



SAMSUNG DISPLAY



Product Specification

- () Product Information
- (√) Preliminary Specification
- () Approval Specification

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

CUSTOMER	G/A Customers
DATE OF ISSUE	01/10/2013

MODEL NO.	LTJ460AN01
EXTENSION CODE	-0

Customer Approval & Feedback	

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REVISION HISTORY

Date.	Rev.No.	Page	Revision Description
01/10/2013	P00	all	First issued

GENERAL DESCRIPTION

DESCRIPTION

LTI460AN01-0 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. This 46.0" model has a resolution of 1,366 x 768 pixels can display up to 16.7 Million colors with the wide viewing angle of 89° or higher in all directions. This panel is intended to support applications by providing an excellent performance for the display products with a flat panel such as DID (Digital Information Display) , Public Monitor

FEATURES

High contrast ratio & aperture ratio with the wide color gamut
 SPVA (Super Patterned Vertical Align) mode
 Wide viewing angle ($\pm 178^\circ$)
 High speed response
 Wide XGA HD resolution (1366X768) resolution (16:9)
 BLU of CCFL
 RoHS compliance (Pb-free)
 Low power consumption
 DE (Data Enable) mode
 The interface (1pixel/clock) of 1ch LVDS (Low Voltage Differential Signaling)
 (Landscape Only)

APPLICATIONS

Digital Information Display (DID)
 High Definition Public Monitor

GENERAL INFORMATION

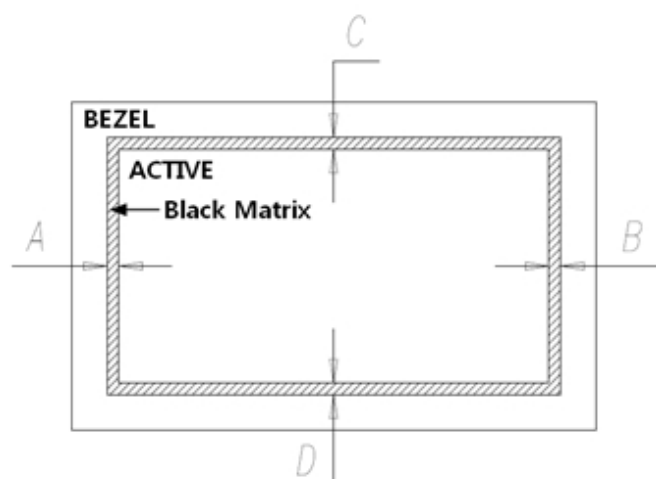
Items	Specification	Unit	Note
Active Display area	1018.353(H) X 572.544(V)	mm	
Switching Components	a-Si TFT active matrix		
Module Size	1025.653(H) x 579.884(V)	mm	Typ
	59.53(D)	mm	Max
Weight	13,500	g	Max
Display colors	16.7M (8bits-True)	Color	
Number of pixels	1,366 x 768	Pixel	16:9
Pixel Arrangement	RGB Vertical stripe		
Display Mode	Normally Black		
Surface Treatment	Haze 2.3% / 2H		Anti-Glare
Luminance of White	450(Typ)	cd/m ²	

MECHANICAL INFORMATION

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	-	1025.653	1026.653	mm	
	Vertical (V)	-	579.884	580.884	mm	
	Depth (D)	-	58.53	59.53	mm	Minimum Depth (2)
Bezel Open	Horizontal (H)	-	1018.553	-	mm	
	Vertical (V)	-	572.744	-	mm	
Black Matrix Shift	Horizontal (H)	-	-	2.0	mm	(1)
	Vertical (V)	-	-	2.0	mm	
Weight		-	12,500	13,500	g	

Note (1) Measure the figure for **Black Matrix shift** to be recorded on the spec. with referring to the drawings.

- $|A - B| \leq \text{Horizontal Spec}$
- $|C - D| \leq \text{Vertical Spec}$



Note (2) Measure point of Depth

TBD

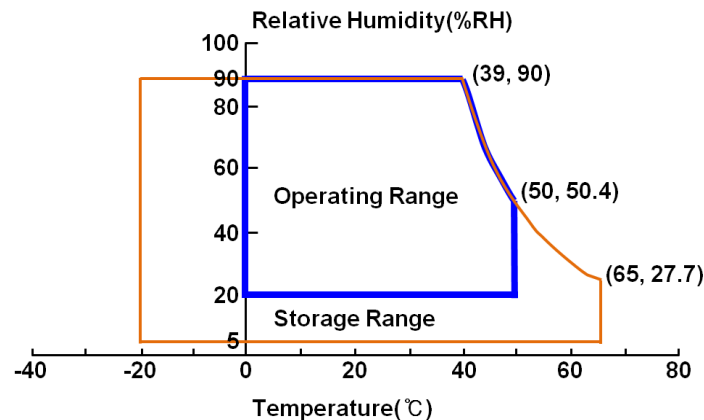
1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

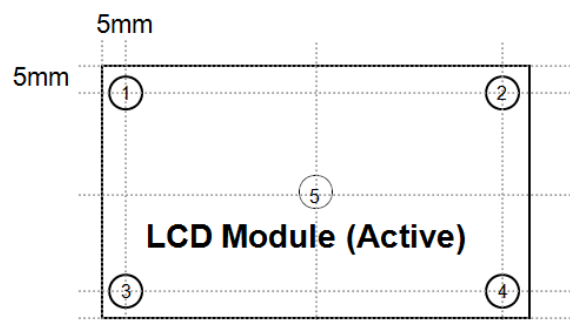
Item		Symbol	Min.	Max.	Unit	Note
Storage temperature		T _{STG}	-20	65	°C	(1)
Operation Temperature		T _{OPR}	0	50	°C	(1)
Humidity of storage		H _{SUR}	5	90	%RH	
Operating humidity		H _{OPR}	20	90	%RH	
Glass surface Temperature (Operation)	Center	T _{CENTER}	0	50	°C	(2)
	T Uniformity	ΔT	-	10	°C	

Note (1) The ranges of temperature and relative humidity are shown in the graph below. 90% RH Max.
(The temperature of Ta shall be over 39°C.)

The maximum temperature of wet-bulb shall be less than 39°C. No condensation



Note (2) Definition of test point



ΔT should be less than 10 °C ($\Delta T = |T_{CENTER} - T_{CORNER}|$)

T_{CENTER} : Temperature of the center of the glass surface (Test point 5)

T_{CORNER} : Temperature of each edge of the glass surface (Test point 1~4)

1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	10.8	13.2	V	(1),(2)
Dimming Control	Max.Lum	0	3.3	V	(1)

Note (1) Within Ta (25 ± 2 °C)

(2) The permanent damage or defect to the device may occur if the panel is operated at the figure set, which exceeds a limit of maximum value stated in the former spec. The functional operation should be limited to the conditions described above under normal operating conditions.

(2) BACKLIGHT UNIT

Item	Symbol	Min.	Typ	Max	Unit	Note
Current of lamp	IL	9.0	-	15	mArms	(2),(3)
Frequency of lamp	FL	30	-	100	KHz	(2),(3)
Pressure of lamp gas		-	25	-	Torr	

Note (2) The back-light shall be operated within the value described above since the permanent damage or defect may occur, if the above-mentioned figures exceed the maximum value.

Note (3) Based on the single lamp.

1.3 The Others Absolute Ratings

STATIC ELECTRICITY PRESSURE RSISTANCE

Item	Symbol	Min.
CONTACT DISCHARGE	150pF, 330Ω, ± 10kV, 200points, 1 time/point	Operating
AIR DISCHARGE	150pF, 330Ω, ± 20kV, 200points, 1 time/point	Operating

2. APPLICATION INFORMATION FOR DID (Digital Information Display)

A DID's screen may display the sudden image such as an image retention.

To extend the lifetime and optimize a function of module, the below-mentioned operating conditions are required.

2.1 Normal operating condition

- a. Temperature: $20 \pm 15^{\circ}\text{C}$
- b. Humidity: $55 \pm 20\%$
- c. Display pattern: Moving image or image, which switches regularly.
Note) The sudden image on the screen can be displayed after the static image is shown in the long-term.

