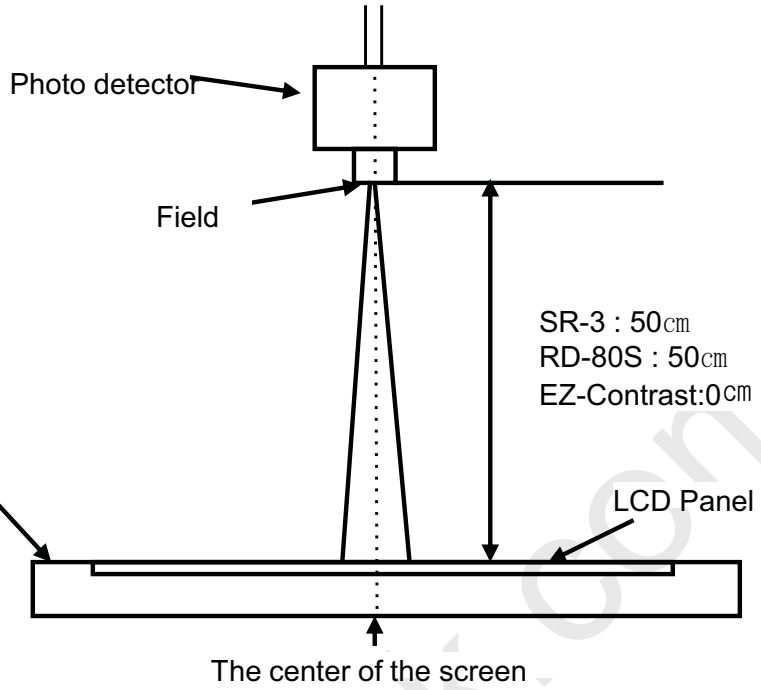
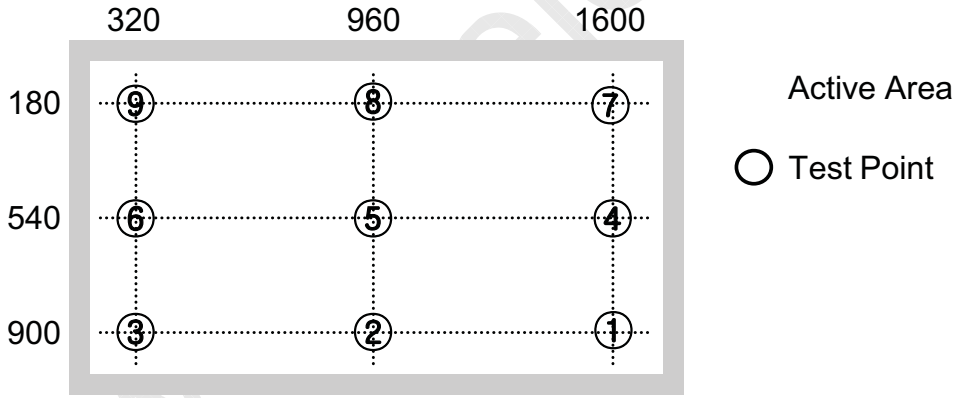
Photo detector	Field
SR-3	1°
RD-80S	2°



- Definition of test point



Note (1) Definition of Contrast Ratio (C/R)
: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G\max}{G\min}$$

Gmax : Luminance with all pixels white
Gmin : Luminance with all pixels black

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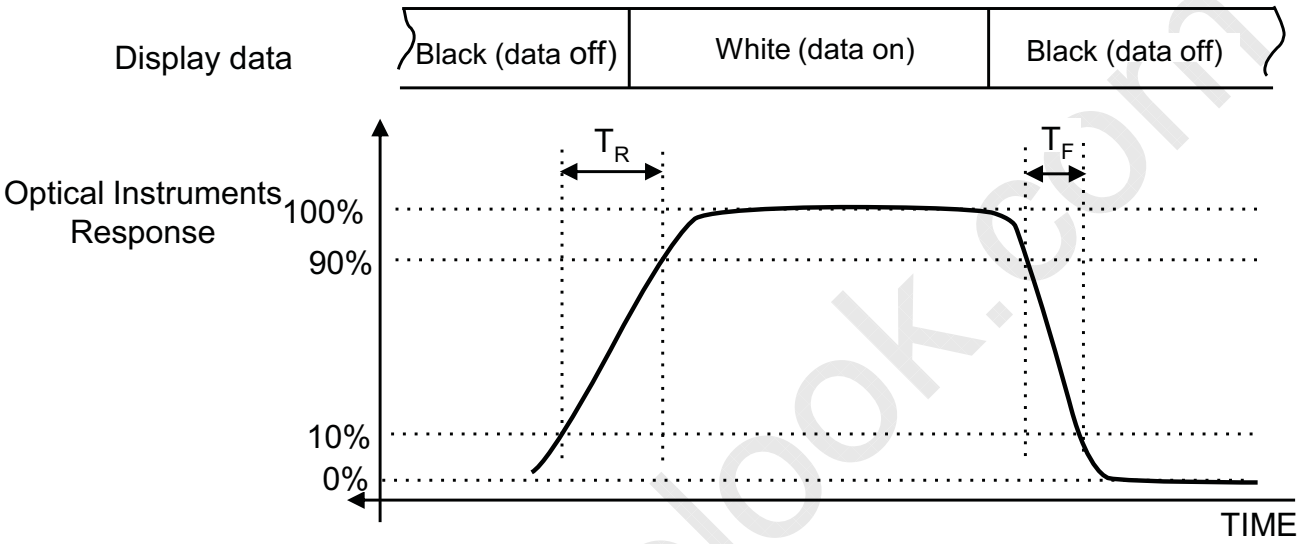
Note (2) Definition of 9 points brightness uniformity (Test pattern : Full White)

$$Buni = 100 * \frac{(B\max - B\min)}{B\max}$$

Bmax : Maximum brightness
Bmin : Minimum brightness

Note (3) Definition of Response time : Sum of Tr, Tf

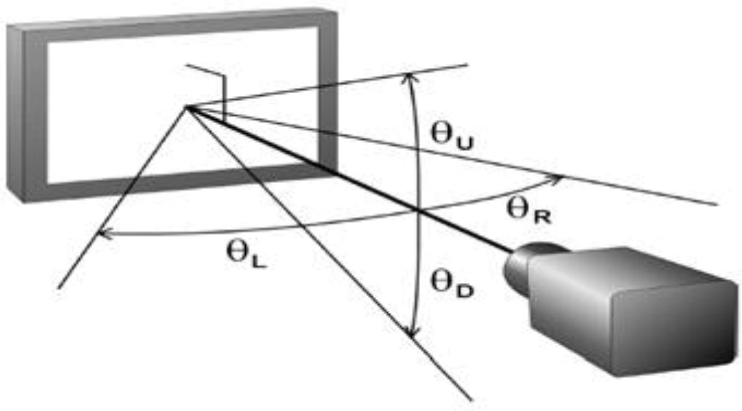


※ G-to-G : Average response time between Gray to Gray (Scale)

Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

Note (5) Definition of Color Chromaticity (CIE 1931)
Color coordinate of Red, Green, Blue & White at center point ⑤

Note (6) Definition of Viewing Angle
: Viewing angle range (C/R ≥10)



3. Electrical Characteristics

3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

Ta = 25°C ± 2 °C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	10.8	12	13.2	V	(1)
Current of Power Supply	(a) Black	I_{DD}	-	950	1050	mA	(2),(3)
	(b) White		-	920	1020	mA	
	(d) H-stripe		-	2200	2450	mA	
Rush Current		I_{RUSH}	-	-	5	A	(4)
			Min.	Typ.	Max.	Unit	
Vsync Frequency		f_V	192	240	245	Hz	
Hsync Frequency		f_H	216	270	275	kHz	
Main Frequency		Fdclk	465	594	606	MHz	

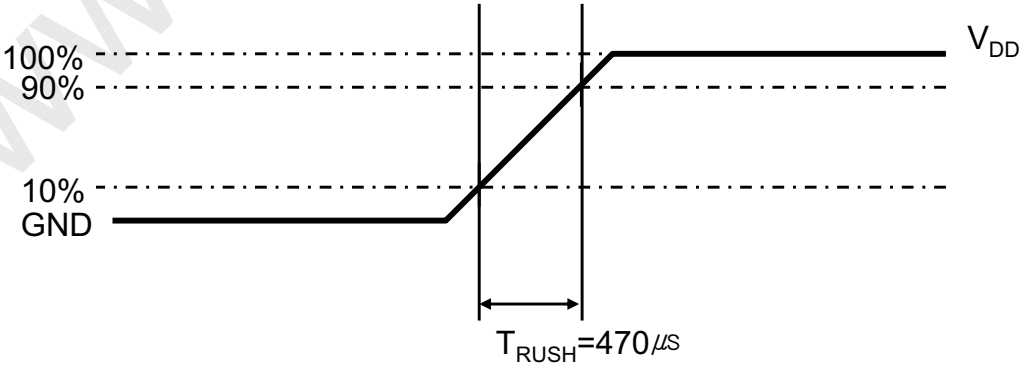
Note (1) The ripple voltage should be controlled under 10% of V_{DD}.

