Product Information

ISSUE DATE : 2003-07-14
MODEL : LTA104S2-L01

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

PREPARED BY : AMLCD Technical Customer Service Team

SAMSUNG ELECTRONICS CO., LTD.

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Revision History

Date	Rev.No.	Page	Summary		
Apr.26.2003	000		Rev.000 was first issues.		

GENERAL DESCRIPTION

DESCRIPTION

LTA104S2-L01 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 back-light system. The resolution of a 10.4 ″ contains
800 x 600 pixels and can display up to 262,144colors. 6 o'clock direction is the optimum
viewing angle.

FEATURES

- High Brightness
- Wide viewing angle
- High speed response time
- High contrast ratio
- SVGA (800 x 600 pixels) resolution
- Low power consumption
- DE(Data enable) mode
- LVDS Interface with 1 pixel / clock (1 channel)

APPLICATIONS

- Display terminals for AV application products
- Desk-top Monitor
- 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	211.2(H) x 158.4(V) (10.4″ diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	800 x 600 (SVGA)	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.264(H) x 0.264(V) (TYP.)	mm	96dpi
Display Mode	Normally white		
Surface treatment	Haze (25), Hard-Coating 3H		

MECHANICAL INFORMATION

ITEM		MIN.	TYP.	MAX.	NOTE
Module size	Horizontal (H)	245.5	246.0	246.5	
	Vertical (V)	177.3	177.8	178.3	
	Depth (D)	9.5	10.0	10.5	
Weight		-	525g	545g	

1. ABSOLUTE MAXIMUM RATINGS

1.1 ABSOLUTE RATINGS OF ENVIRONMENT

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperature	T_{STG}	-35	70	$^\circ$C	(1)
Operating temperature (Temperature of glass surface)	T_{OPR}	-10	65	$^\circ$C	(1)
Shock (non-operating)	Snop	-	50	G	(2),(4)
Vibration (non-operating)	Vnop	-	1.0	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.
　　　95 % RH Max. (50 $^\circ$C $\geq$ Ta)
　　　Maximum wet - bulb temperature at 39 $^\circ$C or less. (Ta > 50°C) No condensation.

Relative Humidity (%RH)
Storage Range
Operating Range
Temperature (^{O}C)
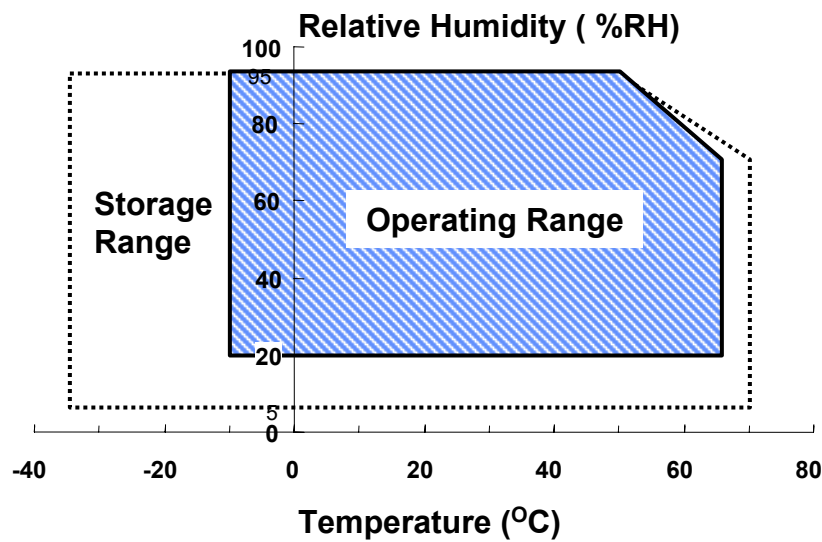
(2) 11ms, (half) sine wave, one time for $\pm$ X, $\pm$ Y, $\pm$ Z.
(3) (5) - (500) Hz, Sweep rate (1) hr, (3)hr for X,Y,Z.
(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be
　　hard and rigid enough so that the Module would not be twisted or bent by the fixture.

1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

(Vss = GND = 0 V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage	V_{DD}	Vss -0.3	4.0	V	(1)
Logic Input Voltage	V_{IN}	Vss -0.3	VDD+0.3	V	(1)

NOTE (1) Within Ta = 25 $\pm$ 2 $°$C

(2) BACK-LIGHT UNIT

Ta = 25 $\pm$ 2 $°$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
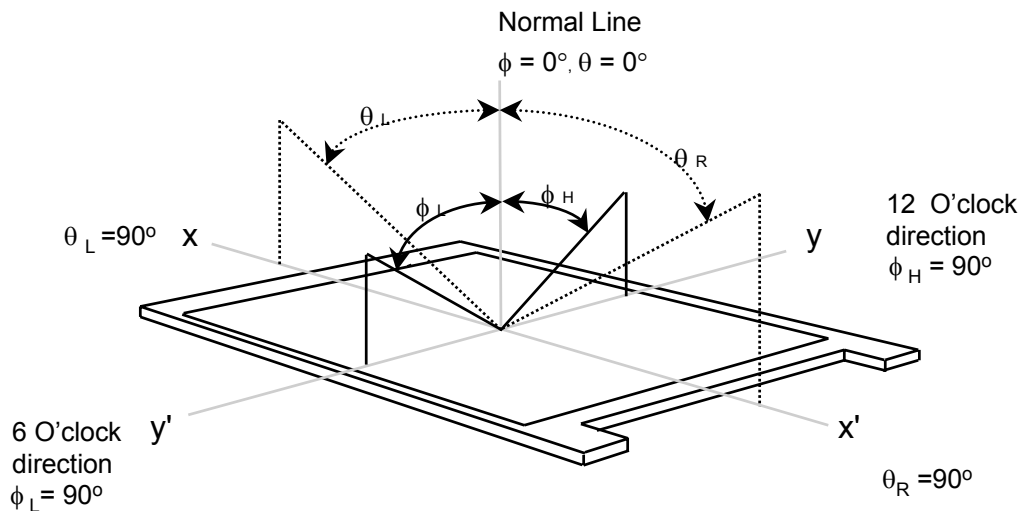Conditions.

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 = $25 \pm 2°C$, V_{DD}=3.3V, f_v= 60Hz, f_{DCLK}=40.0MHz, I_L = 6.0 mA

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio (1 Points)		CR	$\phi = 0$, $\theta = 0$ Normal Viewing Angle	150	-	-		(1), (2), (5)
Response Time at Ta	Rising	T_R		-	10	20	msec	(1), (3)
	Falling	T_F		-	30	50		
Luminance of White (center)		Y_L		320	350	-	cd/m^2	(1), (4)
Color Chromaticity (CIE)	Red	R_X		0.556	0.586	0.616		(1), (5)
		R_Y		0.308	0.338	0.368		
	Green	G_X		0.283	0.313	0.343		
		G_Y		0.497	0.527	0.557		
	Blue	B_X		0.122	0.152	0.182		
		B_Y		0.109	0.139	0.169		
	White	W_X		0.283	0.313	0.353		
		W_Y		0.297	0.327	0.357		
Viewing Angle	Hor.	θ_L	CR $\geq$ 10	50	60	-	Degrees	(1)
		θ_R		50	60	-		
	Ver.	ϕ_H		35	45	-		
		ϕ_L		35	45	-		
5 Points White Variation		δ_L		-	-	1.45		(6)

