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ELECTRONICS

Approval

TO : LENOVO

DATE : Dec, 19, 2008

SAMSUNG TFT-LCD

MODEL NO. : LTN141AT09-201

NOTE :

- Extension code [201]
- Surface type [Anti-Glare]

Any Modification of Specification is not allowed without SEC's Permission.

Yasunasa Taheda Lenovo LCD Dev, 2008/12/19.

Takehiko Noguchi Lenovo LCD Procurement Eng. 2008/12/19

[Signature]

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APPROVED BY :

PREPARED BY : LCD Product Planning Group 1, Marketing Team

SAMSUNG ELECTRONICS CO., LTD.

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Doc.No.

LTN141AT09-201

Rev.No

04-A00-S-081219

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REVISION HISTORY

Approval

Date	Rev. No.	Page	Summary
Dec. 19, 2008	A00	All	<p>-LTN141AT09-201 approval specification was issued first.</p> <ul style="list-style-type: none">● SEC's P/N LTN141AT09-201● Lenovo's product code Lenovo P/N : 42T0622 FRU P/N : 42T0623 EC NO : - Header Code : 1ZF EK

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GENERAL DESCRIPTION

DESCRIPTION

LTN141AT09-201 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight unit. The resolution of a 14.1" contains 1,280 x 800 pixels and can display up to 262,144 colors. 6 O'clock direction is the Optimum viewing angle.

FEATURES

- Attached Protective Glass
- High contrast ratio, high aperture structure
- 1280 x 800 pixels resolution
- Low power consumption
- Fast Response
- LED BLU with LED driver (LED:120ea)
- DE(Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip
- Pb-free product

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	303.36(H) x 189.6(V) (14.1" diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	1280 x RGB(3) x 800	pixel	16 : 10
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.2370(H) x 0.2370(V) (TYP.)	mm	
Display Mode	Normally white		
Surface treatment	HAZE 34, HARD-COATING 3H SUMITOMO : SRS-862AP3 AT3		Anti Glare

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Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	319.0	319.5	320.0	mm	-
	Vertical (V)	205.0	206.5	207.0	mm	
	Depth (D) [With the Glass]	-	-	6.3	mm	-
Weight [With the protective glass]		-		490	g	-

1. ABSOLUTE MAXIMUM RATINGS

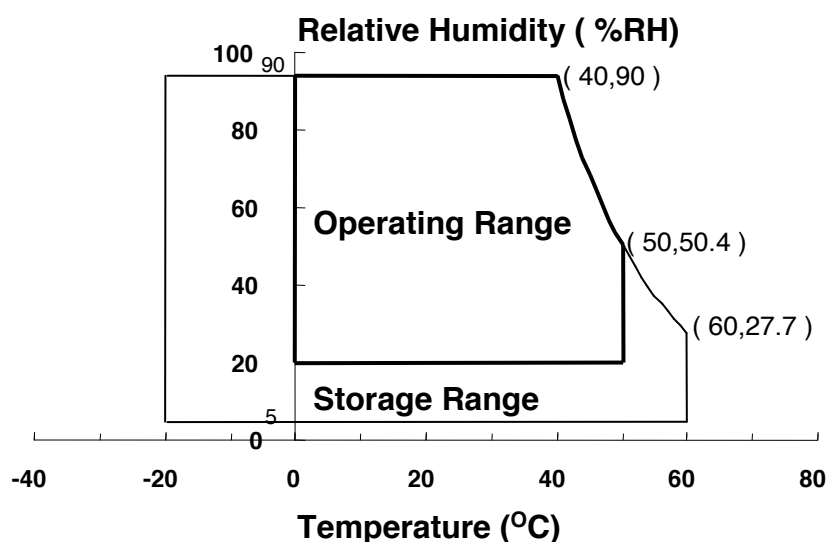
1.1 ENVIRONMENTAL ABSOLUTE RATINGS

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. ($40^{\circ}\text{C} \geq T_a$)

Maximum wet - bulb temperature at 39°C or less. ($T_a > 40^{\circ}\text{C}$) 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}	$V_{SS} - 0.3$	3.6	V	(1)

Note (1) Within T_a ($25 \pm 2^\circ C$)

(2) BACK-LIGHT UNIT

 $T_a = 25 \pm 2^\circ C$

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Current	I_L	-	17	-	mA	(1)
LED Voltage	V_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 BM-5A and PR-650

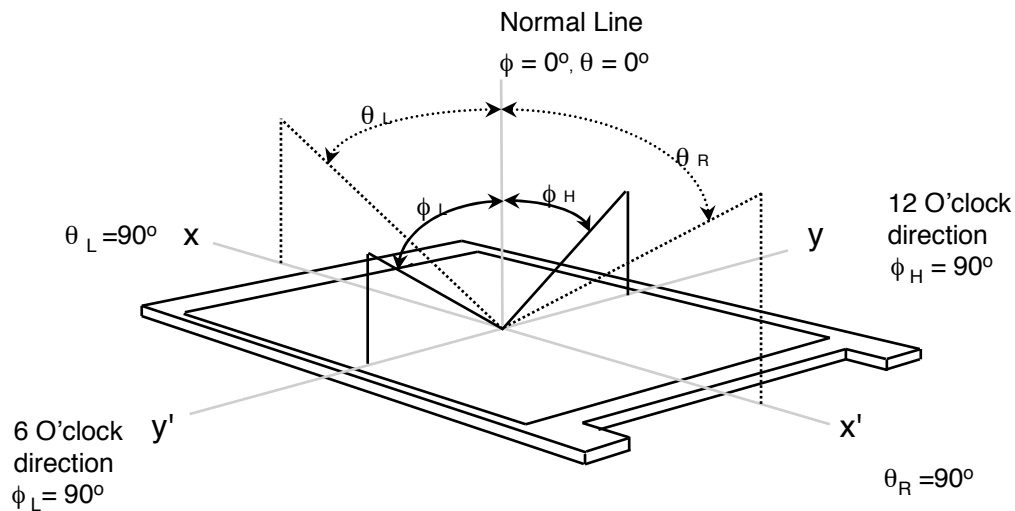
* Ta = 25 ± 2 °C, V_{DD}=3.3V, f_V= 60Hz, f_{DCLK} = 76.77MHz, I_L = 17 mArms

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR		350	400	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T _{RT_BW}		-	16	20	msec	(1), (3)
Average Luminance of White (5 Points)		Y _{L,AVE}	Normal Viewing Angle φ = 0 θ = 0	600	680	-	cd/m²	I _L =17mA (1), (4)
Color Chromaticity (CIE)	Red	R _x		0.580	0.610	0.640	-	(1), (5) PR-650
		R _y		0.310	0.340	0.370		
	Green	G _x		0.315	0.345	0.375		
		G _y		0.560	0.590	0.620		
	Blue	B _x		0.125	0.155	0.185		
		B _y		0.040	0.070	0.100		
	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
		θ _R	70		-	-		
	Ver.	φ _H	50		-	-		
		φ _L	60		-	-		
13 Points White Variation		δ _L		60%	-	-	%	(6)
5 Points White Variation		δ _L		80%	-	-	%	(6)

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Note 1) Definition of Viewing Angle : Viewing angle range($10 \leq C/R$, $100 \leq C/R$)

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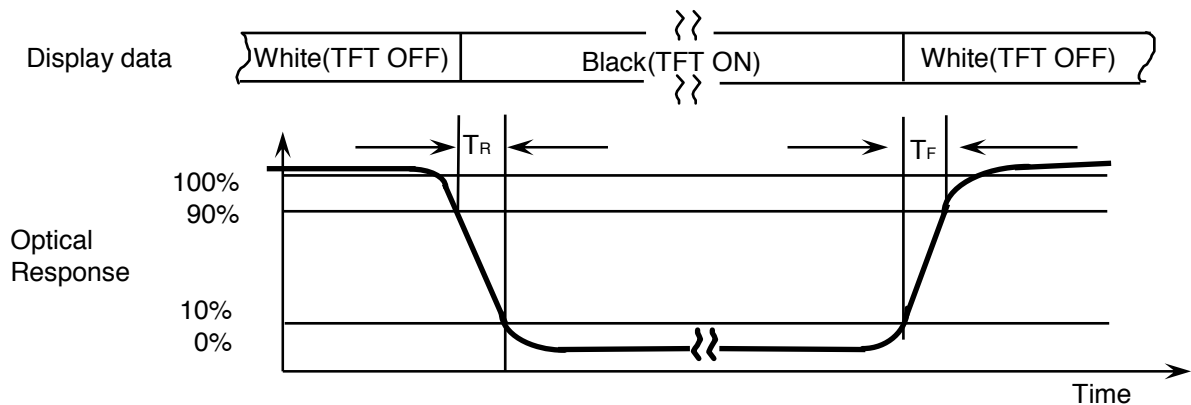


Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax), gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

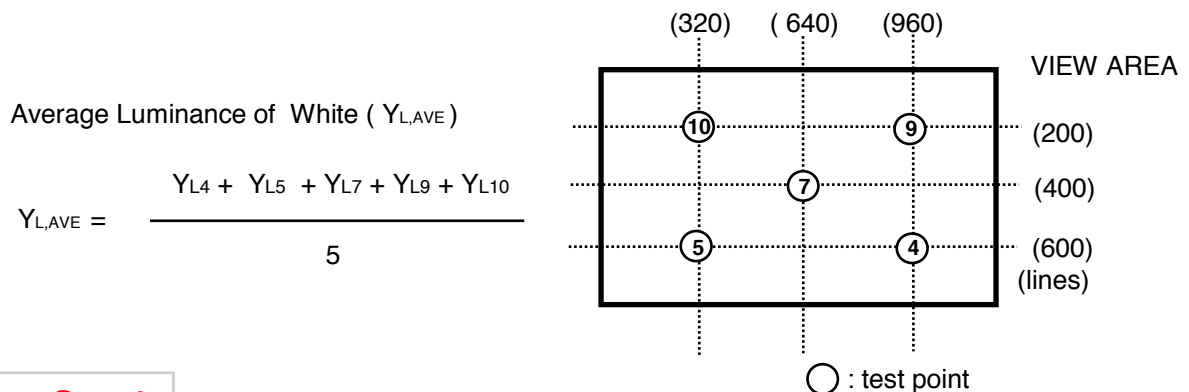
$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

