SAMSUNG ELECTRONICS

Product Information

TO :

DATE : **Oct. 31. 2001.**

SAMSUNG TFT-LCD

MODEL NO. : LTM170W1-L01

APPROVED BY :

Any Modification of Spec is not allowed without SEC's permission.

Senior Engineer :

PREPARED BY : AMLCD Technical Customer Service Team

SAMSUNG ELECTRONICS CO., LTD.

wise view™ SAMSUNG TFT-LCD

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GENERAL DESCRIPTION

DESCRIPTION

LTM170W1-L01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display that uses amorphous silicon TFT switching devices. This model is composed of a TFT LCD panel, a driver circuit and a back-light system. The resolution of 17.0- inch contains 1,280 x 768 pixels and can display up to 16.2 millions colors.

FEATURES

- High contrast ratio, High color saturation
- Wide viewing angle
- High-speed response
- WXGA(1280x768 pixels) resolution
- Low power consumption
- 2 dual CCFTs (Cold Cathode Fluorescent Tube)
- DE Only Mode
- LVDS Interface with 1 pixel / clock : FPD LINK

APPLICATIONS

- Desktop monitors
- Display terminals for AV application products
- Monitors for TV Set

GENERAL SPECIFICATIONS

ITEM	SPECIFICATION	UNIT	NOTE
Active area	370.560(H) X 222.336(V)	mm	
Driver element	a-Si TFT active matrix		
Display colors	16.2M		
Number of pixel	1280 x 768	pixel	Wide XGA
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.2895(H) x 0.2895(V)	mm	
Display Mode	Normally white		
Surface treatment	Haze 25 , Anti-Glare & Hard - Coating (3H)		

Mechanical Information

ITEM		MIN.	TYP.	MAX.	NOTE
Module size	Horizontal (H)	403.5	404.0	404.5	mm
	Vertical (V)	257.5	258.0	258.5	mm
	Depth (D)	-	16.2	16.7	mm
Weight		-	-	2000	g

1. ABSOLUTE MAXIMUM RATINGS

1.1 ABSOLUTE RATINGS OF ENVIRONMENT

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperature	T_{STG}	-20	60	°C	(1)
Operating temperature (Surface of Glass)	T_{OPR}	0	50	°C	(1)
Shock (non-operating)	Snop	-	50	G	(2),(4)
Vibration (non-operating)	Vnop	-	1.5	G	(3),(4)

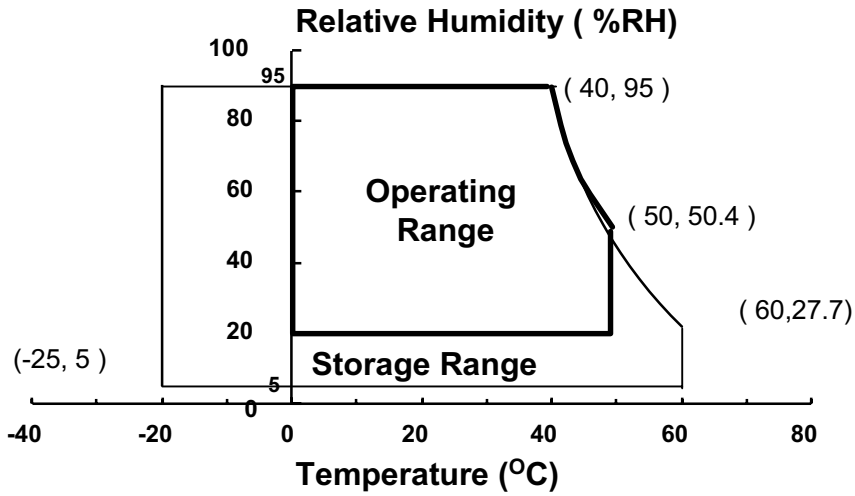
Note (1) Temperature and relative humidity range are shown in the figure below.
Maximum wet-bulb temperature at 39℃ or less.
(Equal to 90 % RH Max. at 40 ℃≥ Ta)
No condensation.

