



DATE : Jan. 4th. 2011

SAMSUNG TFT-LCD

MODEL NO : LTN070NL01

NOTE : Extension code [-]
→ LTN070NL01

Surface type [Glare]

The information described in this SPEC is preliminary and can be changed without prior notice.

검 토 (Proposed by)			고객사 승인 (Approved by)
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SAMSUNG ELECTRONICS CO., LTD.

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Product Specification



GENERAL DESCRIPTION

Preliminary

DESCRIPTION

LTN070NL01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight system. The resolution of a 7.0" contains 1024 x 600 pixels and can display up to 16.2 Mega colors (6bit + FRC).

FEATURES

- High contrast ratio, high aperture structure
- 1024 x 600 pixels resolution
- LED BLU Structure
- DE (Data enable) only mode
- 3.7V Operating Voltage
- LVDS Interface
- RoHS Compliance
- PB, Halogen Free Product

APPLICATIONS

- Tablet

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	153.6(H) X 90.0(V) (7.0" diagonal)	mm	
Driver element	a-Si TFT active matrix	-	
Display colors	16.2M	colors	6bit + FRC
Number of pixel	1024 x 600 (WSVGA)	pixel	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.150(H) x 0.150(V)	mm	
Display Mode	Normally Black, PLS mode	-	
Glass Thickness	0.25	mm	
Module Size	164.05(H) x 100.86(V) (Typ.)	mm	
Response Time	30 (Typ.)	ms	
Surface Treatment	Hardness 3H	-	Glare

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Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	163.85	164.05	164.25	mm	
	Vertical (V)	99.81	99.96	100.11	mm	
	Depth (D)	2.20	2.35	2.50	mm	(1)
Weight		-	-	100	g	

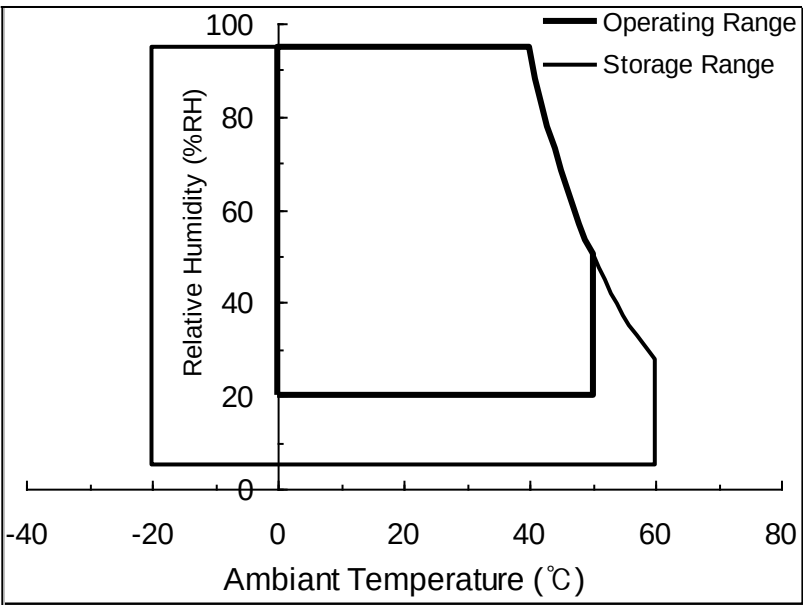
Note (1) Measurement condition of outline dimension
 . Equipment : Vernier Calipers
 . Push Force : 300g · f (minimum)

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1)
Operating temperate (Temperature of glass surface)	TOPR	-20	50	°C	(1)

Note (1) Temperature and relative humidity range are shown in the figure below.
 95 % RH Max. (40 °C ≥ Ta)
 Maximum wet - bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation



1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V _{CC}	- 0.3	4.2	V	(1)
BLU Driving Voltage	V _{BLU}	- 0.3	26.5	V	(1)

Note (1) Within Ta (25 ± 2 °C)

2. OPTICAL CHARACTERISTICS

Preliminary

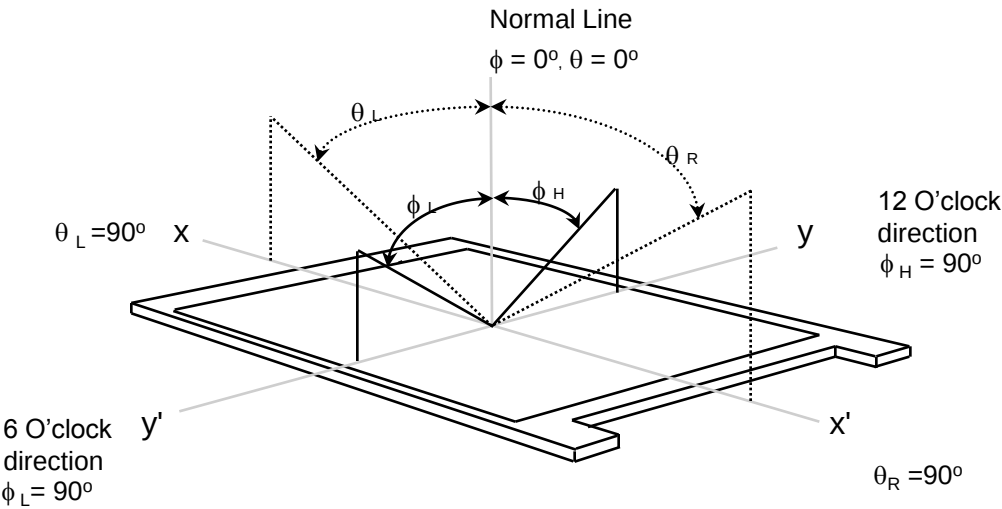
The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state.