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

Note 3) Definition of Response time :

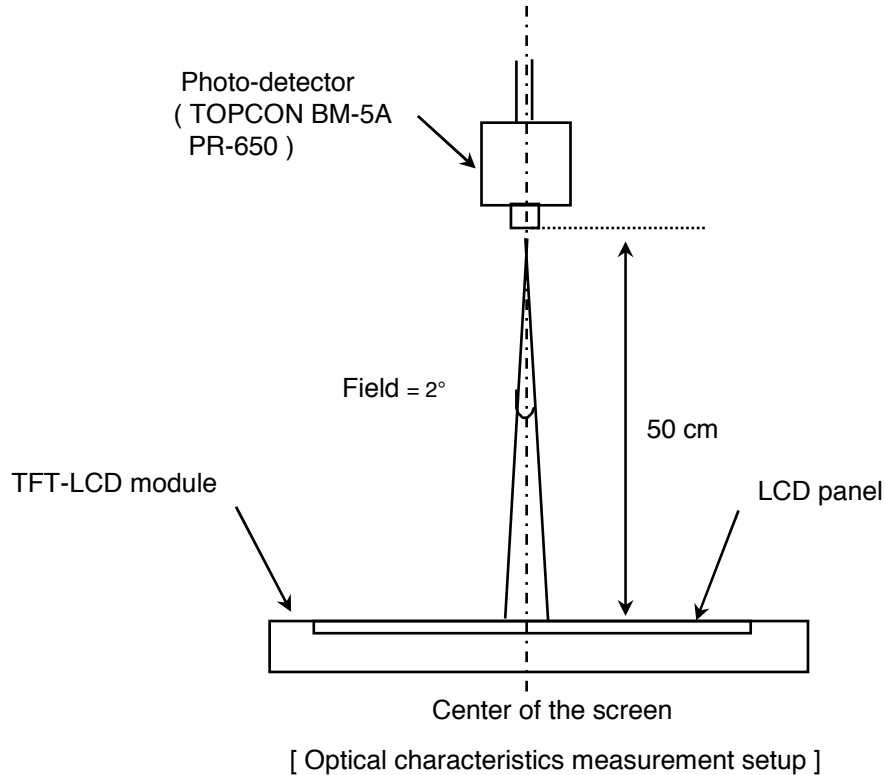


Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.



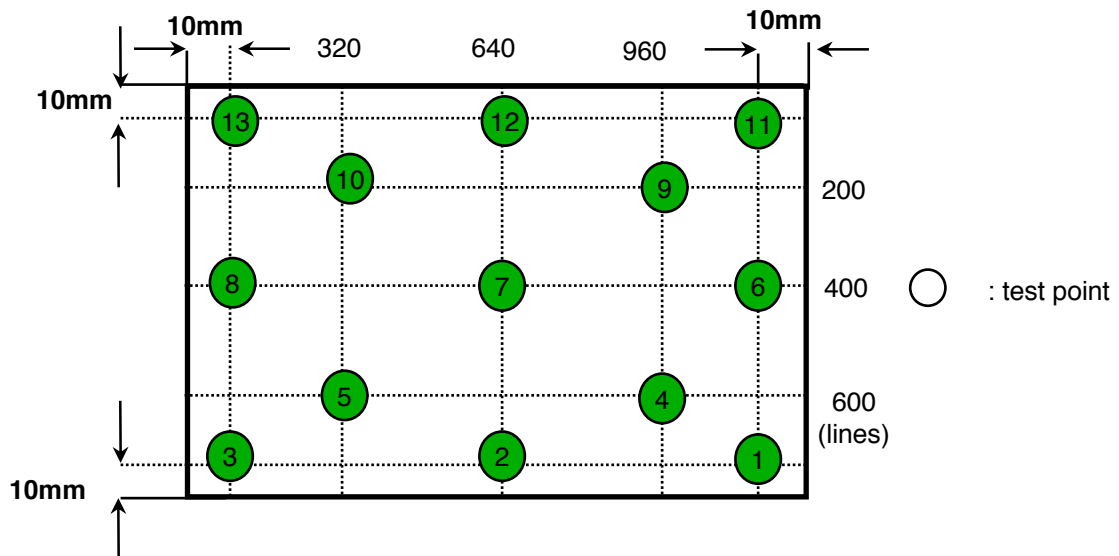
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Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the backlight. This should be measured in the center of screen.
Environment condition : $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$



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

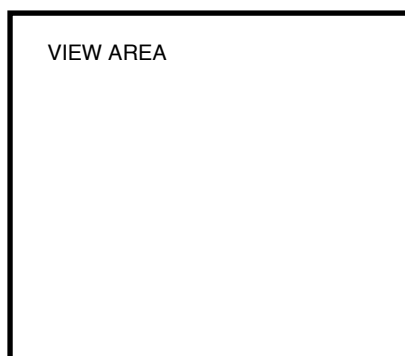
ITEM			SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Voltage of Power Supply			V _{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold		High	V _{IH}	-	-	+100	mV	V _{CM} =+1.2V
		Low	V _{IL}	-100	-	-	mV	
Vsync F r e q u e n c y	60Hz	Hsync Freq	F _H	46.38	48.96	60	KHz	
		Main Freq	F _{DCLK}	60.99	76.77	105	MHz	
	50Hz	Hsync Freq	F _H	38.65	40.80	50	KHz	
		Main Freq	F _{DCLK}	50.8	63.98	87.5	MHz	
	40Hz	Hsync Freq	F _H	30.9	32.92	40	KHz	
		Main Freq	F _{DCLK}	40.66	47.4	70	MHz	
Rush Current			I _{RUSH}	-	-	1.5	A	(4)
Current of Power Supply		White	I _{DD}	-	260	-	mA	(2),(3)*a
		Mosaic		-	350	-	mA	(2),(3)*b
		WinXP Pattern		-	390	-	mA	(2),(3)*c
		Max Pattern		-	470	485	mA	(2),(3)*d

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

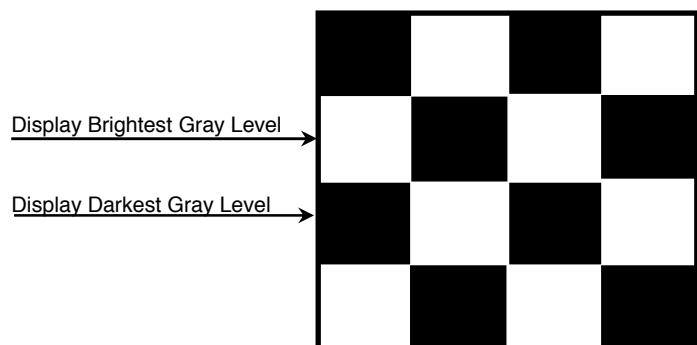
(2) f_V = 60Hz, f_{DCLK} = 76.38MHZ, V_{DD} = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern



*b) Mosaic Pattern



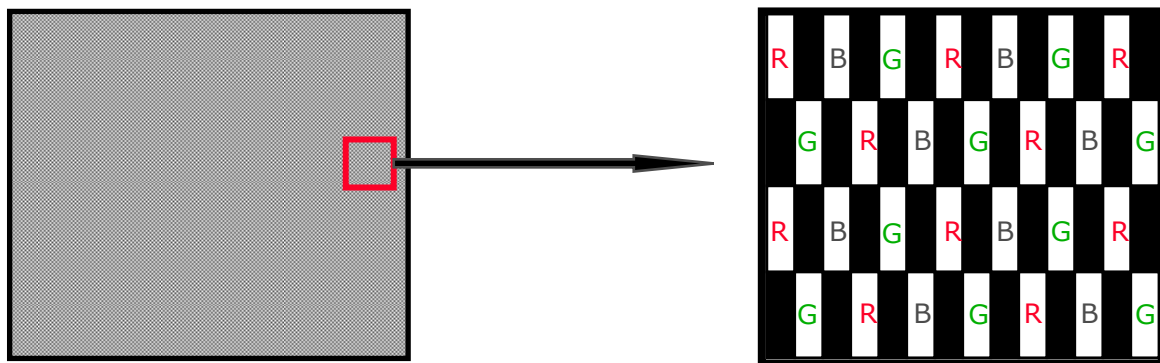
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*c) WinXP Pattern

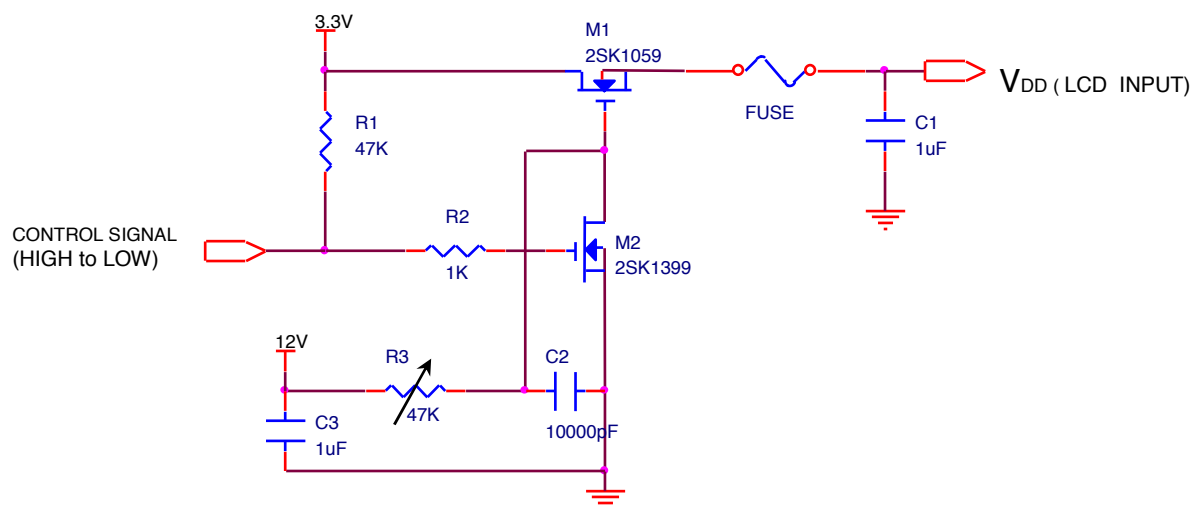


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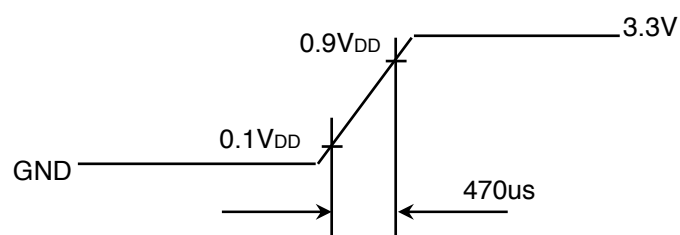
*d) 1dot Inversion Pattern



