



**SAMSUNG DISPLAY**



# Product Specification

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

*Any modification of Spec is not allowed without SDC's permission.*

CUSTOMER	G/A Customers	MODEL NO.	LTI460HN08
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<b>Customer Approval &amp; Feedback</b>	

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## Table of Contents

REVISION HISTORY .....	3
GENERAL DESCRIPTION .....	4
1. ABSOLUTE MAXIMUM RATINGS	
1.1 ENVIRONMENTAL ABSOLUTE RATINGS .....	6
1.2 ELECTRICAL ABSOLUTE RATINGS .....	7
1.3 THE OTHERS ABSOLUTE RATINGS .....	7
2. APPLICATION INFORMATION FOR DID(DIGITAL INFORMATION DISPLAY) .....	8
3. OPTICAL CHARACTERISTICS .....	9
4. ELECTRICAL CHARACTERISTICS	
4.1 TFT LCD MODULE .....	12
4.2 BACK LIGHT UNIT .....	13
4.3 CONDITION & SPECIFICATION OF CONVERTER'S INPUT .....	13
5. INPUT TERMINAL PIN ASSIGNMENT	
5.1 INPUT SIGNAL & POWER .....	14
5.2 CONFIGURATION OF INPUT PIN OF CONVERTER .....	16
5.3 THE POWER SEQUENCE FOR INPUTTING TO THE CONVERTER .....	16
5.4 LVDS INTERFACE .....	17
5.5 INPUT SIGNALS, BASIC DISPLAY COLORS AND GRAY SCALE .....	18
6. INTERFACE TIMING	
6.1 TIMING PARAMETERS (DE ONLY MODE) .....	19
6.2 TIMING DIAGRAMS OF INTERFACE SIGNAL (DE ONLY MODE) .....	20
6.3 CHARACTERISTICS OF INPUT DATA OF LVDS .....	21
6.4 THE SEQUENCE OF POWER ON AND OFF .....	23
OUTLINE DIMENSION .....	24
7. RELIABILITY TEST .....	26
8. PACKING .....	27
9. MARKINGS & OTHERS .....	28
10. GENERAL PRECAUTIONS .....	29

**REVISION HISTORY**

Date.	Rev.No.	Page	Revision Description
12/26/2012	000	all	First issued

For GA Only

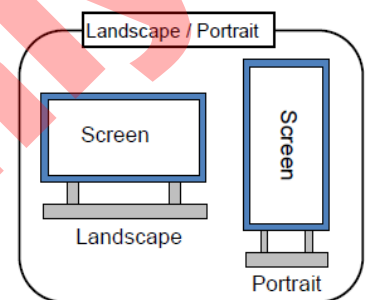
## GENERAL DESCRIPTION

### DESCRIPTION

This model uses a 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 ass'y KIT of source PBA and BLU (Back light Unit) Ass'y. This 46.0" model has a resolution of 1920 x 1080 pixels (16:9) can display up to 16.7 Million colors with the wide viewing angle of 89° or higher in all directions.

### FEATURES

High contrast ratio & aperture ratio with the wide color gamut  
SVA (Super Vertical Align) mode  
Wide viewing angle ( $\pm 178^\circ$ )  
High speed response  
FHD (1920X1080) resolution (16:9)  
Edge LED (Light Emitted Diode) BLU  
RoHS compliance (Pb-free)  
Low power consumption  
DE (Data Enable) mode  
2 Channel LVDS (Low Voltage Differential Signaling) interface  
The interface (2pixel/clock) of LVDS serial interface  
Landscape / Portrait type compatible  
High Tni Liquid Crystal (85°C)



### APPLICATIONS

Digital Information Display (DID)  
High Definition Public Monitor

### GENERAL INFORMATION

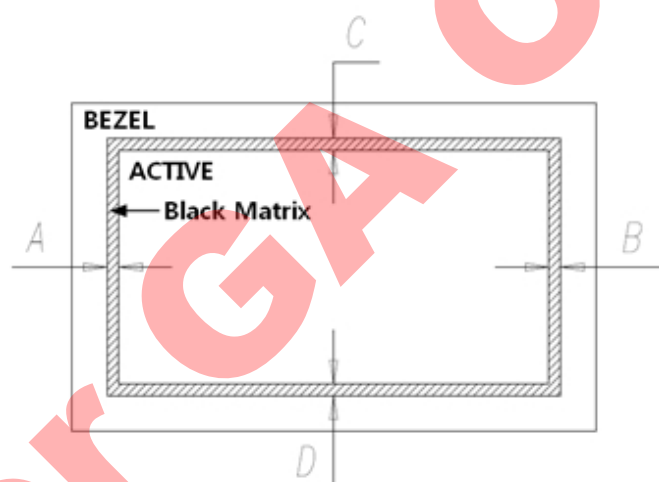
Items	Specification	Unit	Note
Active Display area	1018.08(H) X 572.67(V)	mm	
Switching Components	a-Si TFT active matrix		
Module Size	1047.4(H) x 600.6 (V)	mm	Typ
	10.8(D)	mm	Typ
Weight	12400	g	Typ
Display colors	16.7M (8bits-True)	Color	
Number of pixels	1,920 x 1,080	Pixel	16:9
Pixel Arrangement	RGB Vertical stripe		
Display Mode	Normally Black		
Surface Treatment	Haze 44% / 3H		Anti-Glare
Luminance of White	700(Typ)	cd/m <sup>2</sup>	

## MECHANICAL INFORMATION

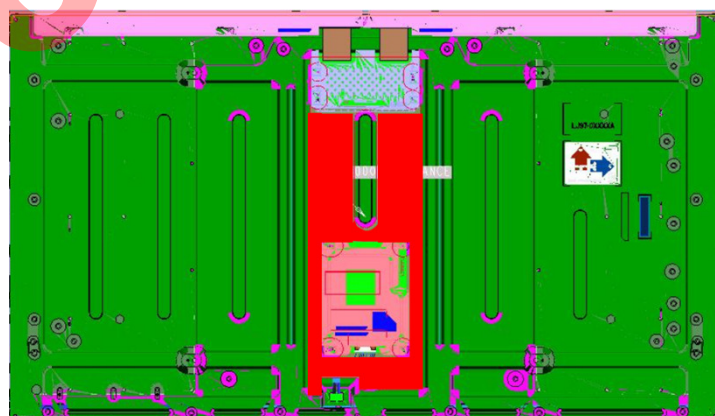
Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	1046.4	1047.4	1048.4	mm	
	Vertical (V)	599.6	600.6	601.6	mm	
	Depth (D)	9.8	10.8	12.8	mm	Minimum Depth (2)
Bezel Open	Horizontal (H)	-	1025.4	-	mm	
	Vertical (V)	-	578.6	-	mm	
Black Matrix Shift	Horizontal (H)	-	-	2.0	mm	(1)
	Vertical (V)	-	-	2.0	mm	
Weight		-	12,400	13,400	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



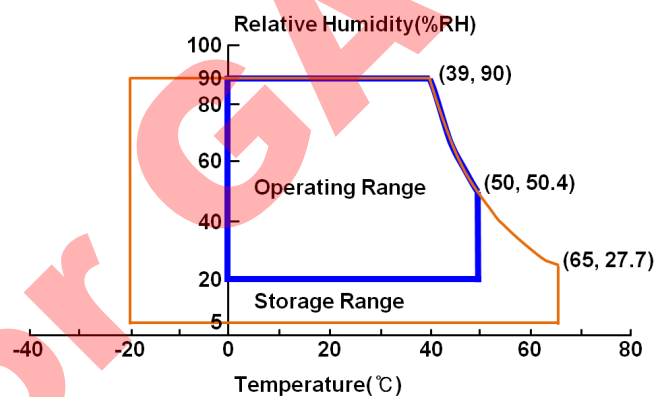
# 1. ABSOLUTE MAXIMUM RATINGS

## 1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item		Symbol	Min.	Max.	Unit	Note
Storage temperature		T <sub>STG</sub>	-20	65	°C	(1)
Operation Temperature		T <sub>OPR</sub>	0	50	°C	(1)
Humidity of storage		H <sub>SUR</sub>	5	90	%RH	
Operating humidity		H <sub>OPR</sub>	20	90	%RH	
Glass surface Temperature (Operation)	Center	T <sub>CENTER</sub>	0	50	°C	
	T Uniformity	ΔT	-	10	°C	
Shock ( non-operating )		Snop(X,Y)	-	40	G	(2), (4)
		Snop(Z)	-	40		
Vibration (non-operating)		V <sub>nop</sub>	-	1.5	G	(3), (4)

Note (1) Temperature and relative humidity range are shown in the figure below.

