

Product Information

ISSUE DATE : December 05, 2002
MODEL : LTM121SH-T01

NOTE : This product information is subject to change after 3 months of issuing date.

TECHNICAL SERVICE TEAM
SAMSUNG ELECTRONICS CO., LTD.

Better Vision through SAMSUNG TFT-LCD



CONTENTS

General Description	----- (3)
1. Absolute Maximum Ratings	----- (4)
1.1 Absolute Ratings of Environment	
1.2 Electrical Absolute Ratings	----- (6)
2. Optical Characteristics	
3. Electrical Characteristics	----- (9)
3.1 TFT LCD Module	
3.2 Backlight Unit	
4. Block Diagram	----- (12)
4.1 TFT LCD Module	
4.2 Backlight Unit	
5. Input Terminal Pin Assignment	----- (13)
5.1 Input Signal & Power	
5.2 Backlight Unit	
5.3 Pixel format	
5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color.	
6. Interface Timing	----- (16)
6.1 Timing Parameters	
6.2 Timing Diagrams of interface Signal	
6.3 Power ON/OFF Sequence	
7. Outline Dimension	----- (19)
8. Packing	----- (21)
9. Markings & others	----- (22)
10. General Precautions	----- (24)

GENERAL DESCRIPTION

DESCRIPTION

LTM121SH-T01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFTs as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight system. The resolution of a 12.1" contains 800 x 600 pixels and can display up to 262,144 colors. 6 o'clock direction is the optimum viewing angle.

FEATURES

- Thin - Light weight
- High contrast ratio, High aperture structure.
- High-speed response
- SVGA (800 x600 pixels) resolution
- Low power consumption
- Dual CCFLs(Cold Cathode Fluorescent Lamp)
- DE (Data enable) mode.
- 3.3V Power Supply

APPLICATIONS

- Notebook PC and desktop monitors
- Display terminals for AV application products
- Monitors for Industrial machine
- 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	246.0(H) x 184.5(V) (12.1"diagonal)	mm	
Driver element	a-si TFT active matrix		
Display colors	262,144		
Number of pixel	800 x 600	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.3075 (H) x 0.3075 (V) (TYP.)	mm	
Display Mode	Normally white		
Surface treatment	Haze 25, Hard-Coating (3H)		

Better Vision through SAMSUNG TFT-LCD



Mechanical Information

ITEM		MIN.	TYP.	MAX.	NOTE
Module size	Horizontal (H)	276.5	277	277.5	mm
	Vertical (V)	208.0	208.5	209.0	mm
	Depth (D)	-	10.2	10.7	mm
Weight		-	650	680	g

1. ABSOLUTE MAXIMUM RATINGS

1.1 ABSOLUTE RATINGS OF ENVIRONMENT

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 (nonoperating)	Snop	-	50	G	(2),(4)
Vibration (nonoperating)	Vnop	-	1.5	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.

90 % RH Max. ($40\text{ °C} \geq T_a$)

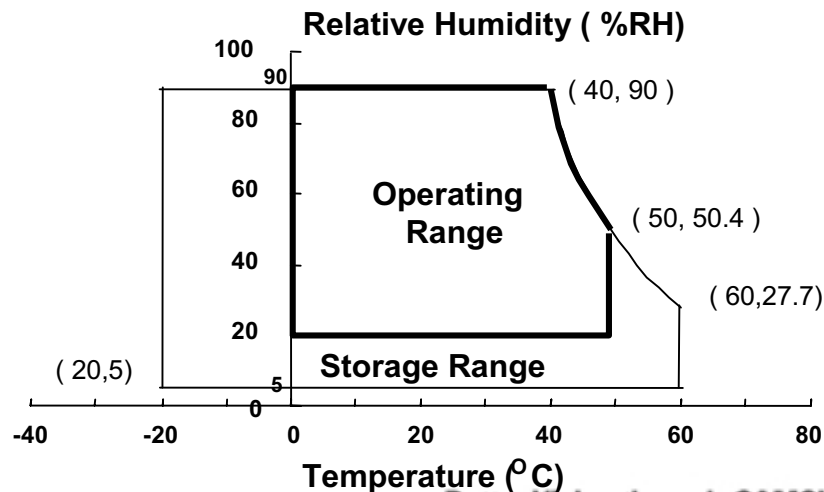
Maximum wet - bulb temperature at 39 °C or less. ($T_a > 40\text{ °C}$) No condensation.

(2) 11ms, sine wave, 1 time for $\pm X, \pm Y, \pm Z$.

(3) 10 - 300 - 10 Hz, Sweep rate: 10 min, 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.

(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.



Better Vision through SAMSUNG TFT-LCD



1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

(GND= 0 V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage	VDD	GND-0.3	3.6	V	(1)

NOTE (1) Within Ta (25 ± 2 °C)

(2) BACK-LIGHT UNIT

Ta = 25 ± 2 °C

ITEM	SYMBOL	MIN.	MAX.	UNIT.	NOTE
Lamp current	IL	3.0	7.0	mArms	(1)
Lamp frequency	FL	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.

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

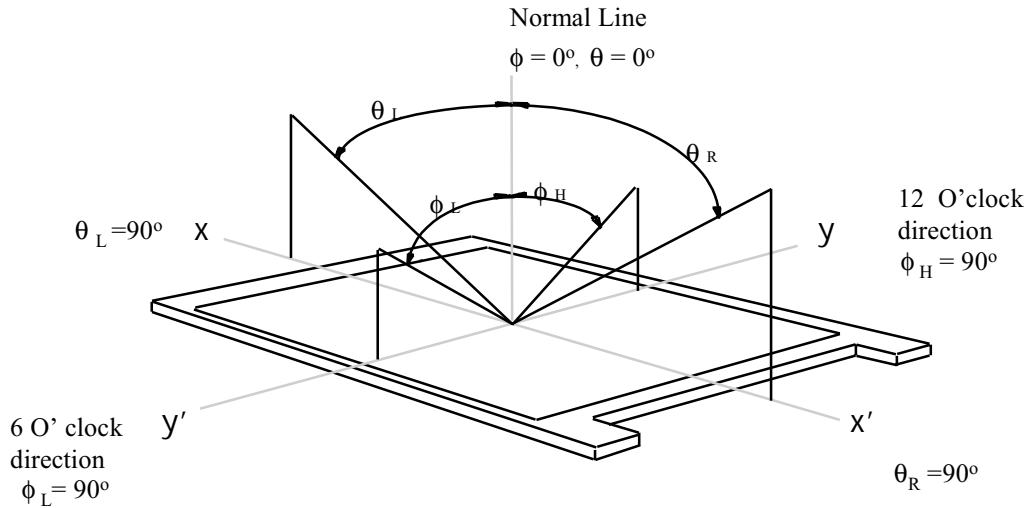
* Ta = 25± 2°C , VDD=3.3V, fv= 60Hz, fdCLK=40MHz, IL = 6.0mA

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Contrast Ratio (Center of screen)	CR		-	350	-		(2),(4)
Response Time at 25 °C	Rise	T_R	-	5	10	msec	(3)
	Fall	T_F	-	20	25		
Average Luminance (Center of screen)	$Y_{L,AVE}$	$\phi = 0$ $\theta = 0$	-	450	-	cd/m ²	(1),(4)
Color Chromaticity (CIE)	Red	R_x	0.603	0.633	0.663	Viewing Normal Angle	
		R_y	0.317	0.347	0.377		
	Green	G_x	0.271	0.301	0.331		
		G_y	0.528	0.558	0.588		
	Blue	B_x	0.117	0.147	0.177		
		B_y	0.060	0.090	0.120		
	White	W_x	0.270	0.300	0.330		
		W_y	0.270	0.300	0.330		
Viewing Angle	Hor.	θ_L	50	60	-	Degrees	
		θ_R	50	60	-		
	Ver.	ϕ_H	40	45	-		
		ϕ_L	50	55	-		
9 Points White Variation	δ_w		75%	-	-		(5)

