



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	신성반도체	MODEL NO.	LTI370LN01
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Customer Approval & Feedback

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REVISION HISTORY

Date	Rev.No.	Page	Revision Description
2015/10/08	000	All	Firstly issued.
2015/11/05	001	15, 16	Modify Connector Type : Flip → Socket
2015/11/23	002	All	TBD Updated
		4	POL haze changed : 25% → 44%
2015/12/30	003	All	Model Code Change : LTI370LN01-V → LTI37LN01-0
2016/12/30	004	28	Packing

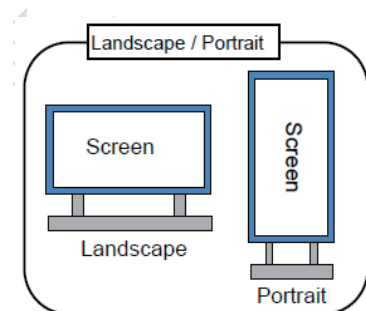
GENERAL DESCRIPTION

DESCRIPTION

LTI370LN01-0 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 backlight unit. The resolution of a 37" is 1920 x 540 and this model can display up to 16.7M colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications by providing an excellent performance for Flat Panel Display such as Public Information Display(PID), Public Monitor.

FEATURES

- RoHS compliance (Pb-free)
- High contrast ratio, High luminance
- SPVA(Super Patterned Vertical Align) mode
- Wide viewing angle ($\pm 178^\circ$)
- 1920 x 540 pixels resolution (32:9)
- Direct LED Backlight
- DE(Data Enable) mode
- 2 Channel LVDS (Low Voltage Differential Signaling) interface
- The interface (2pixel/clock) of LVDS serial interface
- Landscape / Portrait type compatible
- Black Mura Improvement Technology



APPLICATIONS

PID(Public Information Display)

If the intent to use this product is for other purpose, please contact Samsung Display.

GENERAL INFORMATION

Items	Specification	Unit	Note
Module Size	914.912(H) x 280.844(V)	mm	Typ
	34.4 (D)		Typ
Weight	4,700	g	Typ
Active Display Area	899.712(H) x 253.044(V)	mm	-
Surface Treatment	Haze 44%	-	Anti Glare POL
Display Colors	8 bit - 16.7M	colors	-
Number of Pixels	1920 X 540	pixel	32:9
Pixel Arrangement	RGB vertical stripe	-	-
Display Mode	Normally Black	-	-
Luminance of White	700	cd/m ²	Typ
Driver Element	a-Si TFT active matrix	-	-

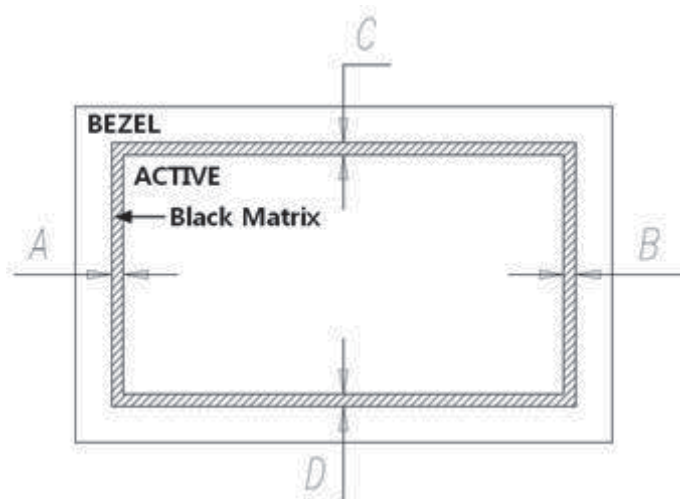
MECHANICAL INFORMATION

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	913.912	914.912	915.912	mm	(1)
	Vertical(V)	279.844	280.844	281.844	mm	(1)
	Depth(D)	33.4	34.4	35.4	mm	(2)
Black Matrix Shift	Horizontal(H)	-	-	2.0	mm	
	Vertical(V)	-	-	2.0	mm	
Weight		-	4,700	5,000	g	

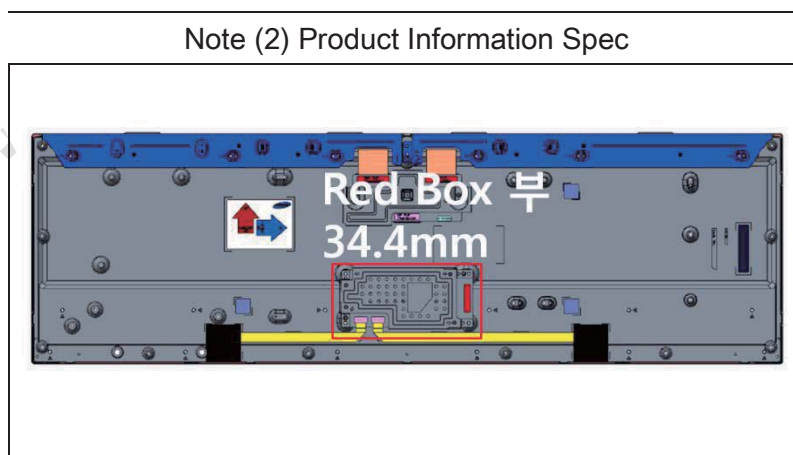
Note (1) Measure the figure for **Black Matrix shift** to be recorded on the spec. with referring to the drawings.

| A - B | ≤ Horizontal Spec

| C - D | ≤ Vertical Spec



Note (2) Measure the figure for **Module Size Depth** to be recorded on the spec. with referring to the drawings



<Module Depth Measure Point>

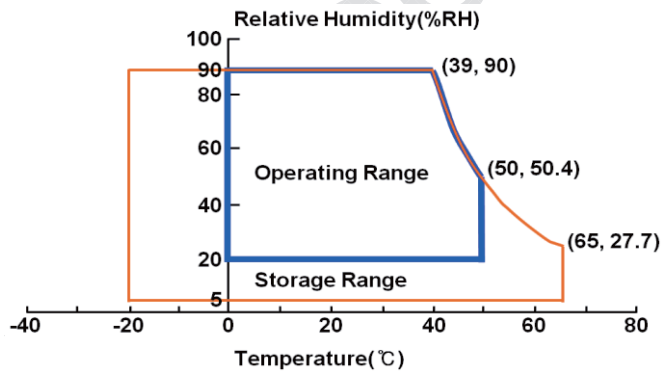
1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLTE RATINGS

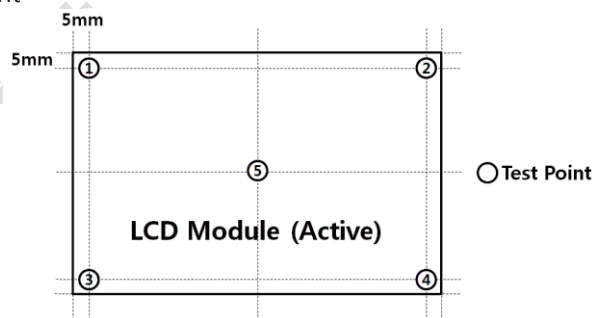
Item	Symbol	Min.	Max.	Unit	Note	
Storage Temperature	T _{STG}	-20	65	°C	(1)	
Operating Temperature	T _{CENTER}	0	50	°C	(1),(2)	
Humidity for storage	HSTG	5	90	%RH		
Operating humidity	HOPR	20	90	%RG		
Endurance on static electricity		-	150	V	(2)	
Glass surface Temperature (Operation)	Center	T _{CENTER}	0	50	°C	(1),(2),
	T. Uniformity	Δ T	-	10	°C	

Note(1) 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



Note(2) Definition of test point



ΔT should be less than 10°C (ΔT = |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)
Dimming Control	V _{DIM}	-	3.3	V	

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) BACK LIGHT UNIT

Item	Symbol	Min.	Max.	Unit	Note
Input Supply Voltage / Converter	V _{CC}	22	26	V	

1.3 The Others Absolute Ratings

STATIC ELECTRICITY PRESSURE RESISTANCE

Item	Symbol	Min.
CONTACT DISCHARGE	150pF, 330Ω, ± 10kV, 210points, 1 time/point	Operating
AIR DISCHARGE	150pF, 330Ω, ± 20kV, 210points, 1 time/point	Operating

2. Application Information for PID(Public Information Display)

A PID'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 PID 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: Up to 24 hours a day.

