



TO : SONY

DATE : May. 6, 2009.

SAMSUNG TFT-LCD

**MODEL NO. : LTN156AT01**

NOTE : Extension code [ -S03 ]  
→ LTN156AT01-**S03**  
Surface type [ **Glare** ]

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

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## GENERAL DESCRIPTION

### DESCRIPTION

LTN156AT01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight unit. The resolution of a 15.6" contains 1366 x 768 pixels and can display up to 262,144 colors. 6 O'clock direction is the optimum viewing angle.

### FEATURES

- High contrast ratio, high aperture structure
- 1366 x 768 pixels resolution (16:9)
- Color Gamut (Typical 60%)
- Low power consumption
- Fast Response Time
- Single CCFL
- DE(Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip
- RoHS Compliance

### 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	344.232 (H) x 193.536(V) ( 15.6" diagonal )	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	1366 x 768	pixel	16 : 9
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.252 (H) x 0.252 (V) (TYP.)	mm	
Display Mode	Normally white		
Surface treatment	Haze 0, Hardness 3H		

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## Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	(358.8)	(359.3)	(359.8)	mm	(1)
	Vertical (V)	(209.0)	(209.5)	(210.0)	mm	
	Depth (D)	-	(5.9)	6.2	mm	
Weight		-	(500)	(520)	g	

Note (1) Measurement condition of outline dimension

- . Equipment : Vernier Calipers
- . Push Force : 500g · f (minimum)

## 1. ABSOLUTE MAXIMUM RATINGS

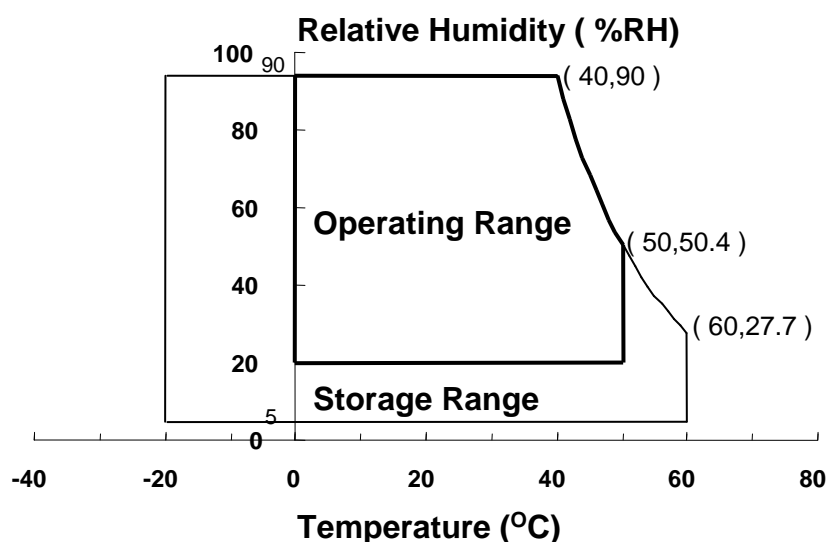
### 1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1),(5)
Operating temperate (Temperature of glass surface)	TOPR	0	50	°C	(1),(5)
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  $39^{\circ}\text{C}$  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.

(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  $T_a$  ( $25 \pm 2^\circ C$ )

### (2) BACK-LIGHT UNIT

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

Item	Symbol	Min.	Max.	Unit	Note
Lamp Current	$I_L$	3.0	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.

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## 2. OPTICAL CHARACTERISTICS

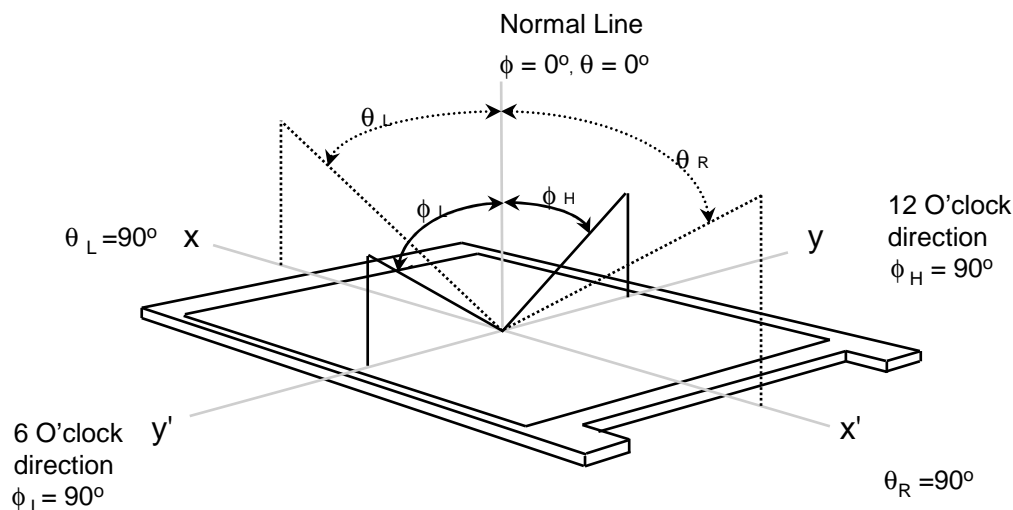
The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5).  
Measuring equipment : TOPCON SR-3

\* Ta = 25 ± 2 °C, V<sub>DD</sub>=3.3V, f<sub>V</sub>= 60Hz, f<sub>DCLK</sub> = (72.33)MHz, I<sub>L</sub> = 6.0 mA

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR	Normal Viewing Angle ϕ = 0 θ = 0	(500)	(600)	-	-	(1), (2), (5)
Response Time at Ta ( Rising + Falling )		T <sub>RT</sub>		-	(16)	(25)	msec	(1), (3)
Average Luminance of White (5 Points)		Y <sub>L,AVE</sub>		(185)	(220)	-	cd/m <sup>2</sup>	I <sub>L</sub> =6.0mA (1), (4)
Color Chromaticity ( CIE )	Red	R <sub>X</sub>		(TBD)	(TBD)	(TBD)	-	(1), (5) SR-3
		R <sub>Y</sub>		(TBD)	(TBD)	(TBD)		
	Green	G <sub>X</sub>		(TBD)	(TBD)	(TBD)		
		G <sub>Y</sub>		(TBD)	(TBD)	(TBD)		
	Blue	B <sub>X</sub>		(TBD)	(TBD)	(TBD)		
		B <sub>Y</sub>		(TBD)	(TBD)	(TBD)		
	White	W <sub>X</sub>		0.283	0.313	0.343		
		W <sub>Y</sub>		0.299	0.329	0.359		
Viewing Angle	Hor.	θ <sub>L</sub>	CR ≥ 10	(40)	45	-	Degrees	(1), (5) SR-3
		θ <sub>H</sub>		(40)	45	-		
	Ver.	ϕ <sub>H</sub>		(10)	15	-		
		ϕ <sub>L</sub>		(30)	35	-		
13 Points White Variation		δ <sub>L</sub>		-	-	(1.54)	-	(6)