Better Vision through SAMSUNG TFT-LCD



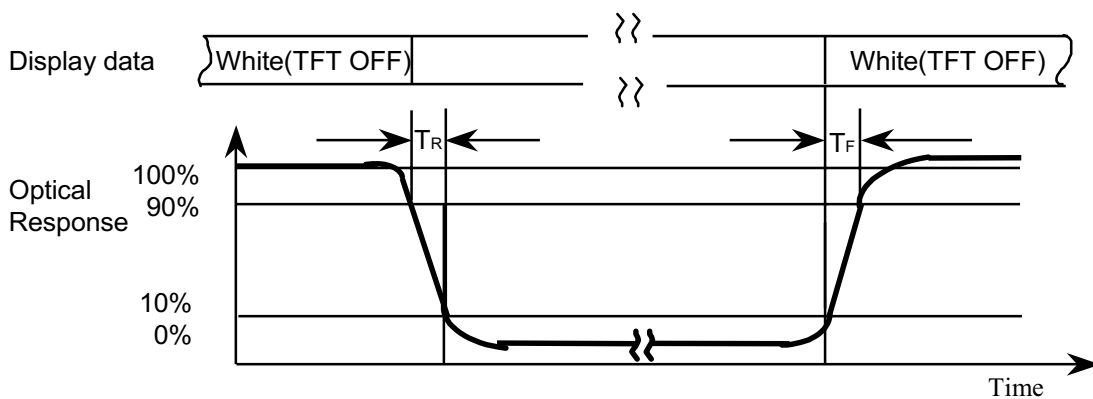
Note 1) Definition of Viewing Angle : Viewing angle range ($10 \leq CR$)



Note (2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at the center point of panel.

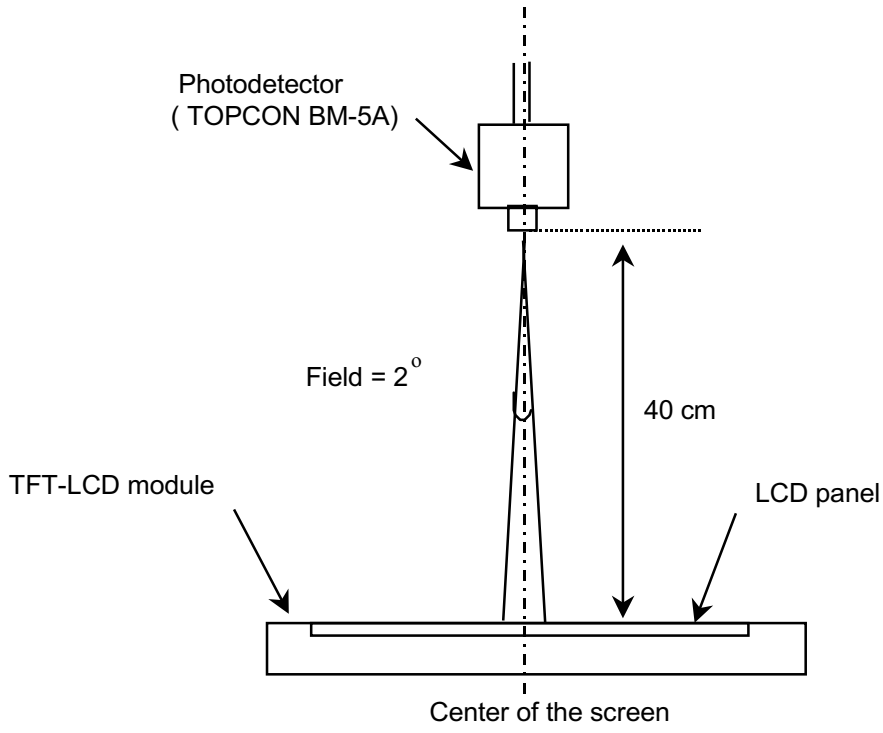
$$CR = \frac{\text{Luminance with all pixels white (Gmax)}}{\text{Luminance with all pixels black (Gmin)}}$$

Note (3) Definition of Response time :



Note (4) Measurement should be executed in a stable, windless, and dark room after lighting the back-light for 30 min to stabilize at a given temperature. This should be measured at the center of screen.

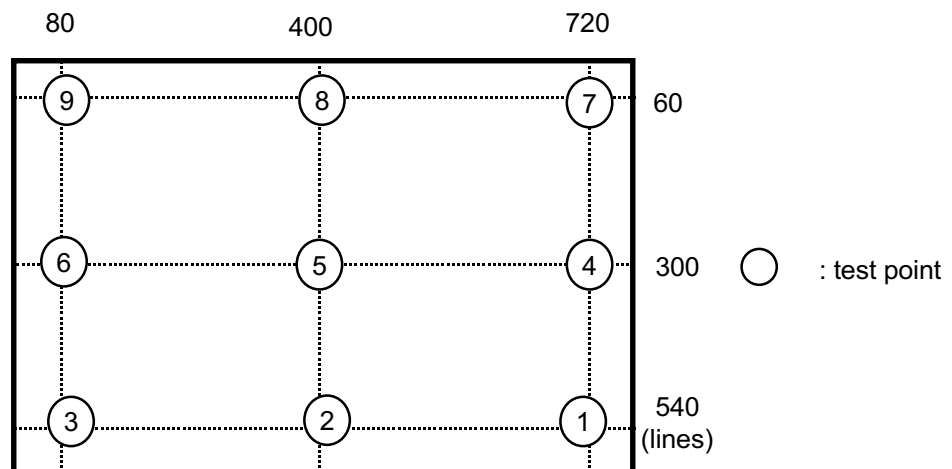
Lamp current : 6.0mA , Environment condition : $T_a = 25 \pm 2 \text{ }^\circ\text{C}$



Optical characteristics measurement setup

Note(5) Definition of 9-point white variation (δ_w)

$$\delta_w = \frac{\text{Minimum luminance of 9 points}}{\text{Maximum luminance of 9 points}} \times 100$$



3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta=25°C ±2 °C

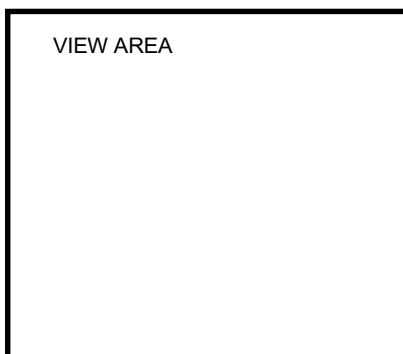
ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE	
Voltage of Power Supply	V _{DD}	3.0	3.3	3.6	V		
Input Voltage for Logic Signals	High	V _{ih}	0.7V _{dd}	-	-	V	(1)
	Low	V _{il}	-	-	0.3V _{dd}	V	(1)
Vsync Frequency	f _v	-	60	-	Hz		
Hsync Frequency	f _H	-	37.879	-	kHz		
Main Frequency	f _{DCLK}	38	40	42	MHz		
Rush Current	I _{RUSH}	-	-	1.5	A	(4)	
Current of Power Supply	White	I _{DD}	-	330	-	mA	(2)(3) *a
	Mosaic		-	340	-	mA	(2)(3) *b
	V.Stripe		-	370	420	mA	(2)(3) *c

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

(2) f_v= 60Hz, f_{DCLK} = 40MHz, V_{DD} =3.3V, DC Current.