(But, Image Sticking is not guaranteed with 24 hours operation)

- 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 PID stated in this spec is guaranteed if the PID is used under the proper operating conditions.

2.5 Clean the system regularly for not accumulating the dust around the system considering User environment, otherwise, its reliability and function may not be satisfied.

3. OPTICAL CHARACTERISTICS

The following items are measured under the stable conditions.* The optical characteristics should be measured in the dark room or the equivalent environment by the methods shown in the Note (5).

Measuring equipment : TOPCON RD-80S, TOPCON SR-3, ELDIM EZ-Contrast

Ta = 25 ± 2 °C, VDD = 12V, fv = 60Hz, fdCLK = 148.5MHz, IF = 100% duty

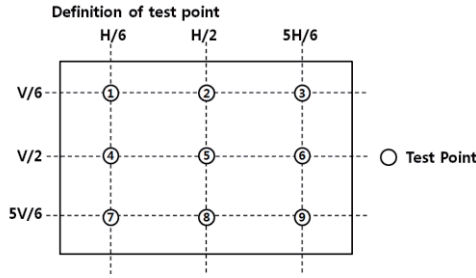
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio (Center of screen)	C/R	Normal θ L,R=0 θ U,D=0		4,000	-		(1), (3) SR-3	
Response Time G-to-G (AVG)	Tg		-	8	16	msec	(5) RD-80S	
Luminance of White (Center of screen)	YL		500	700	-	cd/m ²	(6) SR-3	
Color Chromaticity (CIE 1931)	Red	Rx	Viewing Angle	0.640	TYP. -0.03	TYP. +0.03	(7) SR-3	
		Ry		0.330				
	Green	Gx		0.300				
		Gy		0.600				
	Blue	Bx		0.150				
		By		0.060				
	White	Wx		0.280				
		Wy		0.290				
Color Gamut	-	69	72	-	%	(7) SR-3		
Color Temperature		8000	10,000	12000	K			
Viewing Angle	Hor.	θL	C/R ≥ 10	79	89	-	Degree	(8) SR-3 EZ-Contrast
		θR		79	89	-		
	Ver.	θU		79	89	-		
		θD		79	89	-		
Brightness Uniformity (9 Points)	B _{uni}		-	-	25	%	(2) SR-3	

Note(1) Test Equipment Setup

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.

Environment condition : Ta = 25 ± 2 °C

Note(2) Definition of test point



Note(3) Definition of Contrast ratio(C/R)

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

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

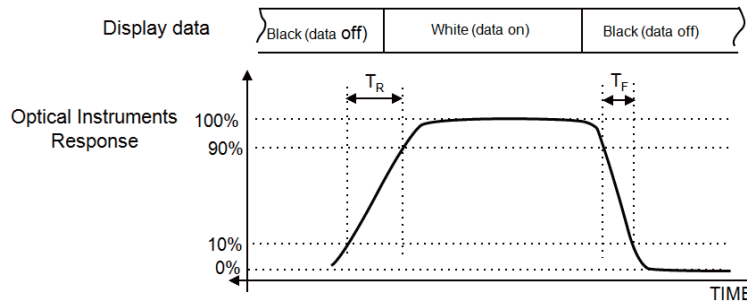
Gmax : Luminance in all white pixels
Gmin : Luminance in all black pixels.

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

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

Bmax : Maximum brightness
Bmin : Minimum brightness

Note(5) Definition of Response time : Average response time of all Gray to Gray except Tr, Tf



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

Gray to Gray Response Time									
	Gray	End							
		63	95	127	159	191	223	255	
Start	0	Tr(0-31)	Tr(0-63)	Tr(0-95)	Tr(0-127)	Tr(0-159)	Tr(0-191)	Tr(0-223)	Tr(0-255)
	31	Tr(31-0)	Tr(31-63)	Tr(31-95)	Tr(31-127)	Tr(31-159)	Tr(31-191)	Tr(31-223)	Tr(31-255)
	63	Tr(63-0)	Tr(63-31)	Tr(63-95)	Tr(63-127)	Tr(63-159)	Tr(63-191)	Tr(63-223)	Tr(63-255)
	95	Tr(95-0)	Tr(95-31)	Tr(95-63)	Tr(95-127)	Tr(95-159)	Tr(95-191)	Tr(95-223)	Tr(95-255)
	127	Tr(127-0)	Tr(127-31)	Tr(127-63)	Tr(127-95)	Tr(127-159)	Tr(127-191)	Tr(127-223)	Tr(127-255)
	159	Tr(159-0)	Tr(159-31)	Tr(159-63)	Tr(159-95)	Tr(159-127)	Tr(159-191)	Tr(159-223)	Tr(159-255)
	191	Tr(191-0)	Tr(191-31)	Tr(191-63)	Tr(191-95)	Tr(191-127)	Tr(191-159)	Tr(191-223)	Tr(191-255)
	223	Tr(223-0)	Tr(223-31)	Tr(223-63)	Tr(223-95)	Tr(223-127)	Tr(223-159)	Tr(223-191)	Tr(223-255)
	255	Tr(255-0)	Tr(255-31)	Tr(255-63)	Tr(255-95)	Tr(255-127)	Tr(255-159)	Tr(255-191)	Tr(255-223)
T _{OFF}									

T*(X-Y) : Response time from level of gray at X to level of gray at Y

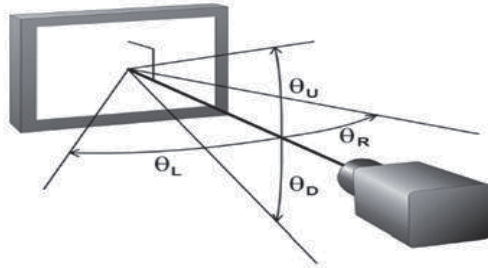
The definition of response time = $\sum [T^*(X-Y)] / 72$

Note(6) Definition of Luminance of White : Luminance of white at center point ⑤

Note(7) Definition of Color Chromaticity (CIE 1931)

Color coordinate of Red, Green, Blue & White at center point ⑤

Note(8) Definition of Viewing Angle : Viewing angle range($C/R \geq 10$)



4. ELECTRICAL CHARACTERISTICS

4.1 TFT LCD MODULE

* Ta = 25 ± 2 °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	-	285	TBD	mA	(2),(3)
	(b) White	-	282	TBD	mA	
	(c) Sub-V Stripe	-	347	TBD	mA	
Vsync Frequency	f _V	48	60	62	Hz	
Hsync Frequency	f _H	54	67.5	69.75	KHz	
Main Frequency	f _{DCLK}	120	148.5	153.5	MHz	
Rush Current	I _{RUSH}	-		TBD	A	(4)

Note (1) The ripple voltage should be controlled under 10% of V
 (2) f_V = 60Hz, f_{DCLK} = 148.5MHz, V_{DD} = 12.0V, DC Current.
 (3) Power dissipation check pattern (LCD Module only)

