

**SAMSUNG DISPLAY**

PRODUCT SPECIFICATION

(√) **PRODUCT INFORMATION**() **APPROVAL SPECIFICATION**

Any modification of specification is not allowed without Samsung's permission.

CUSTOMER	CNC	MODEL	LSM270DP01
PROGRAM	-	EXTENSION CODE	-

CUSTOMER APPROVAL & FEEDBACK			

ARPPROVED BY	13 / Mar. / '17	Scott Lim	<i>Scott Lim</i>
PREPARED BY	13 / Mar. / '17	Sejin Park	<i>Sejin Park</i>
LCD CSE Group Samsung Display Co., Ltd.			

Product Configuration Approval Sheet

Description

Items	Content
Customer	CNC
Product Name	LSM270DP01
Project Name	-

Customer System Configuration

Items		Content
System Name		-
Purpose		-
IC	Scalar	-
	LED Driver	-
Input Interface		-
OS (AIO)		-
Graphic Card (AIO)		-

Notice : SDC product approval spec guarantee a above customer system.

SAMSUNG DISPLAY**Contents**

Revision History	(4)
1. General Description	(5)
2. Absolute Maximum Ratings	(6)
3. Optical Characteristics	(8)
4. Block Diagram	(12)
5. Electrical Characteristics	(13)
5.1 TFT LCD Module	
5.2 eDP Characteristics	
5.3 Timing Parameters	
5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color	
5.5 Power ON/OFF Sequence	
5.6 Input Terminal Pin Assignment	
5.7 IC Tc Spec	
6. Outline Dimension	(25)
7. Reliability Condition	(27)
8. Packing	(28)
9. General Precautions	(29)
9.1 Handling Precautions	
9.2 Storage Precautions	
9.3 Operation Precaution	
9.4 Design Guide for System	

Revision History

Version	Date	Page	Description
P0.0	13. Mar., 2017	All	Product Spec

SAMSUNG DISPLAY

1. General Description

Overview

LSM270DP01 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. The resolution of a 27" is 2560 x 1440 (QHD) 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
eDP Interface
RoHS, Halogen Free

General Information

Items	Specification	Unit
Pixel Pitch	0.2331 (W) x 0. 2331 (H)	mm
Active Display Area	596.736(H) x 335.664(V)	mm
Surface Treatment	Anti-Glare Type, Haze 25%	-
Display Colors	16.7M	colors
Number of Pixels	2,560 x 1,440	pixel
Pixel Arrangement	RGB vertical stripe	-
Display Mode	Normally Black	-
Power Consumption	Panel 4.8 (Typ. @ 60Hz, Mosaic) Panel 5.9 (Typ. @ 144Hz, Mosaic)	W

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	608.70	609.20	609.70	mm	-
	Vertical (V)	347.92	348.42	348.92	mm	Without PCB
		415.30	415.80	416.30	mm	With PCB
	Depth (D)	1.055	1.155	1.255	mm	Without PCB
		-	3.05	-	mm	With PCB
Weight		-	-	600	g	

Note (1) Mechanical tolerance is $\pm 0.5\text{mm}$ 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	$^{\circ}\text{C}$	(2)
Storage temperature	T_{STG}	-20	60	$^{\circ}\text{C}$	
Glass surface temperature (Operation)	T_{SUF}	0	65	$^{\circ}\text{C}$	(3)

Note (1) $T_a = 25 \pm 2^{\circ}\text{C}$

- (2) Temperature and relative humidity range are shown in the figure below.
- 90 % RH Max. ($T_a \leq 39\text{ }^{\circ}\text{C}$)
 - Maximum wet-bulb temperature at $39\text{ }^{\circ}\text{C}$ or less. ($T_a \leq 39\text{ }^{\circ}\text{C}$)
 - 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 $65\text{ }^{\circ}\text{C}$

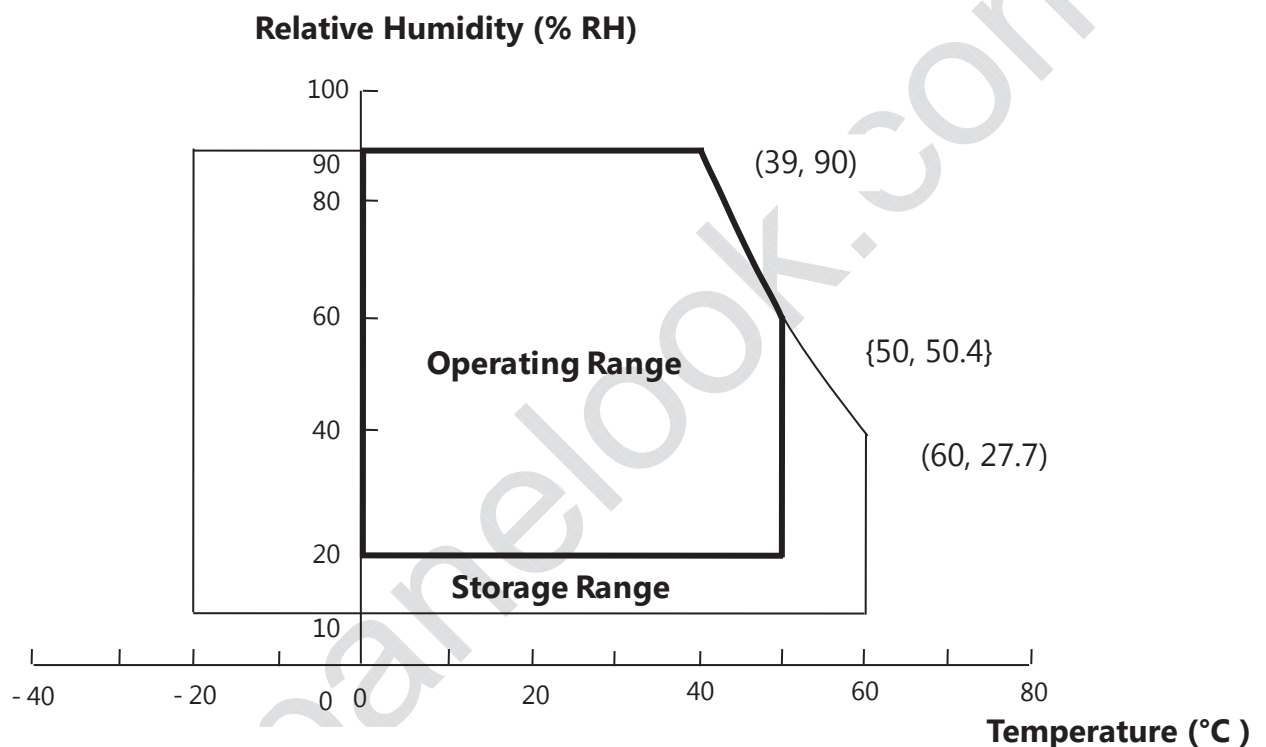


Fig. Temperature and Relative Humidity range

3. 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}=243.17MHz)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R		2100	3000	-	-	(3) SR-3
Response Time (w/ DCC)		GtoG		-	12	-	msec	(5) RD-80S
Transmittance		-		-	2.28	-	%	(6) SR-3
Brightness Uniformity (9 Points)		B _{uni}		-	-	25	%	(4) SR-3
Color Chromaticity (CIE 1931)	Red	Rx	Normal $\theta_{L,R}=0$ $\theta_{U,D}=0$ Viewing Angle	- 0.030	0.662	+0.030		(7),(8) SR-3
		Ry			0.328			
	Green	Gx			0.275			
		Gy			0.592			
	Blue	Bx			0.134			
		By			0.124			
	White	Wx			0.297			
		Wy			0.363			
Color Chromaticity (CIE 1976)	Red	Ru'		-	0.471	-		
		Rv'		-	0.526	-		
	Green	Gu'		-	0.115	-		
		Gv'		-	0.558	-		
	Blue	Bu'		-	0.127	-		
		Bv'		-	0.264	-		
	White	Wu'		-	0.176	-		
		Wv'		-	0.483	-		

