Issued Date: 09/June/2016

SAMSUNG TFT-LCD PRODUCT INFORMATION

MODEL: LSM270HP06-G01

Samsung Display Co., Ltd.

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Revision History

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1. General Description

Overview

LSM270HP06-G01 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 27.0" is 1920 x 1080 (FHD) and this model can display up to 16.7 million colors.

Features

Application - Workstation & Desktop monitors - Display terminals for AV Products - Monitors for Industrial machine
DE (Data Enable) only mode
LVDS (Low Voltage Differential Signaling) interface (4pixel/clock)
RoHS, Halogen Free

General Information

Items	Specification	Unit
Pixel Pitch	0.3114(H) x 0.1038(W)	mm
Active Display Area	597.888(H) x 336.312(V)	mm
Surface Treatment	AG type, Haze 25%	-
Display Colors	16.7M	colors
Number of Pixels	1,920 x 1,080	pixel
Pixel Arrangement	RGB vertical stripe	-
Display Mode	Normally Black	-
Power Consumption	Panel 6.7W(Typ) (@ 60hz) Panel 11.7W(Typ) (@ 144hz)	W

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	607.988	608.288	608.588	mm	
	Vertical (V)	347.737	348.037	348.337	mm	Only Panel
		-	413.312	-		Include PBA
	Thickness (T)	-	1.11	-	mm	Only Panel
		-	5.0	-	mm	Include PBA
Weight (g)		-	-	600	g	LCD module only

Note. Mechanical tolerance is ± 0.5mm unless there is a special comment

2. Absolute Maximum Ratings

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

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	-0.3	14	V	(1)
Operating Temperature	T_{OPR}	0	50	℃	(2)
Storage temperature	T_{STG}	-20	60	℃	
Glass surface temperature (Operation)	T_{SUF}	0	65	℃	(3)
Center of Glass surface temperature (Operation)	T_{SUR}	0	50	℃	(3-1)
[A)] Shock(Non-operating)	Snop	-	50	G	(4)
[A)] Vibration(Non-operating)	Vnop	-	1.5	G	(5)

A) ONLY LCD manufacturer uses internally this item

Note (1) Ta= 25 ± 2 °C

Note (2) Temperature and relative humidity range are shown in the figure below.
a. 90 % RH Max. (Ta ≤ 40 °C)
b. Maximum wet-bulb temperature at 39 °C or less. (Ta ≤ 40 °C)
c. No condensation

(3) The maximum operating temperature of LCD module is defined with surface temperature of active area. Under any condition, the maximum ambient operating temperature should be keeping the surface of active area not any higher than 65 °C

(3-1) The maximum operating temperature of LCD module is defined with surface temperature of active area. Under any condition, the maximum ambient operating temperature should be keeping the center of glass surface (Active area) not any higher than 50 °C

(4) 11ms, 1 times for ±X, ±Y, ±Z

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

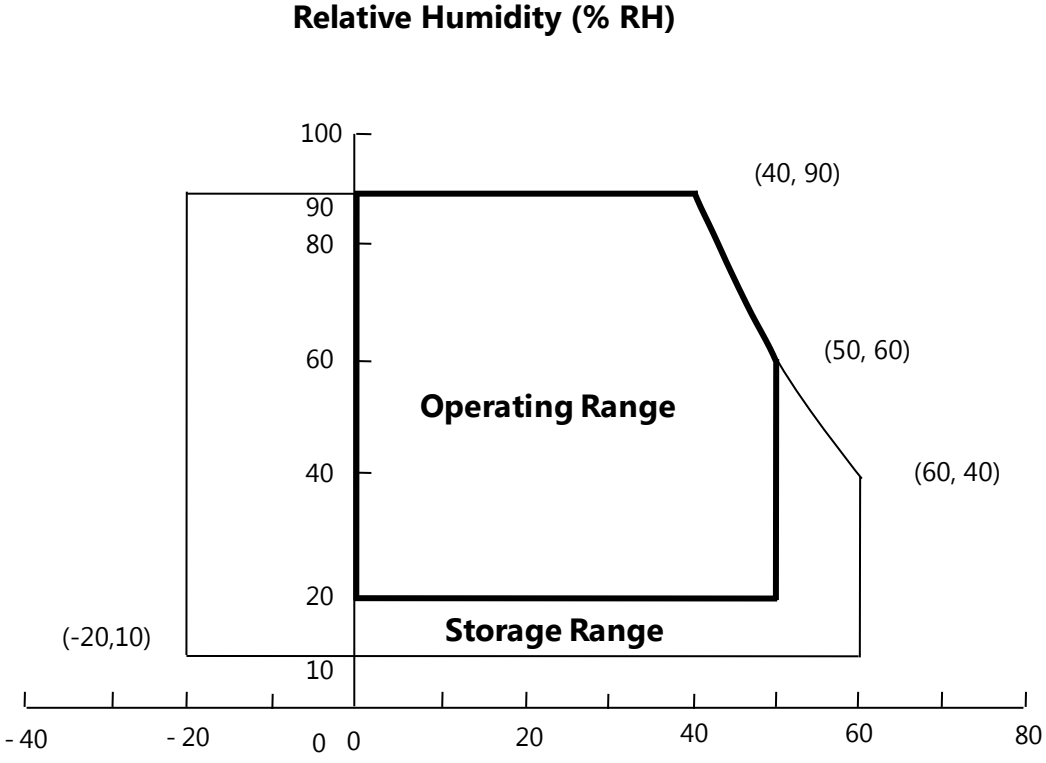


Fig. Temperature and Relative Humidity range

3.1 Optical Characteristics

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

Open Cell

(Ta = 25 ± 2°C, VDD=12V, fv= 60Hz f_{DCLK}=35.3Mhz)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R		2100	3000	-		(3) SR-3
Response Time (w/o DCC)	GtoG	-		-	21	-	msec	(5) RD-80S
Transmittance		-		4.0	4.25	-	%	(6) SR-3
Brightness Uniformity 개발 : 13 Points 응기 : 9Point		B_{uni}		-	-	25	%	(4) SR-3
Color Chromaticity (CIE 1931)	Red	Rx	Normal $\theta_{L,R}$=0 $\theta_{U,D}$=0 Viewing Angle	- 0.025	0.662	+0.025		(7),(8) SR-3
		Ry			0.328			
	Green	Gx			0.274			
		Gy			0.595			
	Blue	Bx			0.134			
		By			0.125			
	White	Wx			0.297			
		Wy			0.367			
©Color Chromaticity (CIE 1976)	Red	Ru'		-	0.472	-		
		Rv'		-	0.526	-		
	Green	Gu'		-	0.114	-		
		Gv'		-	0.558	-		
	Blue	Bu'		-	0.126	-		
		Bv'		-	0.266	-		
	White	Wu'		-	0.175	-		
		Wv'		-	0.485	-		

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
[A)] Gamma value		-		1.9	2.2	2.5	K	
Viewing Angle	Hor.	θ_L	CR≥10	80	89	-	Degrees	(8) EZ-Contrast
		θ_R		80	89	-		
	Ver.	θ_U		80	89	-		
		θ_D		80	89	-		

A) ONLY LCD manufacturer uses internally this item.

*Optical specification is valid only for standard optical source(Estimation of Image Quality Group[LCD])

*Light Source : D65 Standard light

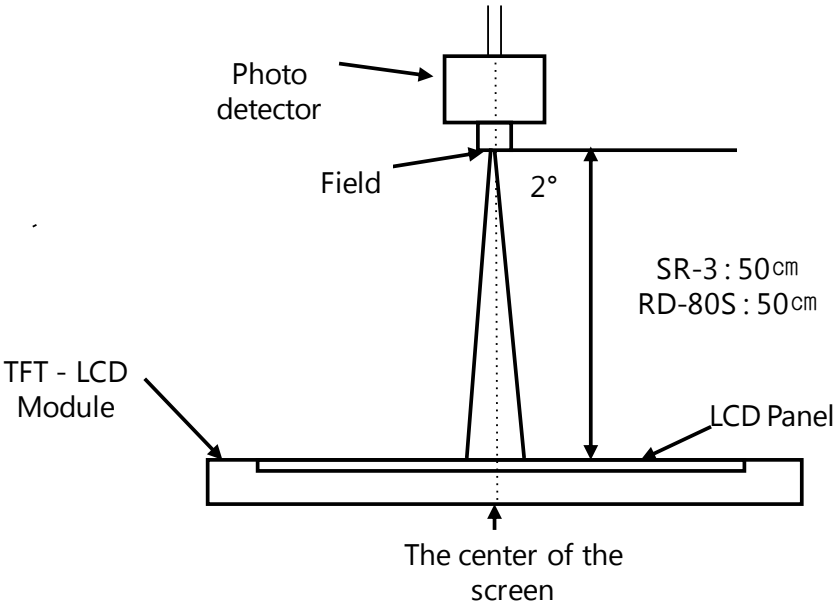
* Guaranteed only in terms of the cell condition