* Viewing Angle : Ez-contrast

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

Normal Line
$\phi = 0°, \theta = 0°$

θ_L

θ_R

ϕ_L ϕ_H

$\theta_L = 90°$ x

y

12 O'clock direction
$\phi_H = 90°$

6 O'clock direction
$\phi_L = 90°$ y'

x'

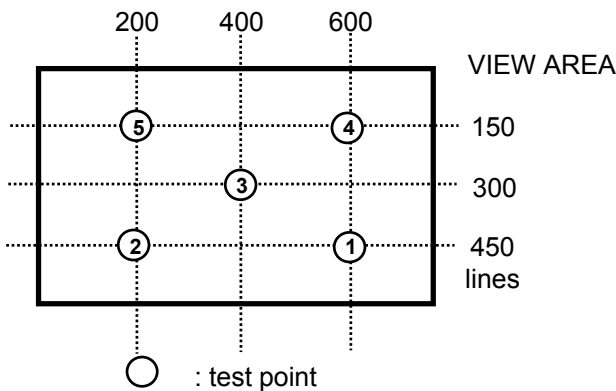$\theta_R = 90°$

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

$$CR = \frac{\text{gray max (Gmax)}}{\text{gray min (Gmin)}}$$

Note 3) Definition of Response time :

Display data　White(TFT OFF)　Black(TFT ON)　White(TFT OFF)

Optical Response

100 %
90 %

10 %
0 %

T_R　T_F

Time
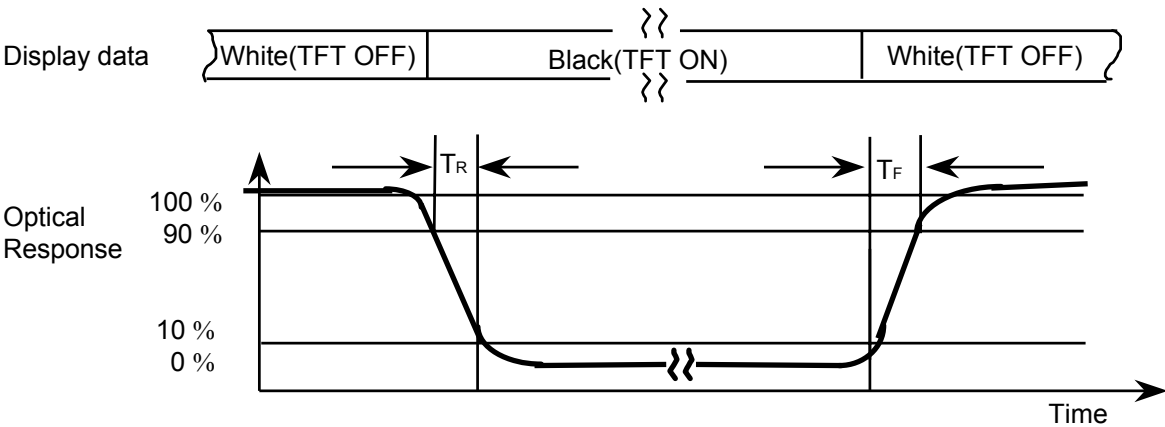
Note 4) Definition of Luminance of White : measure the luminance of white at center point(@ ③)

200　400　600

VIEW AREA

⑤　④　150

③　300

②　①　450 lines

○ : test point

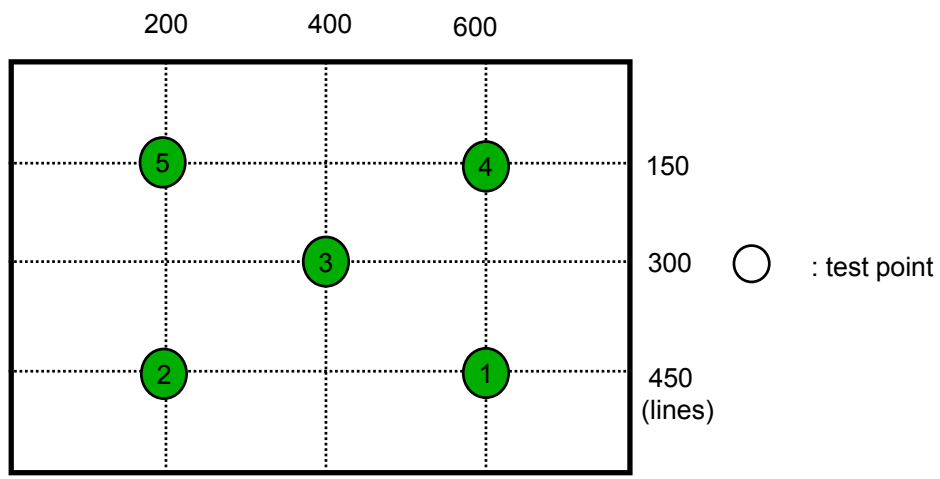| Doc.No. | LTA104S2-L01 | Rev.No | | Page | 8 /26 |

Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless,and dark room. 30 minutes after lighting the back-light. This should be measured in the center of screen.
Lamp current : 6.0 mA
Environment condition : Ta = 25 ± 2 °C

Photo detector
(TOPCON BM-5A)

Field = 2°

40 cm

TFT-LCD module

LCD panel

Center of the screen
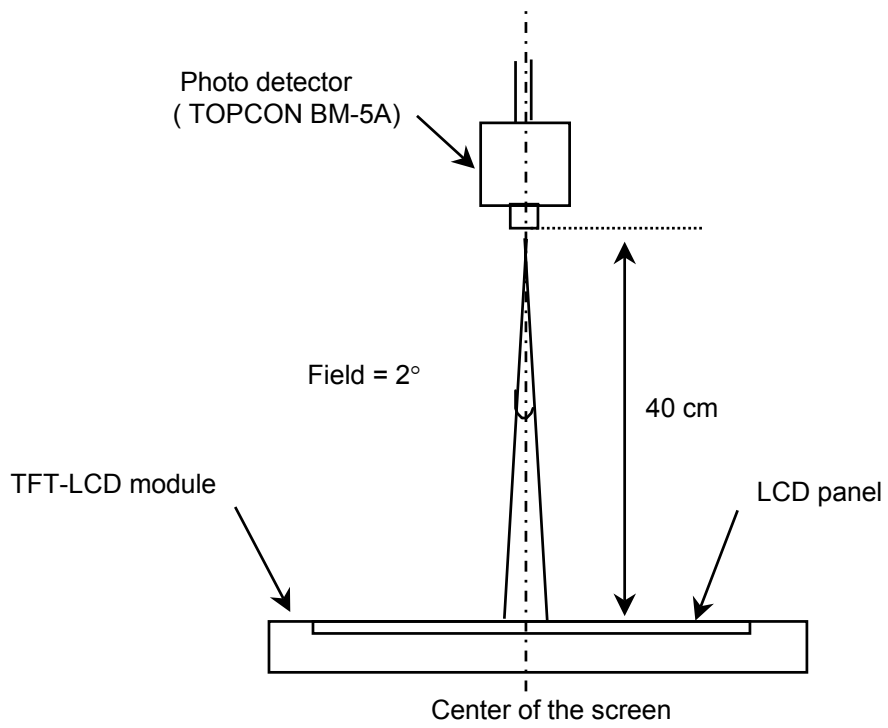
Optical characteristics measurement setup

Note 6) Definition of 5 points white variation (δ_L) [① ~ ⑤]

$$\delta_L \quad = \quad \frac{\text{Maximum luminance of 5 points}}{\text{Minimum luminance of 5 points}}$$

200   400   600

⑤   ④   150

③   300   ◯   : test point

②   ①   450
(lines)

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3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

<div align="right">Ta = 25 ± 2°C</div>

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	(1)
	Low	V_{IL}	-100	-	-	mV	
Vsync Frequency		f_V	-	60	-	Hz	
Hsync Frequency		f_H	-	37.879	-	KHz	
Main Frequency		f_{DCLK}	-	40.0	-	MHz	
Rush Current		I_{RUSH}	-	-	1.5	A	(5)
Current of Power Supply	White	I_{DD}	-	229	256	mA	(2),(4)
	Mosaic		-	250	279	mA	(2),(4)
	Vertical		-	275	306	mA	(2),(4)

Note (1) Condition : V_{CM}=+1.2V(Common mode Voltage)

(2) f_V=60Hz, f_{DCLK} = 40.0MHZ, V_{DD} = 3.3V , DC Current.

