SAMSUNG ELECTRONICS

Approval

LEAD-FREE

TO : Lenovo/Wistron

DATE : Feb 1, 2010

SAMSUNG TFT-LCD

MODEL NO. : LTN170CT08-L01

NOTE : Extension code [-L01]
→ LTN170CT08-L01
Surface type [**Anti-Glare**]

Any modification of Spec is not allowed without SEC's permission

APPROVED BY : *Je-Hwan Oh*

PREPARED BY : *Ju-Ho Park*

LCD Application engineering part 3, TCS Team
Samsung Electronics Co., Ltd.

wise view™

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REVISION HISTORY

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Date	Revision No.	Page	Summary
July 19, 2009	P00	All	. The preliminary specification of LTN170CT08-L01 was issued first.
Aug 3, 2009	P01	9	. Definition of 13 points white variation was updated.
Nov 30, 2009	A00	All	. The approval specification of LTN170CT08-L01 was issued first.
Dec 2, 2009	A01	5	. Max weight was modified 700. . Operating humidity was modified. 8% min/ 95% max. . Maximum storage humidity was modified 95%. .
		10	. 40Hz in Vsync Frequency was added.
		21	.Power sequence was modified.
Dec 9, 2009	A02	23	.2D drawing was updated.
Dec 10, 2009	A03	5	.Humidity was updated.
		7	. Vertical (L) viewing angle was modified from 55 to 60. . Typ. Spec of color gamut was modified from 100 to 110.
Dec 11, 2009	A04	23	.2D drawing was updated. The distance from module edge to active area was added.
Feb 1, 2010	A05	24	.Head Code was changed from 1ZG2X to 1ZHBX.

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GENERAL DESCRIPTION

DESCRIPTION

LTN170CT08 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 17.0" contains 1920 x 1200 pixels and can display up to 16,777,216 colors. 6 O'clock direction is the Optimum viewing angle.

FEATURES

- High contrast ratio, high aperture structure
- WUXGA (1920 x 1200) pixels resolution
- True 8-bit Source IC
- Low power consumption
- Fast Response
- RGB-LED Back Light with 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	367.20(H) X 229.50(V) (17.0” diagonal)	mm	
Driver element	a-si TFT active matrix		
Display colors	16,777,216		
Number of pixel	1920*1200	pixel	16:10
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.19125(H) x 0.19125(V)	mm	
Display Mode	Normally white		
Surface treatment	Haze 40, Hardness ≥ 3H		

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Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	381.7	382.2	382.7	mm	
	Vertical (V)	247.0	247.5	248.0	mm	
	Depth (D)	-	6.8	7.0	mm	(1)
Weight		-	-	700	g	

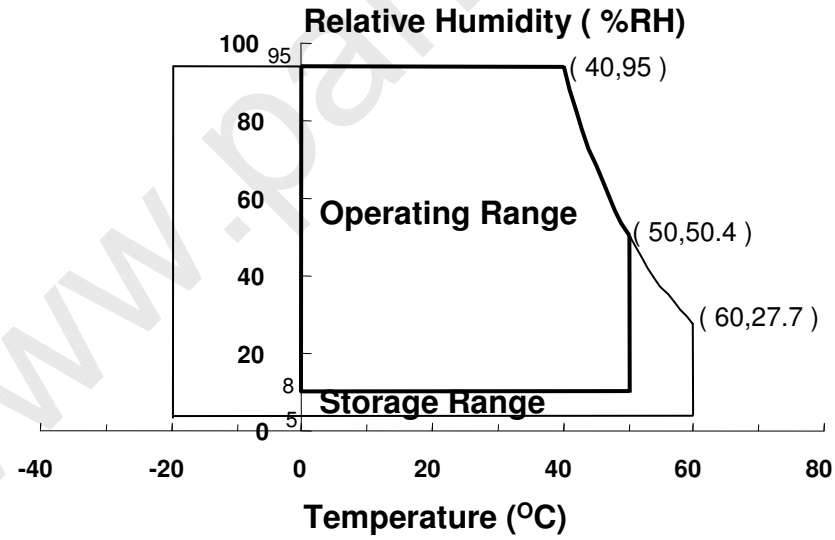
Note (1) Measurement condition of outline dimension
. Equipment : Vernier Calipers
. Push Force : 500g ·f (minimum)

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 °C ≥ Ta)
Maximum wet - bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation



(2) 2ms, half sine wave, one time for ±X, ±Y, ± 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.
(5) If product is used for extended time excessively or exposed to high temperatures for extended time, there is a possibility of wide viewing angle film damage which could affect visual characteristics.

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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 Ta (25 ± 2 °C)

(2) BACK-LIGHT UNIT

Ta = 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Current	RED	-	28.5	-	mA	(1)
	GREEN	-	33	-		
	BLUE	-	21	-		
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 : SR-3

* Ta = 25 ± 2 °C, V_{DD}=3.3V, fv= 60Hz, f_{DCLK} = 161.6MHz

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR	Normal Viewing Angle $\phi = 0$ $\theta = 0$	-	600	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T_{RT}		-	16	25	msec	(1), (3)
Average Luminance of White (5 Points)		$Y_{L,AVE}$		240	280	-	cd/m^2	IF=20.0mA (1), (4)
Color Chromaticity (CIE)	Red	R_X		0.663	0.693	0.723	-	(1), (5) SR-3
		R_Y		0.269	0.299	0.329		
	Green	G_X		0.169	0.199	0.229		
		G_Y		0.684	0.714	0.744		
	Blue	B_X		0.116	0.146	0.176		
		B_Y		0.027	0.057	0.087		
	White	W_X		0.283	0.313	0.343		
		W_Y		0.299	0.329	0.359		
Viewing Angle	Hor.	θ_L	CR ≥ 10	-	70	-	Degrees	(1), (5) SR-3
		θ_R		-	70	-		
	Ver.	ϕ_H		-	50	-		
		ϕ_L		-	60	-		
Color Gamut		C_G		-	110	-	%	
Brightness uniformity		$\delta_{L\,5}$	5points	80	-	-	%	(3)
		$\delta_{L\,13}$	13points	60	-	-		(6)

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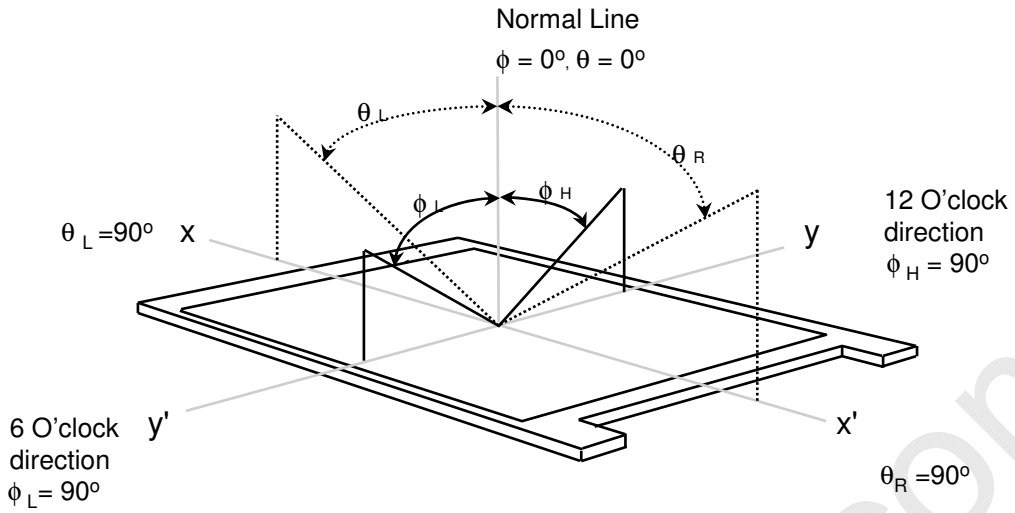
Note 1) Definition of Viewing Angle : Viewing angle range(10 ≤ C/R)