- 90 % RH Max. (Ta ≤ 39 °C)
- Relative Humidity is 90% or less. (Ta > 39 °C)
- No condensation

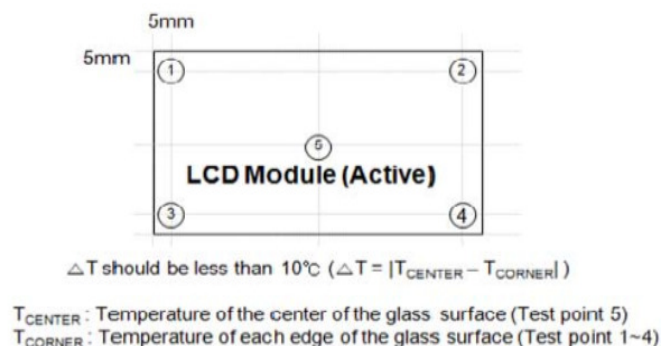


Note (2) 11ms half sine wave, one time for ±X, ±Y, ±Z axis.

Note (3) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis.

Note (4) The fixture for the test of the vibration and shock, which holds the module to be tested shall be hard and rigid in order for the module not to be twisted or bent by the fixture.

Note (5) Definition of Test point



## 1.2 ELECTRICAL ABSOLUTE RATINGS

### (1) TFT LCD MODULE

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V <sub>DD</sub>	10.8	-	13.2	V	(1),(2)
Dimming Control	V <sub>dim</sub>	0	-	5.25	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) BACKLIGHT UNIT

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Supply Voltage / Converter	V <sub>CC</sub>	22	24	26	V	

## 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	-	3000	4000	-	-	(1) SR-3
Response time	G-to-G (AVG)	T <sub>g</sub>	-	-	8	16	msec	(3) RD-80S
Luminance of White (At the center of screen)		Y <sub>L</sub>	-	600	700	-	cd/m <sup>2</sup>	(4) SR-3
Color Chromaticity (CIE 1931)	Red	R <sub>X</sub>	Normal ϕ = 0 θ = 0 Viewing Angle	TYP. -0.03	0.640	TYP +0.03	-	(5), (6) SR-3
		R <sub>Y</sub>			0.330			
	Green	G <sub>X</sub>			0.300			
		G <sub>Y</sub>			0.600			
	Blue	B <sub>X</sub>			0.150			
		B <sub>Y</sub>			0.060			
	White	W <sub>X</sub>			0.280			
		W <sub>Y</sub>			0.290			
Color Gamut		-	-	67	70	-	%	(5) SR-3
Color temperature		-	-	-	10000	-	K	
Viewing Angle	Hor.	θ <sub>L</sub>	CR ≥ 10	79	89	-	Degree	(6) SR-3 EZ-Contrast
		θ <sub>R</sub>		79	89	-		
	Ver.	θ <sub>U</sub>		79	89	-		
		θ <sub>D</sub>		79	89	-		
Brightness Uniformity (9 Point)		B <sub>uni</sub>	-	-	-	25.0	%	(2) SR-3

\* Ta = 25 ± 2 °C, VDD = 3.3V, fv=60Hz, fDCLK = 148.5MHz, IF =100% duty

\* If =560mA (each String 140mA), VF=100.8 (4 LED String)

## 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

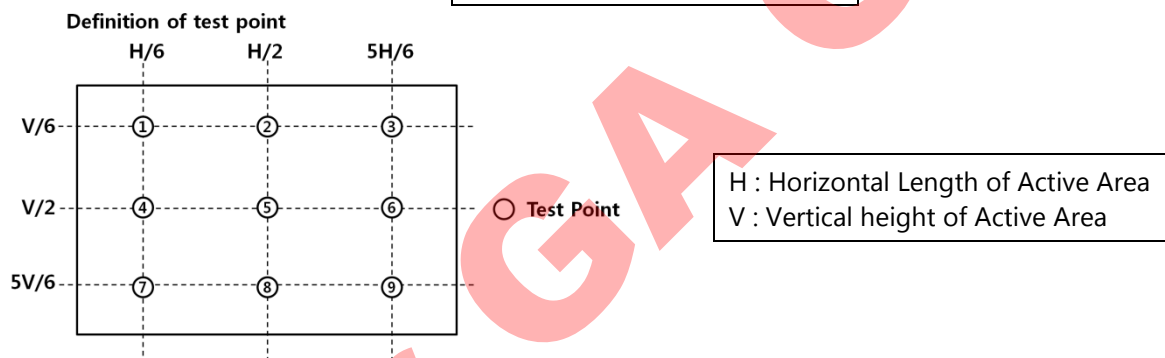
Gmin : Luminance in all black pixels.

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

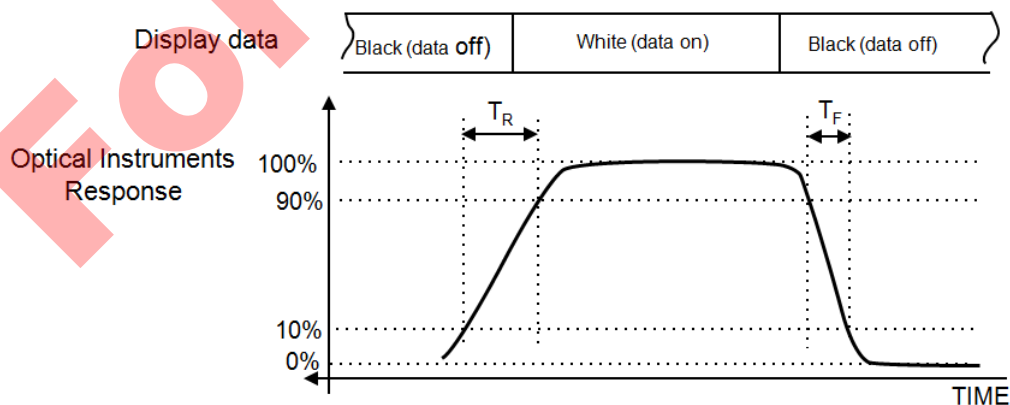
$$B_{uni} = 100 * \frac{(B_{\max} - B_{\min})}{B_{\max}}$$

Bmax : Maximum brightness

Bmin : Minimum brightness



## Note (3) Definition of Response time : Sum of $T_r$ , $T_f$

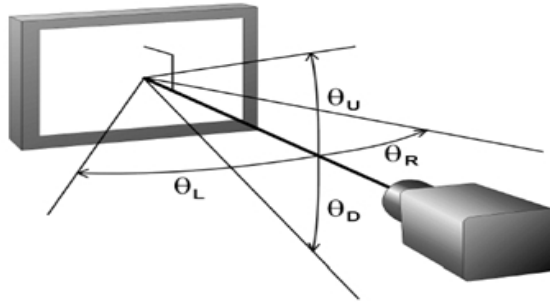


※ G-to-G : Average response time between the whole gray scale to the whole gray scale.

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.