(2) fv=240Hz, f_{DCLK} =594 MHz, V_{DD} = 12.0V, DC Current.

(3) Power dissipation check pattern (LCD Module only)

a) Black Pattern b) White Pattern c) H-stripe

(4) Measurement Conditions

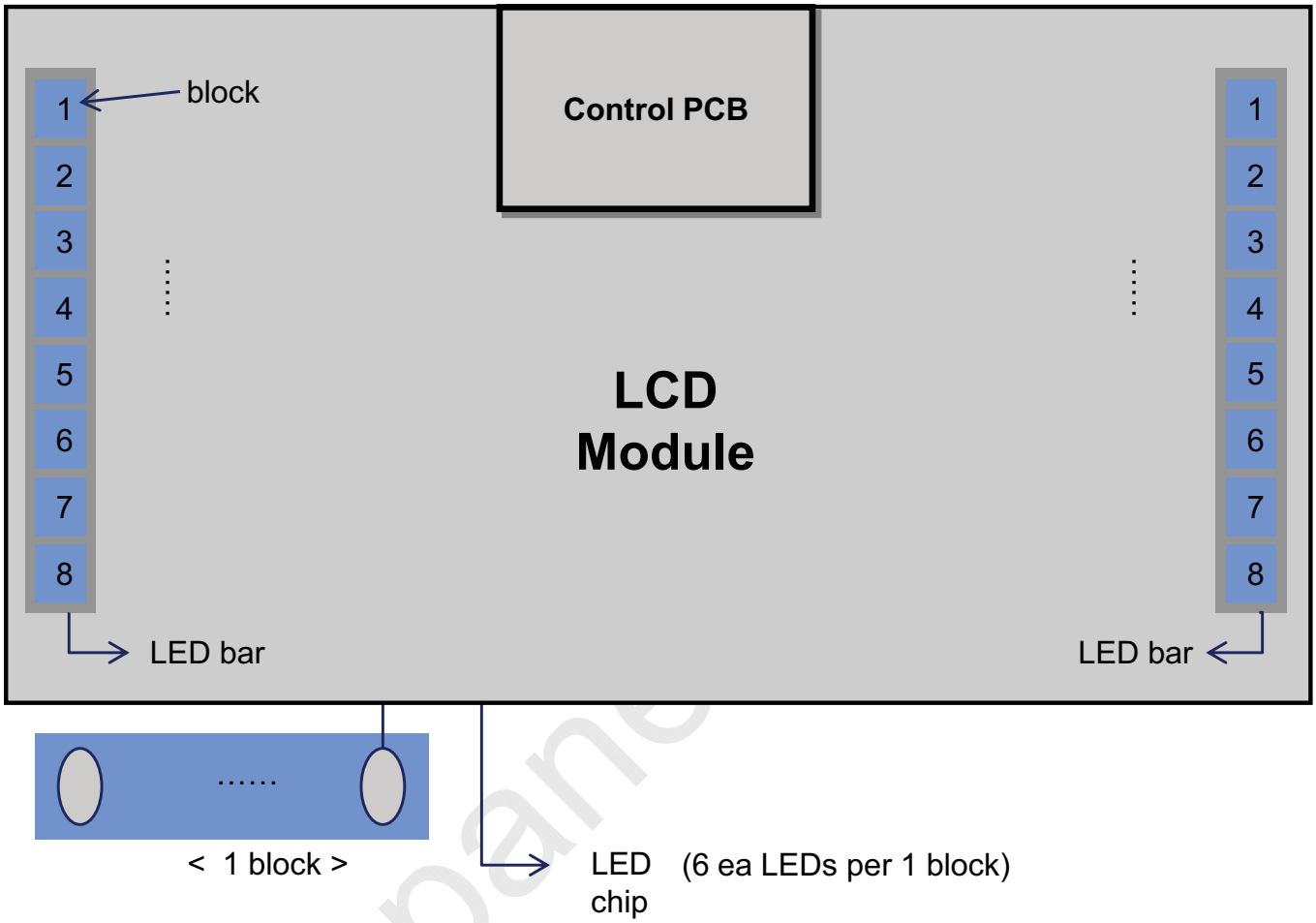


Rush Current I_{RUSH} can be measured when T_{RUSH}. is 470㎲.

3.2 Back Light Unit

Ta=25 ± 2°C

• Back light unit is composed of 2 –LED bars .(96 pcs of LEDs).



Item	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Life Time	Hr	30,000	-	-	Hour	(1)

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value.

[Operating condition : Ta = 25±2℃]

	Min	Typ.	Max	Unit	Note
Vf	-	37.7	39.8	V	Each Block, Bar-voltage at If = 120mA

4. Input Terminal Pin Assignment

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4.1. Input Signal & Power

Connector : FX16K-51S-0.5SH (Hirose)

Pin	Symbol	Description	Pin	Symbol	Description
1	12V	DC power supply	26	GND	Ground
2	12V	DC power supply	27	REN	Vbyone E -
3	12V	DC power supply	28	REP	Vbyone E +
4	12V	DC power supply	29	GND	Ground
5	12V	DC power supply	30	GND	Ground
6	NC	NOTE1	31	RFN	Vbyone F -
7	GND	Ground	32	RFP	Vbyone F +
8	HTPDN	Vbyone link control	33	GND	Ground
9	LOCKN	Vbyone link control	34	GND	Ground
10	GND	Ground	35	RGN	Vbyone G -
11	RAN	Vbyone A -	36	RGP	Vbyone G +
12	RAP	Vbyone A +	37	GND	Ground
13	GND	Ground	38	GND	Ground
14	GND	Ground	39	RHN	Vbyone H -
15	RBN	Vbyone B -	40	RHP	Vbyone H +
16	RBP	Vbyone B +	41	GND	Ground
17	GND	Ground	42	NC	NOTE1
18	GND	Ground	43	NC	NOTE1
19	RCN	Vbyone C -	44	NC	NOTE1
20	RCP	Vbyone C +	45	3D_EN	3D Enable signal Note 2
21	GND	Ground	46	3D sync_I	Shutter glass Sync Input signal
22	GND	Ground	47	3D sync_o	Shutter Glass Sync Signal
23	RDN	Vbyone D -	48	NC	NOTE1
24	RDP	Vbyone D +	49	NC	NOTE1
25	GND	Ground	50	NC	NOTE1
			51	NC	NOTE1

Note 1) SEC internal Only: These PINS are used only for SAMSUNG. (DO NOT CONNECT)
Note 2) 3D Enable / 3D sync_I, signal voltage level
High : Min 3.0 V, Max 3.3 V Low : Min 0 V, Max 0.4V