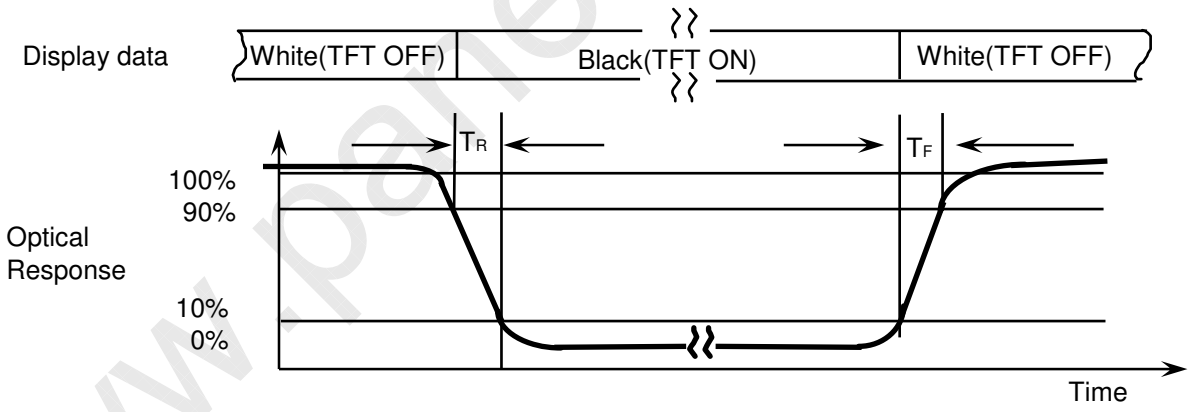


Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

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

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

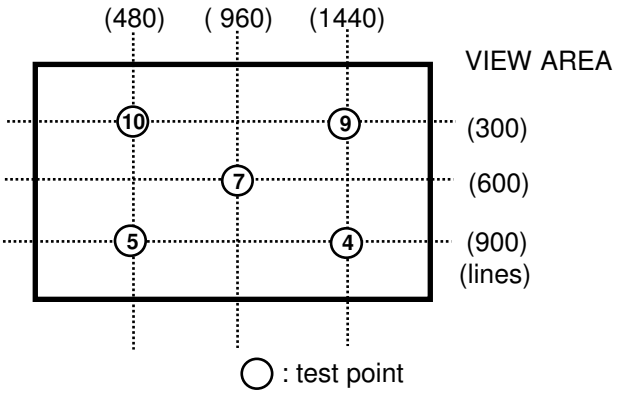
Note 3) Definition of Response time :



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

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

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



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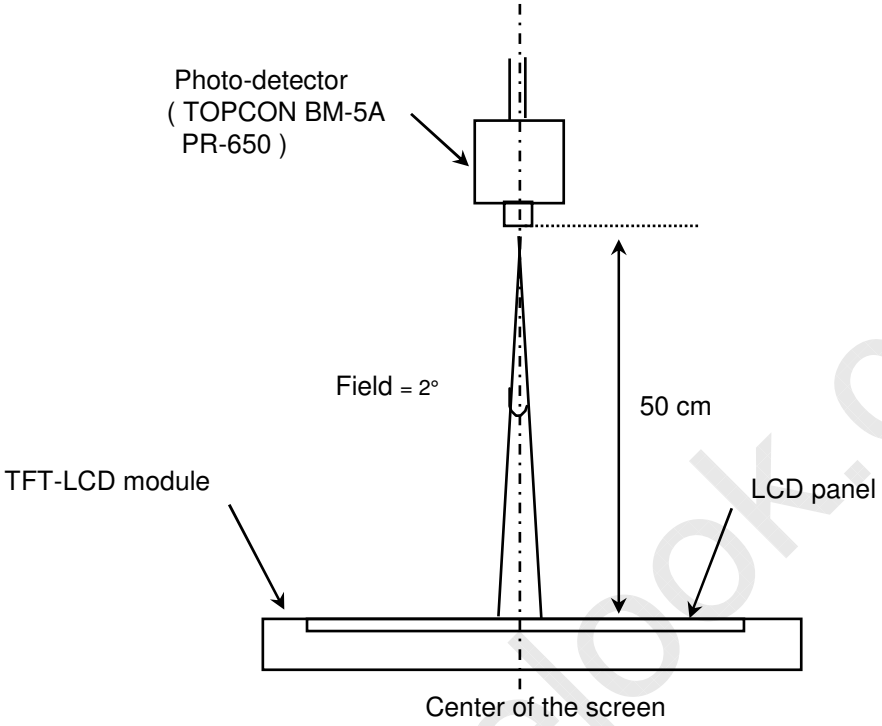
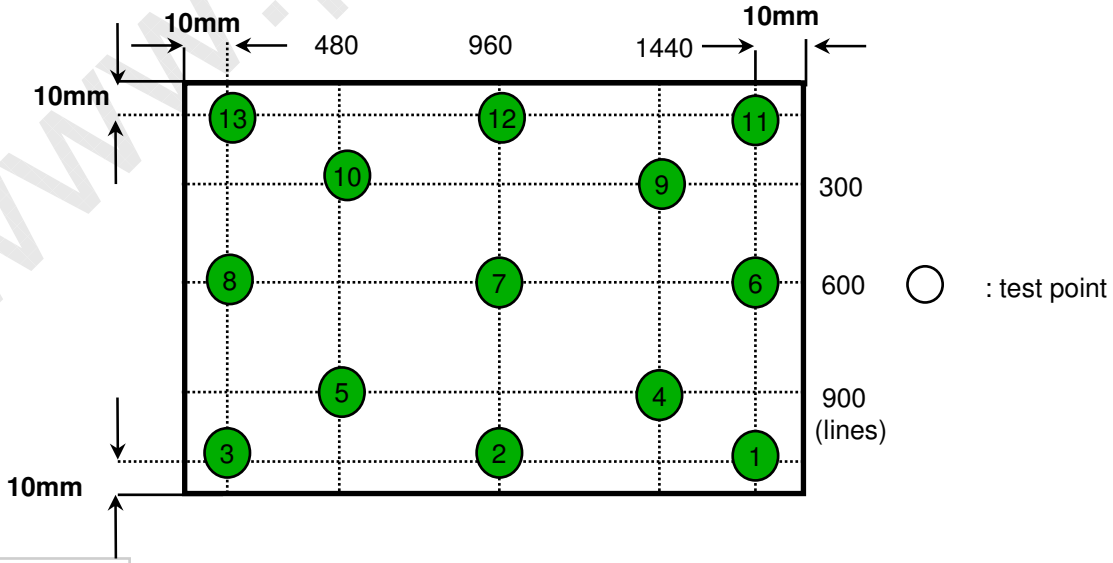
Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless,and dark room.
30 min after lighting the backlight. This should be measured in the center of screen.
LED current : 20mA (Inverter : SIC-130T)
Environment condition : Ta = 25 ± 2 °C



[Optical characteristics measurement setup]

Note 6) Definition of 13 points white variation (δ_L), [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

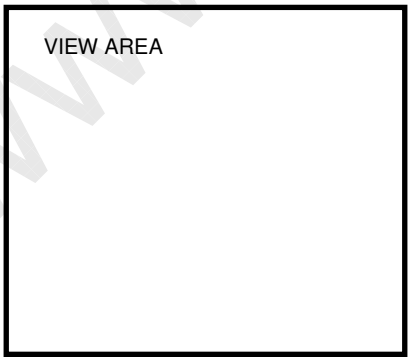
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	High	V_{IH}	-	-	+100	mV	V_{CM} = +1.2V
	Low	V_{IL}	-100	-	-	mV	
Vsync Frequency	60Hz	Hsync Freq.	-	73.20	-	KHz	
		Main Freq.	159.63	161.63	163.63	MH	
	50Hz	Hsync Freq.	-	61.00	-	KHz	
		Main Freq.	132.69	134.69	136.69	MH	
	40Hz	Hsync Freq.	-	48.80	-	KHz	
		Main Freq.	105.75	107.75	109.75	MH	
Main Frequency		f_{DCLK}				MHz	
Rush Current		I_{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	I_{DD}	-	820	-	mA	(2),(3)*a
	Mosaic		-	950	-	mA	(2),(3)*b
	V. Stripe		-	1150	1300	mA	(2),(3)*c

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

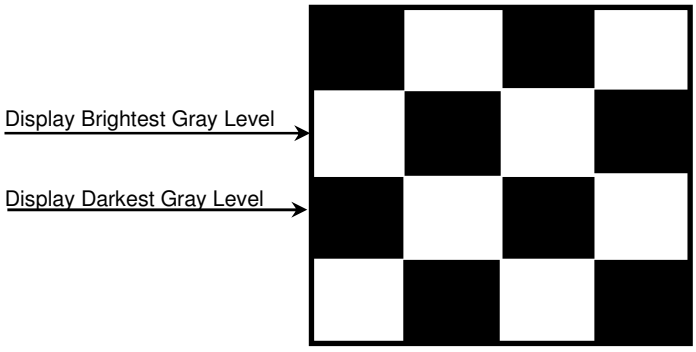
(2) f_V = 60Hz, f_{DCLK} = 161.6MHZ, V_{DD} = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern



*b) Mosaic Pattern



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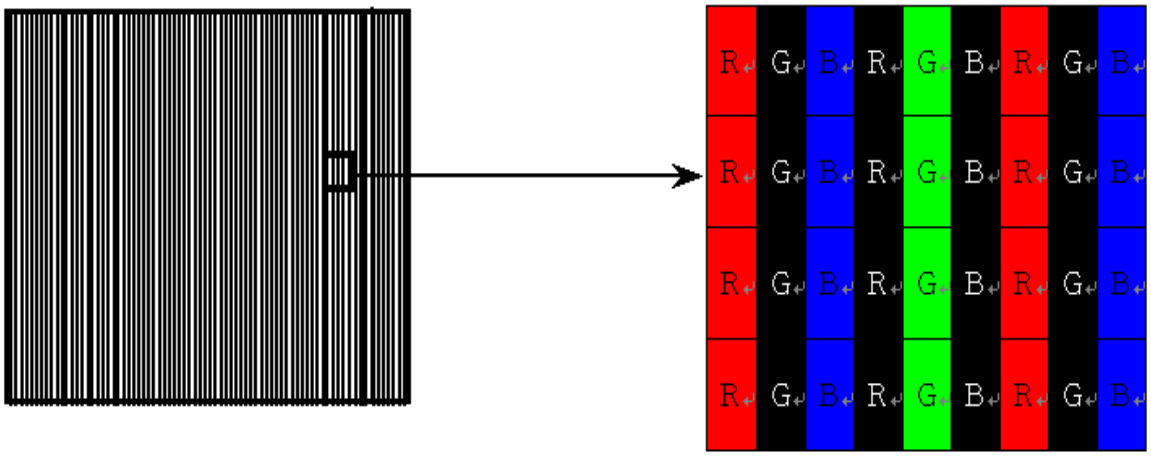
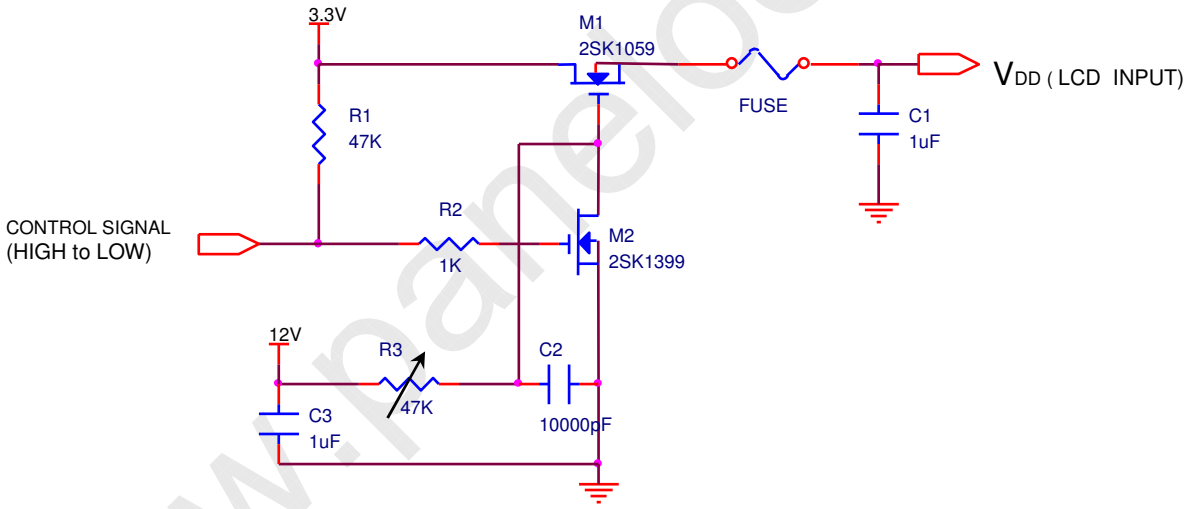
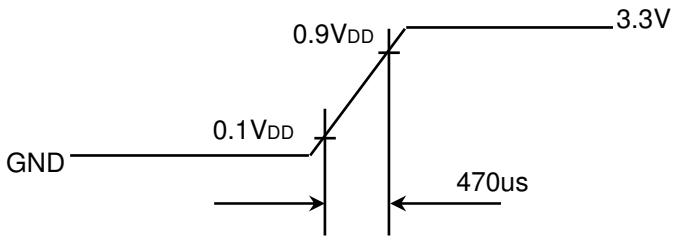
*c) 1dot Vertical stripe pattern



4) Rush current measurement condition



VDD rising time is 470us



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3.2 BACK-LIGHT UNIT

Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	Ir	-	28.5	60	mA	
	Ig	-	33	60	mA	
	Ib	-	21	60	mA	
LED Forward Voltage	VFr	-	-	2.4	V	
	VFg	-	-	3.4	V	
	VFb	-	-	3.4	V	
LED Array Voltage	VPr	16.86	18.06	19.26	V	
	VPg	24.66	25.86	27.06	V	
	VPb	25.26	26.46	27.66	V	
Power Consumption	P	-	13.0	14.0	W	IF X VF X 48LEDs
Operating Life Time	Hr	10000	-	-	Hour	(1)

3.3 LED Driver

- LED Driver Manufacturer : National semiconductor

Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V_{in}	7.5	19.0	21.0	V	
Duty Ratio		10	-	100	%	
PWM Frequency	F_{PWM}	0.1	-	10	KHz	
Operating Frequency	F_o	-	1.25	-	MHz	600KHz Possible
Efficiency	η	80	-	-	%	

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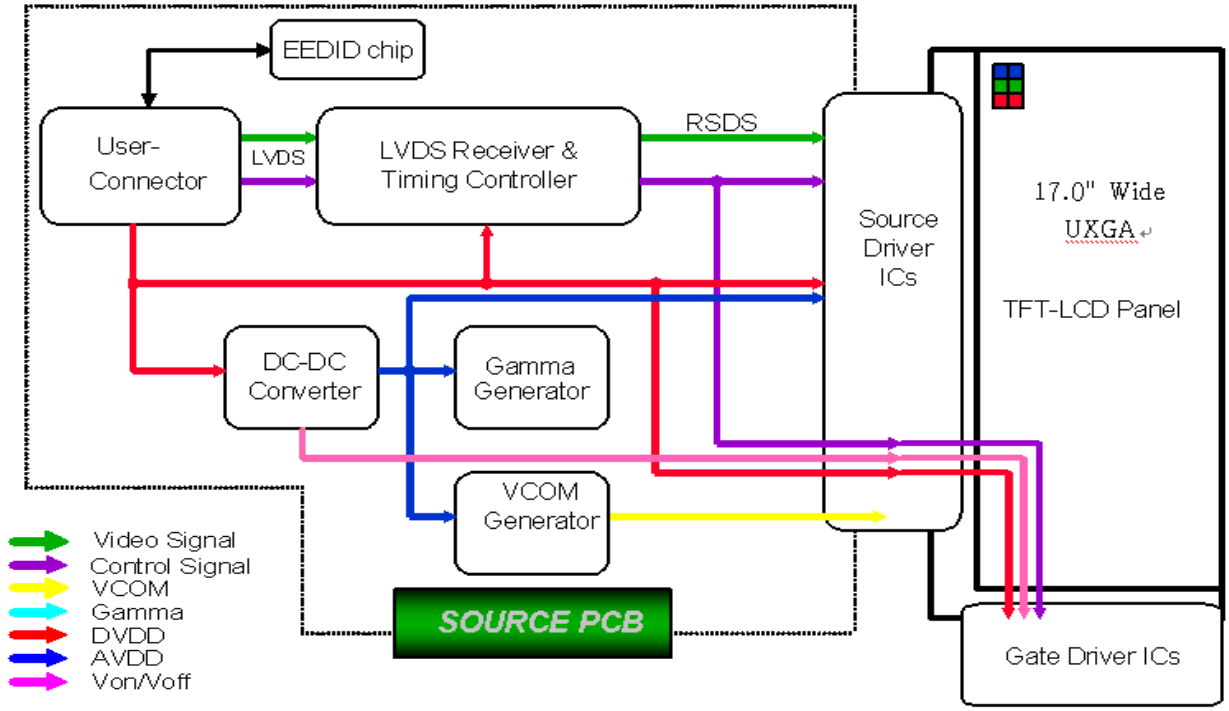
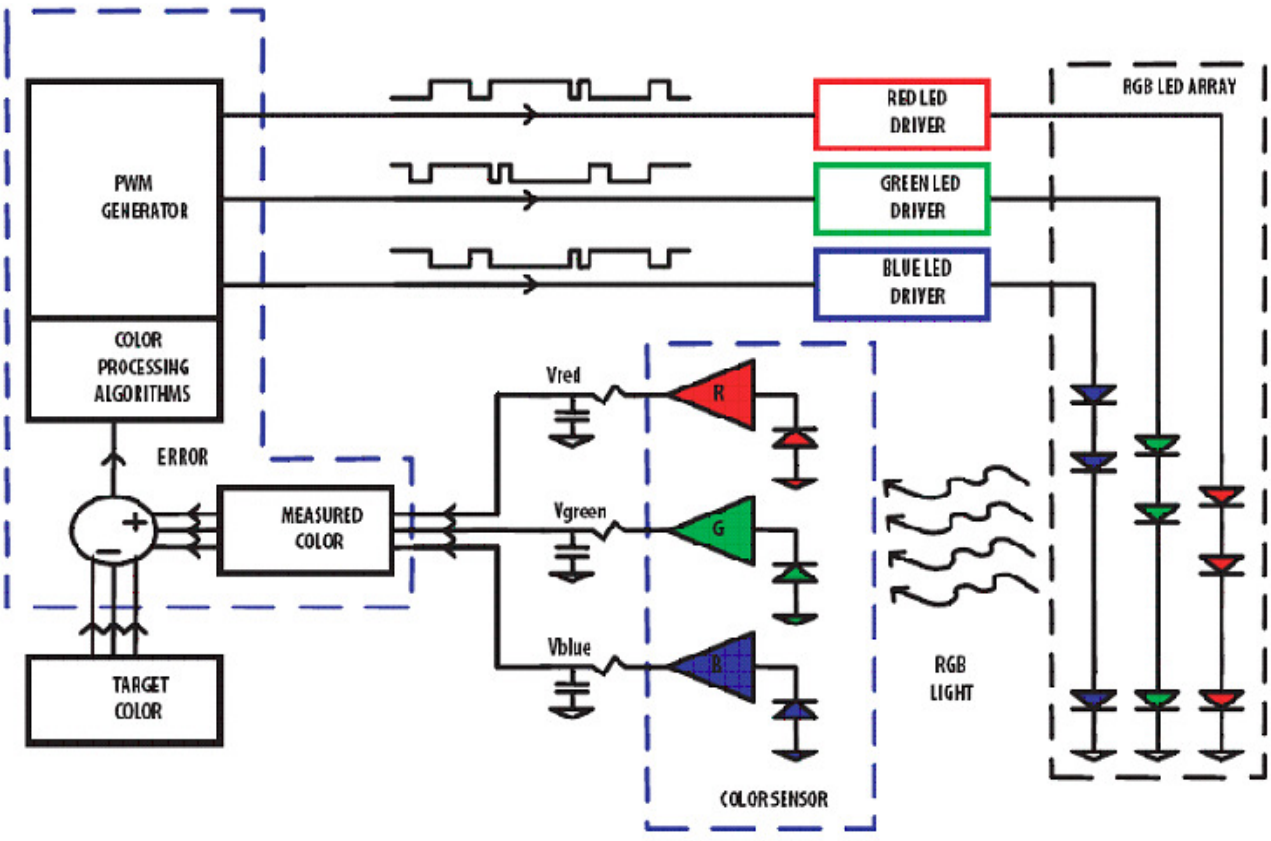
4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 LED placement structure