*Only flat status assurance

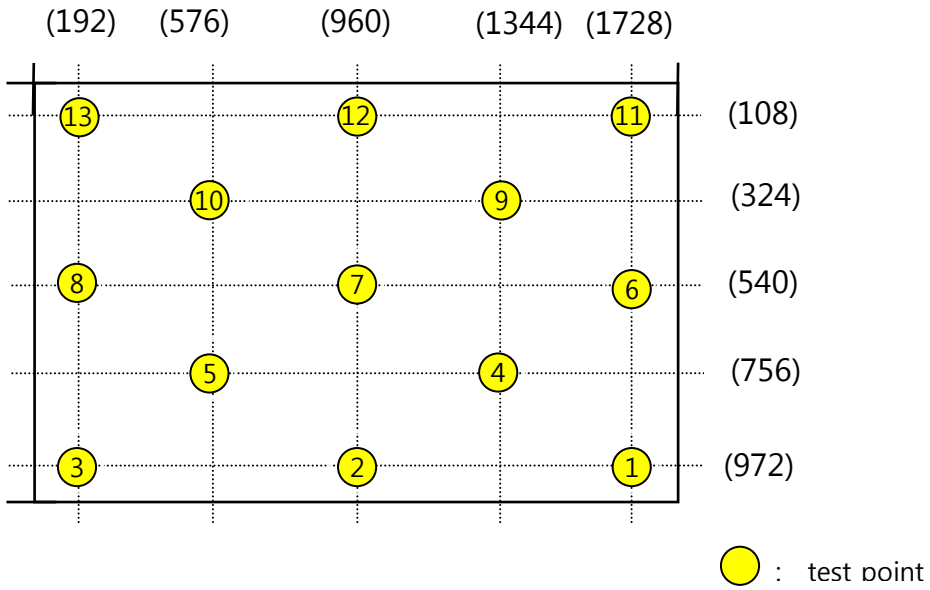
Note (1) Test Equipment Setup

The measurement should be executed in a stable, windless and dark room between 30min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

LED Forward current: If = 300mA Environment condition: Ta = 25 ± 2 °C



(2) Definition of test point



(3) Definition of Contrast Ratio (CR)

: Ratio of gray max (G_{max}) & gray min (G_{min}) at the center point ⑦ of the panel

$$CR = \frac{G_{max}}{G_{min}}$$

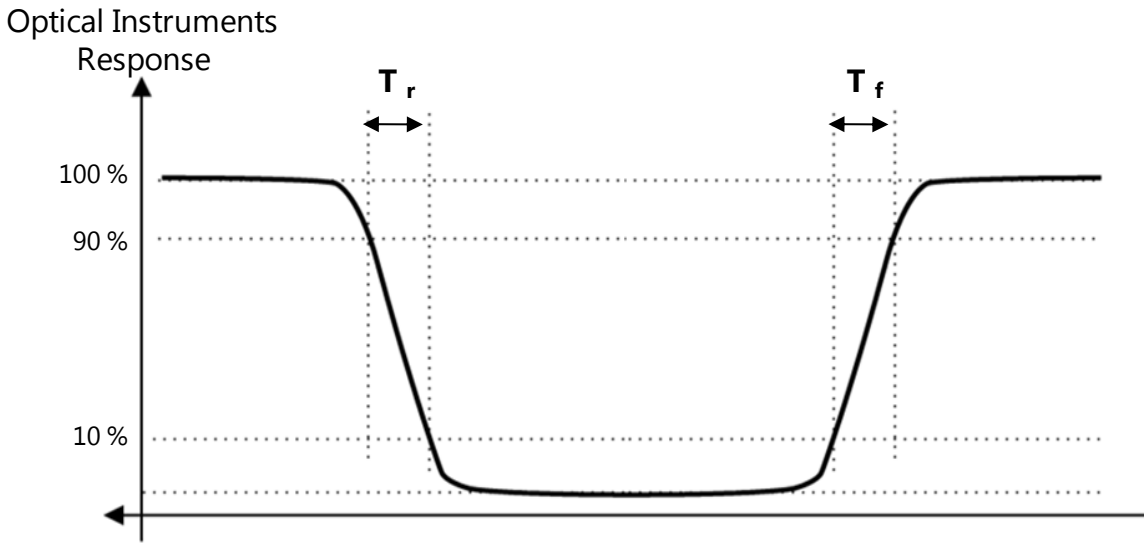
G_{max}: Luminance with all pixels white
G_{min}: Luminance with all pixels black

(4) Definition of 13 points brightness uniformity

$$B_{uni} = 100 \times \frac{B_{max} - B_{min}}{B_{max}}$$

B_{max}: Maximum brightness
B_{min}: Minimum brightness

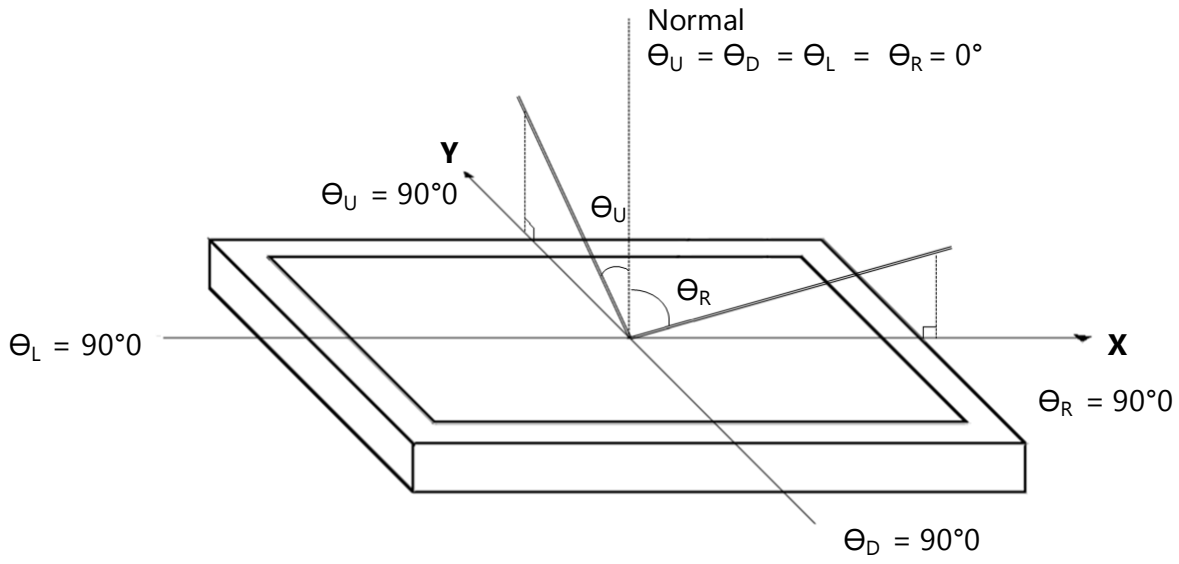
(5) Definition of Response time: Sum of Tr, Tf



(6) Definition of Luminance of White: Luminance of white at center point (7)

(7) Definition of Color Chromaticity (CIE 1931, CIE1976)
Colors coordinate of Red, Green, Blue and White at center point (7)

(8) Definition of Viewing Angle
: Viewing angle range (CR ≥ 10)



4. Block Diagram

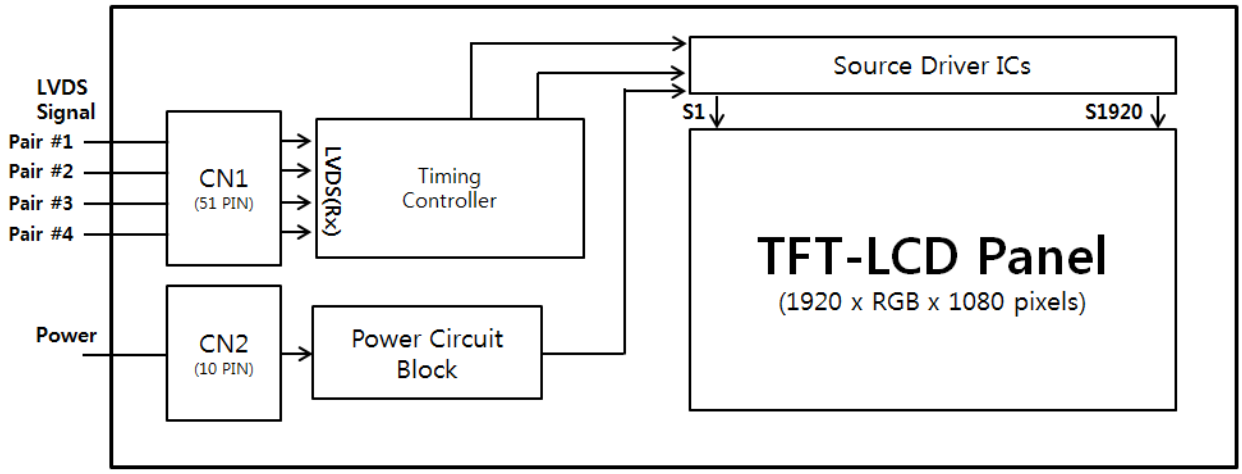


Fig. Function Block Diagram

Note (1) the connector for display data & timing signal should be connected

5. Electrical Characteristics

5.1 TFT LCD Module

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

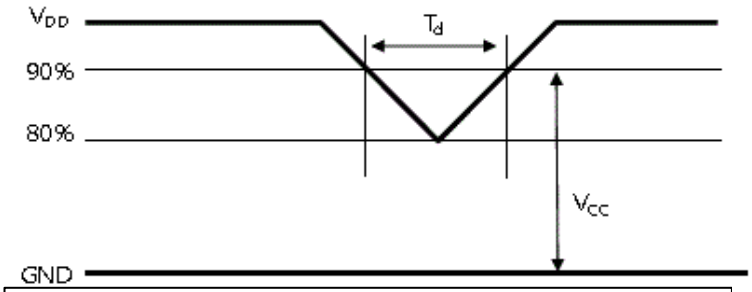
Ta=25 ± 2°C

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) White	I_{DD}	-	487	560	mA	(2),(3)
	(b) Black		-	365	-	mA	
	(c) Mosaic		-	361	-	mA	
	(d) Dot		-	557	635	mA	
	(d) Dot		-	980	1120	mA	(2),(7)
Power Consumption		P_{LCD}	-	6.7	7.6	Watt	(3),(4),(5)
		P_{LCD}		11.7	13.5	Watt	(4),(7)
Rush Current		I_{RUSH}	-	-	3	A	(6)

Note (1) the ripple voltage should be controlled fewer than 10% of V_{DD}

(2) Definition of V_{DD} Power Dip

- The above conditions are for the glitch of the input voltage.
- For stable operation of an LCD Module power, please follow them.