Note(1) Pin number starts from left side

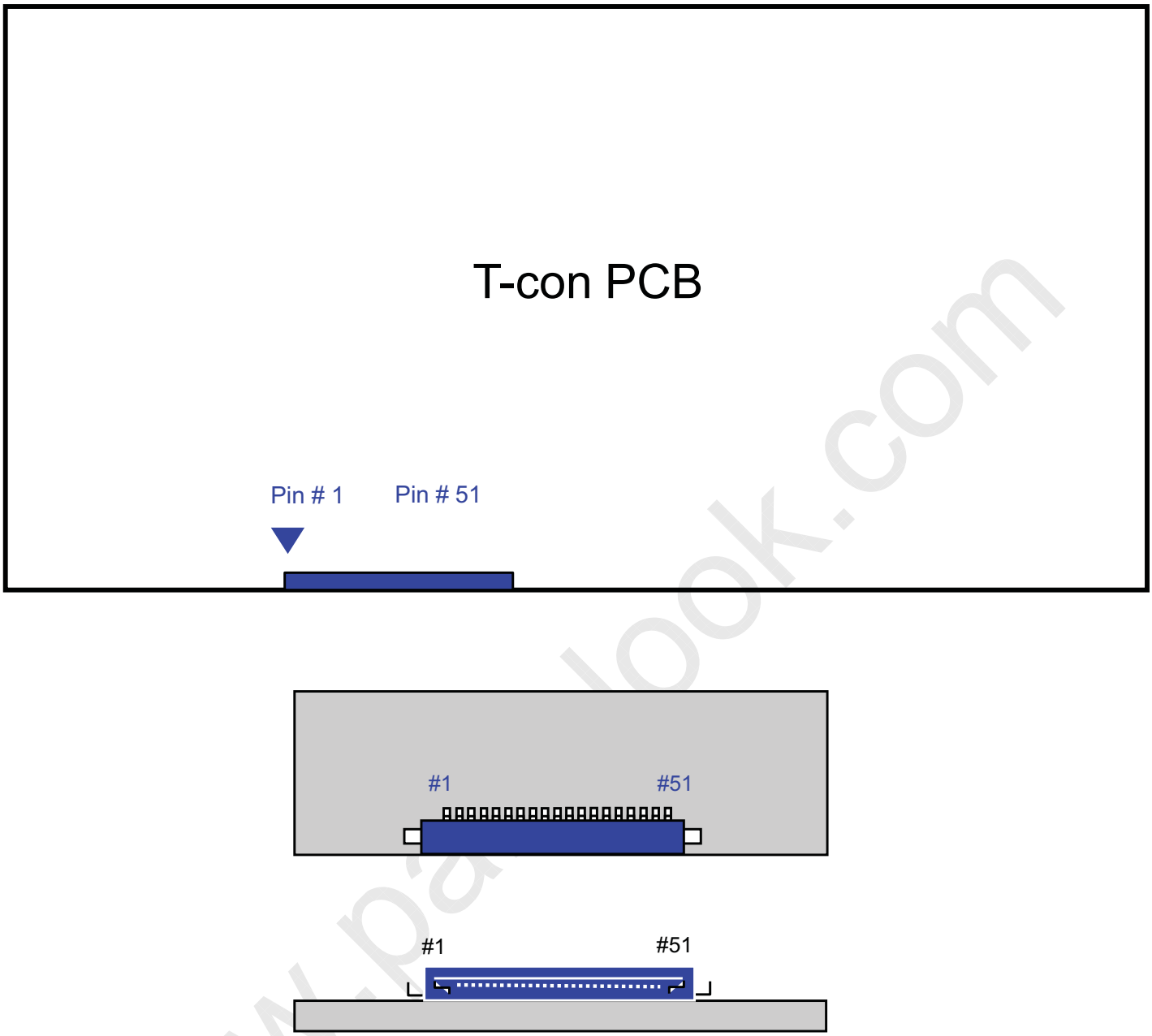

Fig. Connector diagram

a. Power GND pins should be connected to the LCD's metal chassis.
b. All power input pins should be connected together.
c. All NC pin should be separated from other signal or power.

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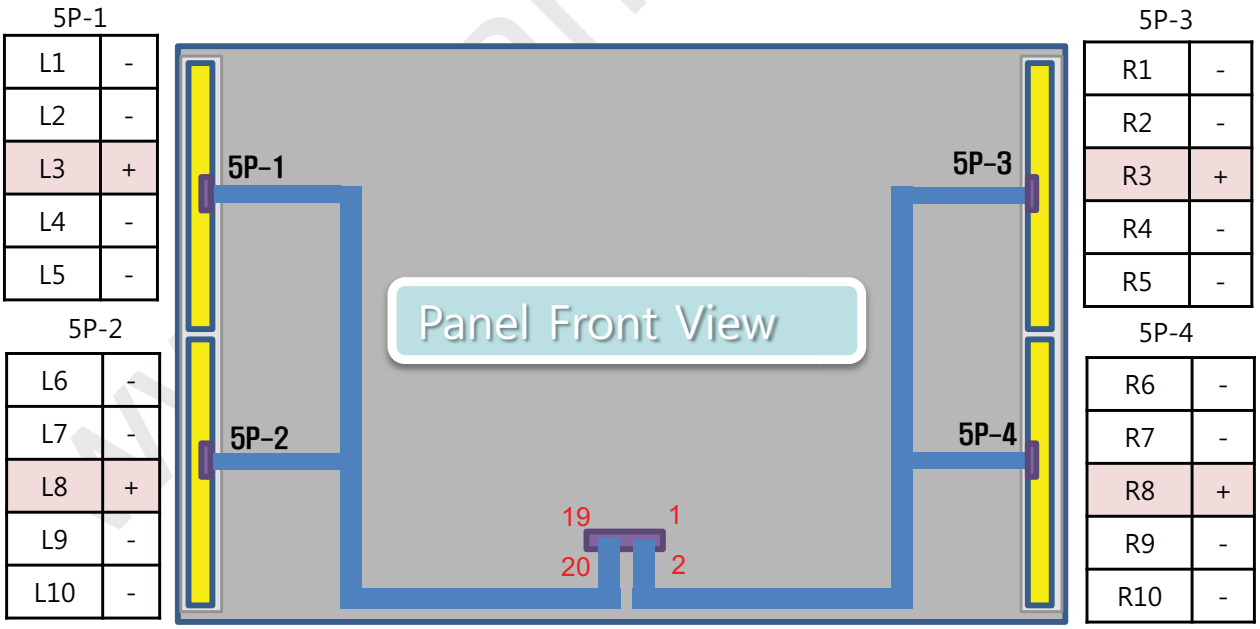
4.2 LED Bar connector

Connector : SMAW200-H30S2(Yeonho)

Pin#	Item	Pin#	Item
1	R3	11	L10
2	R8	12	L9
3	R1	13	L7
4	R2	14	L6
5	R4	15	L5
6	R5	16	L4
7	R6	17	L2
8	R7	18	L1
9	R9	19	L8
10	R10	20	L3



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4.3 V-by-1 Interface (T-con input)
- V-by-1 Receiver : THCV216