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5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (40pins, JAE NXB40SL-HF10, 0.8mm pitch & 20pins, JAE XB20S-HF10, 1.0mm pitch)

Pin	Signal	Function
1~2	GND	Ground
3~5	VDD	Logic power 3.3V(Panel logic)
6~7	VCC_EDID (3.3v	EDID 3.3V power
8	CLK EEDID	EDID clock
9	DATA EEDID	EDID data
10	Odd_Rin0-	G0 /R0,1,2,3,4,5
11	Odd_Rin0+	G0 /R0,1,2,3,4,5
12	GND	Ground
13	Odd_Rin1-	B0,1 / G1,2,3,4,5
14	Odd_Rin1+	B0,1 / G1,2,3,4,5
15	GND	Ground
16	Odd_Rin2-	DE/ VSYNC/ HSYNC/ B2,3,4,5
17	Odd_Rin2+	DE/ VSYNC/ HSYNC/ B2,3,4,5
18	GND	Ground
19	Odd_ClkIN-	- LVDS differential clock input
20	Odd_ClkIN+	+ LVDS differential clock input
21	GND	Ground
22	Odd_Rin3-	B6,7 / G6,7 /R6,7
23	Odd_Rin3+	B6,7 / G6,7 /R6,7
24	GND	Ground
25	Even_Rin0-	G0 /R0,1,2,3,4,5
26	Even_Rin0+	G0 /R0,1,2,3,4,5
27	GND	Ground
28	Even_Rin1-	B0,1 / G1,2,3,4,5
29	Even_Rin1+	B0,1 / G1,2,3,4,5
30	GND	Ground
31	Even_Rin2-	DE/ VSYNC/ HSYNC/ B2,3,4,5
32	Even_Rin2+	DE/ VSYNC/ HSYNC/ B2,3,4,5
33	GND	Ground
34	Even_ClkIN-	- LVDS differential clock input
35	Even_ClkIN+	+ LVDS differential clock input
36	GND	Ground
37	Even_Rin3-	B6,7 / G6,7 /R6,7
38	Even_Rin3+	B6,7 / G6,7 /R6,7
39	GND	Ground
40	WPN	Samsung Internal purpose only for Write Protection Control

Pin	Signal	Function
1	GND	Ground
2	VBL+	7.5V – 21V LED power
3	VBL+	7.5V – 21V LED power
4	VBL+	7.5V – 21V LED power
5	VBL+	7.5V – 21V LED power
6	VBL+	7.5V – 21V LED power
7	MCU VBL+	7.5V – 21V MCU power
8	VBL-	LED power return
9	VBL-	LED power return
10	VBL-	LED power return
11	VBL-	LED power return
12	VBL-	LED power return
13	Calibration Rx	Samsung Internal purpose only for Calibration
14	GND	Ground
15	I2C_DATA	SET I2C DATA
16	I2C CLK	SET I2C CLOCK
17	GND	Ground
18	PWM	BLU Dimming
19	Calibration Tx	Samsung Internal purpose only for Calibration
20	GND	Ground

5.2 LVDS Interface : Transmitter SN75LVDS86 or Compatible

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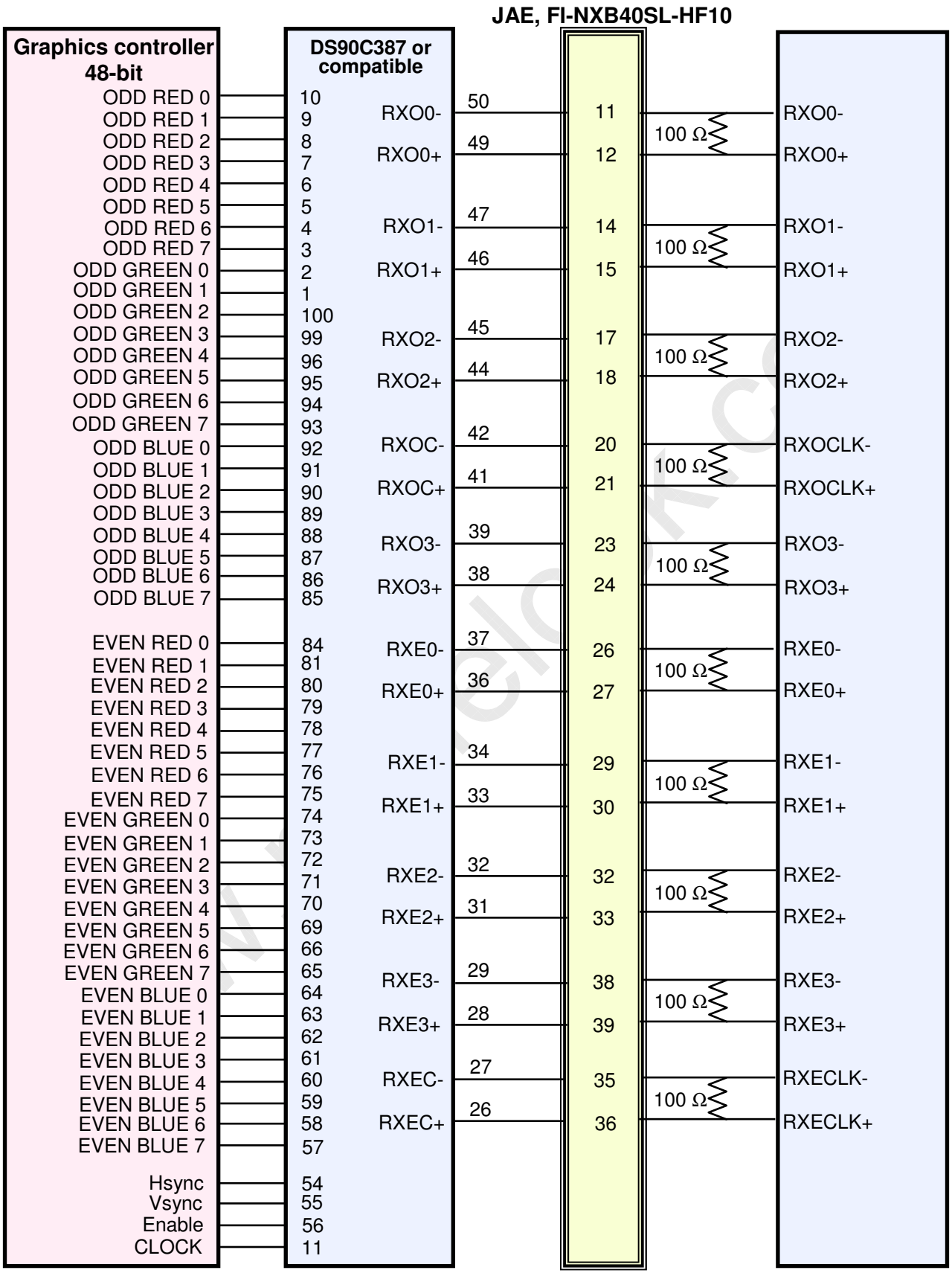
LVDS Interface