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

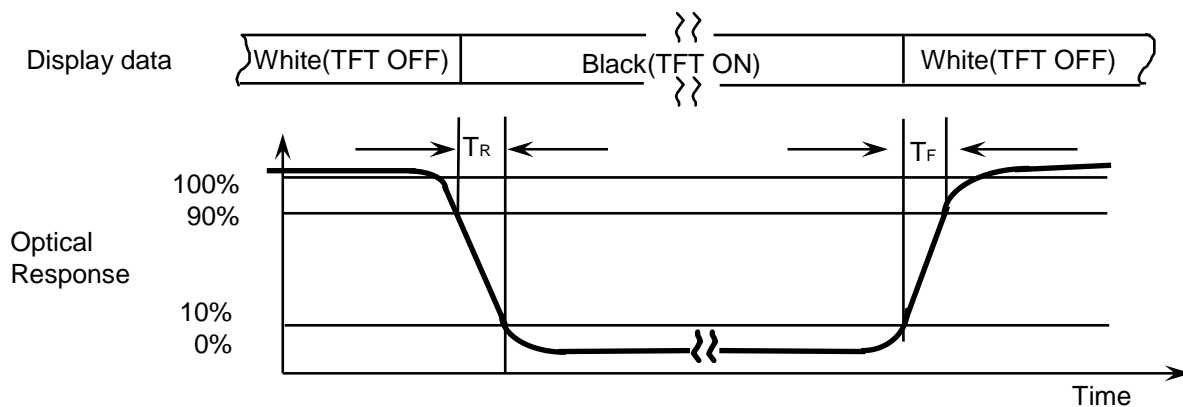


Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

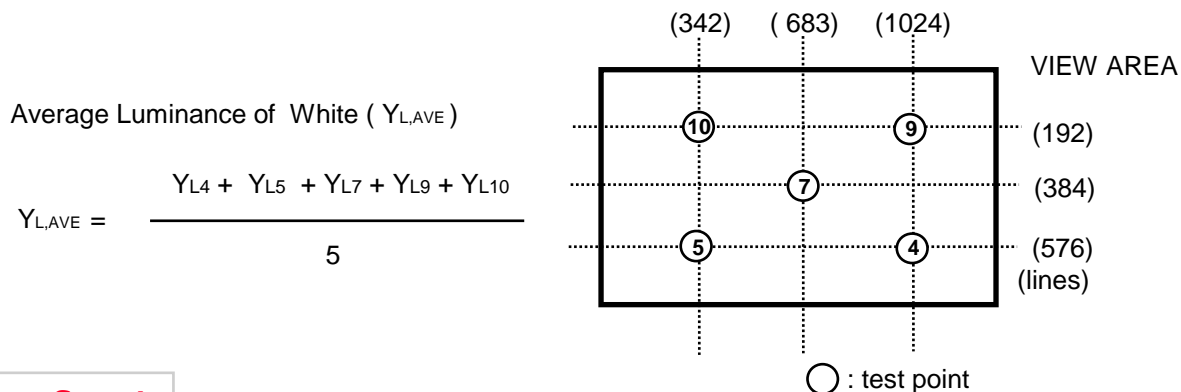
$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

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

Note 3) Definition of Response time :

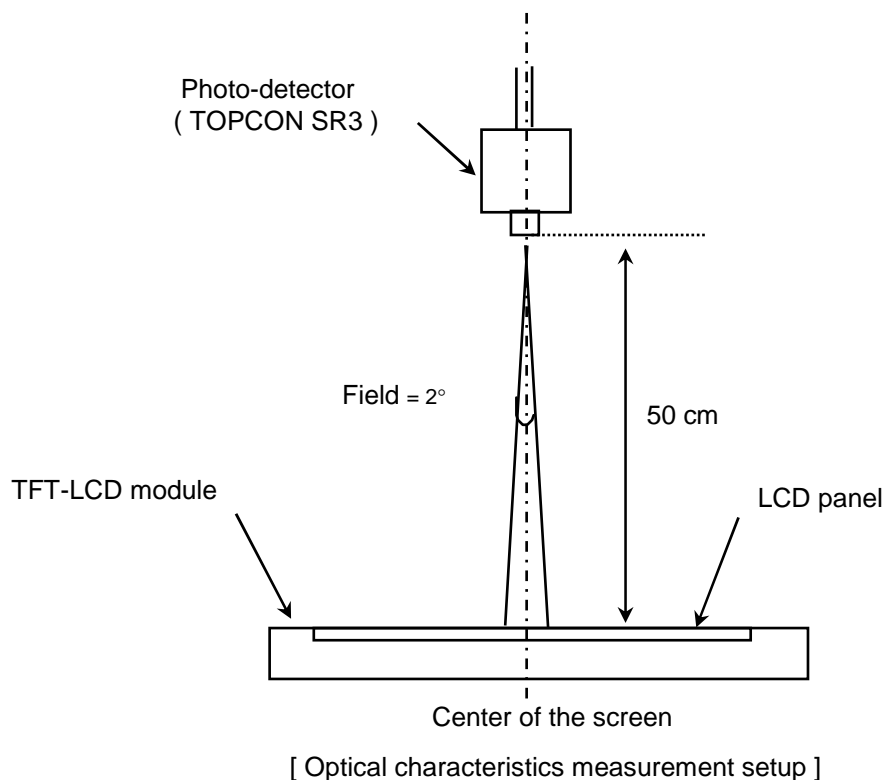


Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.



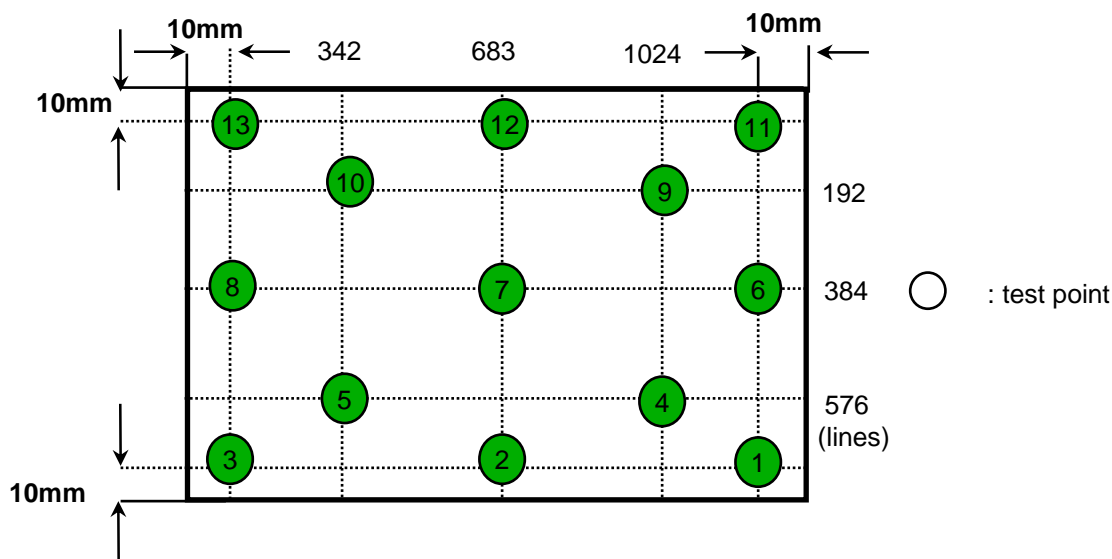
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Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the backlight. This should be measured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