Table 11 RGB/YCbCr444/RGBW/RGBY color data mapping

Mode	Packer input & Unpacker output		36bpp RGB /YCbCr444	30bpp RGB /YCbCr444	24bpp RGB /YCbCr444	18bpp RGB /YCbCr444	40bpp RGBW / RGBY	32bpp RGBW / RGBY
5byte mode, 4byte mode, 3byte mode	Byte0	D[0]	R/Cr[4]	R/Cr[2]	R/Cr[0]	-	R[2]	R[0]
		D[1]	R/Cr[5]	R/Cr[3]	R/Cr[1]	-	R[3]	R[1]
		D[2]	R/Cr[6]	R/Cr[4]	R/Cr[2]	R/Cr[0]	R[4]	R[2]
		D[3]	R/Cr[7]	R/Cr[5]	R/Cr[3]	R/Cr[1]	R[5]	R[3]
		D[4]	R/Cr[8]	R/Cr[6]	R/Cr[4]	R/Cr[2]	R[6]	R[4]
		D[5]	R/Cr[9]	R/Cr[7]	R/Cr[5]	R/Cr[3]	R[7]	R[5]
		D[6]	R/Cr[10]	R/Cr[8]	R/Cr[6]	R/Cr[4]	R[8]	R[6]
		D[7]	R/Cr[11]	R/Cr[9]	R/Cr[7]	R/Cr[5]	R[9]	R[7]
	Byte1	D[8]	G/Y[4]	G/Y[2]	G/Y[0]	-	G[2]	G[0]
		D[9]	G/Y[5]	G/Y[3]	G/Y[1]	-	G[3]	G[1]
		D[10]	G/Y[6]	G/Y[4]	G/Y[2]	G/Y[0]	G[4]	G[2]
		D[11]	G/Y[7]	G/Y[5]	G/Y[3]	G/Y[1]	G[5]	G[3]
		D[12]	G/Y[8]	G/Y[6]	G/Y[4]	G/Y[2]	G[6]	G[4]
		D[13]	G/Y[9]	G/Y[7]	G/Y[5]	G/Y[3]	G[7]	G[5]
		D[14]	G/Y[10]	G/Y[8]	G/Y[6]	G/Y[4]	G[8]	G[6]
		D[15]	G/Y[11]	G/Y[9]	G/Y[7]	G/Y[5]	G[9]	G[7]
	Byte2	D[16]	B/Cb[4]	B/Cb[2]	B/Cb[0]	-	B[2]	B[0]
		D[17]	B/Cb[5]	B/Cb[3]	B/Cb[1]	-	B[3]	B[1]
		D[18]	B/Cb[6]	B/Cb[4]	B/Cb[2]	B/Cb[0]	B[4]	B[2]
		D[19]	B/Cb[7]	B/Cb[5]	B/Cb[3]	B/Cb[1]	B[5]	B[3]
		D[20]	B/Cb[8]	B/Cb[6]	B/Cb[4]	B/Cb[2]	B[6]	B[4]
		D[21]	B/Cb[9]	B/Cb[7]	B/Cb[5]	B/Cb[3]	B[7]	B[5]
		D[22]	B/Cb[10]	B/Cb[8]	B/Cb[6]	B/Cb[4]	B[8]	B[6]
		D[23]	B/Cb[11]	B/Cb[9]	B/Cb[7]	B/Cb[5]	B[9]	B[7]
	Byte3	D[24]	-	-	-	-	R[0]	-
		D[25]	-	-	-	-	R[1]	-
		D[26]	B/Cb[2]	B/Cb[0]	-	-	G[0]	-
		D[27]	B/Cb[3]	B/Cb[1]	-	-	G[1]	-
		D[28]	G/Y[2]	G/Y[0]	-	-	B[0]	-
		D[29]	G/Y[3]	G/Y[1]	-	-	B[1]	-
		D[30]	R/Cr[2]	R/Cr[0]	-	-	W/Y[0]	-
		D[31]	R/Cr[3]	R/Cr[1]	-	-	W/Y[1]	-
	Byte4	D[32]	-	-	-	-	W/Y[2]	W/Y[0]
		D[33]	-	-	-	-	W/Y[3]	W/Y[1]
		D[34]	B/Cb[0]	-	-	-	W/Y[4]	W/Y[2]
		D[35]	B/Cb[1]	-	-	-	W/Y[5]	W/Y[3]
		D[36]	G/Y[0]	-	-	-	W/Y[6]	W/Y[4]
		D[37]	G/Y[1]	-	-	-	W/Y[7]	W/Y[5]
		D[38]	R/Cr[0]	-	-	-	W/Y[8]	W/Y[6]
		D[39]	R/Cr[1]	-	-	-	W/Y[9]	W/Y[7]

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4.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

COLOR	DISPLAY (8bit)	DATA SIGNAL																													GRAY SCALE LEVEL
		RED										GREEN										BLUE										
		R0	R1	R2	R3	R4	R5	R6	R7	R8	R9	G0	G1	G2	G3	G4	G5	G6	G7	G8	G9	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	
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	-
	BLUE	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	-
	GREEN	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	-
	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	-
	RED	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	-
	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	-
GRAY SCALE OF RED	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	R0
	DARK ↑	1	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	R1
		0	1	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	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~ R1020
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		1	0	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	R1021
		0	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	R1022
	RED	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	R1023
GRAY SCALE OF GREEN	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	G0
	DARK ↑	0	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	G1
		0	0	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	G2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~ G1020
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G1021
		0	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	G1022
	GREEN	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	G1023
GRAY SCALE OF BLUE	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	B0
	DARK ↑	0	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	B1
		0	0	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	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~ B1020
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	B1021
		0	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	B1022
	BLUE	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	B1023

Note) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

5. Interface Timing

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5.1 Timing Parameters (Tcon input)

SIGNAL	ITEM	SYMBOL	Min.	Typ.	Max	UNIT	NOTE
Clock	Frequency	1/TC	465	594	606	MHz	-
Hsync		Fh	216	270	275	KHz	(4)
Vsync		Fv	192	240	245	Hz	
Vertical Active Disply Term	Display Period	TVD	-	1080	-	Lines	
	Vertical Total	TV	1110	1125	1800	Lines	-
Horizontal Active Display Term	Display Period	THD	-	1920	-	Clocks	-
	Horizontal Total	TH	2150	2200	2250	clocks	-

Note) This product is H / V mode. The input of Hsync & Vsync signal is essentially needed.

(1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system

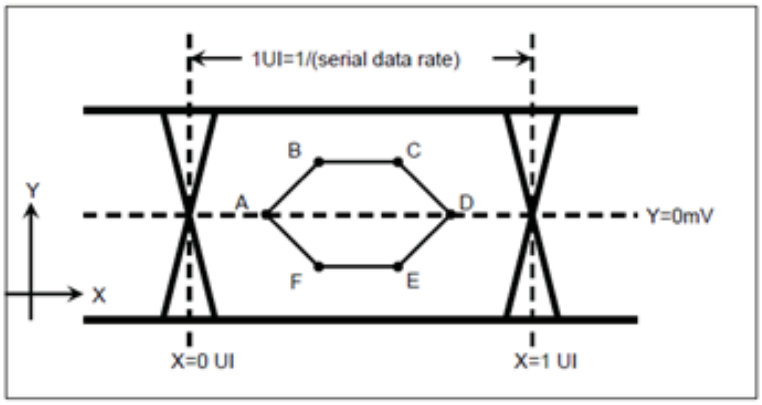
(2) Internal V_{DD} = 3.3V

(3) Hsync, Vsync range is measured by increasing clock frequency.

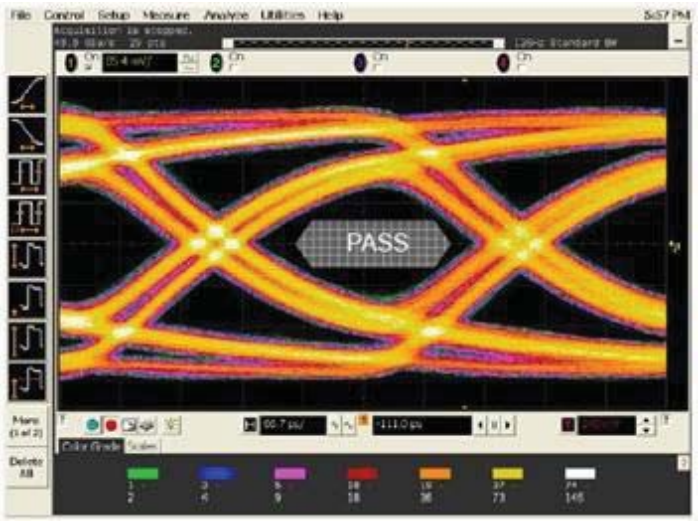
5.2 Spread Spectrum

- Modulation rate (max) : ± 0.5 %
- Modulation Frequency : under 30 KHz

5.3.1 V by one Rx EYE Specifications



	X[UI]	Y[mV]
A	0.25	0
B	0.3	50
C	0.7	50
D	0.75	0
E	0.7	-50
F	0.3	-50



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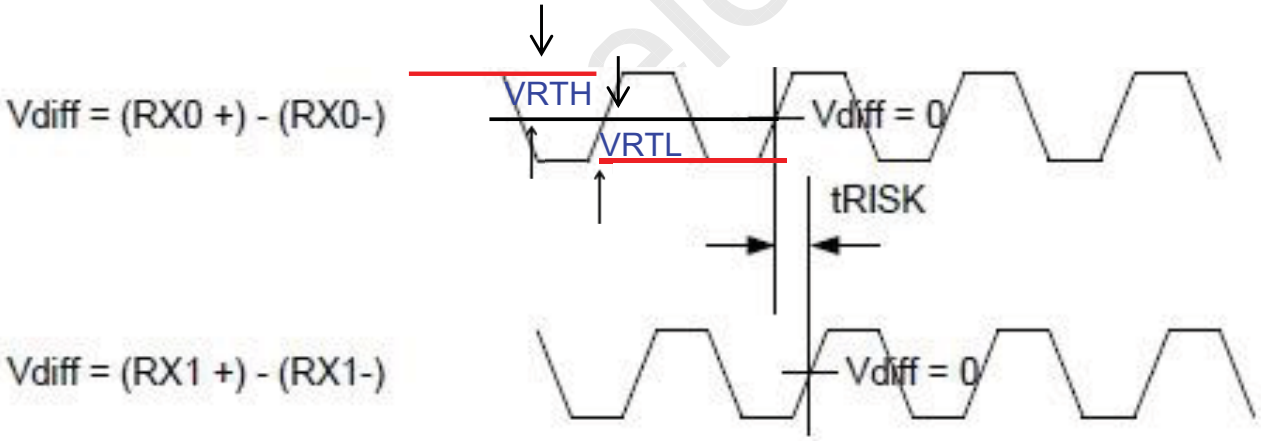
5.3.2 V by One Rx characteristics