* Ta = 25 ± 2 °C, V_{CC}=3.7V, f_v= 60Hz, f_{DCLK}=54MHz

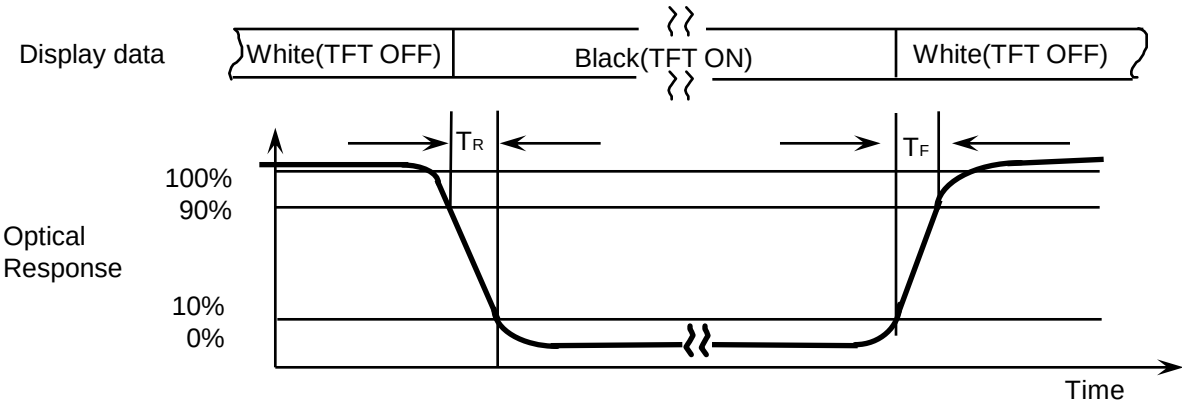
Item		Symbol	Condition	Min.	Typ.	M-ax	Unit	Note
Contrast Ratio		CR	Normal Viewing Angle φ = 0 θ = 0	600	800	-	-	-
Response Time at Ta (Rising + Falling)		T _{RT}		-	30	45	msec	Note (1), (2)
Average Luminance of White (Center)		Y _{L,AVE}		320	400	-	cd/m ²	PWM 77%
Color Temperature		T		6500		8500	K	CA-210
White Balance		-		0	20	40	MPCD	CA-210
Uniformity (9 points)				80	-	-	%	Note(4)
Color Gamut		-		45	50	-	%	-
Color Chromaticity (CIE)	Red	R _x		Typ -0.03	0.614	Typ +0.03	-	CA-210
		R _y			0.335			
	Green	G _x			0.326			
		G _y			0.551			
	Blue	B _x			0.139			
		B _y			0.132			
	White	W _x			0.300			
		W _y			0.325			
Viewing Angle	Hor.	θ _L	CR ≥ 10	80	-	-	Degrees	Note (1), (3)
		θ _H		80	-	-		
	Ver.	φ _H		80	-	-		
		φ _L		80	-	-		

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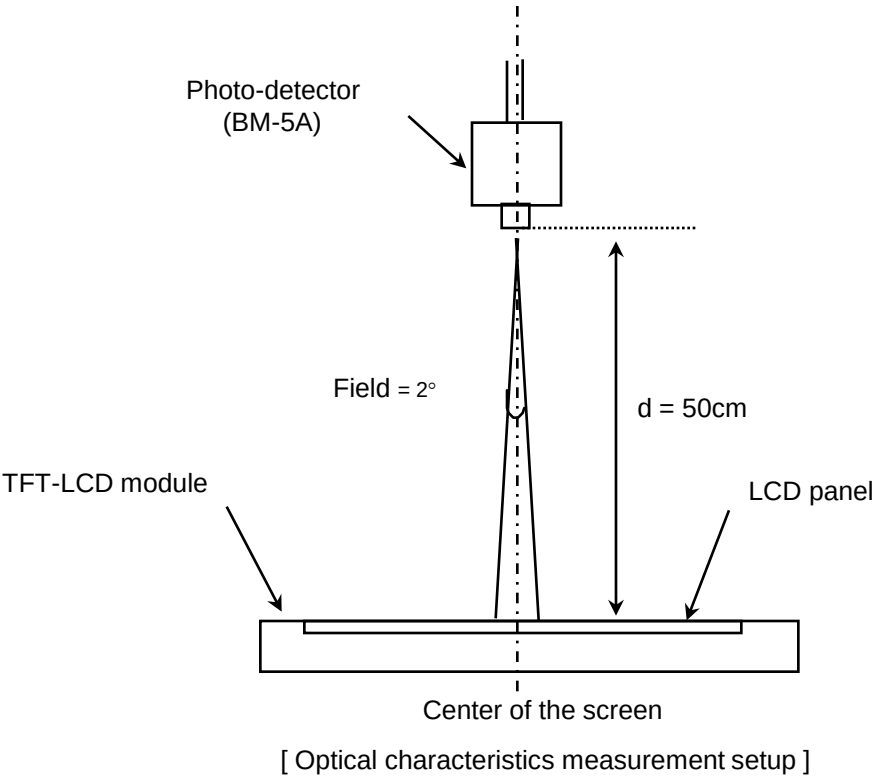
Note 1) Definition of Viewing Angle : Viewing angle range($10 \leq C/R$)



Note 2) Definition of Response time :

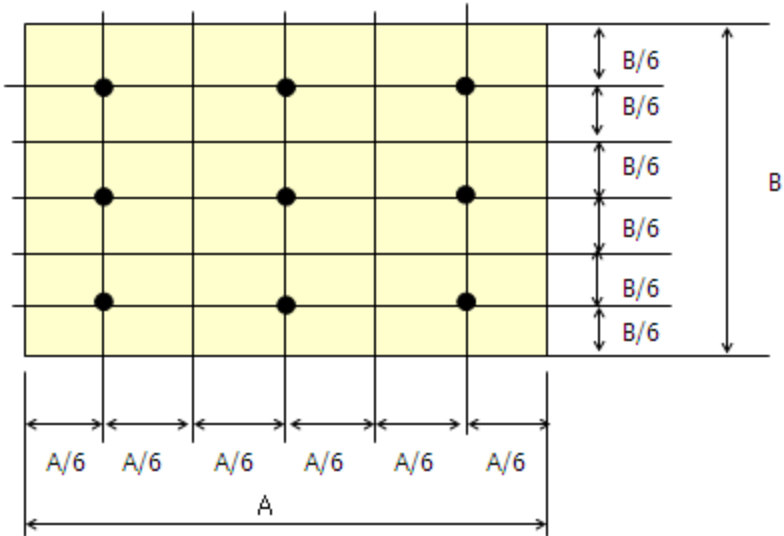


Note 3) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless and dark room. 30 min after lighting the backlight. This should be measured in the center of screen.
Environment condition : Ta = 25 ± 2 °C



Note 4) Definition of 9 points white variation (δ)

$$\delta L = \frac{\text{Maximum luminance of 9 points}}{\text{Minimum luminance of 9 points}}$$



3. ELECTRICAL CHARACTERISTICS

Preliminary

3.1 TFT LCD MODULE

(Ta= 25 ± 2°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V _{CC}	3.0	3.7	4.2	V	
Power Supply Current	I _{Max}	-	554	610	mA	PWM Duty 77% (@3.7V)
Differential input high threshold voltage	V _{TH}	-	-	100	mV	
Differential input high threshold voltage	V _{TH}	-100	-	-		
Vsync Frequency	f _V	-	60	-	Hz	
Main Frequency	f _{DCLK}	-	54	-	MHz	

Note (1) Display data pins and timing signal pins should be connected.(GND = 0V)

(2) f_V = 60Hz, f_{DCLK} = 54 MHZ, V_{CC} = 3.7V , DC Current.