4) Rush current measurement condition



V_{DD} rising time is 470us



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3.2 Back-Light Unit

White LED chip P/N : 0601-002528

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	-	17	-	mA	-
LED Forward Voltage	VF	-	3.2	-	V	-
LED Array Voltage	VP	-	32.0	-	V	VF X 10 LEDs
Power Consumption	P	-	6.53	-	W	IF X VF X 120LEDs
Operating Life Time	Hr	10,000	-	-	Hr	(1)

3.3 LED driver

LED driver Manufacturer : PM6600 (ST)

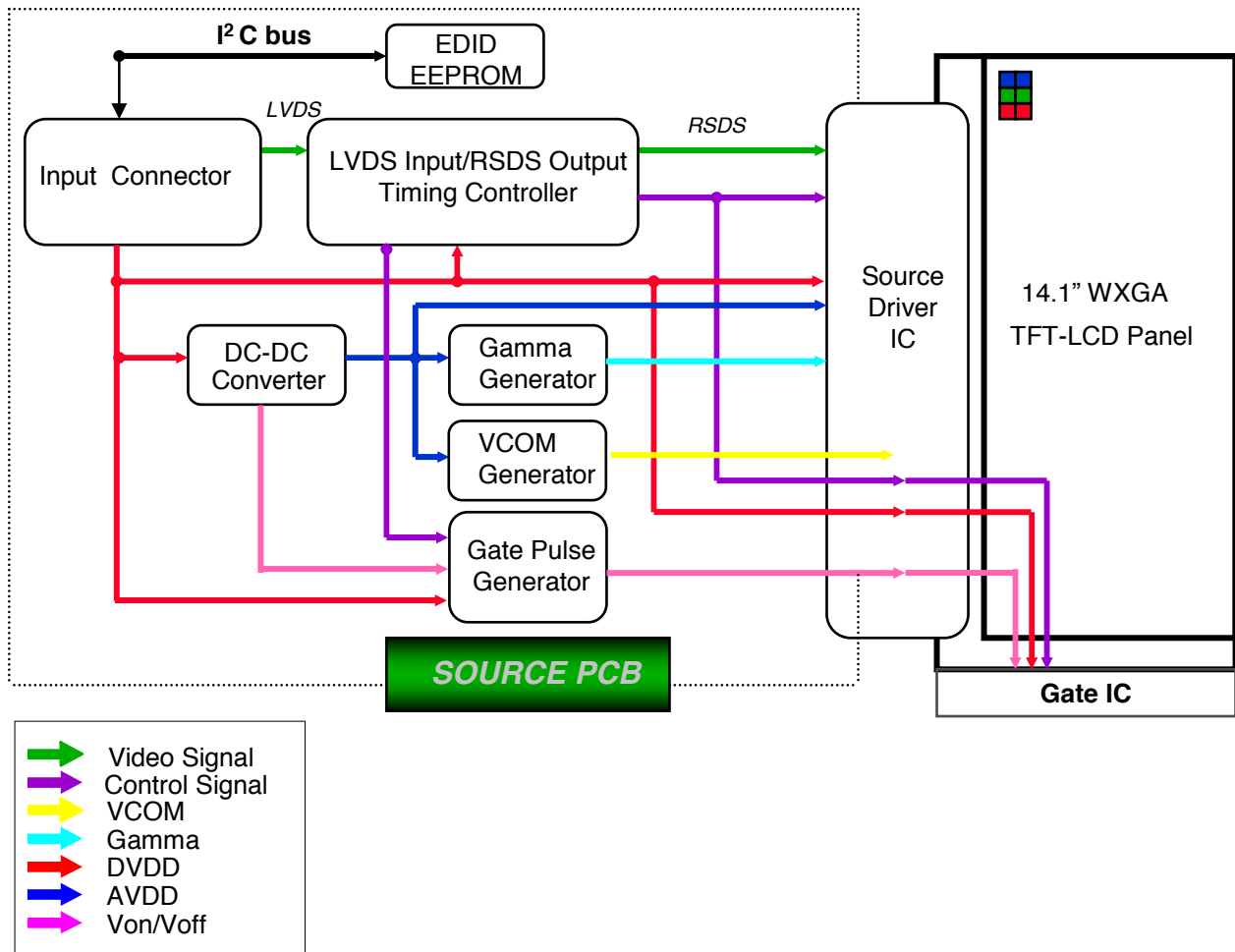
Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V _{in}	7	12	21	V	
Input Current	I	-	700	-	mA	12V, 17mA, BLIM=100%
Input Power	P _{in}	-	8.4	-	W	12V, 17mA, BLIM=100%
Operating Frequency	F _o	0.9	1.0	1.1	MHz	
PWM Frequency	F _o	100	-	-	Hz	

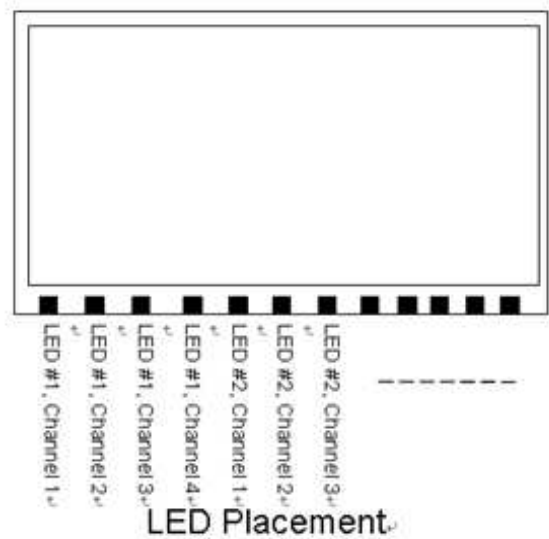
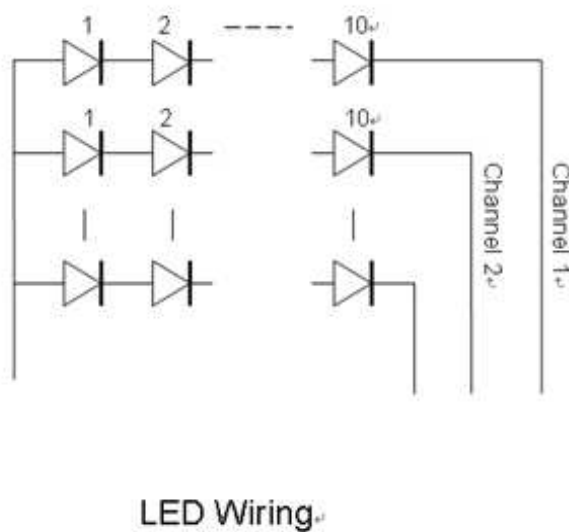
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4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 LED connection and placement



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5. INPUT TERMINAL PIN ASSIGNMENT

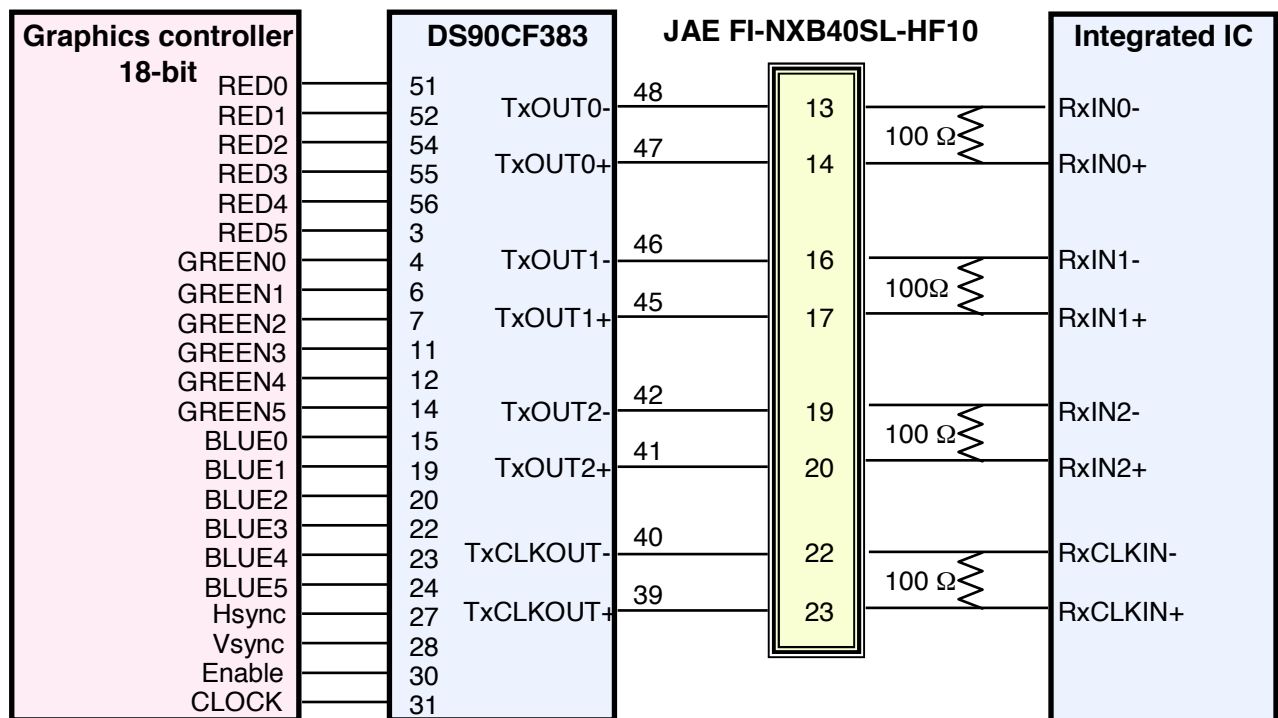
5.1. Input Signal & Power (LVDS, Connector : FI-XB30SRLZ-HF11)