(3) Power dissipation pattern.

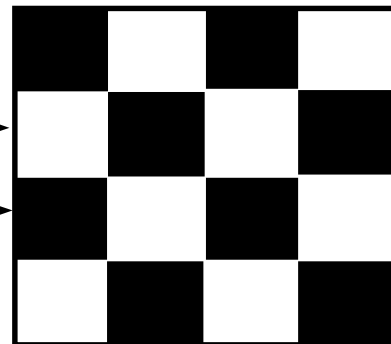
*a) White Pattern



Display Brightest Gray Level →

Display Darkest Gray Level →

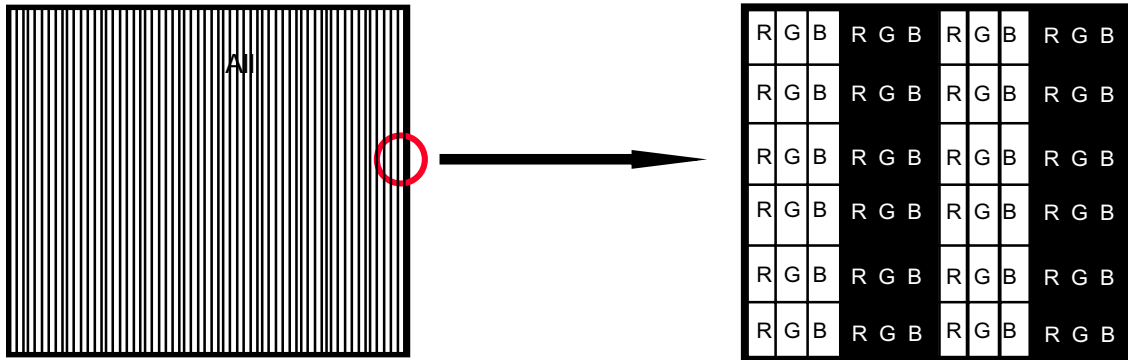
*b)Mosaic Pattern



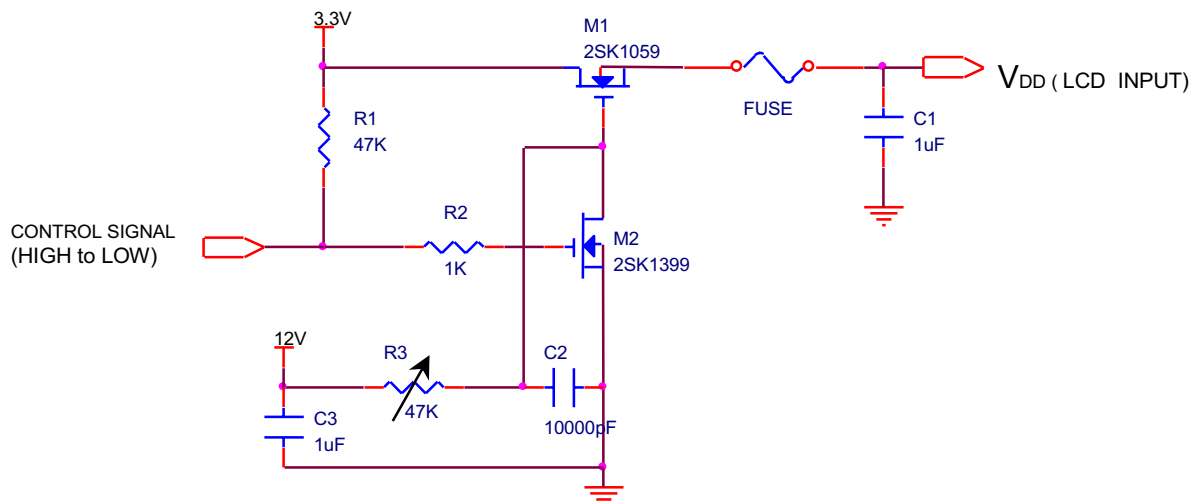
Better Vision through SAMSUNG TFT-LCD



*c) V.Stripe



(4) Rush current measurement condition

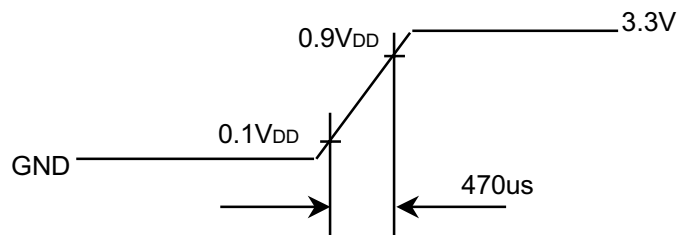


Note : Control Signal : High(+3.3V) -->Low(Ground)

All Signal lines to panel except for power 3.3V : Ground

The rising time of supplied voltage is controlled to 470us by R3 and C2 value.

V_{DD} rising time is 470us



Better Vision through SAMSUNG TFT-LCD



3.2 BACK-LIGHT UNIT

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

INVERTER : SEC 130

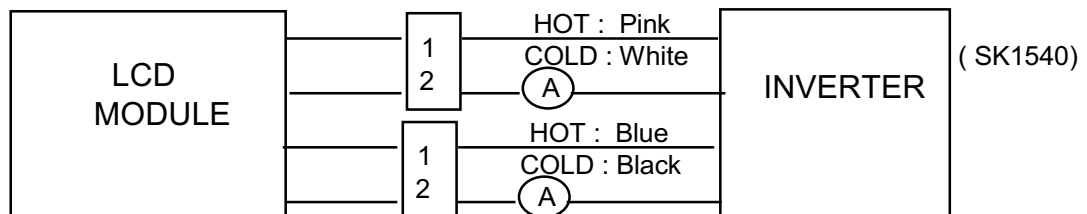
Ta=25°C±2 °C

ITEM	SYMB	MIN	TYP	MAX	UNIT	NOTE
Lamp Current	I _L	3.0	6.0	7.0	mArms	(1)
Lamp Voltage	V _L	-	860	-	Vrms	I _L =6.0mA
Frequency	f _L	40	-	60	KHz	(2)
Power Consumption	P _L	-	10.4	-	W	(3), I _L =6.0mA
Operating Life Time	Hr	40,000	-	-	Hour	(4)
Startup Voltage	V _s	-	-	1704 (25 °C)	Vrms	(5)
				2400 (0 °C)		

Note) The inverter must have a symmetric output voltage waveform and be designed on basis of 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.) will 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.



No 2 Pin is V_{Low}.