(3) Power dissipation pattern (Full white)

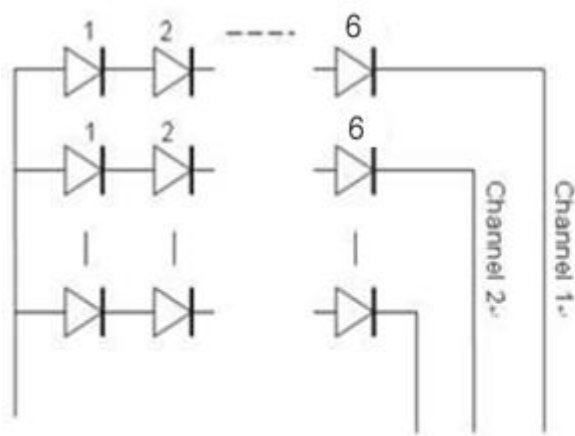
3.2 BACK-LIGHT UNIT

Ta= 25 ± 2 °C

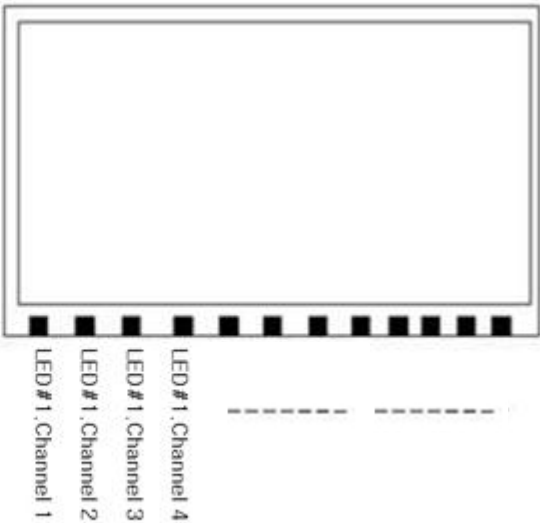
Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	-	15	19.3	mA	Typ : PWM Duty 77%
LED Forward Voltage	VF	2.8	2.9	3.0	V	(1)
LED Number	-	-	24	-	EA	(2)
LED Luminance	-	2150	-	2350	mcd	(1)

Note (1) Life time (Hr) of LEDs can be defined as the time in which it continues to operate under the condition Ta= 25 ± 2 °C and IF = 20 mA until one of the following event occurs.
When the brightness becomes 50% or lower than the original.

Note (2) LED placement structure



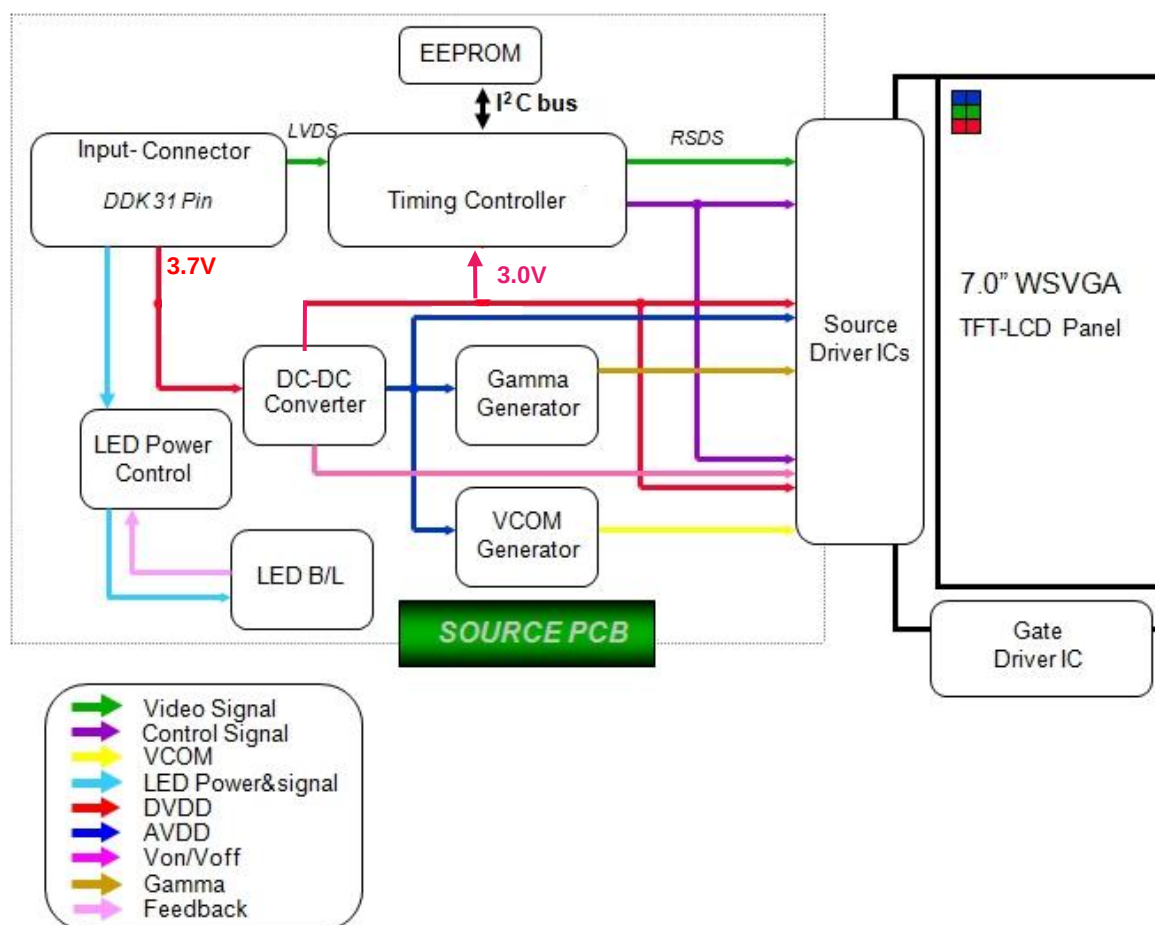
LED Wiring



LED Placement

4. BLOCK DIAGRAM

4.1 TFT LCD Module



5. INPUT TERMINAL PIN ASSIGNMENT

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5.1. Input Signal & Power

(Input Connector DDK 31PIN – FF12-31A-R12BN-D3)

Pin	Symbol	Function	Polarity	Remarks
1	VDD_3.7	Power Supply	-	Typ 3.7V
2	VDD_3.7	Power Supply	-	Typ 3.7V
3	VDD_3.7	Power Supply	-	Typ 3.7V
4	VDD_3.7	Power Supply	-	Typ 3.7V
5	VDD_3.7	Power Supply	-	Typ 3.7V
6	VDD_3.7	Power Supply	-	Typ 3.7V
7	VDD_3.7	Power Supply	-	Typ 3.7V
8	NC	No Connect	-	-
9	NC	No Connect	-	-
10	LDO_EN	LDO enable	-	-
11	GND	Ground	-	-
12	GND	Ground	-	-
13	LxIN0N	LVDS differential DATA input	Negative	R0~R5 G0
14	LxIN0P	LVDS differential DATA input	Positive	
15	GND	Ground	-	-
16	LxIN1N	LVDS differential DATA input	Negative	G1~5 B0~B1
17	LxIN1P	LVDS differential DATA input	Positive	
18	GND	Ground	-	-
19	LxIN2N	LVDS differential DATA input	Negative	B2~B5 Vs,Hs,DE
20	LxIN2P	LVDS differential DATA input	Positive	
21	GND	Ground	-	-
22	LxCLKN	LVDS differential DATA input	Negative	Clock
23	LxCLKP	LVDS differential DATA input	Positive	
24	GND	Ground	-	-
25	Lx1N3N	LVDS differential DATA input	Negative	R,G,B 6~7
26	Lx1N3P	LVDS differential DATA input	Positive	
27	GND	Ground	-	-
28	LED_EN	LED enable (PWM)	-	-
29	GND	Ground	-	-
30	2.5V	2.5V	-	-
31	GND	Ground	-	-

