



SAMSUNG

ELECTRONICS

Approval



TO

DATE : October 25, 2006

SAMSUNG TFT-LCD

MODEL NO.:LTN150XF-L02

NOTE : Extension code [-0] LTN150XF-L02- 0
Surface type [**Anti-Glare**]
Green product (Complied with RoHS requirement)

Any Modification of Spec is not allowed without SEC' permission

APPROVED BY :

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REVISION HISTORY

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Date	Revision No.	Page	Summary
Aug. 26, 2005	P00	All	LTN150XF-L02-0 model specification was first issued. Fujitsu P/N: CP272231-01
Oct. 25, 2005	P01	P21	. Mechanical outline dimension was modified by customer's request. Lamp wire routing : [AS-IS] 2.0mm Max → [TO-BE] 2.3mm Max
Dec.13, 2005	P02	P5 P12 P12 P20	Typical weight: 487g → 485g Minimum lamp current revision by Fujitsu's request 3mA or Min duty 20% → 2mA or Min duty 20% Life time: 10K Hr → 12K Hr @6.5mA by Fujitsu's request Correction of power sequence of T4: 200ms → 500ms
Jan. 05, 2006	A00	P12 P23	Startup voltage specification was changed by Fujitsu's request. . At 25 : Max.1200Vrms → Max.1000Vrms . At 0 : Max.1500Vrms → Max.1300Vrms Fujitsu P/N was updated. [AS-IS] CP272231-01 01A → [TO-BE] CP272231-01 02A
Jan.10, 2006	A01	P13	SEC guarantees the leakage current as Fujitsu's method. → Max. 6.0mA [Vector based]
Oct. 25, 2006	A02	P24	. Fujitsu P / N was updated as below. [AS-IS] CP272231-01 02A → [TO-BE] CP272231-01 03A

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GENERAL DESCRIPTION

DESCRIPTION

LTN150XF-L02 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 system. The resolution of a 15.0" contains 1,024 x 768 pixels and can display up to 262,144 colors. 6 O'clock direction is the Optimum viewing angle.

FEATURES

- High Luminance
- Thin and light weight
- High contrast ratio
- XGA (1024x768 pixels) resolution
- Low power consumption
- DE (Data enable) only mode.
- 3.3V LVDS Interface
- On board EDID chip, VESA Support
- Green product (complied with RoHS requirement)

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	304.128(H)X228.096(V) (15.0"diagonal)	mm	
Driver element	a-si TFT active matrix		
Display colors	262,144		
Number of pixel	1024 x 768 (XGA)	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.297(H) x 0.297(V)	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)	316.8	317.3	317.8	mm	
	Vertical (V)	241.4	242.0	242.6	mm	
	Depth (D)	-	5.7	6.0	mm	
Weight		-	485	500	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	T_{STG}	-20	60	°C	(1)
Operating temperate (Temperature of glass surface)	T_{OPR}	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.

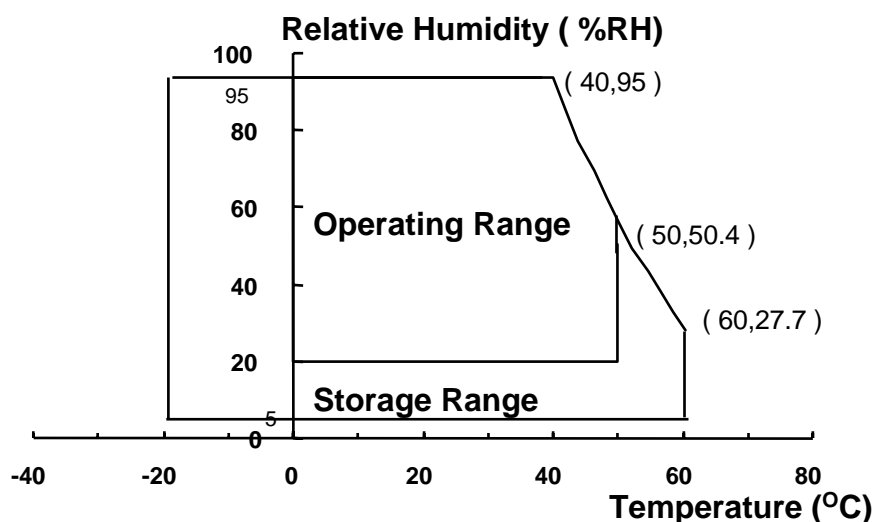
95 % RH Max. (40 °C T_a)

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

(2) 3ms, half sine wave, one time for $\pm X, \pm Y, \pm Z$.

(3) 5~500 Hz, Random vibration, 30 min 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 ($25 \pm 2^\circ C$)

(2) BACK-LIGHT UNIT

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

Item	Symbol	Min.	Max.	Unit	Note
Lamp Current	I_L	2.0	7.0	mArms	(1)
Lamp frequency	F_L	40	80	kHz	(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.

1.3 Others

- MTBF : 50000Hr(except for back-light lamp)

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2. OPTICAL CHARACTERISTICS

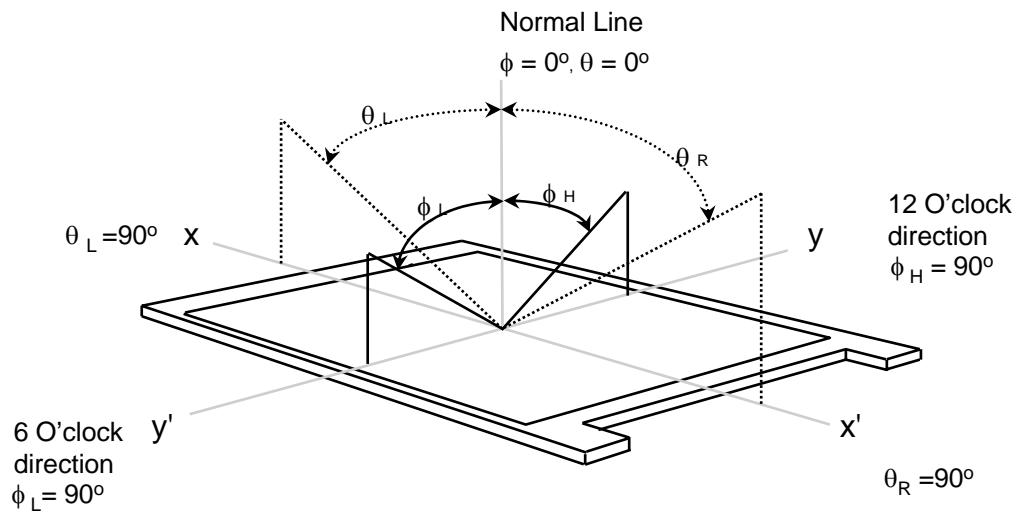
The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5).
Measuring equipment : TOPCON BM-5A

* Ta = 25±2°C , Vcc=3.3V, fv= 60Hz, fDCLK=65MHz, IL= 6.0mA

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note	
Contrast Ratio (5 Points)		CR		200	-	-	-	(1), (2), (5)	
Response Time at Ta	Rising	T _R		Normal Viewing Angle ϕ = 0 θ = 0	-	10	20	msec	(1), (3)
	Falling	T _T			-	30	50		
Average Luminance of White (5 Points)		Y _{L,AVE}	170		200	-	cd/m²	I _L =6.0mA (1), (4)	
Color Chromaticity (CIE)	Red	R _X	0.546		0.576	0.606	-	(1), (5) PR-650	
		R _Y	0.311		0.341	0.371			
	Green	G _X	0.293		0.323	0.353			
		G _Y	0.502		0.532	0.562			
	Blue	B _X	0.123		0.153	0.183			
		B _Y	0.102		0.132	0.162			
	White	W _X	0.283		0.313	0.343			
		W _Y	0.299		0.329	0.359			
Viewing Angle	Hor.	θ _L	CR ≥ 10		40	45		Degrees	(1), (5) BM-5A
		θ _H		40	45				
	Ver.	ϕ _H		20	25				
		ϕ _L		40	45				
13 Points White Variation		δ _L		45	-		%	(6)	