#### 3.1 TFT LCD MODULE

Ta= 25 ± 2°C

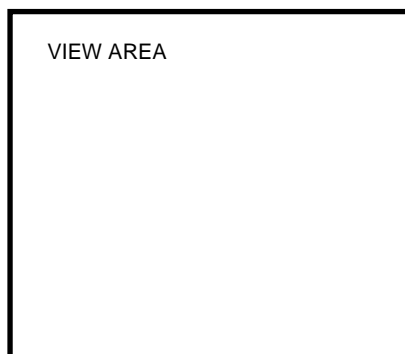
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V <sub>DD</sub>	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	High	V <sub>IH</sub>	-	-	+100	mV	V <sub>CM</sub> = +1.2V
	Low	V <sub>IL</sub>	-100	-	-	mV	
Vsync Frequency		f <sub>v</sub>	-	60	-	Hz	
Hsync Frequency		f <sub>H</sub>	-	(46.8)	-	KHz	
Main Frequency		f <sub>DCLK</sub>	(67.3)	(69.3)	(71.5)	MHz	
Rush Current		I <sub>RUSH</sub>	-	-	1.5	A	(4)
Current of Power Supply	White	I <sub>DD</sub>	-	(360)	-	mA	(2),(3)*a
	Mosaic		-	(420)	-	mA	(2),(3)*b
	V. stripe		-	(530)	(600)	mA	(2),(3)*c

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

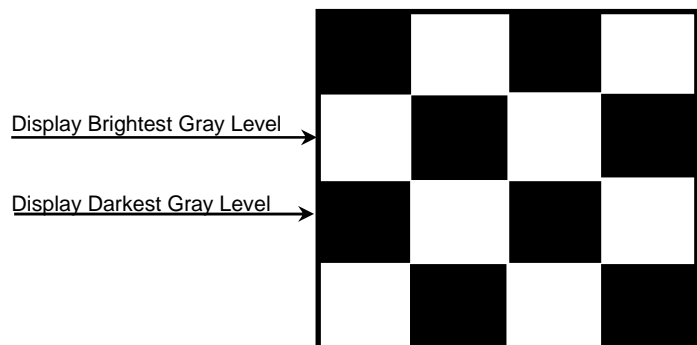
(2) f<sub>v</sub> = 60Hz, f<sub>DCLK</sub> = 72.33 MHz, V<sub>DD</sub> = 3.3V , DC Current.

(3) Power dissipation pattern

\*a) White Pattern



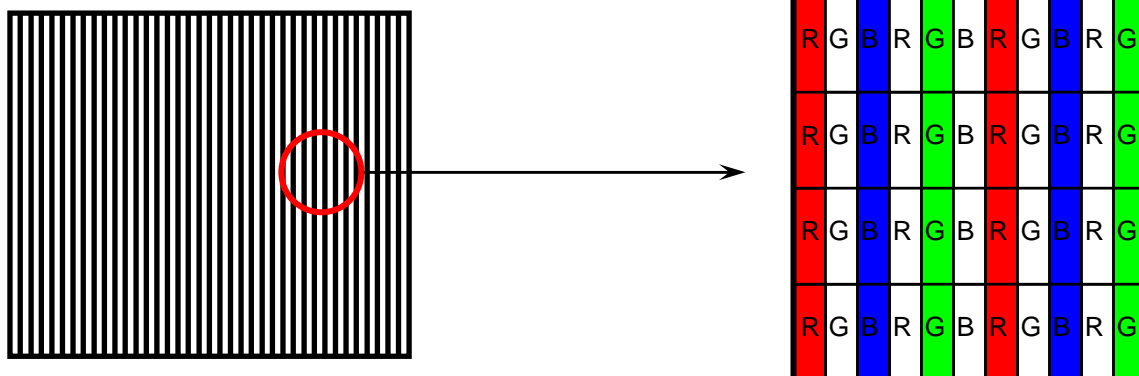
\*b) Mosaic Pattern



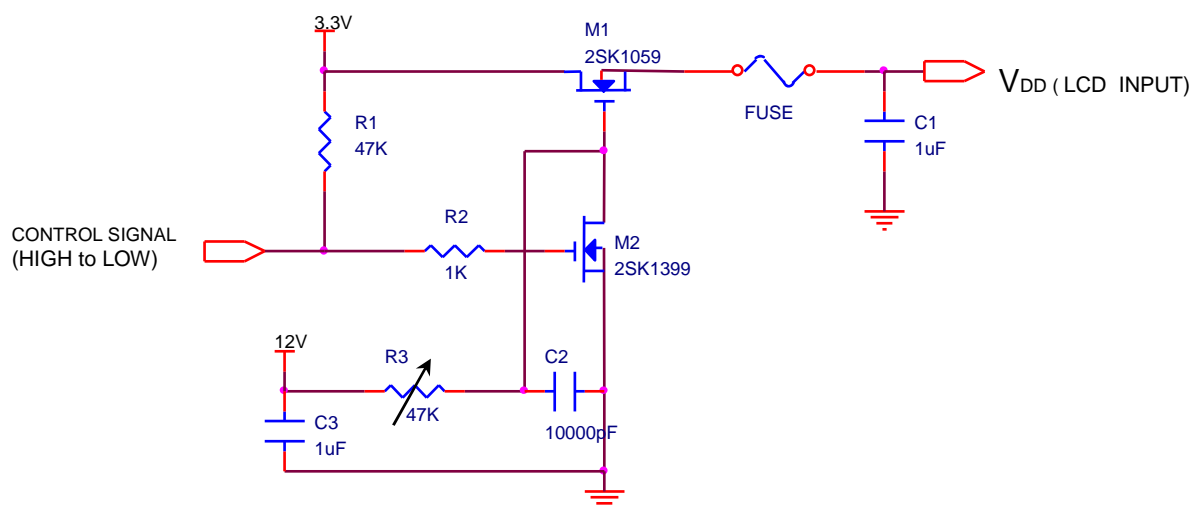
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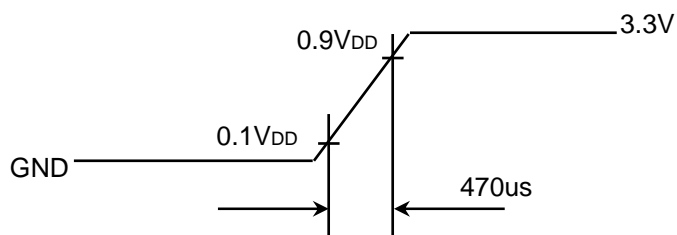
\*c) 1dot Vertical stripe pattern



#### 4) Rush current measurement condition



V<sub>DD</sub> rising time is 470us



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### 3.2 BACK-LIGHT UNIT

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.