a) Black Pattern



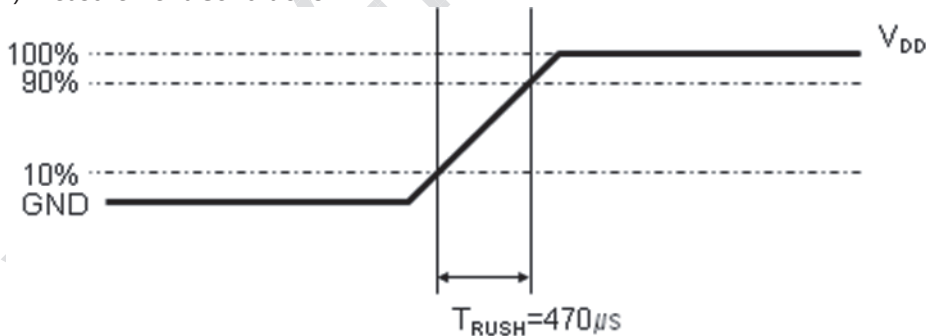
b) White Pattern



c) Sub-V Stripe pattern



(4) Measurement Conditions



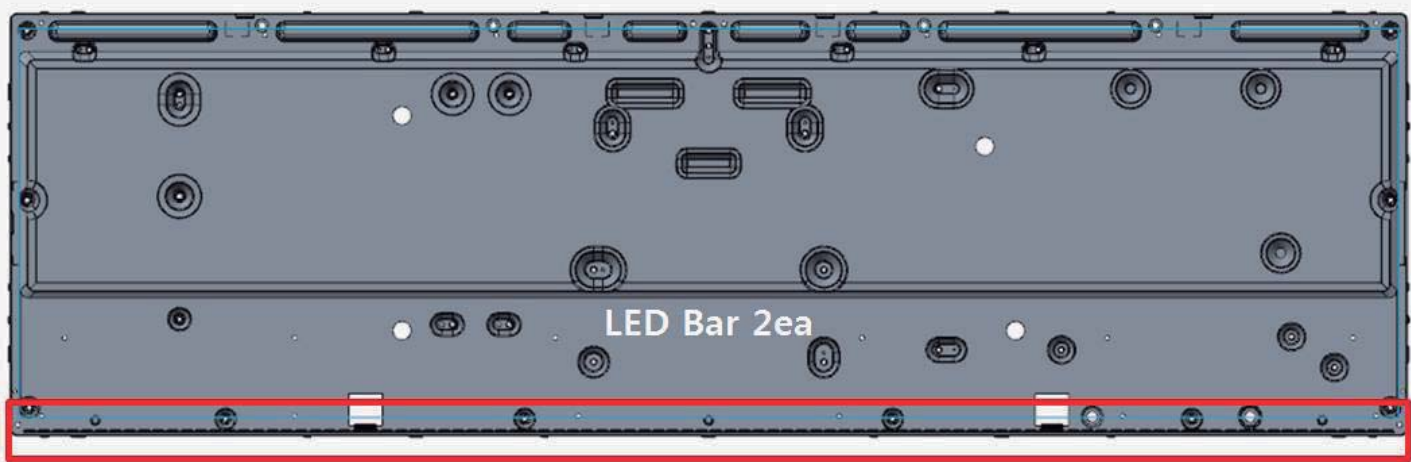
Rush Current I_{RUSH} can be measured when T_{RUSH} is 470μs.

4.2 BACK LIGHT UNIT

The back light unit contains 96 LEDs(Light Emitting Diode).
The characteristics of BLU are shown in the following tables.

Item	Min.	Typ.	Max.	Unit	Note
Operating Life Time	-	50,000	-	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℃]



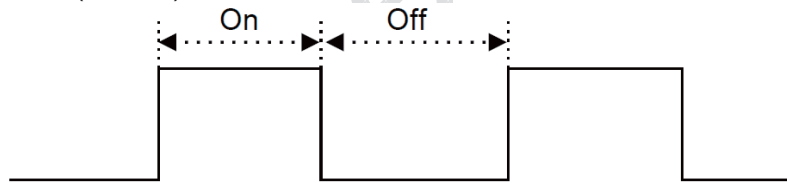
4.3 CONDITION & SPECIFICATION OF CONVERTER'S INPUT

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	Vin	-	22	24	26	V	Ta=25±2 °C
Inrush Current	Inrush	Vin = 24.0V dim =Max	-	-	1.9	Adc	(2)
Output Current	I _{LED}	Vin = 24.0V dim =Max	95	100	105	mA _{mean}	Normal Mode
Converter On/Off Control	ENA	Enable	2.4	-	5.25	V	-
		Disable	-0.3	-	0.4		
A_DIM	V _{A_DIM}	Vin = 24.0V	0	-	3.3	V	(3)
	D _{A_DIM}	Vin = 24.0V VINT_DIM = 3.3V	-	100	-	%	(3)
		Vin = 24.0V VINT_DIM = 0V	-	10	-	%	

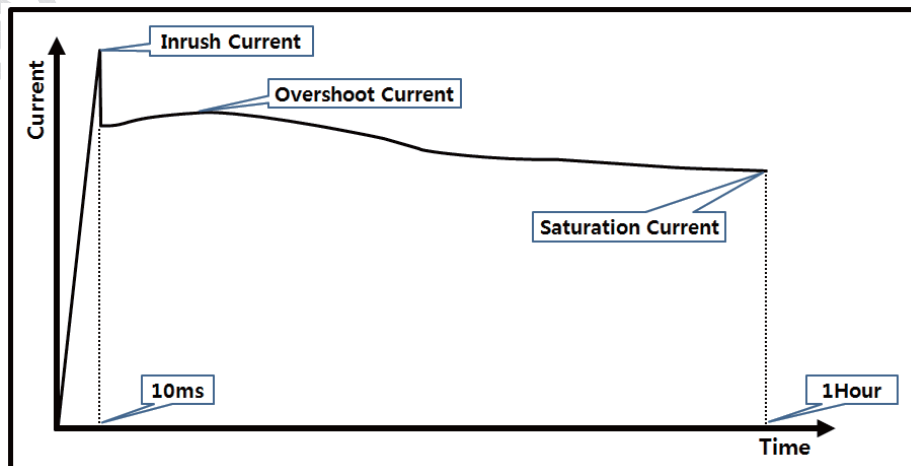
Note (1) All data was approved after running 120 minutes.

(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) High-duty = On/(On+Off)*100



ITEM	SYMBOL	CONDITION	SPECIFICATION			UNIT	NOTE
			MIN	TYP	MAX		
Input Current (Normal Mode)	Iovershoot,N	Vin=24V, Dim=Max	-	1.37	1.41	Amean	Overshoot Current After Turn-on
	Isaturation,N		-	1.35	1.39	Amean	Saturation current after 1hr aging



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 INPUT SIGNAL & POWER

Connector : FI-RXE51S-HF (JAE)

Pin	Description		Pin	Description	
1	Vdd (12V)		26	LVDS Signal	Rx2[A]P
2	Vdd (12V)		27		Rx2[B]N
3	Vdd (12V)		28		Rx2[B]P
4	Vdd (12V)		29		Rx2[C]N
5	Vdd (12V)		30		Rx2[C]P
6	No connection		31		GND
7	GND		32		Rx2CLK_N
8	GND		33		Rx2CLK_P
9	GND		34		GND
10	LVDS Signal	Rx1[A]N	35		Rx2[D]N
11		Rx1[A]P	36		Rx2[D]P
12		Rx1[B]N			Rx2[E]N
13		Rx1[B]P	38		Rx2[E]P
14		Rx1[C]N	39		GND
15		Rx1[C]P	40	SDC Only	
16		GND	41	SDC Only	
17		Rx1CLK_N	42	SDC Only	
18		Rx1CLK_P	43	SDC Only	
19		GND	44	No connection	
20	Rx1[D]N	45	LVDS_SEL		
21	Rx1[D]P	46	SDC Only		
22	Rx1[E]N	47	No connection		
23	Rx1[E]P	48	No connection		
24	GND		49	No connection	
25	Even LVDS	Rx2[A]N	50	No connection	
			51	No connection	

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

Note(2) 8bit & 10bit input mode available

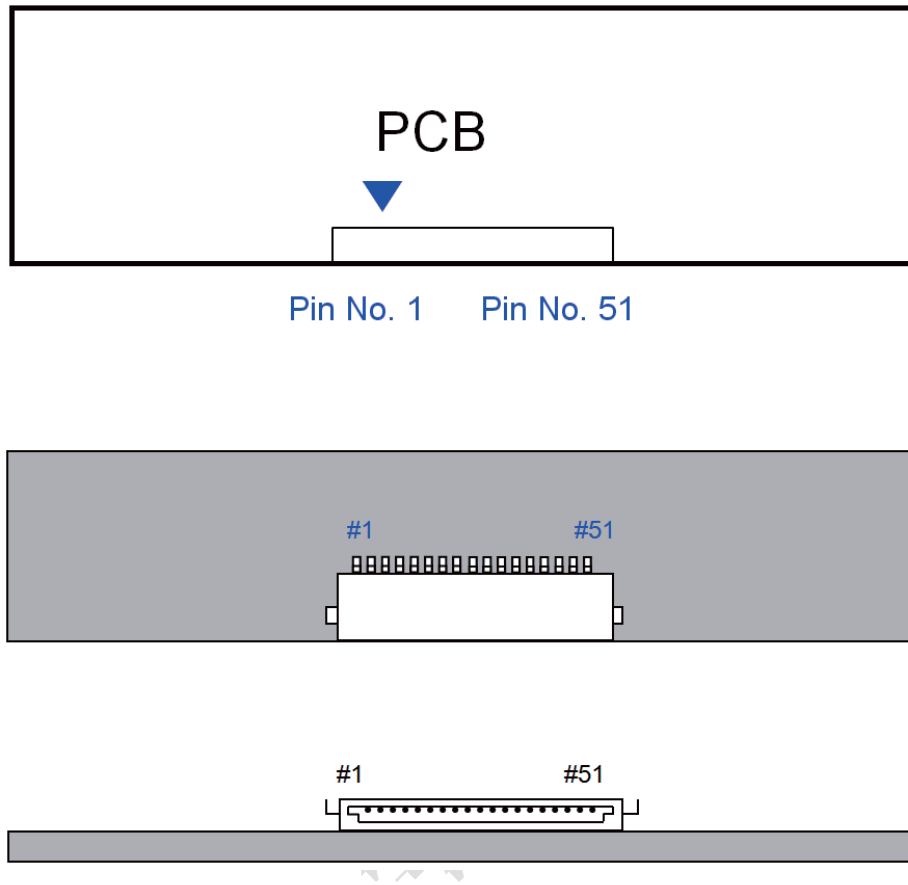
- If input mode is 8bit, → E_Channel : Keep Level '0'