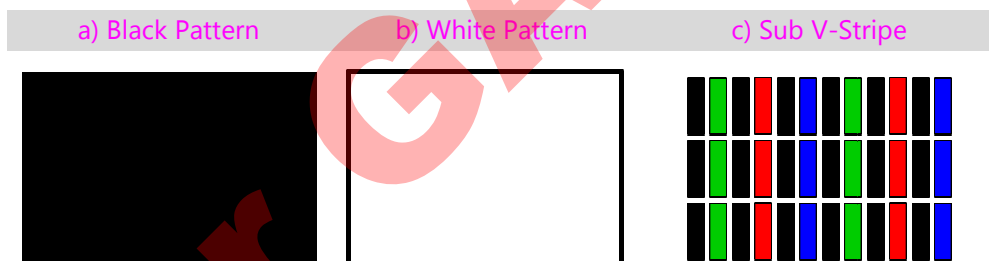
$T_a = 25 \pm 2^\circ\text{C}$

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	450	600	750	mA	(2), (3)
	(b) White	1000	1250	1500		
	(c) Sub V-Stripe	1000	1250	1500		
Vsync Frequency	$f_V$	48	60	62	Hz	-
Hsync Frequency	$f_H$	54	67.5	69.75	kHz	-
Main Frequency	$F_{dclk}$	100	148.5	150	MHz	-
Rush Current	$I_{RUSH}$	-	-	5.0	A	(4)

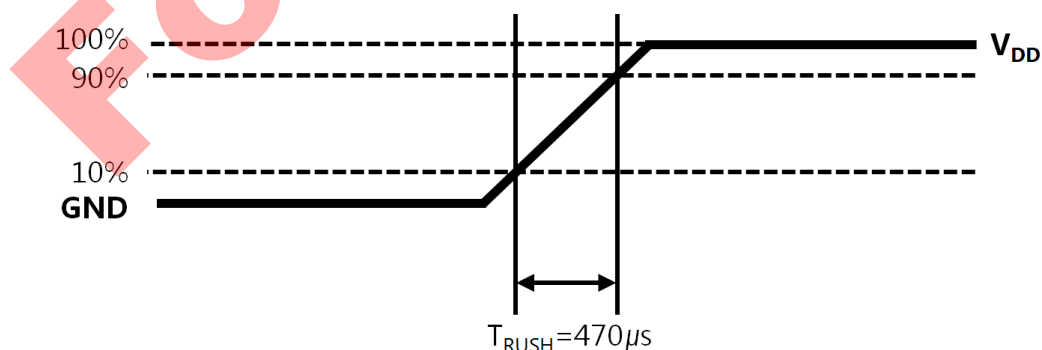
Note (1) The ripple voltage should be controlled under 10% of  $V_{DD}$ .

Note (2)  $f_V=60\text{Hz}$ ,  $f_{DCLK}=148.5\text{MHz}$ ,  $V_{DD}=12.0\text{V}$ , 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	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°C ]

## 4.3 CONDITION &amp; 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 (*2)	Inrush	Vin = 24.0V dim =Max	-	-	6.7	A	Normal Mode Note (2),(3)
Output Current (*1)	ILED	Vin = 22.0~26.0V dim =Max	133	140	147	mAmean	After 1 hour Warm-up, @1string
Converter On/Off Control	ENA	Enable	2.4	-	5.25	V	-
		Disable	-0.3	-	0.8		
A_DIM	V <sub>A_DIM</sub>	V <sub>IN</sub> = 24V	0	-	3.3	V	-
	D <sub>A_DIM</sub> (Duty)	V <sub>IN</sub> = 24V V <sub>A_DIM</sub> = 3.3V	-	-	100	%	
		V <sub>IN</sub> = 24V V <sub>A_DIM</sub> = 0V	20	-	-	%	

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)

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ	Max.		
Input Current (Normal Mode)	Iovershoot	Vin=24V,	-	5.35	5.51	Amean	Overshoot Current After Turn-on
	Isaturation	Dim=Max	-	5.18	5.32	Amean	Saturation current after 1hr aging

## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 INPUT SIGNAL & POWER

Connector : FI-RE51S-HF-J (JAE)

PIN No.	Description		PIN No.	Description	
1	V <sub>DD</sub> (12V)		26	LVDS Signal	Rx2[A]P
2	V <sub>DD</sub> (12V)		27		Rx2[B]N
3	V <sub>DD</sub> (12V)		28		Rx2[B]P
4	V <sub>DD</sub> (12V)		29		Rx2[C]N
5	V <sub>DD</sub> (12V)		30		Rx2[C]P
6	No Connection		31	GND	
7	GND		32	LVDS Clock	Rx2CLK_N
8	GND		33		Rx2CLK_P
9	GND		34	GND	
10	LVDS Signal	Rx1[A]N	35	LVDS Signal	Rx2[D]N
11		Rx1[A]P	36		Rx2[D]P
12		Rx1[B]N	37	No Connection	
13		Rx1[B]P	38	No Connection	
14		Rx1[C]N	39	GND	
15		Rx1[C]P	40	No Connection	
16	GND		41	No Connection	
17	LVDS Clock	Rx1CLK_N	42	No Connection	
18		Rx1CLK_P	43	No Connection	
19	GND		44	No Connection	
20		Rx1[D]N	45	LVDS_SEL	
21		Rx1[D]P	46	No Connection	
22	No Connection		47	No Connection	
23	No Connection		48	No Connection	
24	GND		49	No Connection	
25	LVDS Signal	Rx2[A]N	50	No Connection	
			51	No Connection	

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

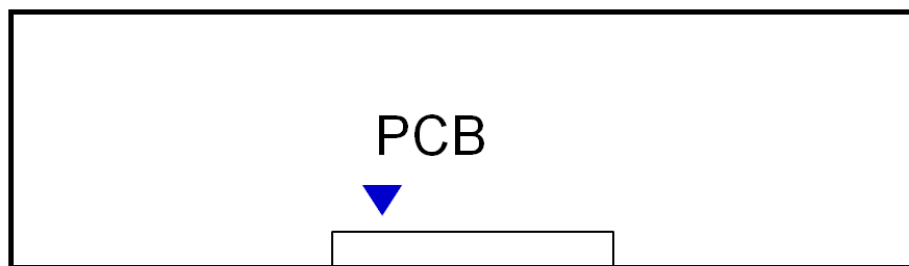
Note (2) LVDS Option : High(3.3V) → Normal NS LVDS format

Low(GND or N.C) → JEIDA LVDS format

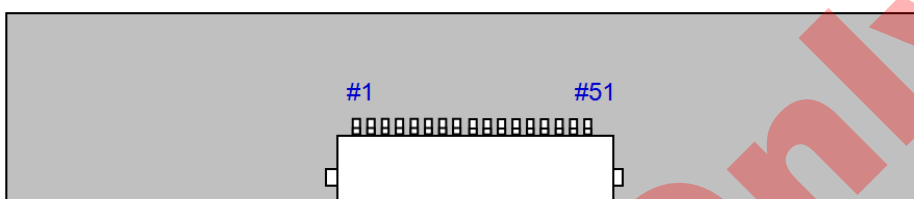
Sequence : On = V<sub>DD</sub>(T1) ≥ LVDS Option ≥ Interface Signal(T2)