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5.2 LVDS Interface

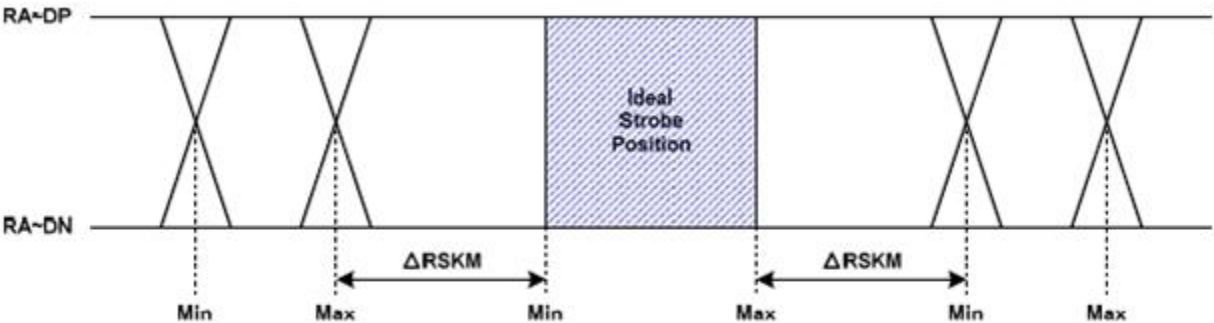
5.2.1 LVDS DC characteristic

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LVDS Differential Voltage	VID	200	-	600	mV	
Input Common Mode Voltage	V_{CM}	0.8	1.2	1.4	V	

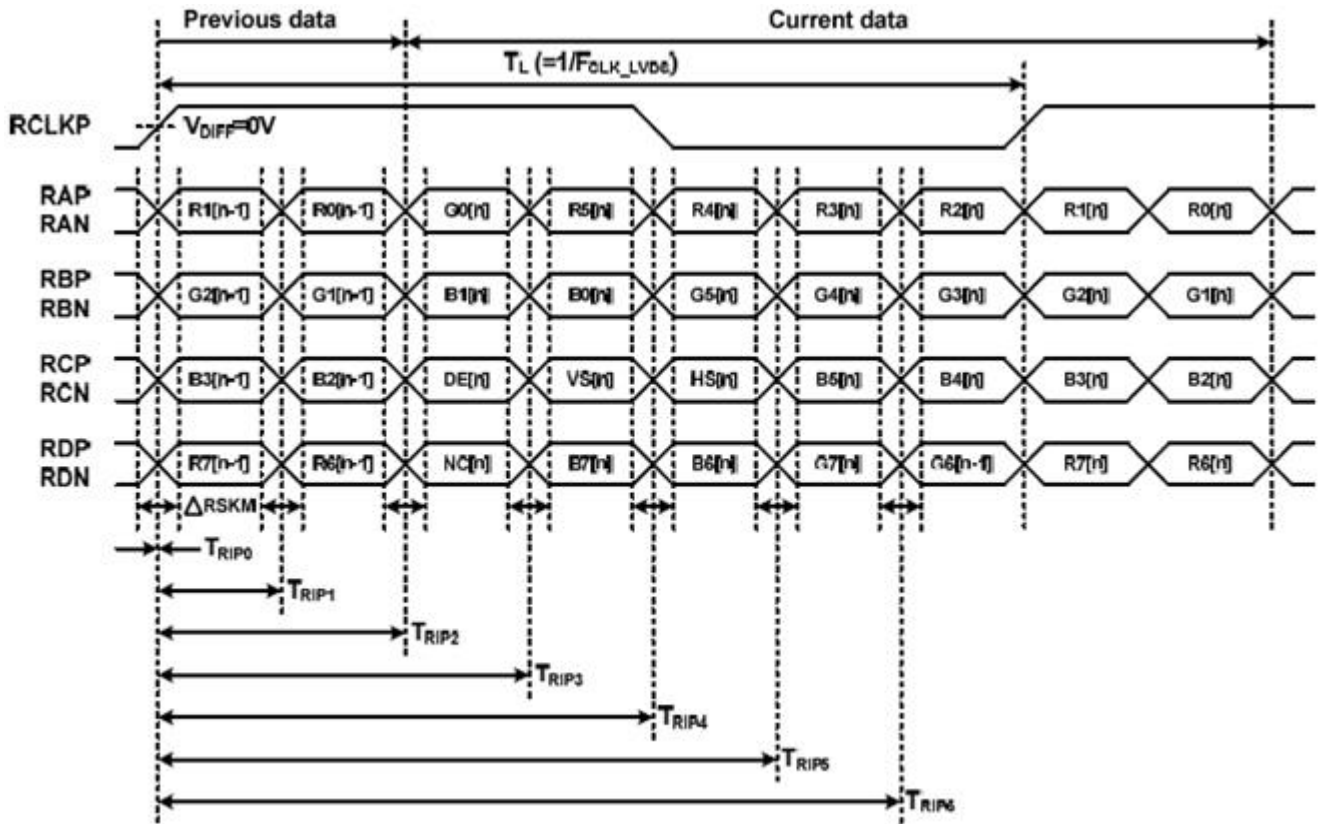
5.2.2 LVDS AC characteristic

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LVDS input clock frequency		F_{CLK_LVDS}	20		90	MHz	
RIN skew margin	$90MHz > F_{CLK_LVDS} \geq 65MHz$	$\Delta RSKM$	-400	0	400	ps	(1),(2)
	$65MHz > F_{CLK_LVDS} \geq 20MHz$		-600	0	600	ps	(1),(2)
Modulating frequency of LVDS input clock during SSCG		F_{CLK_MOD}	-	-	300	KHz	
Maximum deviation of LVDS input clock during SSCG		F_{CLK_DEV}	-	-	± 3	%	