Note : The LCD Module uses a 82ohm 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

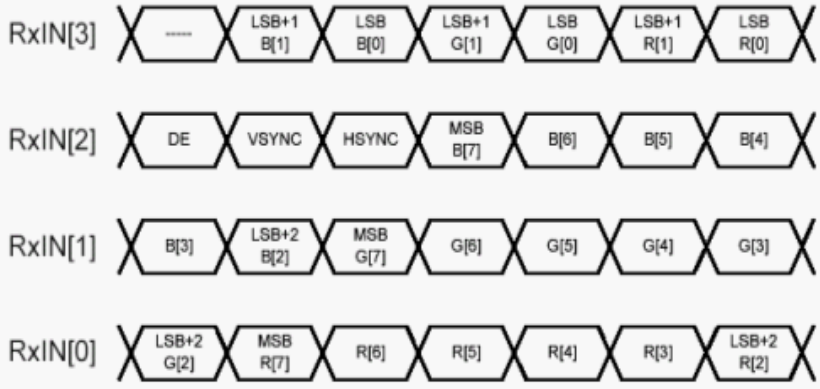

Figure 3: LSB's on RxIN[3]

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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	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	
Basic Colors	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R252
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
	Light	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G252
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253
	Light	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B252
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253
	Light	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)
Note 2)Input signal: 0 =Low level voltage, 1=High level voltage

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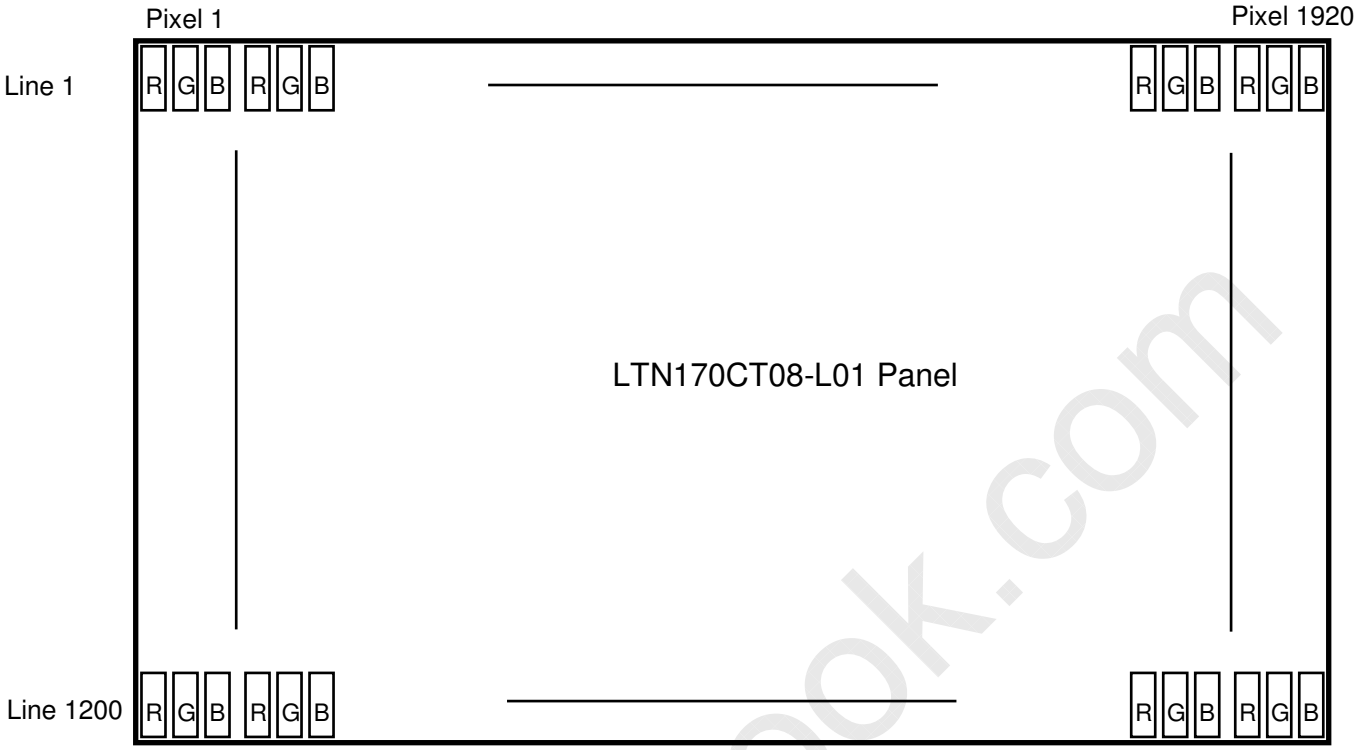
5.5 Pixel Format in the display



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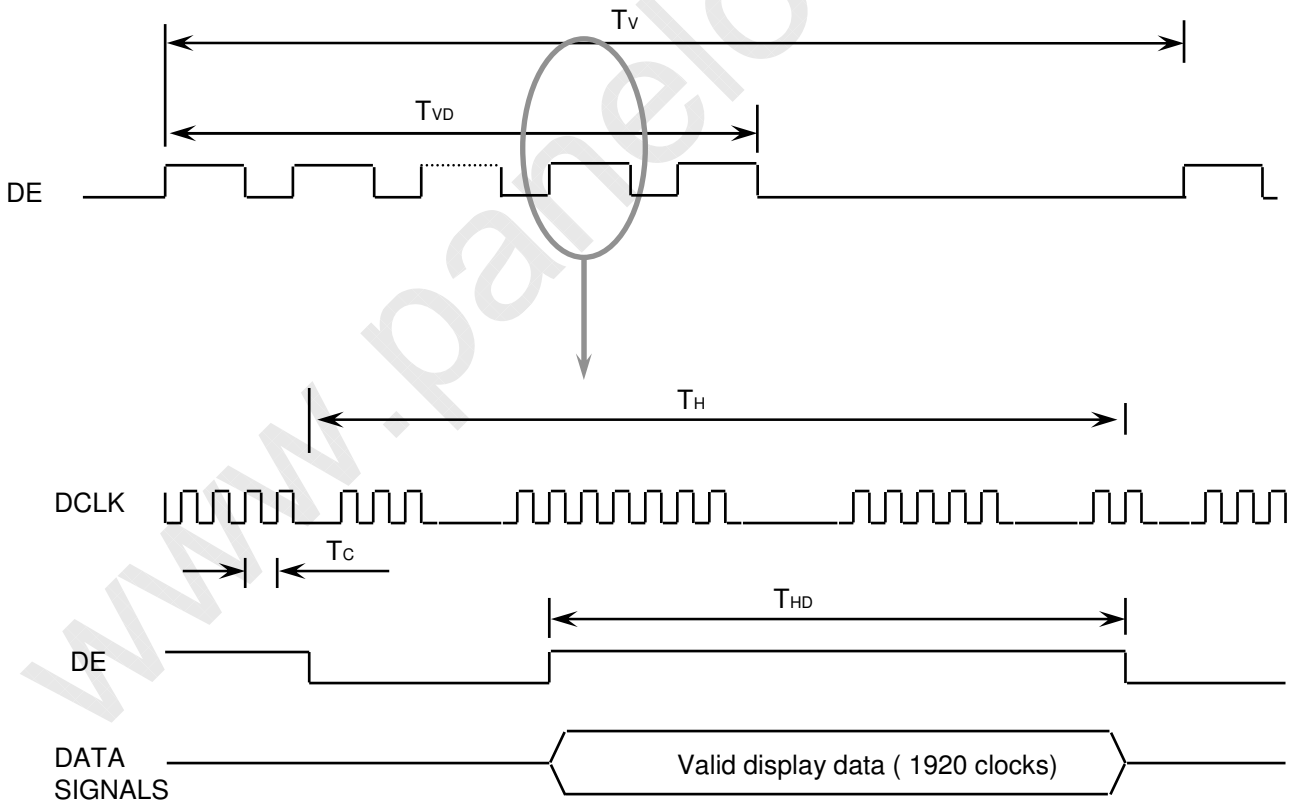
6. INTERFACE TIMING