$10.8V \le V_{DD} \le 13.2V$

If V_{DD} (Typ) x 80% $\le V_{CC} \le V_{DD}$ (Typ) x 90%

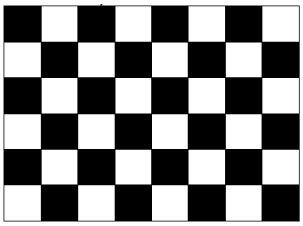
Then $0 < Td \le 20msec$

(3) f_V=60Hz, f_{DCLK} = 35.3 MHz, V_{DD} = 12.0V, DC Current.
(4) Power dissipation check pattern (LCD Module only)

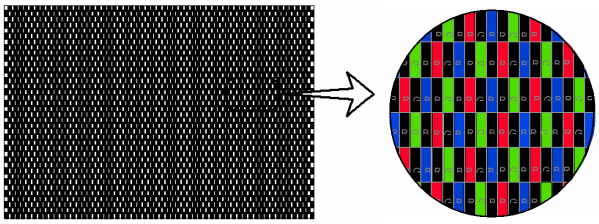
a) White Pattern

b) Black Pattern

c)Mosaic Pattern

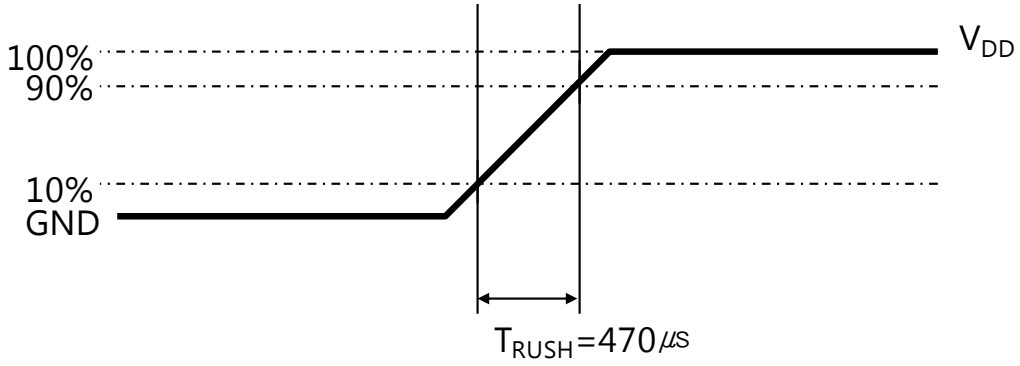


d) Dot Pattern



(5) The power consumption is specified whereas black pattern is displayed at f_V=60Hz, f_{DCLK} = 35.3 MHz, V_{DD} = 12.0V

(6) Measurement Condition



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

(7) f_V=144Hz, f_{DCLK} = 83.95 MHz, V_{DD} = 12.0V, DC Current.
The power consumption is specified whereas black pattern is displayed at f_V=144Hz, f_{DCLK} = 83.95 MHz, V_{DD} = 12.0V.

5.2 LVDS Characteristics

5.2.1. LVDS Input Characteristics

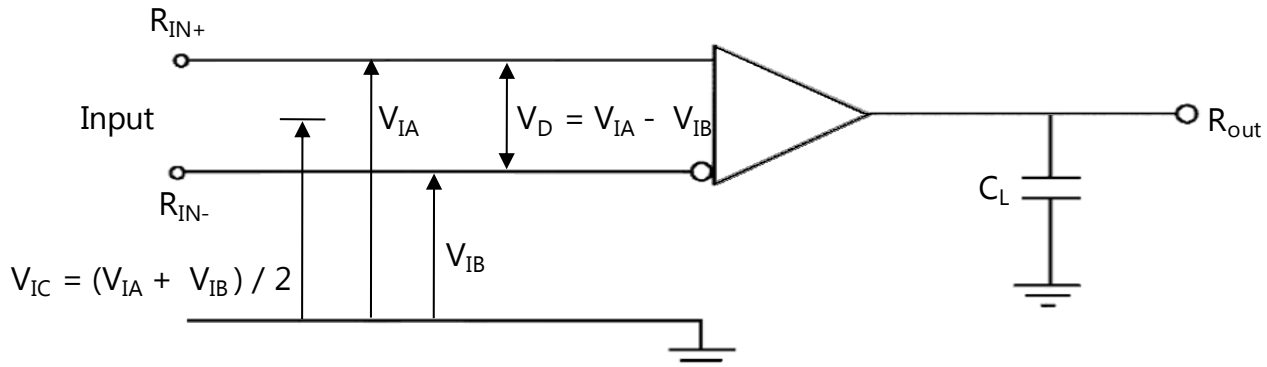
Ta=25 ± 2°C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Differential Input Voltage for LVDS receiver threshold	High	-	-	+100	mV	(1)
	Low	-100	-	-	mV	
LVDS skew	t_{SKEW}	-300	-	300	ps	(2)
Differential input voltage	$\|V_{id}\|$	100	-	600	mV	(3)
Input voltage range(single ended)	V_{in}	0.7	-	1.7	V	(3)
Common mode voltage	V_{cm}	1.0	1.15	1.4	V	(3)

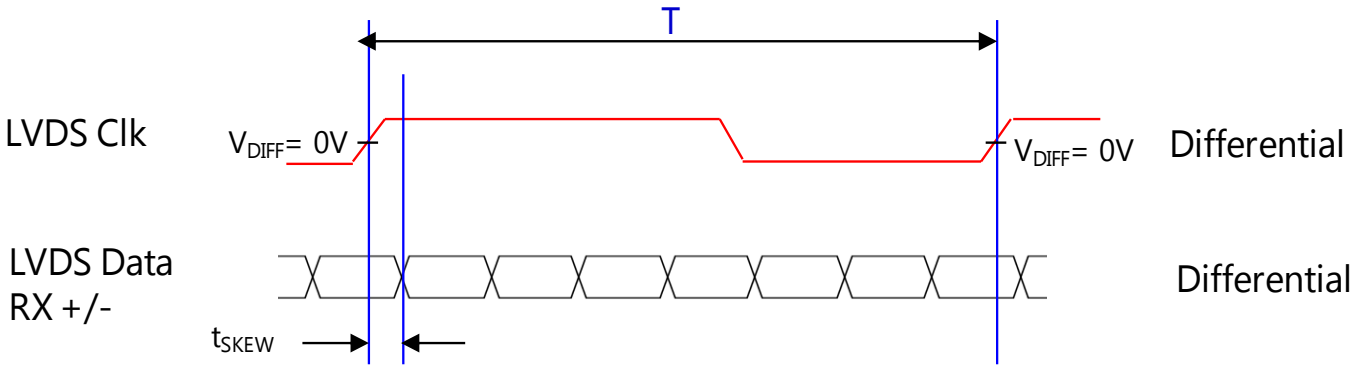
Note (1) Differential receiver voltage definitions and propagation delay and transition time test circuit

a. All input pulses have frequency = 10MHz, t_R or t_F =1ns

b. C_L includes all probe and fixture capacitance

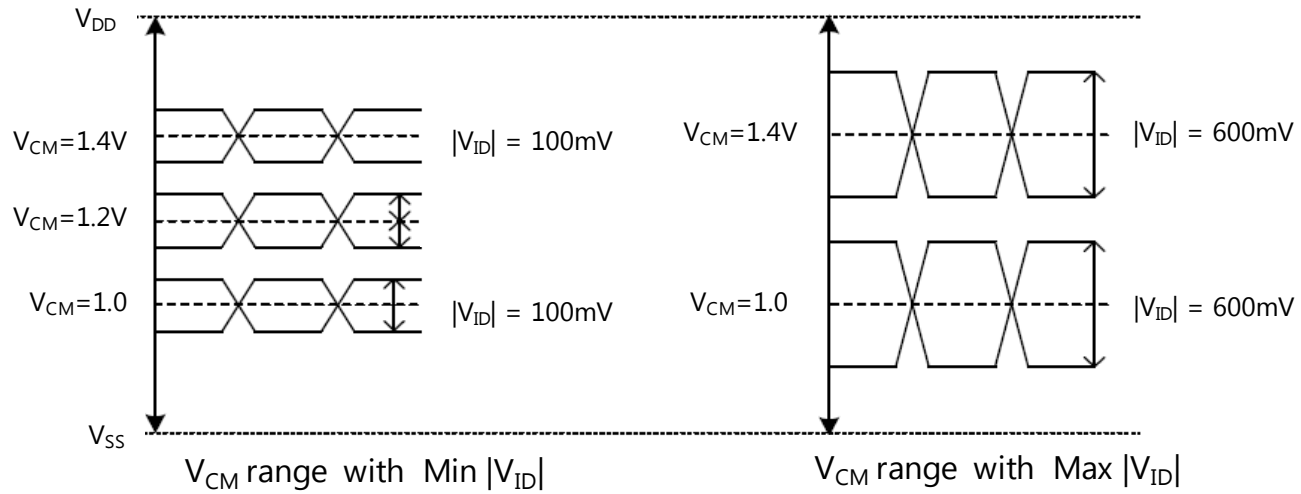


(2) LVDS Receiver DC parameters are measured under static and steady conditions which may not be reflective of its performance in the end application.



