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ELECTRONICS

Approval



TO : General

DATE : July. 30, 2010

SAMSUNG TFT-LCD

MODEL NO. : LTN101NT06-2

NOTE : Extension code [XXX]
→ LTN101NT06[XXX]
Surface type [**Anti-Glare**]

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

A handwritten signature in black ink that reads 'Andrew Cho'.

APPROVED BY : _____

PREPARED BY : _____

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SAMSUNG ELECTRONICS CO., LTD.

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GENERAL DESCRIPTION

DESCRIPTION

LTN101NT06 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 unit. The resolution of a 10.1" contains 1024 x 600 pixels and can display up to 262,144 colors. 6 O'clock direction is the optimum viewing angle.

FEATURES

- High contrast ratio
- WSVGA (1024 x 600 pixels) resolution
- Fast Response
- LED Back Light with embedded LED Driver
- DE (Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip
- Green product (RoHS compliant)

APPLICATIONS

- Notebook PC
- If the usage of this product is not for PC application, but for others, please contact SEC

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	222.72(H) x 125.28(V) (10.1" wide diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	1024 x 600	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.2175(H) x 0.2088(V) (TYP.)	mm	
Display Mode	Normally white		
Surface treatment	Haze 25, Hard-Coating 3H		

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Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	234.5	235.0	235.5	mm	
	Vertical (V)	142.5	143.0	143.5	mm	
	Depth (D)	-	-	5.2	mm	(1)
Weight		-	-	200	g	

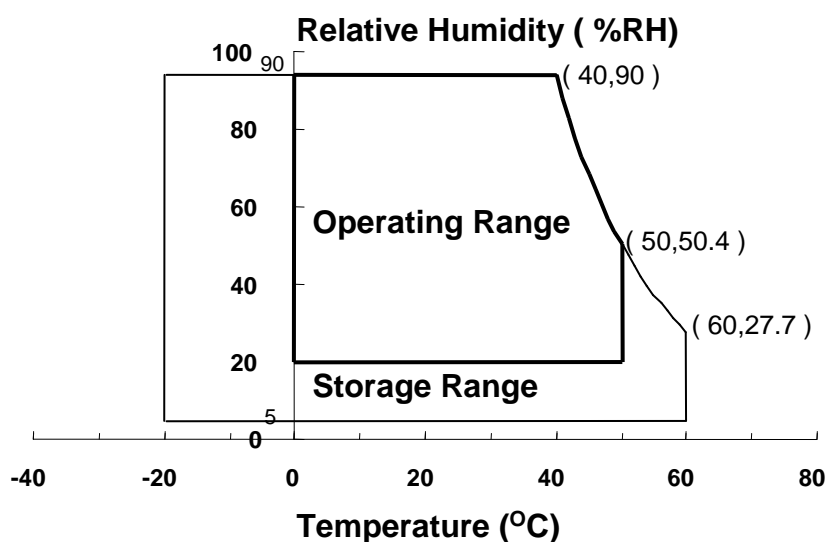
Note (1) Measurement condition of outline dimension
 . Equipment : Bernier Calipers
 . Push Force : 500g · f (minimum)

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	0	50	°C	(1)
Shock (non-operating)	Snop	-	240	G	(2),(4)
Vibration (non-operating)	Vnop	-	2.41	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.
 95 % RH Max. ($40\text{ }^{\circ}\text{C} \geq T_a$)
 Maximum wet - bulb temperature at $39\text{ }^{\circ}\text{C}$ or less. ($T_a > 40\text{ }^{\circ}\text{C}$) No condensation



- (2) 2ms, half sine wave, one time for $\pm X, \pm Y, \pm Z$.
 (3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.
 (4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.

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1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

 $V_{DD} = 3.3V, V_{SS} = GND = 0V$

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)
Logic Input Voltage	V_{IN}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)

Note (1) Within T_a (25 ± 2 °C)

(2) BACK-LIGHT UNIT

 $T_a = 25 \pm 2$ °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Current	I_L	-	25.6	-	mA	(1)
LED Voltage	F_L	-	3.2	-	V	(1)

Note 1) Permanent damage to the device may occur if maximum values are exceeded
 Functional operation should be restricted to the conditions described under normal operating conditions.

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2. OPTICAL CHARACTERISTICS

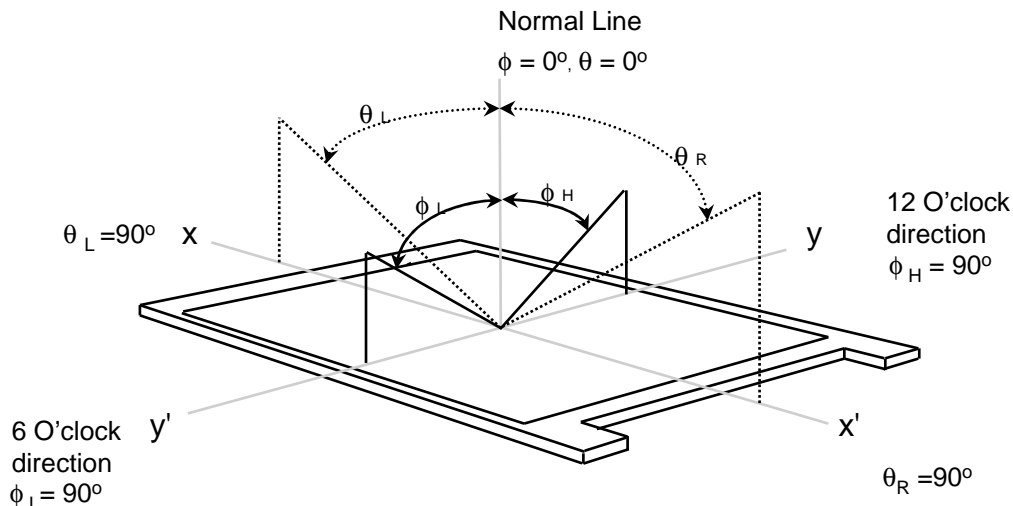
The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5).
Measuring equipment : TOPCON SR-3

* Ta = 25 ± 2 °C, V_{DD}=3.3V, fv= 60Hz, f_{DCLK}=54.03MHz, IL = 25.6 mA

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR	Normal Viewing Angle φ = 0 θ = 0	300	-	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T _{RT}		-	16	25	msec	(1), (3)
Average Luminance of White (5 Points)		Y _{L,AVE}		170	200	-	cd/m ²	(1), (4)
Color Chromaticity (CIE)	Red	R _X		0.543	0.573	0.603	-	(1), (5) SR-3
		R _Y		0.315	0.345	0.375		
	Green	G _X		0.304	0.334	0.364		
		G _Y		0.530	0.560	0.590		
	Blue	B _X	0.130	0.160	0.190			
		B _Y	0.093	0.123	0.153			
	White	W _X	0.283	0.313	0.343			
		W _Y	0.299	0.329	0.359			
Viewing Angle	Hor.	θ _L	-	40	-	Degrees	(1), (5) SR-3	
		θ _H	-	40	-			
	Ver.	φ _H	-	10	-			
		φ _L	-	30	-			
Color Gamut		CG	-	45	-	%		
13 Points White Variation		δ _L	-	-	1.7	-	(6)	