- INVERTER : (SEM SIC 130T)

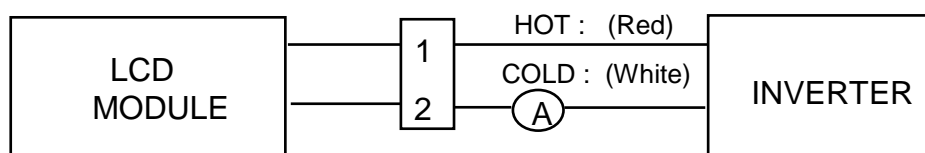
Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I <sub>L</sub>	(3.0)	(6.0)	(7.0)	mArms	(1)
Lamp Voltage	V <sub>L</sub>	-	(630)	-	Vrms	I <sub>L</sub> = 6.0mA
Frequency	f <sub>L</sub>	(40)	(60)	-	KHz	(2)
Power Consumption	P <sub>L</sub>	-	(3.7)		W	(3) I <sub>L</sub> = 6.0mA
Operating Life Time	Hr	(10.000)	-	-	Hour	(4)
Startup Voltage	V <sub>s</sub>	-	-	(1220)	Vrms	25°C, (5)
				(1465)	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.

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.



(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<sub>L</sub> × V<sub>L</sub> 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<sub>L</sub> = 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.)

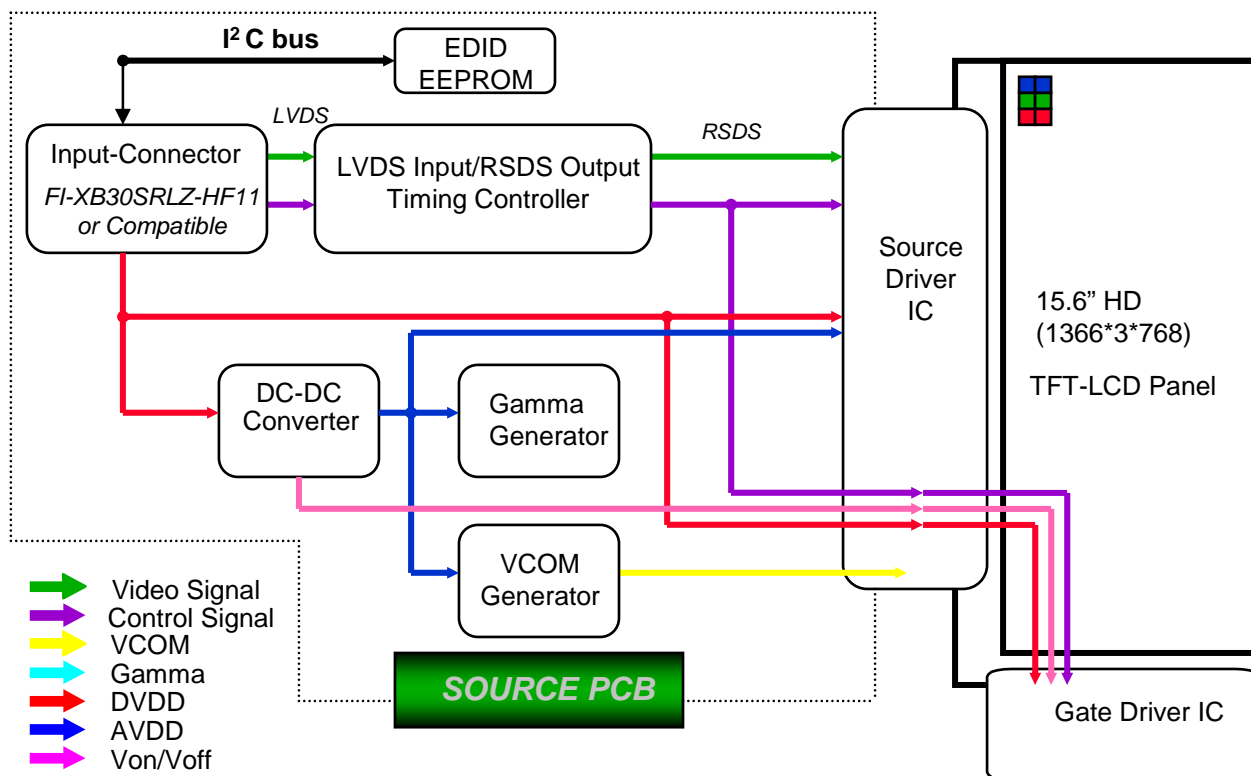
(5) The inverter open voltage - this voltage should be measured after ballast capacitor- have to be larger than the lamp startup voltage, otherwise backlight may has blinking for a moment after turns on or not be turned on.

If an inverter has shutdown function it should keep its open voltage for longer than 1 second even if lamp connector open.

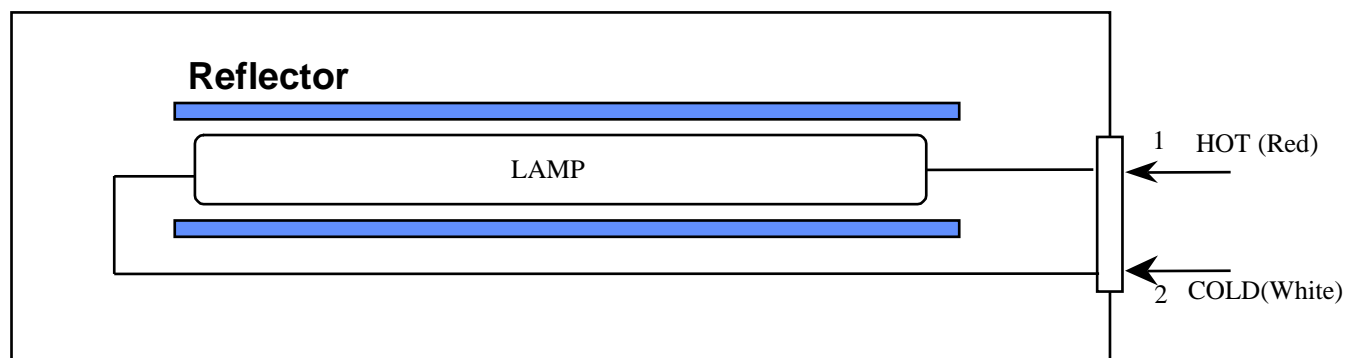
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## 4. BLOCK DIAGRAM

### 4.1 TFT LCD Module



### 4.2 BACK-LIGHT UNIT



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## 5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : JAE FI-XB30SRLZ-HF11 or compatible )  
Mating Connector : JAE FI-X30M or compatible)