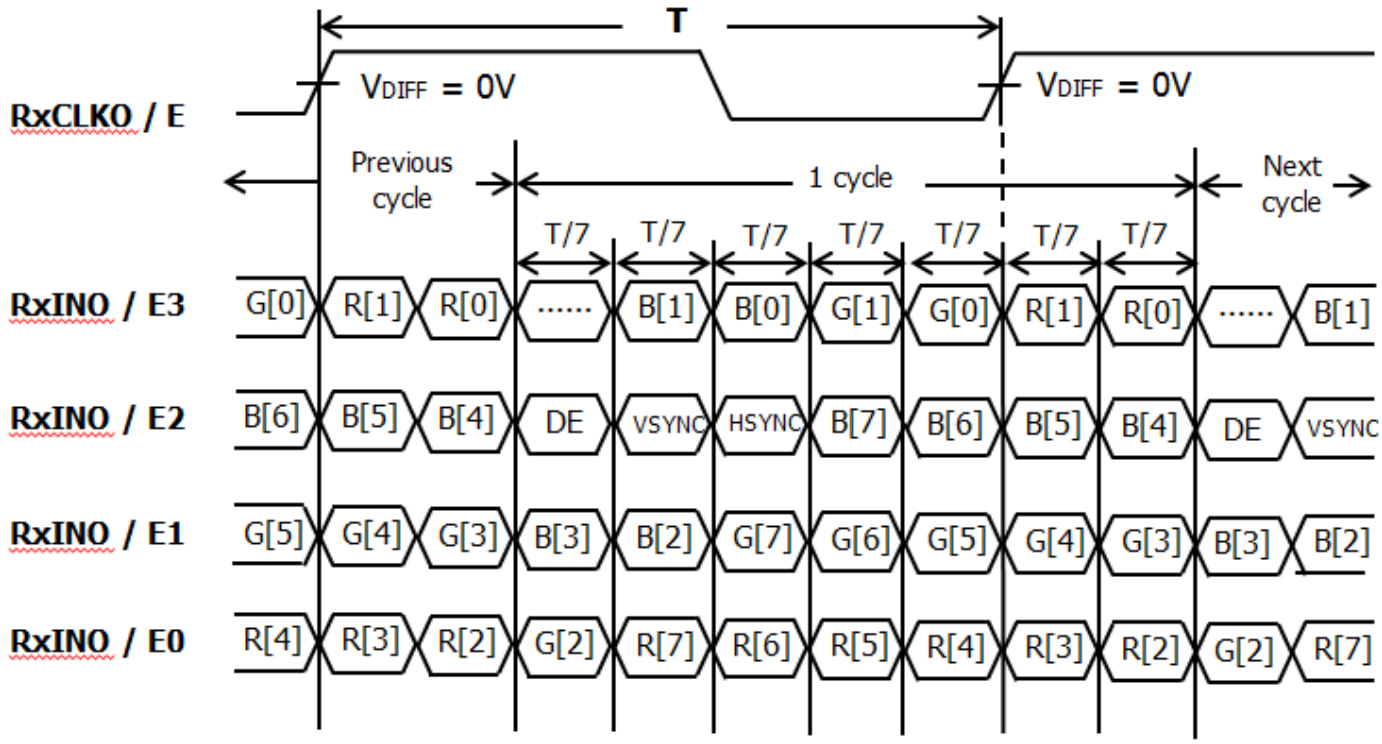
Where t_{SKEW} : skew between LVDS clock & LVDS data,
T : 1 period time of LVDS clock
cf. (-/+) of 300psec means LVDS data goes before or after LVDS clock

(3) Definition of V_{ID} and V_{CM} using single-end signals



5.2.2 LVDS Data format

Timing Diagrams of LVDS for Transmitting
- LVDS Receiver: Integrated T-CON



<JEIDA mapping>

5.3 Interface Timing Specification

5.3.1 Timing Parameters (Normal mode)

SIGNAL	ITEM	SYMBOL	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	$1/T_C$	29.0	35.3	45.7	MHz	-
Hsync		F_H	55.3	66.7	83.8	kHz	-
Vsync		F_V	50	60	75	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	1080	1080	1080	Lines	-
	Vertical Total	T_V	1105	1111	1118	Lines	-
Horizontal Display Term	Active Display Period	T_{HD}	480	480	480	Clocks	4pixel/clock
	Horizontal Total	T_H	525	530	545	clocks	4pixel/clock

Note (1) DE only mode
- While operation, DE signal should be have the same cycle.

(2) Best operation clock frequency is 35.3MHz (60Hz)

(3) Clock frequency = Frame frequency x T_V (Typ.) x T_H (Typ.)

(4) Max, Min variation range is at main clock typical value 35.3MHz

(5) Main frequency Max is 45.7MHz without spread spectrum

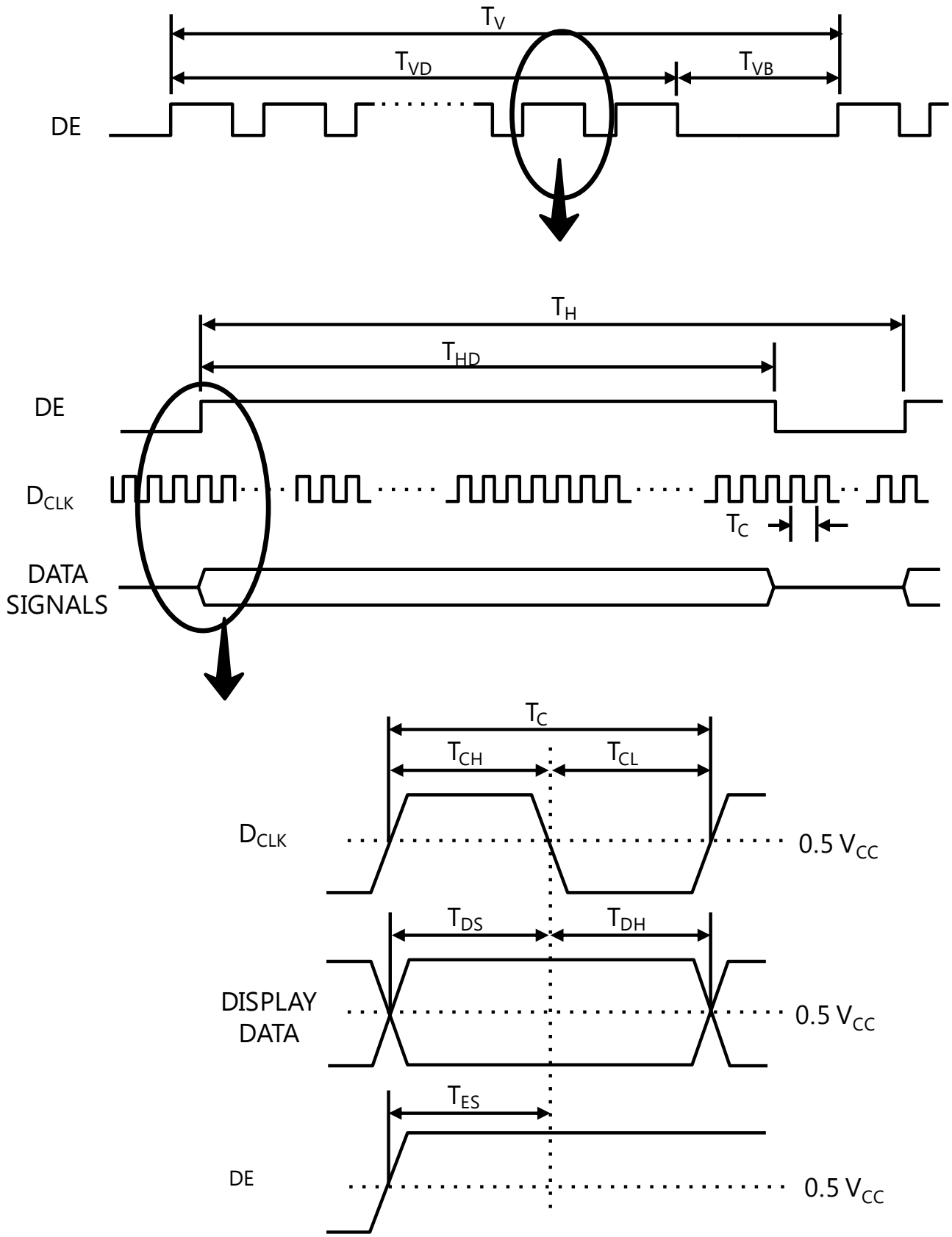
5.3.2 Timing Parameters (Gaming mode)

SIGNAL	ITEM	SYMBOL	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	$1/T_C$	-	83.95	-	MHz	-
Hsync		F_H		158.4		kHz	-
Vsync		F_V	48		144	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	1080	-	1080	Lines	-
	Vertical Total	T_V	1100		3300	Lines	-
Horizontal Display Term	Active Display Period	T_{HD}	-	480	-	Clocks	4pixel/clock (Gaming Mode Only)
	Horizontal Total	T_H		530		clocks	4pixel/clock (Gaming Mode Only)

Note (1) DE only mode
- While operation, DE signal should be have the same cycle.