2.2 The operating conditions when the module is operated under the abnormal condition.

- a. Ambient condition
 - It is recommended to set the DID up in the well-ventilated place.
- b. The function of power off and screen saver
 - The function of periodical power-off or a screen saver is needed when the static image is displayed in the long-term.

2.3 Operating conditions to prevent the sudden display resulted from displaying the static image in the long-term.

- a. The proper operating time: Under 20 hours a day.
- b. The moving image shall be inserted between the static displays periodically.
 - The refresh time for liquid crystal is needed.
- c. The periodic changing of background color and character's color(image)
 - Use the different color for background and character (image) respectively.
 - Change colors periodically.
- d. Avoid combining the color for background with the color for character, which has a largely different luminance.

Note (1) Abnormal condition means all operating condition except normal operating condition.

Note (2) The moving image or black pattern is strongly recommended as a screen saver.

2.4 Only the lifetime of DID stated in this spec is guaranteed if the DID is used under the proper operating conditions.

3. OPTICAL CHARACTERISTICS

The optical characteristics should be measured in a dark room or the space surrounded by the similar ambient setting.

Measuring equipment : TOPCON RD-80S, SR-3, ELDIM EZ-Contrast Ta(25± 2 °C)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		C/R	-	2000	3000	-	-	(1) SR-3
Response time	G-to-G (AVG)	T _g	-	-	8	16	msec	(3) RD-80S
Luminance of White (At the center of screen)		Y _L	-	400	450	-	cd/m ²	(4) SR-3
Color Chromaticity (CIE 1931)	Red	R _X	Normal ϕ = 0 θ = 0 Viewing Angle	TYP. -0.03	0.643	TYP +0.03	-	(5), (6) SR-3
		R _Y			0.328			
	Green	G _X			0.271			
		G _Y			0.599			
	Blue	B _X			0.143			
		B _Y			0.060			
	White	W _X			0.280			
		W _Y			0.290			
Color Gamut		-	-	70	72	-	%	(5) SR-3
Color temperature		-	-	-	10,000	-	K	
Viewing Angle	Hor.	θ _L	CR ≥ 10	79	89	-	Degree	(6) SR-3 EZ-Contrast
		θ _R		79	89	-		
	Ver.	θ _U		79	89	-		
		θ _D		79	89	-		
Brightness Uniformity (9 Point)		B _{uni}	-	-	-	25.0	%	(2) SR-3

* Ta = 25 ± 2 °C, VDD = 3.3V, fv=60Hz, fDCLK = 78.0MHz, IF =100% duty

Notice (a) Setup for test equipment

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

The environment condition : $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$

Note (1) Definition of contrast ratio (C/R)

: The Ratio of max. gray (Gmax) & min. gray (Gmin) at the center point ⑤ of the panel.

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

Gmax : Luminance in all white pixels

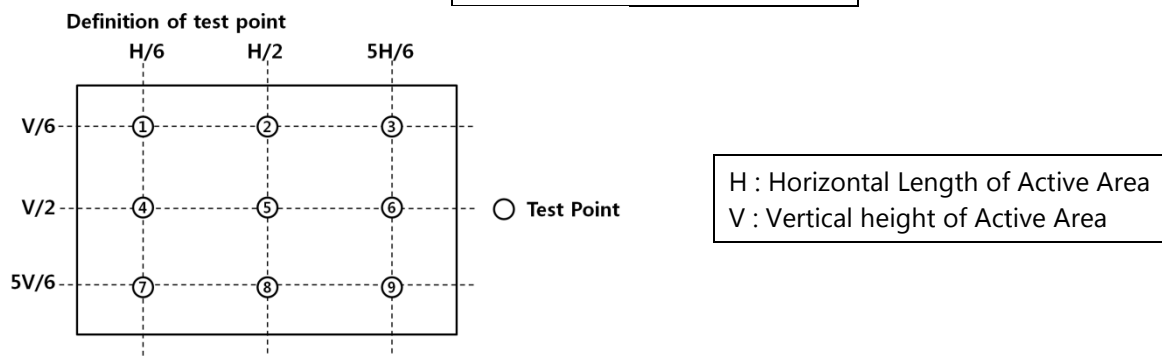
Gmin : Luminance in all black pixels.

Note (4) Definition of brightness uniformity at 9 points (Test pattern : Full white)

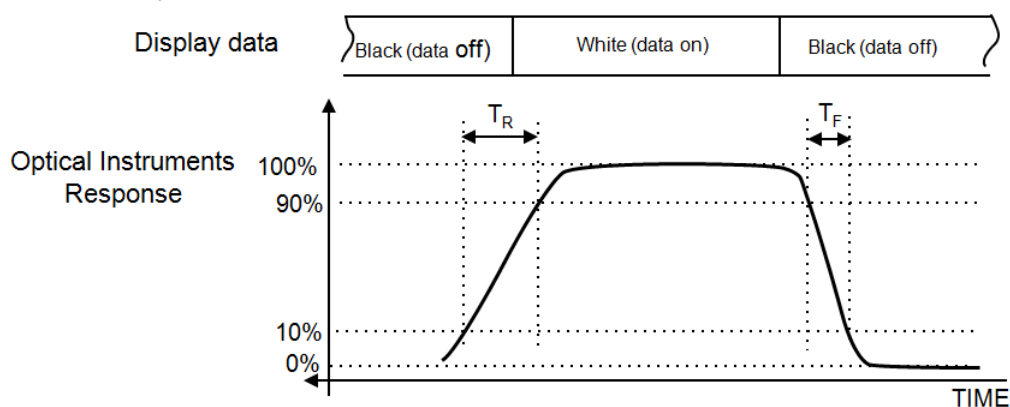
$$B_{uni} = 100 * \frac{(B_{\max} - B_{\min})}{B_{\max}}$$

Bmax : Maximum brightness

Bmin : Minimum brightness



Note (3) Definition of Response time : Sum of T_R , T_F

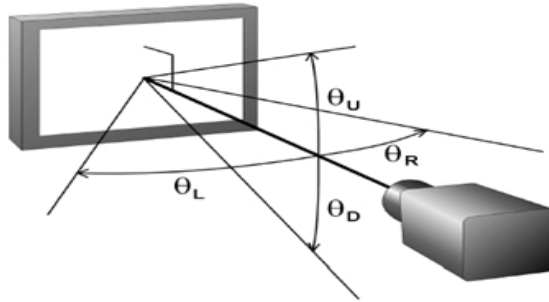


※ G-to-G : Average response time between the whole gray scale to the whole gray scale.

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 ($C/R \geq 10$)

4. ELECTRICAL CHARACTERISTICS

4.1 TFT LCD MODULE

The connector to transmit a display data and a timing signal should be connected.

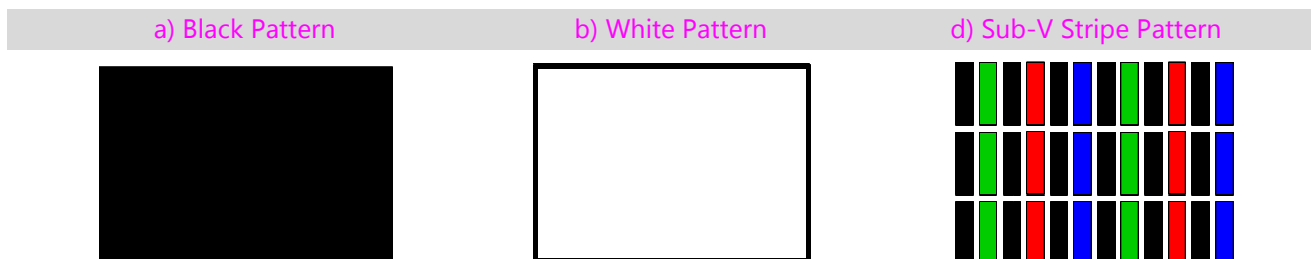
$T_a = 25 \pm 2^\circ\text{C}$

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply	V_{DD}	10.8	12.0	13.2	V	(1)
Current of Power Supply	(a) Black	-	(360)	(400)	mA	(2), (3)
	(b) White	-	(500)	(560)		
	(c) Sub-V Stripe	-	(500)	(570)		
Vsync Frequency	f_V	48.0	60.0	62.0	Hz	-
Hsync Frequency	f_H	43	50.4	53.0	kHz	-
Main Frequency	F_{dclk}	72.0	78.0	85.0	MHz	-
Rush Current	I_{RUSH}	-	-	(3.0)	A	(4)