Pin	Symbol	Function
1	GND	Ground
2	VCC	Logic power 3.3V (Panel logic, BL logic)
3	VCC	Logic power 3.3V (Panel logic, BL logic)
4	VCC_EDID	EDID 3.3V power
5	WPN	Reserved
6	CLK_EDID	DDC Clock
7	DATA_EDID	DDC data
8	LVDS Odd 0-	- LVDS differential data input (R0-R5, G0)
9	LVDS Odd 0+	+ LVDS differential data input (R0-R5, G0)
10	GND	Ground
11	LVDS Odd 1-	- LVDS differential data input (G1-G5, B0-B1)
12	LVDS Odd 1+	+ LVDS differential data input (G1-G5, B0-B1)
13	GND	Ground
14	LVDS Odd 2-	- LVDS differential data input (B2-B5,HS,VS, DE)
15	LVDS Odd 2+	+ LVDS differential data input (B2-B5,HS,VS, DE)
16	GND	Ground
17	LVDS Odd CLK-	- LVDS Differential Data INPUT (Even Clock)
18	LVDS Odd CLK+	+ LVDS Differential Data INPUT (Even Clock)
19	LED_EN	BL_ON signal
20	PWM	PWM for luminance control
21	NC	No connect
22	VBL(7~20)	7.5V – 21V LED power
23	VBL(7~20)	7.5V – 21V LED power
24	VBL(7~20)	7.5V – 21V LED power
25	VBL(7~20)	7.5V – 21V LED power
26	NC	No connect
27	BLU GND	Ground
28	BLU GND	Ground
29	BLU GND	Ground
30	BLU GND	Ground

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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

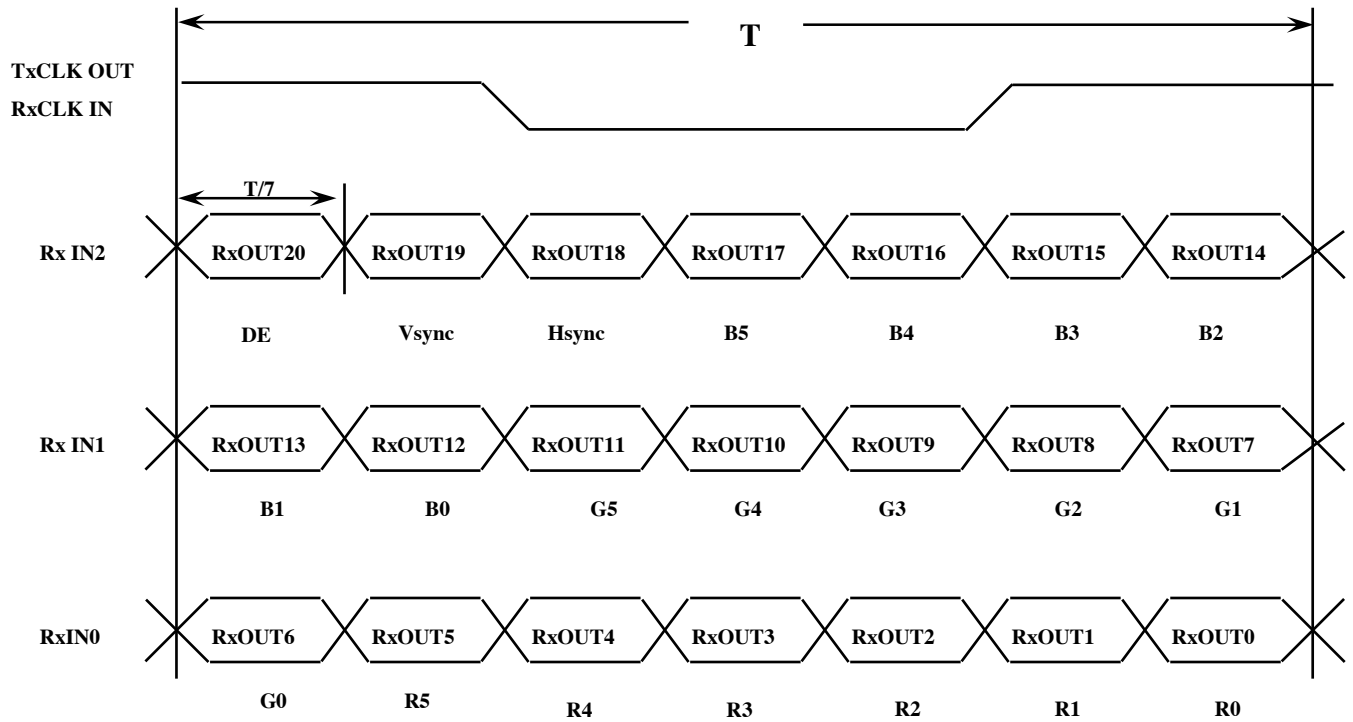
LVDS Interface

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		B5
Basic Colors	Black	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	1	1	1	1	1	1	-
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	Cyan	0	0	0	0	0	0	1	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	0	-
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	-
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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	-
Gray Scale Of Red	Black	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	R1
	↑	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	1	0	1	1	1	1	0	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	0	R62
	Red	1	1	1	1	1	1	0	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	0	G0
	Dark	0	0	0	0	0	0	1	0	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	0	G2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
	Light	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	G62
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	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	0	B0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
	Light	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63

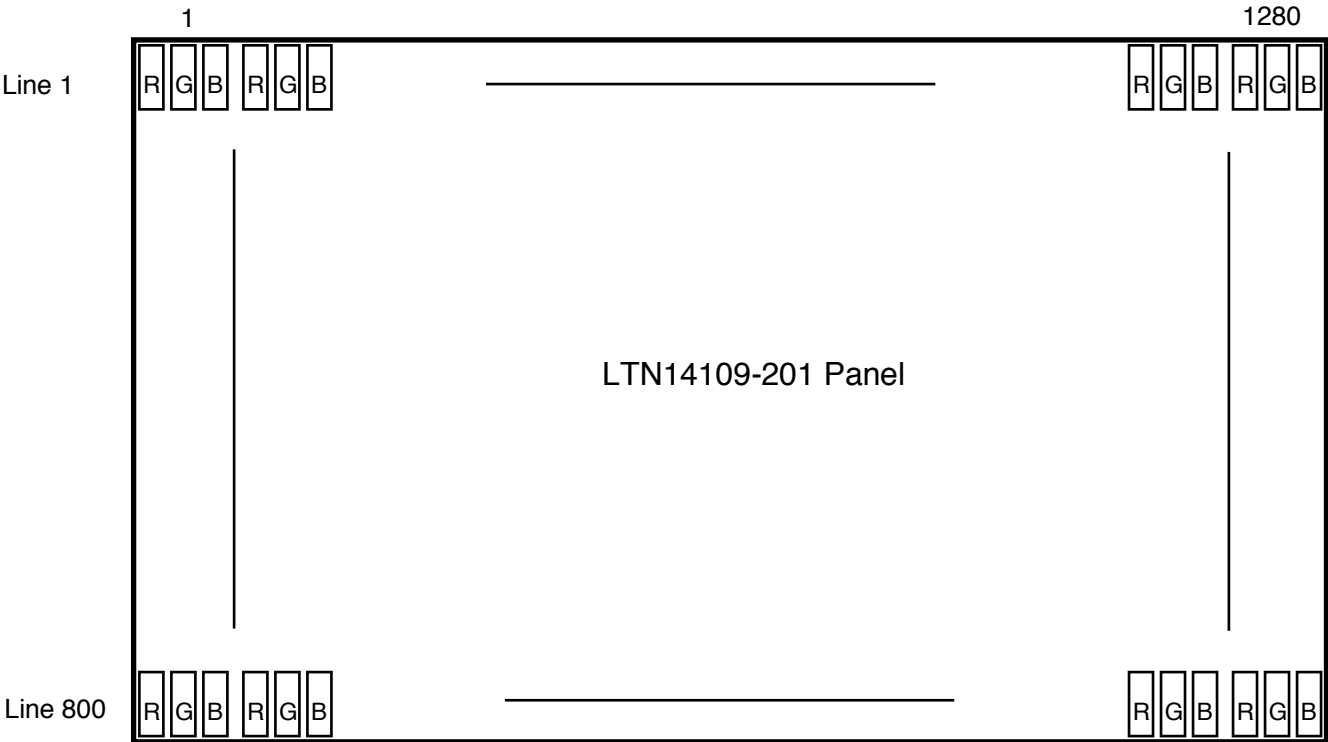
Note 1) Definition of gray :