(3) 1 pixel /clock

(4) Power dissipation check pattern

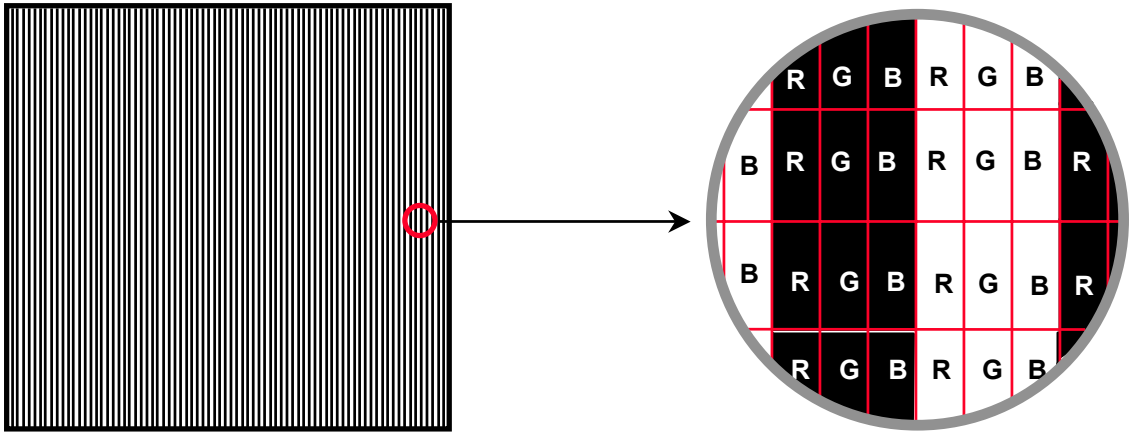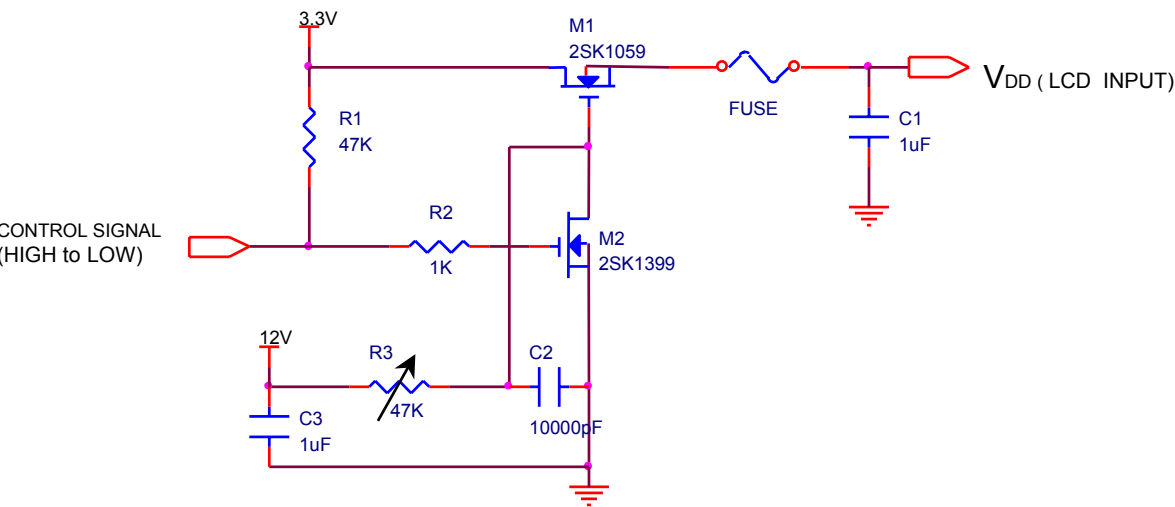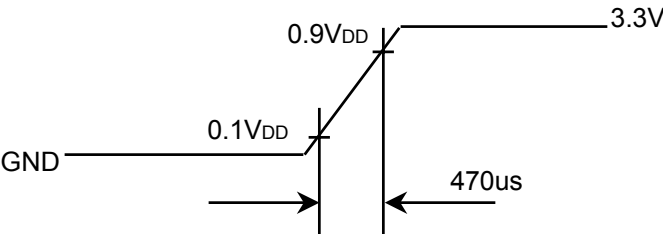*a) White Pattern   *b)Mosaic Pattern

VIEW AREA

Display Brightest Gray Level

Display Darkest Gray Level
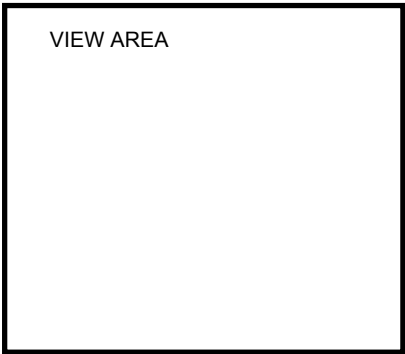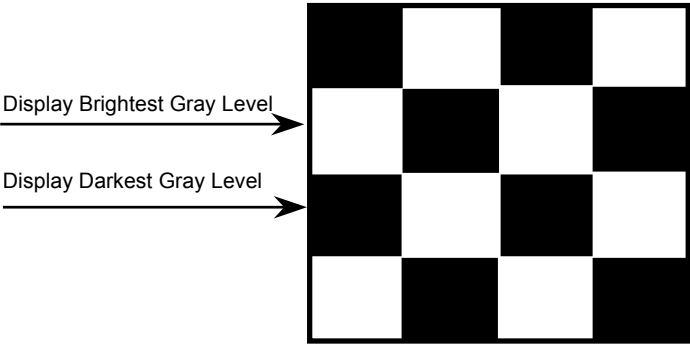
*c) Vertical stripe pattern

5) Rush current measurement condition

<u>V_{DD} rising time is 470us</u>

3.2 BACKLIGHT UNIT

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

INVERTER : TBD   Ta=25 $\pm$ 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	-	500	-	Vrms	I_L=6mA
Frequency	f_L	45	55	80	KHz	(2)
Power Consumption	P_L	-	6.0	-	W	(3), I_L=6mA
Operating Life Time	Hr	30,000	-	-	Hour	(4)
Startup Voltage	V_S	-	-	940(25 °C) / 1130 (0 °C)	Vrms	(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 back-light, 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 back-light 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.
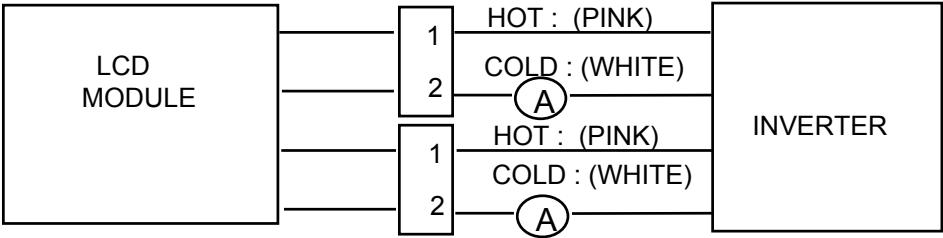
No 2 Pin is V_{LOW}.