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

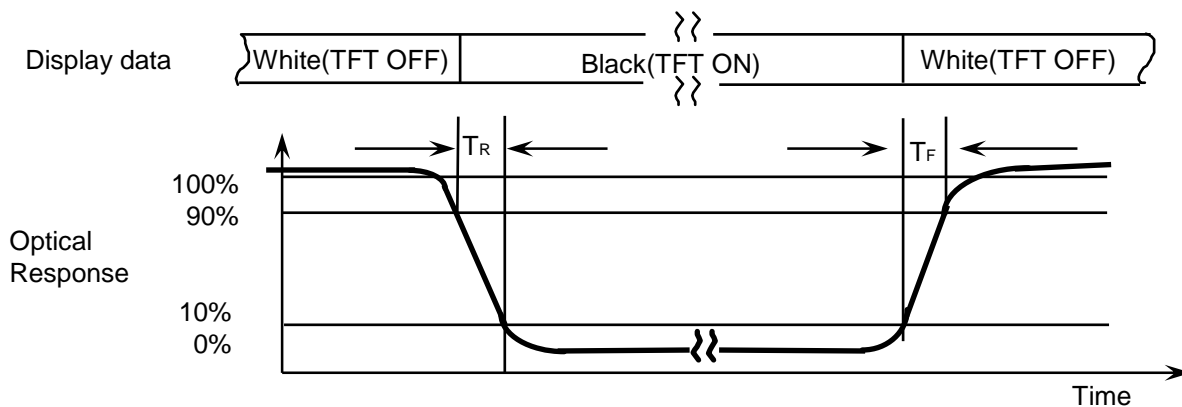


Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

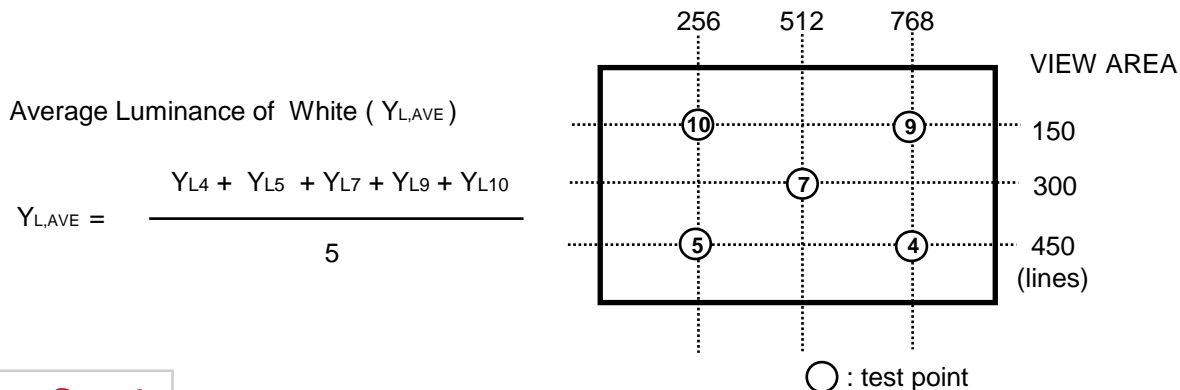
$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

Points : (4) , (5) , (7) , (9) , (10) at the figure of Note (6).

Note 3) Definition of Response time :



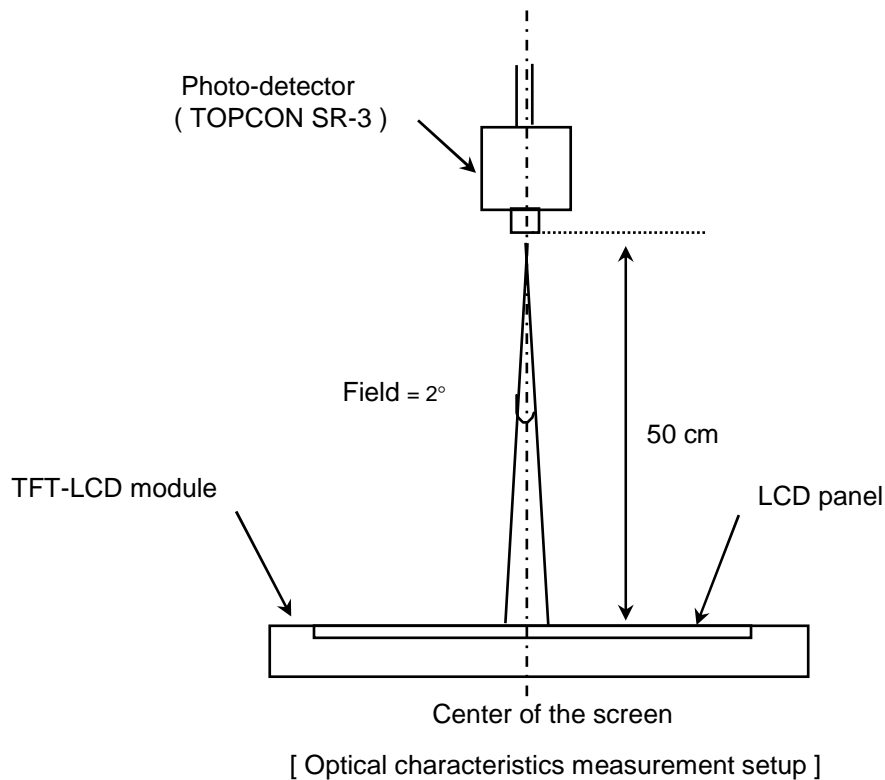
Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.



Average Luminance of White ($Y_{L,AVE}$)

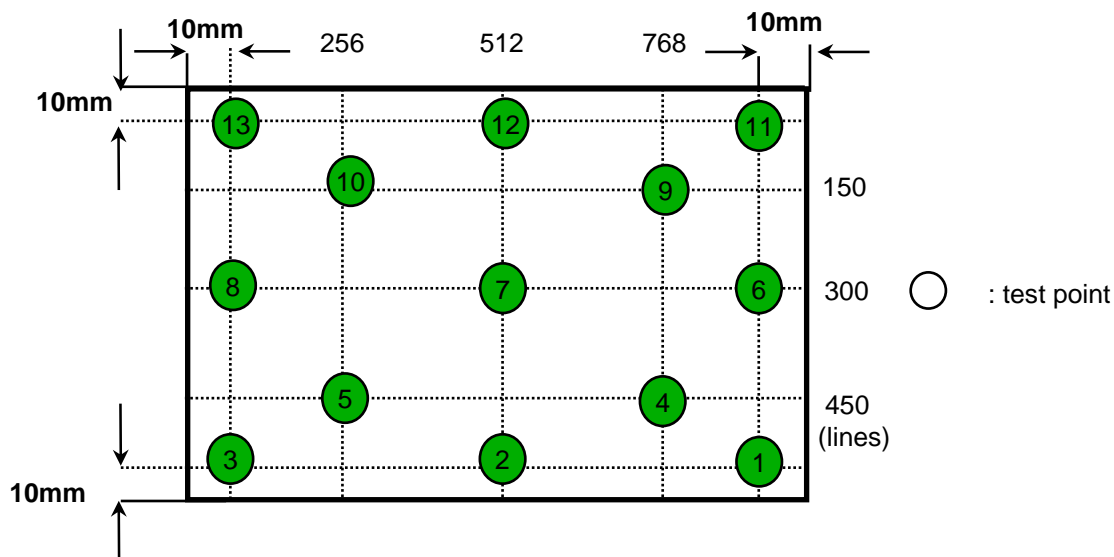
$$Y_{L,AVE} = \frac{Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}}{5}$$

Note 5) 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.
 IF current : 25.6mA
 Environment condition : Ta = 25 ± 2 °C



Note 6) Definition of 13 points white variation (δL), CR variation(C_{VER}) [① ~ ⑬]

$$\delta L = \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$



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3. ELECTRICAL CHARACTERISTICS

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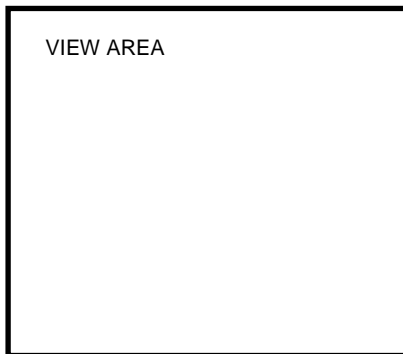
3.1 TFT LCD MODULE