Symbol	SYMBOL	Min	Typ	Max	UNIT	Note
VRTH	Differential Input High Threshold	-	-	50	mV	(1)
VRTL	Differential Input Low Threshold	-50	-	-	mV	(1)
RRIN	Differential Input Resistance	80	100	120	ohm	
tRBIT (=UI)	Unit Interval	266	-	1667	psec	
tRISK _INTRA	Allowable Intra-pair Skew	0.3	-	-	UI	(2)
tRISK _INTER	Allowable Inter-pair Skew	5	-	-	UI	(3)

Note (1) Refer below figure.

Note (2) Allowable intra-pair skew : data to data

Note(3) Allowable inter-pair skew : lane to lane (lane A ~ lane H)



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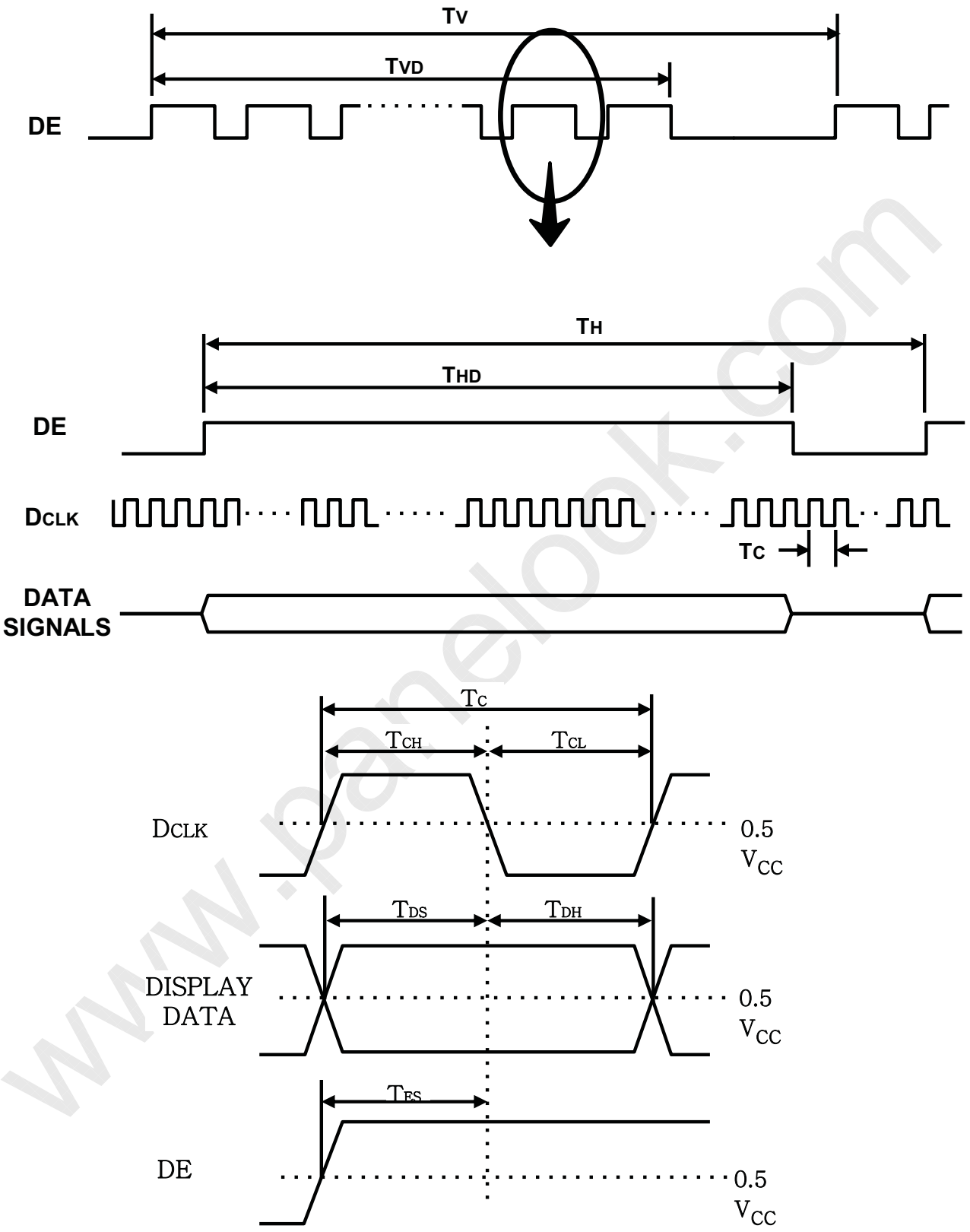
5.4 Timing diagrams of interface signal (DE mode)



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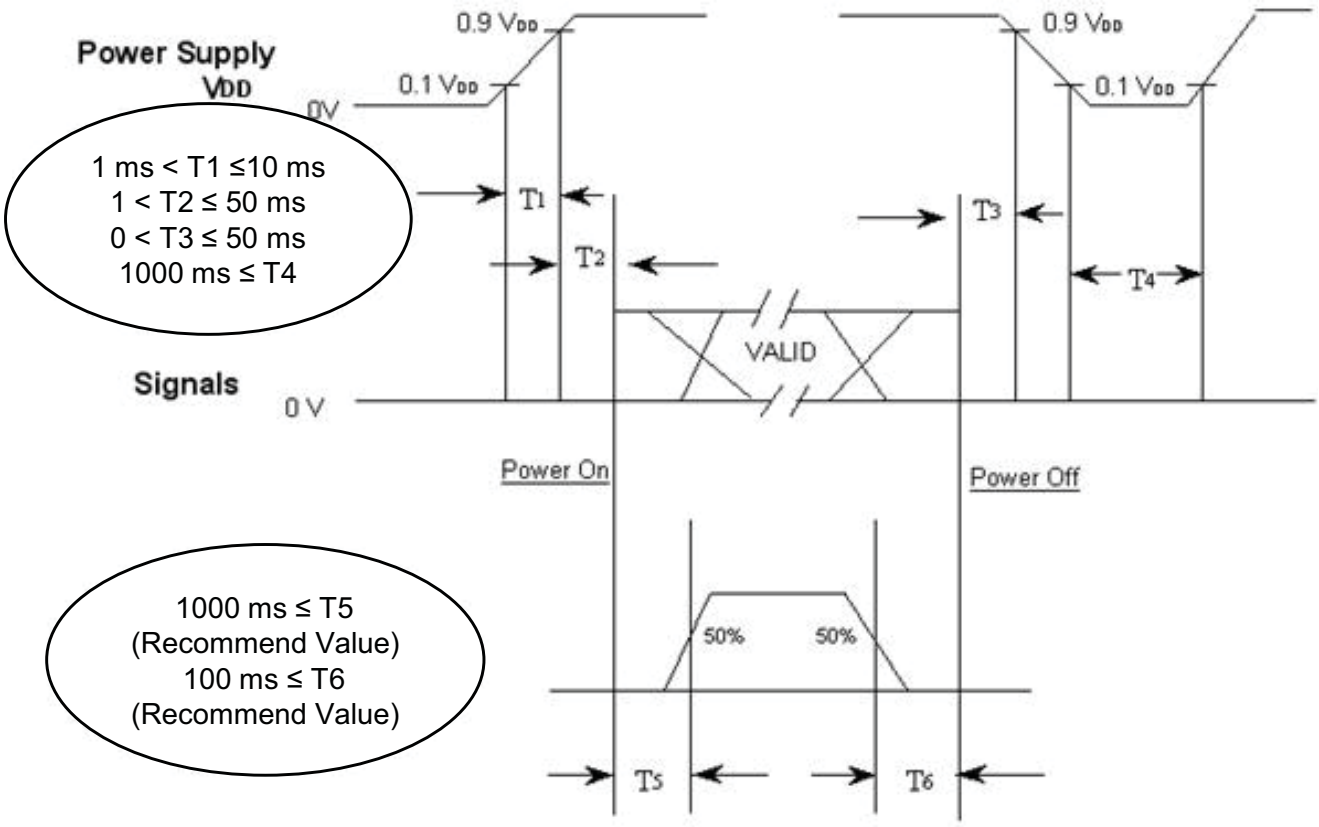
5.5 Power ON/OFF Sequence (T-con input)

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



T1 : V_{DD} rising time from 10% to 90%
T2 : The time from V_{DD} to valid data at power ON.
T3 : The time from valid data off to V_{DD} off at power Off.
T4 : V_{DD} off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L disable at power Off.