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

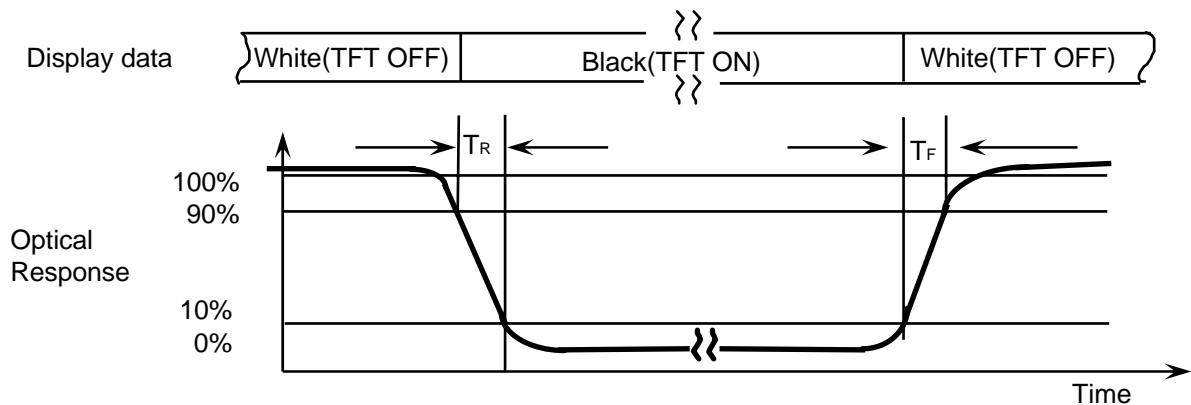


Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

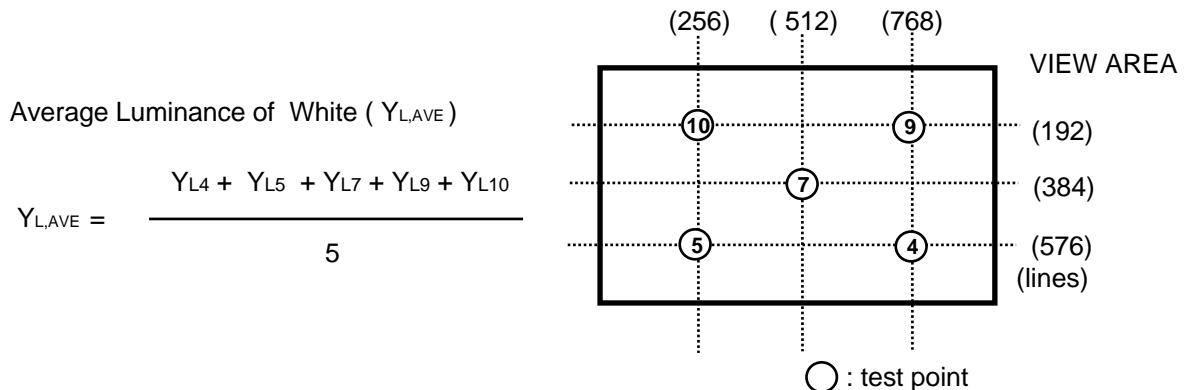
$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

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.

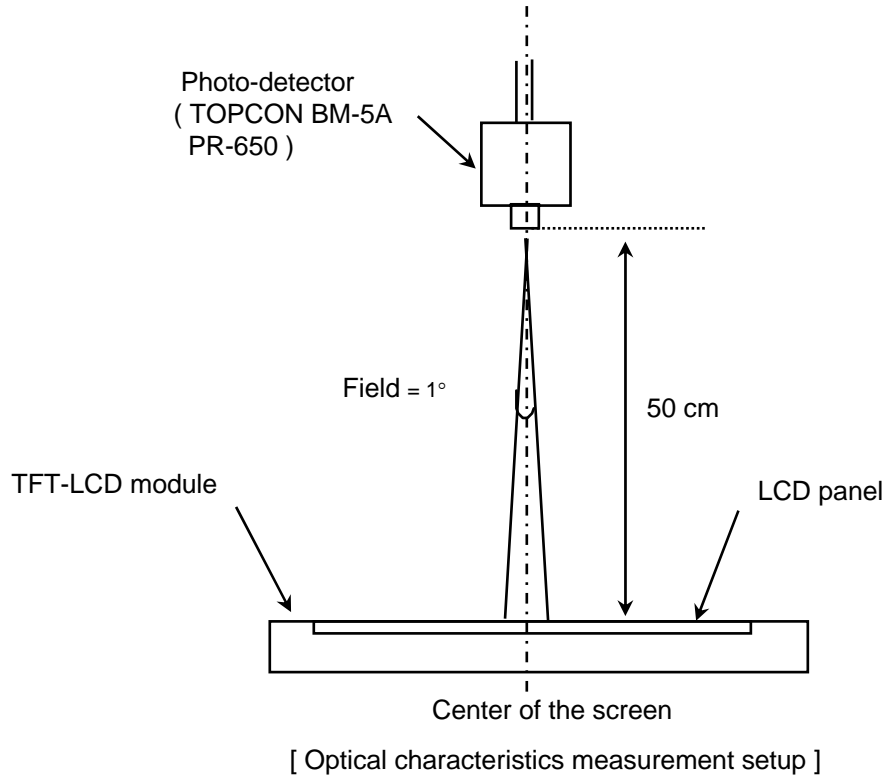


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Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the backlight. This should be measured in the center of screen.

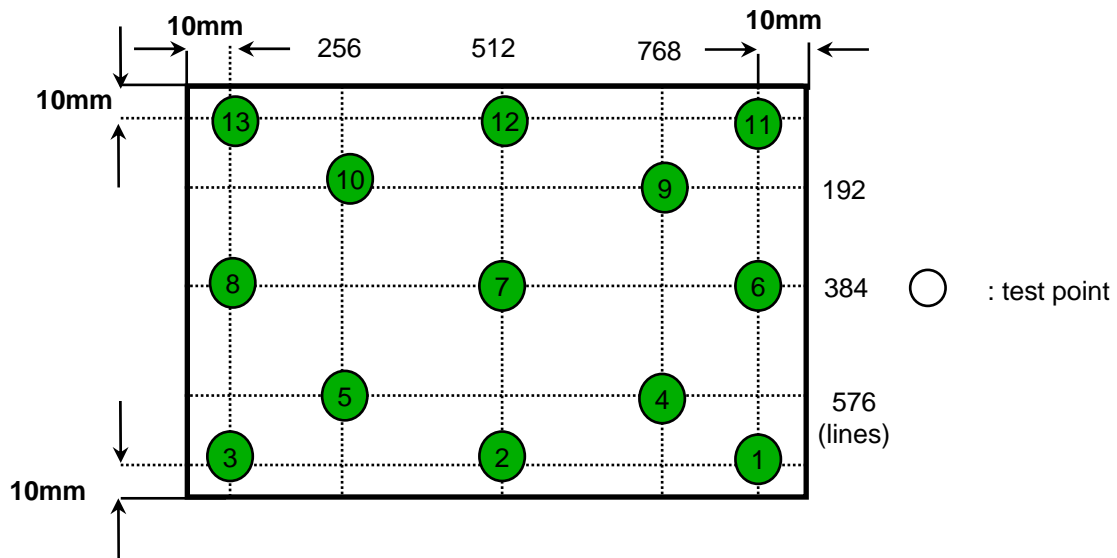
Lamp current : 6.0mA (Inverter : SIC-130T)

Environment condition : $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$



Note 6) Definition of 13 points white variation (δL), [① ~ ⑬]

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



3. ELECTRICAL CHARACTERISTICS

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3.1 TFT LCD MODULE

Ta= 25 ± 2°C

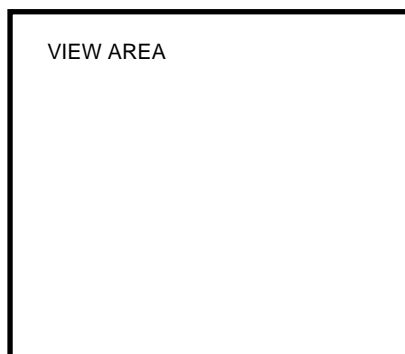
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V _{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	High	V _{IH}	-	-	+100	mV	V _{CM} = +1.2V
	Low	V _{IL}	-100	-	-	mV	
Vsync Frequency		f _v	-	60	-	Hz	
Hsync Frequency		f _H	-	48.36	-	KHz	
Main Frequency		f _{DCLK}	-	65	-	MHz	
Rush Current		I _{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	I _{DD}	-	330	-	mA	(2),(3)*a
	Mosaic		-	350	-	mA	(2),(3)*b
	Max Pattern		-	400	450	mA	(2),(3)*c

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

(2) f_v = 60Hz, f_{DCLK} = 65MHZ, V_{DD} = 3.3V , DC Current.