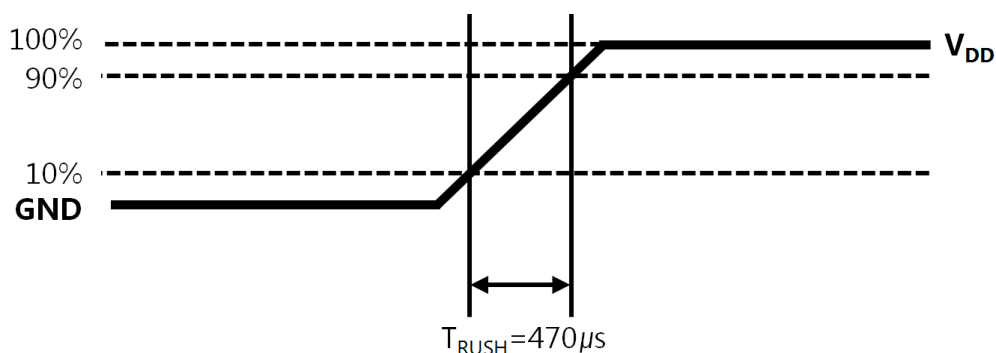
Note (1) The ripple voltage should be controlled under 10% of V_{DD} .

Note (2) $f_V=60\text{Hz}$, $f_{DCLK}=78.0\text{MHz}$, $V_{DD}=12.0\text{V}$, DC Current.

Note (3) The pattern for checking the power dissipation (LCD module only).



Note (4) Conditions for measurement



The rush current, I_{RUSH} can be measured when T_{RUSH} is $470\mu\text{s}$.

4.2 BACK LIGHT UNIT

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Current of lamp	I_L	9.0	13.0	15.0	mArms	(1)
Voltage of lamp	V_L	1,035 $\pm$ 7%(I_L : 9mA) 995 $\pm$ 7%(I_L : 11mA) 975 $\pm$ 7%(I_L : 12mA) 955 $\pm$ 7%(I_L : 13mA) 935 $\pm$ 7%(I_L : 14mA) 915 $\pm$ 7%(I_L : 15mA)			Vrms	(1)
Frequency of lamp	f_L	30		100	kHz	
Operating life Time	Hr	-	50,000	-	Hour	25℃ (2)
		-	-	-		0℃ (2)
Start up voltage		1370	-	-	Vrms	25℃ (3)
		1530	-	-		0℃ (3)
Power Consumption	P	-	148.98	164.7	W	$I_L * V_L * Q$
CCFL Counts	Q	-	12	-	EA	

Note (1) The current of lamp shall be measured with the ammeter for product with a high frequency within the operating range of lamp as shown below-depicted picture.

Min. voltage of lamp: Based on the 15 mArms, current of lamp.

Max . voltage of lamp: Based on the 11 mArms, current of lamp.

(2) The lifetime of lamp shall be the time, until which the luminance of BLU falls below 50% of initial luminance at the standard state when the lamp is operated continuously within the guaranteed period for use.(Ta=25℃)

- The above-mentioned lifetime is for single lamp.

(3) The value of voltage, which is beyond the above-mentioned figure shall be entered to the lamp for over 1 sec. to start the lamp. If not, the lamp may not be lightened.

4.3 CONDITION & SPECIFICATION OF CONVERTER'S INPUT

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Supply Voltage & Current							
Input Voltage	Vin	-	22	24	26	V	Ta=25±2 °C
Inrush Current	Inrush	Vin =24.0V dim=100%	-	-	7.4	Adc	Initial turn on
Output Section							
Output Current	Io	Vin = 24V, Dim=100%	12.8	13.5	14.2	mA(rms)	After aging for 1hour
Frequency	I _{LAMP}	Vin = 24V	-	63	-	kHz	
Voltage for open lamp	VOPEN=VLEFT+VRIGHT	Vin= 24V Dim=100%	1600	-	-	Vrms	All-lamp is NC state.
Enable							
Enable Logic	VON		2.4	-	5.25	VDC	
Disable Logic	VOFF		0	-	0.8	VDC	
DIMMING for INTERNAL PWM							
Voltage range	VDIM		0	-	3.3	VDC	
FREQUENCY of PWM	FINT,PWM	Vin = 24V Dim = 0V	120	150	180	Hz	
Duty range of PWM	DINT,PWM	Vin =24V, Dim = 0~3.3V	20	-	100	%	

Note (1) All data was approved after running 120 minutes.

(2) Inrush is measured within BLU on 10ms after leaving the BLU as it is at least 1hr or more at room temperature(25°C)

(3) Additional Appendix for Input current at room temperature (25 °C)

5. INPUT TERMINAL PIN ASSIGNMENT

5.1 INPUT SIGNAL & POWER

Input Connector Model No. : FI-E30S-SM (JAE)

Pin	Description		Pin	Description	
1	N.C	Not Connected(1)	16	GND	Ground
2			17	Rx3N	LVDS Signal -
3			18	Rx3P	LVDS Signal +
4	GND	Ground	19	GND	Ground
5	Rx0N	LVDS Signal -	20	N.C(1)	Not Connected
6	Rx0P	LVDS Signal +	21	LVDS	LVDS Option(2)
7	GND	Ground	22	N.C	Not Connected
8	Rx1N	LVDS Signal -	23	GND	Ground
9	Rx1P	LVDS Signal +	24	GND	Ground
10	GND	Ground	25	GND	Ground
11	Rx2N	LVDS Signal -	26	VDD	VDD(= +12V)
12	Rx2P	LVDS Signal +	27	VDD	VDD(= +12V)
13	GND	Ground	28	VDD	VDD(= +12V)
14	Rx CLK-	LVDS Signal -	29	VDD	VDD(= +12V)
15	RxCLK+	LVDS Signal +	30	VDD	VDD(= +12V)

Note (1) No Connection : These pins are only used for SAMSUNG internal purpose.

Note (2) LVDS Option : High(3.3V) → Normal NS LVDS format

Low(GND)or OPEN(N.C) → JEIDA LVDS format

Sequence : On = $V_{DD}(T1) \geq \text{LVDS Option} \geq \text{Interface Signal}(T2)$

Off = $\text{Interface Signal}(T3) \geq \text{LVDS Option} \geq V_{DD}$

Note (3) LVDS Connector

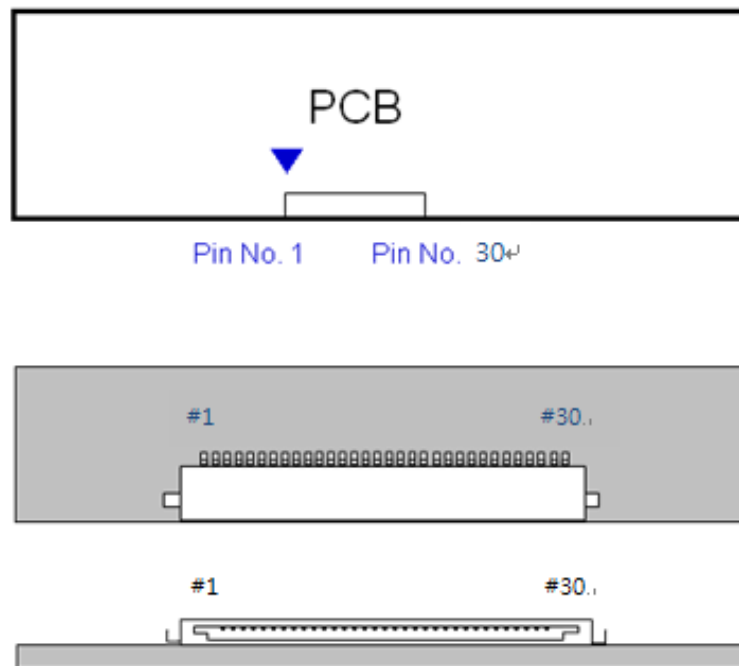


Fig. The diagram of connector .

- a. Pins for power GND shall be connected to the LCD's metal chassis.
- b. All input pins for power shall be connected together.
- c. All NC pins shall be designed with being separated from other signal or power.