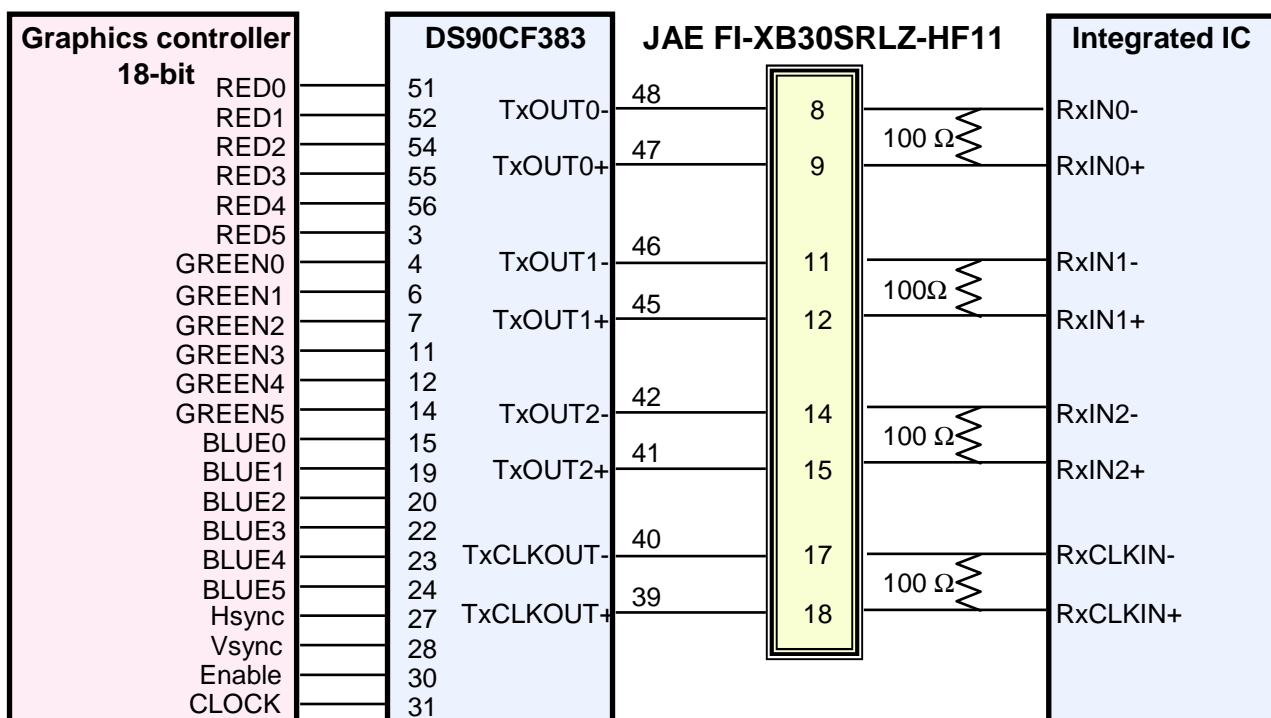
PIN NO	SYMBOL	FUNCTION	POLARITY	REMARK
1	VSS	Ground		
2	VDD	POWER SUPPLY +3.3V		
3	VDD	POWER SUPPLY +3.3V		
4	VEEDID	DDC 3.3V Power		
5	NC	No Connection		
6	CLKEDID	DDC Clock		
7	DATAEDID	DDC data		
8	RxIN0-	LVDS Differential Data INPUT (R0-R5,G0)	Negative	
9	RxIN0+	LVDS Differential Data INPUT (R0-R5,G0)	Positive	
10	VSS	Ground		
11	RxIN1-	LVDS Differential Data INPUT (G1-G5,B0-B1)	Negative	
12	RxIN1+	LVDS Differential Data INPUT (G1-G5,B0-B1)	Positive	
13	VSS	Ground		
14	RxIN2-	LVDS Differential Data INPUT (B2-B5,Sync,DE)	Negative	
15	RxIN2+	LVDS Differential Data INPUT (B2-B5,Sync,DE)	Positive	
16	VSS	Ground		
17	RxCLK-	LVDS Differential Data INPUT (Clock)	Negative	
18	RxCLK+	LVDS Differential Data INPUT (Clock)	Positive	
19	VSS	Ground		
20	NC	No Connection		
21	NC	No Connection		
22	VSS	GND		
23	NC	No Connection		
24	NC	No Connection		
25	VSS	GND		
26	NC	No Connection		
27	NC	No Connection		
28	VSS	GND		
29	NC	No Connection		
30	NC	No Connection		

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## 5.2 LVDS Interface : Transmitter SN75LVDS86 or Compatible

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
44	TxIN0	R0	12	TxIN11	G5
45	TxIN1	R1	13	TxIN12	B0
47	TxIN2	R2	15	TxIN13	B1
48	TxIN3	R3	16	TxIN14	B2
1	TxIN4	R4	18	TxIN15	B3
3	TxIN5	R5	19	TxIN16	B4
4	TxIN6	G0	20	TxIN17	B5
6	TxIN7	G1	22	TxIN18	Hsync
7	TxIN8	G2	23	TxIN19	Vsync
9	TxIN9	G3	25	TxIN20	DE
10	TxIN10	G4	26	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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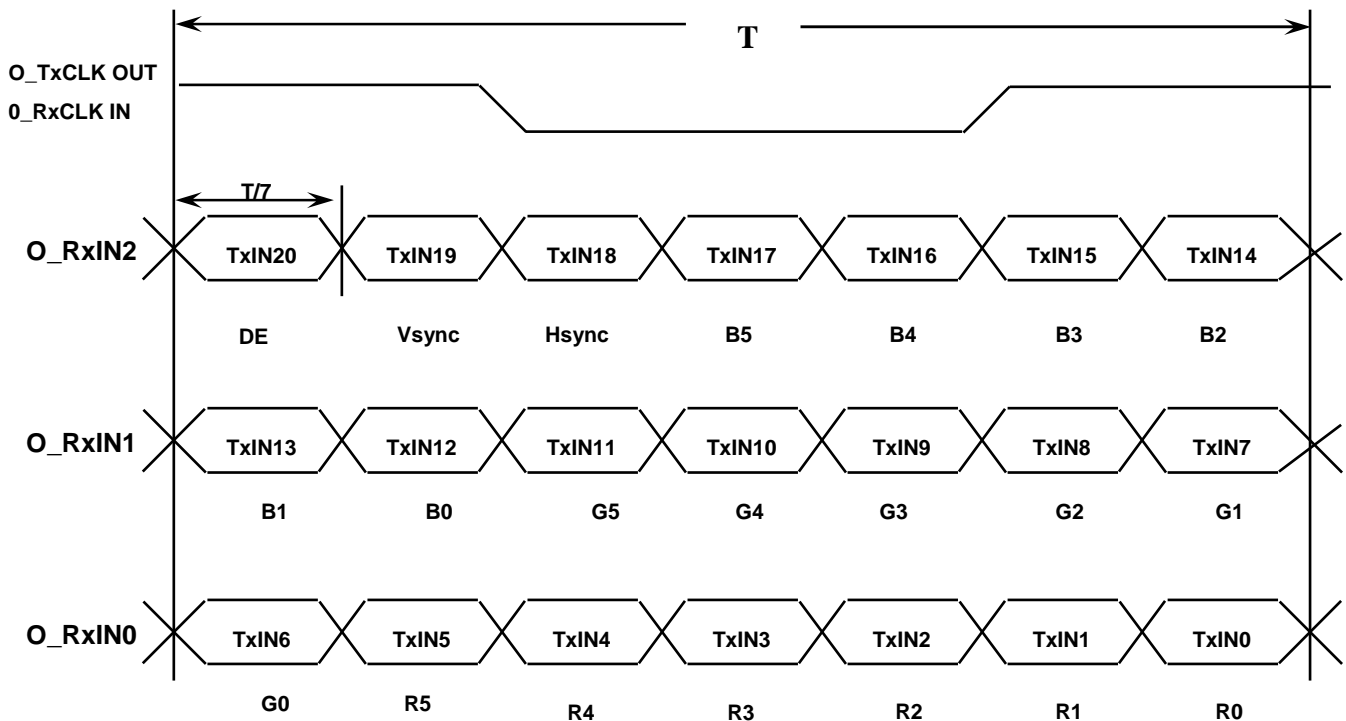
### 5.3 BACK LIGHT UNIT