(2) Gaming Mode 에서는 표시 품질 특성을 보증하지 않음.

5.3.3 Timing diagrams of interface signal (DE only mode)



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

COLOR	DISPLAY (8bit)	DATA SIGNAL																								GRAY SCALE LEVEL
		RED								GREEN								BLUE								
		R0	R1	R2	R3	R4	R5	R6	R7	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
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			. . .
	↓ 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
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			. . .
	↓ 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
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			. . .
	↓ 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

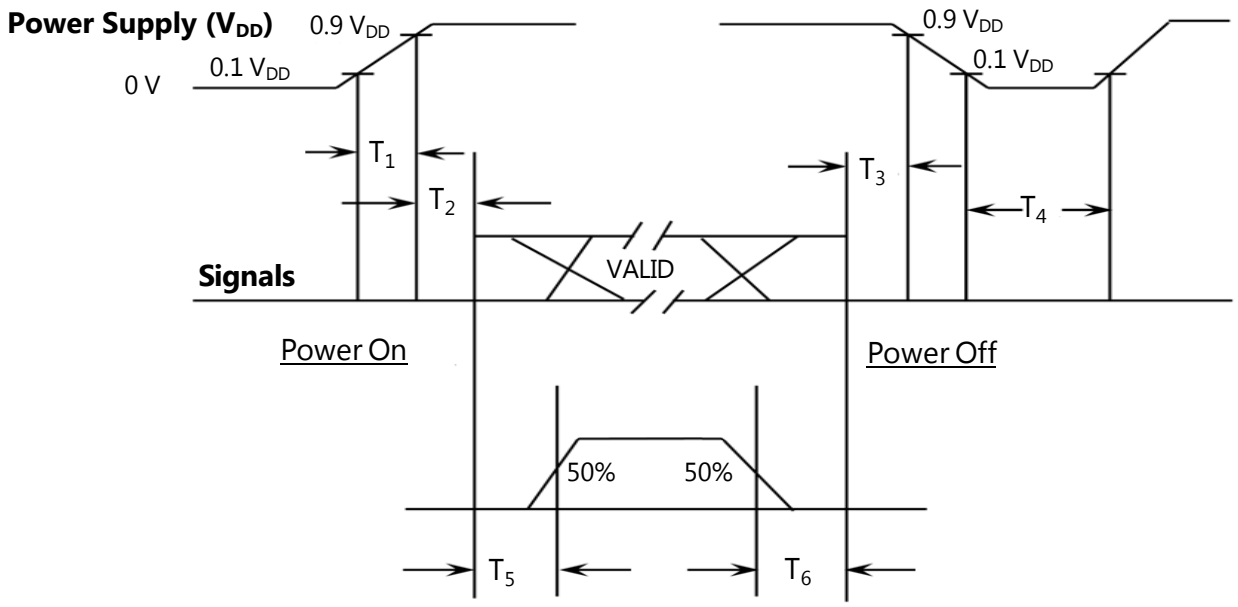
Note (1) Definition of Gray

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

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

5.5 Power ON/OFF Sequence

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



SYMBOL	Min.	Typ.	Max.	Unit	Description
T_1	0.5	-	10	ms	V_{DD} rising time from 10% to 90%
T_2	10	-	50	ms	The time from V_{DD} to signal(including Vcm) at power ON
T_3	100	-	500	ms	The time from valid data off to V_{DD} off at power Off
T_4	1000	-	-	ms	V_{DD} off time for Windows restart
T_5	1000	-	-	ms	The time from valid data to B/L enable at power ON
T_6	100	-	-	ms	The time from valid data off to B/L disable at power Off

Note (1) The supply voltage of the external system for the Module input should be the same as the definition of VDD.

(2) Apply the BLU power within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.

(3) In case of V_{DD} = off level, please keep the level of input signals low or keep a high impedance.

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

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

5.6 Input Terminal Pin Assignment

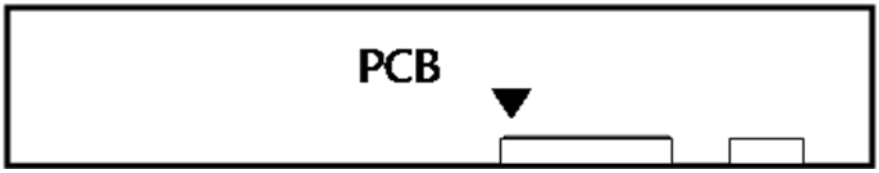
5.6.1 Input signal Pin Assignment

Connector: JAE FI-RXE51S-HF-J or equivalent

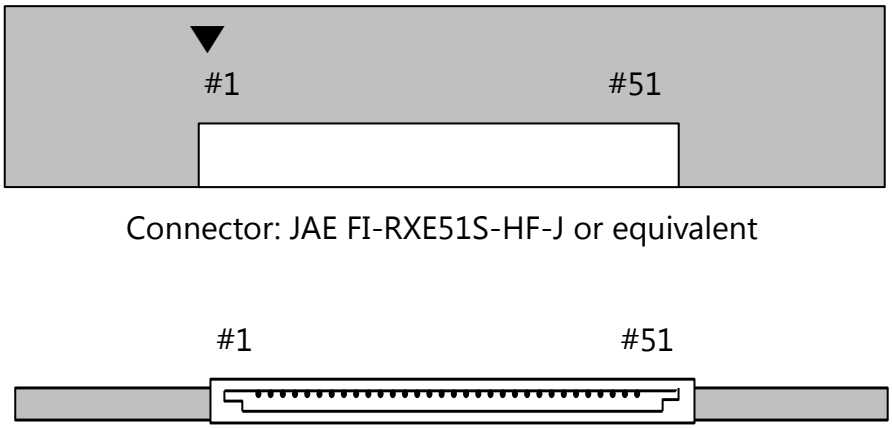
PIN NO	SYMBOL	FUNCTION
1	B_RXO0N	B_Negative Transmission Data of Pixel 0 (ODD data)
2	B_RXO0P	B_Positive Transmission Data of Pixel 0 (ODD data)
3	B_RXO1N	B_Negative Transmission Data of Pixel 1 (ODD data)
4	B_RXO1P	B_Positive Transmission Data of Pixel 1 (ODD data)
5	B_RXO2N	B_Negative Transmission Data of Pixel 2 (ODD data)
6	B_RXO2P	B_Positive Transmission Data of Pixel 2 (ODD data)
7	GND	GND
8	B_RXOCN	B_Negative Sampling Clock (ODD data)
9	B_RXOCP	B_Positive Sampling Clock (ODD data)
10	GND	GND
11	B_RXO3N	B_Negative Transmission Data of Pixel 3 (ODD data)
12	B_RXO3P	B_Positive Transmission Data of Pixel 3 (ODD data)
13	GND	GND
14	B_RXE0N	B_Negative Transmission Data of Pixel 0 (EVEN data)
15	B_RXE0P	B_Positive Transmission Data of Pixel 0 (EVEN data)
16	B_RXE1N	B_Negative Transmission Data of Pixel 1 (EVEN data)
17	B_RXE1P	B_Positive Transmission Data of Pixel 1 (EVEN data)
18	B_RXE2N	B_Negative Transmission Data of Pixel 2 (EVEN data)
19	B_RXE2P	B_Positive Transmission Data of Pixel 2 (EVEN data)
20	GND	GND
21	B_RXECN	B_Negative Sampling Clock (EVEN data)
22	B_RXECP	B_Positive Sampling Clock (EVEN data)
23	GND	GND
24	B_RXE3N	B_Negative Transmission Data of Pixel 3 (EVEN data)
25	B_RXE3P	B_Positive Transmission Data of Pixel 3 (EVEN data)
26	GND	GND
27	F_RXO0N	F_Negative Transmission Data of Pixel 0 (ODD data)
28	F_RXO0P	F_Positive Transmission Data of Pixel 0 (ODD data)
29	F_RXO1N	F_Negative Transmission Data of Pixel 1 (ODD data)
30	F_RXO1P	F_Positive Transmission Data of Pixel 1 (ODD data)