Ta= 25 ± 2°C

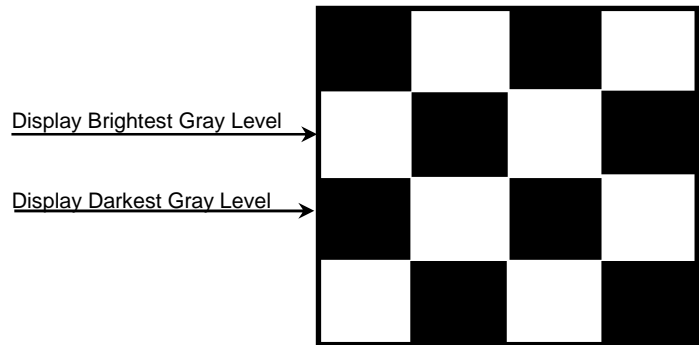
Item	Symbol	Min.	Typ.	Max.	Unit	Note	
Voltage of Power Supply	V _{DD}	3.0	3.3	3.6	V		
Differential Input Voltage for LVDS Receiver Threshold	High	V _{IH}	-	-	+100	mV	V _{CM} = +1.2V
	Low	V _{IL}	-100	-	-	mV	
Vsync Frequency	f _v	-	60	-	Hz		
Hsync Frequency	f _H	-	40.38	-	KHz		
Main Frequency	f _{DCLK}	-	54.2	-	MHz	-	
Rush Current	I _{RUSH}	-	-	1.5	A	(4)	
Current of Power Supply	White	I _{DD}	-	175	-	mA	(2),(3)*a
	Mosaic		-	175	-	mA	(2),(3)*b
	V. stripe		-	210	-	mA	(2),(3)*c

- Note (1) Display data pins and timing signal pins should be connected.(GND = 0V)
 (2) f_v = 60Hz, f_{DCLK} = 54.2 MHz, V_{DD} = 3.3V , DC Current.
 (3) Power dissipation pattern

*a) White Pattern

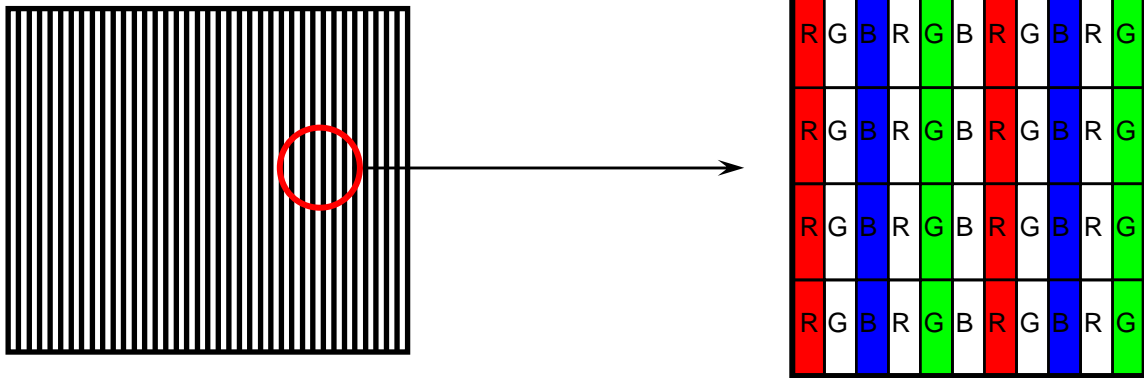


*b) Mosaic Pattern

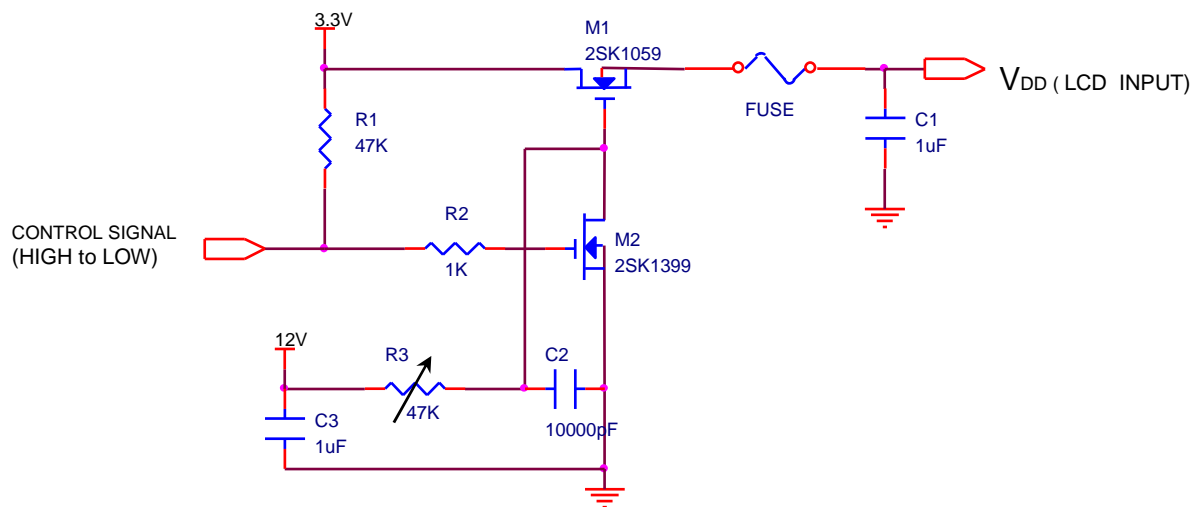


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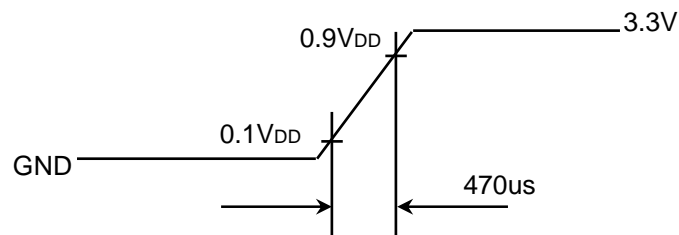
*c) 1dot Vertical stripe pattern



4) Rush current measurement condition



V_{DD} rising time is 470us



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3.2 LED Driver

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	25	25.6	26	mA	
LED Forward Voltage	VF	3.0	3.2	3.4	V	
LED Array Voltage	VP	-	19.2	-	V	Vf X 18 LEDs
Power Consumption	P	-	1.9	2.45	W	@200nit, W/ driver

3.3 LED Driver

- LED Driver Manufacturer : RHICHITEC

Ta= 25 ± 2 °C

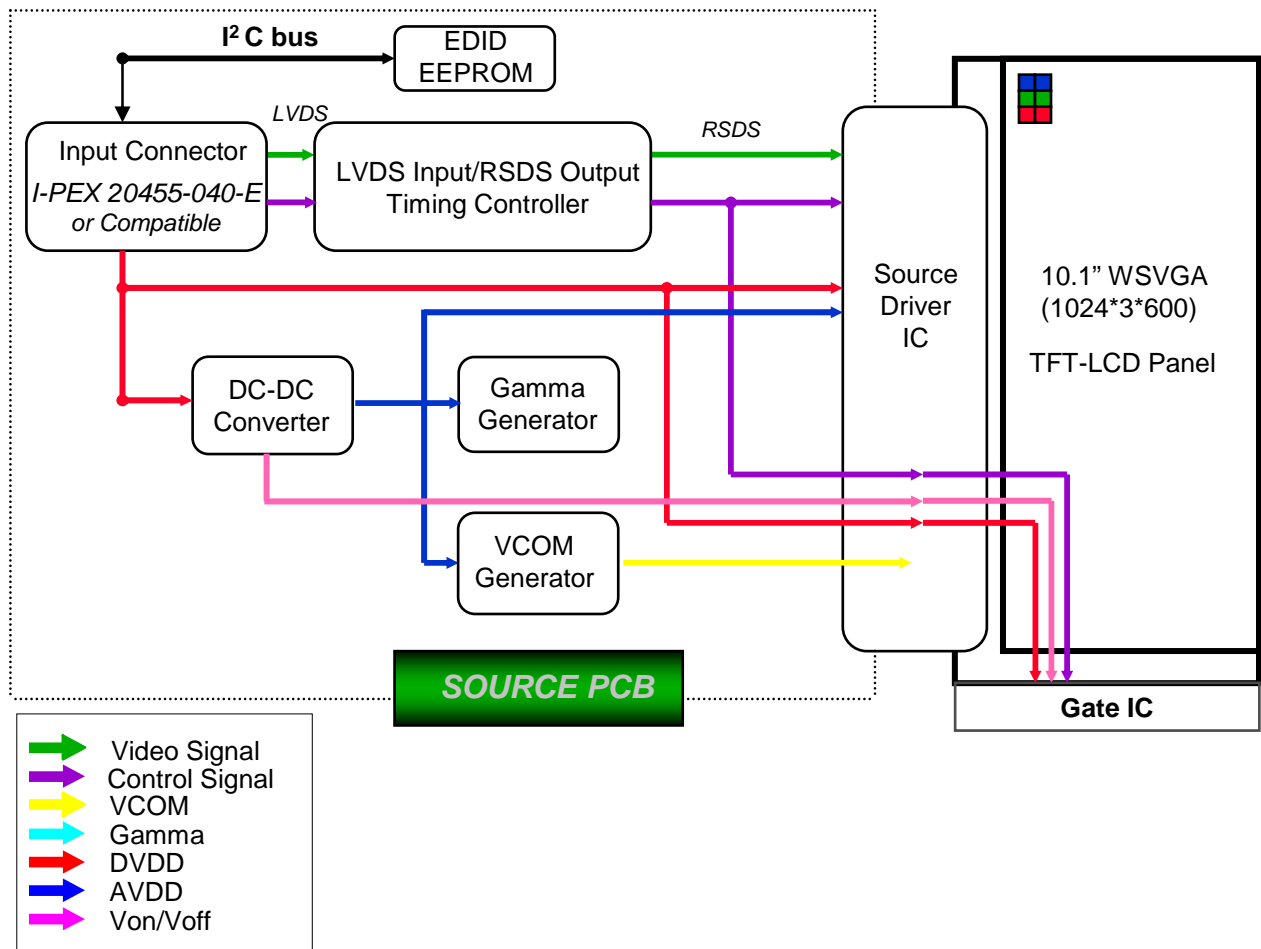
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V _{in}	7	12	21	V	
Input Current	I	-	160	-	mA	
EN Control Level	ON	2	3.3	5.0	V	
	OFF	0	0	0.5	V	
PWM Control Level	ON	2	3.3	5.0	V	
	OFF	0	0	0.5	V	
Duty Ratio	D	10	-	100	%	PWM Freq: 1KHz~10KHz
		5	-	100		200Hz~1KHz
External PWM Dimming Control Frequency (BLIM)	F _{BLIM}	-	1	10	kHz	V _{in} =7~20V, BLIM=PWM 0V~3.3V