Off = Interface Signal(T3) ≥ LVDS Option ≥ V<sub>DD</sub>

Note (3) LVDS Connector



Pin No. 1      Pin No. 51



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

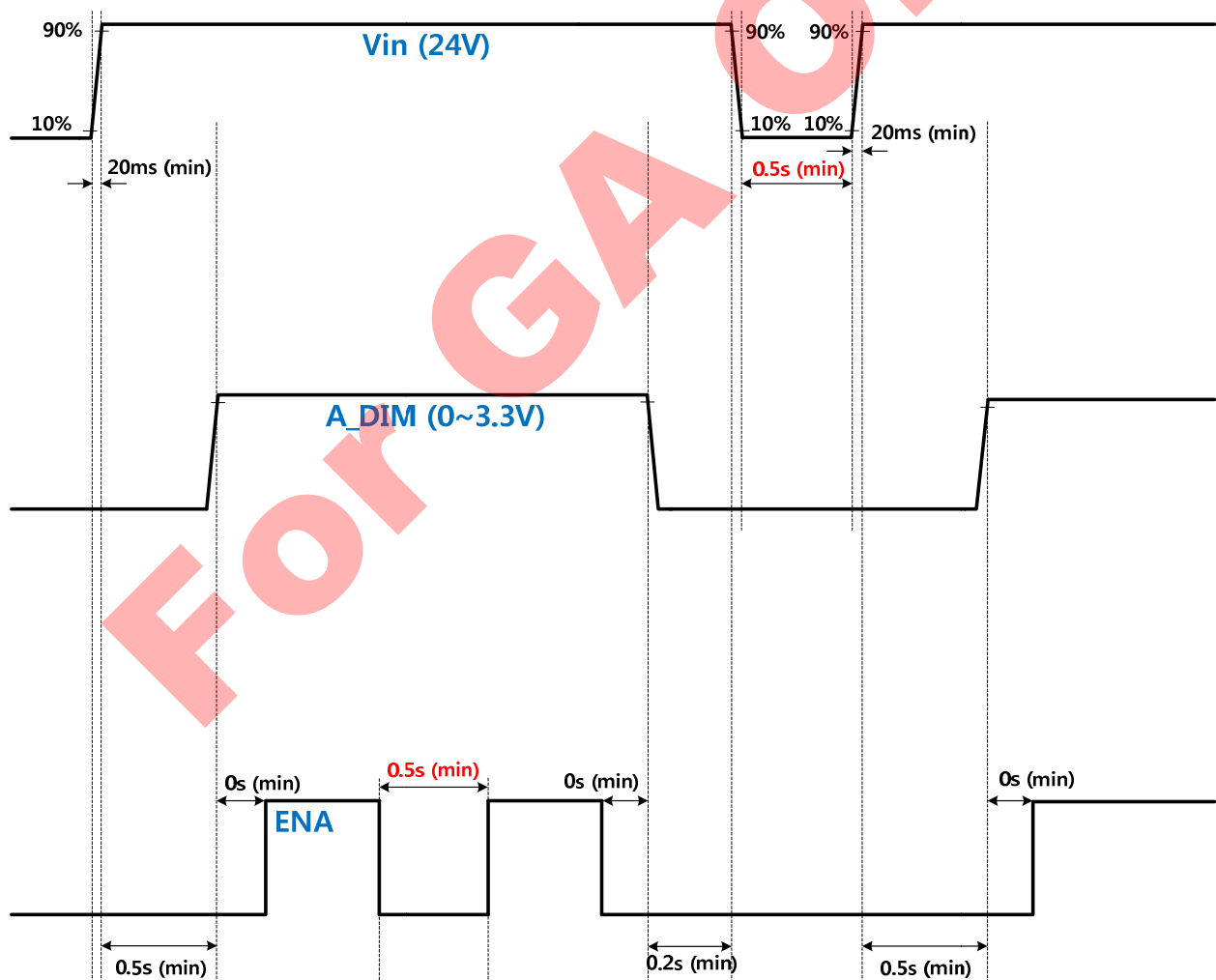
## 5.2 CONFIGURATION OF INPUT PIN OF CONVERTER

Input Connector Model No. : 22022WR-H14B2 (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	Converter on/off Control signal
13	A_DIM	Analog Dimming Control Signal
14	-	No Connection

**Note)** Pin 14 must be disconnected from signal

## 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 NS LVDS FORMAT

	LVDS pin	JEIDA -DATA	VESA -DATA
TxOUT/RxIN0	TxIN/RxOUT0	R2	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	VSNC	VSNC
	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 (8bit)	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	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	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	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	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	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	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	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	-			
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	R0			
	DARK ↑  ↓ LIGHT	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	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	R2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~ R252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
		1	0	1	1	1	1	1	1	0	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	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	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	0	G0			
	DARK ↑  ↓ LIGHT	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	G1			
		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	G2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~ G252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
		0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	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	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	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	0	B0			
	DARK ↑  ↓ LIGHT	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	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	0	B2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~ B252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
		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	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	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	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	$1/T_C$	100	148.5	150	MHz	-
Hsync		$F_H$	54	67.5	69.75	KHz	-
Vsync		$F_V$	48	60	62	Hz	-
Term for the vertical display	Active display period	$T_{VD}$	-	1080	-	Lines	-
	Total vertical	$T_V$	1090	1125	2047	Lines	-
Term for the horizontal display	Active display period	$T_{HD}$	-	1920	-	Clocks	-
	Total Horizontal	$T_H$	2010	2200	2890	clocks	-

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

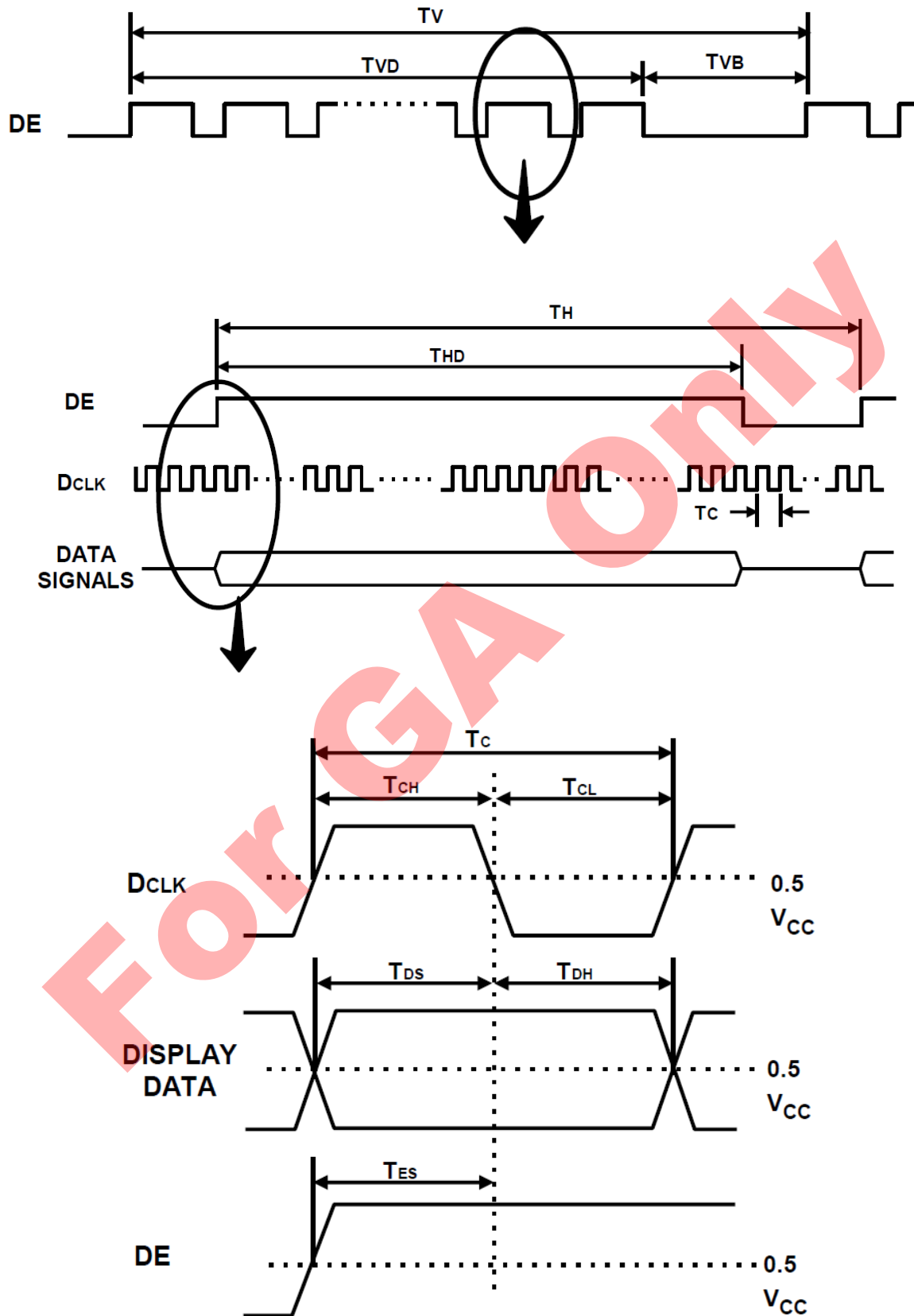
(1) Test Point: TTL controls signal and CLK at LVDS Tx at the input terminal of system.