(3) Power dissipation pattern

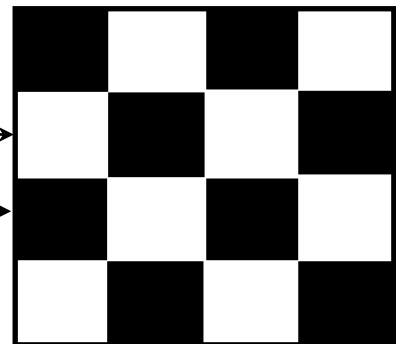
*a) White Pattern



*b) Mosaic Pattern

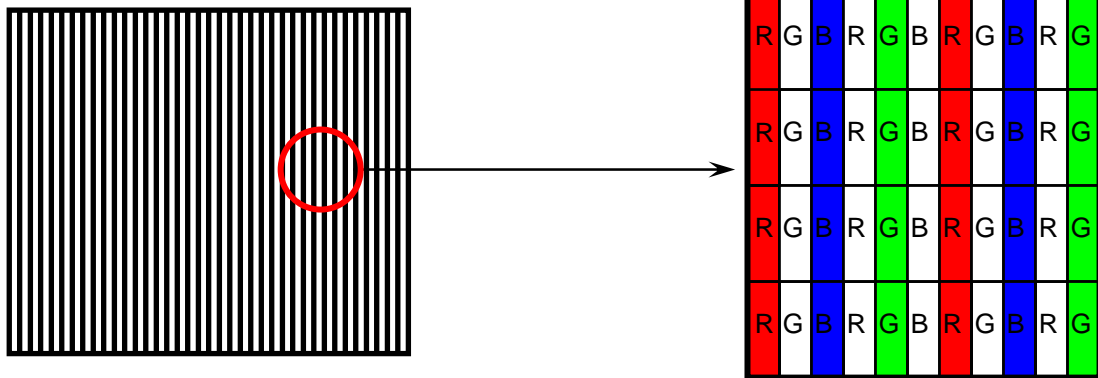
Display Brightest Gray Level →

Display Darkest Gray Level →

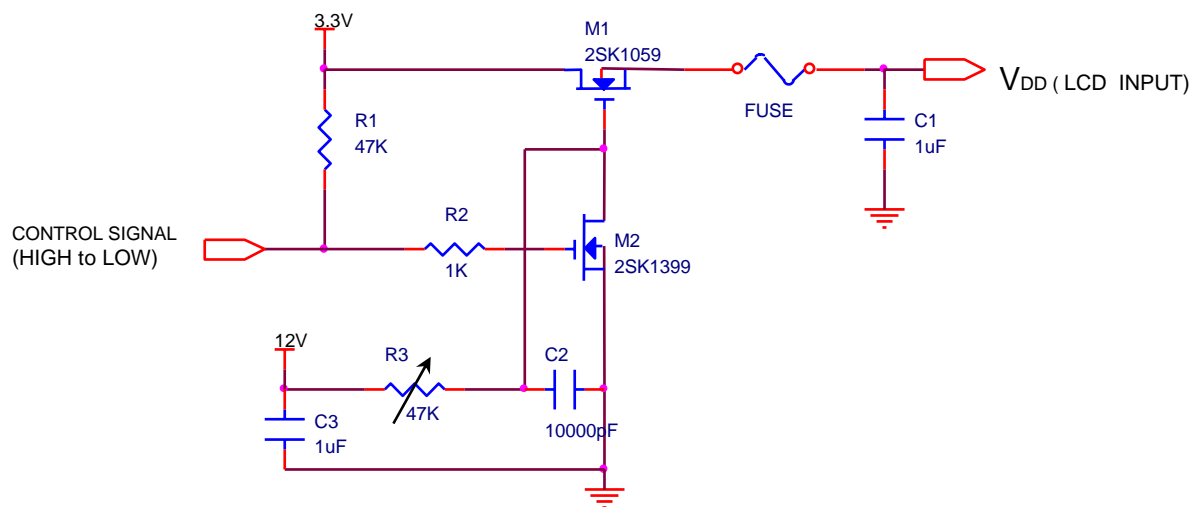


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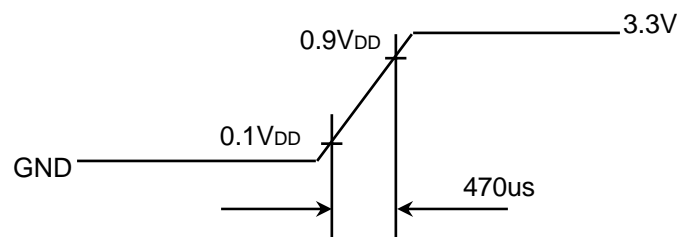
*c) Max Pattern (1dot Vertical stripe pattern)



4) Rush current measurement condition



V_{DD} rising time is 470us



3.2 BACK-LIGHT UNIT

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The backlight system is an edge - lighting type with a single CCFL (Cold Cathode Fluorescent Lamp).
The characteristics of a single lamp are shown in the following tables.

CCFL P/N : MTBK18J()X311MWLEH/C, Harison Toshiba Lighting

Ta=25 ± 2 °C

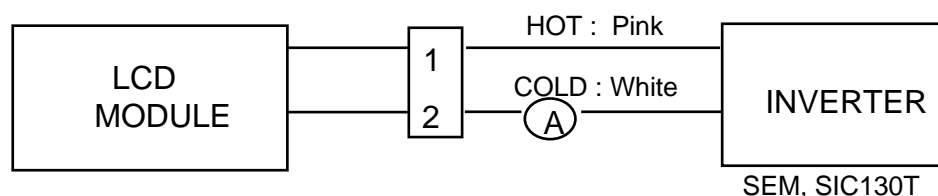
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I _L	2.0 or Duty 20%	6.0	6.5	mArms	(1)
Lamp Voltage	V _L		660	-	Vrms	I _L =6.0mA
Frequency	f _L	45	60	65	KHz	(2)
Power Consumption	P _L		3.96		W	(3), I _L =6.0mA
Operating Life Time	Hr	12,000			Hour	(4), I _L =6.5mA
Startup Voltage	V _s	-	-	1000	Vrms	25°C, (5)
				1300	Vrms	0°C, (5)
Lamp startup time		-	-	1.0	sec	(5)

Note) The waveform of the inverter output voltage must be area symmetric and the design of the inverter must have specifications for the modularized lamp. (Unbalance ratio=Max 10%)

The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.

When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter(miss lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Note (1) Lamp current is measured with a high frequency current meter as shown below.



Switching Frequency : TYP. 60KHz

(2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

(3) Refer to I_L x V_L to calculate.

(4) Life time (Hr) of a lamp can be defined as the time in which it continues to operate under the condition Ta = 25 ± 2 °C and I_L = 6.0 mArms until one of the following event occurs.

1. When the brightness becomes 50% or lower than the original.
2. When the Effective ignition length becomes 80% or lower than the original value.
(Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

(5) The voltage above this value should be applied to the lamp for more than 1 second to startup. Otherwise the lamp may not be turned on.

SEC can guarantee 1400Vrms under only system level not LCD module level.

(Recommendation start up voltage at LCD module status is 1600Vrms)

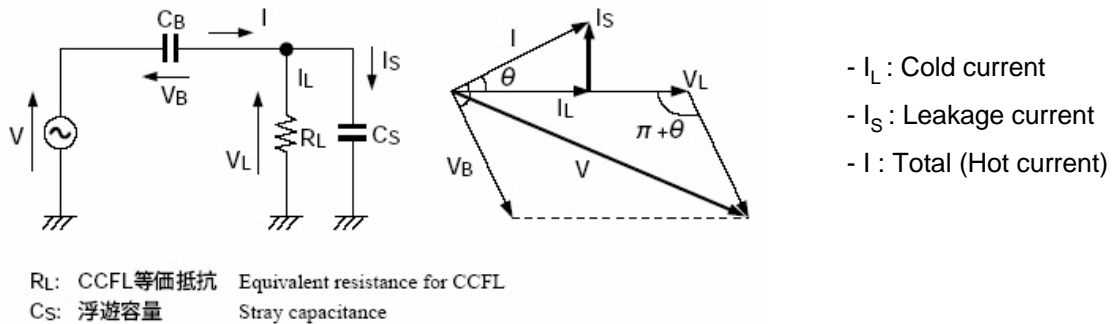
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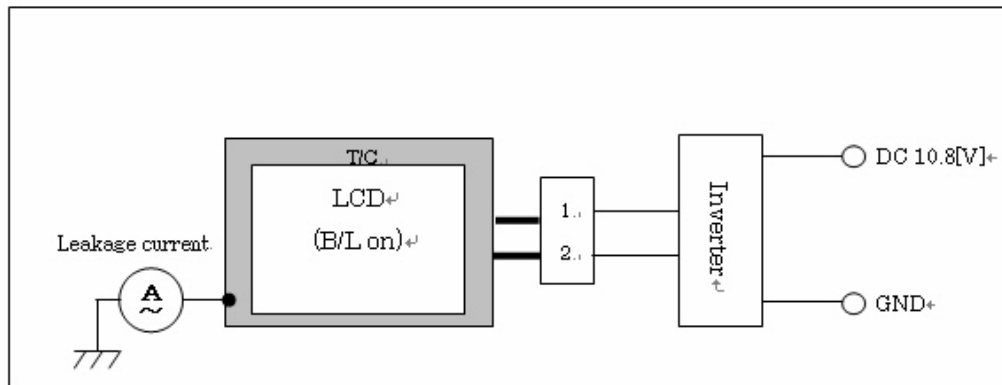
3.3 Leakage current (based on vector & phase difference)

SEC guarantees the leakage current of LCD module as below method.