   (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 X 2CCFT 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 $\pm$ 2°C and I_L = 6 mArms until one of the following event occurs.
         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 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.
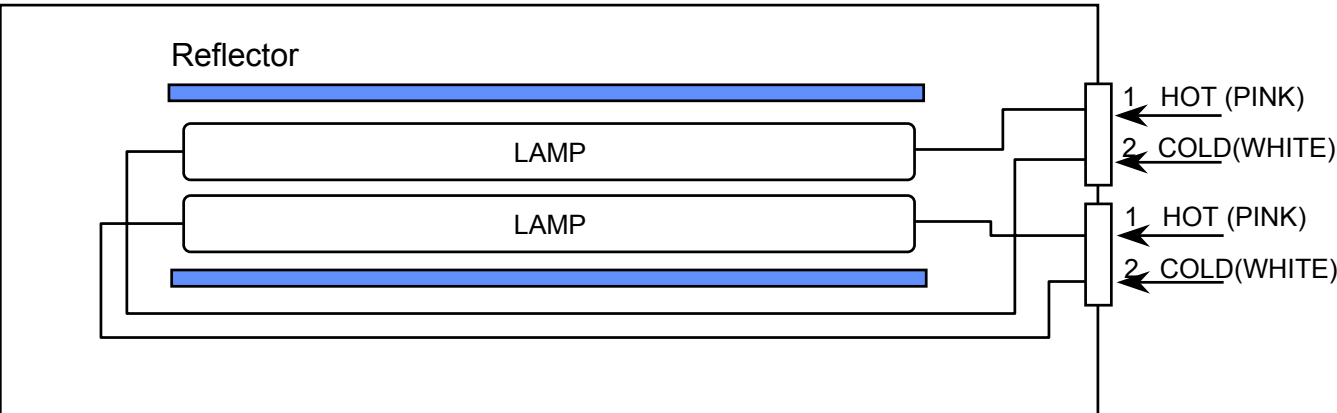
4. BLOCK DIAGRAM

4.1 TFT LCD MODULE

Connector : DF19L-20P-1H
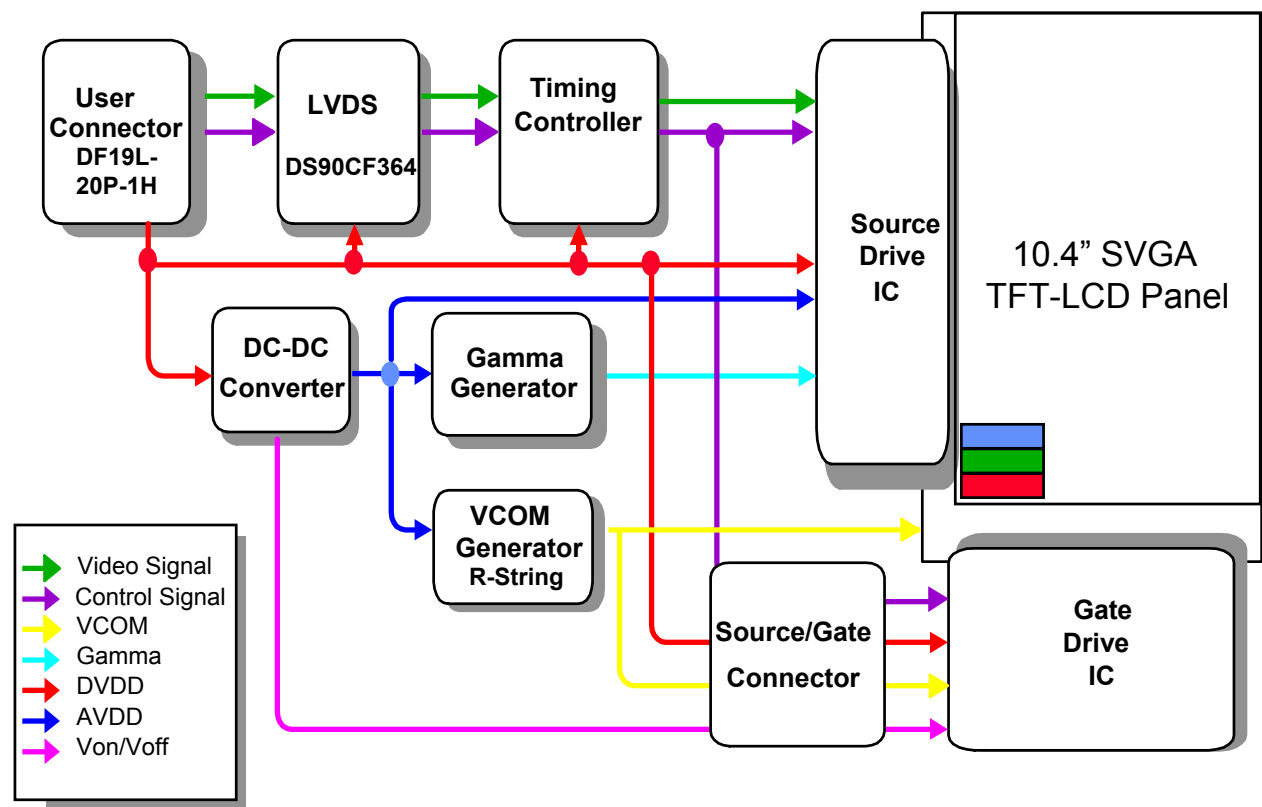
4.2 BACKLIGHT UNIT

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 : DF19L-20P-1H : Hirose)

PIN NO	SYMBOL	FUNCTION	POLARITY	REMARK
1	VDD	POWER SUPPLY +3.3V		
2	VDD	POWER SUPPLY +3.3V		
3	GND	GROUND		
4	GND	GROUND		
5	RxIN0-	LVDS Differential Data INPUT	Negative	R0~R5,G0
6	RxIN0+	LVDS Differential Data INPUT	Positive	
7	GND	GROUND		
8	RxIN1-	LVDS Differential Data INPUT	Negative	G1~G5, B0,B1
9	RxIN1+	LVDS Differential Data INPUT	Positive	
10	GND	GROUND		
11	RxIN2-	LVDS Differential Data INPUT	Negative	B2~B5,Vs, Hs,DE
12	RxIN2+	LVDS Differential Data INPUT	Positive	
13	GND	GROUND		
14	RxCLK-	LVDS Differential Data INPUT	Negative	Clock
15	RxCLK+	LVDS Differential Data INPUT	Positive	
16	GND	GROUND		
17	GND	GROUND		
18	GND	GROUND		
19	GND	GROUND		
20	GND	GROUND		