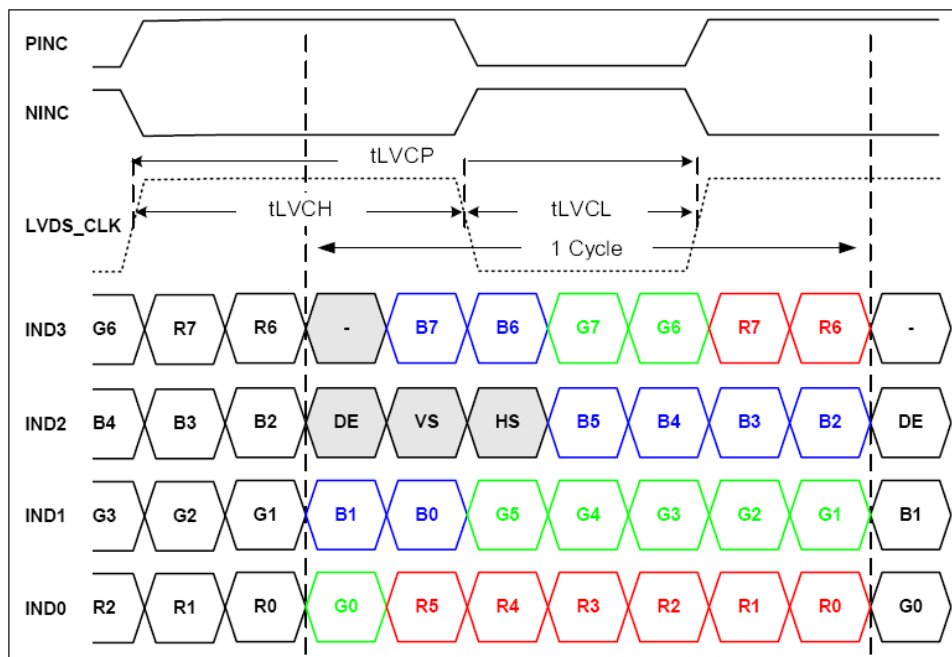
Note (1) : LVDS Input Skew (Strobe) Margin



Note (2) : LVDS Input Timing Diagram



5.3 Timing Diagrams of LVDS For Transmission



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

Preliminary

COLOR	DISPLAY	DATA SIGNAL																												GRAY SCALE LEVEL
		RED									GREEN									BLUE										
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7					
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~ R252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
	↓ LIGHT	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~ G252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
	↓ LIGHT	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	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			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~ B252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	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			

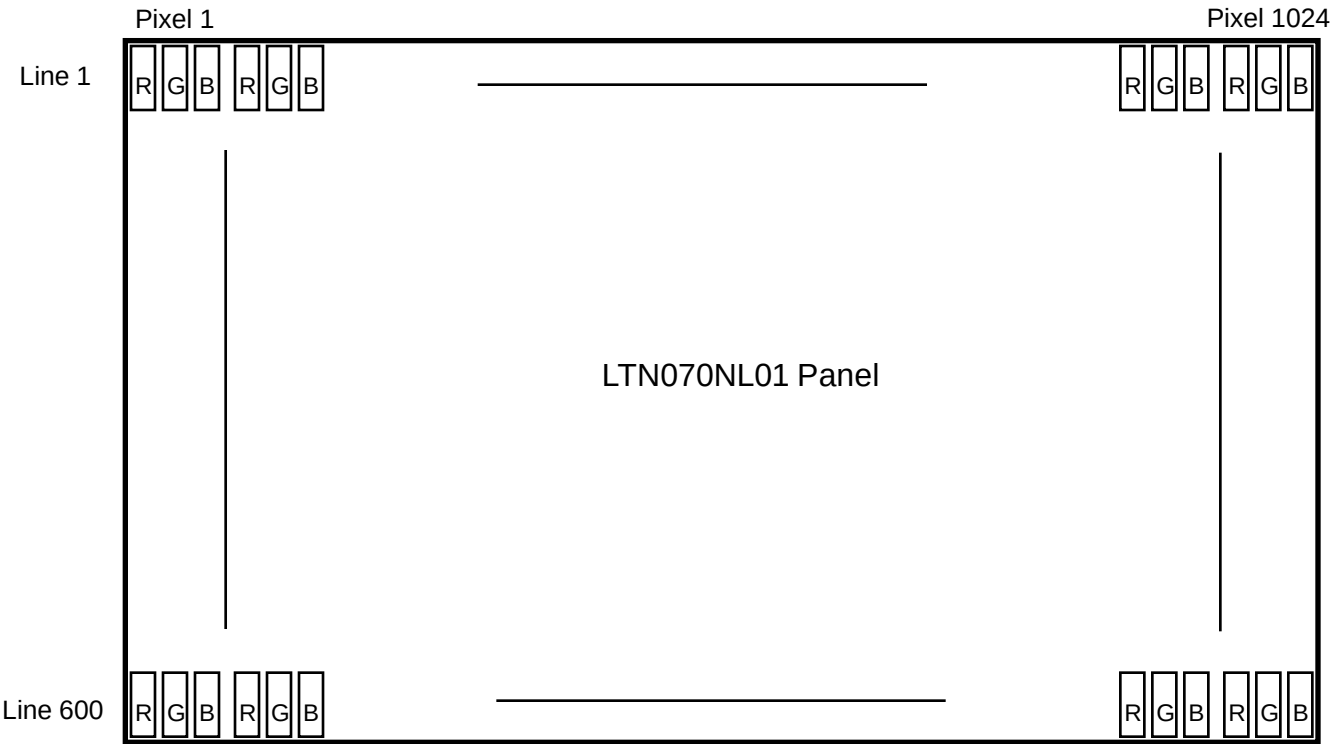
Note 1) Definition of gray :

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

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

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5.5 Pixel Format in the display