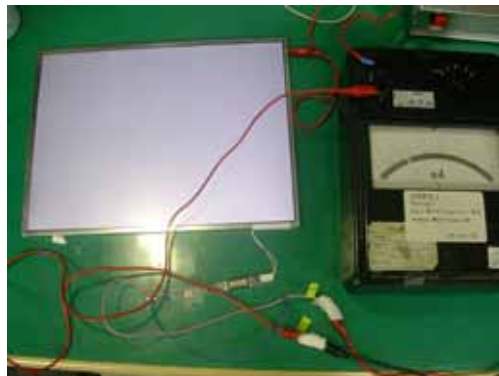
(1) Definition



(2) Measurement method



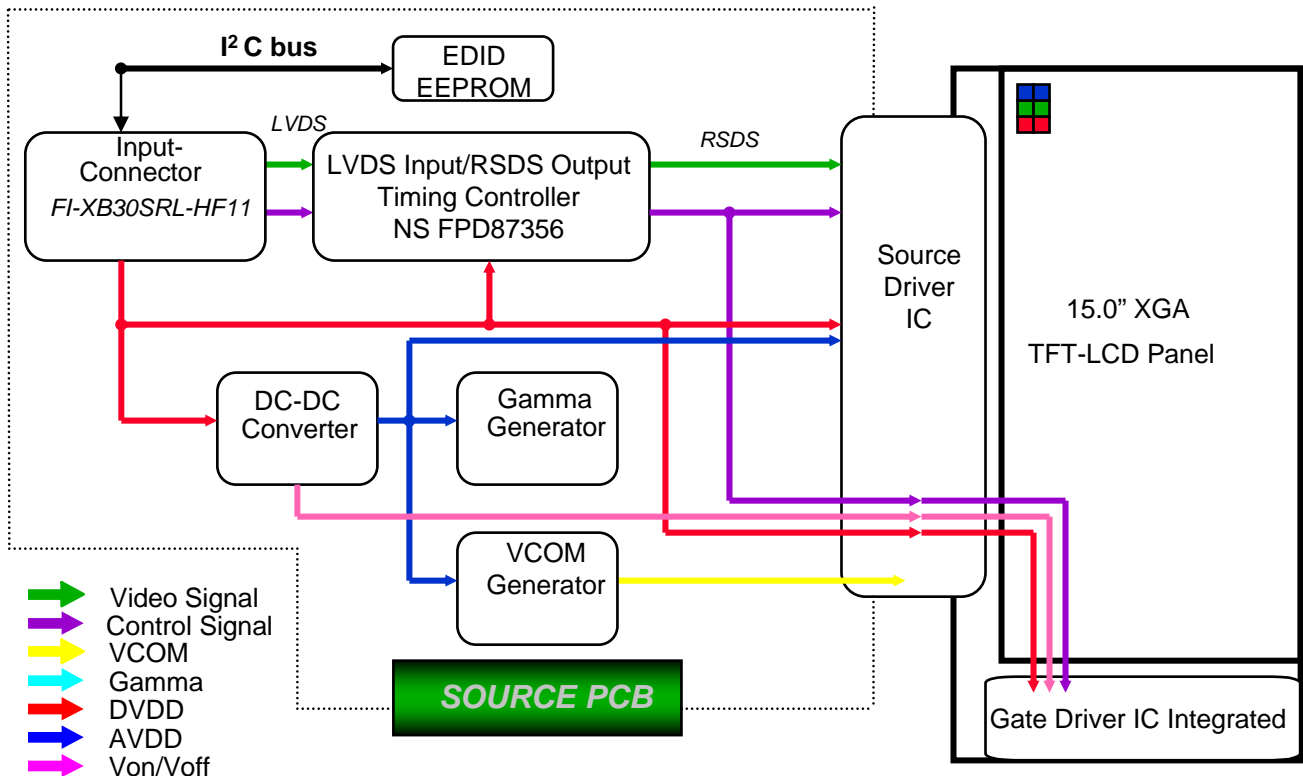
- Test condition : After 5 minutes of turning on backlight unit.



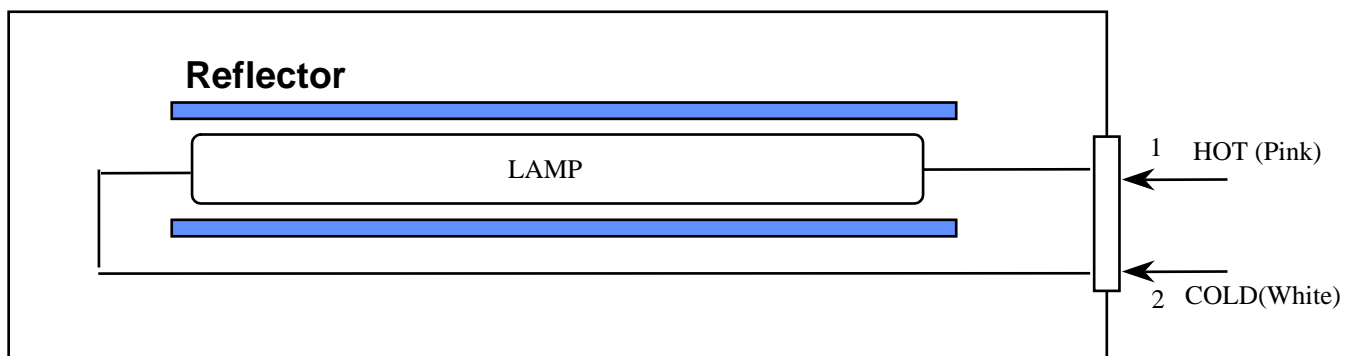
(3) Leakage current specification (I_S): Max. 6mA → Vector value considering phase difference.

4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 BACK-LIGHT UNIT



Note) The output of the inverter may change according to the material of the reflector.

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5. INPUT TERMINAL PIN ASSIGNMENT

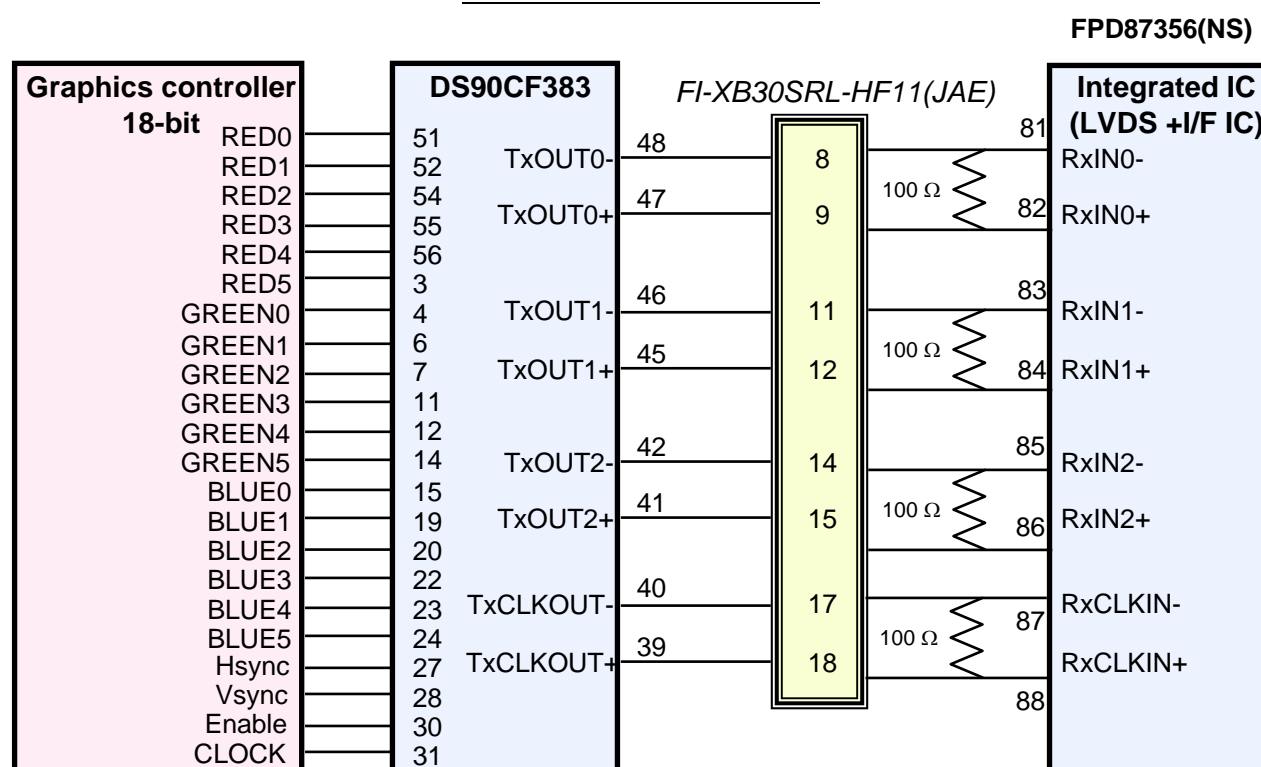
5.1. Input Signal & Power LVDS, Connector : JAE, FI-XB30SRL-HF11
Mating Connector : JAE, FI-X30M