Switching Frequency : 40 ~ 80 KHz

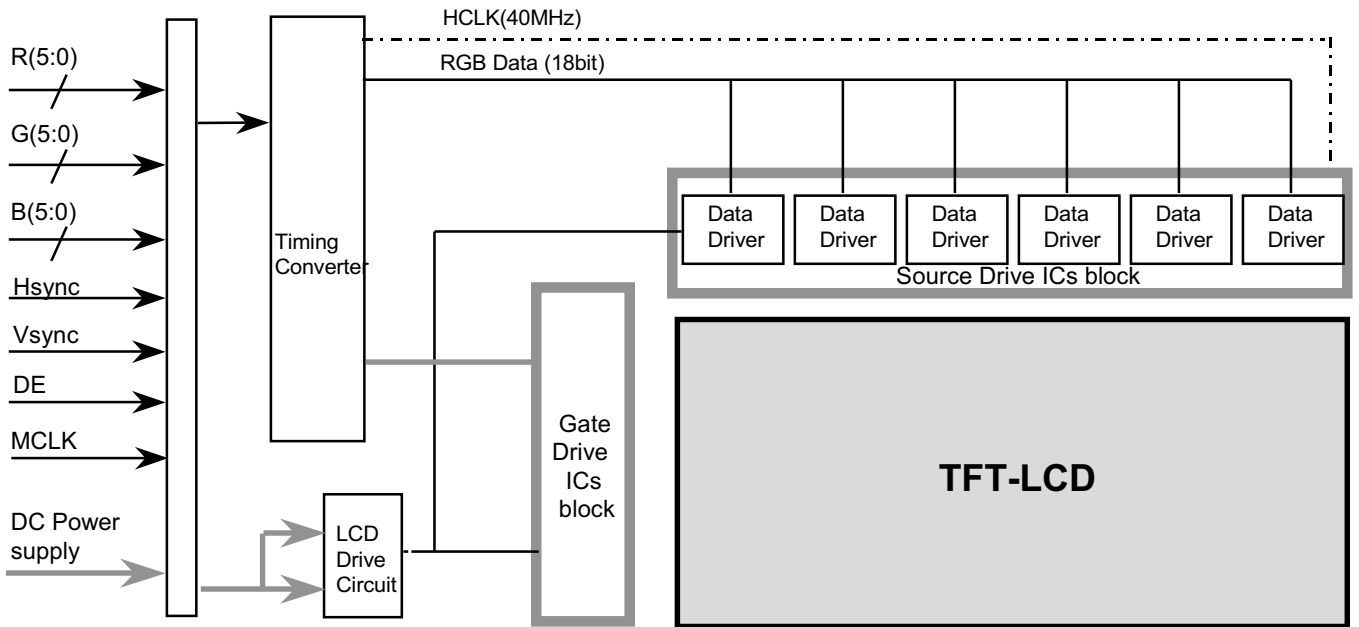
- (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.
- (3) refer to $I_L \times V_L \times 2$ (2 lamps) to calculate.
- (4) 40,000 Hr is to be defined as the lifetime of a lamp which continues to operate under the condition $T_a = 25\text{ °C} \pm 2\text{ °C}$ and $I_L = 6\text{ mArms}$ until one of the following events occur.
 1. When the brightness becomes 50% or lower than it's original.
 2. When the Effective ignition length becomes 80% or lower than it's original value.
(Effective ignition length is defined as an area that has over 70% brightness at the center point.)
- (5) The voltage above this value should be applied to the lamp for more than 1 second to start up. Otherwise the lamp may not be turned on.
- (6) Inverter use high voltage. It should be disconnected power, before Inverter is assembled or disassembled

Better Vision through SAMSUNG TFT-LCD

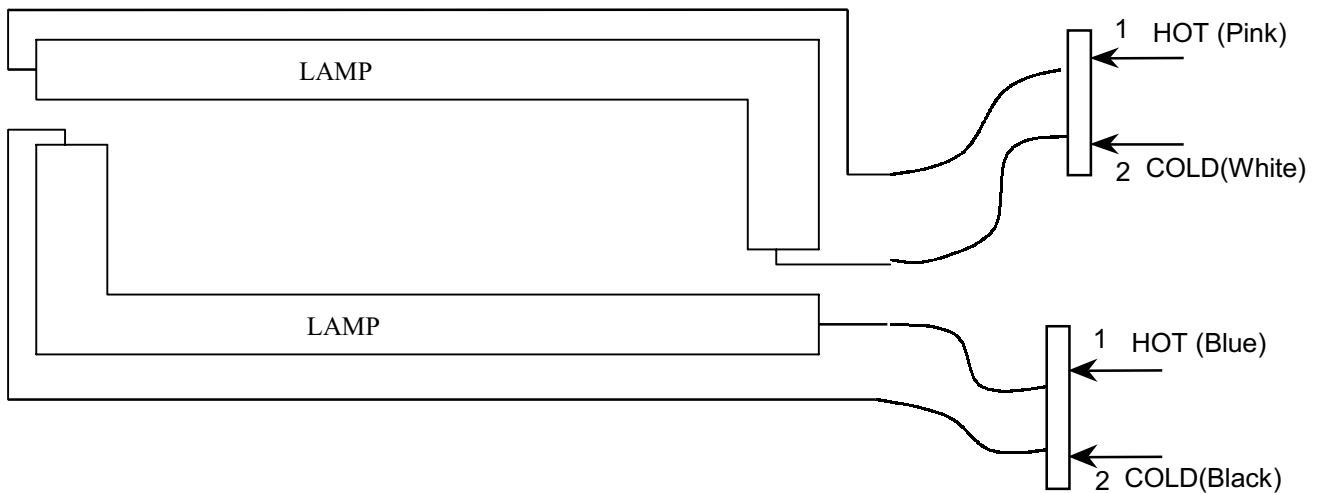


4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 BACK-LIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power

Connector : FI-XB30SR-HF11 / JAE

Pin No.	Symbol	Function	Remark
1	VDD	Power Supply(+3.3V)	
2	VDD	Power Supply(+3.3V)	
3	GND	Ground	
4	MCLK	Data Clock	
5	GND	Ground	
6	VSYNC	Vertical Sync Signal	
7	HSYNC	Horizontal Sync Signal	
8	DE	Data Enable	
9	GND	Ground	
10	R0(ODD)	Red Data(LSB) - ODD	
11	R1	Red Data	
12	R2	Red Data	
13	R3	Red Data	
14	R4	Red Data	
15	R5	Red Data(MSB) - ODD	
16	GND	Ground	
17	G0(ODD)	Green Data(LSB) - ODD	
18	G1	Green Data	
19	G2	Green Data	
20	G3	Green Data	
21	G4	Green Data	
22	G5	Green Data(MSB) - ODD	
23	GND	Ground	
24	B0(ODD)	Blue Data(LSB) - ODD	
25	B1	Blue Data	
26	B2	Blue Data	
27	B3	Blue Data	
28	B4	Blue Data	
29	B5	Blue Data(MSB) - ODD	
30	GND	Ground	

Remark : (1) Display Data is sampled at the negative edge of Data Clock.
 (2) Data level 0 means no color (Black).