Connector : JST BHSR - 02VS -1  
Mating Connector : SM02B-BHSS-1(JST)

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

### 5.4 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON



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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

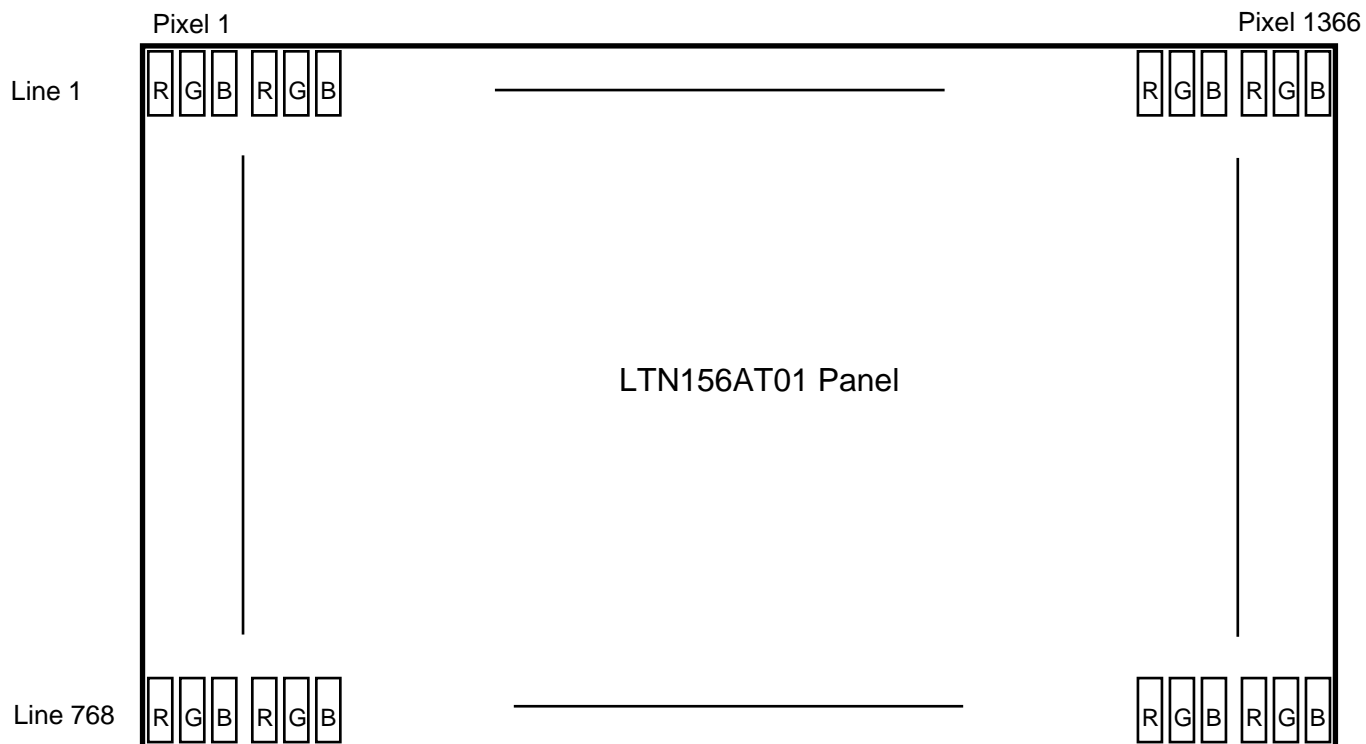
Note 1) Definition of gray :

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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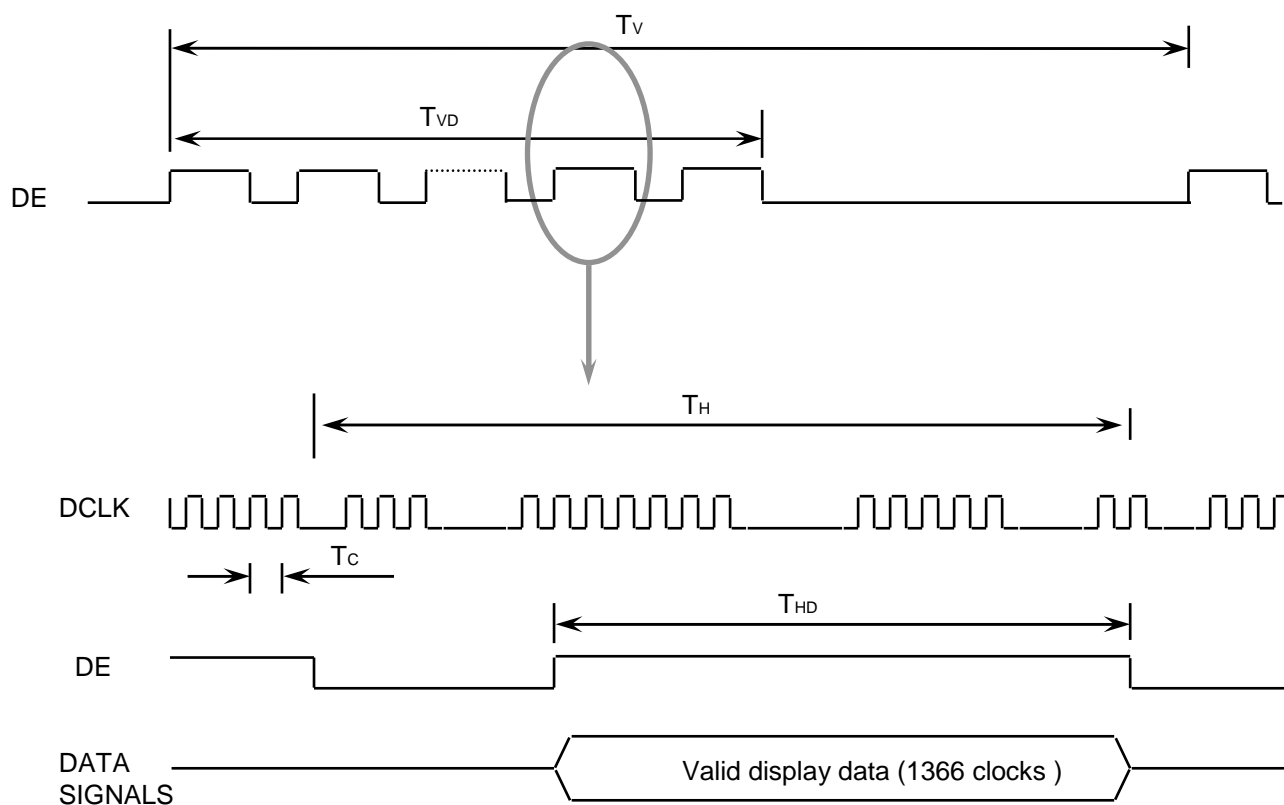


## 6. INTERFACE TIMING

### 6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	(774)	(780)	(810)	Lines	
Vertical Active Display Term	Display Period	TVD	-	768	-	Lines	
One Line Scanning Time	Cycle	TH	(1430)	(1480)	(1530)	Clocks	
Horizontal Active Display Term	Display Period	THD	-	1366	-	Clocks	