5.2 CONFIGURATION OF INPUT PIN OF CONVERTER

(1) Input Connector

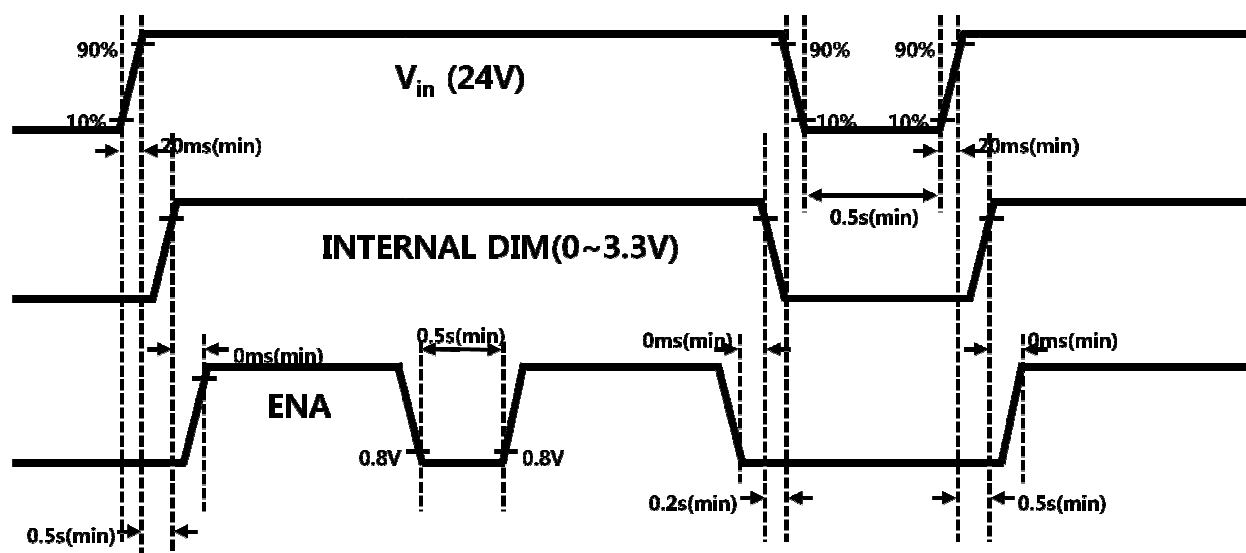
The CN101 connector : 20022WR-14B1 (YEONHO)

Pin No.	SYMBOL	REMARK
1, 2, 3, 4, 5	Vin	Power Supply DC 24V
6, 7, 8, 9, 10	GND	Ground
11	NC	No connection
12	ENA	Inverter On/Off Control Signal
13	INT_DIM	Internal PWM Dimming Signal / 3.3V (Max. Dim) ~ 0V(Min. Dim)
14	NC	No Connection

The CN002 connector : 20022WR-14B1(YEONHO)

Pin No.	SYMBOL	REMARK
1, 2, 3, 4, 5	Vin	Power Supply DC 24V
6, 7, 8, 9, 10	GND	Ground
11,12,13,14	NC	No connection

5.3 THE POWER SEQUENCE FOR INPUTTING TO THE CONVERTER



5.4 LVDS INTERFACE

- LVDS Receiver : Tcon(Merged)
- Data Format (JEIDA & Normal)

Default LVDS Option : JEIDA

LVDS OPTION(input : pin9) : IF THIS PIN : LOW (GND or N/C) → JEIDA LVDS FORMAT
OTHERWISE : HIGH (3.3V) → NORMAL LVDS FORMAT

	LVDS pin	JEIDA -DATA	Normal -DATA
TxOUT/RxIN0	TxIN/RxOUT0	R4	R0
	TxIN/RxOUT1	R3	R1
	TxIN/RxOUT2	R4	R2
	TxIN/RxOUT3	R5	R3
	TxIN/RxOUT4	R6	R4
	TxIN/RxOUT6	R7	R5
	TxIN/RxOUT7	G2	G0
TxOUT/RxIN1	TxIN/RxOUT8	G3	G1
	TxIN/RxOUT9	G4	G2
	TxIN/RxOUT12	G5	G3
	TxIN/RxOUT13	G6	G4
	TxIN/RxOUT14	G7	G5
	TxIN/RxOUT15	B2	B0
	TxIN/RxOUT18	B3	B1
TxOUT/RxIN2	TxIN/RxOUT19	B4	B2
	TxIN/RxOUT20	B5	B3
	TxIN/RxOUT21	B6	B4
	TxIN/RxOUT22	B7	B5
	TxIN/RxOUT24	HSYNC	HSYNC
	TxIN/RxOUT25	VSYNC	VSYNC
	TxIN/RxOUT26	DEN	DEN
TxOUT/RxIN3	TxIN/RxOUT27	R0	R6
	TxIN/RxOUT5	R1	R7
	TxIN/RxOUT10	G0	G6
	TxIN/RxOUT11	G1	G7
	TxIN/RxOUT16	B0	B6
	TxIN/RxOUT17	B1	B7
	TxIN/RxOUT23	RESERVED	RESERVED

5.5 INPUT SIGNALS, BASIC DISPLAY COLORS AND GRAY SCALE

COLOR	DISPLAY	DATA SIGNAL																										GRAY SCALE LEVEL
		RED								GREEN								BLUE										
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7			
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	-		
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-		
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-		
	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	-		
	RED	1	1	1	1	1	1	1	1	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	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	-		
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	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	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	R2		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~ R252		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:				
	↓ LIGHT	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253		
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254		
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255		
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	G0		
	DARK ↑	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~ G252		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:				
	↓ LIGHT	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253		
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G254		
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G255		
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	B0		
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	B2		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~ B252		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:				
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253		
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B254		
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B255		

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

6. INTERFACE TIMING

6.1 TIMING PARAMETERS (DE ONLY MODE)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	72	78	85	MHz	-
Hsync		F_H	54	67.50	69.75	KHz	-
Vsync		F_V	48	60	62	Hz	-
Term for the vertical display	Active display period	T_{VD}	-	768	-	Lines	-
	Total vertical	T_V	775	802	1420	Lines	-
Term for the horizontal display	Active display period	T_{HD}	-	1368	-	Clocks	-
	Total Horizontal	T_H	1420	1624	2770	clocks	-

Note) The signals of Hsync and Vsync must be inputted even though this T-con is operated at DE mode.