Better Vision through SAMSUNG TFT-LCD



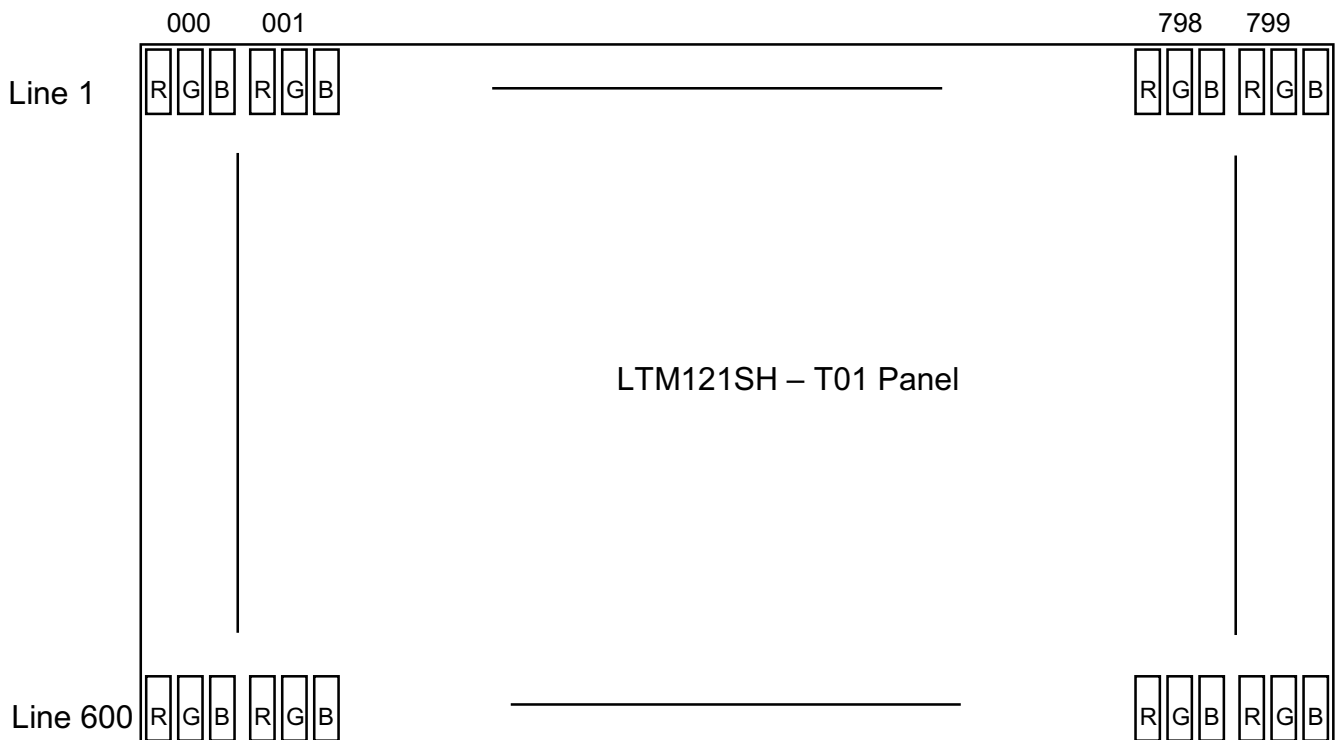
5.2 BACK LIGHT UNIT

Connector : BHSR-02VS-1

Pin NO.	Symbol	Color	Function
1	HOT	PINK	High Voltage
2	COLD	WHITE	Low Voltage

Pin NO.	Symbol	Color	Function
1	HOT	BLUE	High Voltage
2	COLD	BLACK	Low Voltage

5.3 PIXEL FORMAT



Better Vision through SAMSUNG TFT-LCD



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	B4	B5	
COLOR	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	
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
		1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0		R61
		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	
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
		0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0		G61
		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	
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
		0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1		B61
		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

Better Vision through SAMSUNG TFT-LCD



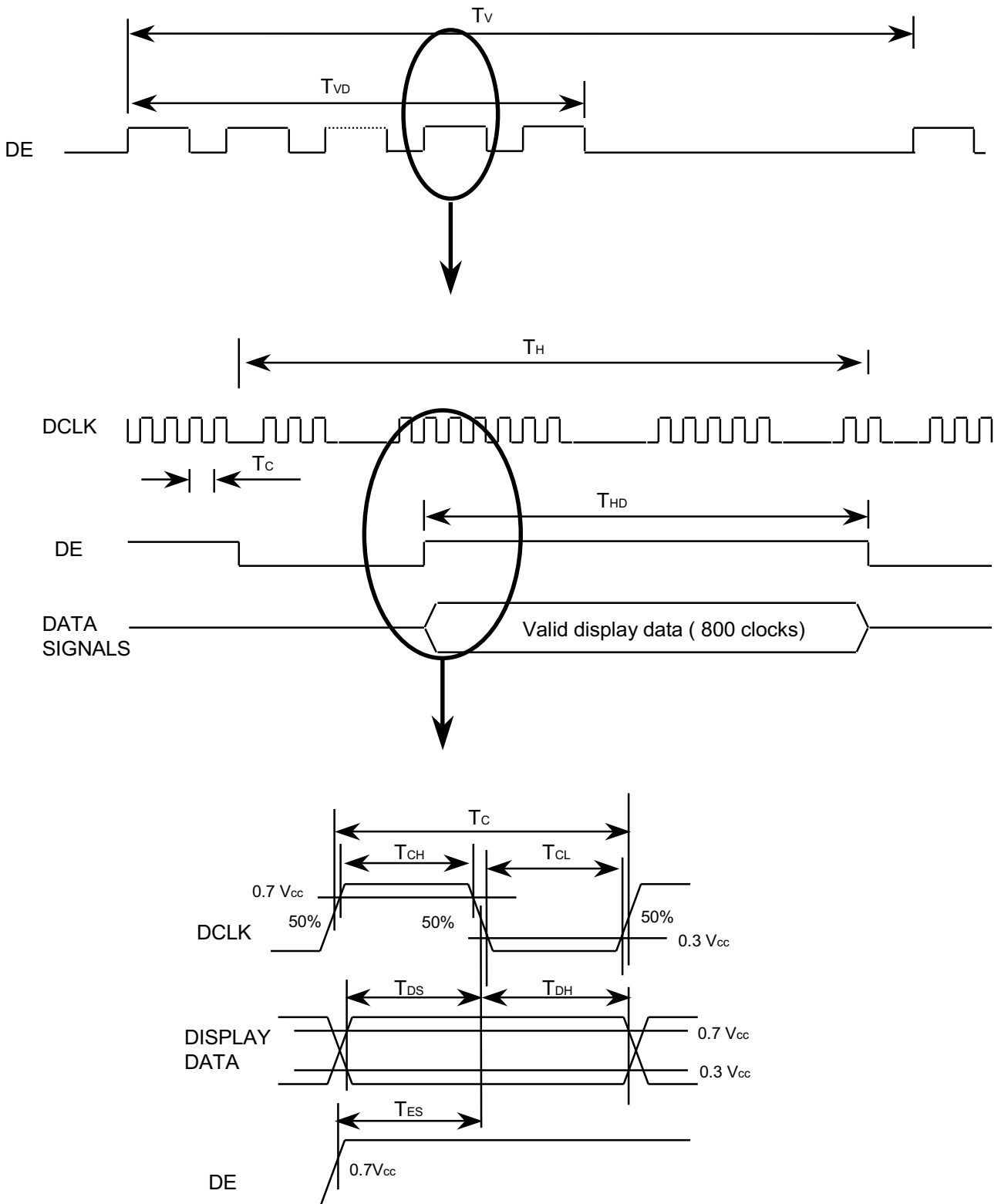
6. INTERFACE TIMING

6.1 Timing Parameters (DE mode)

Signal	Item	Symbol	MIN	TYP	MAX	Unit	Note
Clock	Frequency	1/Tc	38.0	40.0	42.0	MHz	
	High Time	TCH	10	-	-	nsec	
	Low Time	TCL	10	-	-	nsec	
Data	Setup Time	Tds	2	-	-	nsec	
	Hold Time	TdH	0	-	-	nsec	
Data Enable	Setup Time	TES	5	-	-	nsec	(1)
One Line Scanning Time	Cycle	TH	1024	1056	1056	clocks	
Frame Frequency	Cycle	Tv	620	628	664	lines	
Vertical Active Display Term	Display Period	TvD	600	600	600	lines	
Horizontal Active Display Term	Display Period	THD	800	800	800	clocks	