SAMSUNG DISPLAY

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	Hor.	θ_L	CR $\geq$ 10	80	89	-	Degrees	(8) EZ-Contrast
		θ_R		80	89	-		
	Ver.	θ_U		80	89	-		
		θ_D		80	89	-		

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

* Light Source : D65 Standard light

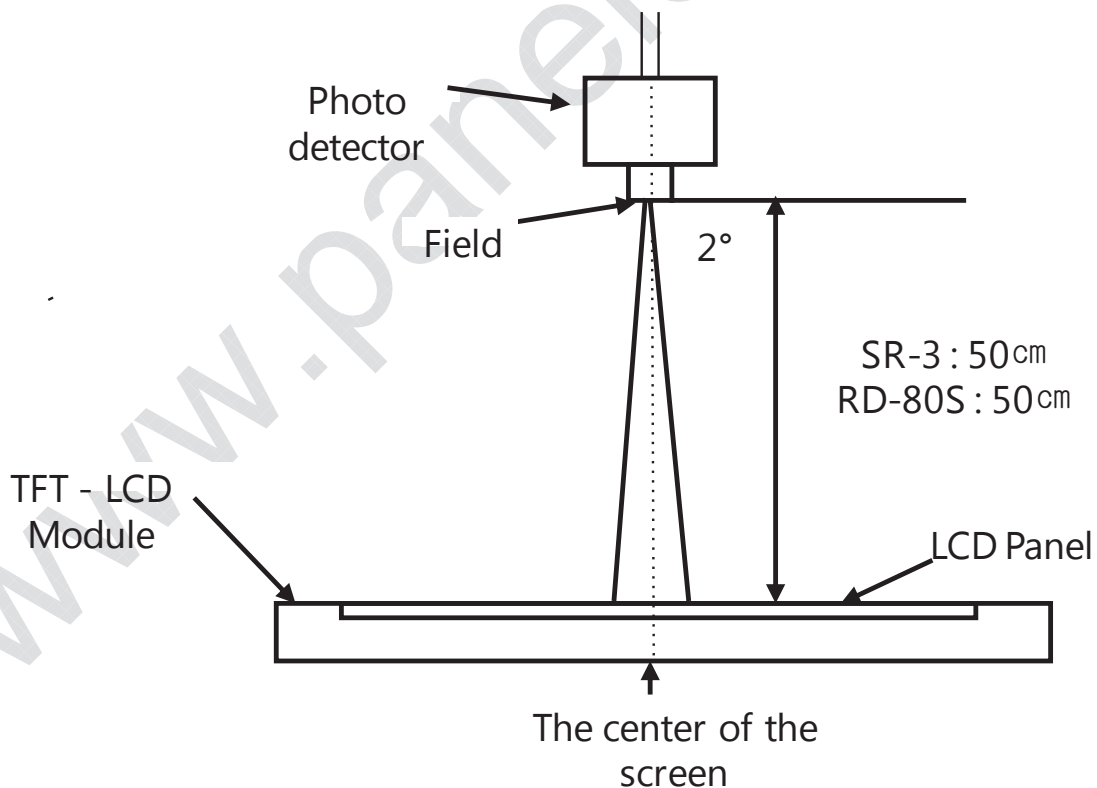
* Guaranteed only in terms of the cell condition

* Only Flat Status assurance

Note (1) Test Equipment Setup

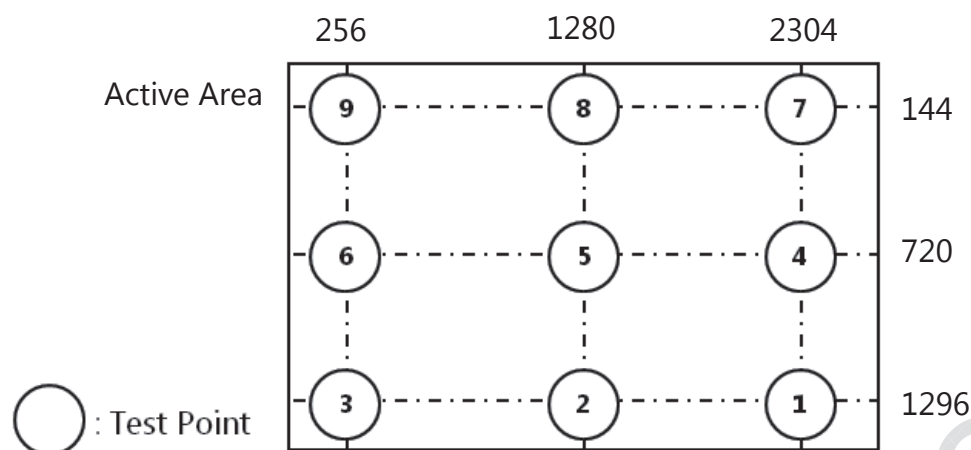
The measurement should be executed in a stable, windless and dark room between 30min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

Environment condition : Ta = 25 $\pm$ 2 °C



SAMSUNG DISPLAY

(2) Definition of test point



(3) Definition of Contrast Ratio (CR)

: Ratio of gray max (G_{max}) & gray min (G_{min}) at the center point⑤ 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 9 points brightness uniformity

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

B_{max} : Maximum brightness

B_{min} : Minimum brightness

SAMSUNG DISPLAY

(5) Definition of Response time : Sum of T_r , T_f

GtoG : The time for transitions between specific gray levels

- 31 → 63, 63 → 95, 95 → 127, 127 → 159, 159 → 191, 191 → 223 grays and vice versa
- G to G typ. : Average time at rising and falling for gray transition except the transition

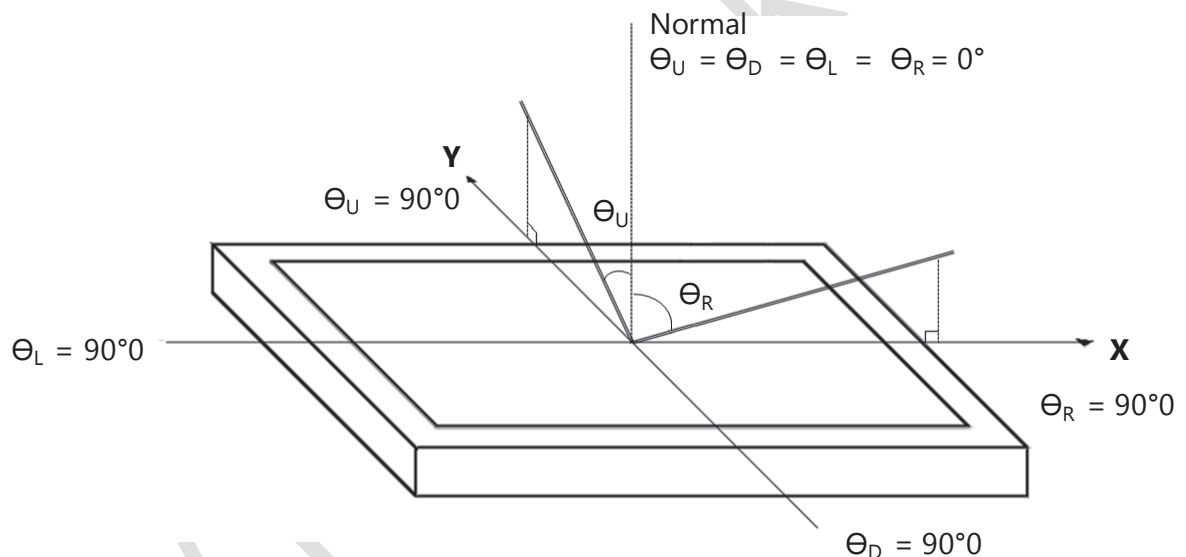
(6) Definition of Luminance of White : Luminance of white at center point (5)