6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	-	1220	-	Lines	-
Vertical Active Display Term	Display Period	TVD	-	1200	-	Lines	-
One Line Scanning Time	Cycle	TH	2180	2208	2236	Clocks	-
Horizontal Active Display Term	Display Period	THD	-	1920	-	Clocks	-

6.2 Timing diagrams of interface signal



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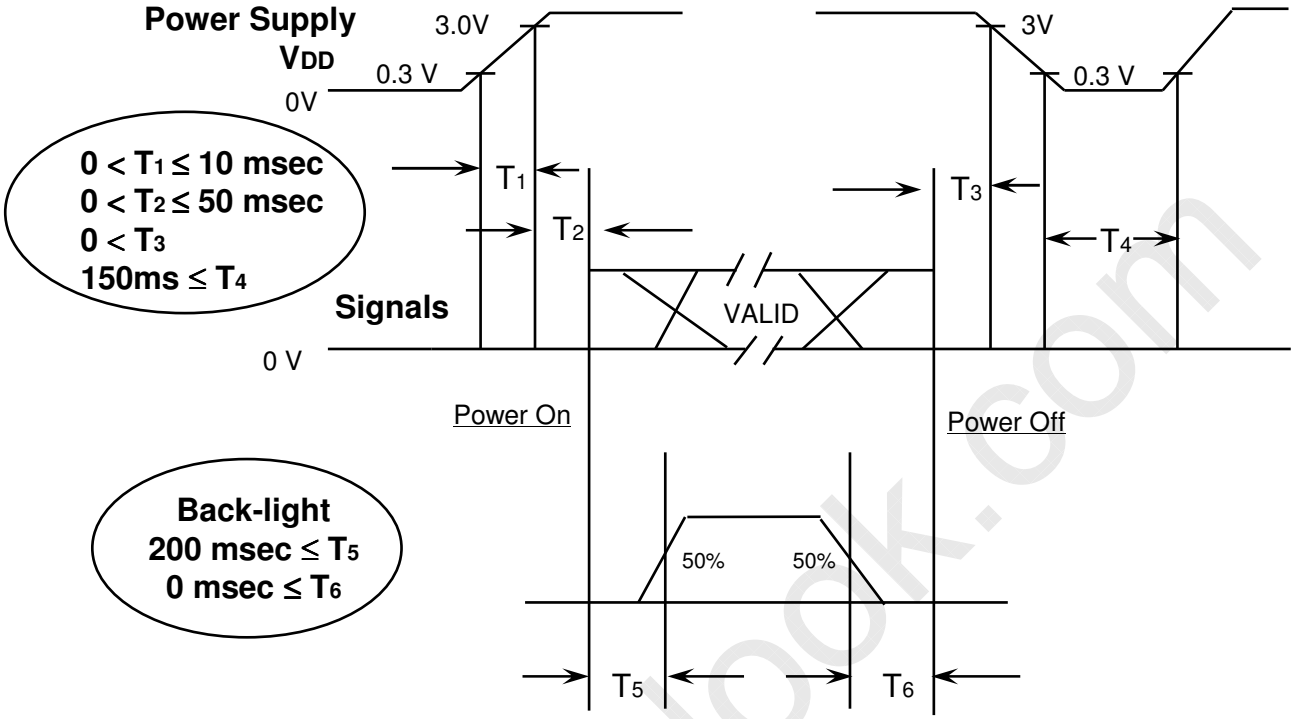
6.3 Power ON/OFF Sequence

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



Power ON/OFF Sequence

T1 : Vdd rising time from 0.3V to 3.0V
T2 : The time from Vdd to valid data at power ON.
T3 : The time from valid data off to Vdd off at power Off.
T4 : Vdd off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : 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 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} = off level, please keep the level of input signals on the 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 shall not be kept at high impedance when the power is on.

7. MECHANICAL OUTLINE DIMENSION

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[Refer to the next page]

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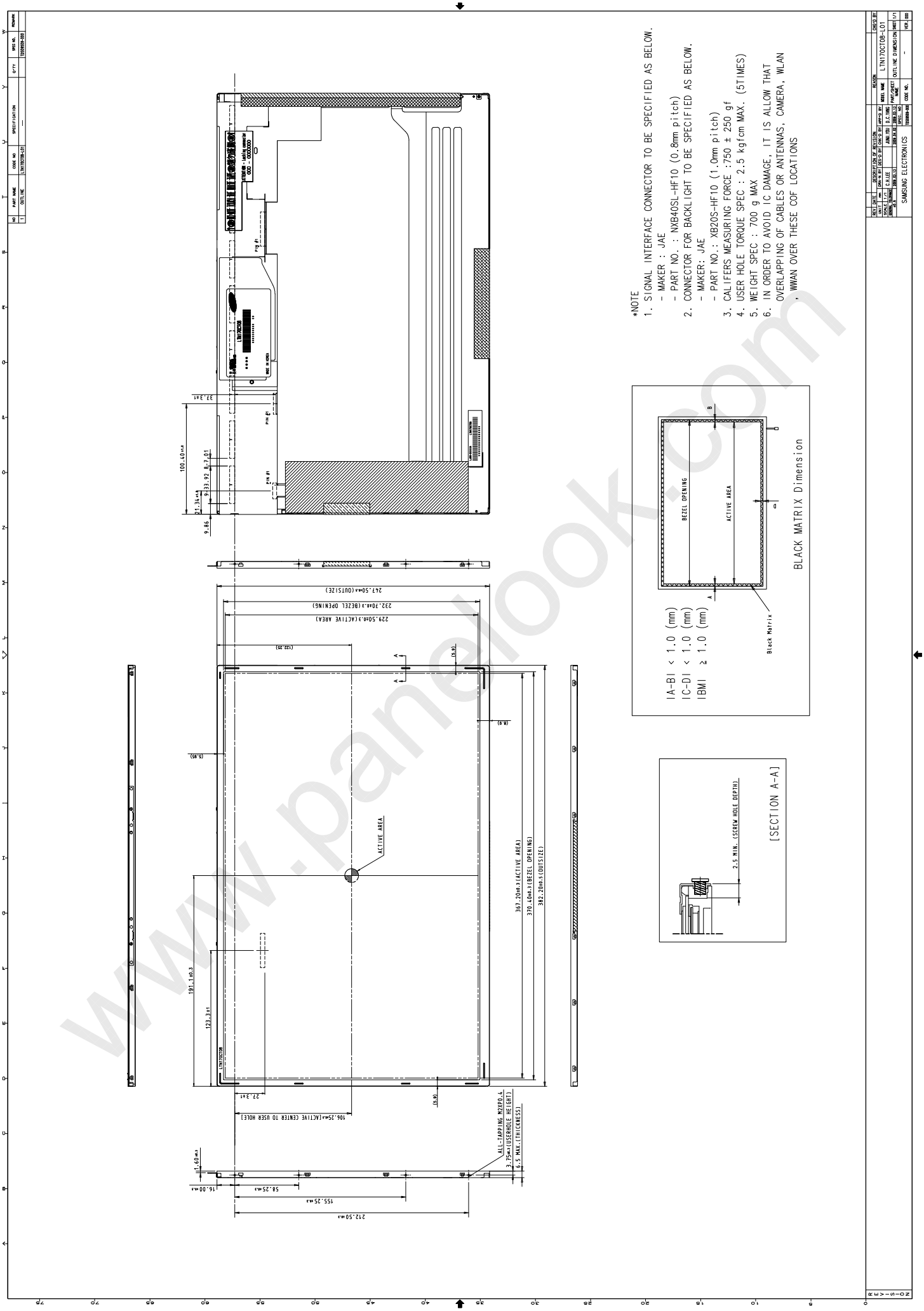