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



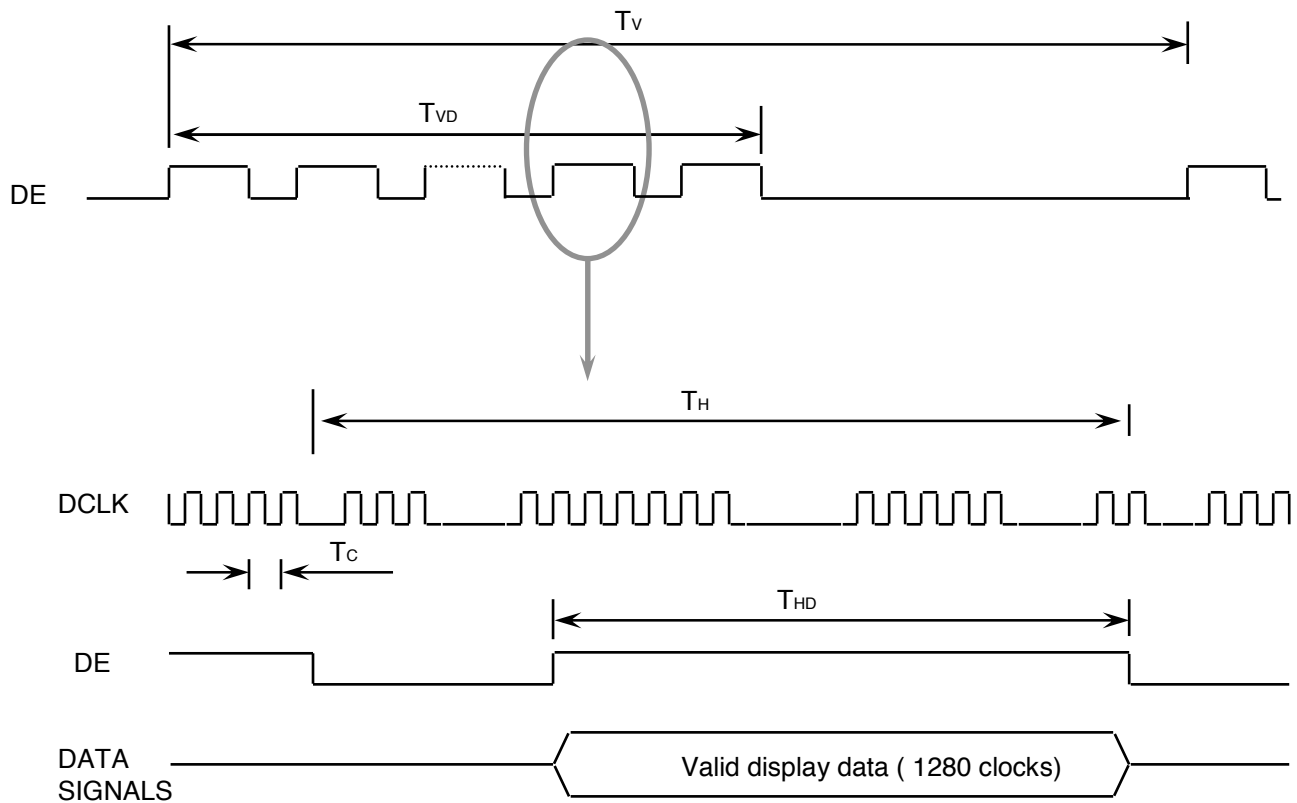
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6. INTERFACE TIMING

6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	T_V	773	823	1000	Lines	
Vertical Active Display Term	Display Period	T_{VD}	-	800	-	Lines	
One Line Scanning Time	Cycle	T_H	1315	1440	1750	Clocks	
Horizontal Active Display Term	Display Period	T_{HD}	-	1280	-	Clocks	

6.2 Timing diagrams of interface signal

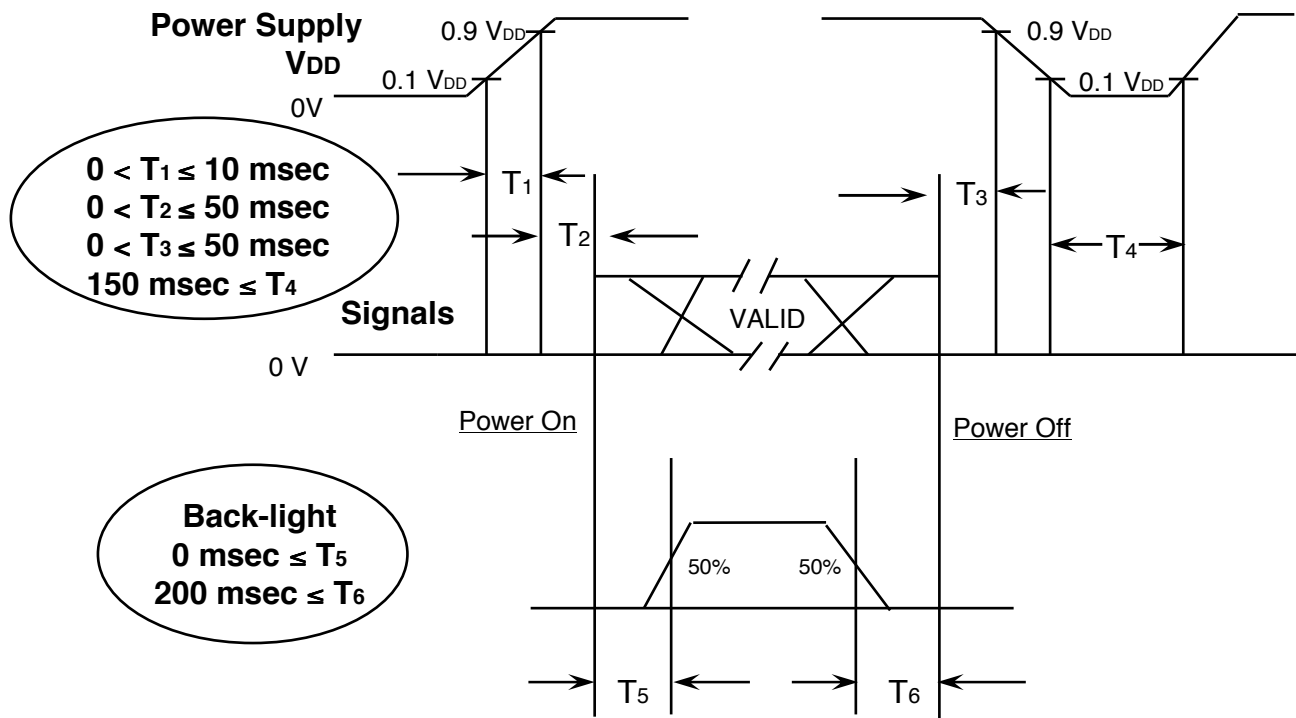


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6.3 Power ON/OFF Sequence

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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

- T₁ : V_{DD} rising time from 10% to 90%
- T₂ : The time from V_{DD} to valid data at power ON.
- T₃ : The time from valid data off to V_{DD} off at power Off.
- T₄ : V_{DD} 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.