a. E_Channel N(Rxx(E)_N) : Pull up (3.3V) with 1.5k ohm resistor

b. E_Channel P(Rxx(E)_P) : Pull down(GND) with 1.5k ohm resistor

* Level of LVDS signals are based on LVDS CHARACTERISTICS

Note (3) LVDS Connector



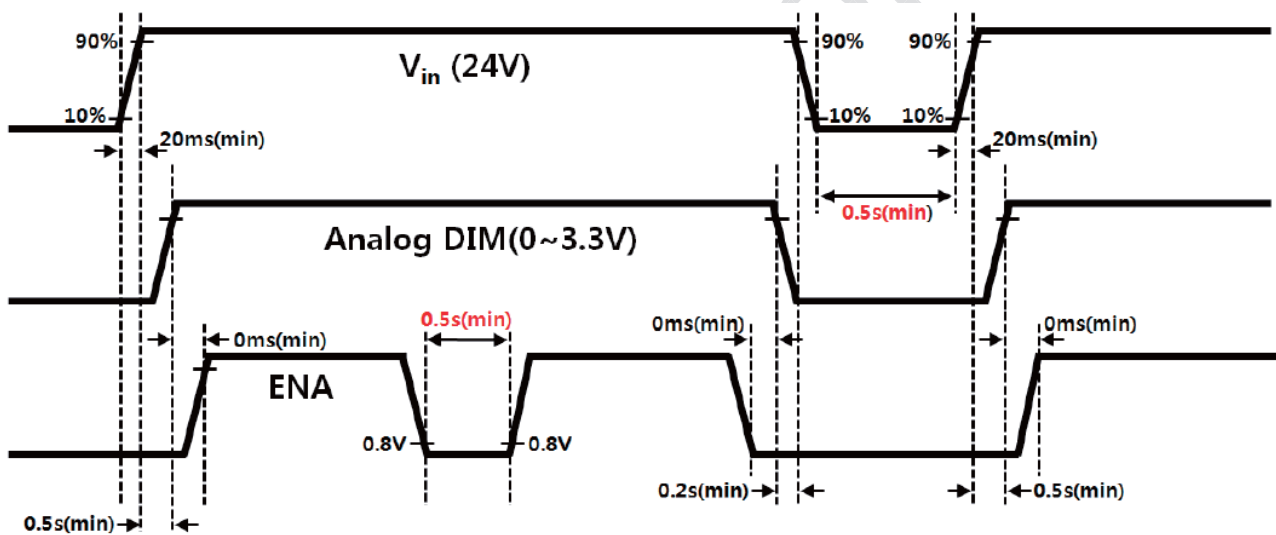
- a. All GND pins should be connected together and also be connected to the LCD's metal chassis.
- b. All power input pins should be connected together.
- c. All N.C pins should be separated from other signal or power.

5.2 CONFIGURATION OF INPUT PIN OF CONVERTER

Connector : 22022WR-014B2 (YEONHO)

Pin No.	SYMBOL	Pin Configuration(FUNCTION)
1, 2, 3, 4, 5	Vin	Power Supply DC 24V
6, 7, 8, 9, 10	GND	Ground
11	NC	No connection
12	ENA	ENA (Converter On/Off Control signal)
13	A_DIM	Analog Dimming Control [0V: Min, 3.3V: MAX] No Connection (In case of using)
14	NC	No Connection

5.3 THE POWER SEQUENCE FOR INPUTTING TO THE CONVERTER



5.4 LVDS INTERFACE

- LVDS Receiver : T-CON (merged) (8bit)
- Data Format : JEIDA

	LVDS pin	JEIDA -DATA
TxOUT/RxIN0	TxIN/RxOUT0	R2
	TxIN/RxOUT1	R3
	TxIN/RxOUT2	R4
	TxIN/RxOUT3	R5
	TxIN/RxOUT4	R6
	TxIN/RxOUT6	R7
	TxIN/RxOUT7	G2
TxOUT/RxIN1	TxIN/RxOUT8	G3
	TxIN/RxOUT9	G4
	TxIN/RxOUT12	G5
	TxIN/RxOUT13	G6
	TxIN/RxOUT14	G7
	TxIN/RxOUT15	B2
	TxIN/RxOUT18	B3
TxOUT/RxIN2	TxIN/RxOUT19	B4
	TxIN/RxOUT20	B5
	TxIN/RxOUT21	B6
	TxIN/RxOUT22	B7
	TxIN/RxOUT24	HSYNC
	TxIN/RxOUT25	VSYNC
	TxIN/RxOUT26	DEN
TxOUT/RxIN3	TxIN/RxOUT27	R0
	TxIN/RxOUT5	R1
	TxIN/RxOUT10	G0
	TxIN/RxOUT11	G1
	TxIN/RxOUT16	B0
	TxIN/RxOUT17	B1
	TxIN/RxOUT23	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	-	
	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	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	R1	
		0	1	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	R253	
		0	1	1	1	1	1	1	1	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	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	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	G1	
		0	0	0	0	0	0	0	0	0	1	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	G253	
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	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	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	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	B1	
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	B253	
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	B255	

Note (1) Definition of gray : Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)