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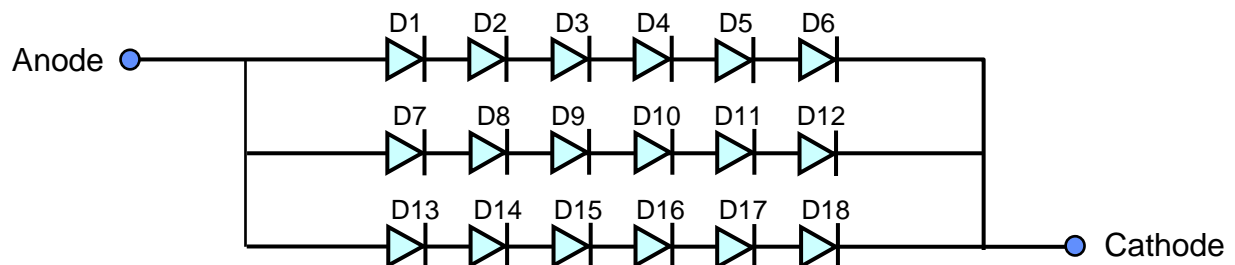
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4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 LED placement structure



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5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : I-PEX 20455-040E-## or equivalent)

No.	Symbol	Function	Polarity	Remarks
1	NC	No Connect		
2	VDD	Power Supply +3.3V		
3	VDD	Power Supply +3.3V		
4	VEDID	EDID +3.3V Power		
5	NC	No Connect		
6	CLK_EDID	EDID Clock Input		
7	DATA_EDID	EDID Data Input		
8	RxOIN0-	-LVDS Differential Data (Odd R0-R5, G0)	Negative	
9	RxOIN0+	+LVDS Differential Data (Odd R0-R5, G0)	Positive	
10	VSS	Ground		
11	RxOIN1-	-LVDS Differential Data (Odd G1-G5,B0-B1)	Negative	
12	RxOIN1+	+LVDS Differential Data (Odd G1-G5,B0-B1)	Positive	
13	VSS	Ground		
14	RxOIN2-	-LVDS Differential Data (Odd B2-B5,HS,VS,DE)	Negative	
15	RxOIN2+	+LVDS Differential Data (Odd B2-B5,HS,VS,DE)	Positive	
16	VSS	Ground		
17	RxOCKIN-	-LVDS Odd Differential CLK	Negative	
18	RxOCKIN+	+LVDS Odd Differential CLK	Positive	
19	VSS	Ground		
20	NC	No Connect		
21	NC	No Connect		
22	NC	No Connect		
23	NC	No Connect		
24	NC	No Connect		
25	NC	No Connect		
26	NC	No Connect		
27	NC	No Connect		
28	NC	No Connect		
29	NC	No Connect		
30	NC	No Connect		

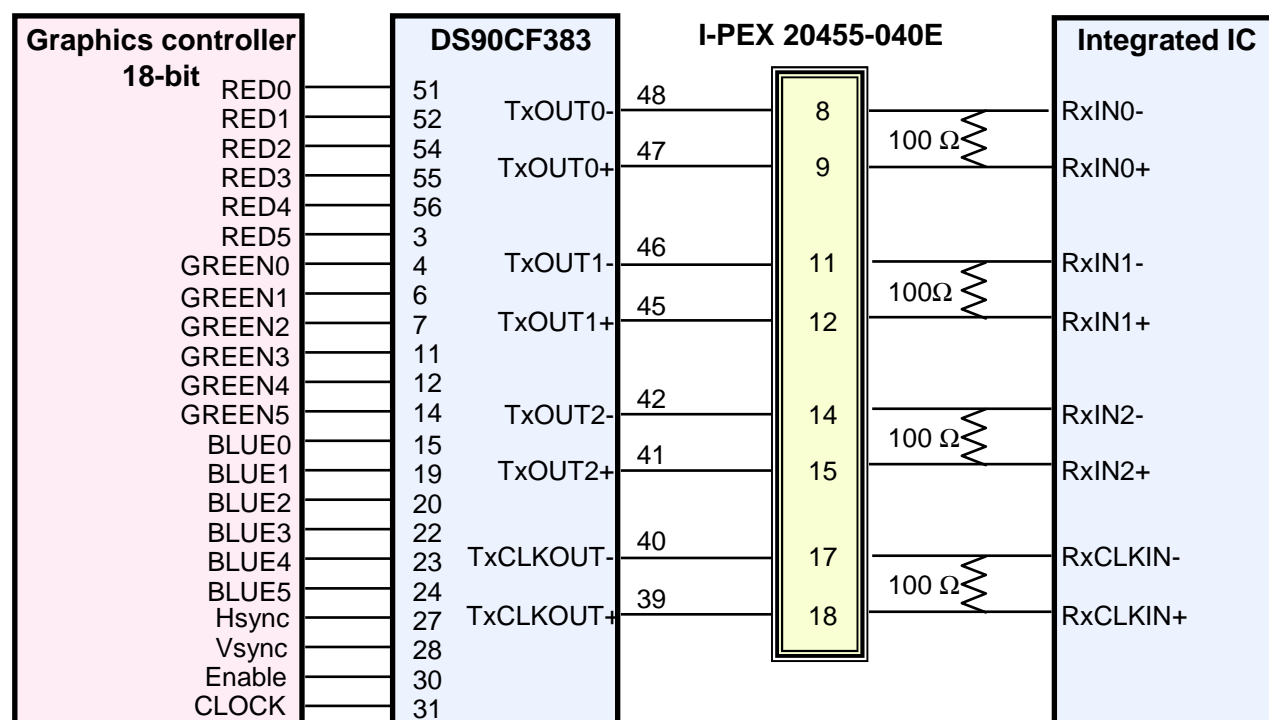
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No.	Symbol	Function	Polarity	Remarks
31	VLED_GND	LED Ground		
32	VLED_GND	LED Ground		
33	VLED_GND	LED Ground		
34	NC	No Connect		
35	S_PWMIN	System PWM signal Input		
36	BL_ON	LED enable pin (+3V input, +5V tolerance)		
37	NC	No Connect		
38	VLED	LED Power Supply 7V-21V		
39	VLED	LED Power Supply 7V-21V		
40	VLED	LED Power Supply 7V-21V		