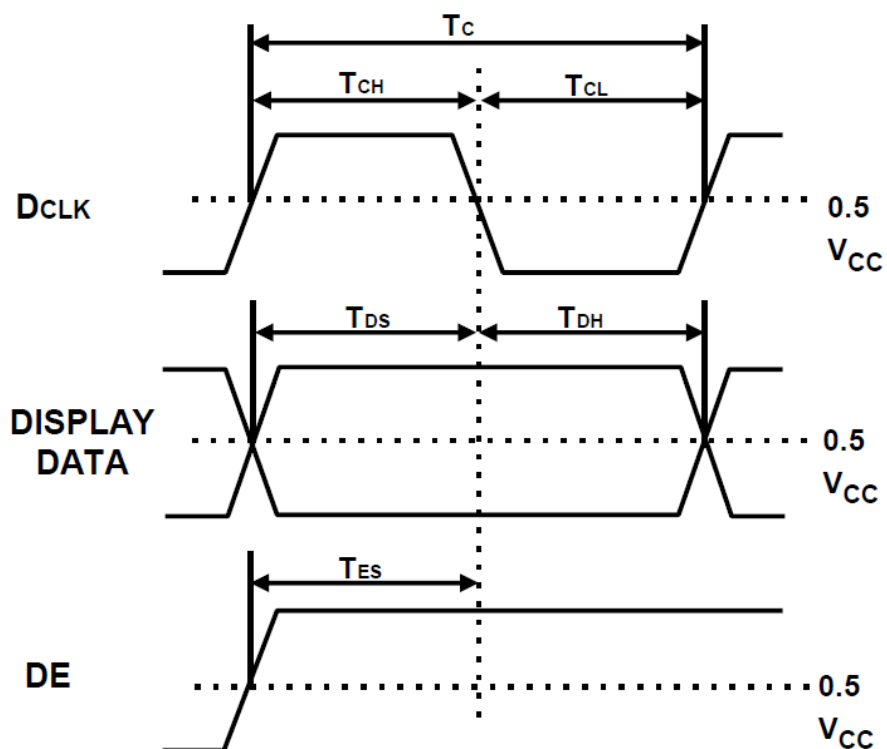
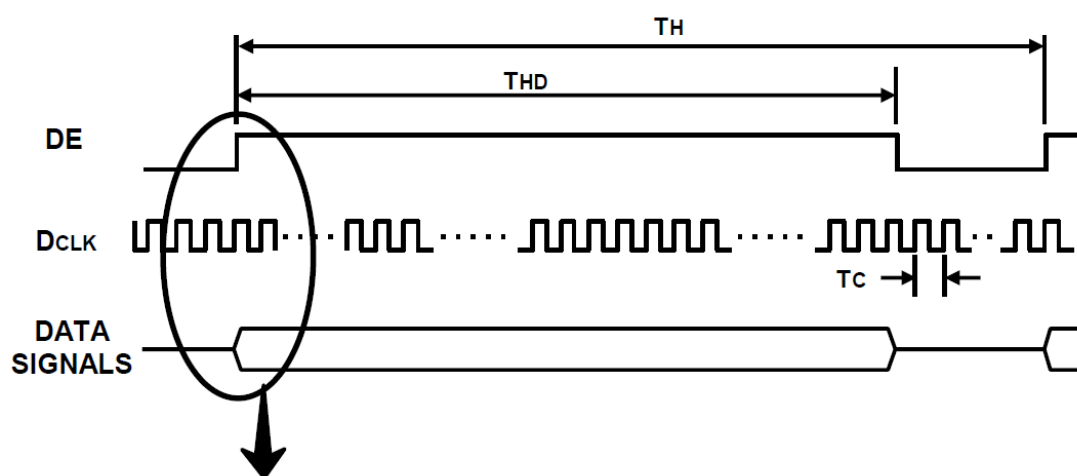
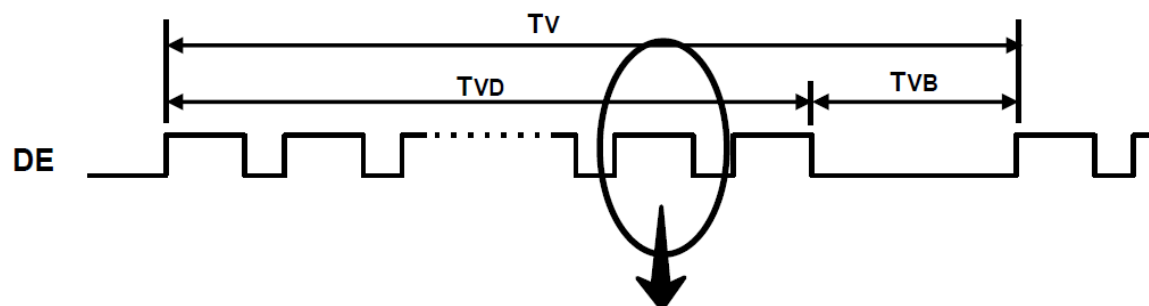
(1) Test Point: TTL controls signal and CLK at LVDS Tx at the input terminal of system.

(2) Internal VDD = 3.3V

(3) The spread spectrum

- The limit of spread spectrum's range of SET in which the LCD module is assembled should be within $\pm 3\%$
- Modulation frequency : min 30kHz~300kHz

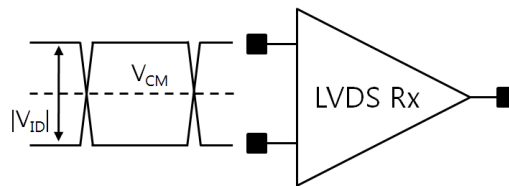
6.2 TIMING DIAGRAMS OF INTERFACE SIGNAL (DE ONLY MODE)



6.3 CHARACTERISTICS OF INPUT DATA OF LVDS

(1) Specification for DC

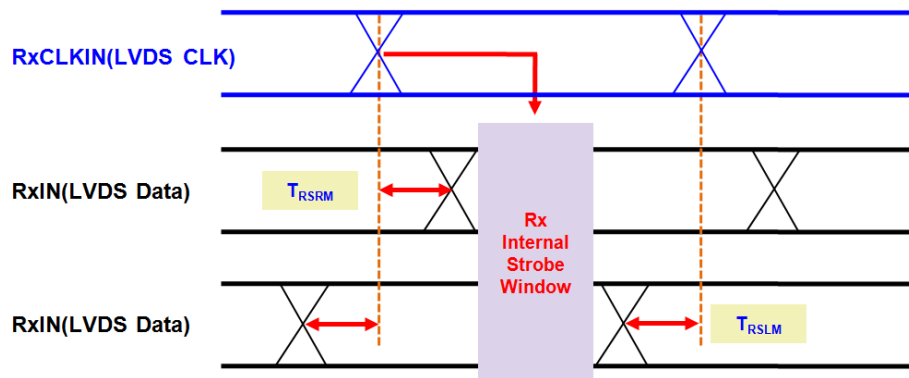
ITEM	SYMBOL	Min.	Typ.	Max.	UNIT
Supply voltage for IO	VDD33_LVDS	3.0	3.3	3.6	V
Supply voltage in the core	VDD12_LVDS	1.1	1.2	1.3	V
Color depth			8		Bit
Input voltage at the common mode	V_{CM}	0.3		1.8	V
Input voltage for differential	$ V_{ID} $	100	350	600	mV



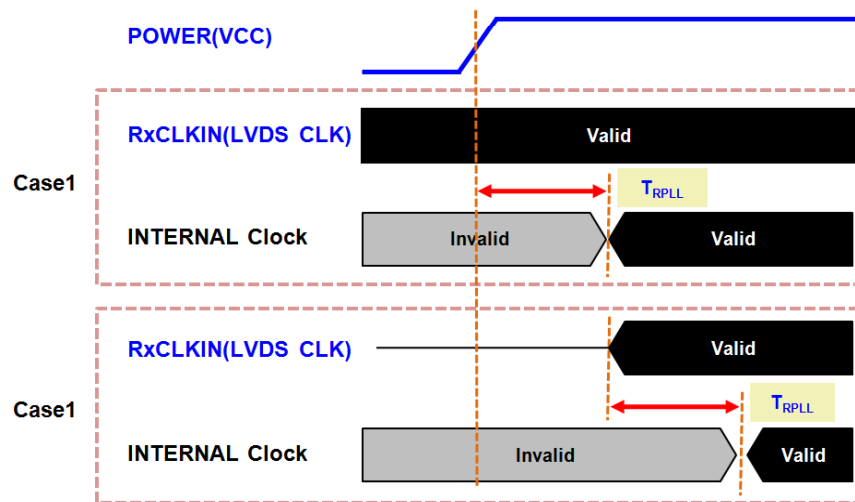
< Definition of DC characteristics of LVDS receiver >

(2) Specification for AC

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT
Frequency for input clock (=1/T)	FIN	25	-	90	MHz
Period of output clock	t_{RCP}	11.11	-	40	ns
Position of input data	FIN=85MHZ	t_{RSRM}	-	+400	ps
	FIN=78MHZ		-	+450	
	FIN=75MHZ		-	+500	
Position of input data	FIN=85MHZ	t_{RSLM}	-400	-	ps
	FIN=78MHZ		-450	-	
	FIN=75MHZ		-500	-	
Lock time	t_{RPLL}	-	-	100	usec
Duty ratio of Rx's clock for output	T_{duty}	45	50	55	%