5.2 LVDS Interface : Transmitter DS90CF363 or Compatible

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
44	TxIN0	RO0	12	TxIN11	GO5
45	TxIN1	RO1	13	TxIN12	BO0
47	TxIN2	RO2	15	TxIN13	BO1
48	TxIN3	RO3	16	TxIN14	BO2
1	TxIN4	RO4	18	TxIN15	BO3
3	TxIN5	RO5	19	TxIN16	BO4
4	TxIN6	GO0	20	TxIN17	BO5
6	TxIN7	GO1	22	TxIN18	GND
7	TxIN8	GO2	23	TxIN19	GND
9	TxIN9	GO3	25	TxIN20	DE
10	TxIN10	GO4	26	TxCLK IN	Clock

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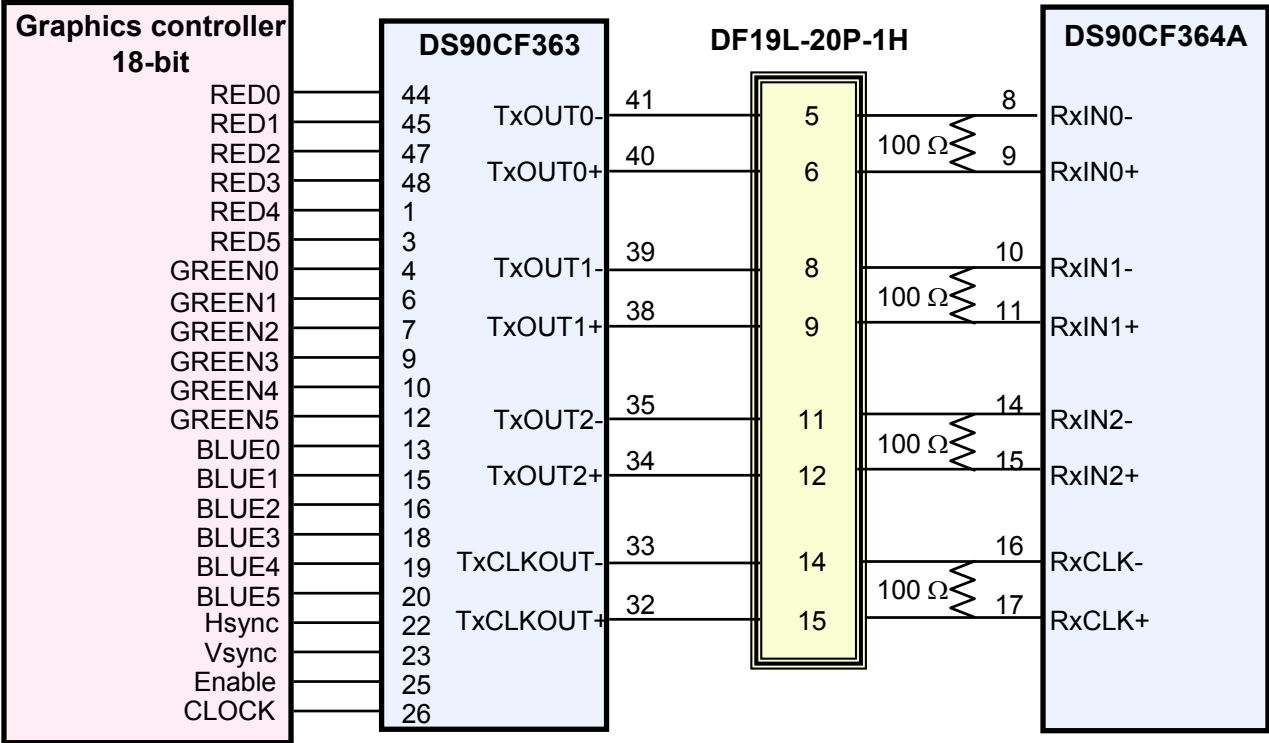
Note : The LCD Module uses a 100ohm resistor between positive and negative lines of each receiver input.

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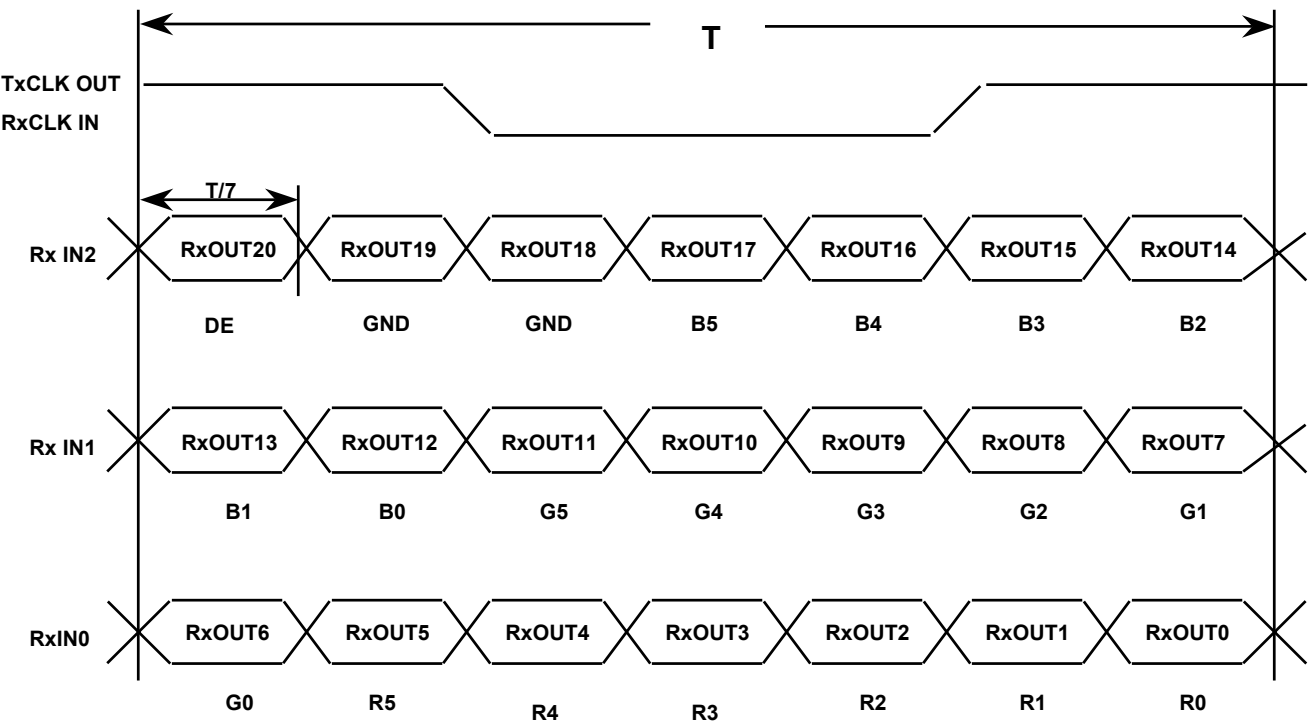## 5.3 BACK LIGHT UNIT