Note (2) Input signal: 0 =Low level voltage, 1=High level voltage

6. INTERFACE TIMING

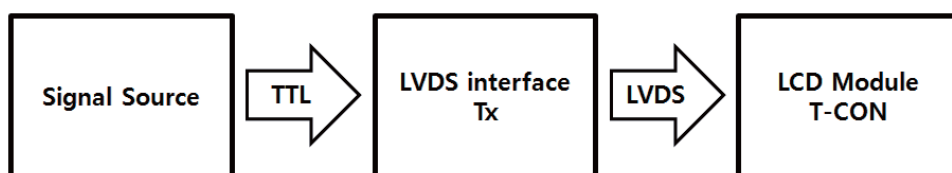
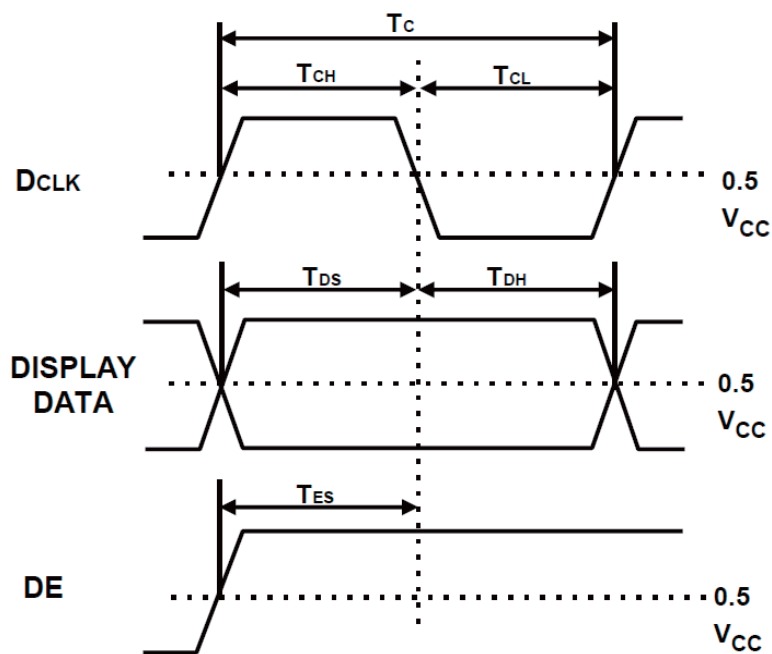
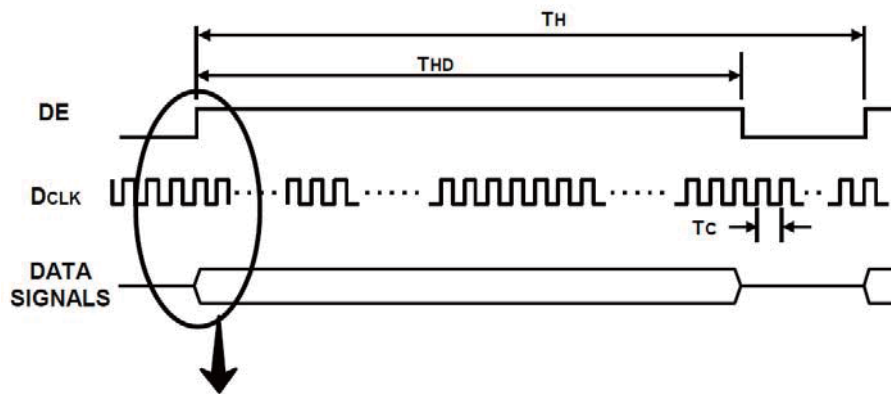
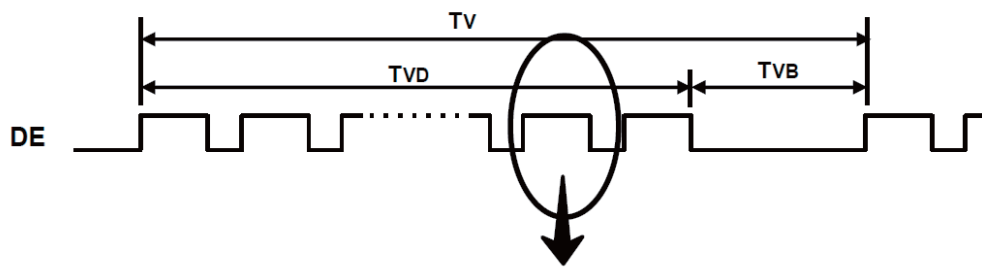
6.1 THE PARAMETERS OF TIMING(DE MODE)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	$1/T_C$	120	148.5	153.5	MHz	
Hsync		F_H	54	67.5	69.75	KHz	-
Vsync		F_V	48	60	62	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	-	540	-	Lines	-
	Vertical Total	T_V	1115	1125	1380	Lines	-
Horizontal Display Term	Active Display Period	T_{HD}	-	1920	-	Clocks	-
	Horizontal Total	T_H	2115	2200	2345	Clocks	-

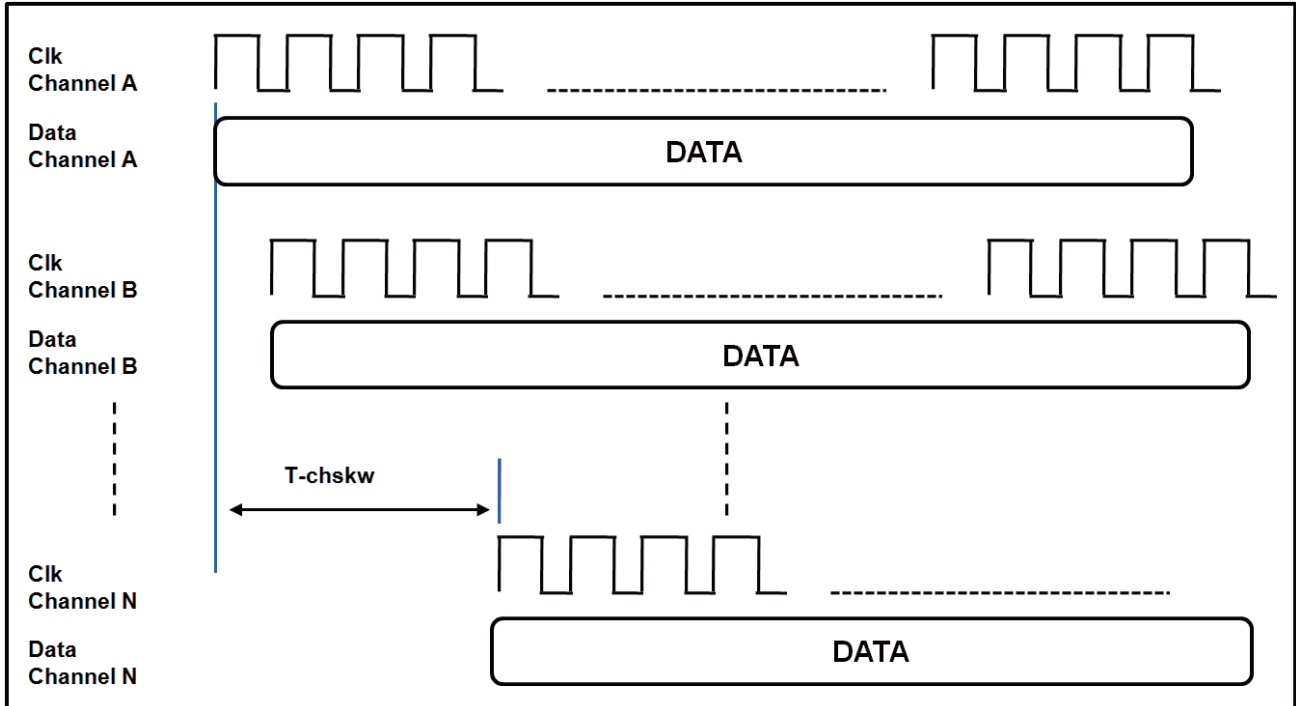
Note)

- (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 $\pm 3\%$
 - Frequency for modulation : Max 300KHz

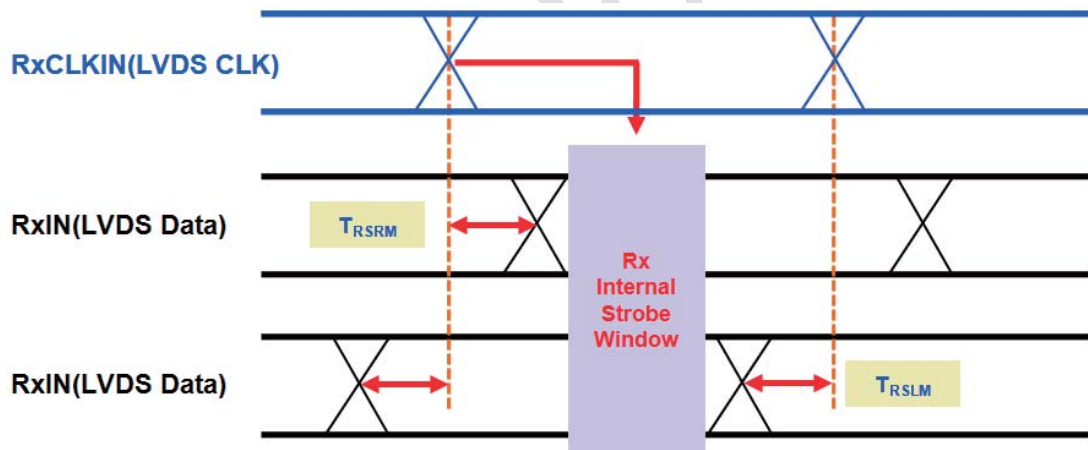
6.2 TIMING DIAGRAMS OF INTERFACE SIGNAL (DE ONLY MODE)