- The supply voltage of the external system for the Module input should be the same as the definition of V_{DD}.
- Apply the CCFL voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.
- In case of V_{DD} = off level, please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off and on period.
- Interface signal should not be kept at high impedance when the power is on.

5.5.1 3D ON/OFF Sequence

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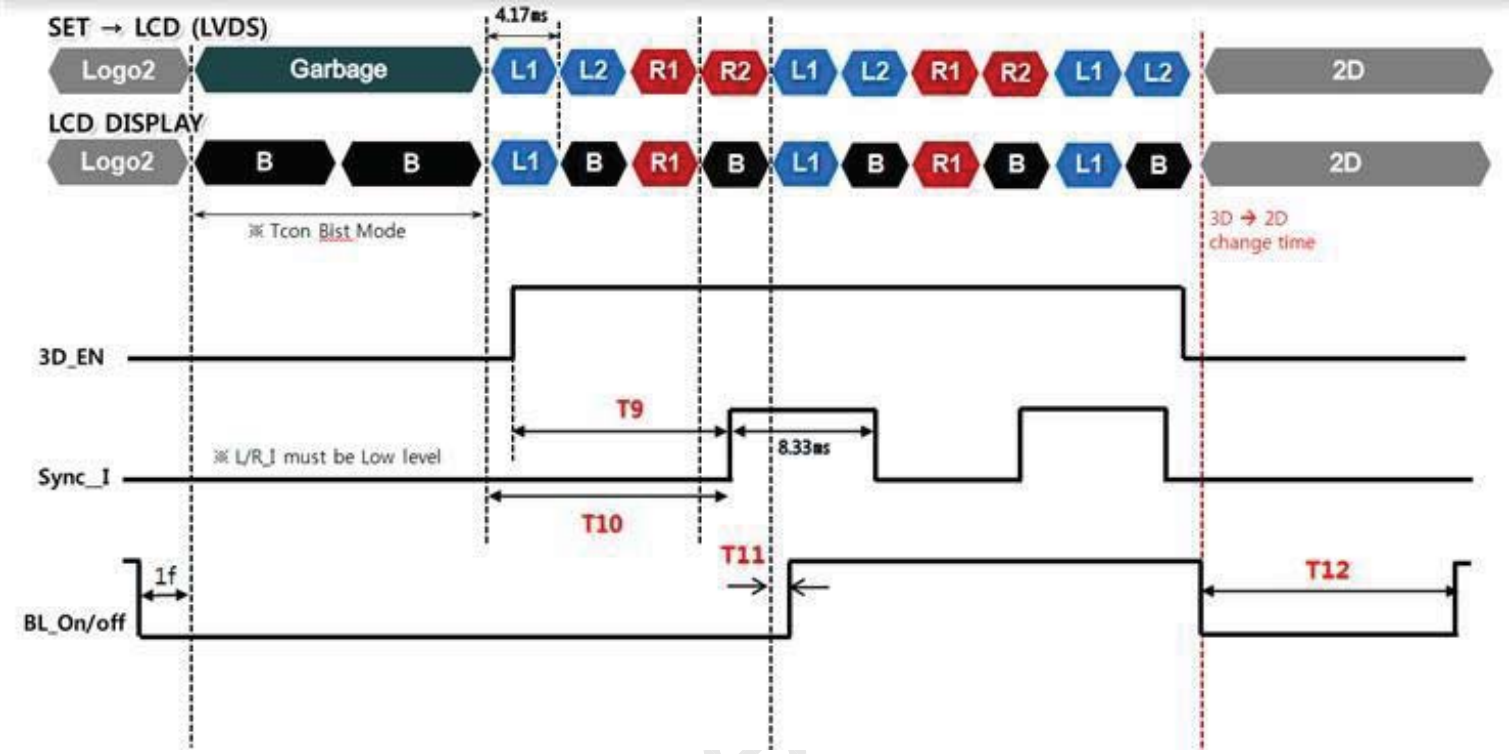
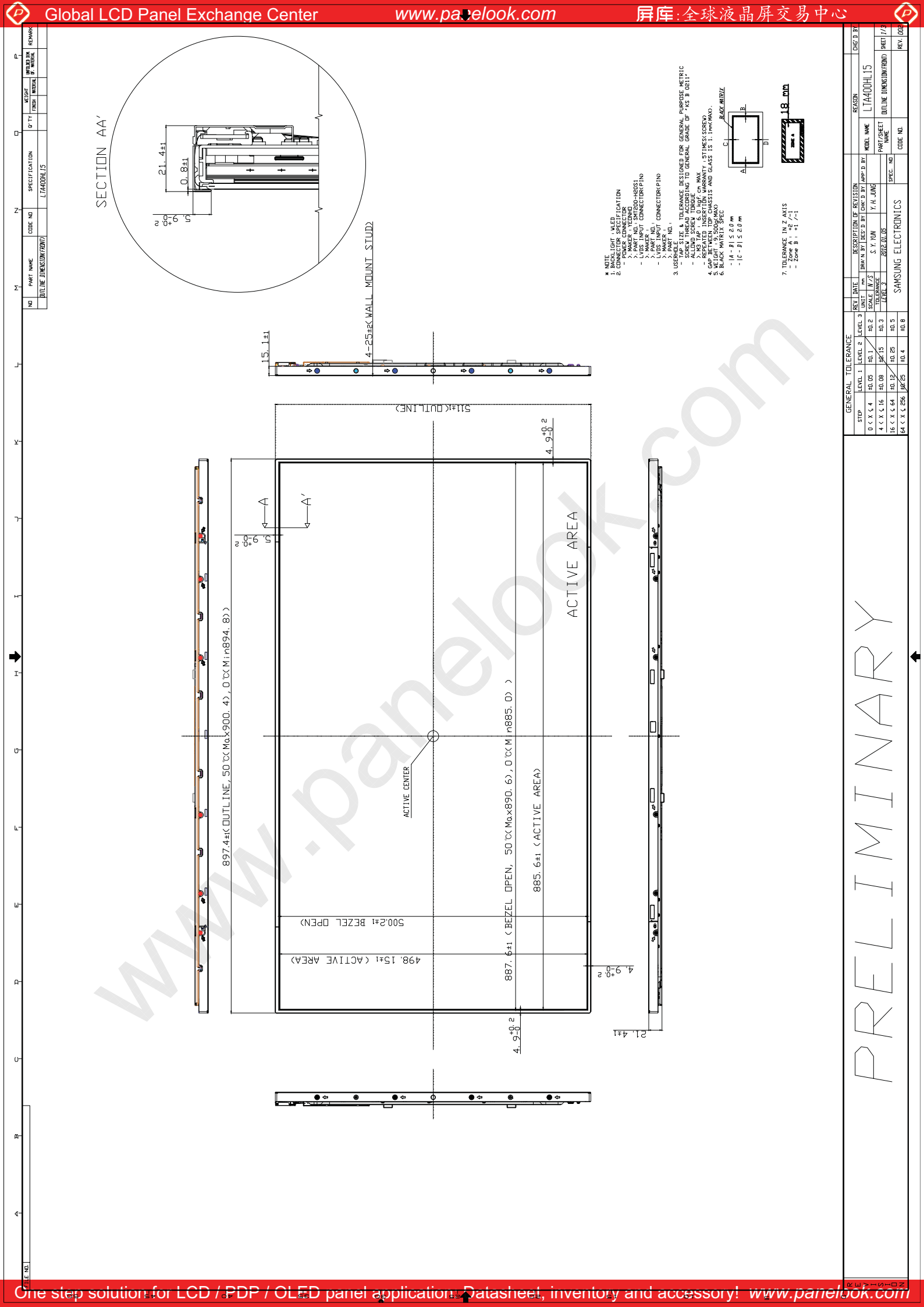
To prevent an abnormal display or garbage display of the LCD Module, the 3D on/off sequence should be as the diagram below.