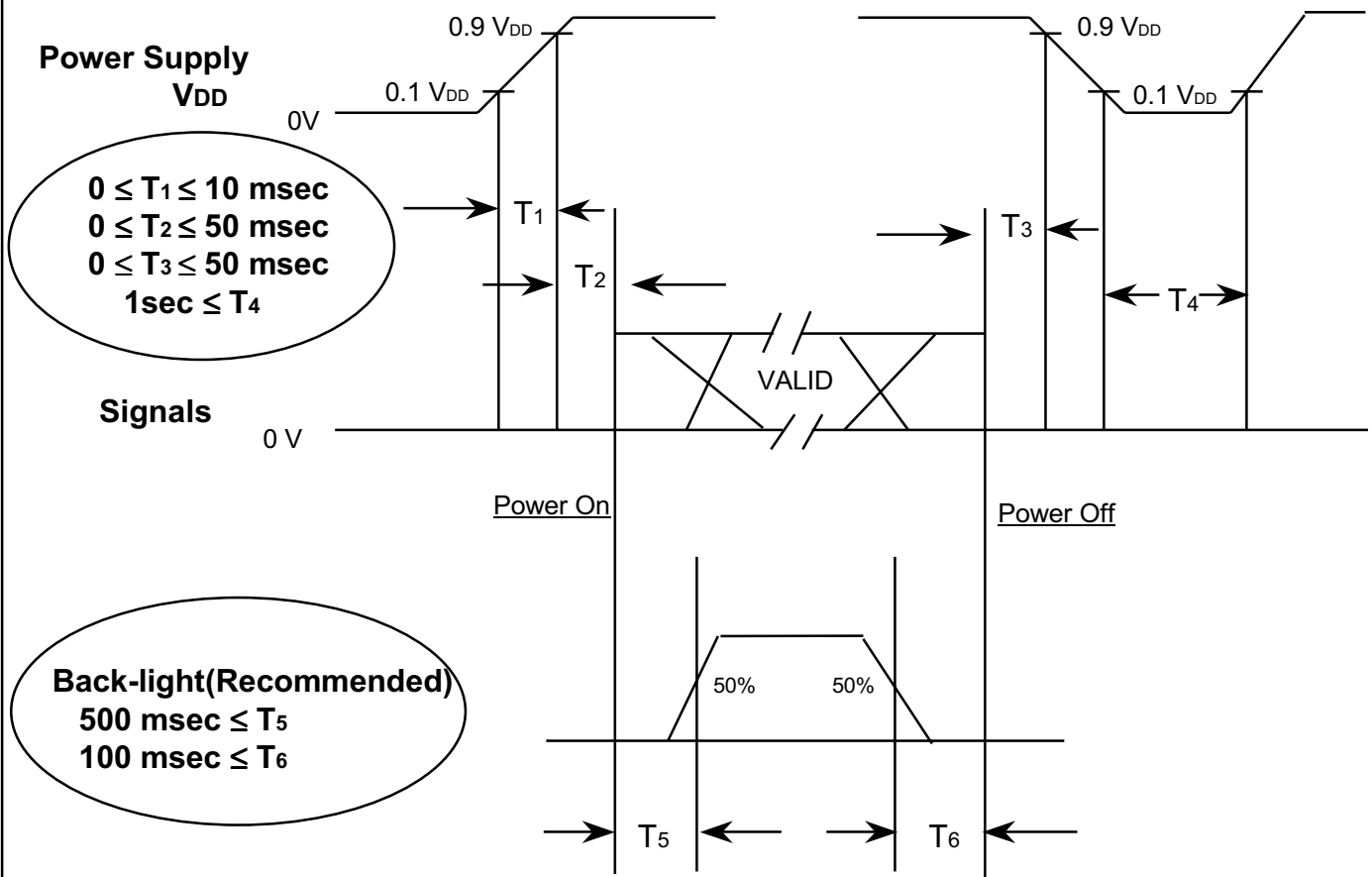
Note (1) The duration of DE [DTMG] signal must be longer than 1 clock period at every horizontal sync. Period.

6.2 Timing diagrams of interface signal (DE mode)



6.3. Power ON/OFF Sequence

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

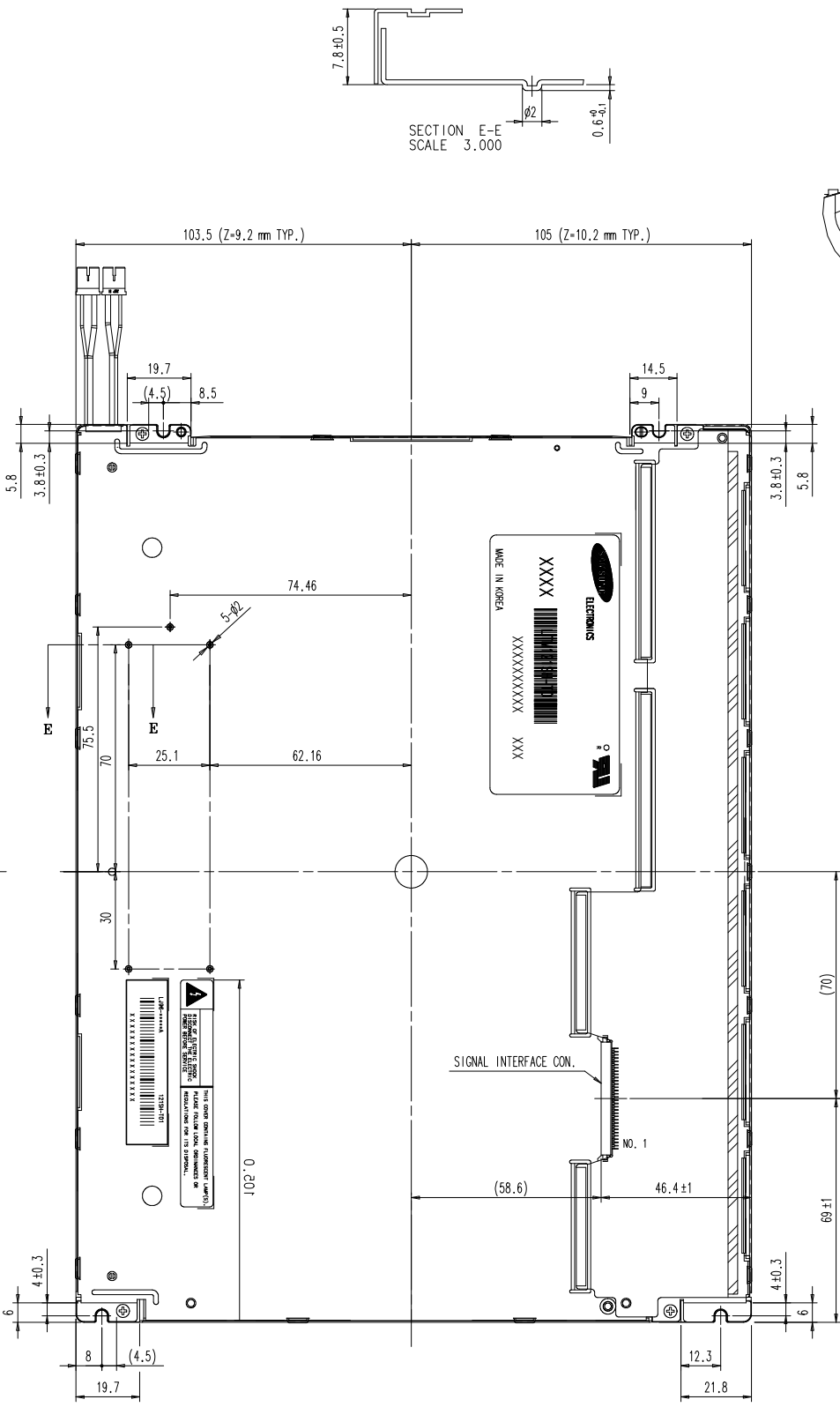
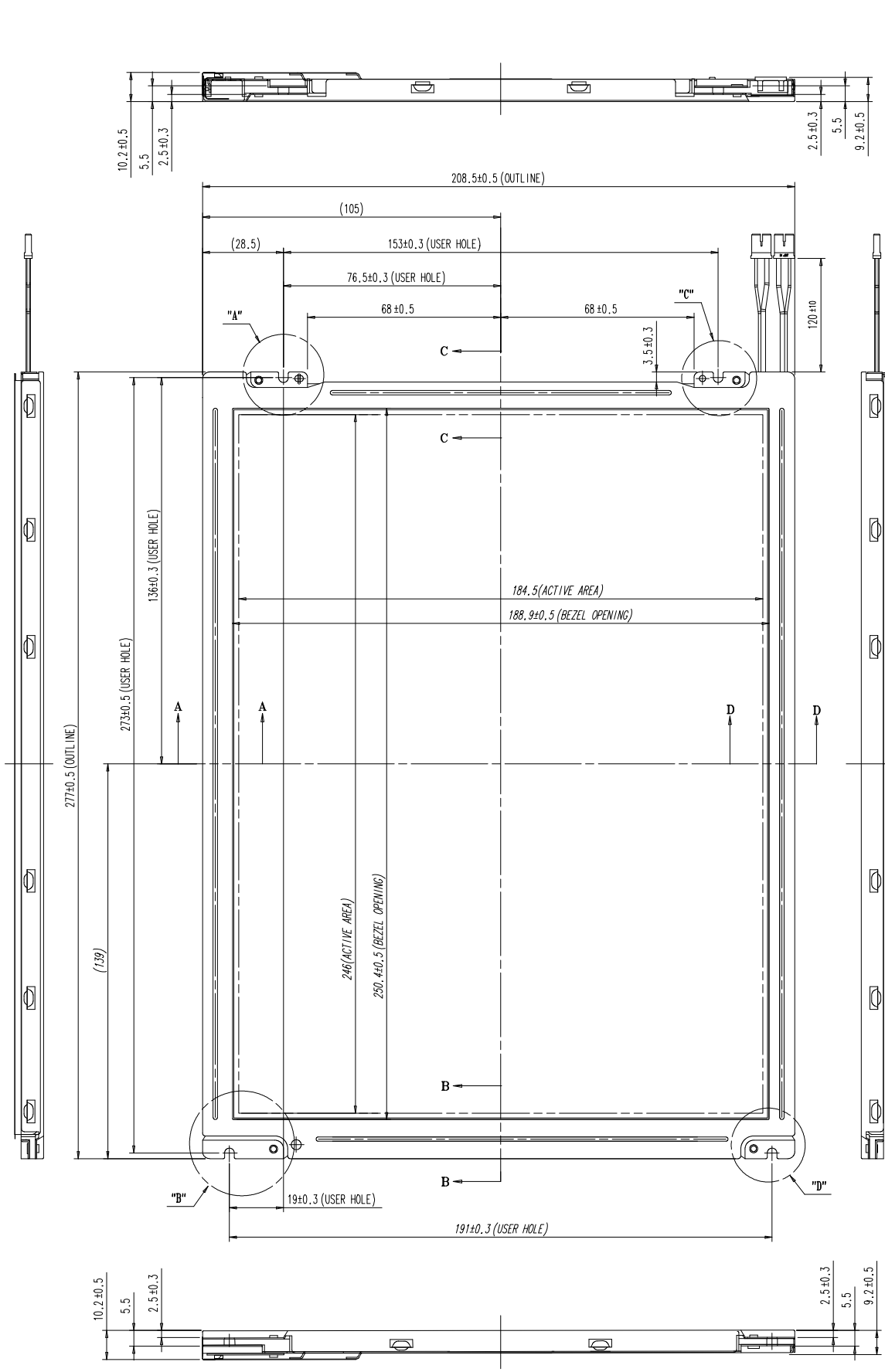