(7) Definition of Color Chromaticity (CIE 1931, CIE1976)

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

(8) Definition of Viewing Angle

: Viewing angle range ($CR \geq 10$)



4. Block Diagram

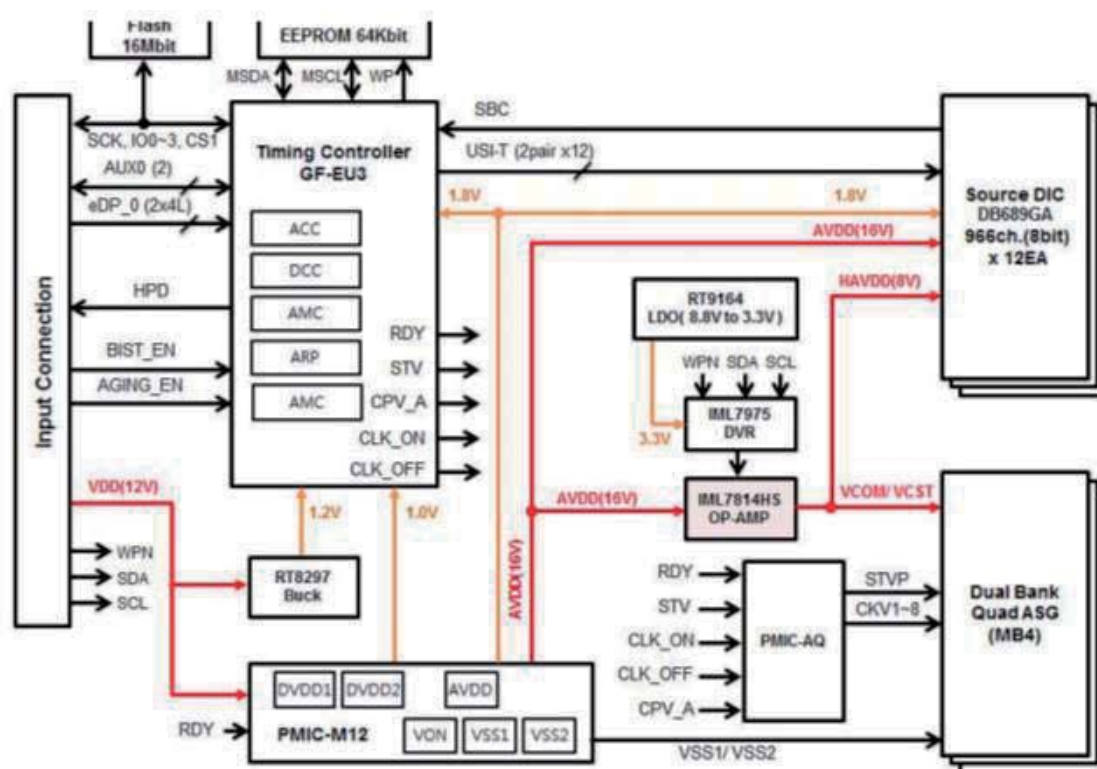


Fig. Function Block Diagram

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.

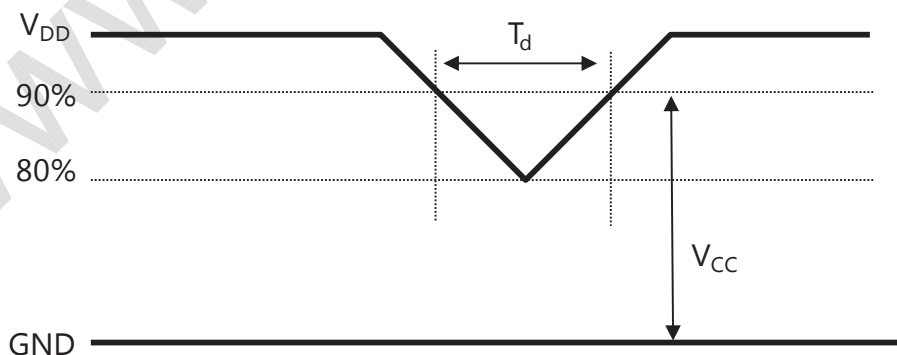
Ta=25 ± 2°C

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 (@60Hz)	White	I _{DD}	-	400	460	mA	(2),(3)
	Black		-	395	455	mA	
	Mosaic		-	395	455	mA	
Current of Power Supply (@144Hz)	White	I _{DD}	-	500	575	mA	(2),(4)
	Black		-	490	565	mA	
	Mosaic		-	490	565	mA	
Power Consumption(@60Hz) [Mosaic pattern]		P _{LCD_60Hz}	-	4.8	-	Watt	(3)
Power Consumption(@144Hz) [Mosaic pattern]		P _{LCD_144Hz}	-	5.9	-	Watt	(4)
Rush Current		I _{RUSH}	-	-	2.5	A	(6)

Note (1) The ripple voltage should be controlled under 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.



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

$$\text{If } V_{DD}(\text{Typ.}) \times 80\% \leq V_{CC} \leq V_{DD}(\text{Typ.}) \times 90\%,$$

$$\text{then } 0 < T_d \leq 20\text{msec}$$

SAMSUNG DISPLAY

(3) $f_V=60\text{Hz}$, $V_{DD} = 12.0\text{V}$, DC Current.

(4) $f_V=144\text{Hz}$, $V_{DD} = 12.0\text{V}$, DC Current.

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

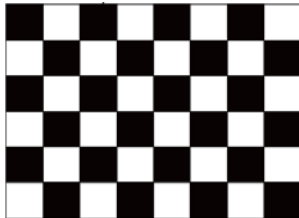
a) White Pattern



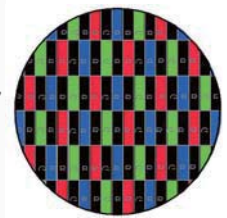
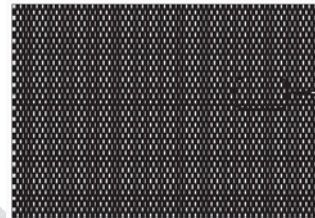
b) Black Pattern



c) Mosaic Pattern

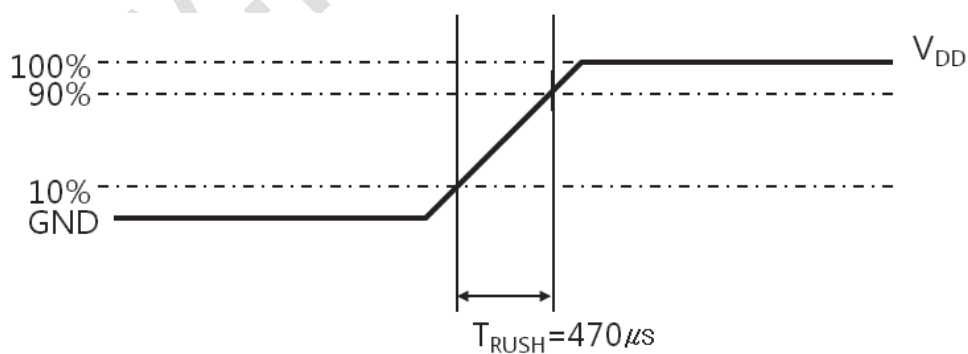


d) Dot Pattern



(5) The power consumption is specified whereas Mosaic pattern is displayed at $f_V=60\text{Hz}$, $f_{DCLK} = (243.17)\text{MHz}$, $V_{DD} = 12.0\text{V}$