Connector : JST BHSR - 03VS -01
Mating Connector : JST SM02(8.0)B-BHS

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

5.4 Timing Diagrams of LVDS For Transmission

LVDS Receiver : DS90CF364A or Compatible

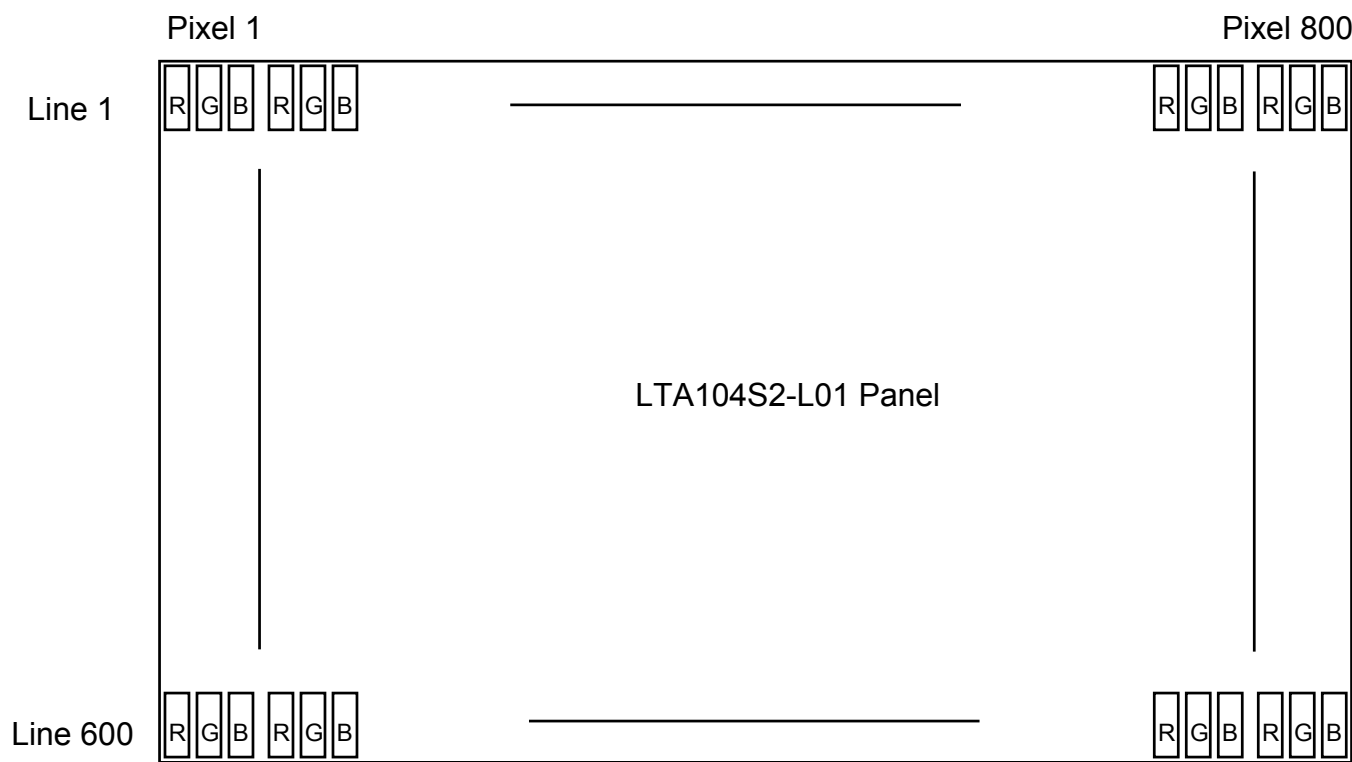## 5.5 Input Signal,Basic Display Colors and Gray Scale of Each Colors

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	
BASIC 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
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	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)

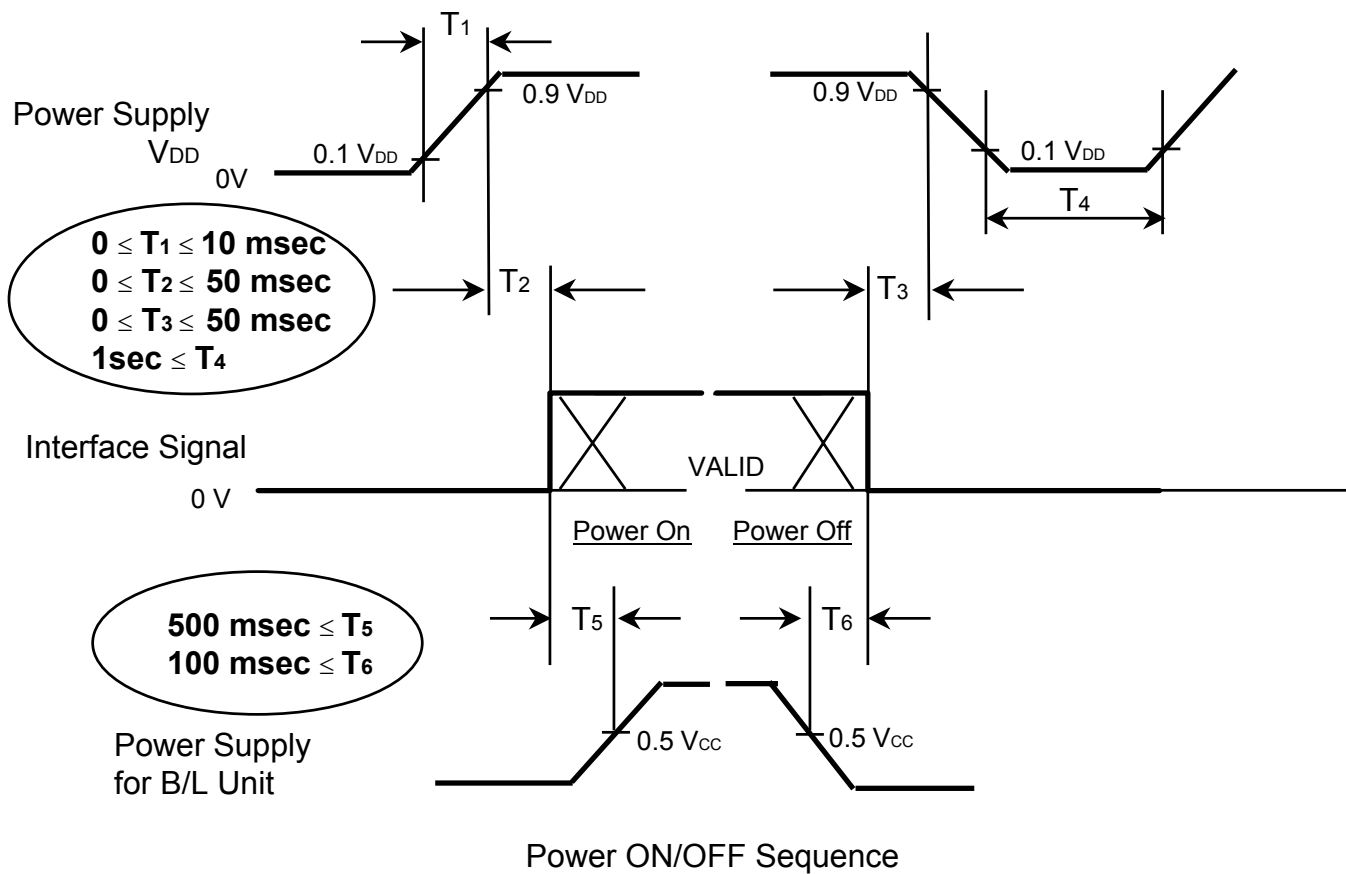(2) Input Signal : 0 = Low level voltage, 1 = High level voltage