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5.2 LVDS Interface : Transmitter DS90CF363 or Compatible

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
51	TxIN0	R0	14	TxIN14	G5
52	TxIN1	R1	15	TxIN15	B0
54	TxIN2	R2	19	TxIN18	B1
55	TxIN3	R3	20	TxIN19	B2
56	TxIN4	R4	22	TxIN20	B3
3	TxIN6	R5	23	TxIN21	B4
4	TxIN7	G0	24	TxIN22	B5
6	TxIN8	G1	27	TxIN24	Hsync
7	TxIN9	G2	28	TxIN25	Vsync
11	TxIN12	G3	30	TxIN26	DE
12	TxIN13	G4	31	TxCLKIN	Clock

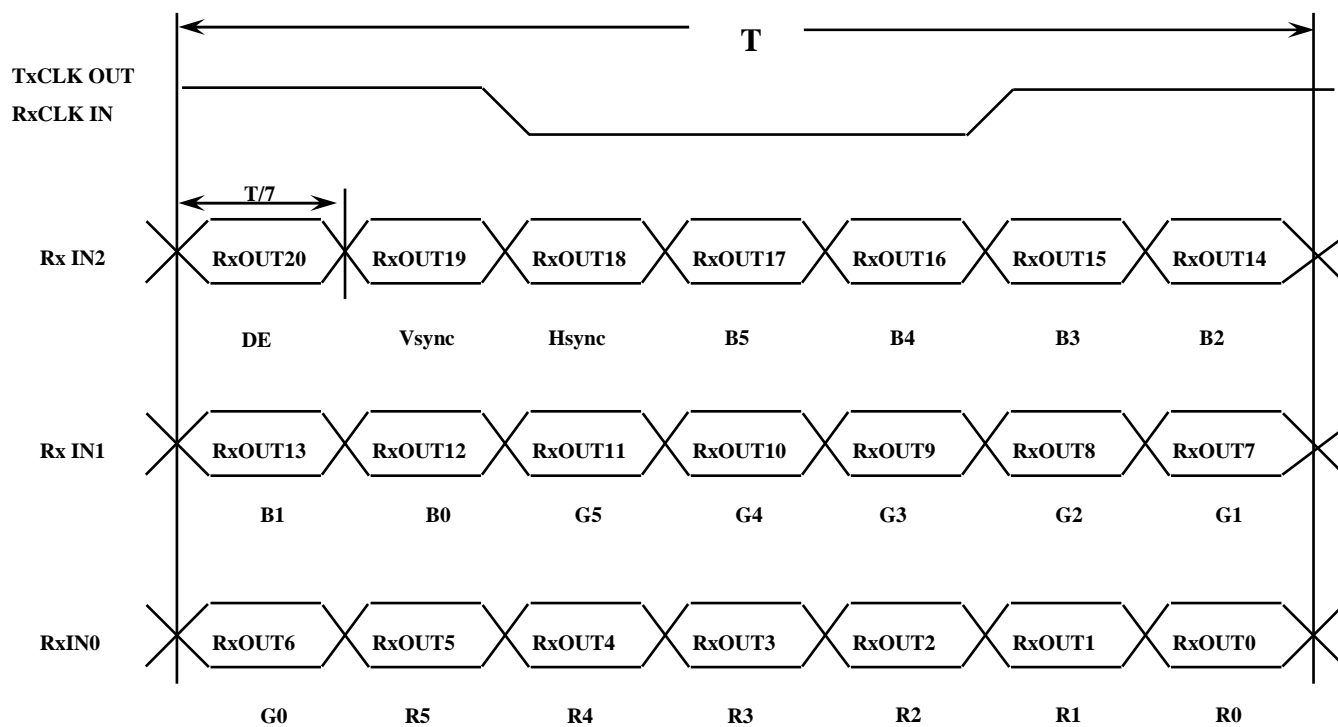
LVDS INTERFACE

Note : The LCD Module uses a 100ohm resistor between positive and negative lines of each receiver input.

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5.3 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON



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

Color	Display	Data Signal																Gray Scale Level	
		Red					Green					Blue							
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3		45
Basic Colors	Black	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	1	1	1	1	1	-
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	-
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	-
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	-
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	-
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	-
	White	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	R0
	Dark	1	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	R3~R60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R61
	Light	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R62
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R63
Gray Scale Of Green	Black	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	1	0	0	0	0	0	0	0	0	0	0	G1
	↑	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	G3~G60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	G61
	Light	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	G62
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	G63
Gray Scale Of Blue	Black	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	1	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	B2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	
	Light	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	B62
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B63

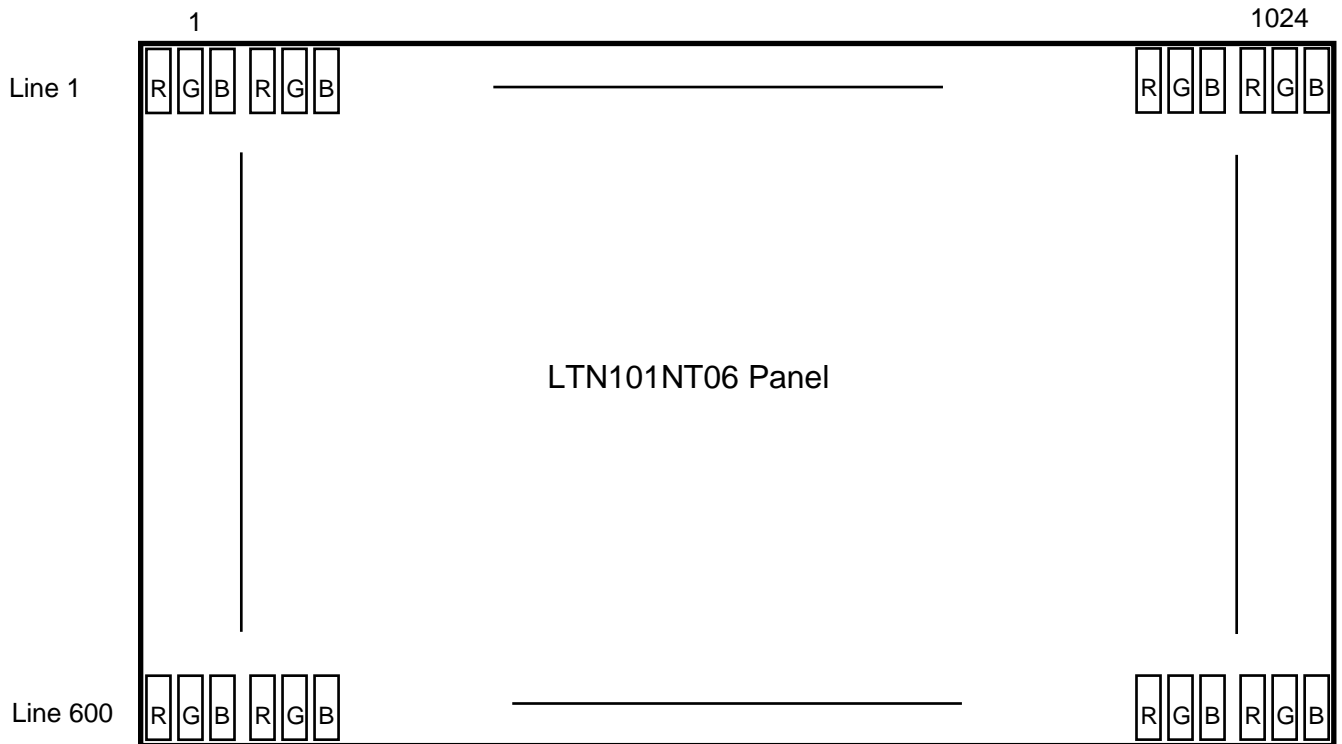
Note 1) Definition of gray :