Timing	Spec (ms)	Description
T9	> 0	
T10	12.51 < T10 < 16.68	3 frame < T10 < 4 frame
T11	≥ 2.74	
T12	≥ 16.0	

Note) Delay between 3D sync_I and 3D sync_o is 4.3ms.



NO	PART NAME	CODE NO.	SPECIFICATION	Q'TY	WEIGHT	REMARK
	OUTLINE DIMENSION(FRONT)		LTA400HL15			

REV.	DATE	DESCRIPTION OF REVISION	CHK'D BY

GENERAL TOLERANCE			
STEP	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 4	±0.05	±0.1	±0.2
4 < X ≤ 16	±0.08	±0.15	±0.3
16 < X ≤ 64	±0.12	±0.25	±0.5
64 < X ≤ 256	±0.25	±0.4	±0.8

DRAW'N BY	DES'D BY	CHK'D BY	APP'D BY
S.Y.YOU		Y.H.JUNG	

UNIT : mm
SCALE : N/S
TOLERANCE LEVEL 3
2012.01.06

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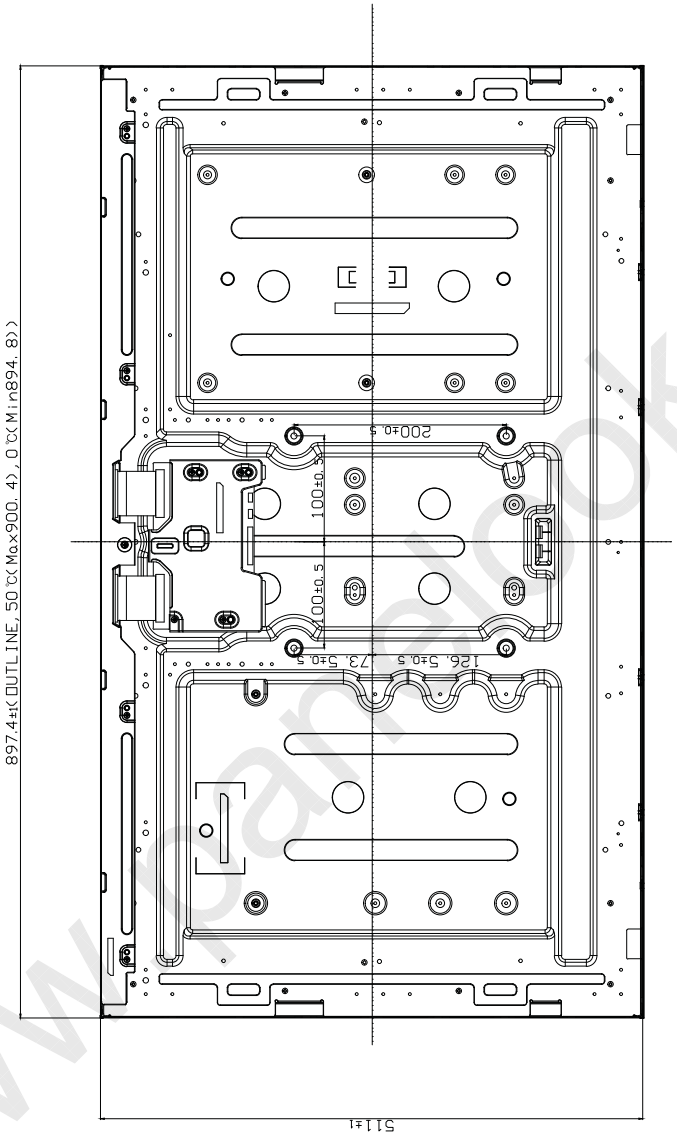
MODEL NAME	REASON
LTA400HL15	

PART/SHEET NAME	SHEET 1/3
OUTLINE DIMENSION(FRONT)	REV. 002

SPEC. NO
CODE NO.

PRELIMINARY



NO	PART NAME	CODE NO.	SPECIFICATION	Q'TY	WEIGHT / FINISH / MATERIAL	APPLIED DIM. & MATERIAL	REMARK
	OUTLINE DIMENSION (BACK)		LTA400HL15				

GENERAL TOLERANCE

STEP	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 4	±0.05	±0.1	±0.2
4 < X ≤ 16	±0.08	±0.15	±0.3
16 < X ≤ 64	±0.12	±0.25	±0.5
64 < X ≤ 256	±0.25	±0.4	±0.8

REV.	DATE	DESCRIPTION OF REVISION	CHG'D BY
		REASON	

UNIT	mm	DRAW'N BY	S.Y.YUN	CHK'D BY	Y.H.JUNG	APP'D BY		MODEL NAME	LTA400HL15	SHEET 2/3
SCALE	N/S	DES'D BY						PART/SHEET NAME	OUTLINE DIMENSION (BACK)	REV. 000
TOLERANCE	LEVEL 3		2011.12.27				SPEC. NO	CODE NO.		

SAMSUNG ELECTRONICS

PRELIMINARY

7. Reliability Test

Item	Test condition	Quantity
Temperature Step Stress	-20 ~ 60℃, 40hr, 5 Cycle determination	4EA
HTOL	50℃, 500hr determination	8EA
LTOL	0℃, 500hr determination	4EA
HTS	70℃, 50[illegible]ination	4EA
LTS	-30℃, 500hr [illegible]etermination	4EA
THB	40℃ / 95%RH, 50[illegible]hr determination	4EA
WHTS	60℃ / 75%RH, 250hr determination	4EA
Thermal Shock	-20 ℃ ~ 60 ℃, 200cycle determination	4EA
ESD (operation)	contact : ±10 kV ,150pF/330Ω,200Point,1 time/Point non-contact : ±20 kV,150pF/330Ω,200Point,1 time/Point	3EA
Vibration	10~300Hz/1.5G/10minSR, XYZ, 30min/axis	3EA
Shock	Half Sine, 11msec, ±[illegible], ± Z 30G 1time/axis	3EA

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these should be no change which may affect practical display functions.

* HTOL/ LTOL : High/Low Temperature Operating Life
* THB : Temperature Humidity Bias
* HTS/LTS : High/Low Temperature Storage
* WHTS : Wet Humidity Temperature Storage