(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  $\pm 3\%$
- Frequency for modulation : 30~ 300KHz

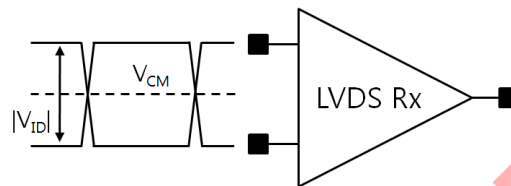
## 6.2 TIMING DIAGRAMS OF INTERFACE SIGNAL (DE ONLY MODE)



## 6.3 CHARACTERISTICS OF INPUT DATA OF LVDS

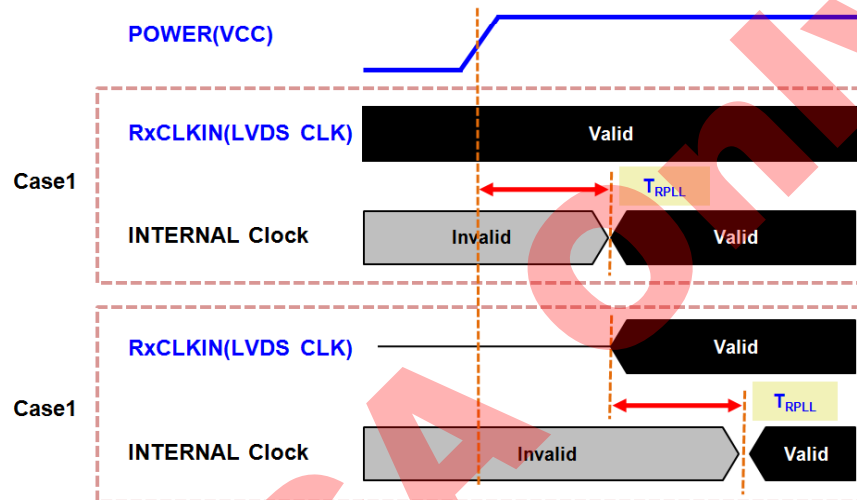
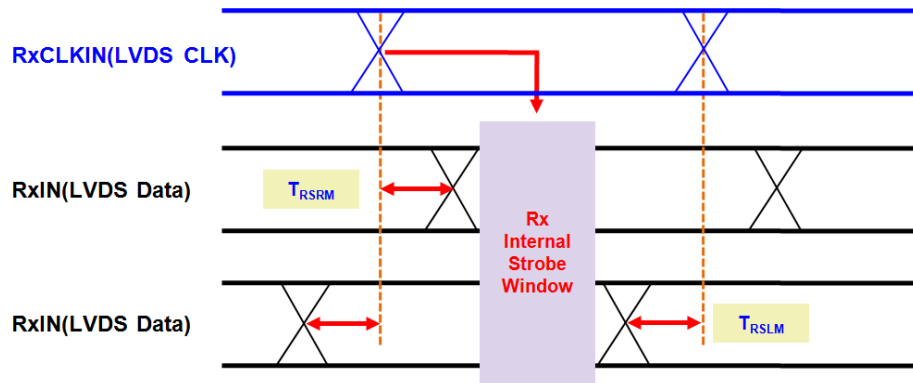
### (1) Specification for DC

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

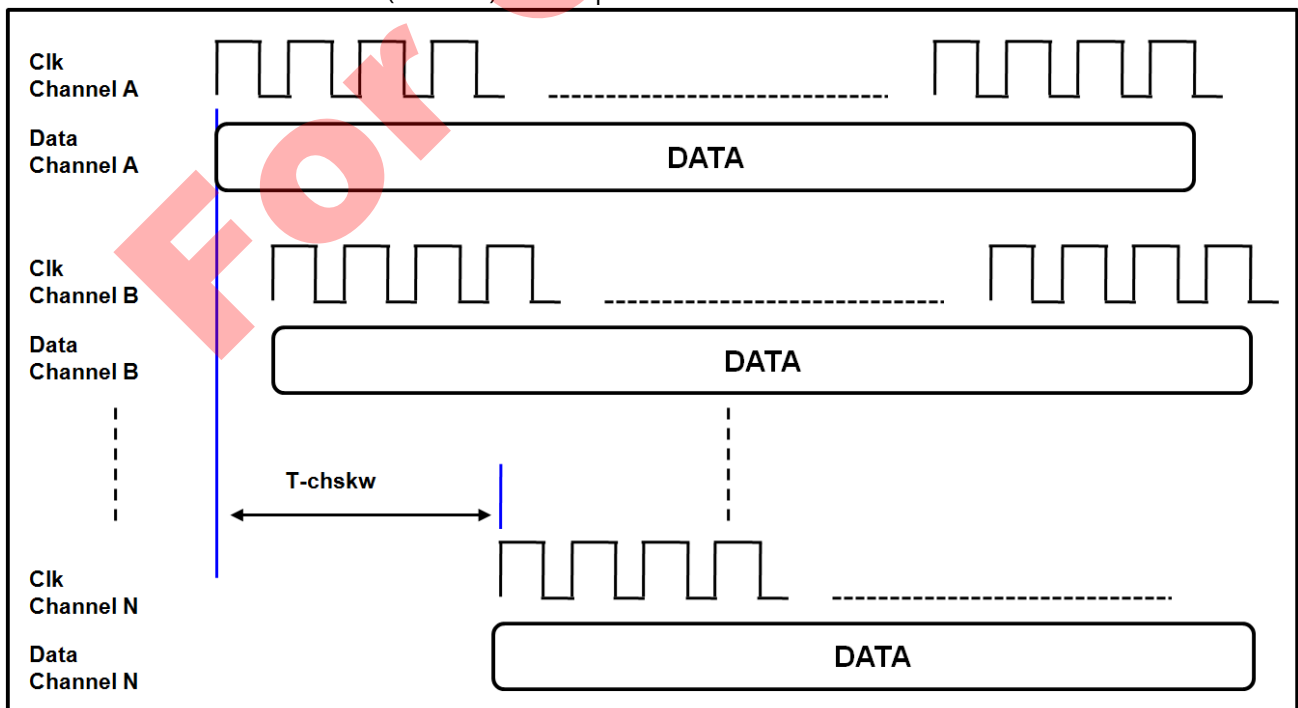


### (2) Specification for AC

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	-	-	+400	ps
	FIN=78MHZ	-	-	+450	
	FIN=75MHZ	-	-	+500	
Position of input data	FIN=85MHZ	-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	%



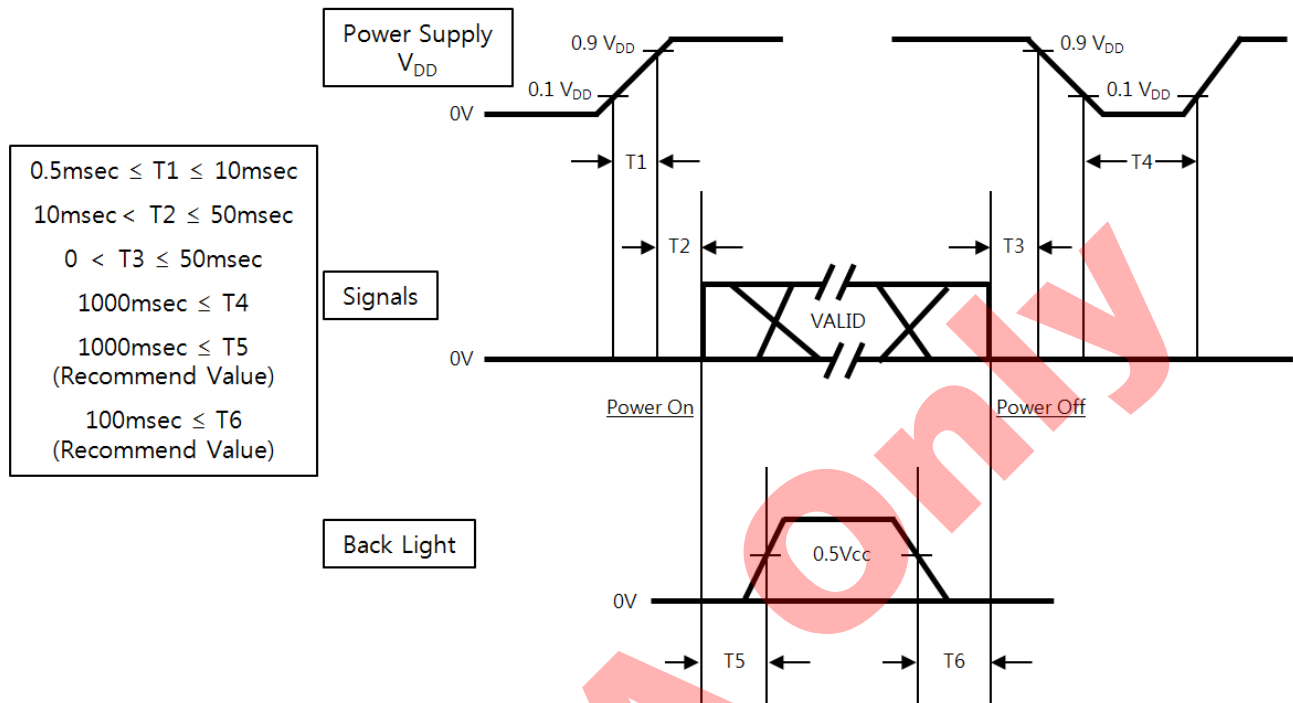
\* LVDS Channel to Channel Skew( $T_{chskw}$ ) in Multiple LVDS Channels