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



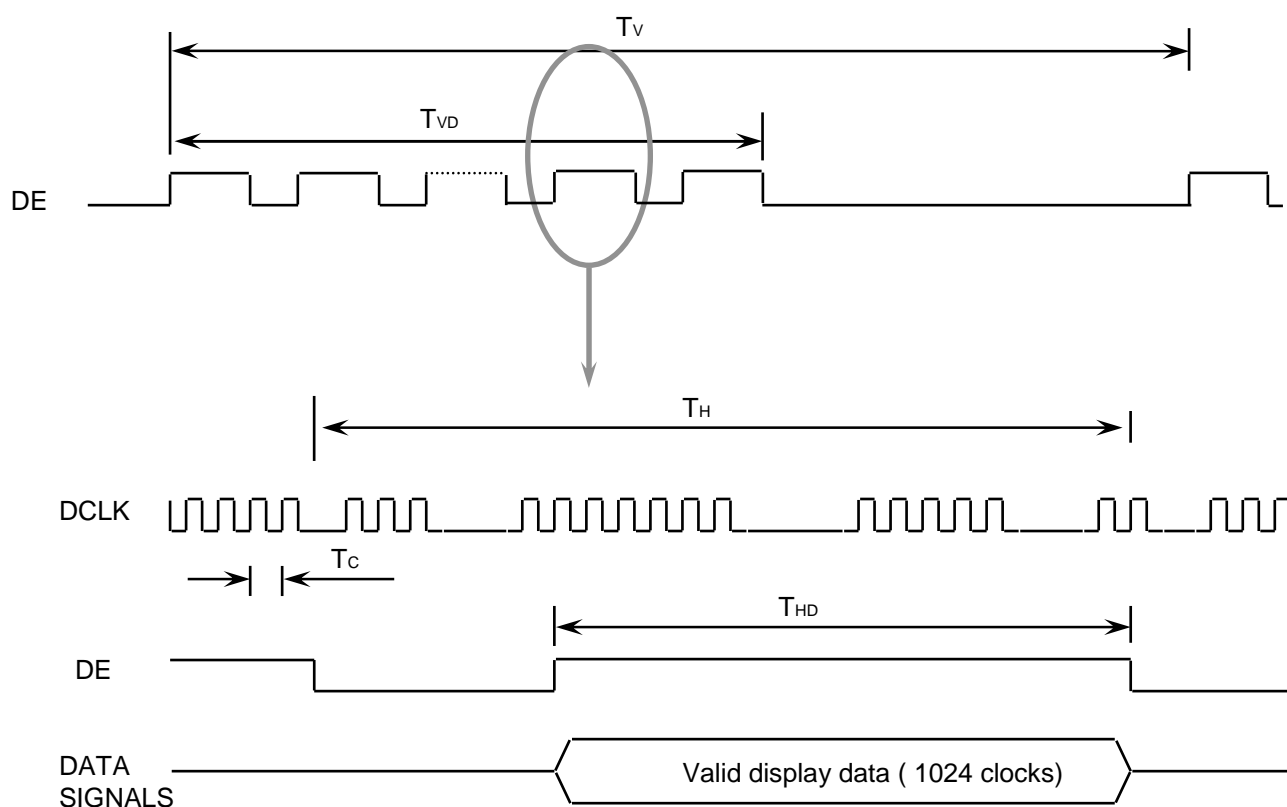
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6. INTERFACE TIMING

6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	-	673	-	Lines	
Vertical Active Display Term	Display Period	TVD	-	600	-	Lines	
One Line Scanning Time	Cycle	TH	1200	1400	1600	Clocks	
Horizontal Active Display Term	Display Period	THD	-	1024	-	Clocks	

6.2 Timing diagrams of interface signal

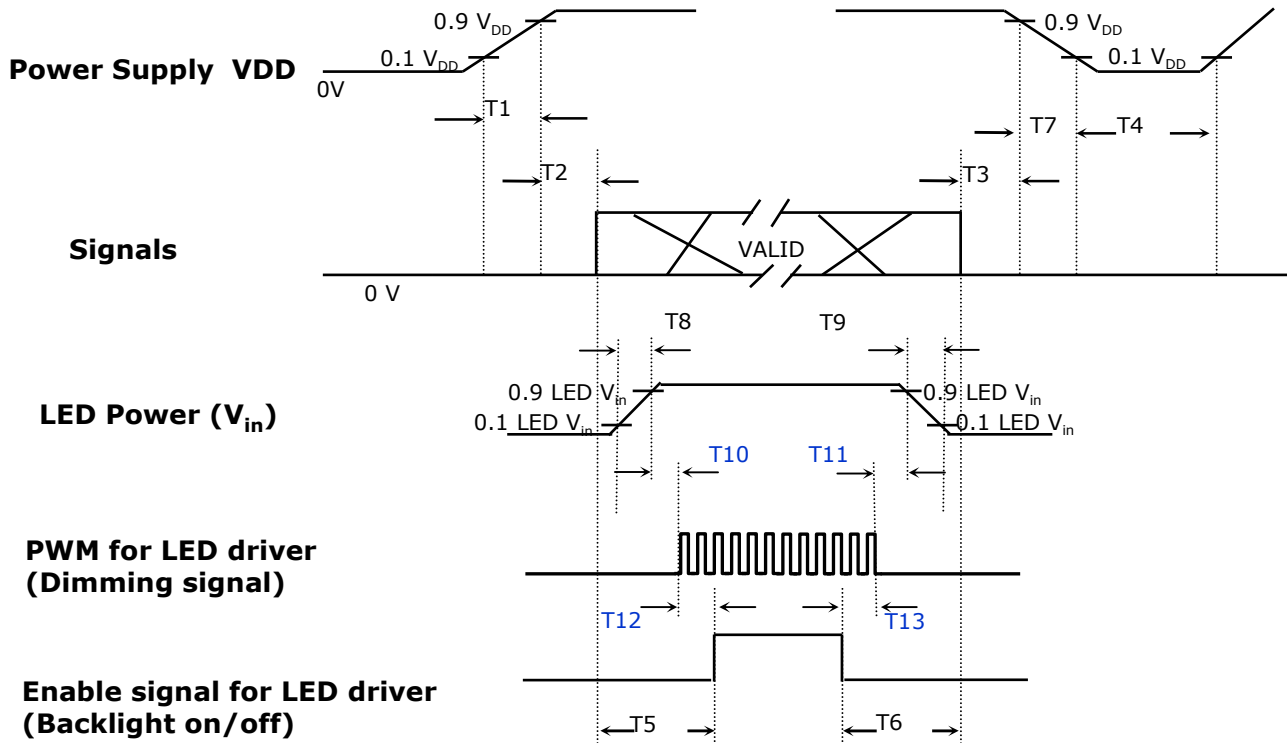


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6.3 Power ON/OFF Sequence

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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

Timing (ms)	Remarks
$0.5 < T1 \leq 10$	V _{DD} rising time from 10% to 90%
$0 < T2 \leq 50$	Delay from V _{DD} to valid data at power ON
$0 < T3 \leq 50$	Delay from valid data OFF to V _{DD} OFF at power Off
$500 \leq T4$	V _{DD} OFF time for Windows restart
$200 \leq T5$	Delay from valid data to B/L enable at power ON
$200 \leq T6$	Delay from valid data off to B/L disable at power Off
$0 < T7 \leq 10$	V _{DD} falling time from 90% to 10%
$0.5 < T8 \leq 10$	LED V _{in} rising time from 10% to 90%
$0.5 < T9 \leq 10$	LED V _{in} falling time from 90% to 10%
$0 \leq T10$	Delay from LED driver Vin rising time 90% to PWM ON
$0 \leq T11$	Delay from PWM Off to LED driver Vin falling time 10%, Must Keep rule
$0 \leq T12$	Delay from PWM ON to B/L Enable ON, Must Keep rule
$0 \leq T13$	Delay from B/L Enable Off to PWM Off

Power Sequence & Timing Parameters

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6.3 Power ON/OFF Sequence

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NOTE.