8. PACKING

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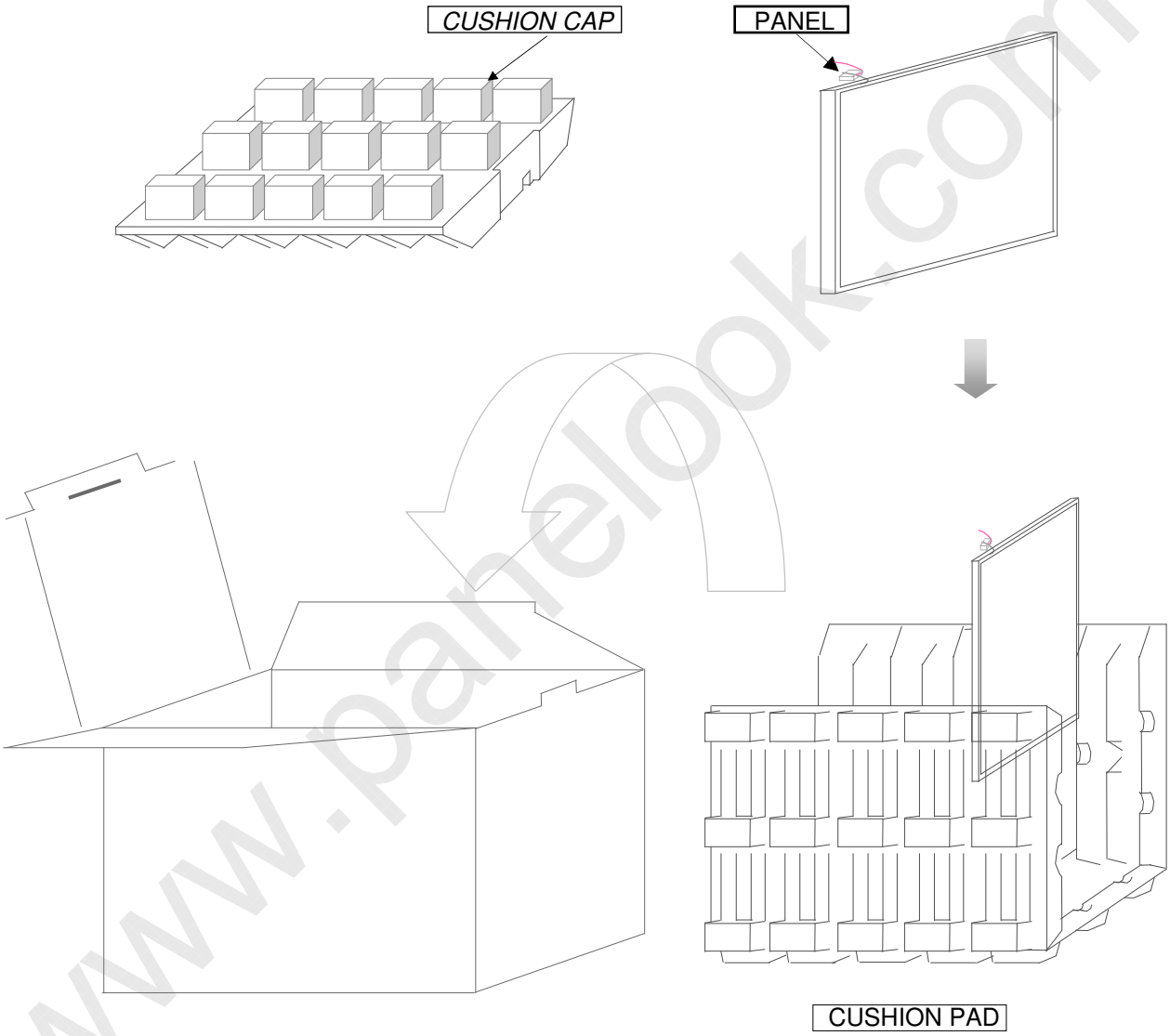
1. CARTON (Internal Package)

(1) Packing Form
Corrugated Cardboard box and Corrupad form as shock absorber

(2) Packing Method



Note 1)Total Weight : Approximately 10 kg
2) Acceptance number of piling : 10 sets
3) Carton size : 376(W)*326(D)*404(H)

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(3)Packing Material

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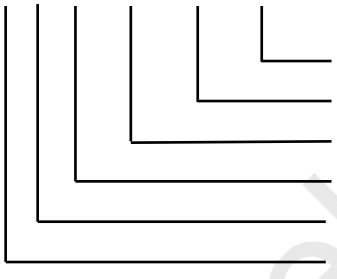
No	Part name	Quantity
1	Static electric protective sack	10
2	Packing case (Inner box)	1 set
3	Pictorial marking	2 pcs
4	Silicagel (500 x 1)	1
5	Carton	1 set

9. MARKINGS & OTHERS

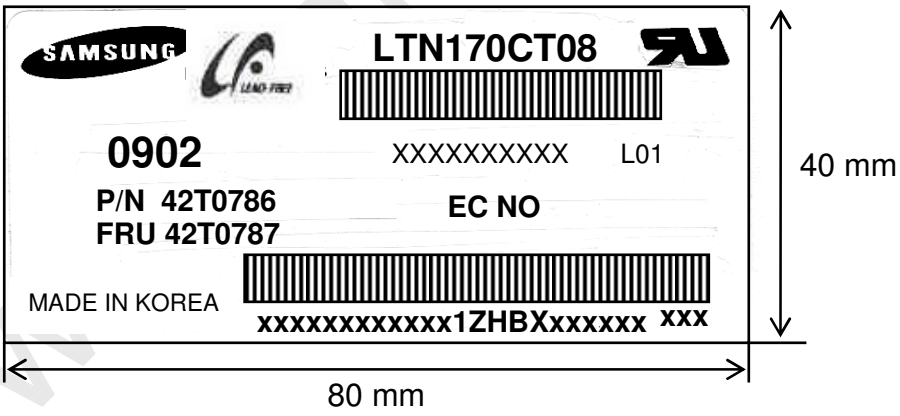
A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1)Parts number : LTN170CT08-L01
(2)Revision : One letter
(3)Control code : One letter
(4)Lot number : X X X XXX XX XX



NOTE 1). This code indicating year is omitted in the products of TG site.

(5) Product Label Definition



TFT-LCD Product name : LTN170CT08
Lot number : XXXXXXXXXX
Revision Code : L01
Inspected work week : 1008(2010 Year, 8nd week)
P/N : Lenovo Part Number (42T0786)
EC NO : Engineering Change Number (Blank)
FRU : Field Replaceable Unit Part Number(42T0787)
Header Code : 1ZHBX (one Z H B X)

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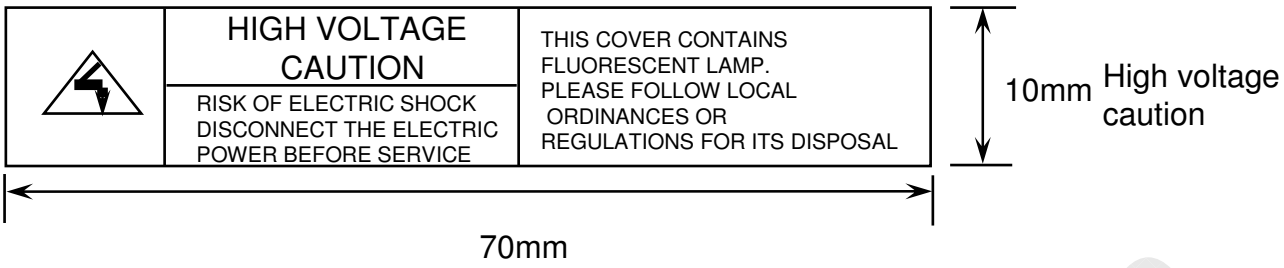
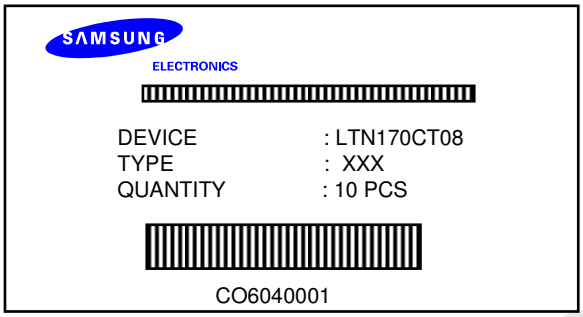
(6) High voltage caution label

This HIGH VOLTAGE CAUTION is carved in mold frame



(7) Packing small box attach



(8) Packing box Marking : Samsung TFT-LCD Brand Name

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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 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 (Isoprophyl Alcohol) or Hexane.
Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.

(i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(j) Do not disassemble the module.

(k) Do not pull or fold the lamp wire.

(l) Do not 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.