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

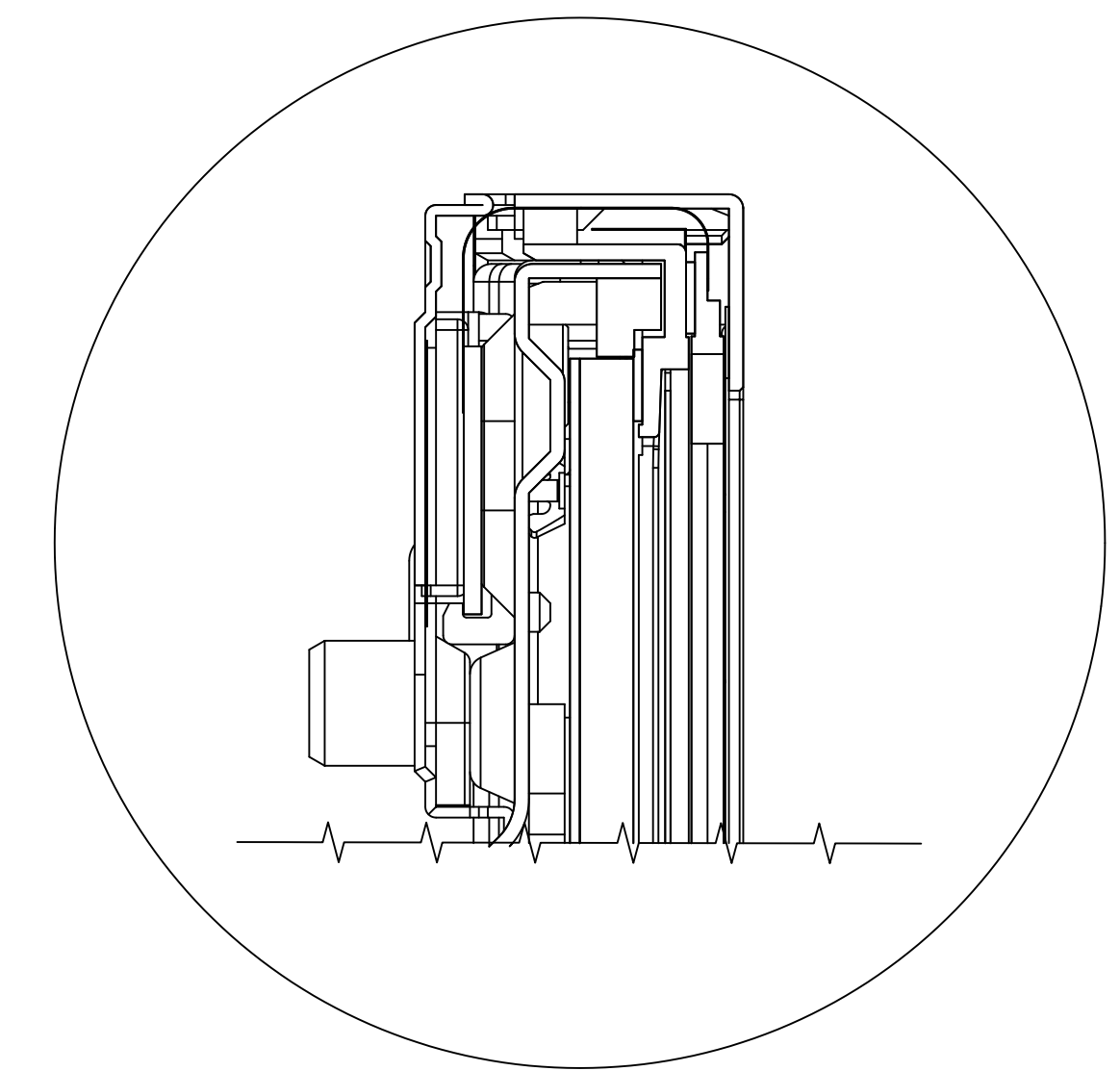
To prevent the product from being latched up or the DC in the LCD module from starting an operation, the order to turn the power on and off should be changed to the order as shown in the diagram below.