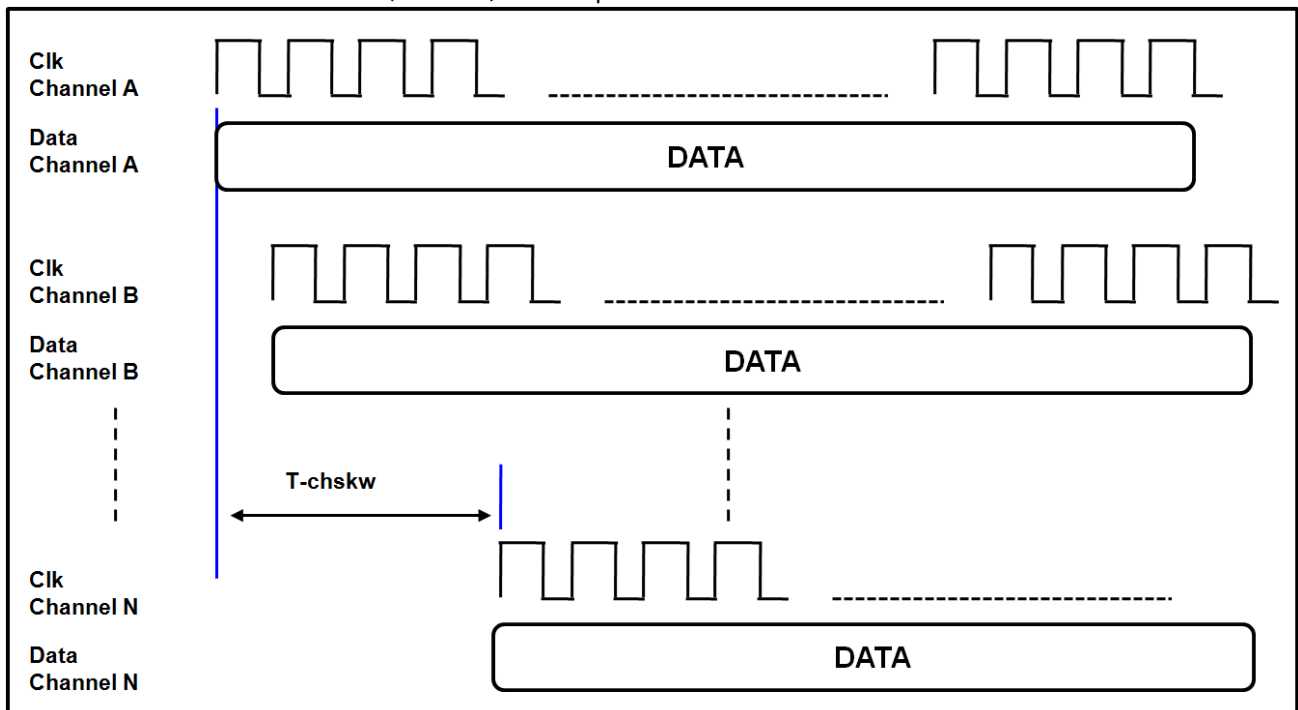


< Timing diagram of skew margin of LVDS receiver >



< Timing diagram of LVDS receiver's operation >

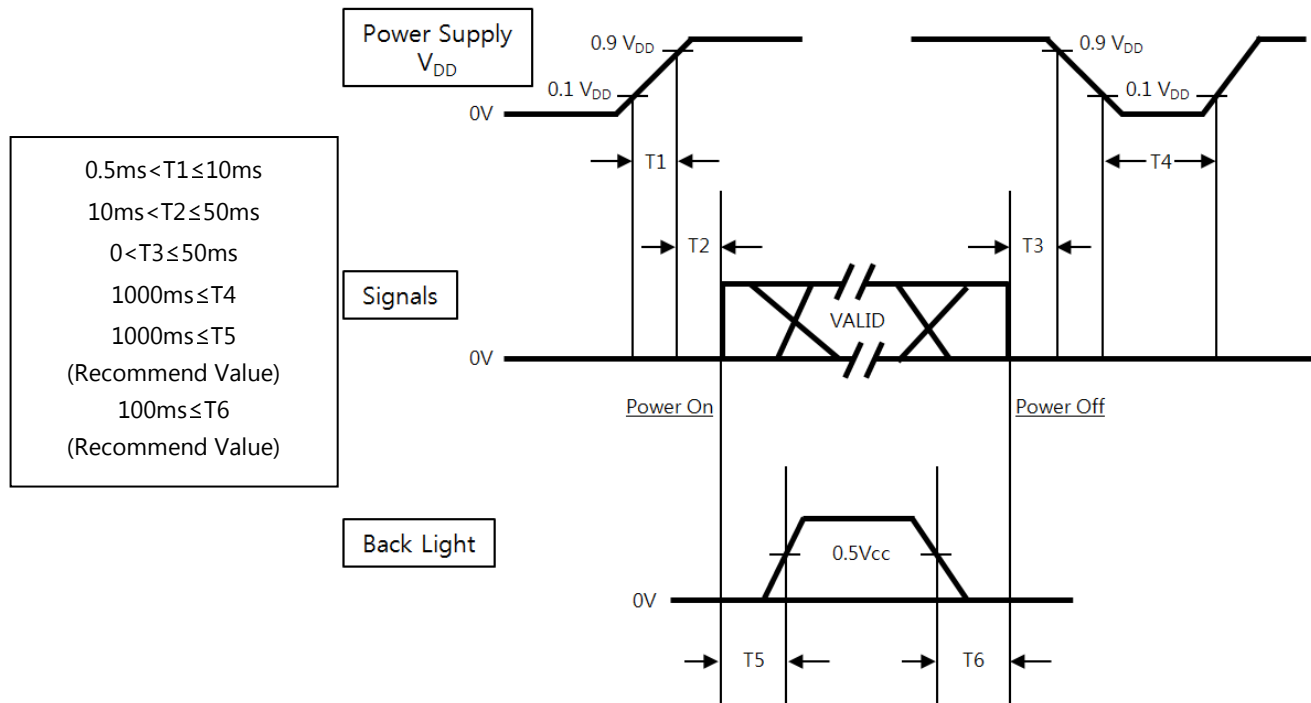
* LVDS Channel to Channel Skew(T_{chskw}) in Multiple LVDS Channels



Note : DE should be synchronized with DE per each LVDS Channel and $T_{chskw} < 16 \times \text{LVDS Clock Period}$

6.4 THE SEQUENCE OF POWER ON AND OFF

To prevent the LCD module from being latched up or being operated at the DC.
The order to turn the power on and off should be same as shown in the diagram below.



T1 : The time, during which the level of V_{DD} is rising from 10% to 90%.

T2 : The changing time, during which the V_{DD} starts rising beyond 90% until the valid data of signal started coming in.

T3 : The changing time, during which the valid data of signal starts leaving out until the V_{DD} starts falling below 90%.

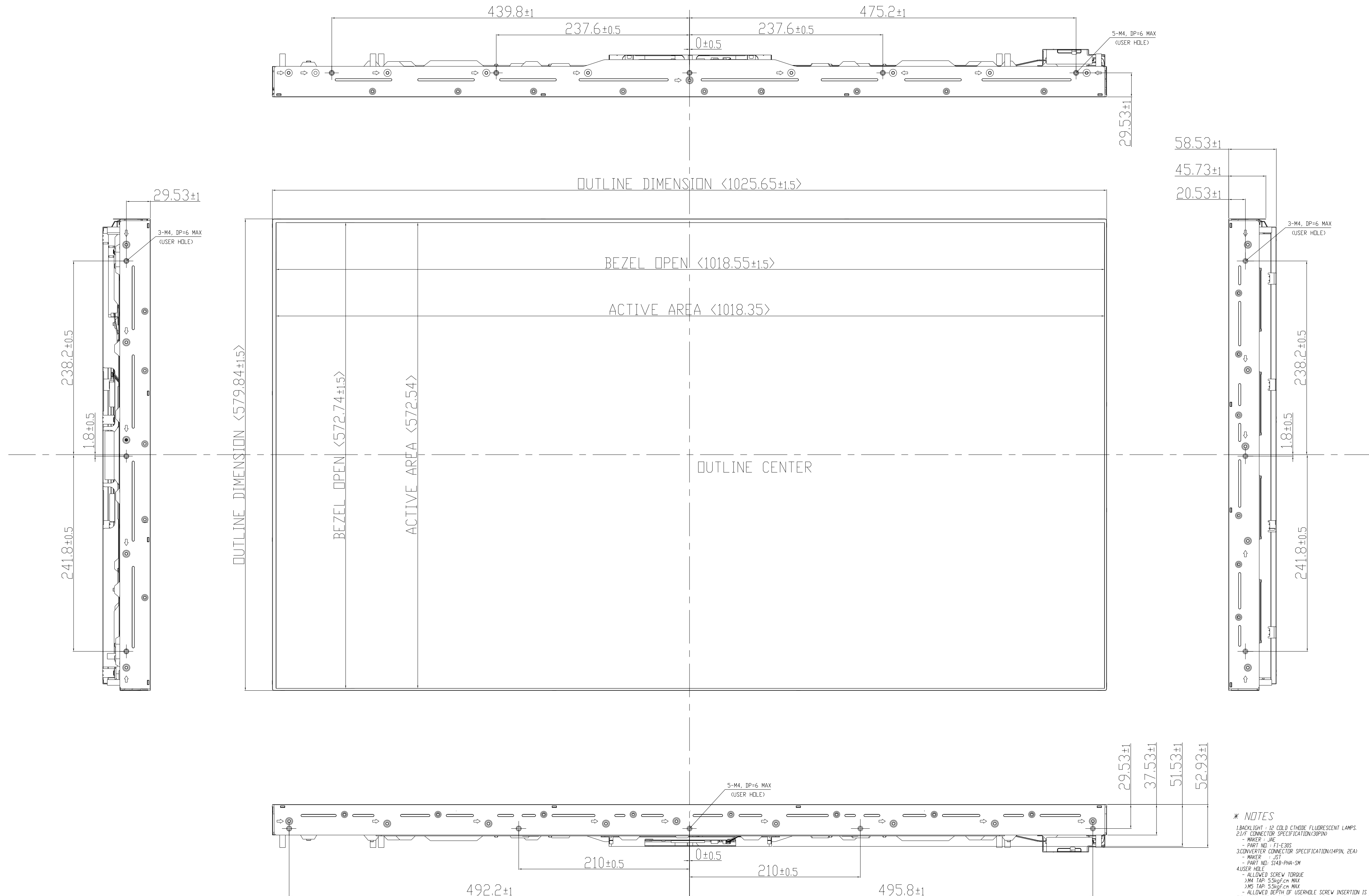
T4 : The changing time, during which the V_{DD} starts falling below 10% to restart the Windows.