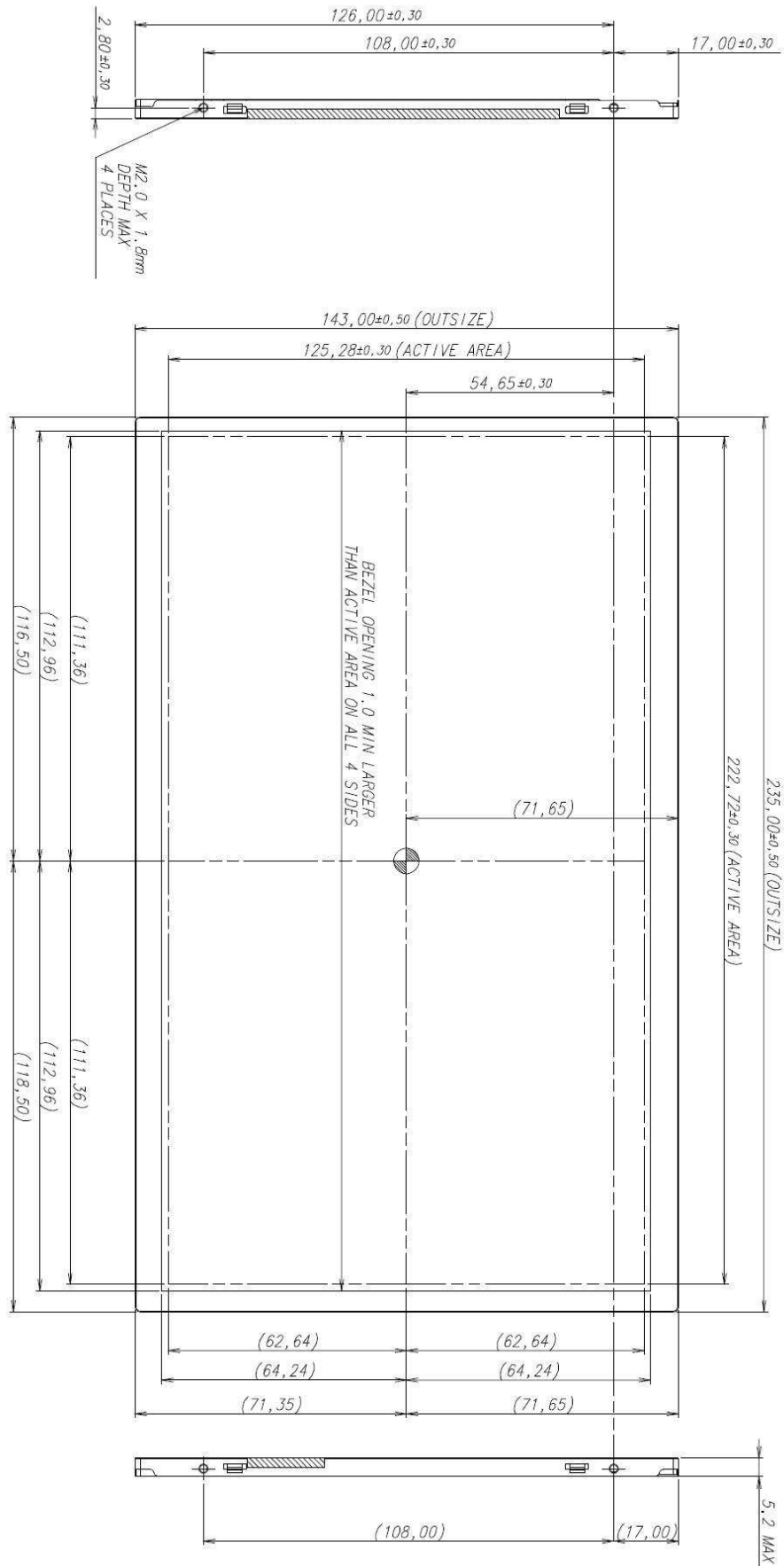
- (1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD} .
- (2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.
- (3) In case of $V_{DD} = \text{off level}$, please keep the level of input signals on the low or keep a high impedance.
- (4) T_4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

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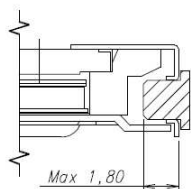
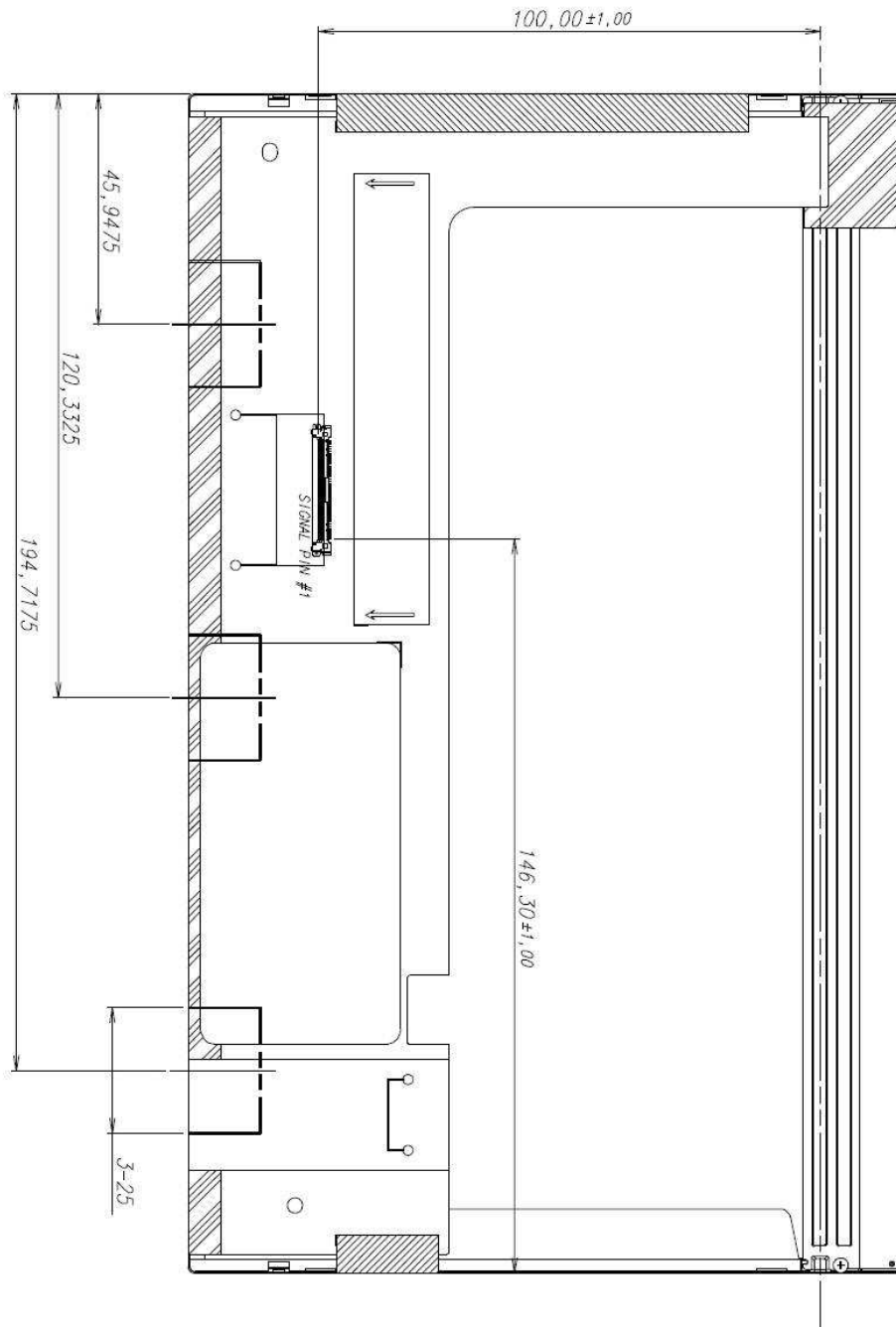
7. Mechanical Outline Dimension

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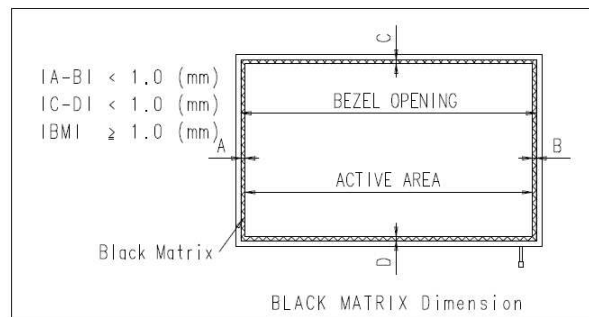