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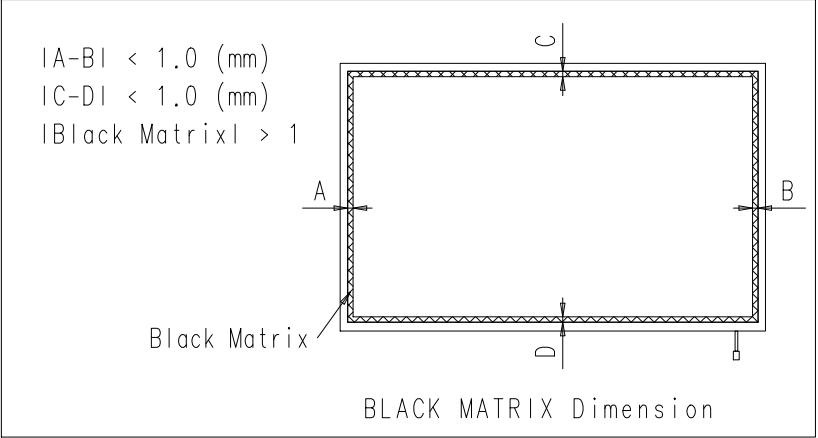
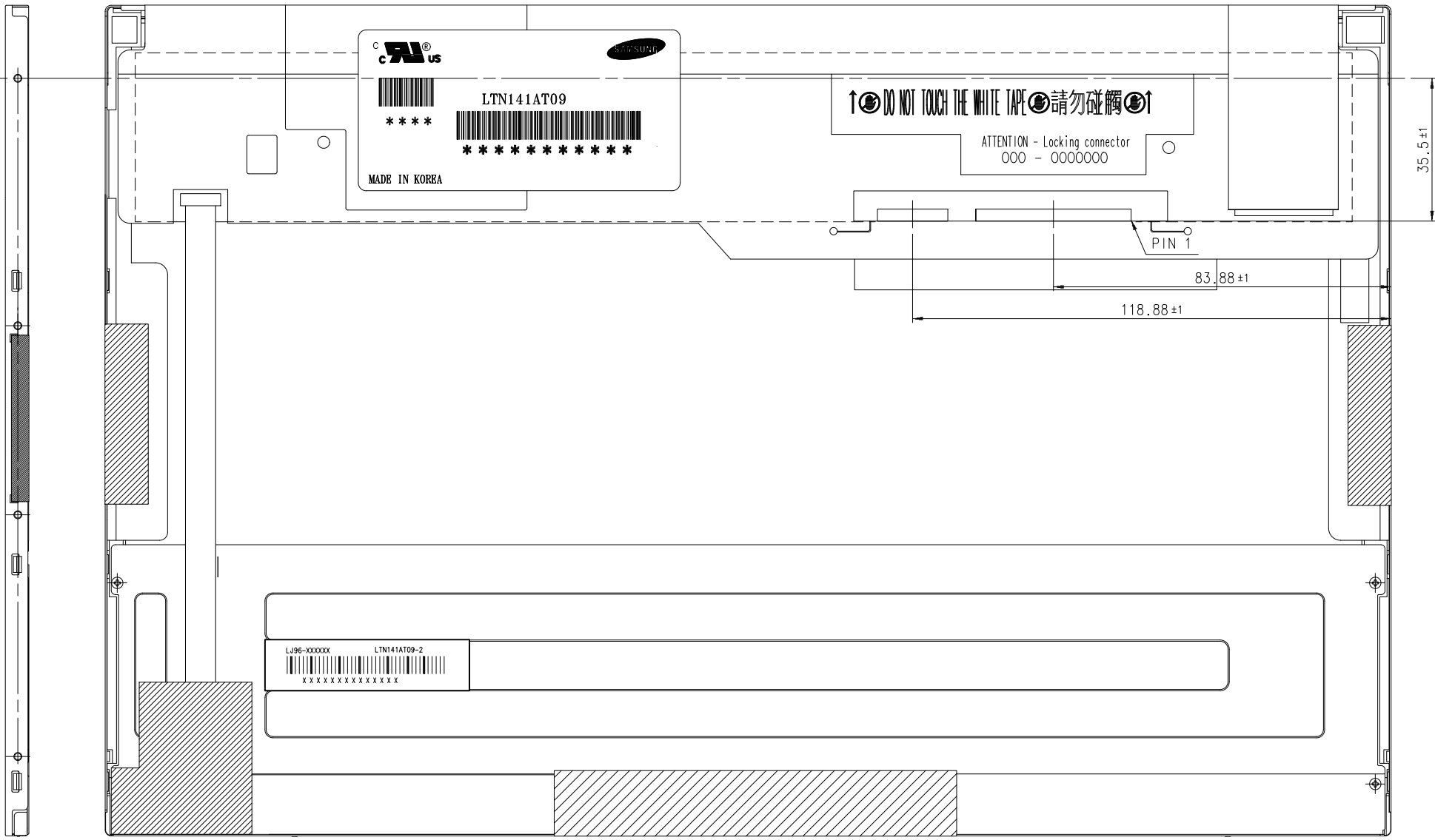
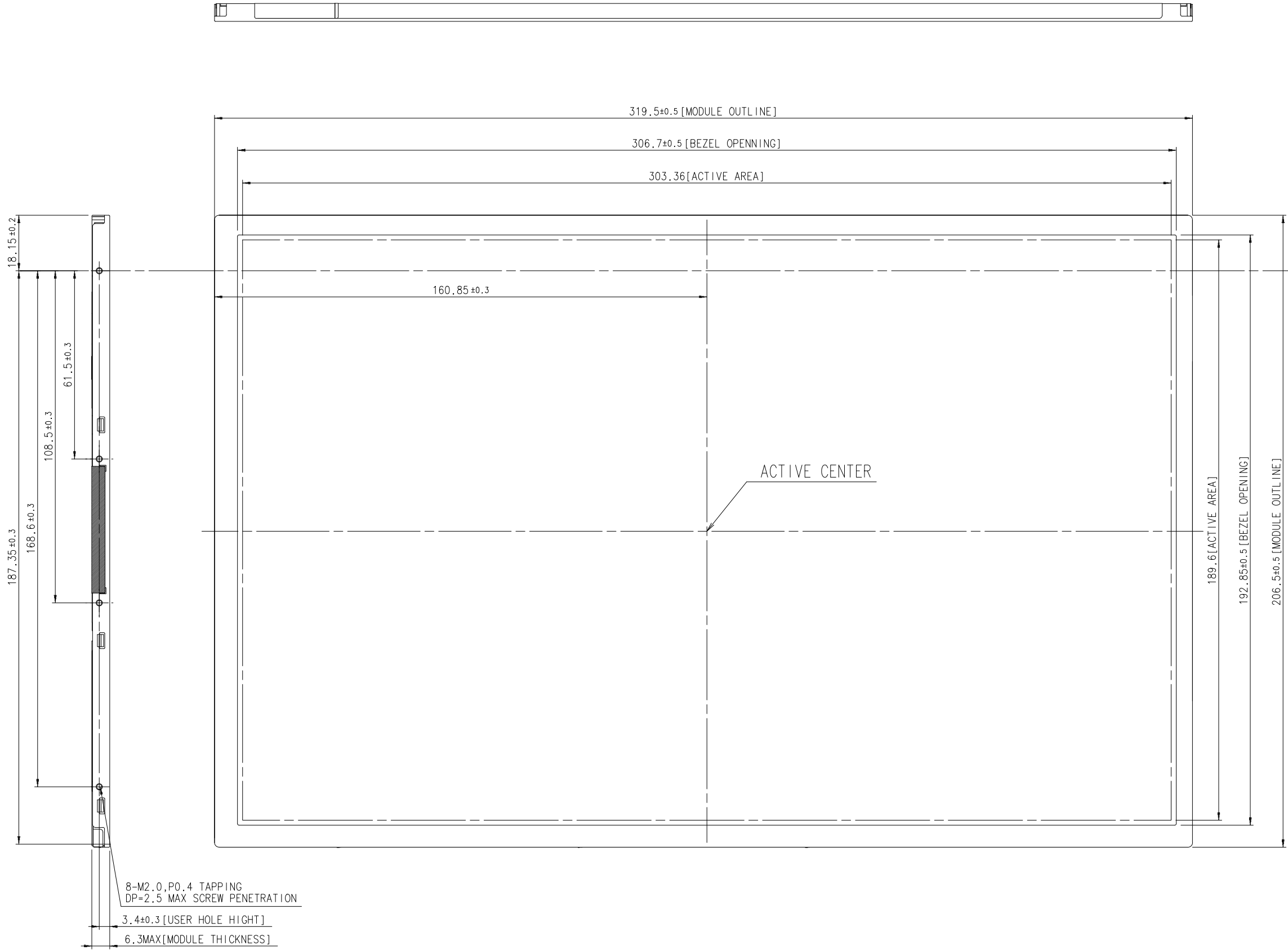
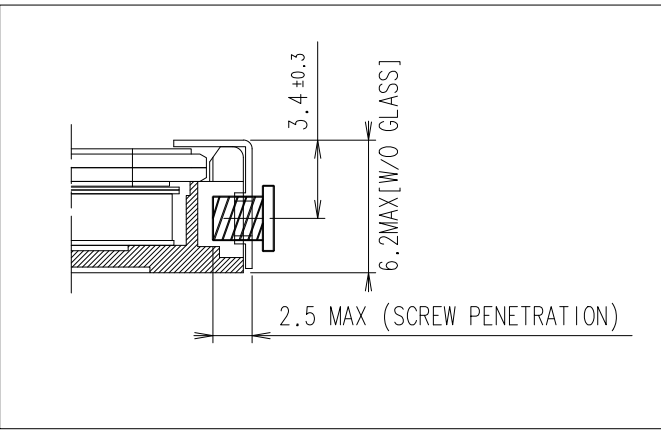
7. Mechanical Outline Dimension

Approval

It will be attached with PDF file

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NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	WEIGHT FINISH	MATERIAL	UNFOLDED DIM. OF. MATERIAL	REMARK
1	LTN141AT09-2			1EA				



- INPUT SIGNAL INTERFACE CONNECTOR TO BE SPECIFIED AS BELOW.
- PART NO./MAKER : FI-NXB40SL-HF10/JAE (or compatible)
- LED CONNECTOR FOR BACKLIGHT TO BE SPECIFIED AS BELOW.
- PART NO.: 51441-1028 (or compatible)
- CALIFERS MEASURING FORCE : 530 ± 150 gf
- USER HOLE TORQUE SPEC : 2.5Kgfcmm MAX (5 TIMES)
- WEIGHT SPEC : 490g MAX

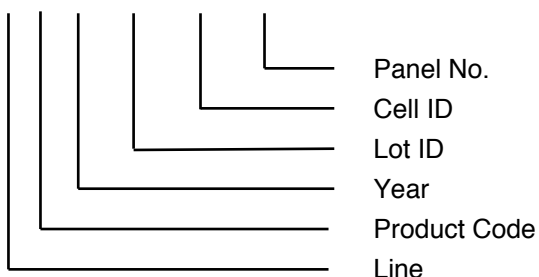
GENERAL TOLERANCE				REV	DATE	DESCRIPTION OF REVISION				REASON		CHG'D BY
STEP	LEVEL 1	LEVEL 2	LEVEL 3	UNIT	mm	DRA'N BY	DES'D BY	CHK'D BY	APP'D BY	MODEL NAME	LTN141AT09-2	
0 < X ≤ 4	±0.05	±0.1	±0.2	SCALE	1/1					PART/SHEET NAME	Outline-Dimension	SHEET 1/1
4 < X ≤ 16	±0.08	±0.15	±0.3	TOLERANCE			CH. Y. BANG	H. S. CHUN	D. C. YANG			
16 < X ≤ 64	±0.12	±0.25	±0.5	LEVEL2			08.12.12	08.12.15	08.12.15	SPEC. NO		
64 < X ≤ 256	±0.25	±0.4	±0.8				SAMSUNG ELECTRONICS			DDS*****000	CODE NO.	VER. 000

8. Product Markings and Others

Approval

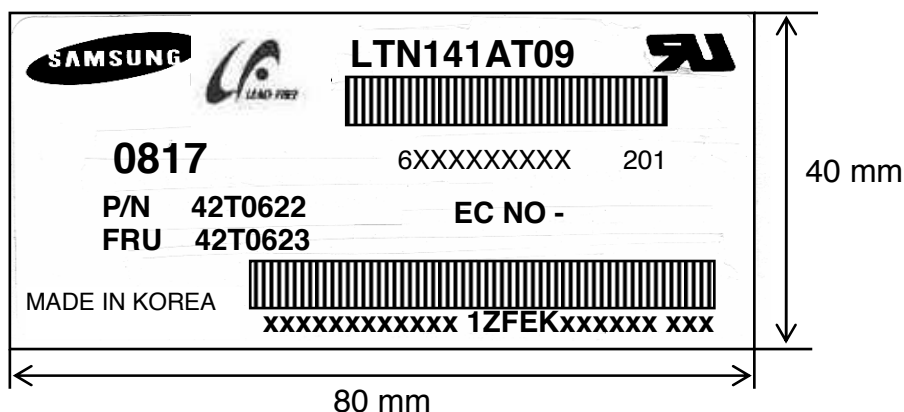
A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

- (1) Parts number : LTN141AT09-201
- (2) Revision : One letter
- (3) Control code : One letter
- (4) Lot number : 6 X X XXX XX XX



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

(5) Product Label Definition



TFT-LCD Product name : LTN141AT09-201
Lot number : 6XXXXXXXXXX
Revision Code : 201
Inspected work week : 0817(2008 Year, 17th week)
P/N : Lenovo Part Number (42T0622)
EC NO : Engineering Change Number (Blank)
FRU : Field Replaceable Unit Part Number(42T0623)
Header Code : 1ZF EK

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5.12. 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

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- (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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10. EDID