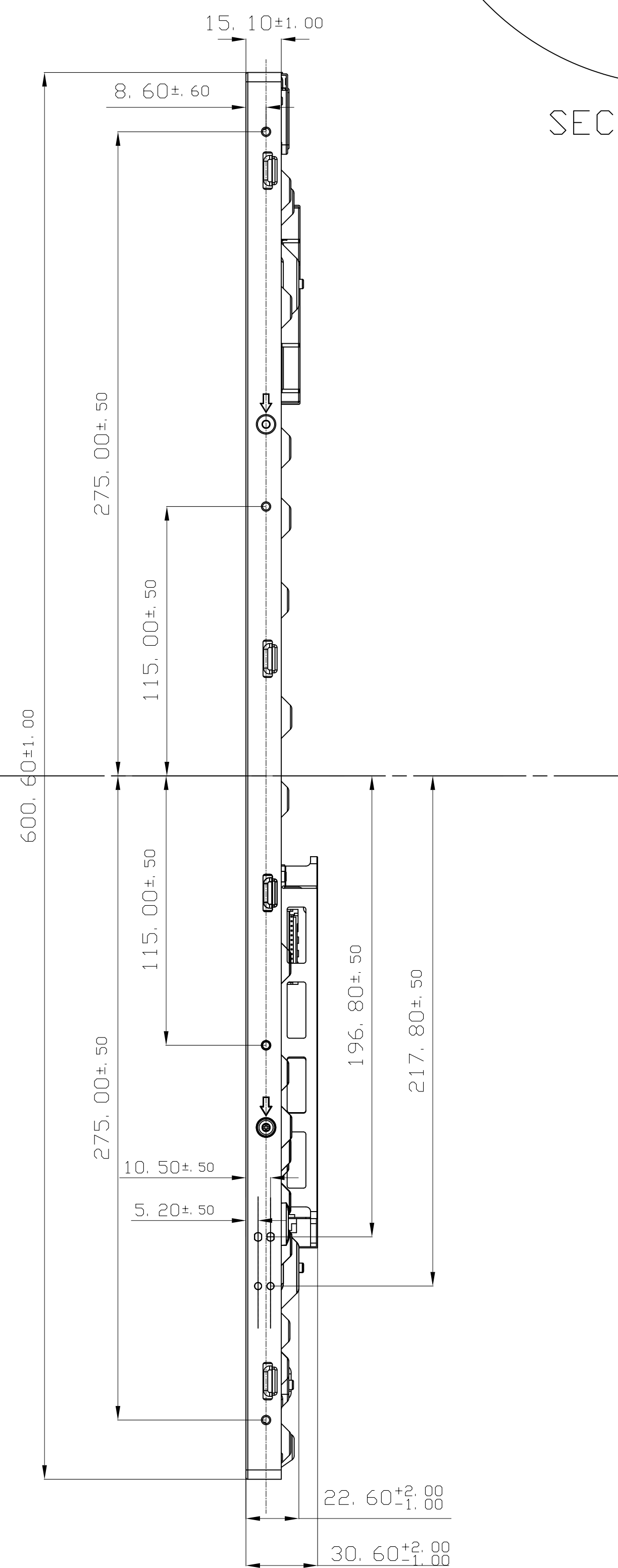
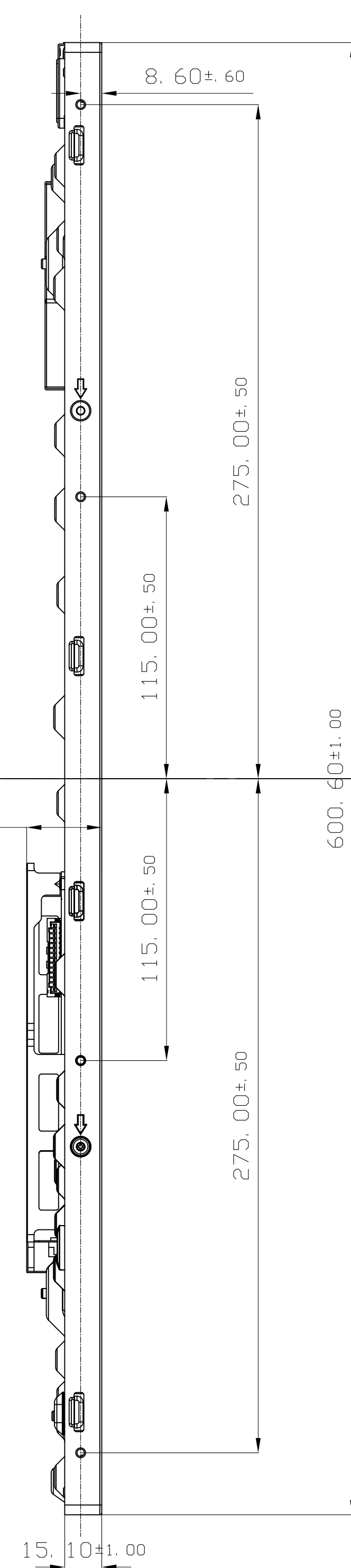
Timing	Remarks
$T_1$	The time, during which the level of $V_{DD}$ is rising from 10% to 90%.
$T_2$	The change for time, during which the $V_{DD}$ starts rising beyond 90% until the valid data of signal started coming in.
$T_3$	The change for time, during which the valid data of signal starts leaving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

NO	PART NAME	CODE NO	SPECIFICATION	Q' TY	WEIGHT		UNFOLDED DIM. OF. MATERIAL	REMARK
					FINISH	MATERIAL		
	OUTLINE FRONT		LTI460HN08-0					

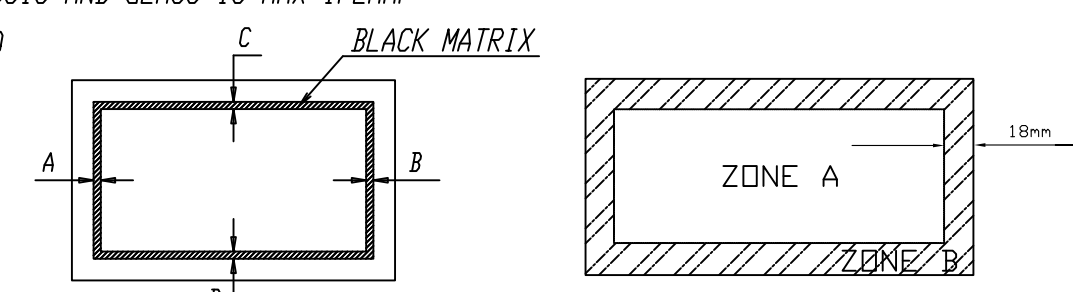


SECTION A-A



\* NOTES

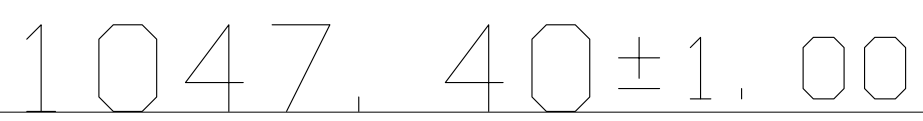
1. BACKLIGHT : 128 LIGHT EMITTING DIODES.
2. CONVERTER CONN. SPEC :
  - MAKER : YEONHO
  - PART NO. : SMH00-15
3. I/F CONN. SPEC
  - MAKER : JAE
  - PART NO. : FI-RESIS-W-J
4. USER HOLE
  - TAP SIZE & TOLERANCE DESIGNED FOR GENERAL PURPOSE METRIC SCREW
  - HEAD ADJUSTING TO GENERAL GRADE OF "KS B 0211"
  - SIDE USER HOLE : ALLOWED DEPTH OF HOLE SCREW INSERTION IS 3.00mm MAX
  - TORQUE SPEC : M3 MACHINE SCREW 8.0 kgf.cm MAX
  - M4 MACHINE SCREW 10.0 kgf.cm MAX
  - M5 MACHINE SCREW 13.0 kgf.cm MAX
  - SCREW REPEATED INSERTION WARRANTY : 5 TIMES
5. GAP BETWEEN TOP CHASSIS AND GLASS IS MAX 1.2mm
6. WEIGHT : MAX 13.700g
7. BLACK MATRIX SPEC
  - A - B | ≤ 2.0 mm
  - C - D | ≤ 2.0 mm
8. TOLERANCE IN Z AXIS
  - ZONE A : +2 / -1
  - ZONE B : +1 / -1



GENERAL TOLERANCE				REV		DATE		DESCRIPTION OF REVISION				REASON		CHG' D BY	
STEP	LEVEL 1	LEVEL 2	LEVEL 3	UNIT	mm	DRAW' N BY	BES' D BY	CHK' D BY	APP' D BY	MODEL NAME	LTI460HN08-0		SHEET	1/2	
0 < X < 4	±0.05	±0.1	±0.2	SCALE	1/1	S. I. JANG				PART/SHEET NAME	OUTLINE_FRONT				
4 < X < 16	±0.08	±0.15	±0.3	TOLERANCE		12.12.04				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												



NO	PART NAME	CODE NO	SPECIFICATION	Q' TY	WEIGHT		UNFOLDED DIM. OF. MATERIAL	REMARK
					FINISH	MATERIAL		
	OUTLINE BACK		LT1460HN08-0					



600.60 + 1.00

GENERAL TOLERANCE				REV		DATE		DESCRIPTION OF REVISION				REASON		CHG'D BY	
STEP	LEVEL 1	LEVEL 2	LEVEL 3	UNIT	MM	DR	DATE	DES'D BY	CHK'D BY	APP'D BY	MODEL NAME			SHEET	2/2
0 < X < 4	±0.05	±0.1	±0.3	SCALE	1/4	1	S. I. JANG				PART/SHEET NAME	LT1460HN08-0			
4 < X < 16	±0.09	±0.15	±0.3	TOLERANCE		LEVEL 3		12.12.04			OUTLINE_BACK				
16 < X < 64	±0.12	±0.25	±0.5	SAMSUNG DISPLAY						SPEC. NO.	CODE NO.	VER. 001			
64 < X < 256	±0.25	±0.4	±0.8												

## 7. RELIABILITY TEST

Item	Test condition	Quantity
HTOL	50℃, 500hr determination	8EA
LTOL	0℃, 500hr determination	4EA
HTS	70℃, 500hr determination	4EA
LTS	-25℃, 500hr determination	4EA
THB	50℃ / 90%RH, 500hr determination	10EA
WHTS	60℃ / 75%RH, 500hr determination	4EA
T/S	-20 ~ 60℃, Dwell time : 30Min, 200cycle	4EA
TSS	-20 ~ 65℃, 220cycle	4EA
Image sticking	50℃, Mosaic pattern (9X10), 12hrs	8EA
Contact ESD	±10 kV, 210Point, 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 / 5hr(Portrait 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