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SCREW PENETRATION DEPTH



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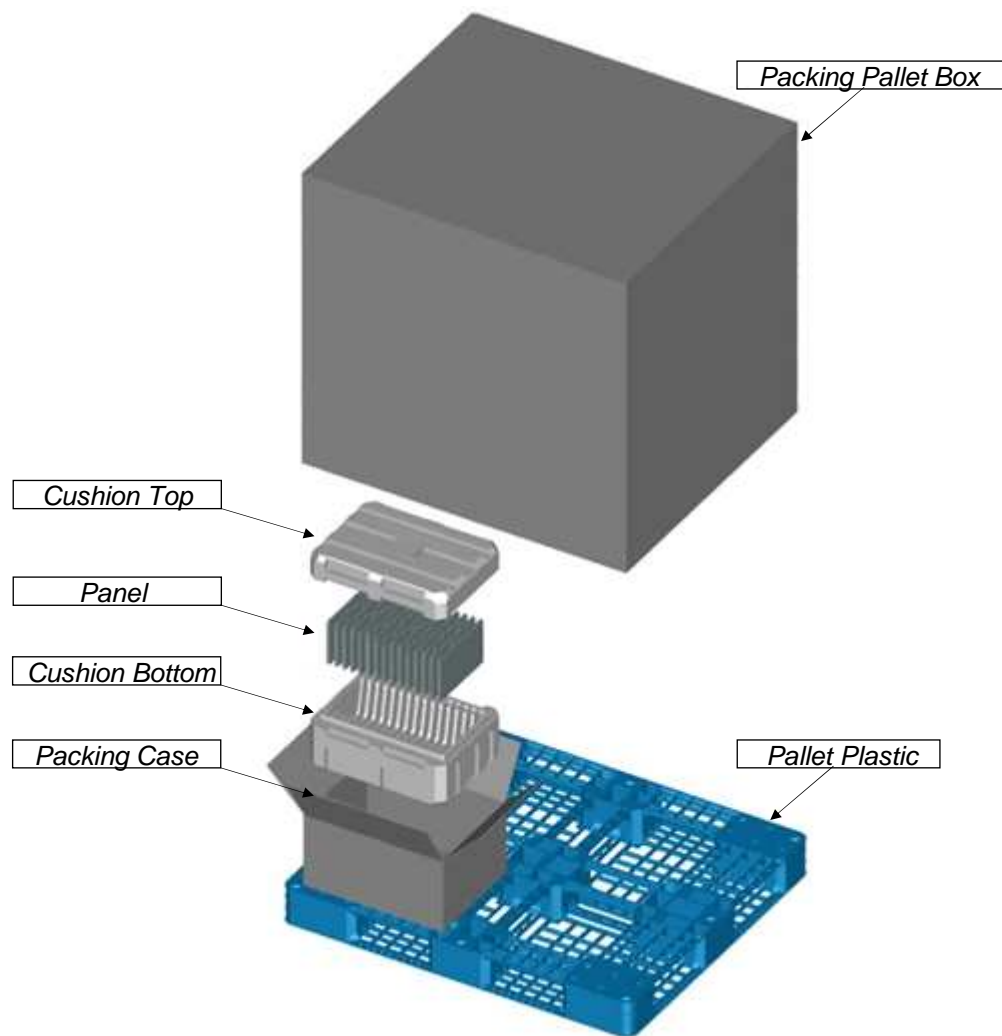
8. PACKING

1. CARTON(Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated pad form as shock absorber

(2) Packing Method



PACKING CASE

- Note 1) Total Weight : Approximately 7 kg
 2) Acceptance number of piling : 30 sets
 3) Carton size : 450(W) × 340(D) × 230(H)

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(3)Packing Material

No	Part name	Quantity
1	Static electric protective sack	30
2	Packing case (Inner box) included shock absorber	1 set
3	Pictorial marking	2 pcs
4	Carton	1 set

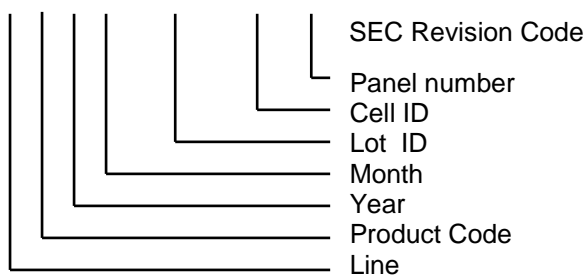
9. MARKINGS & OTHERS

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

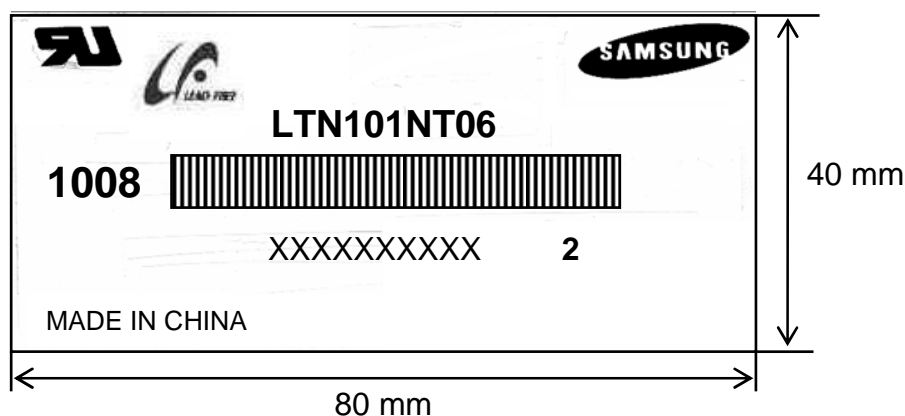
(1)Parts number : LTN101NT06

(2)Revision code : 3 letters

(3)Lot number : X X X X XXX XX X 2



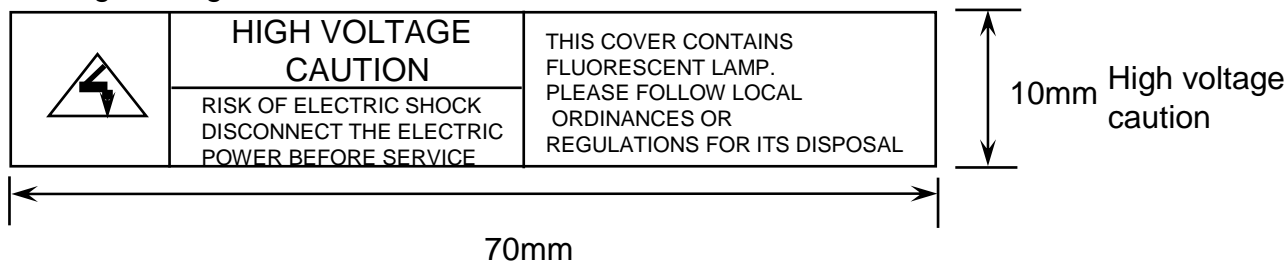
(5) Nameplate Indication



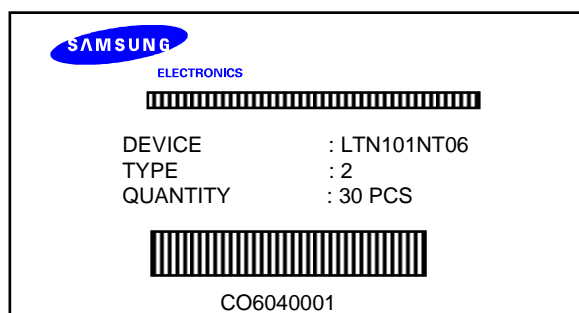
Parts name : LTN101NT06
 Lot number : XXXXXXXXXX
 Inspected work week :1008(2010 year, 8nd week)

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High voltage caution label



(6) Packing small box attach



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

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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 cable between the back-light connector and its inverter power supply shall be a minimized length and be connected directly . The longer cable between the back-light and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage (Vs).
- (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.

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