T5 : The changing time, during which the signal of BLU starts rising beyond 50%.

T6 : The changing time, during which the signal of BLU starts falling below 50%.

- The inputted V_{DD} 's value for supply voltage, BLU, and signal to the external system of the module shall be computed with referring to the former mentioned value.
- The method to apply the voltage to the lamp within the range, which the LCD operates. When the back-light is turned on before the LCD is operated or the power of LCD is turned off before the back-light is turned off, the abnormal display on the screen may be shown momentarily.
- Please keep the level of input signal low or keep the level of impedance high when the value of V_{DD} is below 10%.
- The value shall be measured after the module has been fully discharged between the period, which the power is turned on and the period, which the power is turned off like the T4 timing.

NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	WEIGHT		UNFOLDED DIM OF MATERIAL	REMARK
					FINISH	MATERIAL		
	OUTLINE DIMENSION		LT1460A01					



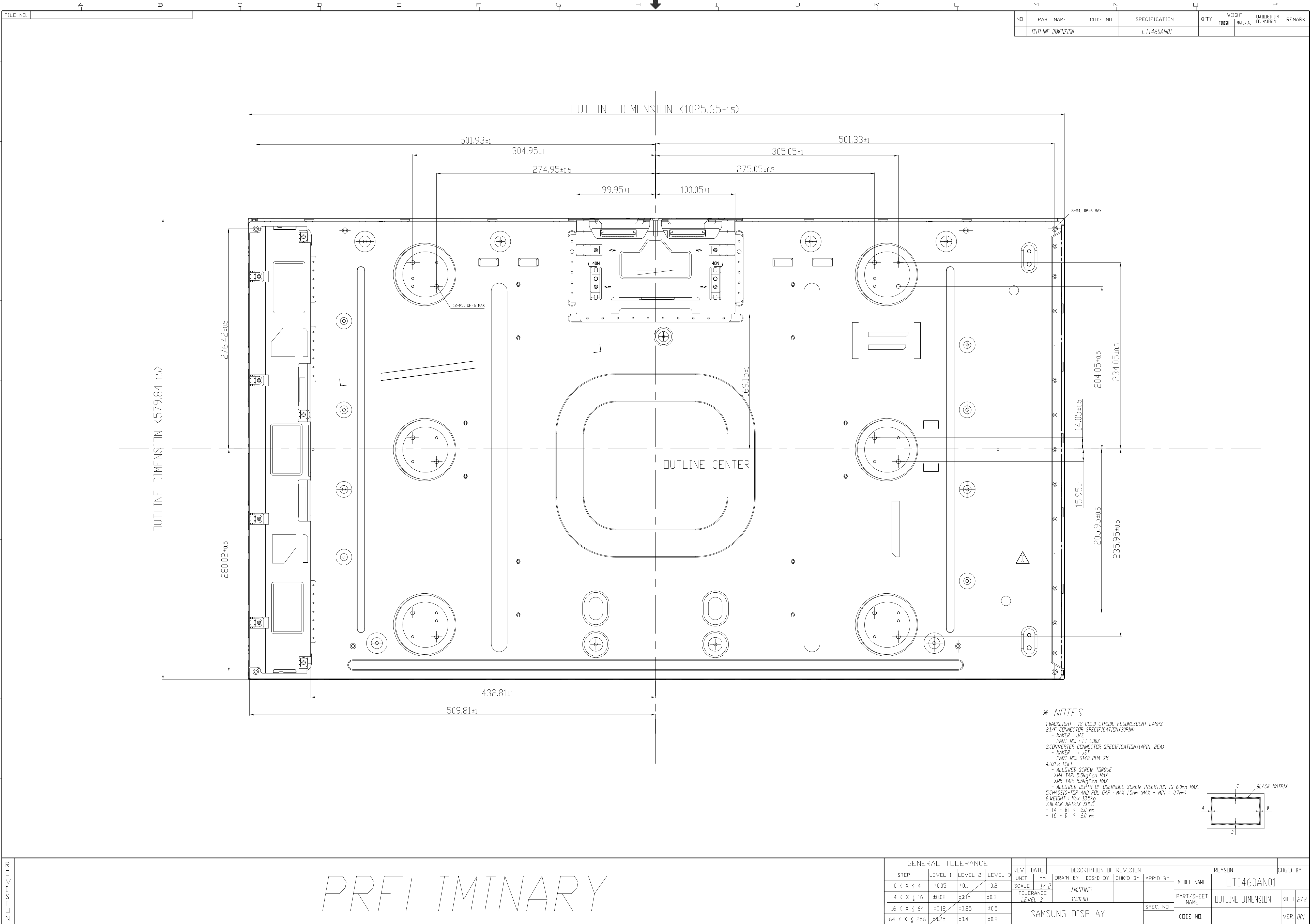
* **NOTES**

1.BACKLIGHT : 12 COLD CATHODE FLUORESCENT LAMPS.
2.I/F CONNECTOR SPECIFICATION(30PIN)
- WAKER : J4E
- PART NO : E1-F30S
3.INVERTER CONNECTION SPECIFICATION(14PIN, 2CA)
- WAKER : J5T
- PART NO: S14B-PWM-SM
4.USER HOLE
- ALLOWED SCREW TORQUE
o)M4 TAP 5.5kgf/cm MAX
o)M5 TAP 5.5kgf/cm MAX
- ALLOWED DEPTH OF USERABLE SCREW INSERTION IS 6.0mm MAX.
5.SCHASTS-TIP AND PDL GAP : MAX 15mm (MAX - MIN = 0.7mm)
6.WEIGHT : Max 13.5kg
7.BLACK MATRIX SPEC
- 1A - B1 ≤ 2.0 mm
- 1C - D1 ≤ 2.0 mm

The diagram shows a square frame representing the backlight assembly. At each of the four corners, there is a small square with a dot in the center, labeled A (top-left), B (top-right), C (bottom-right), and D (bottom-left). A rectangular area is inscribed within the square frame, with the text 'BLACK MATRIX' written to its right. The entire diagram is enclosed in a rectangular border.