5.6 PIXEL FORMAT

Pixel 1   Pixel 800

Line 1   R G B R G B   R G B R G B

LTA104S2-L01 Panel

Line 600   R G B R G B   R G B R G B

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6. INTERFACE TIMING

6.1 Timing Parameters

| SIGNAL	ITEM	SYMBOL	MIN.	TYP	MAX.	UNIT	NOTE
Clock	Frequency	1/Tc	-	40.0	-	MHz	
	High Time	TCH	10	-	-	nsec	
	Low Time	TCL	10	-	-	nsec	
Data	Setup Time	TDS	2	-	-	nsec	
	Hold Time	TDH	0	-	-	nsec	
Frame Frequency	Cycle	Tv	-	16.7	16.7	msec	
			620	628	-	lines	
Vertical Active Display Term	Display Period	TVD	-	600	-	lines	
	Vertical Blank Period	TVB	-	28	-	lines	
One Line Scanning Time	Cycle	TH	-	1056	-	clocks	
Horizontal Active Display Term	Display Period	THD	-	800	-	clocks	

6.2 Power ON/OFF Sequence

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

Power Supply
V_{DD}

$0 \leq T_1 \leq 10$ msec
$0 \leq T_2 \leq 50$ msec
$0 \leq T_3 \leq 50$ msec
$1sec \leq T_4$

Interface Signal

VALID

Power On   Power Off

500 msec $\leq T_5$
100 msec $\leq T_6$

Power Supply for B/L Unit

Power ON/OFF Sequence

NOTE.
  (1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD}.

  (2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

  (3) In case of V_{DD} = off level, please keep the level of input signals on the low or keep a high impedance.

  (4) T4 should be measured after the module has been fully discharged between power off and on period.

  (5) Interface signal shall not be kept at high impedance when the power is on.
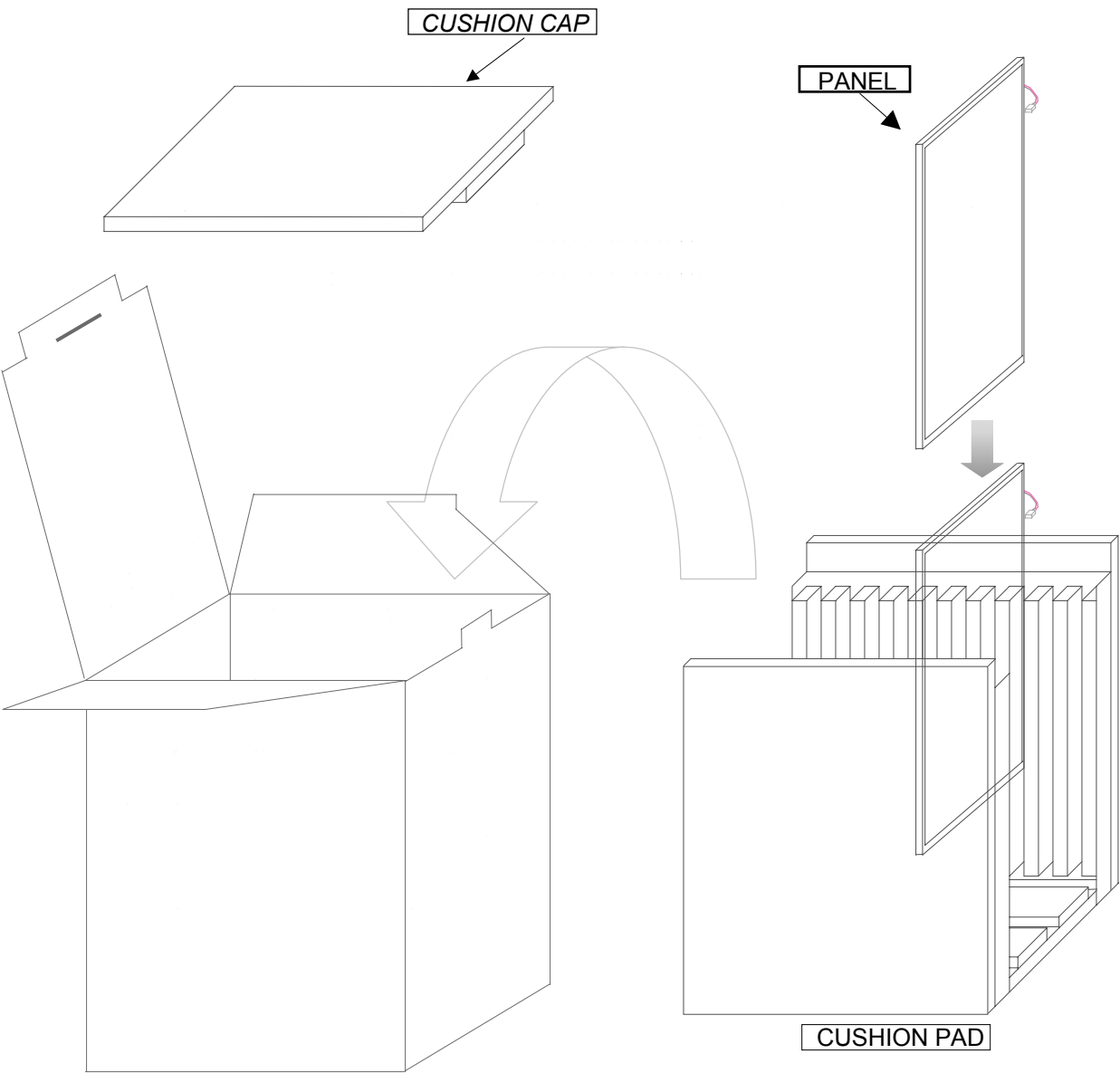
7. Outline Dimension
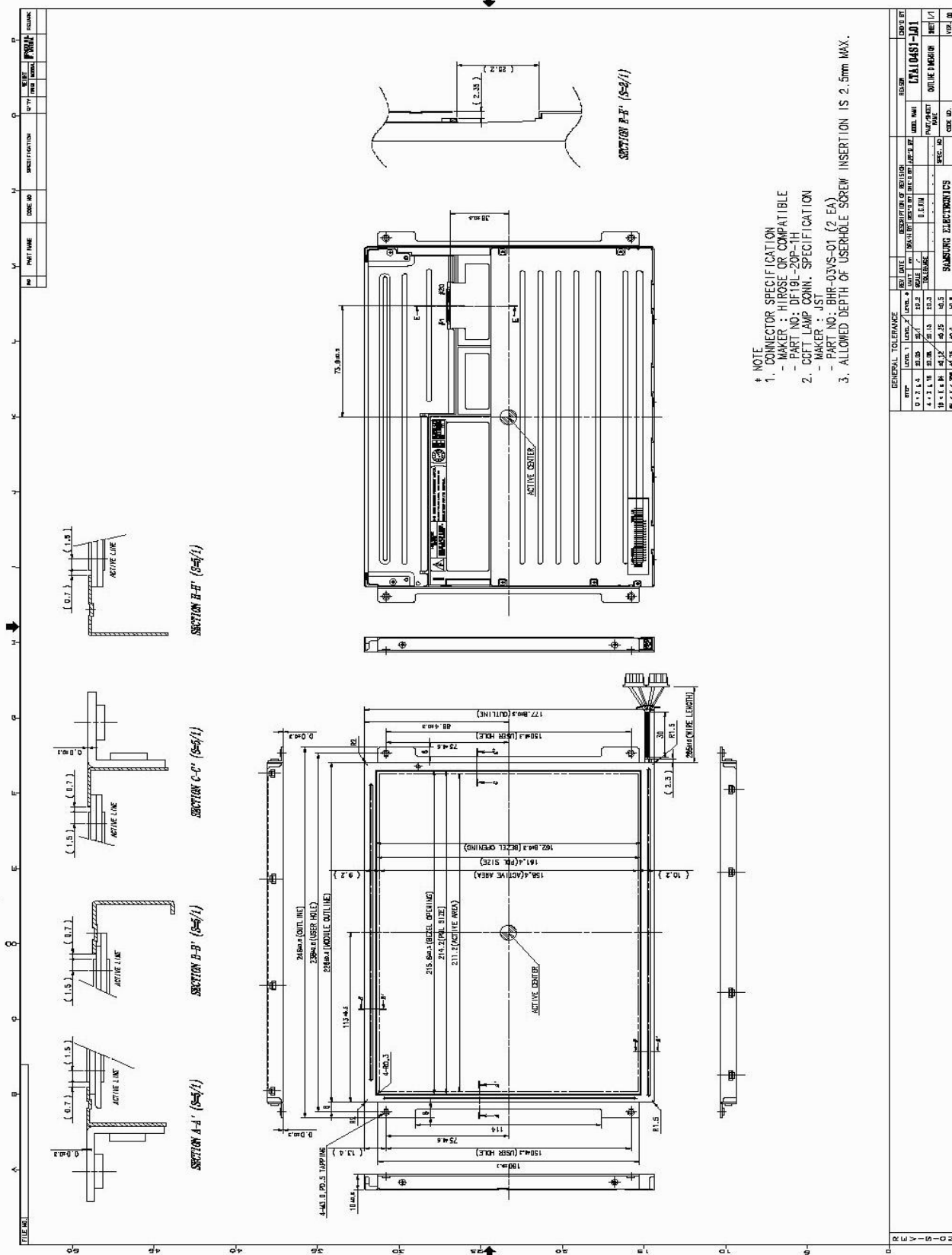
8. Packing