(6) Measurement Condition



Rush Current I_{RUSH} can be measured when T_{RUSH} is $470\mu\text{s}$

5.2 eDP Characteristics

5.2.1. eDP Input Characteristics

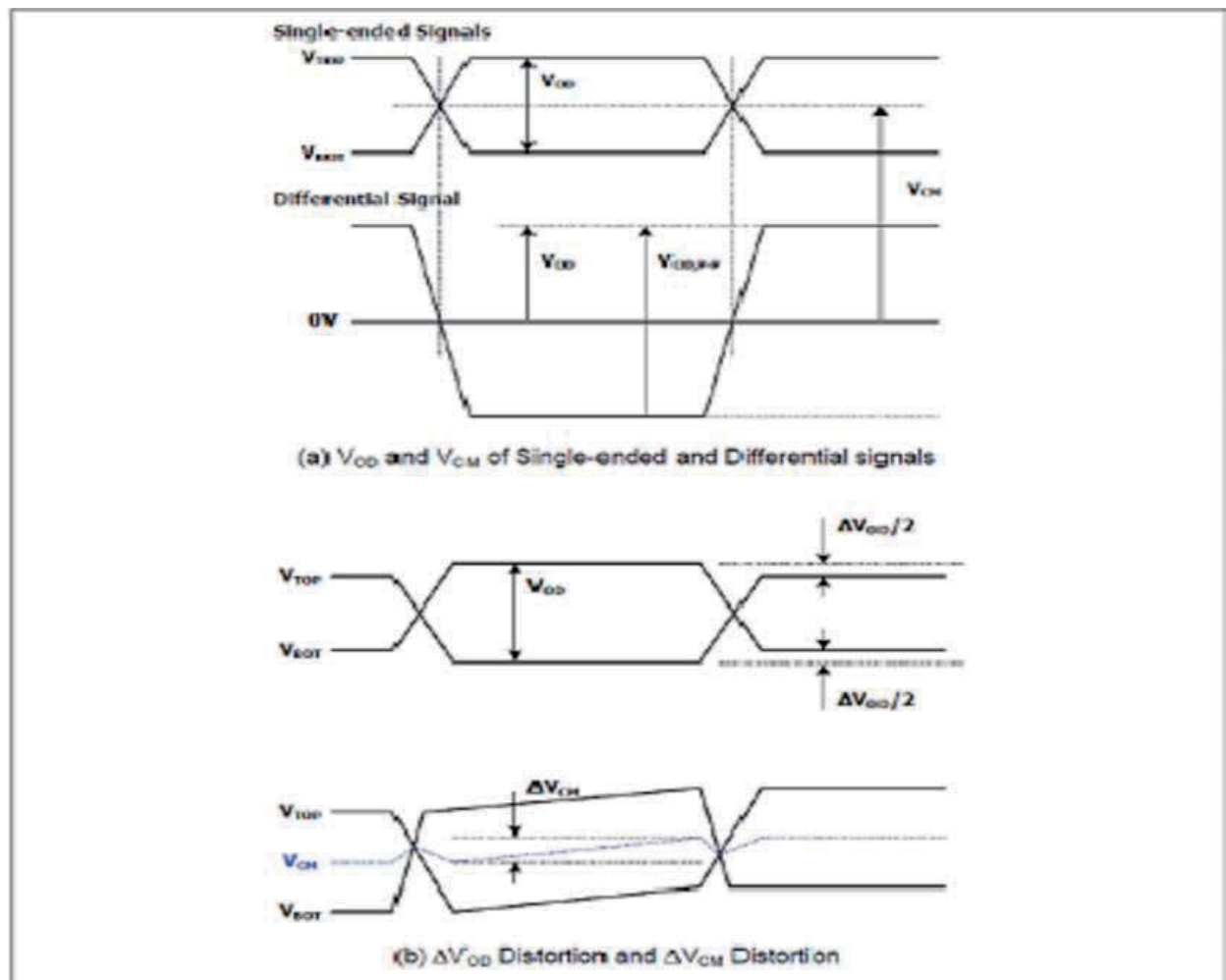
Ta=25 ± 2°C

Symbol	Parameter	Min	Typ	Max	Unit
V _{od}	Output differential voltage $ V_{top} - B_{bot} $ 1	75	100	130	mV
		150	200	250	
		250	300	350	
		320	400	480	
		400	500	600	
		500	600	700	
V _{cm}	Output common mode voltage $(V_{top} + B_{bot})/2$	0.4	0.55	0.65	V
△V _{od}	Variation in V _{od} between 0 and 1	-	-	30	mV
△V _{cm}	Variation in V _{cm} between 0 and 1	-	-	30	mV
R _{tx}	Transmitter differential output impedance 2	70	100	130	ohm
		84	120	156	
		91	130	169	
		98	140	182	
		119	170	221	
		129.5	185	240.5	
		140	200	260	
		154	220	286	
		224	320	416	
		252	360	468	
		308	440	572	

Note (1) $|V_{top} - B_{bot}|$: To reduce power consumption and peak current, Vod is programmed By an external EEPROM

(2) R_{tx} is programmed by an external EEPROM, This is for EMI reduction by controlling rising falling time of output signals.

SAMSUNG DISPLAY



5.3 Interface Timing Specification

5.3.1. Timing Parameters

SIGNAL	Min.	Typ.	Max.	Note
H active	-	2560	-	Pixel
H blank	120	160	200	Pixel
H Total	2665	2720	2760	Pixel
V active	-	1440	-	Line
V blank	30	50	2656	Line
V total	1470	1490	4627	Line
Horizontal refresh rate	70.56	89.4	214.56	KHz
Vertical refresh rate	48	60	144	Hz
Pixel clock frequency	189.1	243.17	595	MHz

Note (1) DE only mode

- While operation, DE signal should be have the same cycle.