No.	Symbol	Function	Polarity	Remarks
1	VSS	Ground		
2	VDD	POWER SUPPLY +3.3V		
3	VDD	POWER SUPPLY +3.3V		
4	VEEDID	DDC 3.3V Power		
5	NC	NC		
6	CLKEDID	DDC Clock		
7	DATAEDID	DDC data		
8	O_RxIN0-	LVDS Differential Data INPUT (Odd R0-R5,G0)	Negative	
9	O_RxIN0+	LVDS Differential Data INPUT (Odd R0-R5,G0)	Positive	
10	GND	Ground		
11	O_RxIN1-	LVDS Differential Data INPUT (Odd G1-G5,B0-B1)	Negative	
12	O_RxIN1+	LVDS Differential Data INPUT (Odd G1-G5,B0-B1)	Positive	
13	GND	Ground		
14	O_RxIN2-	LVDS Differential Data INPUT (Odd B2-B5,Sync,DE)	Negative	
15	O_RxIN2+	LVDS Differential Data INPUT (Odd B2-B5,Sync,DE)	Positive	
16	GND	Ground		
17	O_RxCLK-	LVDS Differential Data INPUT (Odd Clock)	Negative	
18	O_RxCLK+	LVDS Differential Data INPUT (Odd Clock)	Positive	
19	GND	Ground		
20	NC	NC		
21	NC	NC		
22	NC	NC		
23	NC	NC		
24	NC	NC		
25	NC	NC		
26	NC	NC		
27	NC	NC		
28	NC	NC		
29	NC	NC		
30	NC	NC		

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5.2 LVDS Transmitter : DS90CF383 (National Semiconductor) 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

FLAT LINK INTERFACE

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

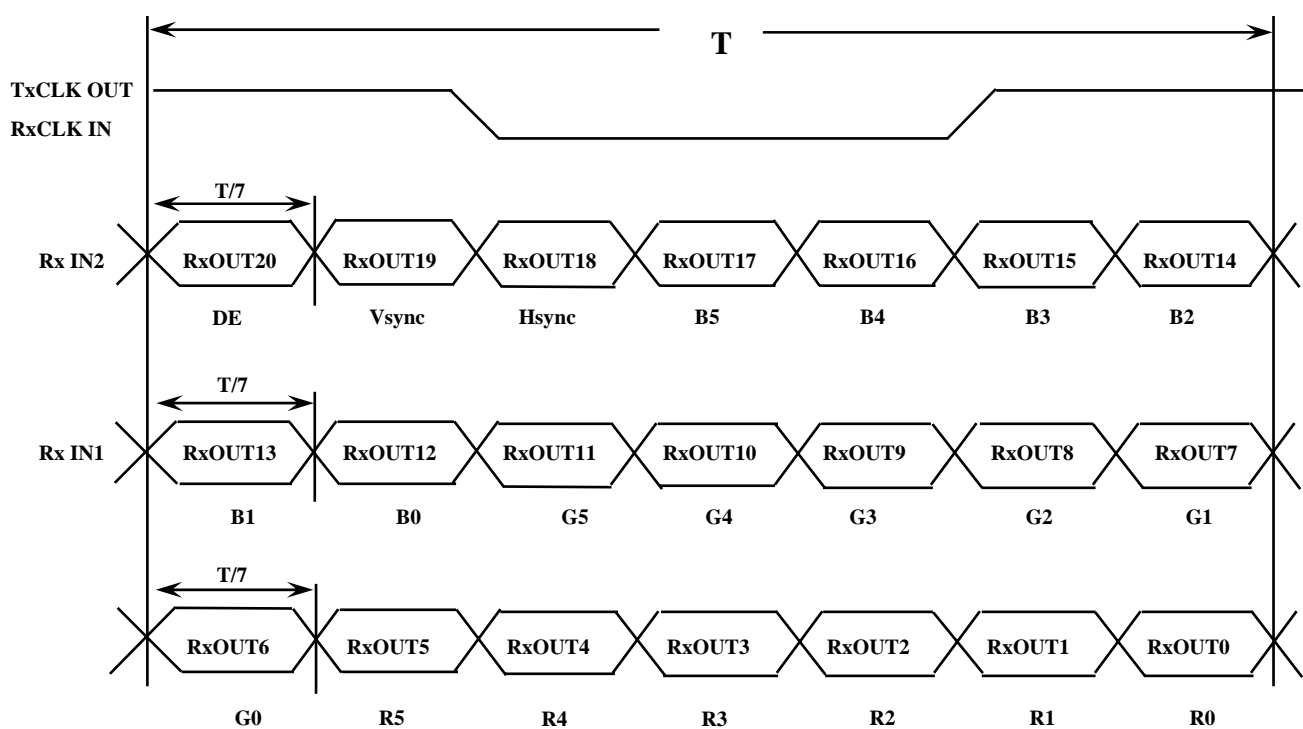
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5.3 BACK LIGHT UNIT

Connector : JST, BHSR - 02VS –1

Pin NO.	Symbol	Color	Function
1	HOT	Pink	High Voltage
2	COLD	White	Low Voltage

5.4 Timing Diagrams of LVDS For Transmission



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5.5 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

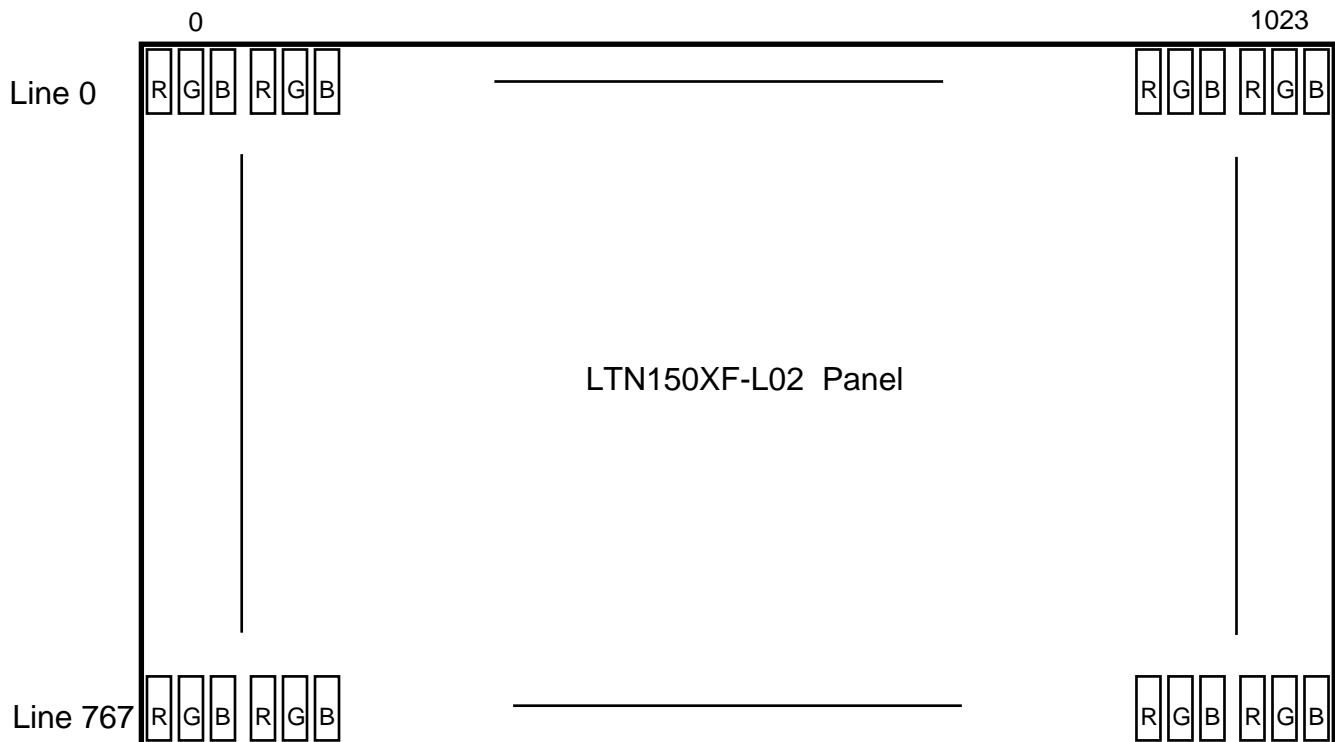
Note 1) Definition of gray :