8.1 Packing

CARTON(Internal Package)

(1)Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2)Packing Method

CUSHION CAP

PANEL

CUSHION PAD

Note (1)Total : Approx.　5.0Kg

(2)Acceptance number of piling : 10 sets

(3)Carton size : 310(W) X 256(D) X 344(H)
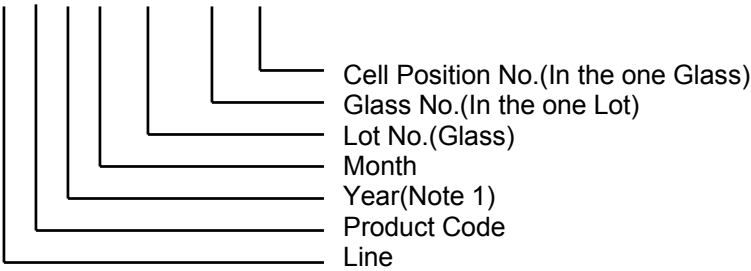
(4)Max accumulation quality : 5cartons

(3)Packing Material

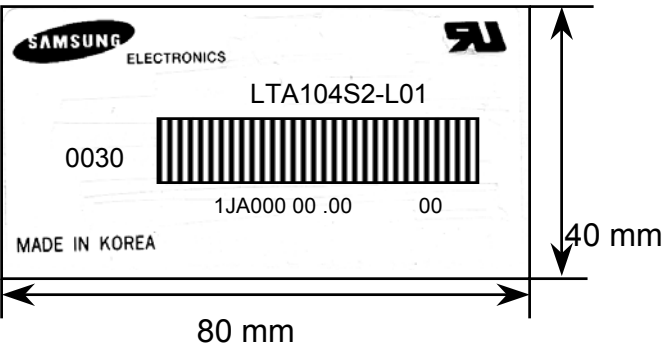| NO.	Parts name	Quantity
1.	Static electric protective sack	10
2.	Cushion pad(inner box) included shock absorber	1 set
3.	Pictorial marking	2 pics
4.	Desiccant (50g X 1)	1
5.	Carton	1 set

9. MARKINGS & OTHERS

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

(1)Parts number : LTA104S2 - L01
(2)Revision   : One letter
(3)Control code   : One letter
(4)Lot number   : 1 J 0 A XXX XX XX
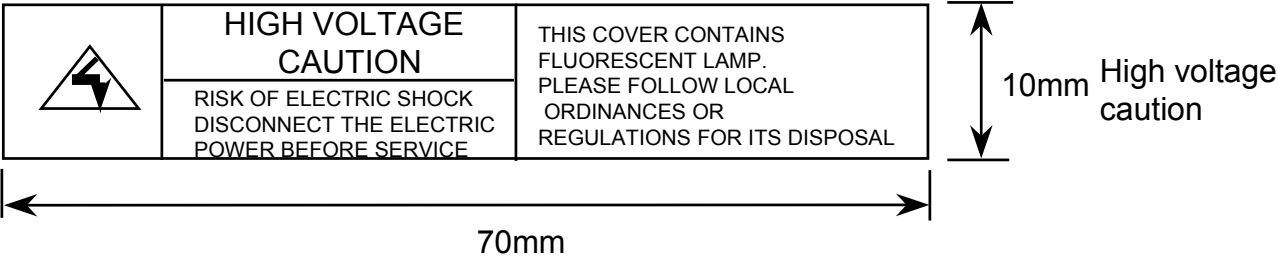
Cell Position No.(In the one Glass)
Glass No.(In the one Lot)
Lot No.(Glass)
Month
Year(Note 1)
Product Code
Line

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

(5) Nameplate Indication

LTA... : Parts name
1JA… : Lot number
0030 : Inspected work week

80 mm

40 mm

High voltage caution label

	HIGH VOLTAGE CAUTION	THIS COVER CONTAINS FLUORESCENT LAMP. PLEASE FOLLOW LOCAL ORDINANCES OR REGULATIONS FOR ITS DISPOSAL
⚠	RISK OF ELECTRIC SHOCK DISCONNECT THE ELECTRIC POWER BEFORE SERVICE	

10mm High voltage caution

70mm

(6) Packing box attach

SAMSUNG ELECTRONICS 🅤🅛

||||||||||||||||||||||||||||||

DEVICE TYPE : **LTA104S2-L01**
QUANTITY : **10 PCS**

||||||||||||||||||||||||||||||

MADE IN KOREA   XXXXXXXXXX
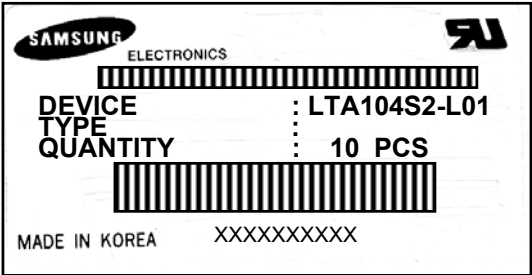
10. GENERAL PRECAUTIONS

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 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 finger-stalls with soft gloves in order to keep display clean during the incoming
     inspection and assembly process.

(j) Do not disassemble the module.

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

(l) Do not adjust the variable resistor which is located on the back side.

(m) Protection film for polarizer on the module shall be slowly peeled off just before use so
      that the electrostatic charge can be minimized.

(n) Pins of I/F connector shall not be touched directly with bare hands.

2. STORAGE

(a) Do not leave the module in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 °C and
relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent
light during the store.

3. OPERATION

(a) Do not connect,disconnect the module in the " Power On" condition.

(b) Power supply should always be turned on/off by following item 6.2
" 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).

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.