PIN NO	SYMBOL	FUNCTION
31	F_RXO2N	F_Negative Transmission Data of Pixel 2 (ODD data)
32	F_RXO2P	F_Positive Transmission Data of Pixel 2 (ODD data)
33	GND	GND
34	F_RXOCN	F_Negative Sampling Clock (ODD data)
35	F_RXOCP	F_Positive Sampling Clock (ODD data)
36	GND	GND
37	F_RXO3N	F_Negative Transmission Data of Pixel 3 (ODD data)
38	F_RXO3P	F_Positive Transmission Data of Pixel 3 (ODD data)
39	GND	GND
40	F_RXE0N	F_Negative Transmission Data of Pixel 0 (EVEN data)
41	F_RXE0P	F_Positive Transmission Data of Pixel 0 (EVEN data)
42	F_RXE1N	F_Negative Transmission Data of Pixel 1 (EVEN data)
43	F_RXE1P	F_Positive Transmission Data of Pixel 1 (EVEN data)
44	F_RXE2N	F_Negative Transmission Data of Pixel 2 (EVEN data)
45	F_RXE2P	F_Positive Transmission Data of Pixel 2 (EVEN data)
46	GND	GND
47	F_RXECN	F_Negative Sampling Clock (EVEN data)
48	F_RXECP	F_Positive Sampling Clock (EVEN data)
49	GND	GND
50	F_RXE3N	F_Negative Transmission Data of Pixel 3 (EVEN data)
51	F_RXE3P	F_Positive Transmission Data of Pixel 3 (EVEN data)

Note (1) Pin number starts from Left side



Pin No. 1 Pin No. 51



Connector: JAE FI-RXE51S-HF-J or equivalent

Fig. Connector diagram

Note (2) All GND pins should be connected together and also be connected to the LCD's metal chassis.

(3) All power input pins should be connected together.

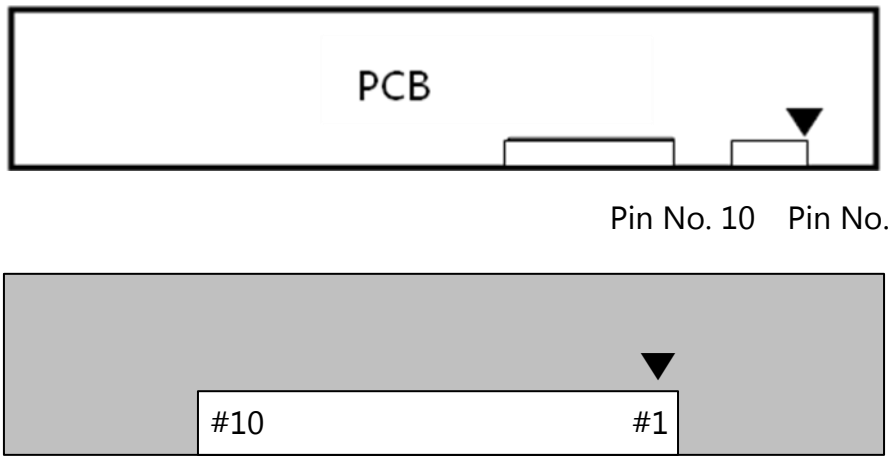
(4) All NC pins should be separated from other signal or p

5.6.2 Input Power Pin Assignment

Connector: Molex 104091-1020 or equivalent

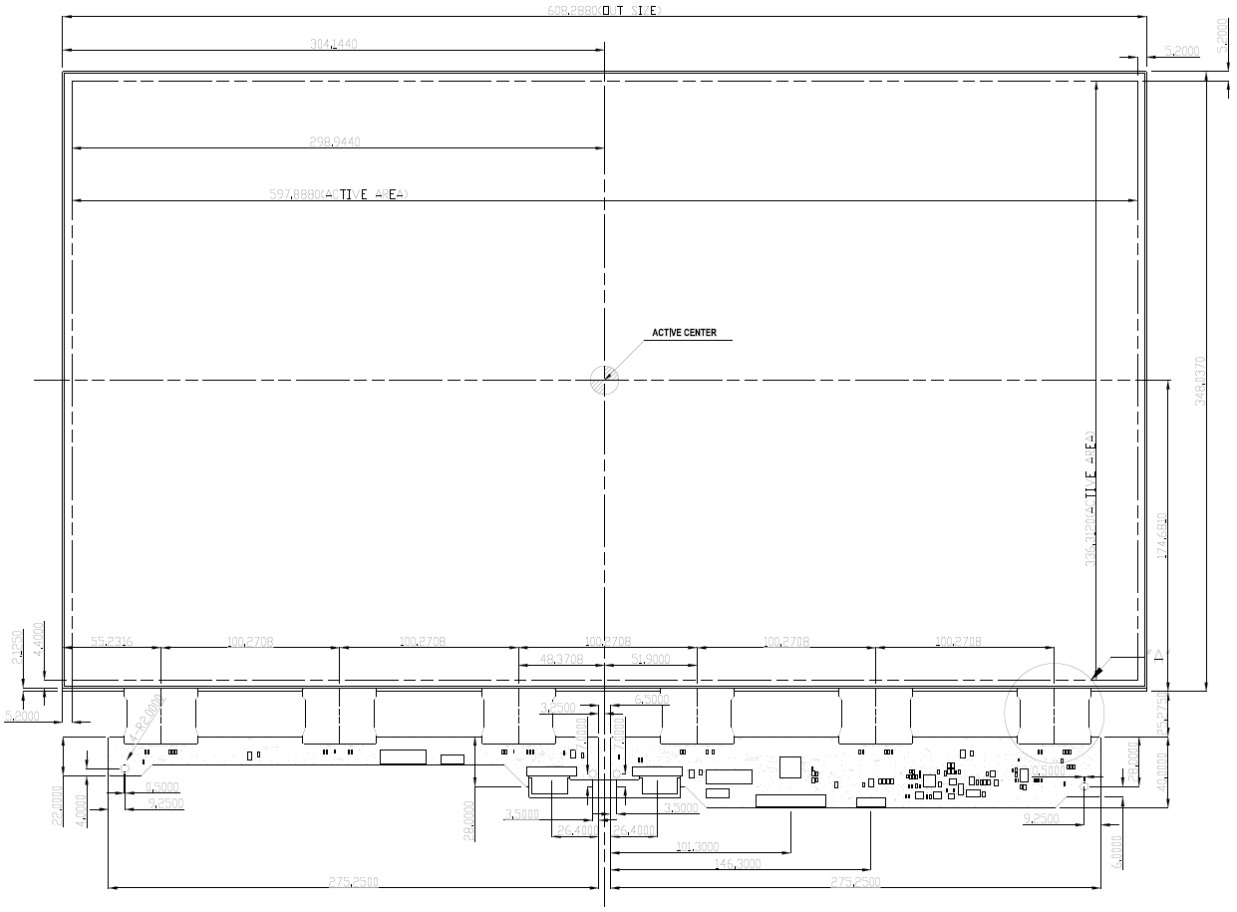
- The mating type connector: Molex 104092-1000 or equivalent

PIN NO	SYMBOL	FUNCTION
1	GND	GND
2	N.C	Reserved for LCD manufacturer's use (WPN)
3	N.C	Reserved for LCD manufacturer's use (SCL)
4	N.C	Reserved for LCD manufacturer's use (SDA)
5	GND	GND
6	GND	GND
7	PVDD	Power Supply +12V
8	PVDD	Power Supply +12V
9	PVDD	Power Supply +12V
10	PVDD	Power Supply +12V



Note (1) If the system already uses the 3, 4pins, it should keep under GND level
The voltage applied to those pins should not exceed -200mV.