6. INTERFACE TIMING

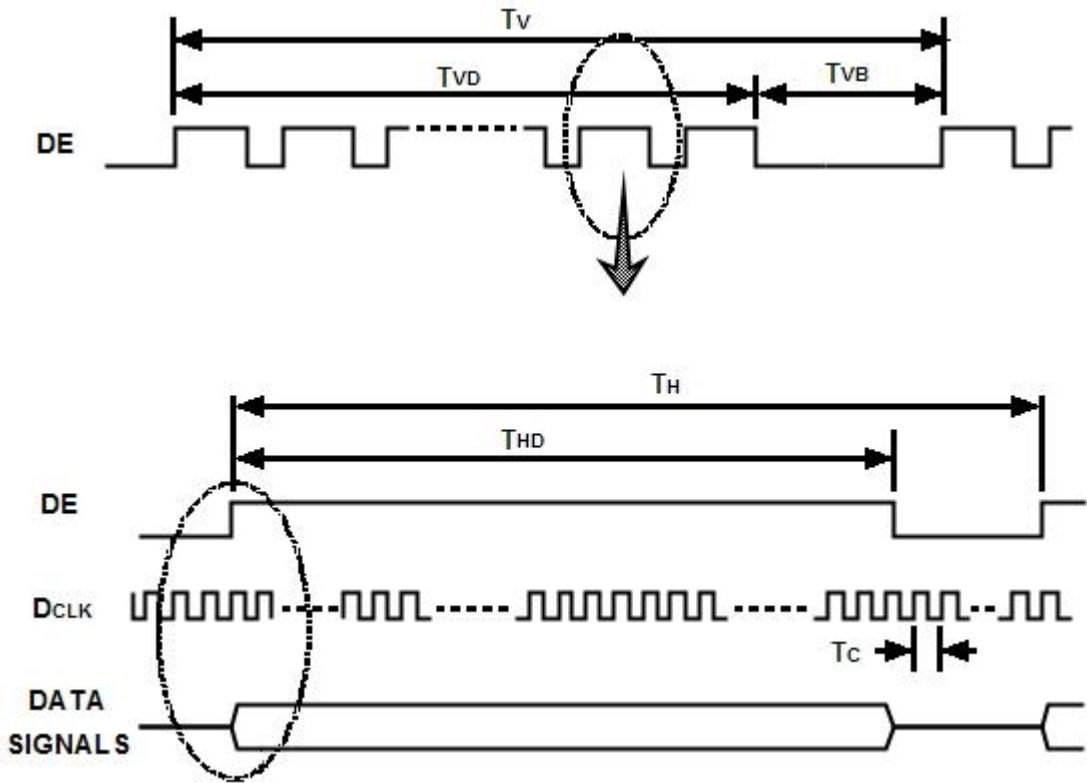
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6.1 Timing Parameters (DE Only Mode)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	f_v	-	60	-	Hz	
		T_v	-	631	-	Lines	(1)
Vertical Active Display Term	Display Period	T_{VD}	-	600	-	Lines	
	Vertical Blank Period	T_{VB}	-	31	-	Lines	(1)
One Line Scanning Time	Cycle	T_H	-	1426	-	Clocks	(1)
Horizontal Active Display Term	Display Period	T_{HD}	-	1024	-	Clocks	(1)
		T_{HB}	-	402	-	Pixels	
Main CLK Freq.	Cycle	$1/T_c$	-	54	-	MHz	

Note (1) The value of $(T_v + T_H) * f_v$ cannot exceed MAX value of Main CLK Freq.