GENERAL TOLERANCE				REV	DATE	DESCRIPTION OF REVISION				REASON		CHG'D BY	
STEP	LEVEL 1	LEVEL 2	LEVEL 3	UNIT	1/2	DRAWN BY	DES'D BY	CHK'D BY	APP'D BY	MODEL NAME	LTJ460AN01		
0 < X ≤ 4	+0.05	+0.1	+0.2	SCALE	1/2	J.M.SONG					PART/SHEET NAME	OUTLINE DIMENSION	SHEET 1/2
4 < X ≤ 16	+0.08	+0.15	+0.3	TOLERANCE (LEVEL 3)		13.01.08					CODE NO.	VER.	001
16 < X ≤ 64	+0.12	+0.25	+0.5	SAMSUNG DISPLAY						SPEC. NO.			
64 < X ≤ 256	+0.25	+0.4	+0.8										

PRELIMINARY

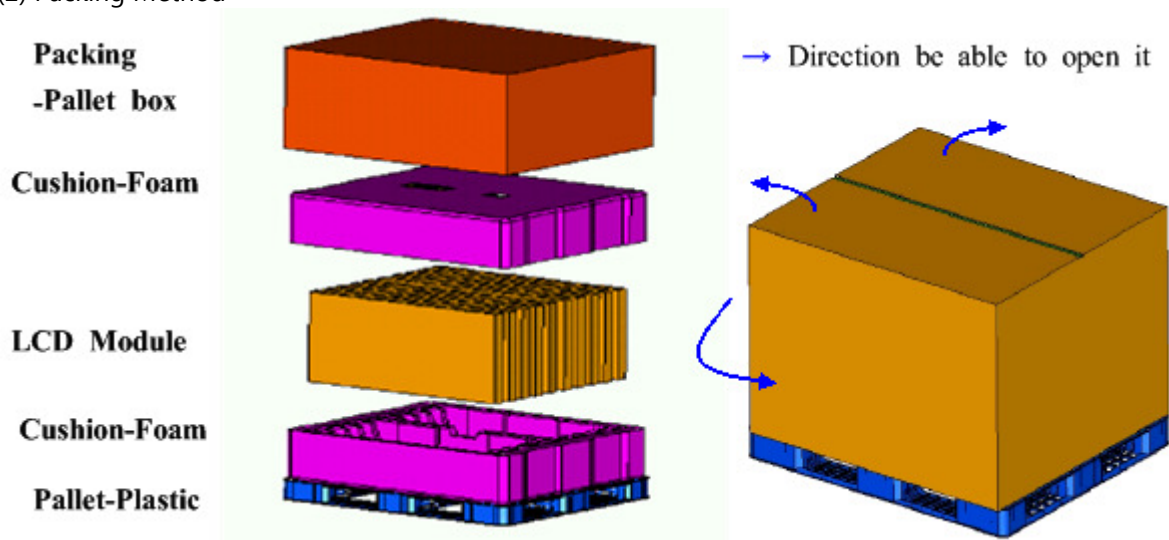


7. PACKING

7.1 CARTON (INTERNAL PACKAGE)

(1) Packing Form : Corrugated fiberboard box and cardboard as shock absorber

(2) Packing Method



Note(1) Total Weight : Approximately 151.8kg [With Pallet Plastic]

Note(2) Acceptance number of piling : 10Pallets

Note(3) Carton size : 1270mm(H) x 1150mm(V) x 844mm(Height) [With Pallet Plastic]

(3) Packing Material

No.	Part Name	Quantity
1	Cushion-Pallet	2 EA
2	Cushion-Pallet BOX	1 EA
3	Bag-Shielding	10 EA
4	Protector-Panel	10 EA
5	Pallet-Plastic	1 EA

8. MARKINGS & OTHERS

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

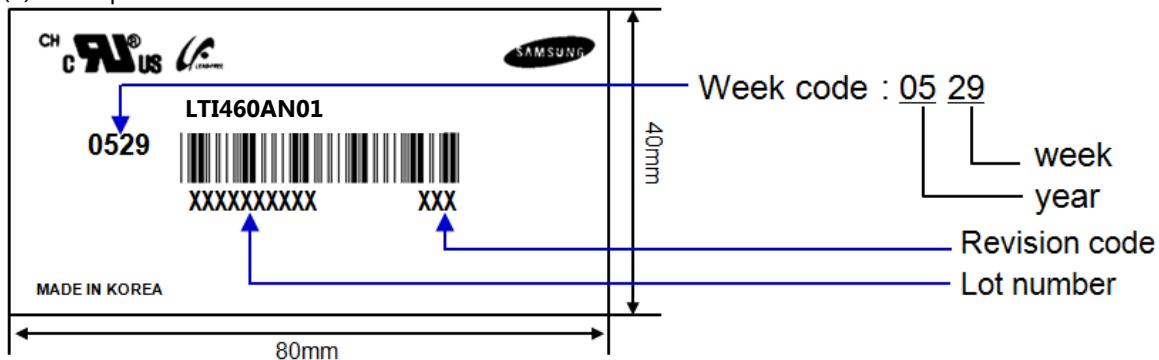
(1) Parts number : LTI460AN01-0

(2) Revision code : Three letters

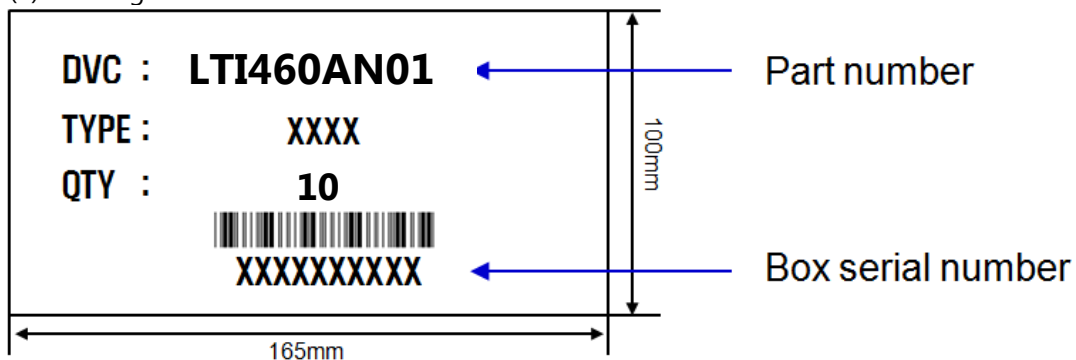
(3) Lot number : X X X X XXX XX X

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

(4) Nameplate Indication



(5) Packing small box attach



9. GENERAL PRECAUTIONS

9.1 HANDLING

- (a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.
- (b) 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 CCFT back-light.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The 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.
- (g) 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 thoroughly with soap.
- (h) Protect the module from static. it may cause damage to the C-MOS Gate Array IC.
- (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Do not pull or fold the Lamp wire.
- (l) Do not touch any component which is located on the back side.
- (m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (n) Pins of I/F connector shall not be touched directly with bare hands.

9.2 STORAGE

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

ITEM	Unit	Min.	Max.
Storage Temperature	(°C)	5	40
Storage Humidity	(%rH)	35	75
Storage Life	12 months		
Storage Condition	- The storage room should be equipped with a good ventilation facility, which has a temperature controlling system. - Products should be placed on the pallet, which is away from the wall not on the floor. - Prevent products from being exposed to the direct sunlight, moisture, and water. Be cautious not to pile the products up. - Avoid storing products in the environment, which other hazardous material is placed. - If products are delivered or kept in the storage facility more than 3 months, we recommend you to leave products under the condition including a 20°C temperature and a humidity of 50% for 24 hours. - If you store semi-manufactured products for more than 3 months, bake the products under the condition including the 50°C temp. and the 10% humidity for 24hrs after being used.		

9.3 OPERATION

- (a) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (b) The power shall be always turned on/off by the item 6.5. "Power on/off sequence"
- (c) The module has a circuit with a high frequency. The system manufacturers shall suppress the electromagnetic interference sufficiently. The methods to ground and shield are important to minimize the interference.
- (d) Design the length of cable to connect between the connector for back-light and the inverter as short as possible and the shorter cable shall be connected directly.
The longer cable between that of back-light and that of inverter may cause the luminance of lamp(CCFL) to lower and need a higher startup voltage(Vs).

9.4 OPERATION CONDITION GUIDE

- (a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
 - Temperature : 20±15°C
 - 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 SDC 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.

9.5 OTHERS

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Module should be turned clockwise (regular front view perspective) when used in portrait mode.
- (c) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (d) 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.
- (e) 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.
- (f) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.
- (g) Please contact SDC in advance when you display the same pattern for a long time.