NOTE.

- (1) The supply voltage applied to the module input should be the same as with V_{DD}.
- (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 does, 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 a high impedance.
- (4) T₄ should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal should not be kept at high impedance when the power is on.

7. Outline Dimension

[Refer to the Next Page]



SECTION E-E
SCALE 3.000

DETAIL A
SCALE 3.000

DETAIL B
SCALE 3.000

DETAIL C
SCALE 3.000

DETAIL D
SCALE 3.000

SECTION A-A
SCALE 3.000

SECTION B-B
SCALE 3.000

SECTION C-C
SCALE 3.000

SECTION D-D
SCALE 3.000

- *NOTE
- SIGNAL INTERFACE CONNECTOR TO BE SPECIFIED AS BELOW.
 - MAKER : JAE
 - PART NO : FI-XB30SR-HF11
 - CCFT CONNECTOR FOR BACKLIGHT TO BE SPECIFIED AS BELOW.
 - MAKER : JST
 - PART NO : BHSR-02VS-01

REVISION

GENERAL TOLERANCE				REV	DATE	DESCRIPTION OF REVISION			REASON		CHK'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	LTM121SH
0 < X ≤ 4	+0.05	+0.1	+0.2	SCALE	1.000	S. W. LEE				PART/SHEET NAME	OUTLINE DIM.
4 < X ≤ 16	+0.08	+0.15	+0.3	TOLERANCE						SPEC. NO	
16 < X ≤ 64	+0.12	+0.25	+0.5	LEVEL	3	01.12.07				CODE NO.	
64 < X ≤ 256	+0.25	+0.4	+0.8								VER. 00