6.2 Timing diagrams of interface signal

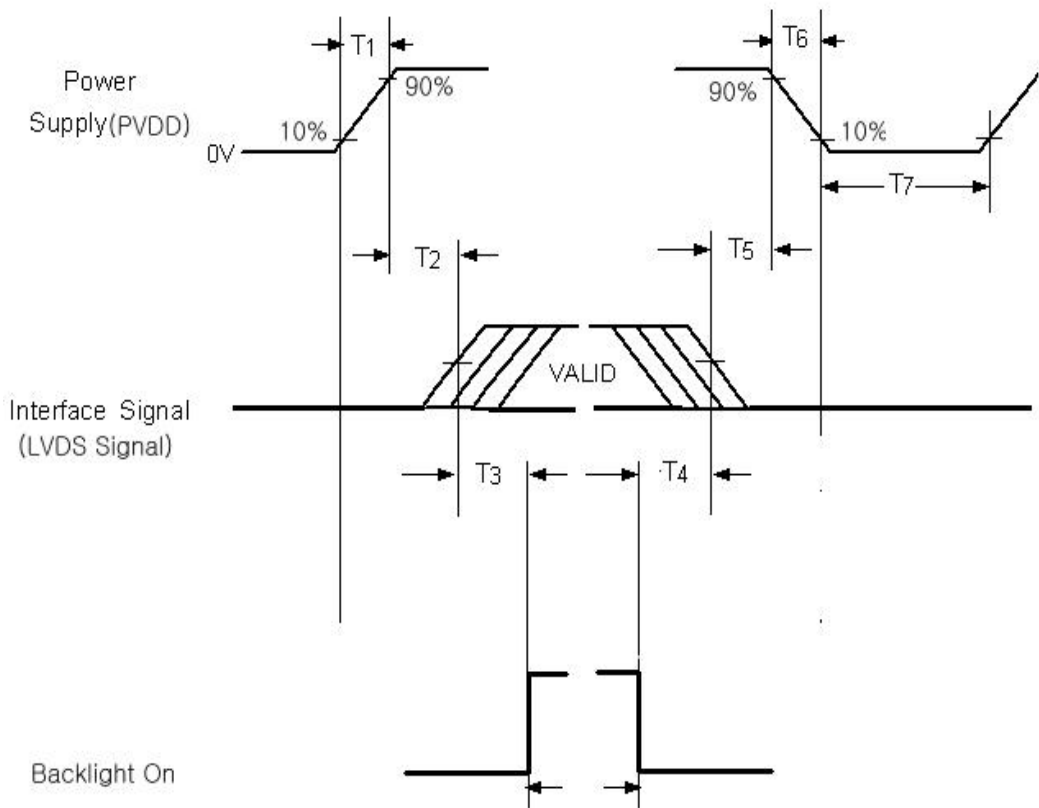


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6.3 Power ON/OFF Sequence

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



Power ON / OFF Sequence

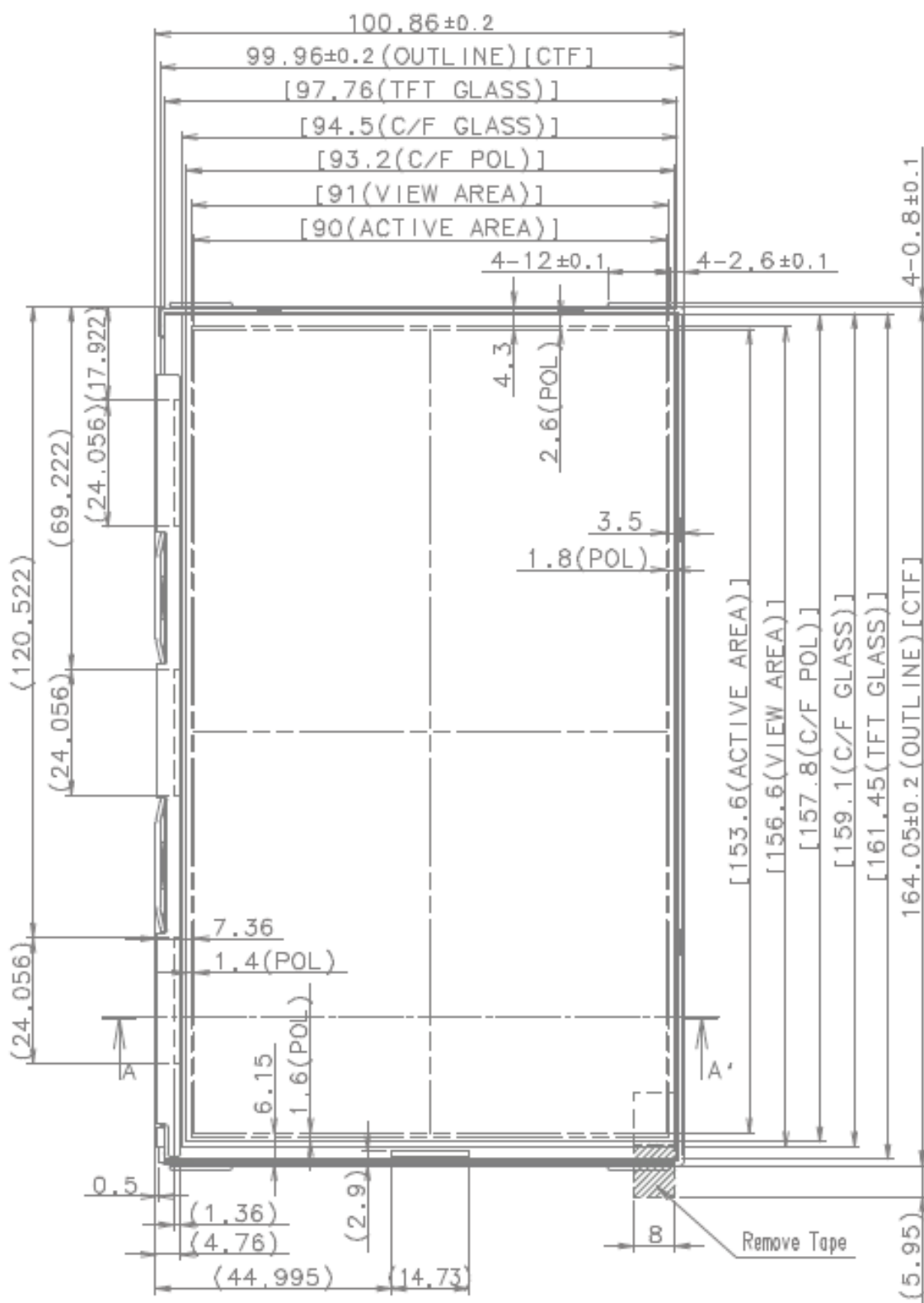
Item	Spec
T1	$0.5 \leq T1 \leq 10\text{msec}$
T2	$0 \leq T2 \leq 50\text{msec}$
T3	$T3 \geq 300\text{msec}$
T4	$T4 \geq 200\text{msec}$
T5	$0 \leq T5 \leq 50\text{msec}$
T6	$0 \leq T6 \leq 10\text{msec}$
T7	$T7 \geq 500\text{msec}$

Power Sequence & Timing Parameters

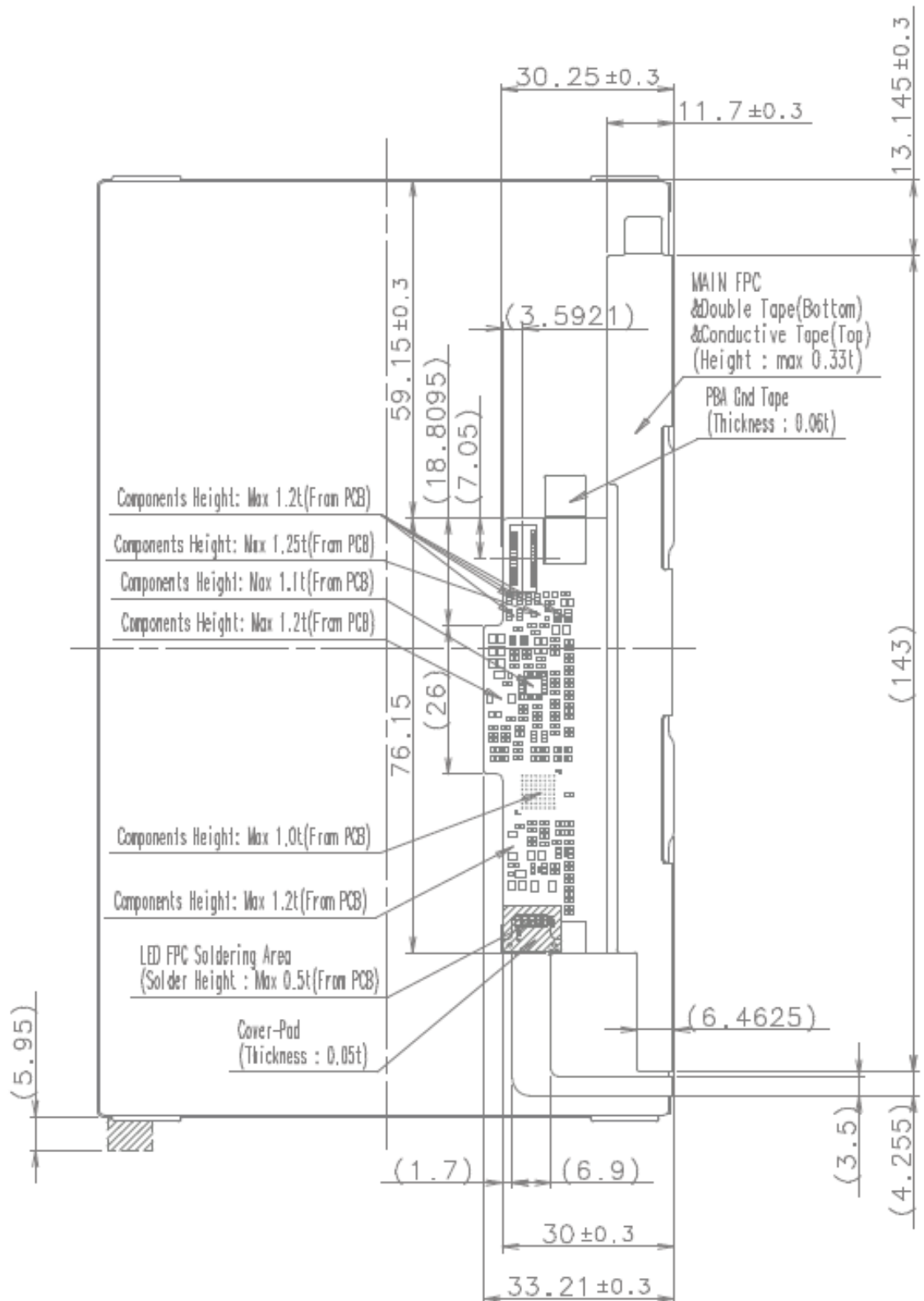
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7. MECHANICAL OUTLINE DIMENSION