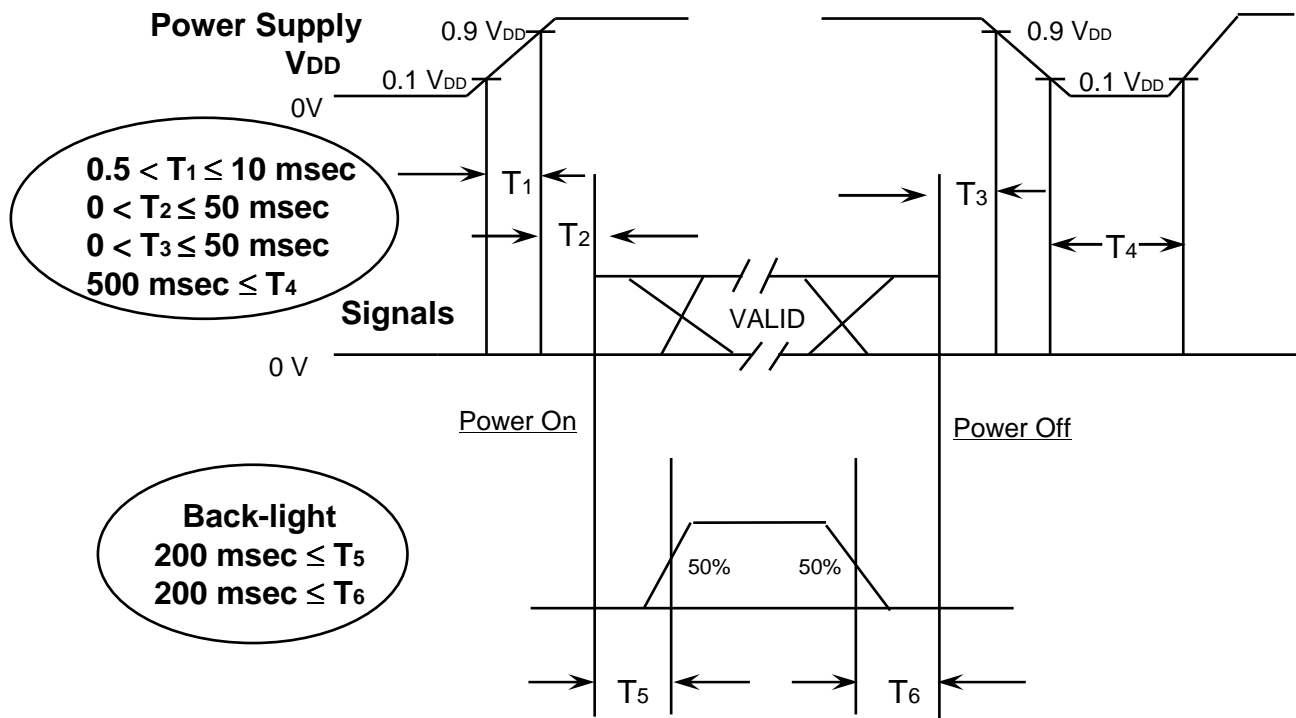
### 6.2 Timing diagrams of interface signal


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### 6.3 Power ON/OFF Sequence

Preliminary

: 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 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 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 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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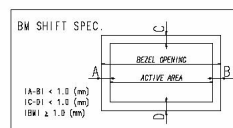
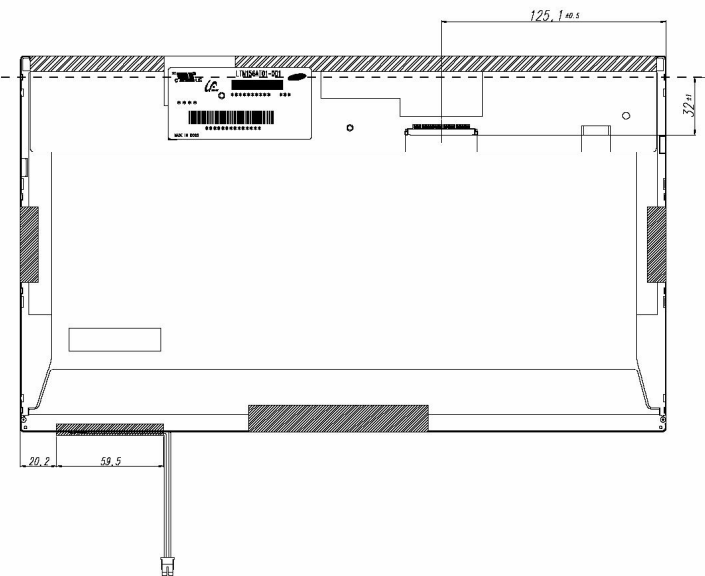
7. Mechanical Outline Dimension

Preliminary

[ Refer to the next page ]

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1. SIGNAL INTERFACE CONNECTOR TO BE SPECIFIED AS BELOW.
  - MAKER : UJU OR COMPATIBLE
  - INPUT CONNECTOR : UJU IS100-L30R-C15
2. LAMP CONNECTOR FOR BACKLIGHT TO BE SPECIFIED AS BELOW.
  - MAKER : JST (TBD)
  - PART NO : BHSR-02VS-1 (TBD)
  - LAMP DIAMETER :  $\phi 2.0$
3. ALLOWED DEPTH OF USERHOLE SCREW INSERTION IS MAX 2.5mm
4. TORQUE SPEC : MAX 2.5 Kg $\cdot$ cm (5TIMES)
5. CALIFERS MEASURING FORCE : 750 150 gf
6. WEIGHT : TYP 500, MAX 520 g (TBD)

REV. DATE		DESCRIPTION OF REVISION				REASON		CHK'D BY	
REV.	DATE	CHG'N BY	DES'G'D BY	CHK'D BY	APP'D BY	MODEL NAME	LTN156AT01-001		
SCALE		J.A. LEE S.G. JEONG				PART/SHEET NAME	OUTLINE DIMENSION		
QUOTA, TOLERANCE		2500, 0.05, 2500, 0.05				CODE NO.	VER. 000		
SAMSUNG ELECTRONICS									