(2) Best operation clock frequency is 243.17 MHz (60Hz)

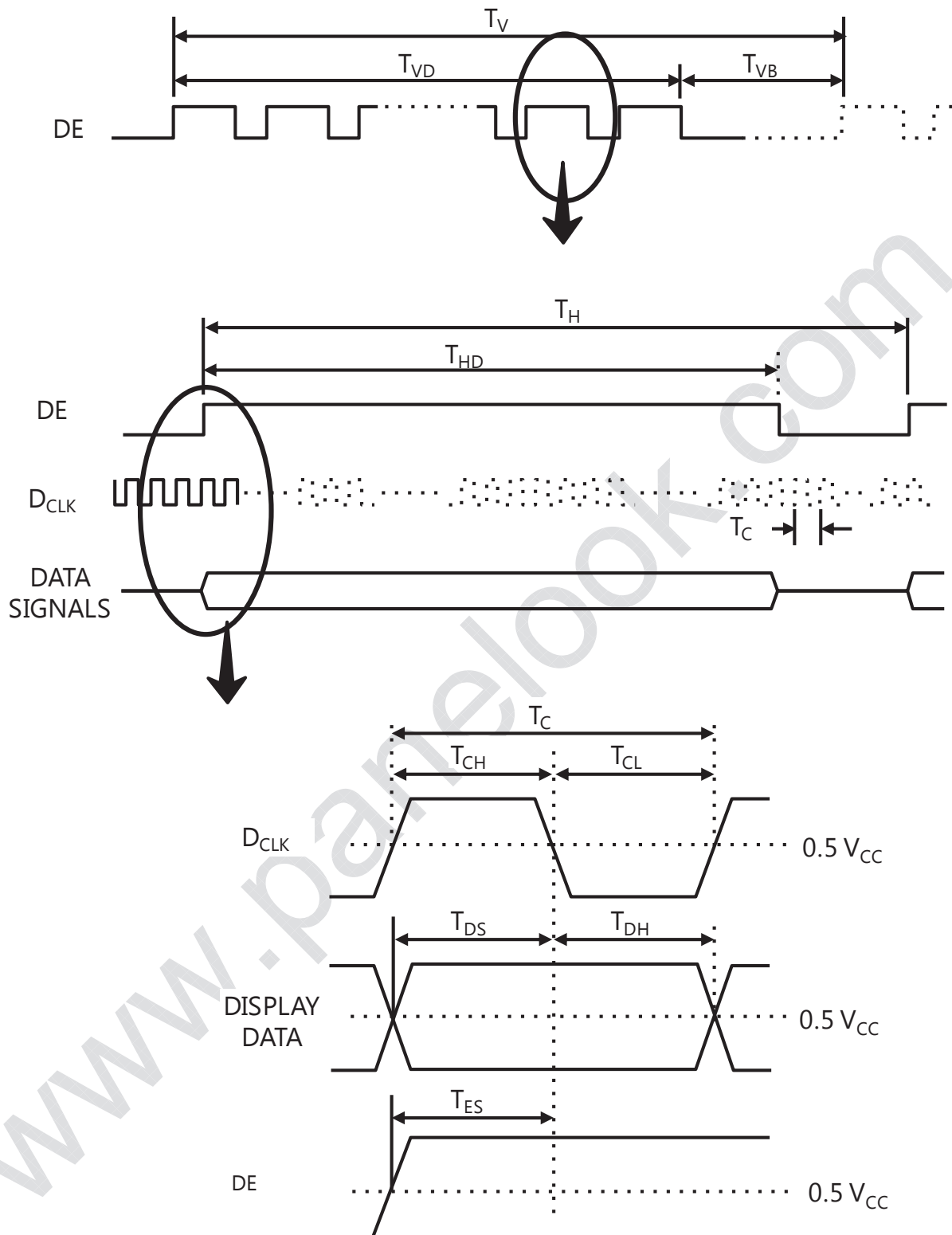
(3) Clock frequency = Frame frequency x T_V (Typ.) x T_H (Typ.)

(4) Max, Min variation range is at main clock typical value 243.17MHz

(5) Except Best operation clock frequency range, FOS (Flicker & Brightness & Crosstalk etc.) are not guaranteed

SAMSUNG DISPLAY

5.3.2. Timing diagrams of interface signal (DE only mode)



SAMSUNG DISPLAY

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	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 ↑	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					
		↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
	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	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 ↑		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	1	0	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	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 ↑	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					
		↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
	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	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					

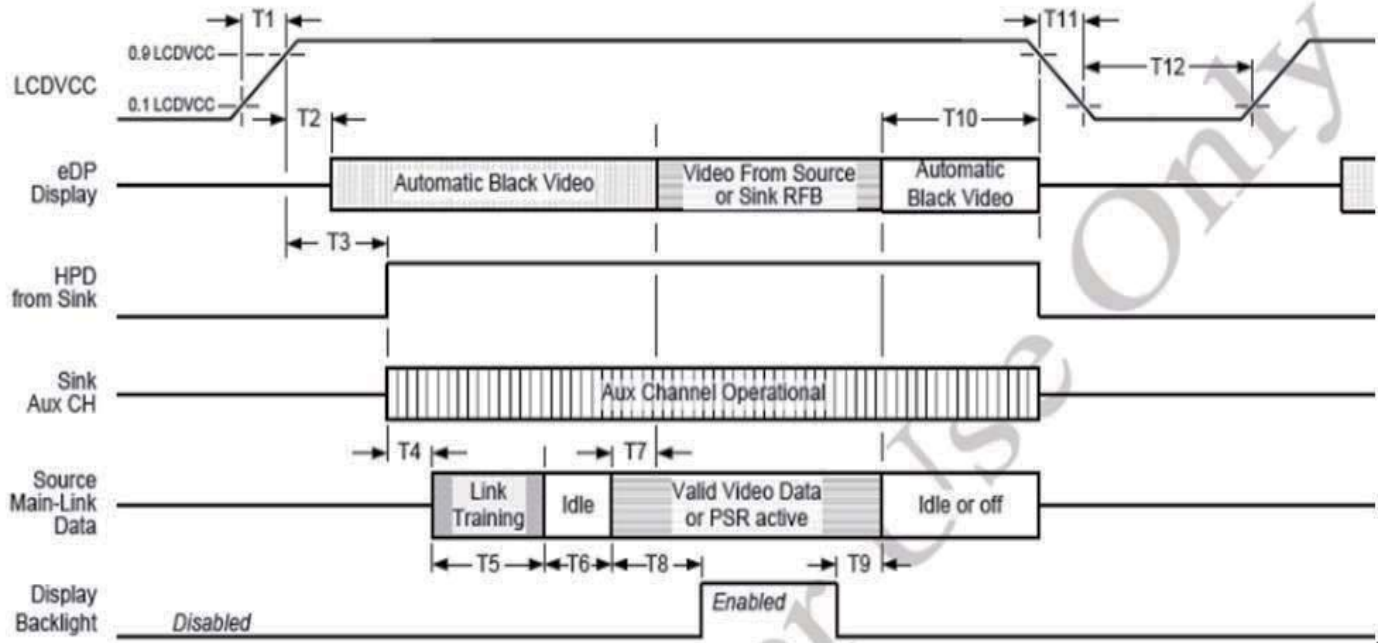
Note (1) Definition of Gray

- 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.



Timing (ms)	Remarks
$0.5 < T_1 \leq 10$	Power rail rise time 10% to 90%
$0 < T_2 \leq 550$	Delay from LCDVCC to automatic Black Video generation
$0 < T_3 \leq 500$	Delay from LCDVCC to HPD high
$0 \leq T_4$	Delay from HPD high to link training initialization
$0 \leq T_5$	Link training duration
$0 \leq T_6$	Link idle
$0 < T_7 \leq 50$	Delay from valid video data from source to video on display
$50 < T_8$	Delay from valid video data from source to backlight enable
$50 < T_9$	Delay from backlight disable to end of valid video data
$100 < T_{10} \leq 500$	Delay from end of valid video data from source to power off
$0 < T_{11} \leq 20$	Power rail fall time 09% to 10%
$500 < T_{12}$	Power off time

SAMSUNG DISPLAY

Note (1) The power voltage from system shall be supplied to the input pin of LCD constantly.