SAMSUNG ELECTRONICS

8. Packing

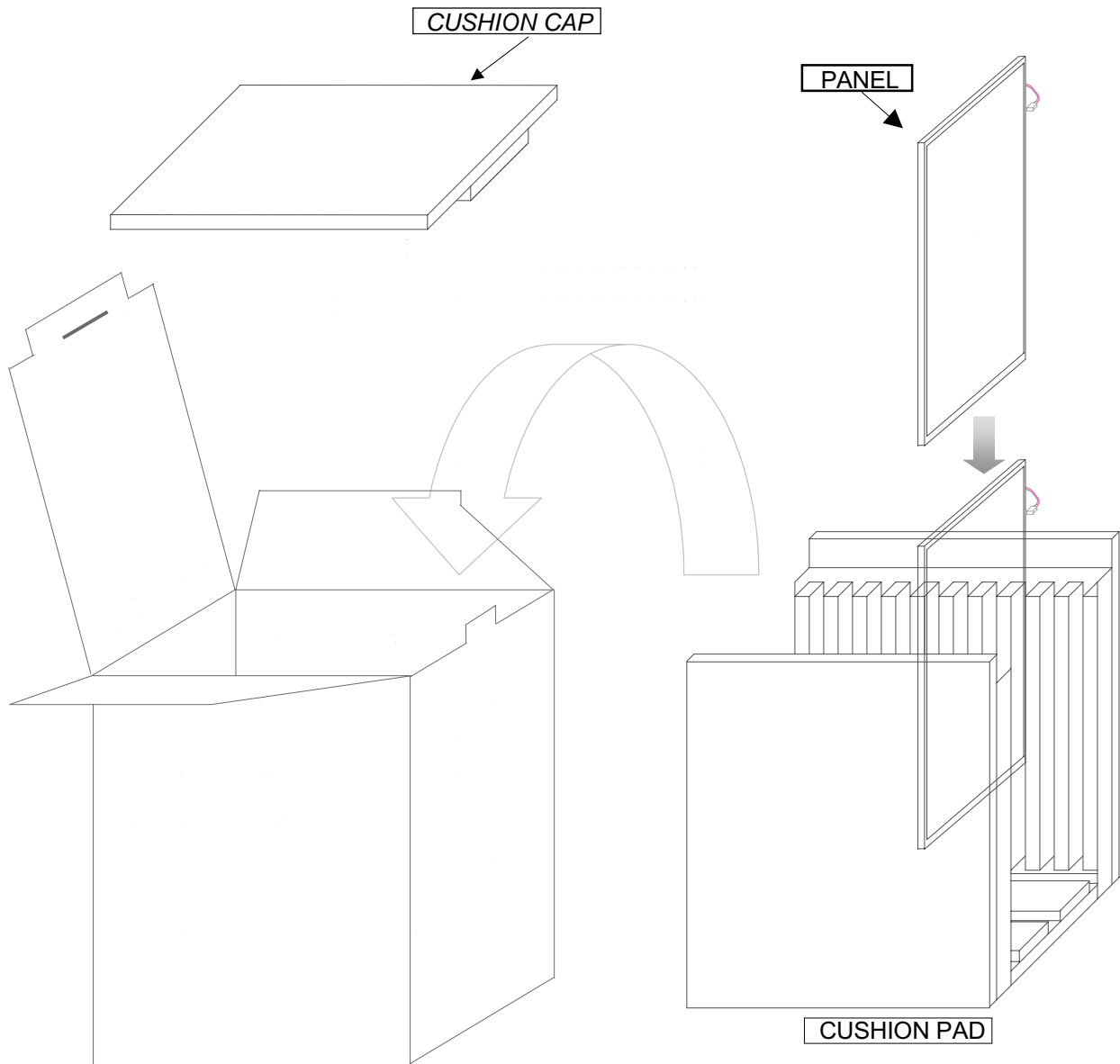
8.1 Packing

CARTON(Internal Package)

(1)Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2)Packing Method



Note (1)Total : Approx. 8.5Kg

(2)Acceptance number of piling : 10 sets

(3)Carton size : 310(W) X 256(D) X 344(H)

(4)Max accumulation quality : 5cartons

Better Vision through SAMSUNG TFT-LCD



(3)Packing Material

NO.	Parts name	Quantity
1.	Static electric protective sack	10
2.	Packing case(inner box) included shock absorber	1 set
3.	Pictorial marking	2 pics
4.	Silica gel(50g X 2)	2
5.	Carton	1 set

9. MARKINGS & OTHERS

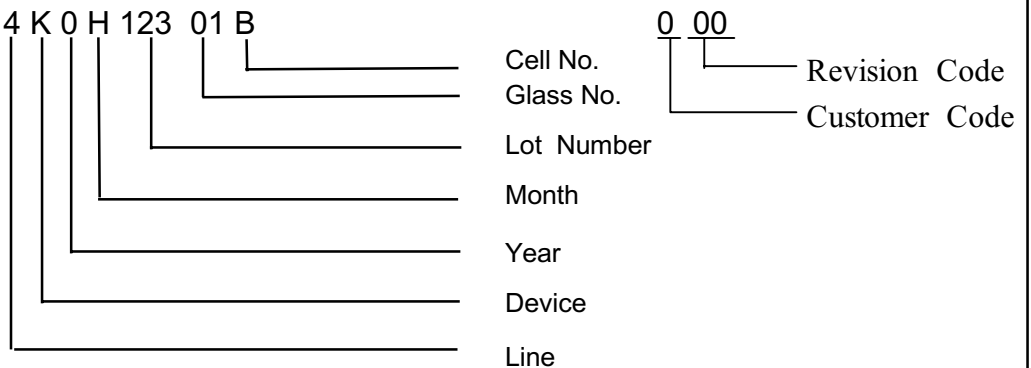
A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1)Parts number : LTM121SH – T01

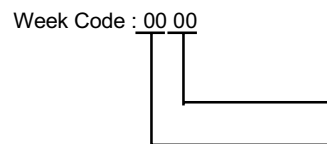
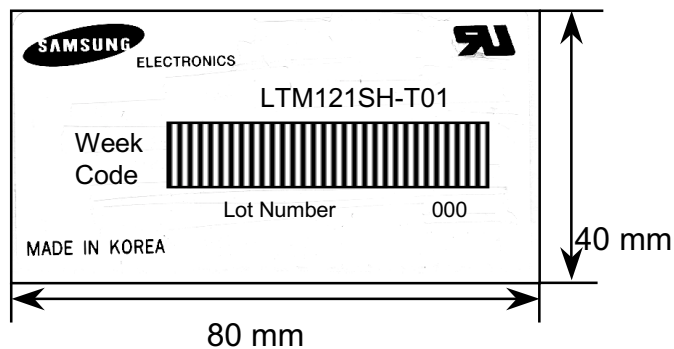
(2)Customer code : One letter

(3)Revision code : Two letter

(4)Lot number : 4 K 0 H 123 01 B



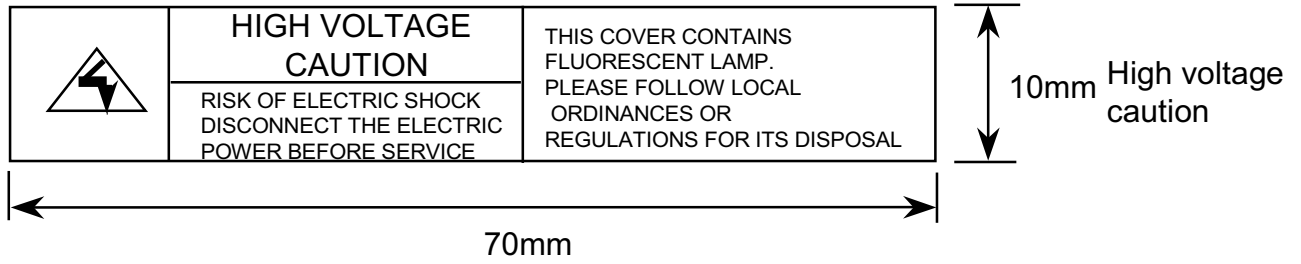
(5) Nameplate Indication



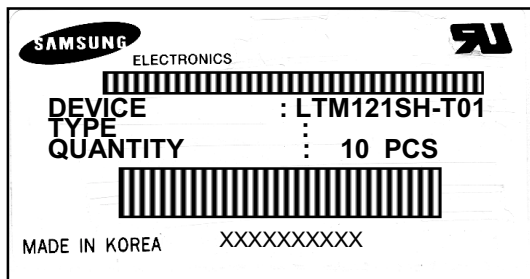
Better Vision through SAMSUNG TFT-LCD



High voltage caution label



(6) Packing box attach



10. GENERAL PRECAUTIONS

8.1 Handling

- (a) When the module is assembled, it should be attached to the system firmly using every mounting hole. Be careful not to twist and bend the module.
- (b) Inverter use high voltage. It should be disconnected power, before Inverter is assembled or disassembled.
- (c) 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.
- (d) Note that polarizers are very fragile and could be damage deasily. Do not press or scratch the surface harder than a HB pencil lead.
- (e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (f) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (g) 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.
- (h) 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 with soap thoroughly.
- (i) Protect the module from static, or the CMOS Gate Array IC would be damaged.
- (j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (k) Do not disassemble the module.
- (l) Do not pull or fold the lamp wire.
- (m) Do not adjust the variable resistor which is located on the module.
- (n) Protection film for polarizer on the module should be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (o) Pins of I/F connector should not be touched directly with bare hands.

10.2 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 should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

10.3 Operation

- (a) Do neither connect nor 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 should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (d) A cable between the backlight connector and its inverter power supply should be a minimized length and be connected directly . A longer cable between the backlight and the inverter may cause lower luminance of lamp(CCFT) and require higher startup voltage(Vs).

10.4 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. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature and so on) Otherwise the module may be damaged.
- (d) If the module displays the same pattern continuously for a long time, it can bring about the situation that the image “sticks” to the screen.
- (e) Because this module has its circuitry PCB on the rear side, it should be handled carefully in order not to be stressed.