* LVDS Channel to Channel Skew(T-chskw) in Multiple LVDS Channels



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

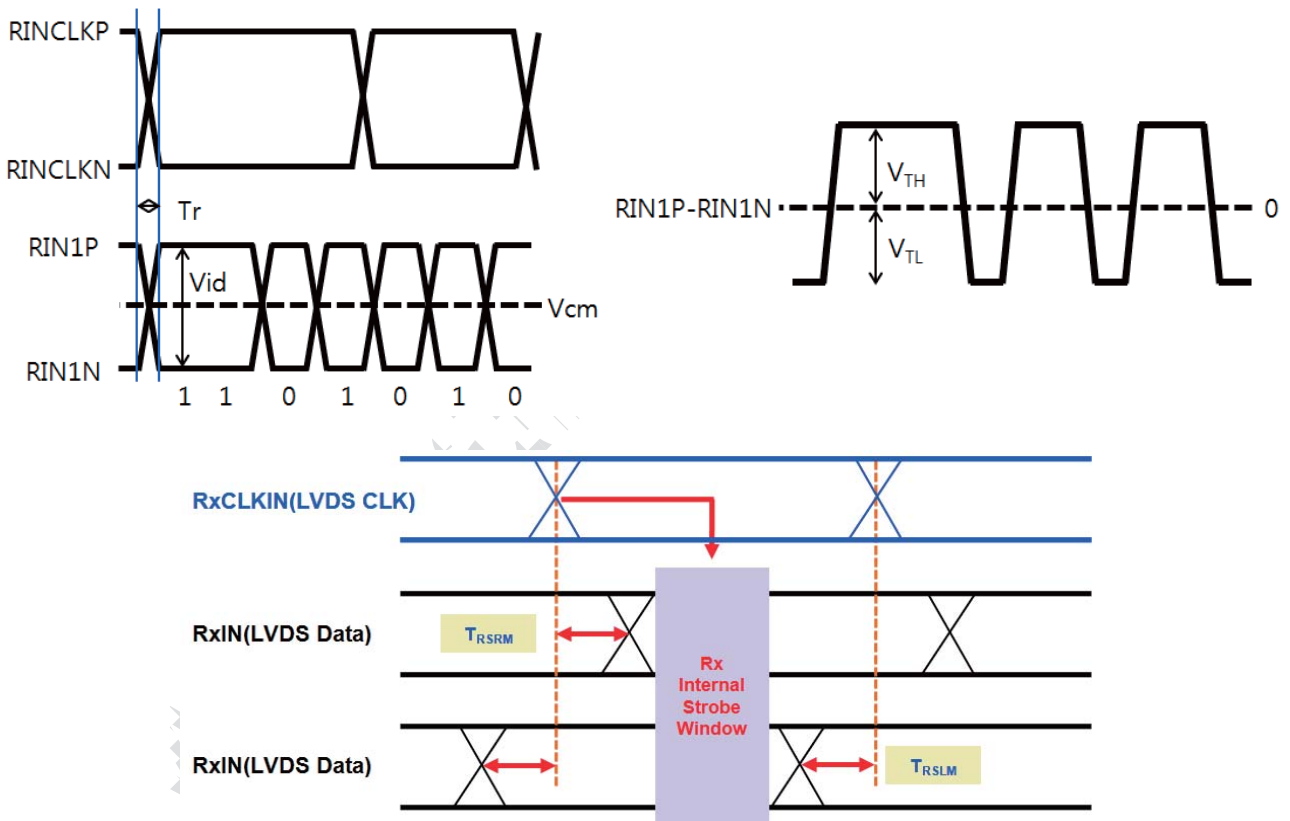


SYMBOL	ITEM	Min	Typ	Max	UNIT
t _{RSRM}	LVDS CLK=85MHz	-	-	400	ps
	LVDS CLK=78MHz	-	-	450	ps
	LVDS CLK=75MHz	-	-	500	ps
t _{RSLM}	LVDS CLK=85MHz	400	-	-	ps
	LVDS CLK=78MHz	450	-	-	ps
	LVDS CLK=75MHz	500	-	-	ps

6.3 CHARACTERISTICS OF INPUT DATA OF LVDS

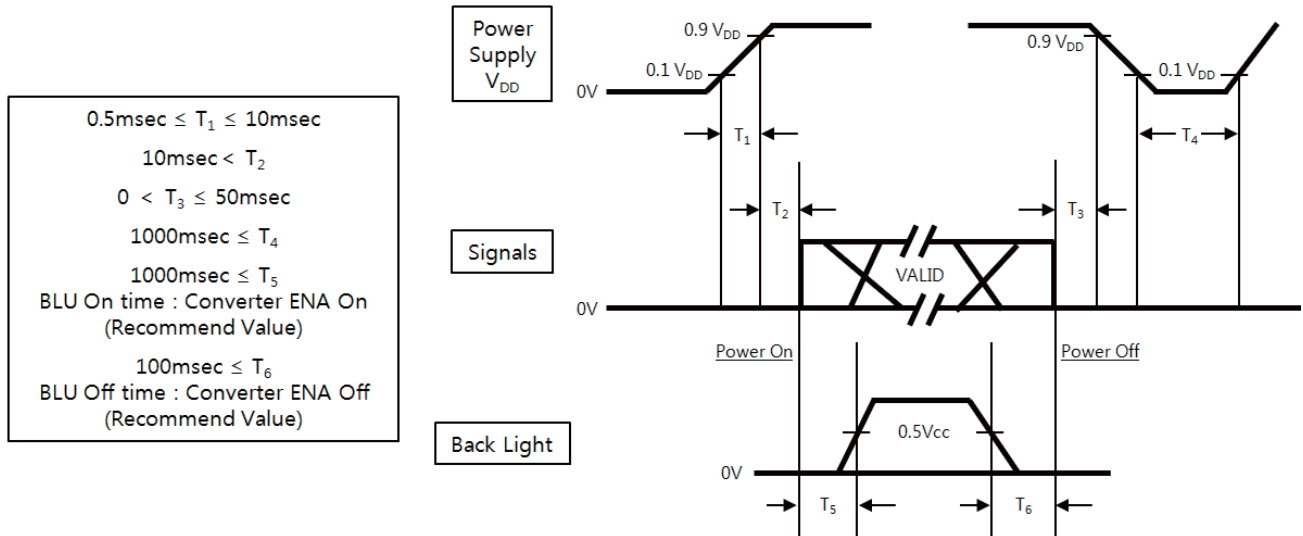
ITEM	SYMBOL	Min	Typ	Max	UNIT	NOTE	
Differential input high threshold voltage	V_{TH}	-	-	120	mV	$V_{CM} = 1.2V$	
Differential input low threshold voltage	V_{TL}	-120	-	-	mV		
Input common mode voltage	V_{CM}	0.3	1.2	1.8	V	-	
Differential Input Voltage	$ V_{ID} $	120	200	600	mV	-	
Input data position	$F_{IN}=80MHz$	t_{RSRM}	-	-	400	ps	-
		t_{RSLM}	-400	-	-	ps	-

Note) The spread spectrum should be 0% when the skew is measured.
 Position of a measurement is T-CON LVDS input pin.



6.4 THE SEQUENCE OF POWER ON AND OFF

To prevent the product from being latched up or the DC in the LCD module from starting an operation, the order to turn the power on and off should be changed to the order as shown in the diagram below.