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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5.6 Pixel Format in the display



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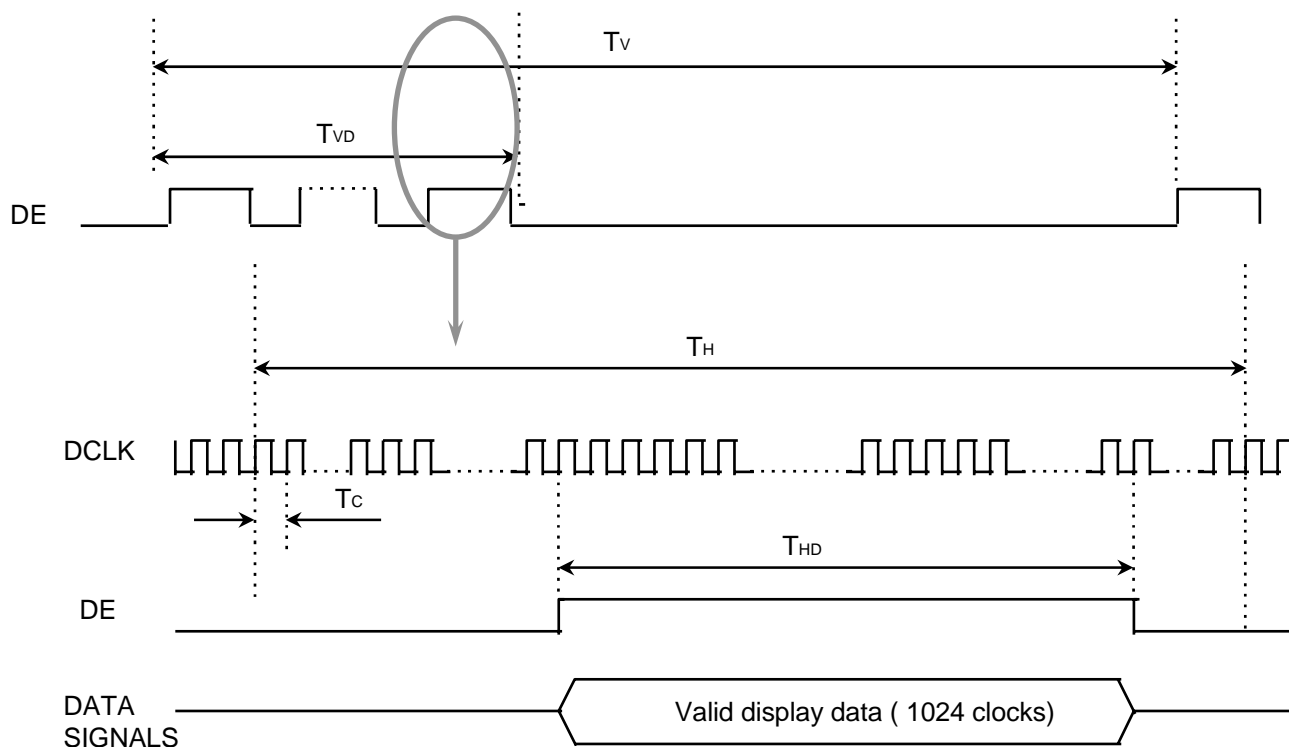
6. INTERFACE TIMING

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6.1 Timing Parameters

Signal	Item	Symbol	Min	Typ	Max	Unit	Note
Frame Frequency	Cycle	T_V	-	806	-	Line	
Vertical Active Display time	Display period	T_{VD}	-	768	-	Line	
One line Scanning time	Cycle	T_H	-	1344	-	Clock	
Horizontal Active Display time	Display period	T_{HD}	-	1024	-	Clock	

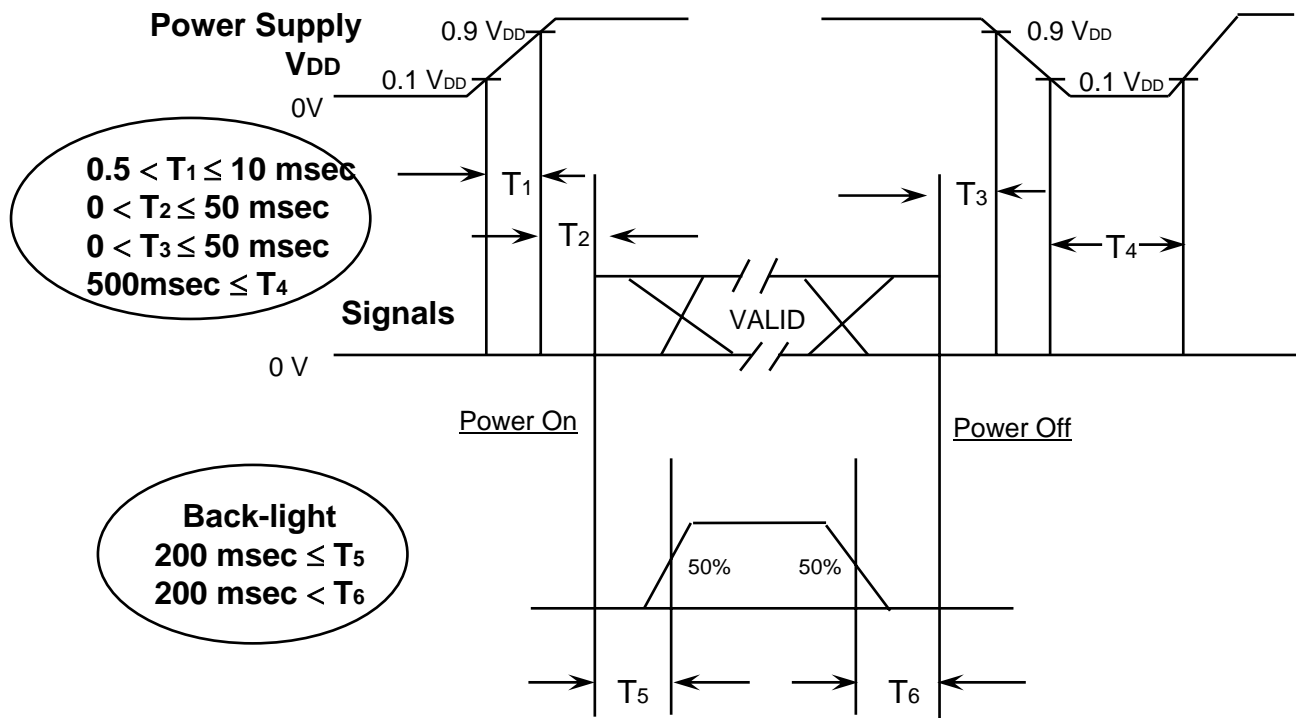
6.2 Timing diagrams of interface signal



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6.3 Power ON/OFF Sequence (Based on VESA standard)