- (2) The Sink must include the ability to automatically generate black video autonomously. The Sink must automatically enable black video under the following conditions:
Upon LCDVCC power-on (within T2 max)
When the "NoVidoeStream_Flag" is received from the Source (at the end of T9)
When the no main link data, is received from the Source. Black Video must be display within 50ms (max) from the start of either condition.
- (3) The Sink may implement the ability to disable the automatic black video function, as described in Note 1, above, for system development and debugging purposes.
- (4) The Sink must support AUX Channel polling by the source immediately following LCDVCC power-on without causing damage to the Sink device (the Source can re-try if the Sink is not ready.) The Sink must be able to respond to an AUX Channel transaction with the time specified within T3 max

5.6 Input Terminal Pin Assignment**5.6.1. Input signal Pin Assignment**

Connector : KN35-51S-0.5H (HRSK) eDP 51Pin CNT

Pin No.	Symbol	Function
1	PVDD	Power Supply +12V
2	PVDD	Power Supply +12V
3	PVDD	Power Supply +12V
4	PVDD	Power Supply +12V
5	PVDD	Power Supply +12V
6	PVDD	Power Supply +12V
7	N.C	N.C
8	N.C	N.C
9	AGING_EN	Reserved for LCD manufacturer's use
10	N.C	N.C
11	BIST_EN	Reserved for LCD manufacturer's use
12	GND	Ground
13	WPN	Reserved for LCD manufacturer's use (WPN)
14	SCL	Reserved for LCD manufacturer's use (SCL)
15	SDA	Reserved for LCD manufacturer's use (SDA)
16	GND	Ground
17	GND	Ground
18	DRX0P	Signal Sink Lane
19	DRX0N	Signal Sink Lane
20	GND	Ground
21	DRX1P	Signal Sink Lane
22	DRX1N	Signal Sink Lane
23	GND	Ground
24	DRX2P	Signal Sink Lane
25	DRX2N	Signal Sink Lane
26	GND	Ground
27	DRX3P	Signal Sink Lane
28	DRX3N	Signal Sink Lane
29	GND	Ground
30	DAUXN	Auxiliary Channel

SAMSUNG DISPLAY

Pin No.	Symbol	Function
31	DAUXP	Auxiliary Channel
32	GND	Ground
33	HPD	Hot Plug Detect
34	GND	Ground
35	N.C	N.C
36	GND	Ground
37	N.C	N.C
38	N.C	N.C
39	GND	Ground
40	N.C	N.C
41	N.C	N.C
42	GND	Ground
43	N.C	N.C
44	N.C	N.C
45	GND	Ground
46	N.C	N.C
47	N.C	N.C
48	GND	Ground
49	N.C	N.C
50	N.C	N.C
51	GND	Ground

Note (1) Pin number starts from Left side

(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 power

SAMSUNG DISPLAY**5.7 IC Tc Spec**

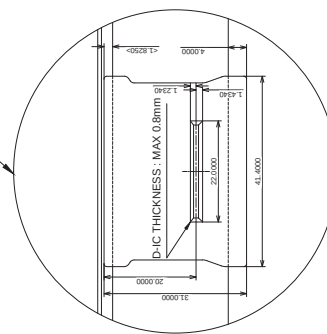
Temperature Spec	D-IC	T-con	PMIC
Silk	-	IC1	IC2
Tc	125°C	100°C	122°C

6. Outline Dimension

[Refer to the next page]

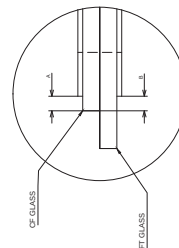
www.panelook.com

"A"



	CF GLASS - POL		GLASS-SEAL C(SIDE SEAL)
	A(CF POL)	B(TFT POL)	
UP	-0.2	3.98	0.3
LEFT	-0.2	4.15	0.3
RIGHT	-0.2	4.15	0.3

DIMENSION OF POL ATTACHMENT-1



	CF GLASS - POL	
POSITION	A(CF POL)	B(TFT POL)
DOWN	0.8	0.8

DIMENSION OF POL ATTACHMENT-2

	UP	DOWN	LEFT	RIGHT
	5.93	4.30	5.93	5.93

REAL BM (FROM ACTIVE)

[illegible]

PRELIMINARY

NOTE

1. PANEL : TFT-LCD
2. REFER TO "PRODUCT INFORMATION" OR "PRODUCT SPECIFICATION" DOCUMENTS
 - TOLERANCE
 - FFC CABLE INFORMATION
 - CONNECTOR INFORMATION
 - HEIGHT OF CIRCUIT COMPONENTS
3. PANEL THICKNESS
 - CF POL : T0.180
 - CF GLASS : T0.4
 - TFT GLASS : T0.4
 - TFT POL : T0.175
4. SOURCE PBA
 - PCB THICKNESS : T0.6
 - CONNECTOR MAX HEIGHT : T245

▲ CIRCUIT COMPONENT MAX HEIGHT : T245

 - SDC RECOMMEND NOT TO USE "JIG HOLDER" AS THE METHOD OF FIXING SOURCE PBA (SDC INTERNAL PROCESS ONLY)

5. APPLY TO GENERAL TOLERANCE ABOUT UNDEFINED TOLERANCE (SDE INTERVAL PROCESS UNL1)

R	REV	DATE	DESCRIPTION OF REVISION	REASON	OWNED BY
001	16/06/22		A PMA OUTLINE CHANGED	PM REQUEST	LOW
002	18/07/22		A CNT LOCATION CHANGED	PM REQUEST	LHS
003	18/08/22		A PANEL CAB PMA SIZE CHANGED	PM REQUEST	RSC
004	18/08/22		A PANEL CAB PMA SIZE CHANGED	PM REQUEST	RSC
005	18/08/22		A PANEL CAB PMA SIZE CHANGED	PM REQUEST	RSC
006	18/11/23		A PANEL CAB PMA SIZE CHANGED	PM REQUEST	RSC
007	17/01/23		A ANTI-CORROSION LINE	PM REQUEST	RSC

7. Reliability test

Test Item		Condition	Time/Cycle
HTOL		50°C , Bias	500 hrs
LTOL		0°C , Bias	500 hrs
THB		40°C / 90% , Bias	500 hrs
HTS		70°C , No Bias	500 hrs
LTS		-20°C , No Bias	500 hrs
Thermal Cycle		-20°C/30min ~ +60°C/30min , No bias	100 cycle
ESD	Non-Operation Open Cell	Air(non-contact) : 150pF, 330Ω, 100point	± 15kV
Altitude		Thermal :-10~50 °C, 15000ft(Operating), 40000ft(Non-operating) Normal :45 °C, 15000ft	8Hr 10Hr

[Result Evaluation Criteria]

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

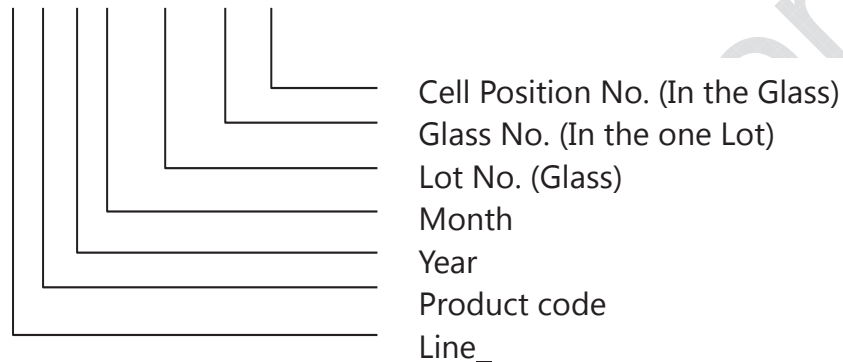
- HTOL / LTOL : High/Low Temperature Operating Life
- THB : Temperature Humidity Bias
- HTS/LTS : High/Low Temperature Storage