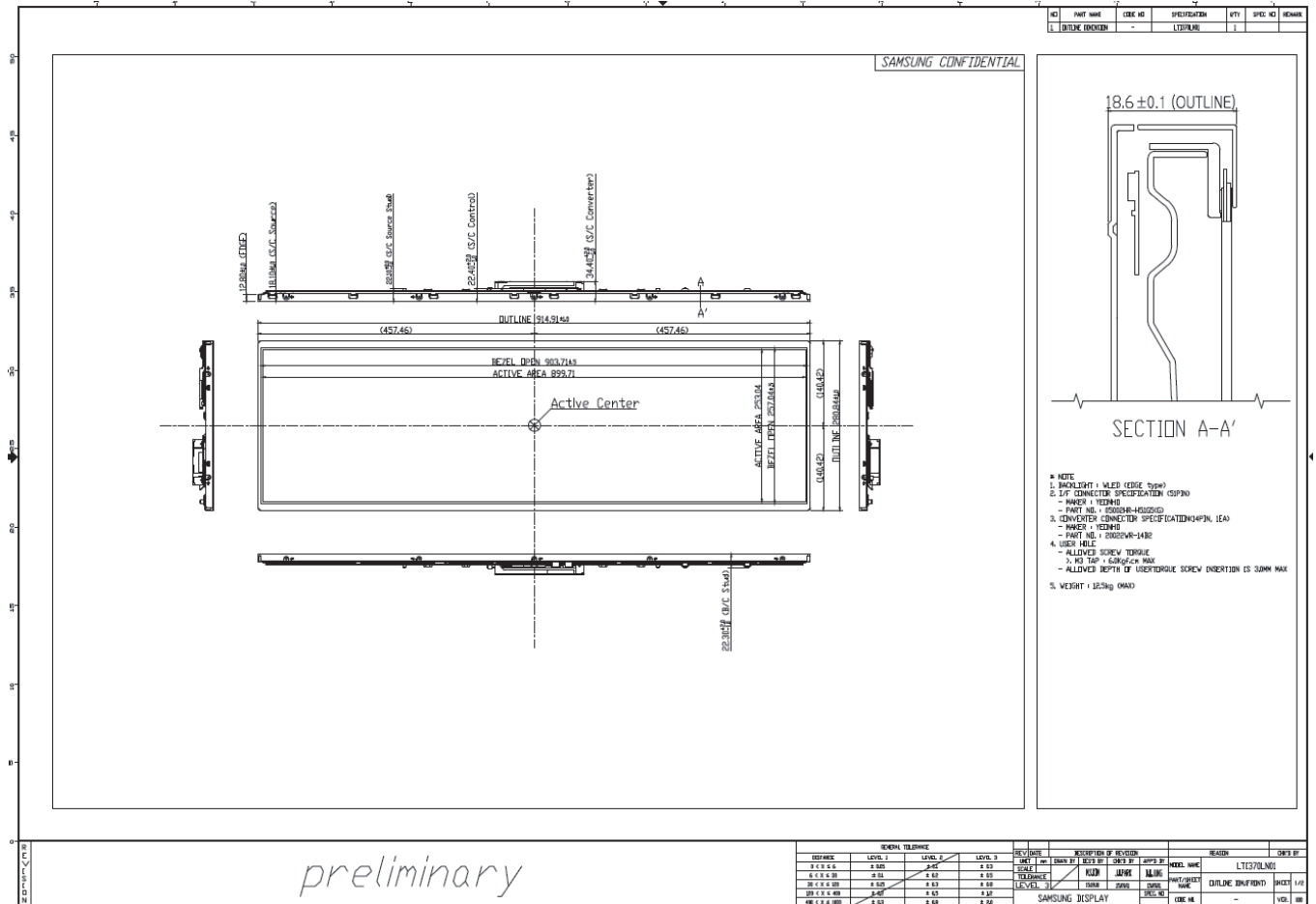


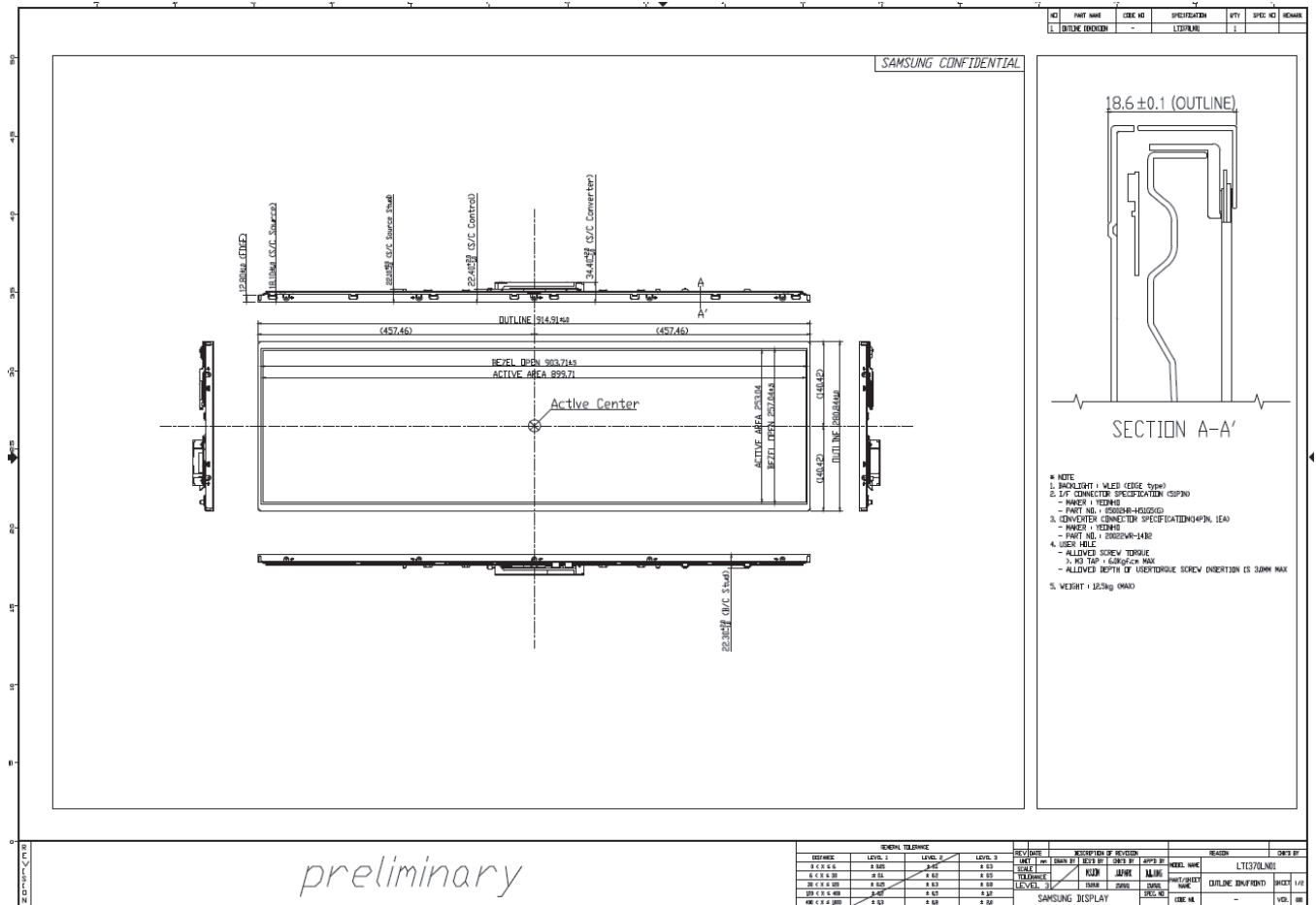
Timing	Remarks
T_1	The time, during which the level of V_{DD} is rising from 10% to 90%.
T_2	The changing time, during which the V_{DD} starts rising beyond 90% until the valid data of signal started coming in.
T_3	The changing time, during which the valid data of signal starts leaving out until the V_{DD} starts falling below 90%.
T_4	The changing time, during which the V_{DD} starts falling below 10% to restart the Windows.
T_5	The changing time, during which the signal of BLU starts rising beyond 50%.
T_6	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 LED 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 T_4 timing. The backlight may be flashed if the interface signal remains floated when the above-mentioned signal becomes invalid.

7. OUTLINE DIMENSION

Please refer next 2pages





NO	PART NAME	CODE NO	SPECIFICATION	QTY	SPEC NO	REMARK
1	OUTLINE (FRONT)	-	LT370LN01	1	-	-

SAMSUNG CONFIDENTIAL

18.6±0.1 (OUTLINE)

SECTION A-A'

* NOTE

1. DIMENSION 1: MATED (CASE TYPE)
2. I/F CONNECTOR SPECIFICATION (CSPIN)
3. CONVENTION CONNECTOR SPECIFICATION (PIN, LEAD)
4. USER HOLE
 - ALLOWED SCREW TORQUE
 - NO TOP / BOTTOM MAX
 - ALLOWED DEPTH OF USER TORQUE SCREW ORIENTATION IS SUMM MAX
5. WEIGHT : 125.9g (MAX)

REVISION				REV	DATE	DESCRIPTION OF REVISION	REVISION	DATE BY
NO	DATE	BY	REASON	NO	DATE	NO	DATE	NO
1	2018.08.08	LT370LN01	INITIAL	1	2018.08.08	1	2018.08.08	1
2	2018.08.08	LT370LN01	INITIAL	2	2018.08.08	2	2018.08.08	2
3	2018.08.08	LT370LN01	INITIAL	3	2018.08.08	3	2018.08.08	3
4	2018.08.08	LT370LN01	INITIAL	4	2018.08.08	4	2018.08.08	4

8. RELIABILITY TEST

Item	Test condition	Quantity
HTOL	50°C, 500hr determination	8EA
LTOL	-5°C, 500hr determination	4EA
HTS	70°C, 500hr determination	4EA
LTS	-25°C, 500hr determination	4EA
THB	50°C / 90%RH, 500hr determination	10EA
WHTS	60°C / 75%RH, 500hr determination	4EA
T/S	-20 ~ 60°C, Dwell time : 30Min, 200cycle	4EA
TSS	-20 ~ 65°C, 220cycle	4EA
Image sticking	50°C, Mosaic pattern (9X10), 336hrs	8EA
Contact ESD	±8 kV, 200Point, 1 time/Point	3EA
Air ESD	±20 kV, 210Point, 1 time/Point	3EA
Input Con. ESD	±15kV, Input Con. Pin, 3 times/Pin	3EA
Dust	5sec spray, 5min sedimentation / 10hr Power 10min on, 10min off	2EA
Pallet Vibration → Pallet Drop	Pallet vibration : 1.05Grms, 5 ~ 200Hz, 2hr/stack side Pallet Drop : 20cm, bottom side 2 angles, 1side(Bottom)	2Pallet
Altitude	-40~50 , 0m(0ft) ~ 13,700m(45,000ft), 72.5Hr	4EA

[Criteria on evaluation]

The components of product, which may affect to the function of display shall not be changed when the display quality test is executed under the normal operating condition.