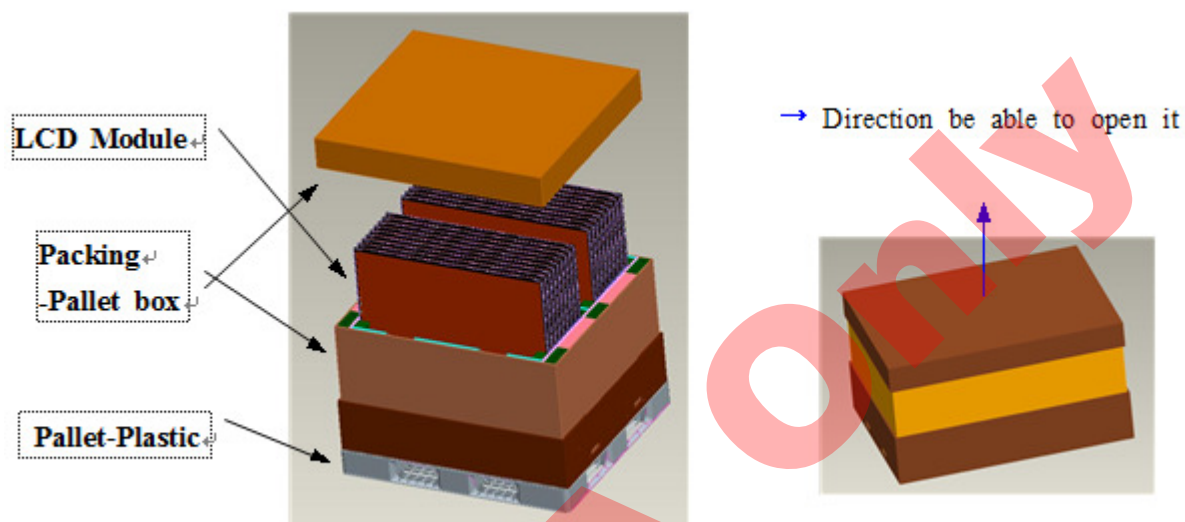
\* WHTS : The storage condition at the high temperature with the high humidity

## 8. PACKING

### 8.1 CARTON (INTERNAL PACKAGE)

(1) Packing Form : Paper

(2) Packing Method



Note(1) Total Weight : Approximately 287.08kg [With Pallet Plastic]

Note(2) Acceptance number of piling : 3 Pallets

Note(3) Carton size : 1255mm(H) x 1097mm(V) x 657mm(Height) [Without Pallet Plastic]

1270mm(H) x 1150mm(V) x 782mm(Height) [With Pallet Plastic]

(3) Packing Material

No	Part name	Quantity
1	Packing-Pallet BOX	1 EA
2	Bag-Shielding	18 EA
3	Protector-Panel	18 EA
4	Pallet-Plastic	1 EA

## 9. MARKINGS & OTHERS

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

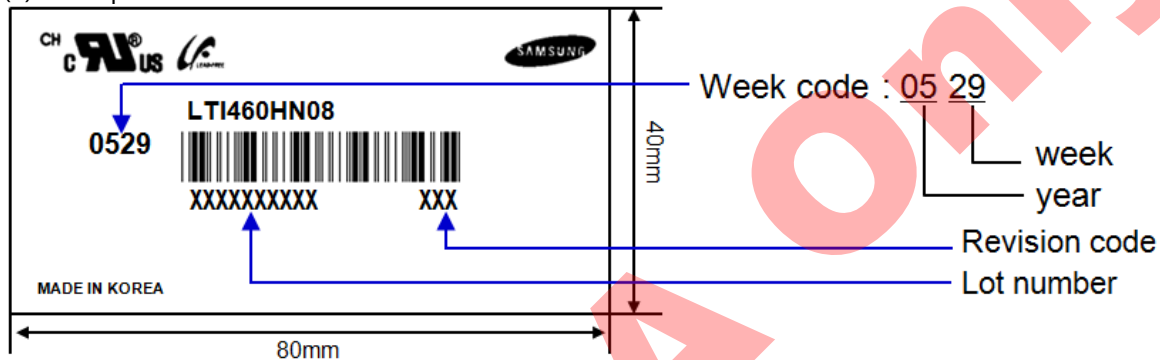
(1) Parts number : LTI460HN08

(2) Revision code : Three letters

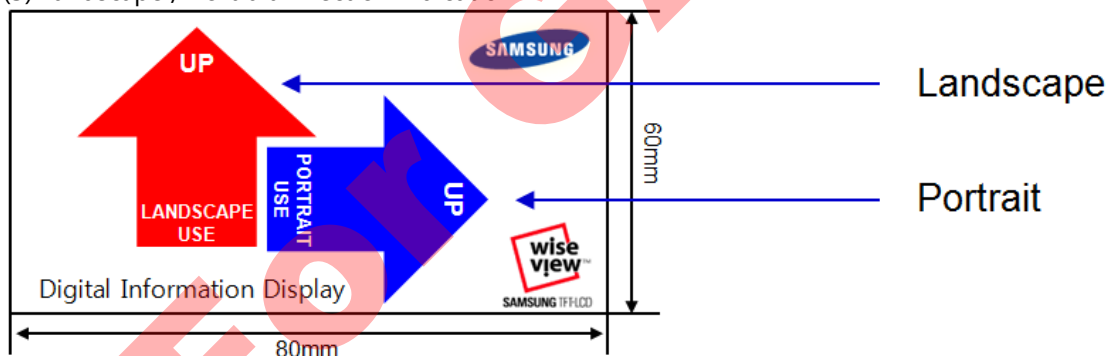
(3) Lot number : X X X X XXX XX X

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

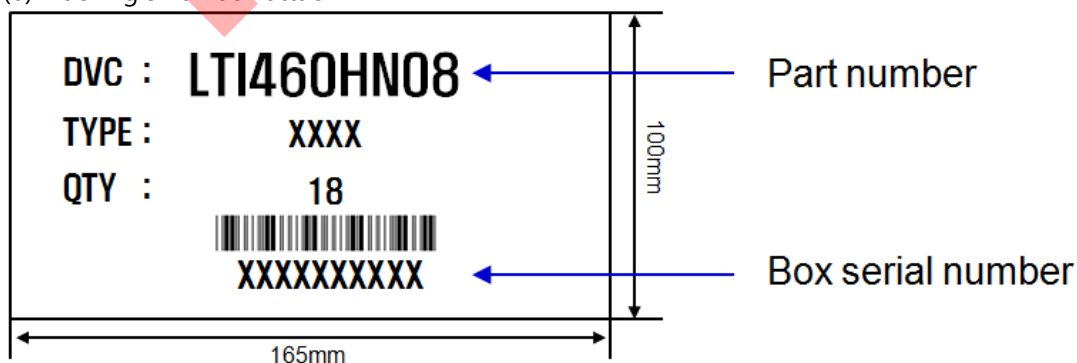
(4) Nameplate Indication



(5) Landscape / Portrait Direction Indication



(6) Packing small box attach



## 10. GENERAL PRECAUTIONS

### 10.1 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 (Isoprophyl 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.

## 10.2 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"> <li>- The storage room should be equipped with a good ventilation facility, which has a temperature controlling system.</li> <li>- Products should be placed on the pallet, which is away from the wall not on the floor.</li> <li>- Prevent products from being exposed to the direct sunlight, moisture, and water. Be cautious not to pile the products up.</li> <li>- Avoid storing products in the environment, which other hazardous material is placed.</li> <li>- 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.</li> <li>- 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.</li> </ul>		

## 10.3 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).

## 10.4 OPERATION CONDITION GUIDE

- (a) The LCD product should be operated under normal conditions.  
Normal condition is defined as below;
  - Temperature : 0~65°C
  - Humidity : 20~90%
  - 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.



## 10.5 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.