Address (HEX)	FUNCTION	Value	BIN	DEC	ASCII or Data	Notes
		HEX				
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 E N	3 character ID
09		AE	10101110	174		"LEN" as an end-customer
0A	ID Product Code	37	00110111	55		#WXGA High Bright
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	12	00010010	18	2008	2007
12	EDID Structure Ver.	01	00000001	1	1	EDID Ver. 1.0
13	EDID revision #	03	00000011	3	3	EDID Rev. 3
14	Video input definition	80	10000000	128		
15	Max H image size	1E	00011110	30	30	30 cm (approx)
16	Max V image size	13	00010011	19	19	19 cm (approx)
17	Display Gamma	78	01111000	120	2.2	Gamma 2.2
18	Feature support	EA	11101010	234		
19	Red/green low bits	44	01000100	68		10000111
1A	Blue/white low bits	C5	11000101	197		11111110
1B	Red x/ high bits	9C	10011100	156	0.610	Red x 0.610= 10011100
1C	Red y	57	01010111	87	0.340	Red y 0.340= 01010111
1D	Green x	58	01011000	88	0.345	Green x 0.345= 01011000
1E	Green y	97	10010111	151	0.590	Green y 0.544= 1000110011
1F	Blue x	27	00100111	39	0.155	Blue x 0.155= 00100111
20	Blue y	12	00010010	18	0.070	Blue y 0.070= 00010010
21	White x	50	01010000	80	0.313	White x 0.313= 01010000
22	White y	54	01010100	84	0.329	White y 0.329= 01010100
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
27		01	00000001	1		
28	Standard timing #2	01	00000001	1		not used
29		01	00000001	1		
2A	Standard timing #3	01	00000001	1		not used
2B		01	00000001	1		
2C	Standard timing #4	01	00000001	1		not used
2D		01	00000001	1		
2E	Standard timing #5	01	00000001	1		not used
2F		01	00000001	1		
30	Standard timing #6	01	00000001	1		not used
31		01	00000001	1		
32	Standard timing #7	01	00000001	1		not used
33		01	00000001	1		
34	Standard timing #8	01	00000001	1		not used
35		01	00000001	1		

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36	Detailed timing/monitor descriptor #1	26	00100110	38	69.5	Main clock= 69.5 MHz (@60Hz)
37		1B	00011011	27		
38		00	00000000	0	1280	Hor active=640*2 pixels
39		88	10001000	136	136	Hor blanking=136 pixels
3A		50	01010000	80		4bit : 4bit
3B		20	00100000	32	800	Vertical active=800 lines
3C		12	00010010	18	18	Vertical blanking=18 lines
3D		30	00110000	48		4bit : 4bit
3E		34	00110100	52	52	Hor sync. Offset=52 pixels
3F		40	01000000	64	64	H sync. Width=64 pixels
40		33	00110011	51	3 3	V sync. Offset=3 lines V sync. Width=3 lines
41		00	00000000	0		2bit : 2bit :2bit :2bit
42		2F	00101111	47	303	H image size= 303 mm (approx)
43		BE	10111110	190	190	V image size = 190 mm (approx)
44		10	00010000	16		
45		00	00000000	0		No Horizontal Border
46		00	00000000	0		No Vertical Border
47		19	00011001	25		
48	Detailed timing/monitor descriptor #2	8B	10001011	139	57.71	Main clock= 57.71 MHz (@50Hz)
49		16	00010110	22		
4A		00	00000000	0	1280	Hor active=640*2 pixels
4B		68	01101000	104	104	Hor blanking=104 pixels
4C		50	01010000	80		4bit : 4bit
4D		20	00100000	32	800	Vertical active=800 lines
4E		22	00100010	34	34	Vertical blanking=34lines
4F		30	00110000	48		4bit : 4bit
50		34	00110100	52	52	Hor sync. Offset=52 pixels
51		40	01000000	64	64	H sync. Width=64 pixels
52		33	00110011	51	3 3	V sync. Offset=3 lines V sync. Width=3 lines
53		00	00000000	0		2bit : 2bit :2bit :2bit
54		2F	00101111	47	303	H image size= 303 mm (approx)
55		BE	10111110	190	190	V image size = 190 mm (approx)
56		10	00010000	16		
57		00	00000000	0		No Horizontal Border
58		00	00000000	0		No Vertical Border
59		19	00011001	25		
5A	descriptor #3	00	00000000	0		Manufacturer Specified (Timing)
5B		00	00000000	0		
5C		00	00000000	0		
5D		0F	00001111	15		
5E		00	00000000	0		
5F		81	10000001	129		(Horizontal active pixel /8)-31
60		0A	00001010	10		Image Aspect Ratio(16:10)
61		32	00110010	50		Low Refresh Rate #1(50Hz)
62		81	10000001	129		(Horizontal active pixel /8)-31
63		0A	00001010	10		Image Aspect Ratio(16:10)
64		28	00101000	40		Low Refresh Rate #1(40Hz)
65		44	01000100	68		Brightness(1/10nit)
66		09	00001001	9		Feature flag(TN/LEDmode)
67		00	00000000	0		
68		4C	01001100	76		supplier ID "SEC"
69		A3	10100011	163		
6A		41	01000001	65	[A]	Product code "AT"
6B		54	01010100	84	[T]	(Hex, LSB first)

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6C	Detailed timing/monitor descriptor #4	00	00000000	0		Monitor Name Tag (ASCII)
6D		00	00000000	0		
6E		00	00000000	0		
6F		FE	11111110	254		
70		00	00000000	0		
71		4C	01001100	76	[L]	
72		54	01010100	84	[T]	
73		4E	01001110	78	[N]	
74		31	00110001	49	[1]	
75		34	00110100	52	[4]	
76		31	00110001	49	[1]	
77		41	01000001	65	[A]	
78		54	01010100	84	[T]	
79		30	00110000	48	[0]	
7A		39	00111001	57	[9]	
7B		32	00110010	50	[2]	
7C		30	00110000	48	[0]	
7D		31	00110001	49	[1]	
7E	Extension Flag	00	00000000	0		
7F	Checksum	8D	10001101	141		

5.2 Cosmetic

Cosmetic Outgoing Inspection Specification

(TFT – LCD ; WXGA Model)

Lenovo R.Sannohmaru Aug.15, 2006

SAMSUNG



J. S. Shim
Sr. Manager. CS Team

CS Team
LCD Business
SAMSUNG Electronics Co.

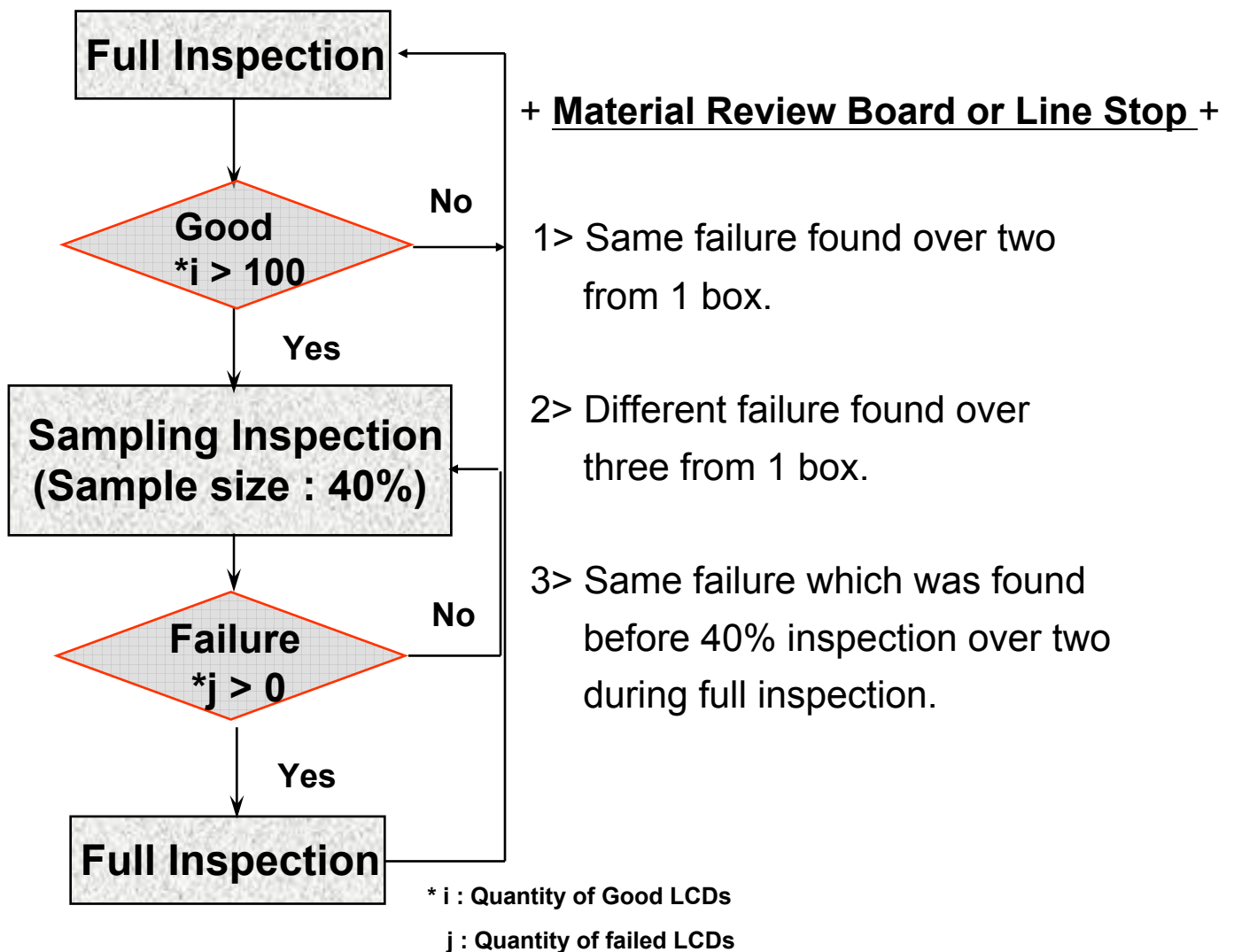
1. Outgoing Inspection

1.1 Outgoing Inspection Plan

1.1-1 Sampling Plan

+ Sample size : 40 %

1.1-2 Flow Chart



1.2 Outgoing Inspection Criteria

1.2-1 Inspection Introduction

1.2-1-1 Conditions

<i>viewing distance</i>	<i>30cm</i>
<i>ambient illumination</i>	<i>500 ~ 700 Lux</i>
<i>ambient temperature</i>	<i>25 +/-3'C</i>
<i>viewing angle</i>	<i>Blacklight-Off : At Right Angle to Polarizer Surface</i> <i>Blacklight-On : Within LCD viewing Angle Specification</i>
<i>Inspection Pattern</i> <i>(Blacklight-On)</i>	<i>In White and 32-Gray for Appearance & Uniformity</i> <i>In White, Black, R,G,B and 32-Gray for Dot Defect</i>
<i>Inspection Area</i>	<i>Active Area</i>

1.2-1-2 Defect Modes

Dark / Bright spots

points on the display which appear dark / bright and remain unchanged in size

Dark / Bright lines

lines on the display which appear dark / bright and remain unchanged in size

Polarizer scratch

when the unit is lit a light, line is seen across a darker background; line does not vary in size

Polarizer dent

when the unit is lit a light, light(white) spots appear against a darker background, and do not vary in size

Bright/Dark dot

a sub-pixel (R, G, B dot) stuck off / on

1.2-2 Mechanical Inspection

Chassis Gap max. 0.5mm



< Measurement location >

Silicone Gasket (Glue) Silicone material shall not be exposed beyond the metal frame edge into the view area

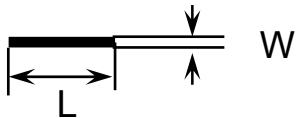
Light Leakage There shall be no visible light around the edges of the screen.