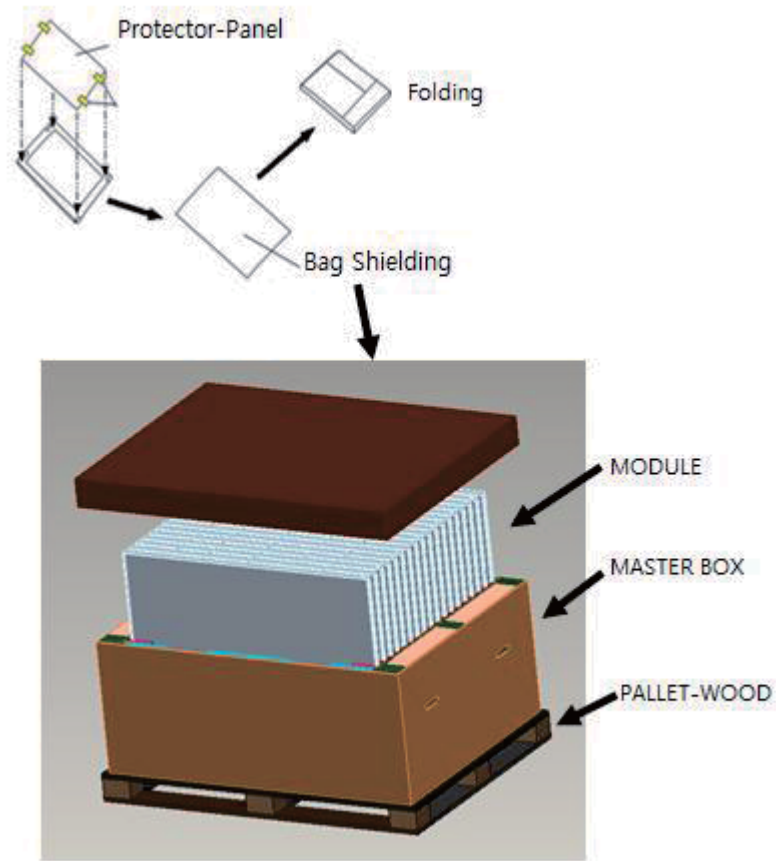
- * HTOL / LTOL : The operating at the high and low temperature
- * THB : The slant of temperature and humidity
- * HTS / LTS : The storage at the high and low temperature
- * WHTS : The storage condition at the high temperature with the high humidity

9. PACKING

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method



Note (1) Total Weight : Approximately 117.36kg

(2) Acceptance number of piling :

(3) Carton size : 1150mm(H) x 985mm(V) x 122mm(Height)

(3) Packing Material

No	Part name	Quantity
1	Master Box	1 EA
2	Bag-Shielding	20 EA
3	Protector-Panel	20 EA
4	Pallet-Wood	1 EA

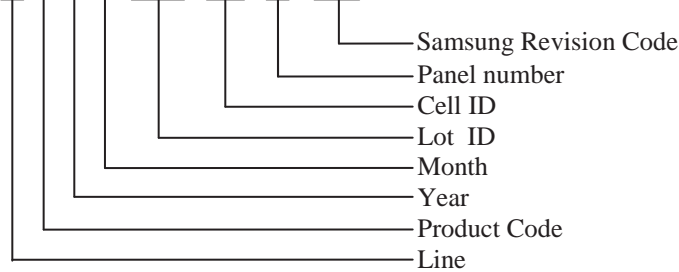
10. MARKING

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

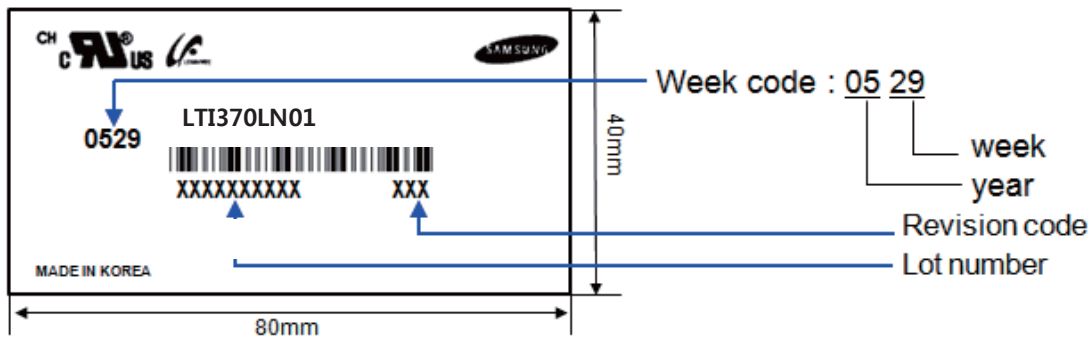
(1) Parts number : LTI370LN01-001

(2) Revision code : 3 letters

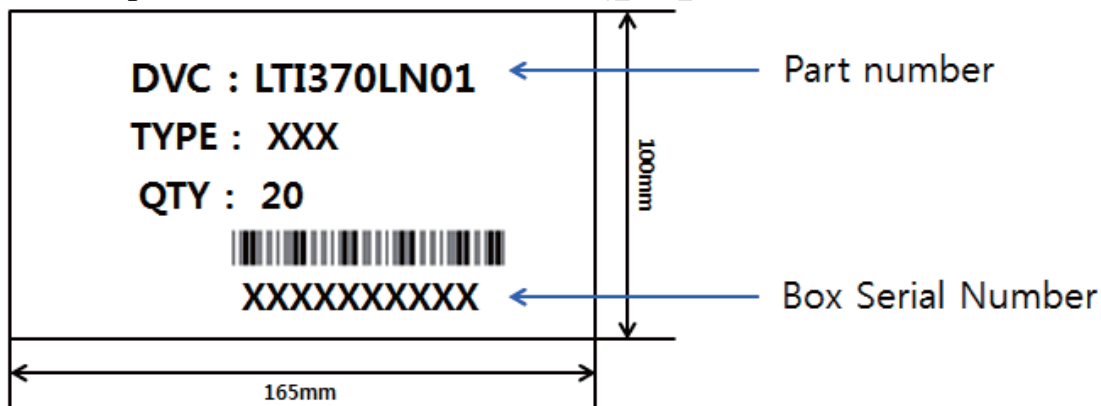
(3) Lot number : X X X X XXX XX X VOX



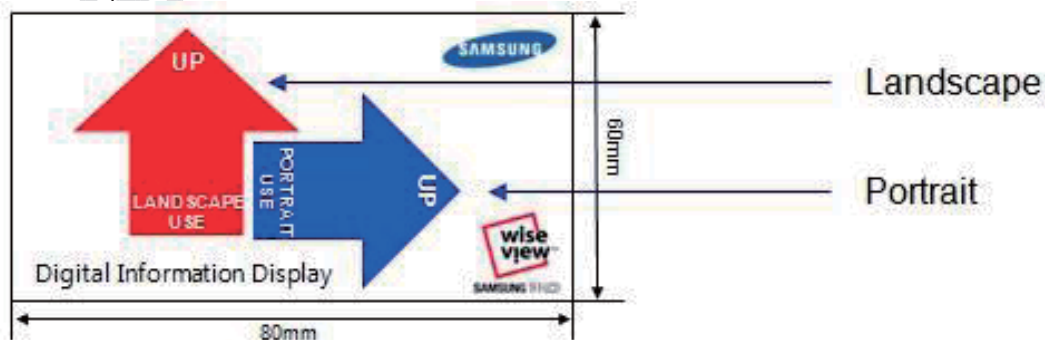
(4) Nameplate Indication



(5) Packing small box attach



(6) Landscape/Portrait Indication



11. GENERAL PRECAUTIONS

11.1 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 LED FPC.
- (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.

11.2 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	<ul style="list-style-type: none"> - 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. 		

11.3 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).

11.4 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 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.

11.5 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.