8. Packing

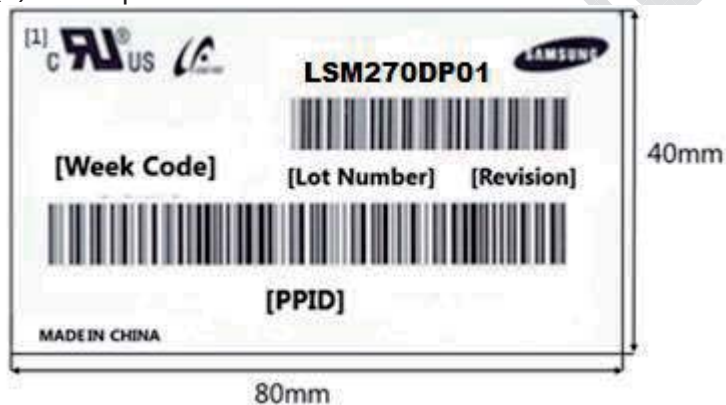
8.1 Marking

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

- (1) Parts number : LSM270DP01
- (2) Revision: Three letters
- (3) Lot number : X X X X XXX XX X



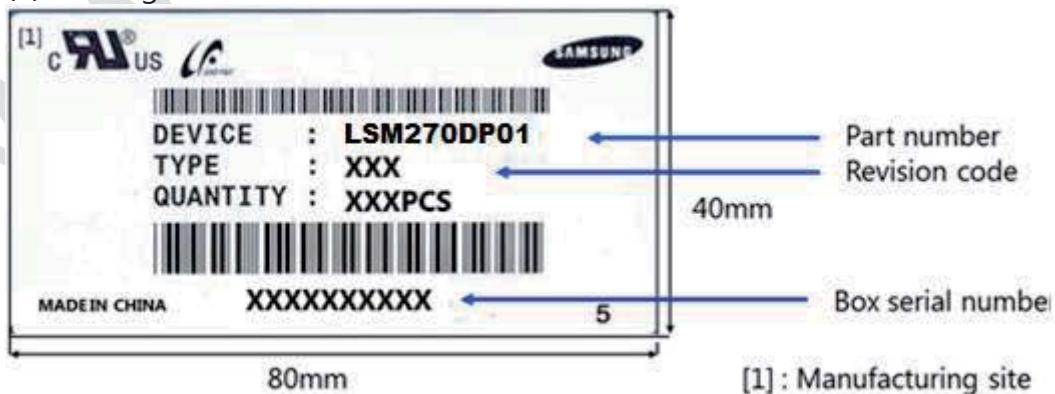
- (4) Nameplate Indication



Week code : 11 09
└─ week
└─ year

[1] : Manufacturing site

- (5) Packing box attach



9. General Precautions

9.1 Handling Precautions

- A. When assembling LCD module into its system, using all the mounting holes is strongly suggested.
- B. Keep LCD module from any external shock or force which can cause physical damage to LCD module. It may cause improper operation or damage to LCD module.
- C. Polarizer films are very fragile. It could be damaged easily. Do not press or scratch the surface harder than a HB pencil lead.
- D. Wipe off water droplets or oil immediately. Water drops or oils can cause permanent stain or discoloration.
- E. To clean LCD module, please use IPA (Isopropyl Alcohol) or Hexane.
- F. Do not use ketone type material (ex. Acetone), ethyl alcohol, toluene, ethyl acid or methyl chloride. Using these could cause permanent polarizer damage to the LCD module.
- G. If the liquid crystal leaks from LCD module, keep it away from human eyes or mouth. In case of contact with human body or clothes, it should be washed with soap thoroughly.
- H. Protect LCD module from static discharge.
 - I. To keep the LCD module clean, make sure to wear fabric gloves and finger coats when you are inspecting and/or assembling the unit.
- J. Do not disassemble LCD module.
- K. Protection film on LCD module display area should be slowly peeled off just before assembly to prevent static discharge.
- L. Pins of the Interface connector should not be touched directly with bare hands.

9.2 Storage Precautions

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

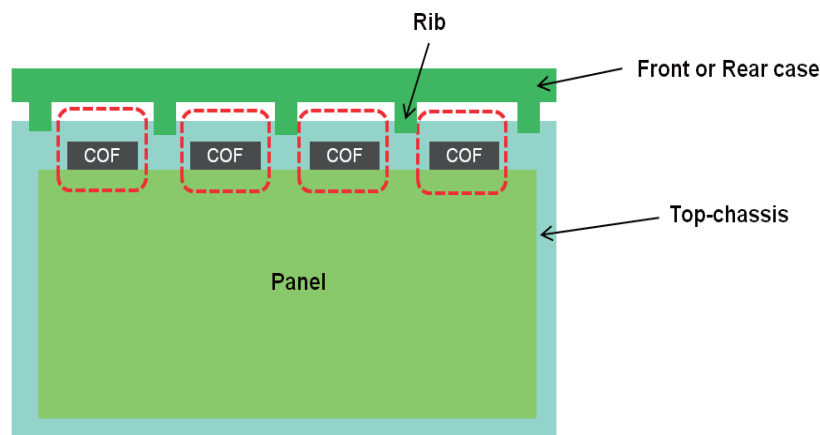
Item	Unit	Min.	Max.
Storage Temperature	(°C)	5	40
Storage Humidity	(%rH)	35	75
Storage life	12 months		
Storage Condition	- The storage room should provide good ventilation and temperature Control . - Products should not be placed on the floor, but on the Pallet away from a wall . - Prevent products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

9.3 Operating Precautions

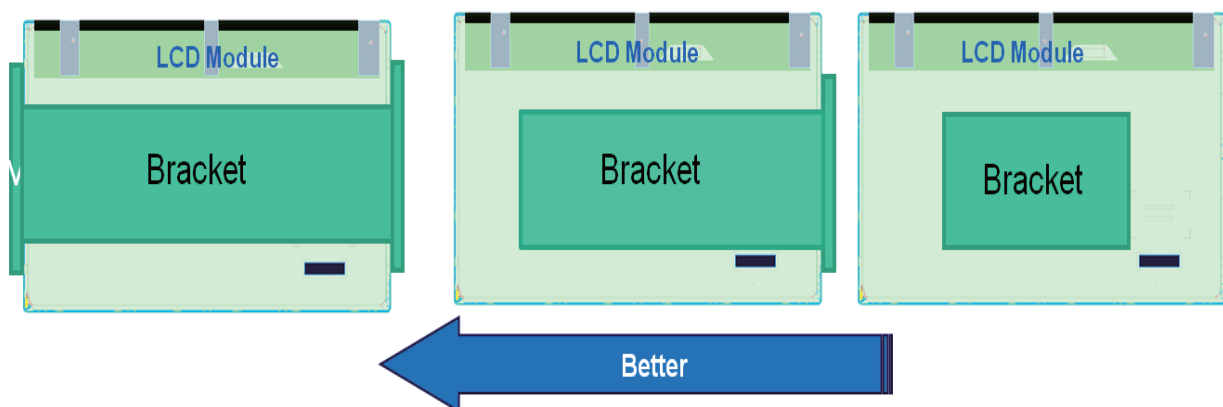
- A. If the module is used to other applications besides the recommendation on General Description, please contact SAMSUNG for application engineering device in advance
- B. Do not connect or disconnect the LCD module when it is set to the "Power On" condition.
- C. Input power should always follow '5.6 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 .

9.4 Design Guide for System

- 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.