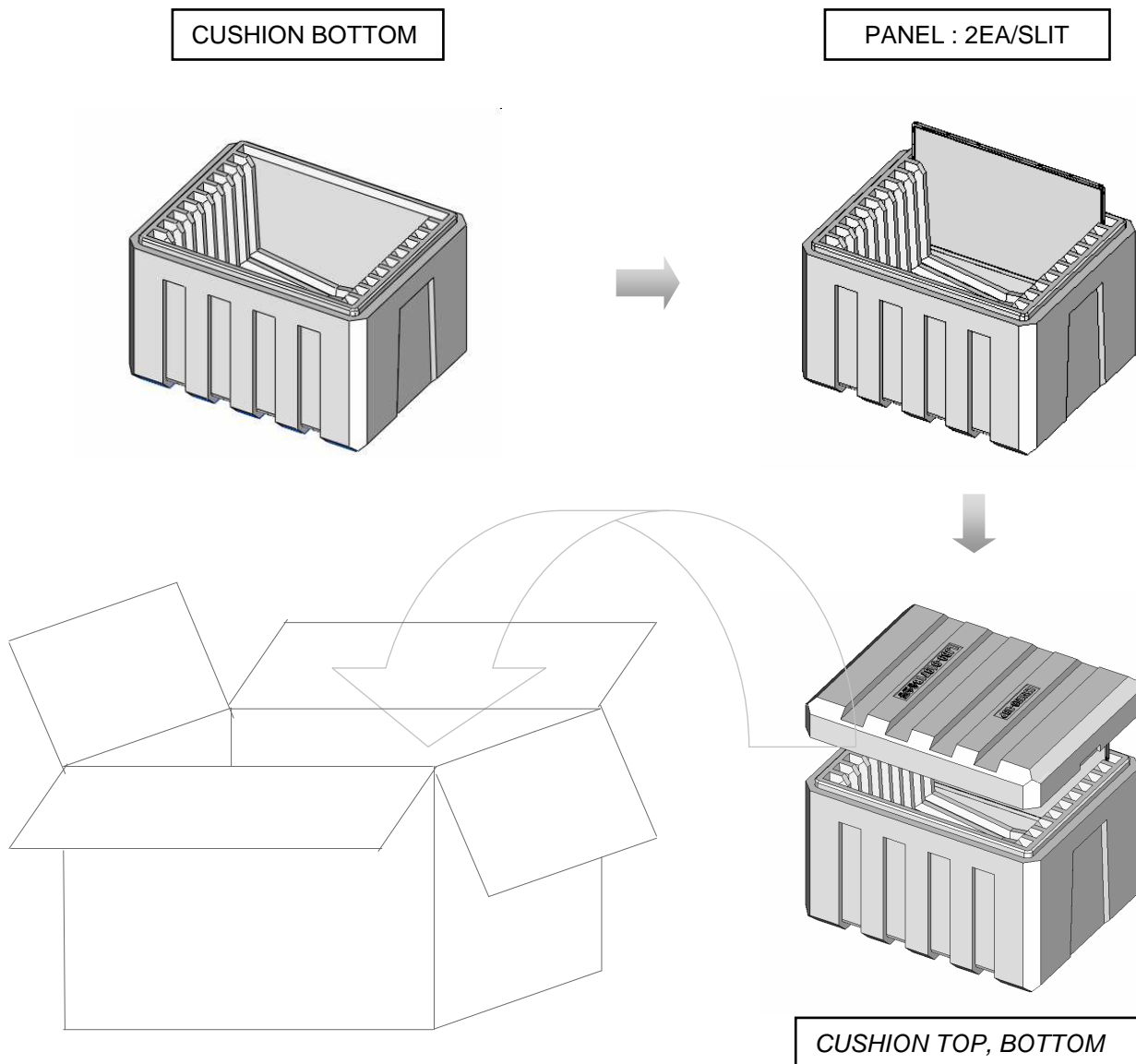
## 8. PACKING

### 1. CARTON(Internal Package)

#### (1) Packing Form

Corrugated Cardboard box and Corrupad form as shock absorber

#### (2) Packing Method



Note (1) Total : Approx. 12.4 Kg

(2) Acceptance number of piling : 20 sets

(3) Carton size : 344(W) X 432(D) X 329(H)

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## (3)Packing Material

No	Part name	Quantity
1	Static electric protective sack	10 pcs
2	Packing case (Inner box) included shock absorber	1 set
3	Pictorial marking	2 pcs
4	Carton	1 set

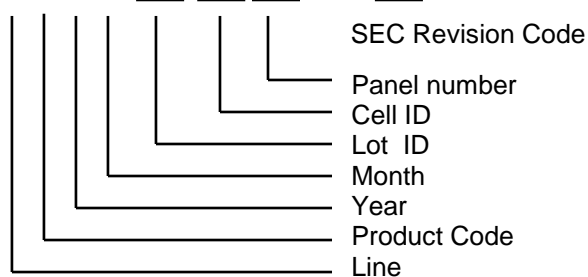
## 9. MARKINGS &amp; OTHERS

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

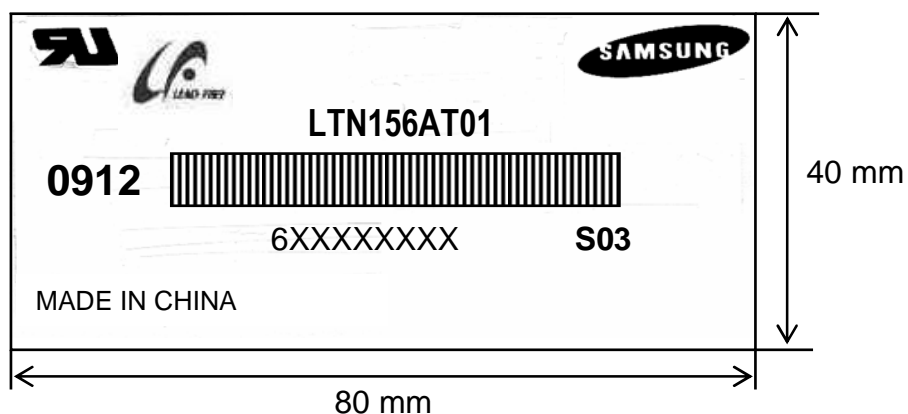
(1)Parts number : LTN156AT01

(2)Revision code : 3 letters

(3)Lot number : X X X X XX XX XX S03



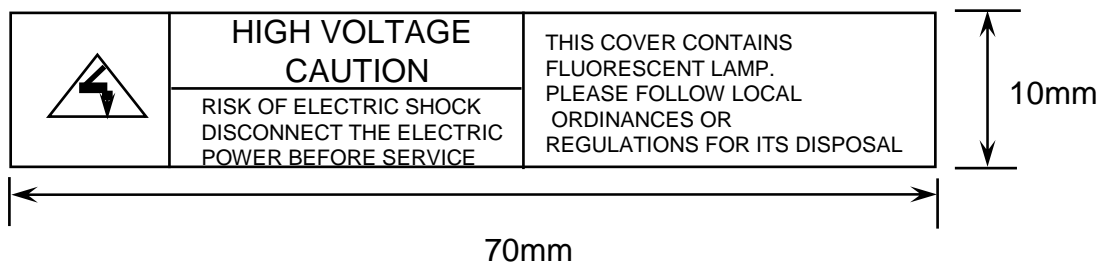
## (4) Nameplate Indication



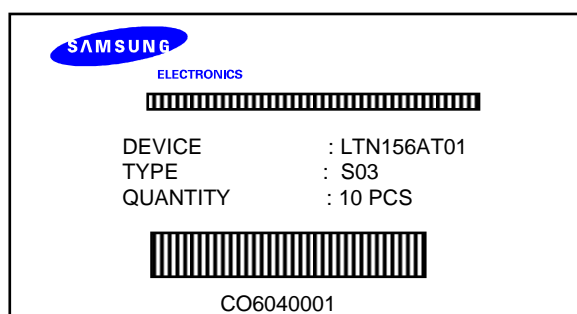
Parts name : LTN156AT0X  
 Lot number : 6XXXXXXXXXX  
 Inspected work week : 0912 (2009 year 12th week)  
 Product Revision Code : S03

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(5) High voltage caution notice



(6) Packing small box attach



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



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## 10. GENERAL PRECAUTIONS

### 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 backlight.
- (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 backlight connector and its inverter power supply shall be a minimized length and be connected directly . The longer cable between the backlight 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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