6. Outline Dimension



7. Packing

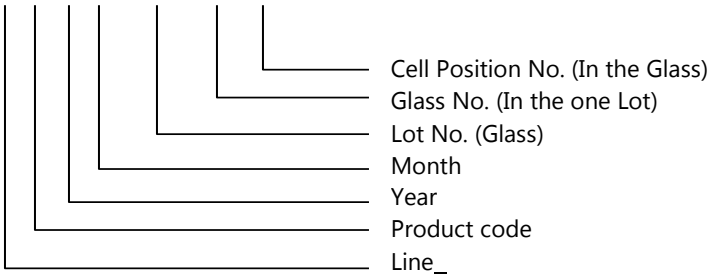
7.1 Marking

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

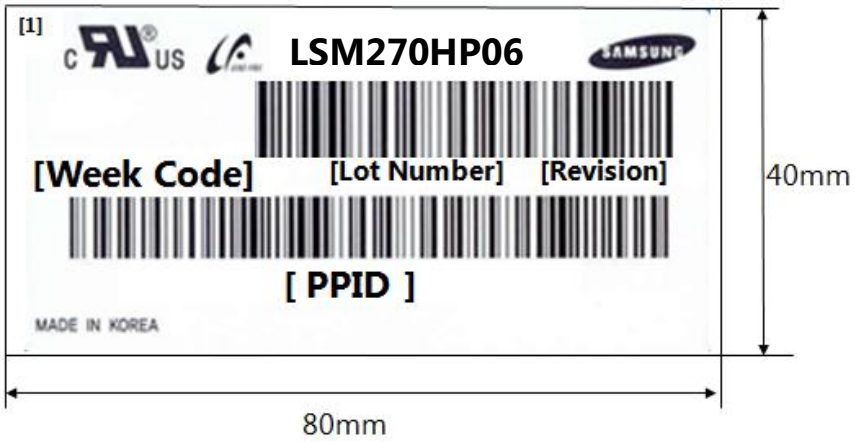
(1) Parts number : LSM270HP06

(2) Revision: Three letters

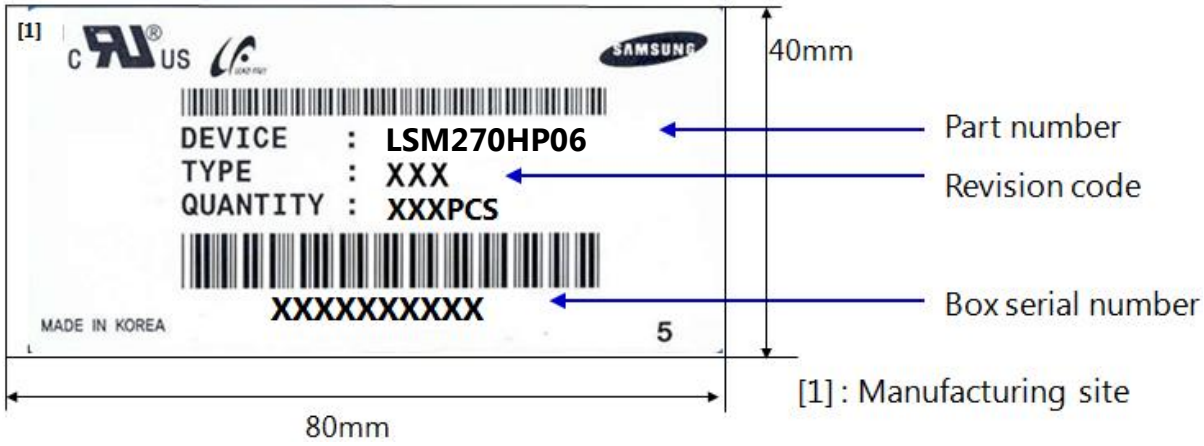
(3) Lot number : X X X X XXX XX X



(4) Nameplate Indication



(5) Packing Box Attach



8. General Precautions

8.1 Handling Precautions

(a) When the panel kit and BLU kit are assembled, the panel kit and BLU kit should be attached to the set system firmly by combining each mounted holes. Be careful not to give the mechanical stress.

(b) Be careful not to give any extra mechanical stress to the panel when designing the set, and BLU kit.

(c) Be cautious not to give any strong mechanical shock and / or any forces to the panel kit. Applying the any forces to the panel may cause the abnormal operation or the damage to the panel kit and the back light unit kit.

(d) Refrain from applying any forces to the source PBA and the drive IC in the process of the handling or installing to the set. If any forces are applied to the products, it may cause damage or a malfunction in the panel kit.

(e) Refrain from applying any forces which cause a constant shock to the back side of panel kit, the set design and BLU kit. If any forces are applied to the products, it may cause an abnormal display, a functional failure and etc.

(f) Note that polarizer could be damaged easily.
Do not press or scratch the bare surface with the material which is harder than a HB pencil lead.

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

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

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

(j) If the liquid crystal material leaks from the panel, this should be kept away from the eyes or mouth. If this contacts to hands, legs, or clothes, you must washed it away with soap thoroughly and see a doctor for the medical examination.

(k) Protect the panel kit and BLU Kit out of the static electricity. Otherwise the circuit IC could be damaged.

- Reference : Process control standard of SDC

No.	Item	Control standard
1	Ionizer	All Equipment should be controlled under 150V.(Typ. 100V)
2	Carrying Roller	Carrying Roller should be controlled under 200V.
3	Equipment Ground Resistance	All Equipment Ground Should be less than 1ohm.

(l) Remove the stains with finger-stalls wearing soft gloves in order to keep the display clean in the process of the incoming inspection and the assembly process.

(m) Do not pull or fold the source drive IC which connects to the source PBA and the panel or the gate drive IC.

(n) Do not pull, fold or bend the source drive IC and the gate drive IC in any processes.
If not, the source drive IC could be bent one time in the process of assembling the panel Kit and the BLU Kit.

(o) Do not adjust the variable resistor located on the panel kit and BLU kit except when adjusting the flicker.

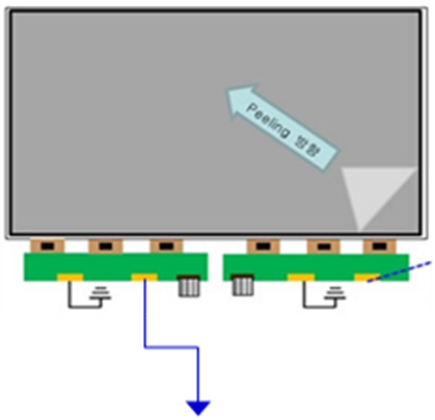


Fig. GND SR-Open Pattern – Be sure to be contacted to the ground while peeling of the protection film

- Make sure to peel off slowly
(It is recommended to peel it off at the speed of more than 8sec. constantly.)
- The peeling direction is shown at the Fig
- Instruct the ground worker to work with the adequate methods such as the antistatic wrist band.
- Maker sure to be grounded the source PBA while peeling of the protection film.
- Ionized air should be blown over during the peeling
- The protection film should not t be contacted to the source drive IC.
- If the adhesive stains remain on the polarizer after the protection film is peeled off, please move stains with isopropyl-alcohol liquid.

(r) The protection film for the polarizer on the panel kit should be slowly peeled off just before using so that the electrostatic charge can be minimized.

(s) The panel kit and BLU kit have high frequency circuits. The sufficient suppression to the EMI should be done by the set manufacturers.

(t) The set of which the panel is assembled shall not be twisted. If the product is twisted, it may cause the damage on the product.

(u) Surface Temp. of IC should be controlled less than 100℃, operating over the Temp. can cause the damage or decrease of lifetime.

8.2 Storage Precautions

It is highly recommended to comply with the criteria in the table below

Item	Unit	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage life	12 months		
Storage Condition	- The storage room should provide good ventilation and temperature Control . - Products should not be placed on the floor, but on the Pallet away from a wall. - Prevent products from direct sunlight, moisture nor water; Be cautious of a buildup of condensation. - Avoid other hazardous environment while storing goods. - If products delivered or kept in conditions of over the storage period of 3 months, the recommended temperature or humidity range, it is recommended to leave them at a temperature of 20℃ and a humidity of 50% for 24 hours.		

8.3 Operating Precautions

A. If the module is used to other applications besides the recommendation on General Description, please contact SAMSUNG for application engineering device in advance

B. Do not connect or disconnect the LCD module when it is set to the “Power On” condition.

C. Input power should always follow ‘5.6 Power on/off sequence’

D. Polarizer films are very fragile. It could be damaged easily. Do not press or scratch the Polarizer films

E. LCD module contains electrical circuits that operate in high frequencies. To minimize electromagnetic interference, be sure to sufficiently ground and shield the LCD module and system.

F. If LCD module containing system is out of SAMSUNG ’s operating condition, SAMSUNG can not guarantee LCD module operating properly.

G. If the product will be used in extreme conditions such as high temperature, humidity, display patterns, operation time, etc., it is strongly recommended to contact SAMSUNG for application engineering device. Otherwise, the reliability and function of the module may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stocks, markets, and controlling systems.

H. Ultra-violet ray filter is necessary for outdoor operation.

I. If the module keeps displaying the same pattern for a long period of time, the image maybe burned in to the screen. To avoid image retention, it is recommended to use a screen saver.

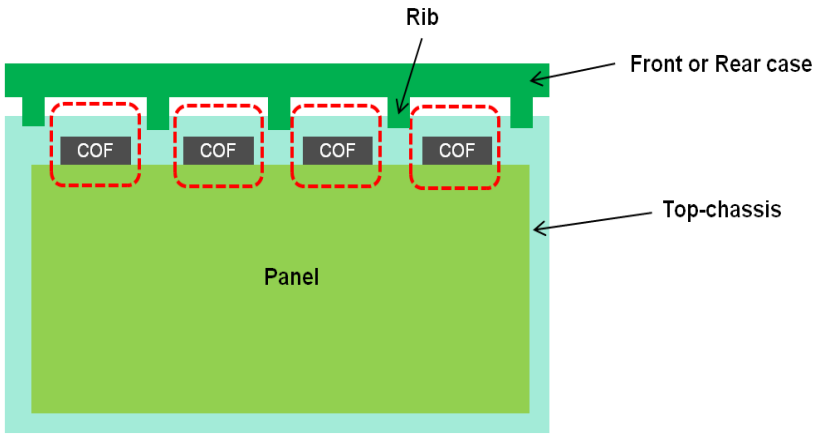
J. This module has its PCB’s circuitry on the rear side and should be handled carefully in order to avoid stress.

K. Please contact SAMSUNG beforehand, if you plan to display the same pattern for a long period of time.

L. Any foreign materials brought into an LCD module by external forced-airflow are not guaranteed by SAMSUNG .

A. The LED driver should be designed in compliance with the specifications of LED bar strictly to make the LED in LCD module perform as expected.