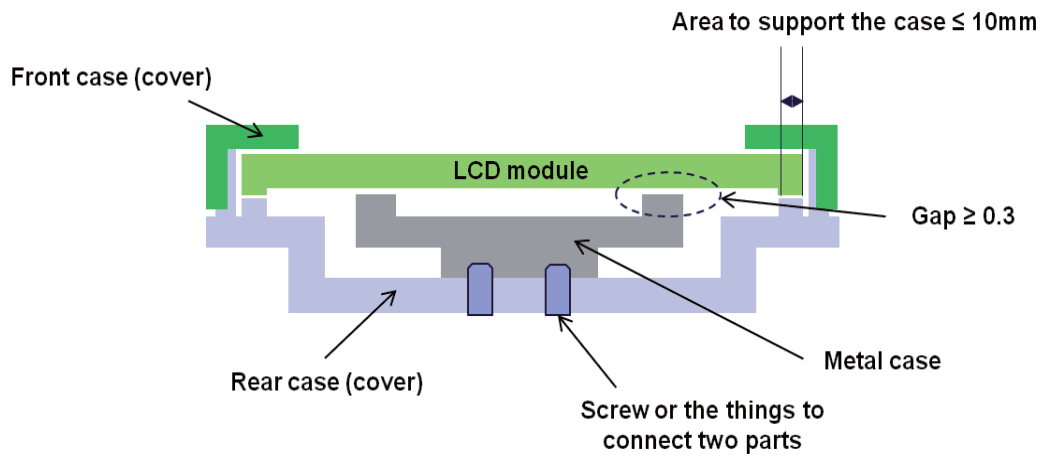
- C. It is recommended that assemble the bracket which has two sides with holes for assembly.
- D. It is recommended that you design the bracket with the structure which covers the sides of module when designing the bracket for customer.
- E. It is recommended that you design the bracket not to be interfered with the SET at the area where the PBA of module is located.



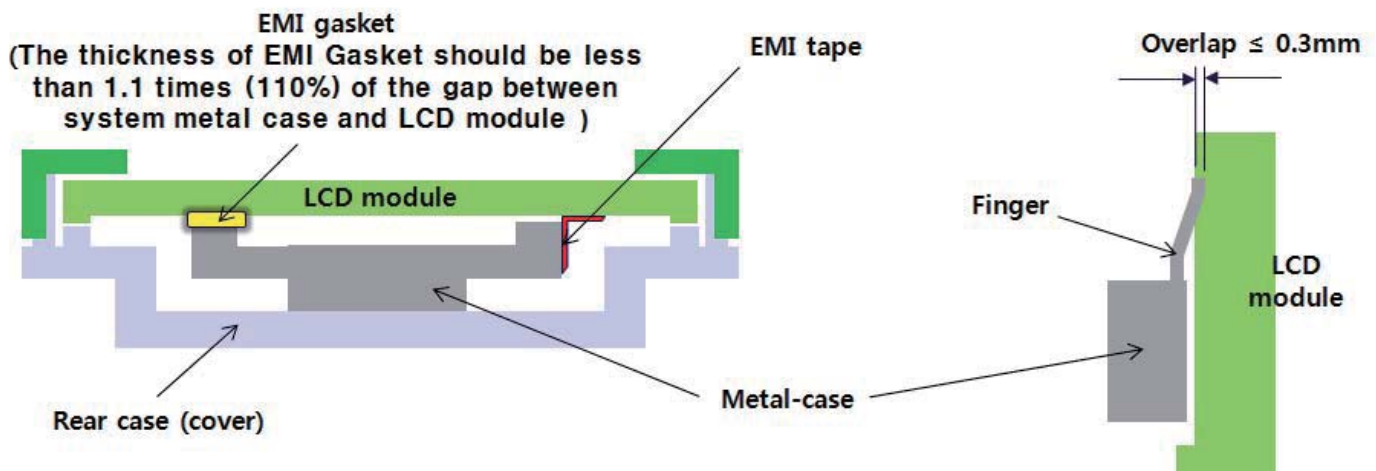
- F. It is recommended that more than 0.3 mm is allowable as a gap between the metal case and the rear of module.
- G. It is recommended that structure to support the module shall be far away 10mm from the edge of border.

SAMSUNG DISPLAY

- 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.

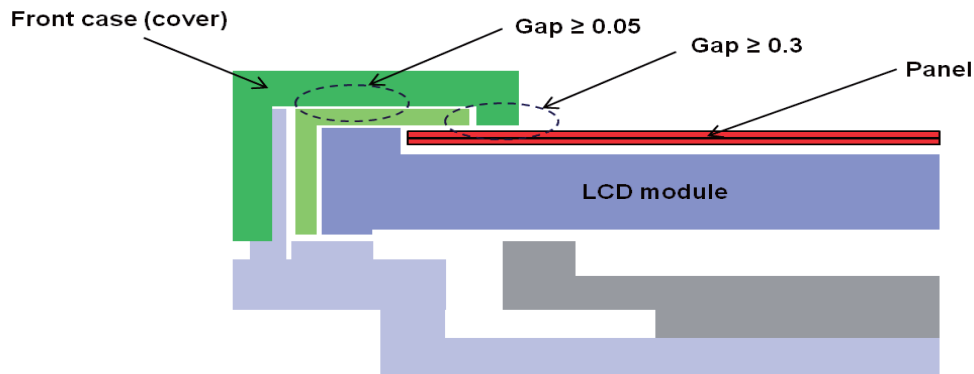


- I. When applying the measures described below to reduce the level of EMI which occurs between the metal cover and the rear of module.
- J. If you use Finger, less than 0.3mm is allowable for overlap.

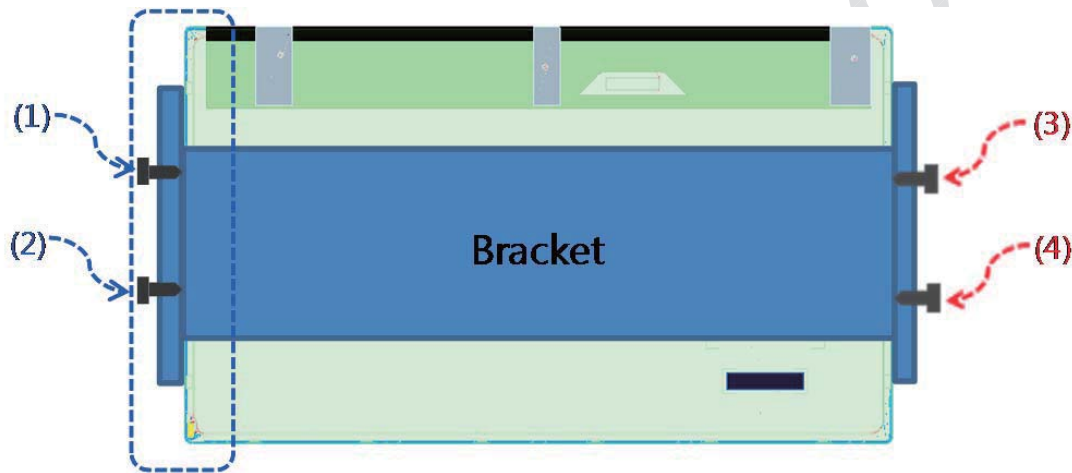


- K. It is recommended that more than 0.3mm gap between the front case (or cover) and the panel glass is allowable.
- L. It is recommended that more than 0.05mm gap between the front case and the top chassis is allowable.

SAMSUNG DISPLAY



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.