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



Power ON/OFF Sequence

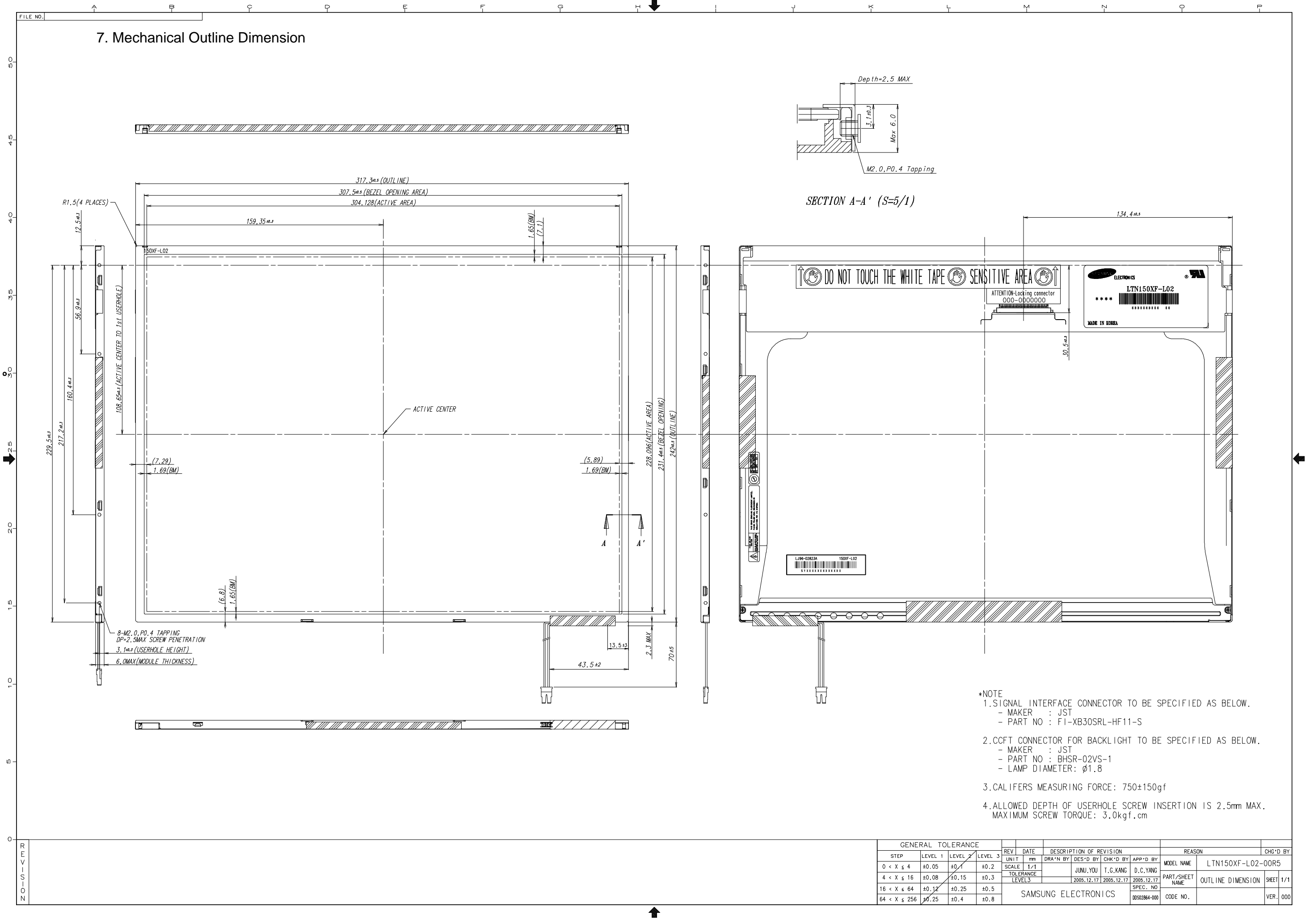
- T1 : Vdd rising time from 10% to 90%
- T2 : The time from Vdd to valid data at power ON.
- T3 : The time from valid data off to Vdd off at power Off.
- T4 : Vdd off time for Windows restart
- T5 : The time from valid data to B/L enable at power ON.
- T6 : The time from valid data off to B/L disable at power Off.

NOTE.

- (1) The supply voltage of the external system for the module input should be the same as the definition of VDD.
- (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become white.
- (3) In case of VDD = 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



- *NOTE
- 1.SIGNAL INTERFACE CONNECTOR TO BE SPECIFIED AS BELOW.
 - MAKER : JST
 - PART NO : FI-XB30SRL-HF11-S
 - 2.CCFT CONNECTOR FOR BACKLIGHT TO BE SPECIFIED AS BELOW.
 - MAKER : JST
 - PART NO : BHSR-02VS-1
 - LAMP DIAMETER: $\phi 1.8$
 - 3.CALIFERS MEASURING FORCE: 750 \pm 150gf
 - 4.ALLOWED DEPTH OF USERHOLE SCREW INSERTION IS 2.5mm MAX.
MAXIMUM SCREW TORQUE: 3.0kgf.cm

GENERAL TOLERANCE				REVISION				DESCRIPTION OF REVISION				REASON			
STEP	LEVEL 1	LEVEL 2	LEVEL 3	REV	DATE	DRAWN BY	DES'D BY	CHK'D BY	APP'D BY	MODEL NAME	LTN150XF-L02-00R5	PART/SHEET NAME	OUTLINE DIMENSION	SHEET	1/1
0 < X \leq 4	± 0.05	± 0.1	± 0.2	UNIT	mm	JUNU.YOU	T.G.KANG	D.C.YANG	2005.12.17	2005.12.17	2005.12.17	CODE NO.		VER.	000
4 < X \leq 16	± 0.08	± 0.15	± 0.3	SCALE	1/1										
16 < X \leq 64	± 0.12	± 0.25	± 0.5	TOLERANCE	LEVEL 3										
64 < X \leq 256	± 0.25	± 0.4	± 0.8	LEVEL 3											
SAMSUNG ELECTRONICS															

8. PACKING

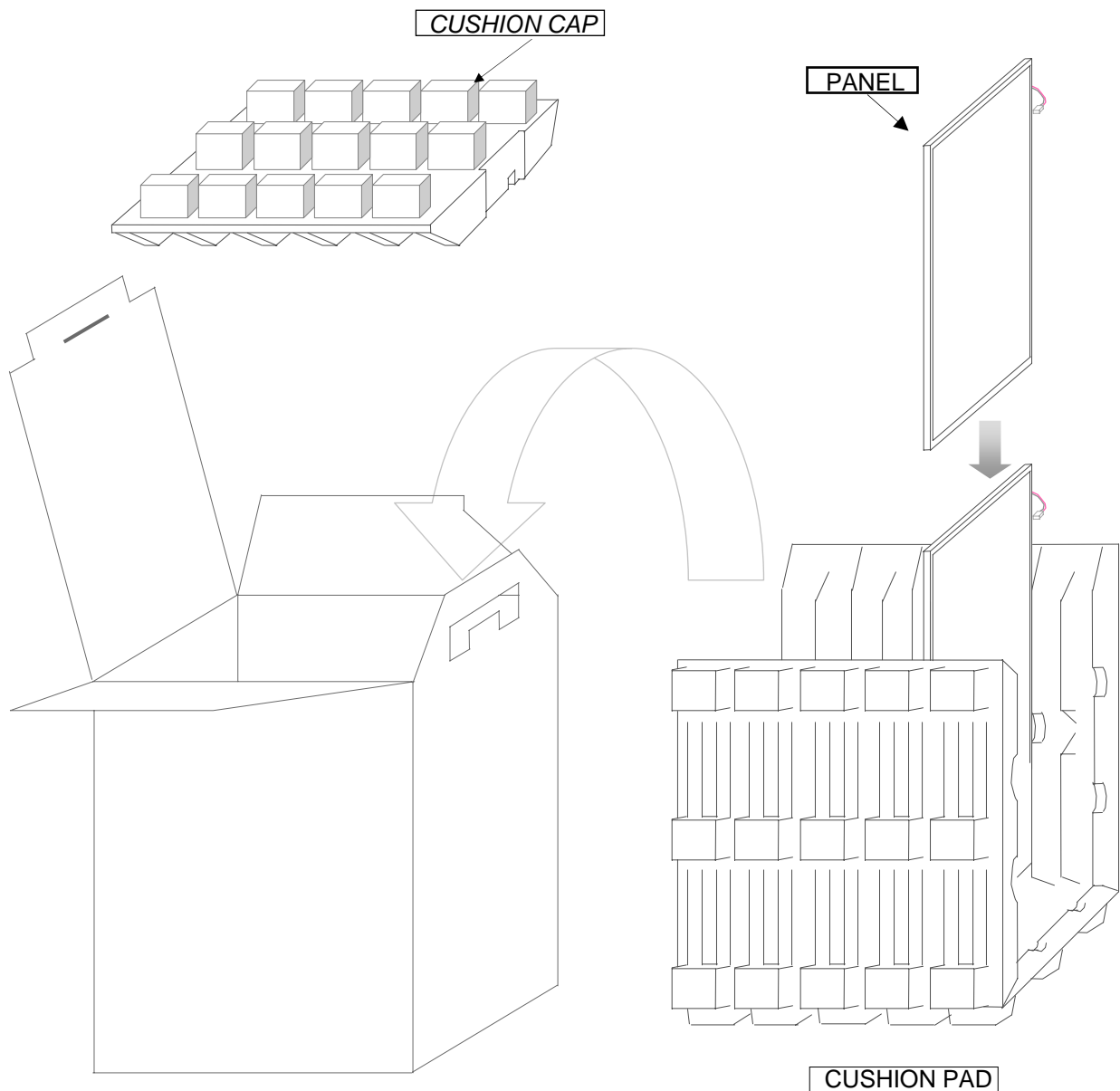
8.1 Packing

CARTON(Internal Package)

(1)Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2)Packing Method



Note (1)Total : Approx. 7.5Kg

(2)Acceptance number of piling : 10 sets

(3)Carton size : 325(W) X 260(D) X 420(H)

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(3)Packing Material

No.	Parts name	Quantity
1	Static electric protective sack	10
2	Cushion pad (Inner box) Included shock absorber	1set
3	Pictorial marking	2 pieces
4	Carton	1 set