*** If there is none identified criteria in this specification, Samsung will refer production specification that Customer and Samsung agreed.**

*** If there is mechanical dimension issue which has no designated tolerance, SAMSUNG will apply natural tolerance.**

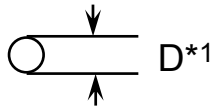
1.2-3 Visual Inspection

+ Polarizer scratch(Line shape); Backlight-off condition

	Size(mm)	Maximum allowable number
	-----	-----
	$W < 0.05$	Ignore
	$0.05 \leq W < 0.1$	
	$0.3 \leq L \leq 3.0$	4 pcs
	$3.0 < L$	Not allowed
	$0.1 \leq W$	Not allowed
	-----	-----

1) Shall be no visible at backlight-on.

+ Polarizer dent (Dot shape); Backlight-off condition

	Size(mm)	Maximum allowable number
	-----	-----
	$D < 0.2$	Ignore
	$0.2 \leq D < 0.5$	5 pcs
	$0.5 \leq D$	Not allowed
	-----	-----

1) In case of dents($0.2 \leq D < 0.4$), the spacing between defects shall be more than 30mm.

2) Shall be no visible at backlight-on.

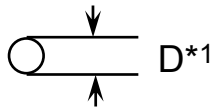
*1 Translucent edge is ignored in measuring the diameter of spot.

- Continued -

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+ Bubble (Dot shape); Backlight-off condition

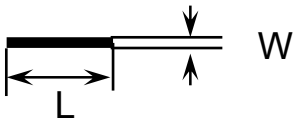


Size(mm)	Maximum allowable number
-----	-----
$D < 0.2$	Ignore
$0.2 \leq D < 0.5$	5 pcs
$0.5 \leq D$	Not allowed
-----	-----

1) The bubble shall be no visible at backlight-on.

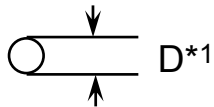
*1 Translucent edge is ignored in measuring the diameter of spot.

+ Foreign material / Stain (Line shape); Backlight-on condition



Size(mm)	Maximum allowable number
-----	-----
$W < 0.05$	Ignore
$0.3 < L \leq 2.0$ and $0.05 \leq W < 0.10$	4 pcs
$0.10 \leq W$ or $2.0 < L$	Not allowed
-----	-----

+ Foreign material / Stain (Dot shape); Backlight-on condition

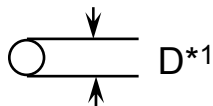


Size(mm)	Maximum allowable number
-----	-----
$D < 0.2$	Ignore
$0.2 \leq D < 0.5$	5 pcs
$0.5 \leq D$	Not allowed
-----	-----

1) If the core material is visible under POL film, it shall be discussed.

*1 Translucent edge is ignored in measuring the diameter of spot.

+ Peeling in polarizer edge(Dot shape); Backlight-off condition



Size(mm)	Maximum allowable number
-----	-----
$D < 0.2$	Ignore
$0.2 \leq D < 0.5$	5 pcs
$0.5 \leq D$	Not allowed
-----	-----

1) Bubble or glue shall not be visible within PC bezel opening area with specified inspection viewing angle.

2) Continuous peeling off on POL edge shall be discussed.

3) Shall be no visible at backlight-on.

*1 Translucent edge is ignored in measuring the diameter of spot.

D: Diameter $D = (\text{major axis} + \text{minor axis}) / 2$ **W: Line width** **L: Line length**

1.2.4 Electrical Inspection

<i>Defect Type</i>	<i>Accept</i>	<i>Reject</i>
<i>Bright Dot</i> <i>Random</i> <i>90%</i> <i>10%</i> <i>Two or more Adjacent</i>	<i>N ≤ 0</i>	
	<i>N ≤ 2</i>	<i>N > 2</i>
	<i>Not Allowed</i>	
<i>Dark Dot (Fig.1)</i> <i>Random</i> <i>Two Adjacent</i> <i>Three or more Adjacent</i>	<i>N ≤ 3</i>	<i>N > 3</i>
	<i>N ≤ 1</i>	<i>N > 1</i>
	<i>Not Allowed</i>	
<i>Maximum allowable number of dot defect</i>	<i>N ≤ 5</i>	<i>N > 5</i>
<i>Minimum distance between defects (Fig. 2)</i> <i>Bright dot - to - Bright dot</i> <i>Dark dot - to - Dark dot</i>	<i>L ≥ 15mm</i>	<i>L < 15mm</i>
	<i>L ≥ 5mm</i>	<i>L < 5mm</i>

[L : length, N : count]

Inspection pattern for electrical defect should be pure R, G, B, Black and White.

Image sticking image sticking pattern shall not be to persist longer than 10 seconds in the next pattern

Glue / stain / dirt glue, non-removable stain and dirt which are visible in the inspection area are not acceptable.

Fig.1 Bright dot defect description

【two adjacent】

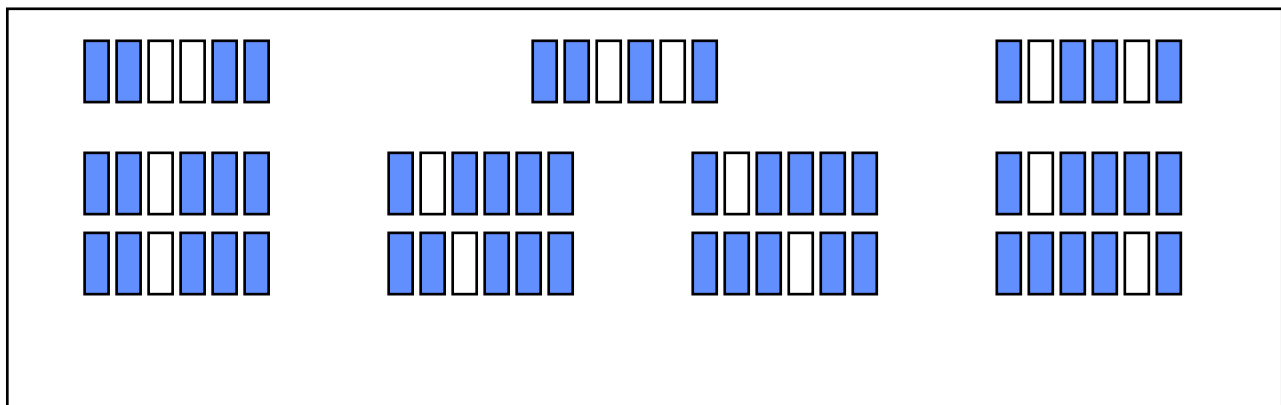
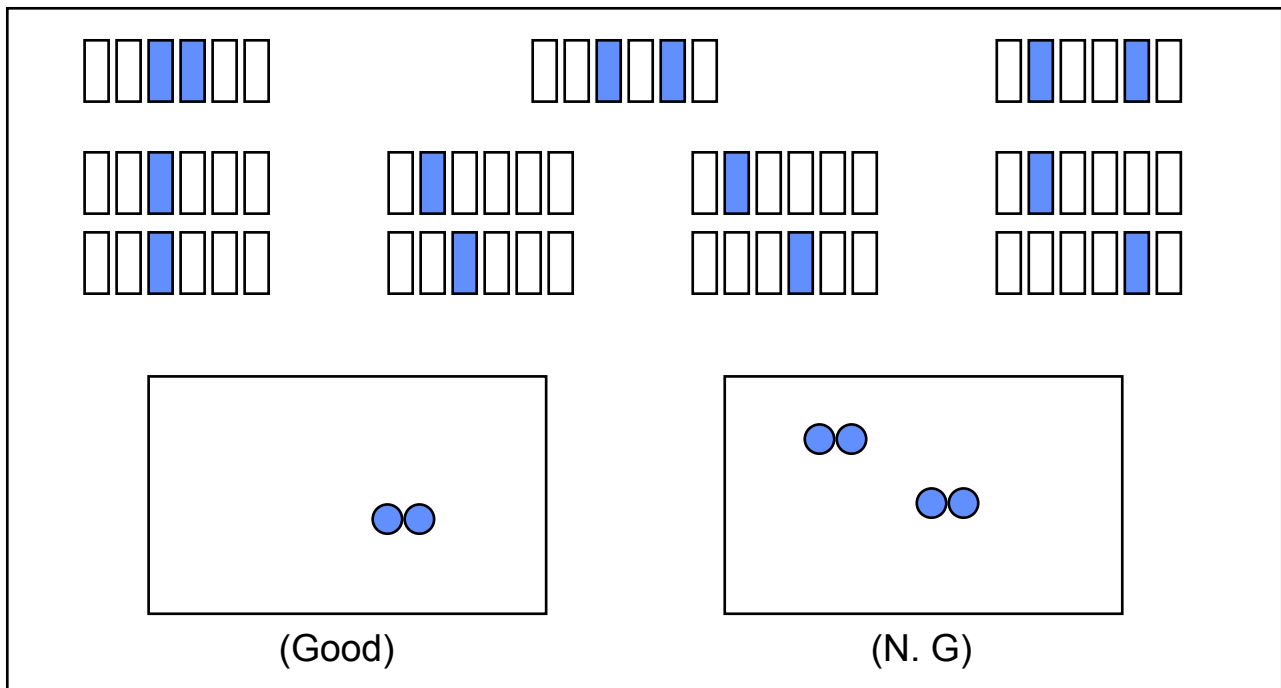


Fig.2 Dark dot defect description

【two adjacent】



* Adjacent two dots in horizontal direction are considered as two dot.

Fig. 3 Minimum distance between dot defects

【bright dot - to - bright dot】



【dark dot - to - dark dot】