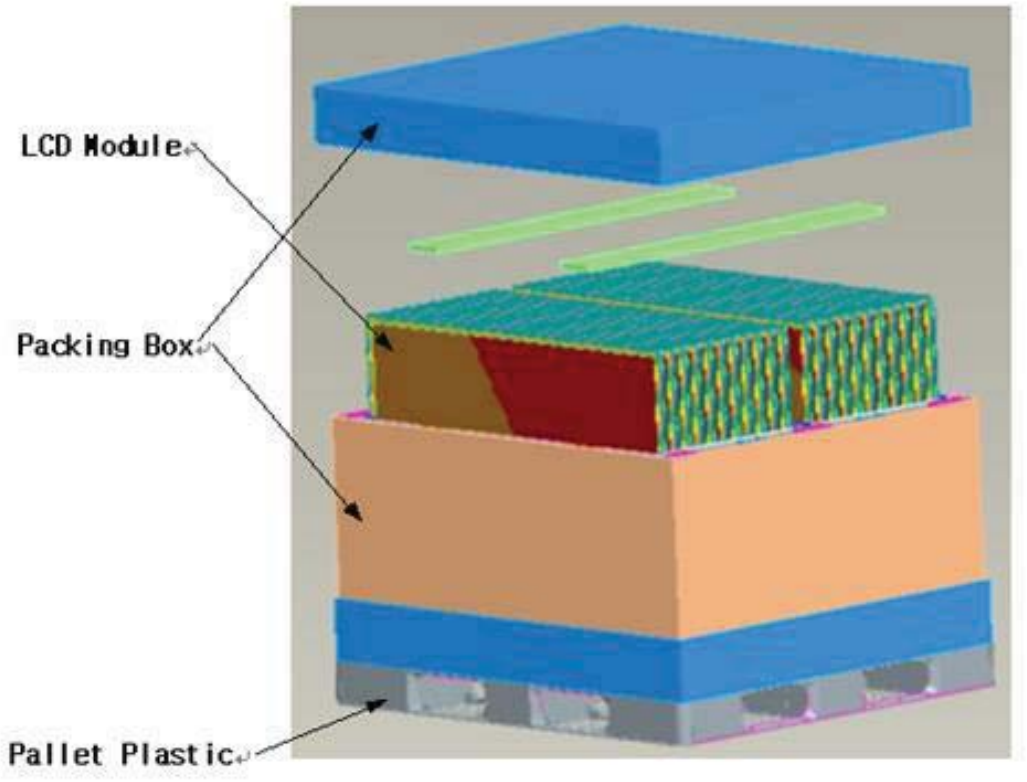
8. PACKING

8.1 CARTON (Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method



8.2 Packing Specification

Item	Specification	Remark
LCD Packing	18ea / Box (Packing-Pallet Box)	1. 7.3 Kg / LCD (18ea) 2. 23.8 Kg / Packing Box (1set) > Packing Box Material : Paper
Pallet	1Box / Pallet	1. Pallet weight = 5.3 kg > Pallet Material : HDPE
Packing Direction	Vertical	
Total Pallet Size	H x V x height	1124mm(H) x 945mm(V) x 565mm(height)
Total Pallet Weight	162 kg	Pallet(5.3kg) + Module(131.4kg) + Packing BOX(23.8kg) + Silica-Gel(0.72kg)

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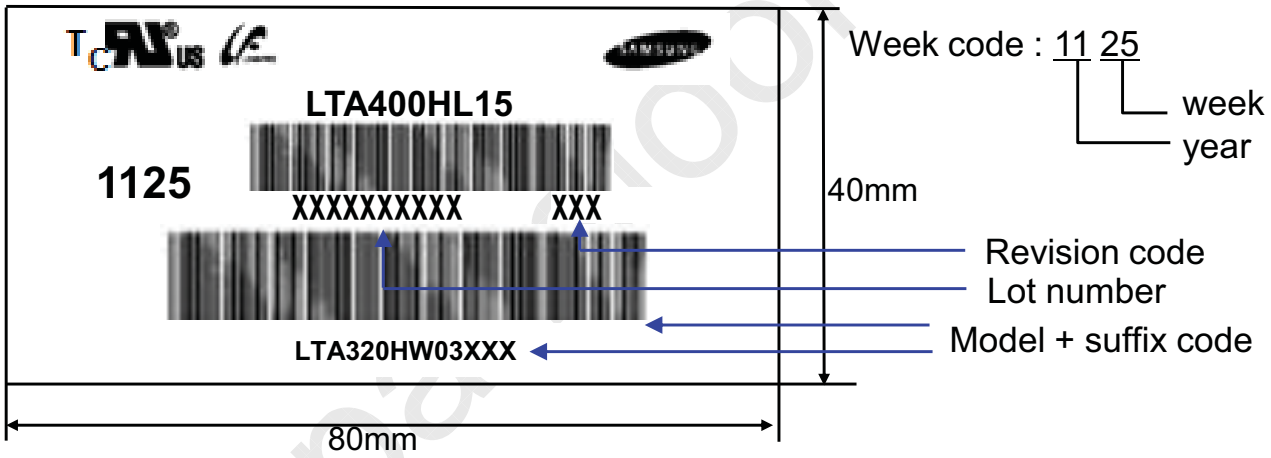
9. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

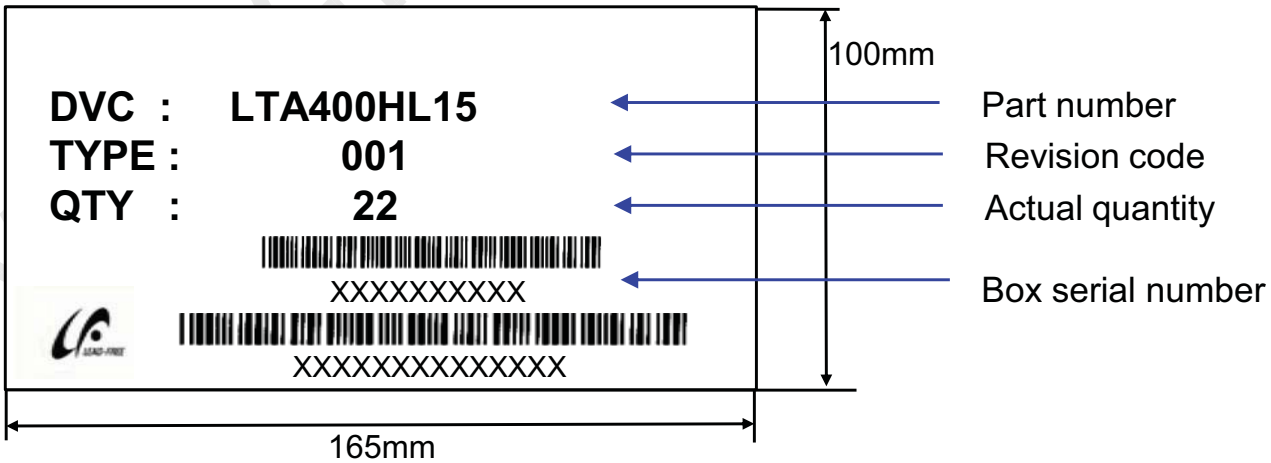
(1) Part number : LTA400HL15
(2) (2) Revision: Three letters
(3) Lot number : X X X X XXX XX X

- X: Line
- X: Product code
- X: Year (Note1)
- X: Month
- XXX: Lot No. (Glass)
- XX: Glass No. (In the one Lot)
- X: Cell Position No. (In the Glass)

(4) Nameplate Indication



(5) Packing box attach



10. General Precautions

10.1 Handling

(a) When the Module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the Module.

(b) Because the inverter use high voltage, it should be disconnected from power before it is assembled or disassembled.

(c) Refrain from strong mechanical shock and / or any force to the Module. In addition to damage, this may cause improper operation or damage to the Module and LED back light.

(d) Note that polarizers are very fragile and could be damage easily. Do not press or scratch the surface harder than a HB pencil lead.

(e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.

(f) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.

(g) Desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(h) 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, legs or clothes, it must be washed away with soap thoroughly.

(i) Protect the module from Electrostatic discharge. Otherwise the ASIC IC or Semiconductor would be damaged.

(j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(k) Do not disassemble the Module.

(l) Do not disassemble shield case of converter & C-PBA

(m) Do not connect N.C pins. (Samsung internal use only)

(n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized. Must put on antistatic glove while handle a module

(o) Pins of I/F connector should not be touched directly with bare hands.

10.2 Storage

We highly recommend to comply with the criteria in the table below.

ITEM	UNIT	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage Life	6 months		
Storage Condition	- The storage room should provide good ventilation and temperature control. - Products should not be placed on the floor, but on the Pallet away from a wall. - Prevent products from direct sunlight, moisture nor water; Be cautious of a build up of condensation. - Avoid other hazardous environment while storing goods. - If products delivered or kept in conditions of over the storage period of 3months, the recommended temperature or humidity range, we recommend you leave them at a temperature of 20℃ and a humidity of 50% for 24 hours.		

10.3 Operation

(a) Do not connect or disconnect the Module in the "Power On" condition.

(b) Power supply should always be turned on/off by the "Power on/off sequence"

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

10.4 Operation Condition Guide

(a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
- Temperature : 20±15℃
- Humidity : 55±20%
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc.., It is strongly recommended to contact SEC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

10.5 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the Module may be damaged.

(d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked " to the screen.
To avoid image sticking, it is recommended to use a screen saver.

(e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

(f) Please contact SEC in advance when you display the same pattern for a long time.