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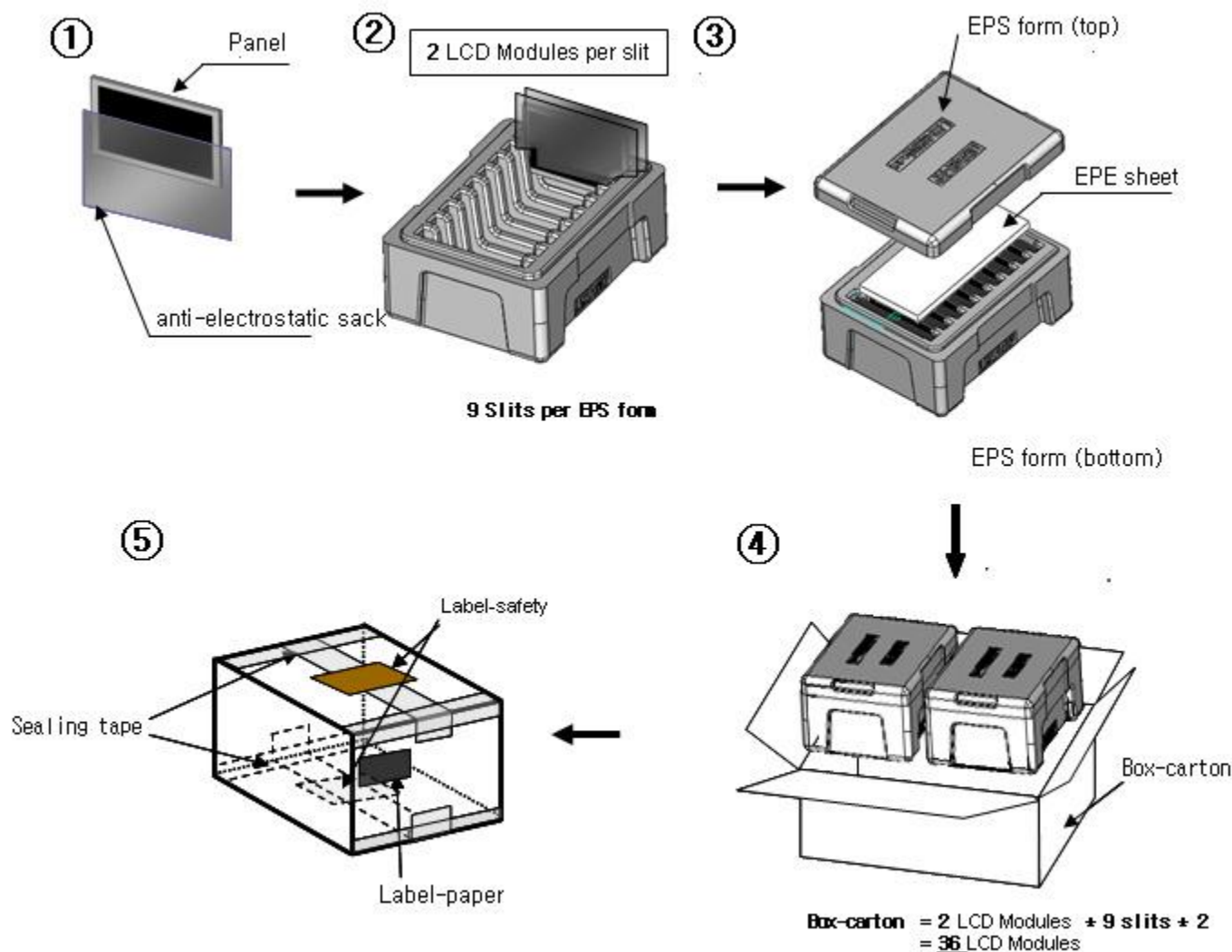


8. PACKING

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(1) Packing Method (Small box)



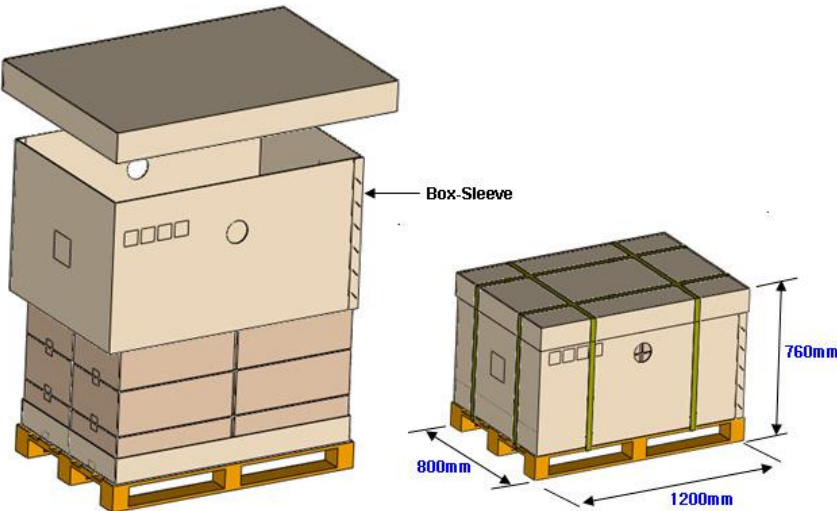
Note

- Total : Box-carton approx. : 5.0kg
- Size : 583(W) x 388(D) x 210(H)

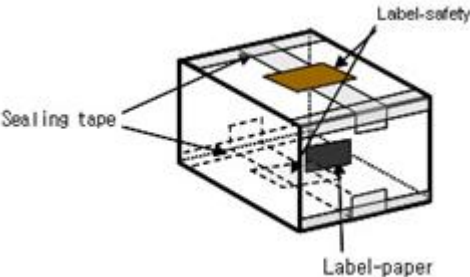
- (1) Put the LCD Module the Anti-Electrostatic Sack
- (2) Put 2 LCD Modules in the each slit of EPS form
- (3) Put the EPE sheet and cover the top ESP form with bottom ESP form
- (4) Put 2 EPS forms in the box-carton
- (5) Seal the Box-carton and affix the Label-safety & Label-paper.

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(2) Packing Method (Palette)



1 palette =



X 12 boxes (4 x 3)

(3) Packing Material

No	Part name	Quantity
1	Static electric protective sack	18 X 2
2	Cushion Pad(Inner Box) Included shock absorber.	2 set

9. GENERAL PRECAUTIONS

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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 LED back-light.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (h) Protect the module from static, it may cause damage to the C-MOS Gate Array IC.
- (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Do not pull or fold the lamp wire.
- (l) Do not adjust the variable resistor 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.

2. STORAGE

- (a) Do not leave the module in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD module in direct sunlight.
- (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

3. OPERATION

- (a) Do not connect, disconnect the module in the “ Power On ” condition.
- (b) Power supply should always be turned on / off by following item 6.3
“ Power on / off sequence ”.
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (d) The FPC cable between the LED chips and its converter power supply shall be a minimized length and be connected directly. The longer cable between the back-light and the converter may cause lower luminance of light source (LED).
- (e) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, SEC is not to be held reliable for the defective operations. It is strongly recommended to contact SEC to find out fitness for a particular purpose.

4. OTHERS

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, so on.)
Otherwise the module may be damaged.
- (d) If the module displays the same pattern continuously for a long period of time, it can be the situation when the image “sticks” to the screen.
- (e) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.