11. EDID

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Address (HEX)	FUNCTION	Value HEX	BIN	DEC	ASCII or Data	Notes	Comments
00	Header	00	00000000	0		EDID Header	
01		FF	11111111	255			
02		FF	11111111	255			
03		FF	11111111	255			
04		FF	11111111	255			
05		FF	11111111	255			
06		FF	11111111	255			
07		00	00000000	0			
08	ID Manufacturer Name	30	00110000	48	L	3 character ID	These Characters represent Vendor ID which is assigned
					E		
09		AE	10101110	174	N	"LEN" as an end-customer	by Microsoft.
0A	ID Product Code	6A	01101010	106		#WUXGA	
0B		40	01000000	64			
0C	32-bit serial no.	00	00000000	0			
0D		00	00000000	0			
0E		00	00000000	0			
0F		00	00000000	0			
10	Week of manufacture	00	00000000	0			
11	Year of manufacture	13	00010011	19	2009	2008	**value**=year-1990
12	EDID Structure Ver.	01	00000001	1	1	EDID Ver. 1.0	Version no.
13	EDID revision #	03	00000011	3	3	EDID Rev. 3	Revision no.
14	Video input definition	80	10000000	128			
15	Max H image size	25	00100101	37	37	37 cm(approx)	horizontal size (cm)
16	Max V image size	17	00010111	23	23	23 cm(approx)	vertical size (cm)
17	Display Gamma	78	01111000	120	2.2	Gamma 2.2	gamma value=(1.00~3.54) / value stored=(gamma x 100)-100
18	Feature support	EA	11101010	234			
19	Red/green low bits	87	10000111	135		10000111	Color coordinates Data
1A	Blue/white low bits	F5	11110101	245		11111110	
1B	Red x/ high bits	94	10010100	148	0.580	Red x 0.580= 1001010010	
1C	Red y	57	01010111	87	0.340	Red y 0.340= 0101011100	
1D	Green x	4F	01001111	79	0.310	Green x 0.310= 0100111101	
1E	Green y	8C	10001100	140	0.550	Green y 0.550= 1000110011	
1F	Blue x	27	00100111	39	0.155	Blue x 0.155= 001001111	
20	Blue y	27	00100111	39	0.155	Blue y 0.155= 001001111	
21	White x	50	01010000	80	0.313	White x 0.313= 0101000001	
22	White y	54	01010100	84	0.329	White y 0.329= 0101010001	
23	Established timing 1	00	00000000	0			
24	Established timing 2	00	00000000	0			
25	Established timing 3	00	00000000	0			
26	Standard timing #1	01	00000001	1		not used	Unused field in this section shall be set to 01H.
27		01	00000001	1			
28	Standard timing #2	01	00000001	1		not used	Unused field in this section shall be set to 01H.
29		01	00000001	1			
2A	Standard timing #3	01	00000001	1		not used	Unused field in this section shall be set to 01H.
2B		01	00000001	1			
2C	Standard timing #4	01	00000001	1		not used	Unused field in this section shall be set to 01H.
2D		01	00000001	1			
2E	Standard timing #5	01	00000001	1		not used	Unused field in this section shall be set to 01H.
2F		01	00000001	1			
30	Standard timing #6	01	00000001	1		not used	Unused field in this section shall be set to 01H.
31		01	00000001	1			
32	Standard timing #7	01	00000001	1		not used	Unused field in this section shall be set to 01H.
33		01	00000001	1			
34	Standard timing #8	01	00000001	1		not used	Unused field in this section shall be set to 01H.
35		01	00000001	1			

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36	Detailed timing/monitor descriptor #1	23	00100011	35	161.63	Main clock= 163.63 MHz (@60Hz)	Pixel clock / 10000 (Stored LSB first)
37		3F	00111111	63			
38		80	10000000	128	1920	Hor active=960*2 pixels	Horizontal Active
39		20	00100000	32	288	Hor blanking=160pixels	Horizontal Blanking
3A		71	01110001	113		4bit : 4bit	Horizontal Active : Horizontal Blanking (upper 4bit)
3B		B0	10110000	176	1200	Vertcal active=1200 lines	Vertical Active
3C		14	00010100	20	20	Vertical blanking=35 lines	Vertical Blanking (DE Blanking min for DE only mode panel)
3D		40	01000000	64		4bit : 4bit	Vertical Active : Vertical Blanking (upper 4bit)
3E		30	00110000	48	48	Hor sync. Offset=64 pixels	Horizontal Sync. Offset
3F		20	00100000	32	32	H sync. Width=16 pixels	Horizontal Sync. Pulse Width
40		26	00100110	38	2	V sync. Offset=29 lines	Vertical Sync. Offset : Vertical Sync. Pulse Width
					6	V sync. Width=6 lines	
41		00	00000000	0		2bit : 2bit :2bit :2bit	Horizontal Sync. Offset (upper 2bit) Horizontal Sync Pulse Width (upper 2bit) Vertical Sync. Offset (upper 2bit) Vertical Sync. Pulse Width (upper 2bit)
42		6F	01101111	111	367	H image size= 367 mm(approx)	Horizontal Image Size
43		E6	11100110	230	230	V image size = 230 mm(approx)	Vertical Image Size
44		10	00010000	16			Horizontal & Vertical Image Size (upper 4bit)
45		00	00000000	0		No Horizontal Border	Horizontal Border
46		00	00000000	0		No Vertical Border	Vertical Border
47		19	00011001	25			Flag
48	Detailed timing/monitor descriptor #2	9C	10011100	156	134.68	Main clock= 128.44 MHz (@50Hz)	Pixel clock / 10000 (Stored LSB first)
49		34	00110100	52			
4A		80	10000000	128	1920	Hor active=960*2 pixels	Horizontal Active
4B		20	00100000	32	288	Hor blanking=160 pixels	Horizontal Blanking
4C		71	01110001	113		4bit : 4bit	Horizontal Active : Horizontal Blanking (upper 4bit)
4D		B0	10110000	176	1200	Vertcal active=1200 lines	Vertical Active
4E		14	00010100	20	20	Vertical blanking=35 lines	Vertical Blanking (DE Blanking min for DE only mode panel)
4F		40	01000000	64		4bit : 4bit	Vertical Active : Vertical Blanking (upper 4bit)
50		30	00110000	48	48	Hor sync. Offset=64 pixels	Horizontal Sync. Offset
51		20	00100000	32	32	H sync. Width=16 pixels	Horizontal Sync. Pulse Width
52		26	00100110	38	2	V sync. Offset=3 lines	Vertical Sync. Offset : Vertical Sync. Pulse Width
					6	V sync. Width=6 lines	
53		00	00000000	0		2bit : 2bit :2bit :2bit	Horizontal Sync. Offset (upper 2bit) Horizontal Sync Pulse Width (upper 2bit) Vertical Sync. Offset (upper 2bit) Vertical Sync. Pulse Width (upper 2bit)
54		6F	01101111	111	367	H image size= 367 mm(approx)	Horizontal Image Size
55		E6	11100110	230	230	V image size = 230 mm(approx)	Vertical Image Size
56		10	00010000	16			Horizontal & Vertical Image Size (upper 4bit)
57		00	00000000	0		No Horizontal Border	Horizontal Border
58		00	00000000	0		No Vertical Border	Vertical Border
59		19	00011001	25			Flag
5A	descriptor #3	00	00000000	0		Manufacturer Specified (Timing)	Data type Tag
5B		00	00000000	0			
5C		00	00000000	0			
5D		0F	00001111	15			
5E		00	00000000	0			
5F		D1	11010001	209	209	**(Horizontal active pixel /8)-31**	DE only mode
60		0A	00001010	10		**Image Aspect Ratio(16:10)**	
61		32	00110010	50		**Low Refresh Rate #1(50Hz)**	
62		D1	11010001	209		**(Horizontal active pixel /8)-31**	
63		0A	00001010	10		**Image Aspect Ratio(16:10)**	
64		28	00101000	40		**Low Refresh Rate #1(40Hz)**	
65		1E	00011110	30		**Brightness(1/10nit)**	
66		21	00100001	33		**Feature flag(TN mode)**	
67		00	00000000	0			
68		4C	01001100	76		**supplier ID "SEC"**	
69		A3	10100011	163			
6A		43	01000011	67	[C]	**Product code "CT"**	
6B		54	01010100	84	[T]	**(Hex, LSB first)**	

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6C		00	00000000	0		Monitor Name Tag (ASCII)	Data type Tag
6D		00	00000000	0			
6E		00	00000000	0			
6F		FE	11111110	254			
70		00	00000000	0			
71		4C	01001100	76	[L]		Supplier Product Name
72		54	01010100	84	[T]		
73	Detailed timing/monitor	4E	01001110	78	[N]		
74	descriptor #4	31	00110001	49	[1]		
75		37	00110111	55	[7]		
76		30	00110000	48	[0]		
77		43	01000011	67	[C]		
78		54	01010100	84	[T]		
79		30	00110000	48	[0]		
7A		38	00111000	56	[8]		
7B		4C	01001100	76	[L]		
7C		30	00110000	48	[0]		
7D		31	00110001	49	[1]		
7E	Extension Flag	00	00000000	0			
7F	Checksum	AD	10101101	173			

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