9. MARKINGS & OTHERS

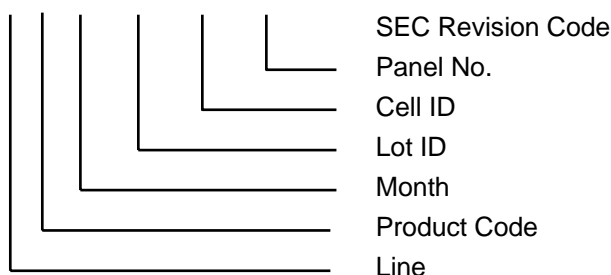
A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1)Parts number : LTN150XF-L02

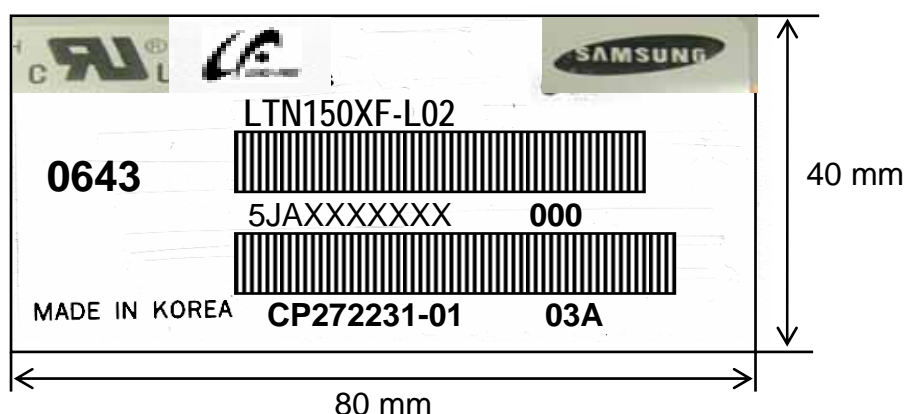
(2)Revision : Three letters

(3)Control code : One letter

(4)Lot number : 5 J A XXX XX XX 000



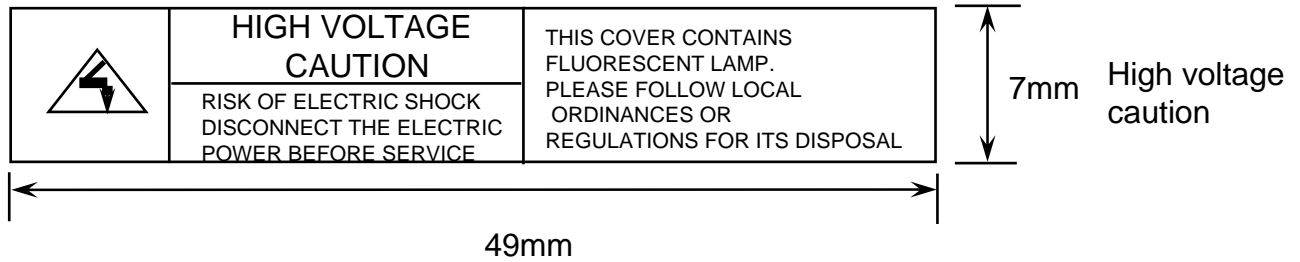
(5) Nameplate Indication



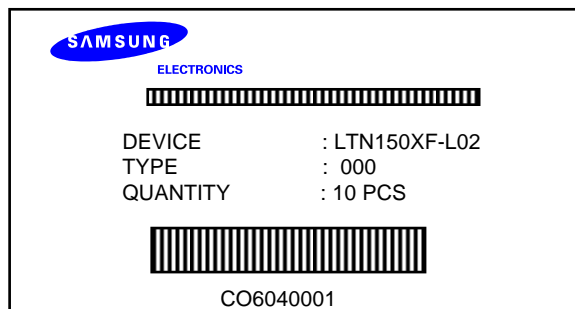
Parts name : LTN150XF - L02
 Lot number : 5JAXXXXXXX
 Inspected work week : 0643(Year 2006, 43th week)
 Product Revision Code : 000
 Fujitsu's part name : CP272231-01 03A

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High voltage caution Mark



(6) Packing small box attach



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



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.

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11. EDID

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Address (HEX)	FUNCTION	Value HEX	BIN	DEC	ASCII or Data	Notes
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	4C	01001100	76	S	3 character ID
09		A3	10100011	163	E C	"SEC"
0A	ID Product Code	58	01011000	88	[X]	
0B		46	01000110	70	[F]	
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	0F	00001111	15	2005	2005
12	EDID Structure Ver.	01	00000001	1	1	EDID Ver. 1.0
13	EDID revision #	03	00000011	3	3	EDID Rev. 0.3
14	Video input definition	80	10000000	128		
15	Max H image size	1F	00011111	31	31	304 cm(approx)
16	Max V image size	17	00010111	23	23	228 cm(approx)
17	Display Gamma	78	01111000	120	2.2	Gamma 2.2
18	Feature support	0A	00001010	10		
19	Red/green low bits	D9	11011001	217		10000111
1A	Blue/white low bits	0E	00001110	14		11111110
1B	Red x/ high bits	96	10010110	150	0.589	Red x 0.580= 1001010010
1C	Red y	56	01010110	86	0.337	Red y 0.340= 0101011100
1D	Green x	52	01010010	82	0.322	Green x 0.310= 0100111101
1E	Green y	86	10000110	134	0.524	Green y 0.550= 1000110011
1F	Blue x	27	00100111	39	0.152	Blue x 0.155= 0010011111
20	Blue y	23	00100011	35	0.137	Blue y 0.155= 0010011111
21	White x	50	01010000	80	0.315	White x 0.315= 0101000011
22	White y	54	01010100	84	0.330	White y 0.330= 0101010010
23	Established timing 1	00	00000000	0		
24	Established timing 2	00	00000000	0		
25	Established timing 3	00	00000000	0		

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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		
36	Detailed timing/monitor descriptor #1	64	01100100	100	65	main clock=65 Mhz
37		19	00011001	25		
38		00	00000000	0	1024	Hor active=1024 pixels
39		40	01000000	64	320	Hor blanking=320 pixels
3A		41	01000001	65		4bit : 4bit
3B		00	00000000	0	768	Vertical active=768 lines
3C		26	00100110	38	38	Vertical blanking=38lines
3D		30	00110000	48		4bit : 4bit
3E		18	00011000	24	24	Hor sync. Offset=24 pixels
3F		88	10001000	136	136	H sync. Width=136 pixels
40		36	00110110	54	3 6	V sync. Offset=3 lines V sync. Width=6 lines
41		00	00000000	0		2bit : 2bit :2bit :2bit
42		30	00110000	48	304	H image size= 304 mm(approx)
43		E4	11100100	228	228	V image size = 228 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	00	00000000	0		Manufacturer Specified (Timing)
49		00	00000000	0		
4A		00	00000000	0		
4B		0F	00001111	15		
4C		00	00000000	0		
4D		04	00000100	4		Value=HSPWmin / 2
4E		7E	01111110	126		Value=HSPWmax / 2
4F		18	00011000	24		Value=Thbpmin /2
50		FF	11111111	255		Value=Thbpmax /2
51		01	00000001	1		Value=VSPWmin /2
52		05	00000101	5		Value=VSPWmax /2
53		02	00000010	2		Value=TVbpmin / 2
54		6F	01101111	111		Value=TVbpmax / 2
55		18	00011000	24		Thpmin=value*2 + Hapixelclks
56		FF	11111111	255		Thpmax=value*2 + Hapixelclks
57		02	00000010	2		Tvpmin=value*2 + Valines
58		74	01110100	116		Tvpmax=value*2 + Valines
59		00	00000000	0	0	Module revision

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5A	Detailed timing/monitor descriptor #3	00	00000000	0		ASCII Data String Tag
5B		00	00000000	0		
5C		00	00000000	0		
5D		FE	11111110	254		
5E		00	00000000	0		
5F		53	01010011	83	[S]	
60		41	01000001	65	[A]	
61		4D	01001101	77	[M]	
62		53	01010011	83	[S]	
63		55	01010101	85	[U]	
64		4E	01001110	78	[N]	
65		47	01000111	71	[G]	
66		0A	00001010	10	[^]	
67		20	00100000	32	[]	
68		20	00100000	32	[]	
69		20	00100000	32	[]	
6A		20	00100000	32	[]	
6B		20	00100000	32	[]	
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		35	00110101	53	[5]	
76		30	00110000	48	[0]	
77		58	01011000	88	[X]	
78		46	01000110	70	[F]	
79		2D	00101101	45	[.]	
7A		4C	01001100	76	[L]	
7B		30	00110000	48	[0]	
7C		32	00110010	50	[2]	
7D		0A	00001010	10	[^]	
7E	Extension Flag	00	00000000	0		
7F	Checksum	A7	10100111	167		