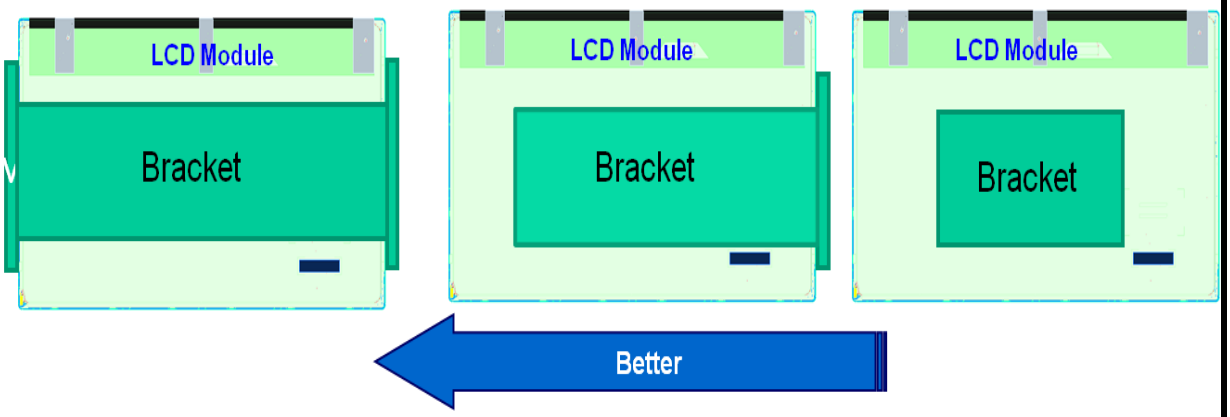
B. It is recommended that you locate the rib on the front or rear cover not to be placed on the spot where D-IC is located on the upper or left of LCD module
(See '**6. Outline Dimension** ' for the exact location of driver ICs)



C. It is recommended that assemble the bracket which has two sides with holes for assembly.

D. It is recommended that you design the bracket with the structure which covers the sides of module when designing the bracket for customer.

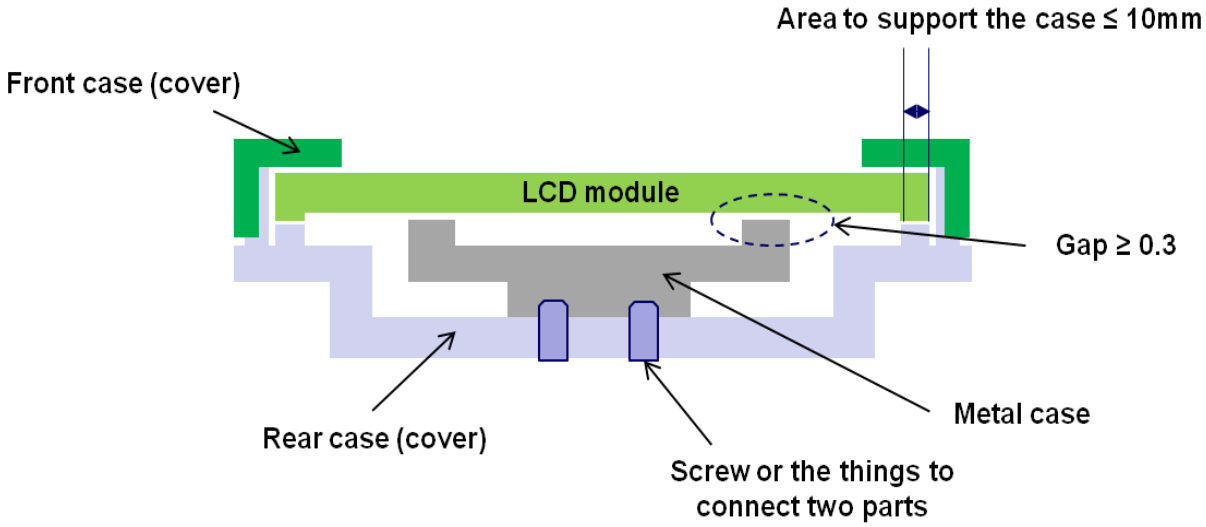
E. It is recommended that you design the bracket not to be interfered with the SET at the area where the PBA of module is located.



F. D. It is recommended that more than 0.3 mm is allowable as a gap between the metal case and the rear of module

G. It is recommended that structure to support the module shall be far away 10mm from the edge of border.

H. It is recommended that metal case (or board) shall be affixed to the rear case at the spot where is far away 10mm from the edge of border.



I. When applying the measures described below to reduce the level of EMI which occurs between the metal cover and the rear of module.

J. If you use Finger, less than 0.3mm is allowable for overlap.

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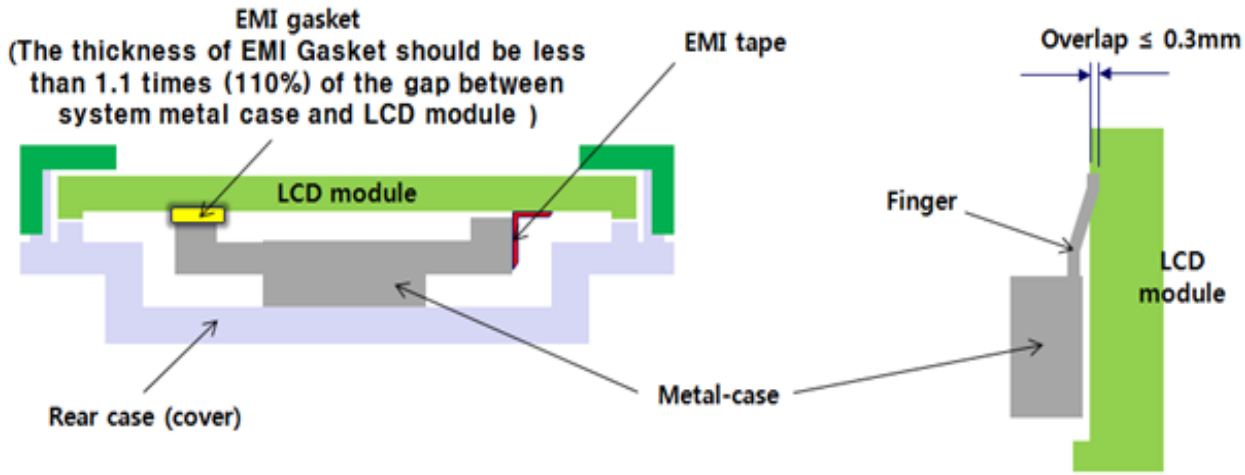
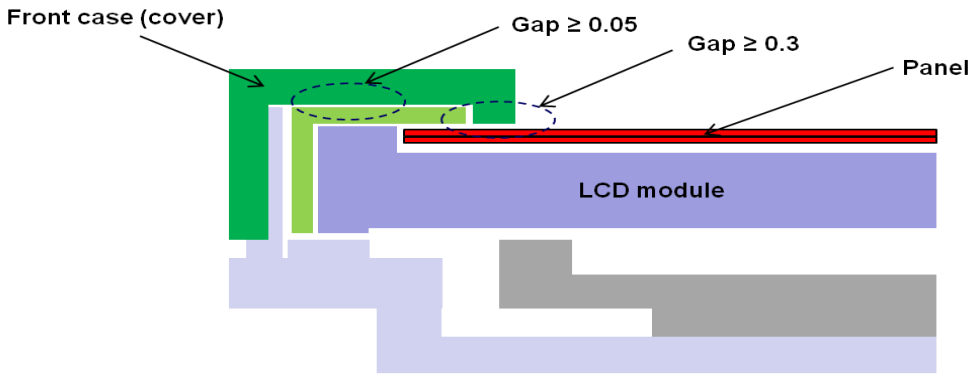


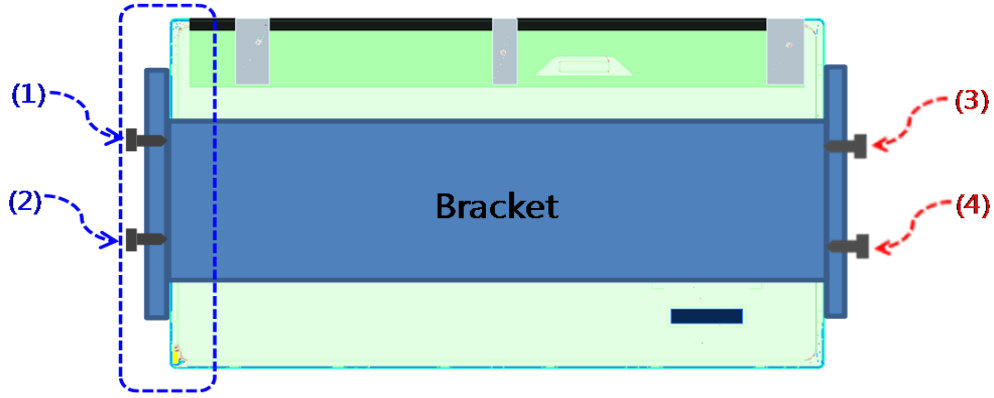
K. It is recommended that more than 0.3mm gap between the front case (or

cover) and the panel glass is allowable.

L. It is recommended that more than 0.05mm gap between the front case and the top chassis is allowable.



M. It is recommended that insert the screws into user holes from the ones on the parts, which the light comes out to ones in the corresponding parts.



N. It is recommended that design the metal frame and the top chassis to be in parallel with having no gap after inserting the side screw.