(2) 11ms, sine wave, one time for ±X,±Y,±Z axis

(3) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

(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 temperature for extended time, there is a possibility of wide viewing angle film damage which could affect visual characteristics.



1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

(Vss = GND = 0 V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage	V_{DD}	GND	5.0	V	(1)

NOTE (1) With Ta (25 ± 2 ^{O}C)

(2) BACK-LIGHT UNIT

Ta = 25 ± 2 ^{O}C

ITEM	SYMBOL	MIN.	MAX.	UNIT.	NOTE
Lamp current	I_L	3.0	8.5	mA_{rms}	(1) (2)
Lamp frequency	f_L	40	60	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) Specified values are for a single lamp

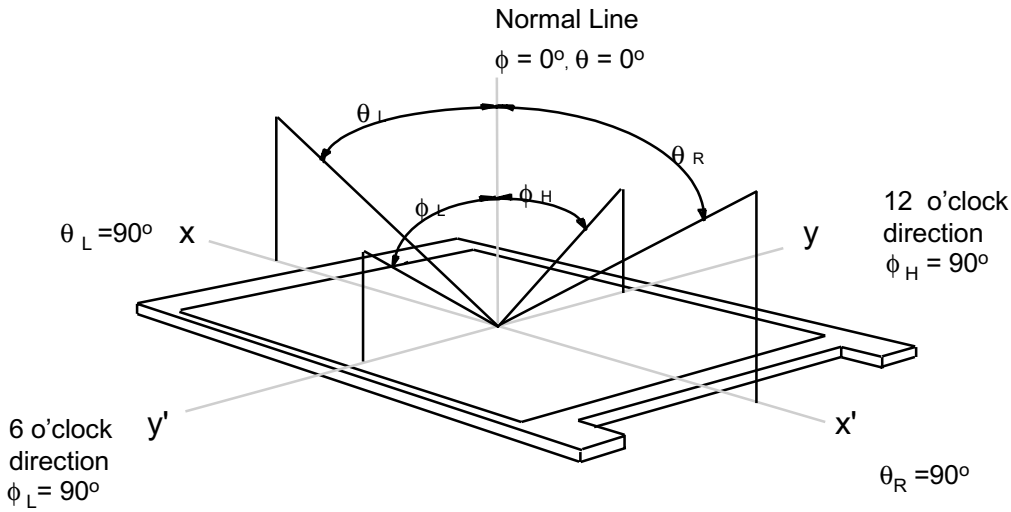
2. OPTICAL CHARACTERISTICS

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 (1).
Measuring equipment : TOPCON BM-5A , BM-7, PHOTO RESEARCH PR650,Eldim EZ-Contrast

* Ta = 25 ± 2 °C , V_{DD} = 5.0V, fv= 60Hz, f_{DCLK}=65MHz, I_L = 7.0 mArms

ITEM		SYMBOL	Condition	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio (Center of screen)		CR	ϕ = 0, θ = 0 Normal Viewing Angle	400	450	-		(1),(2),(4)
Response Time at Ta	Rising	T_R		-	5	10	msec	(1),(3)
	Falling	T_F		-	20	25		
Luminance of White (Center of screen)		Y_L		350	400	-	cd/m^2	BM7
Color Chromaticity (CIE 1933)	Red	R_X		Typ. -0.03	0.626	Typ. +0.03		(1),(4)
		R_Y			0.355			
	Green	G_X			0.285			
		G_Y			0.582			
	Blue	B_X			0.143			
		B_Y			0.078			
	White	W_X			0.280			
		W_Y			0.290			
Viewing Angle	Hor.	θ_L	CR ≥ 10	65	70	-	Degrees	(1) BM5A
		θ_R		65	70	-		
	Ver.	ϕ_H		45	50	-		
		ϕ_L		55	60	-		
Brightness Uniformity (9 Point)		B_{UNI}		-	-	25	%	(5),BM5A

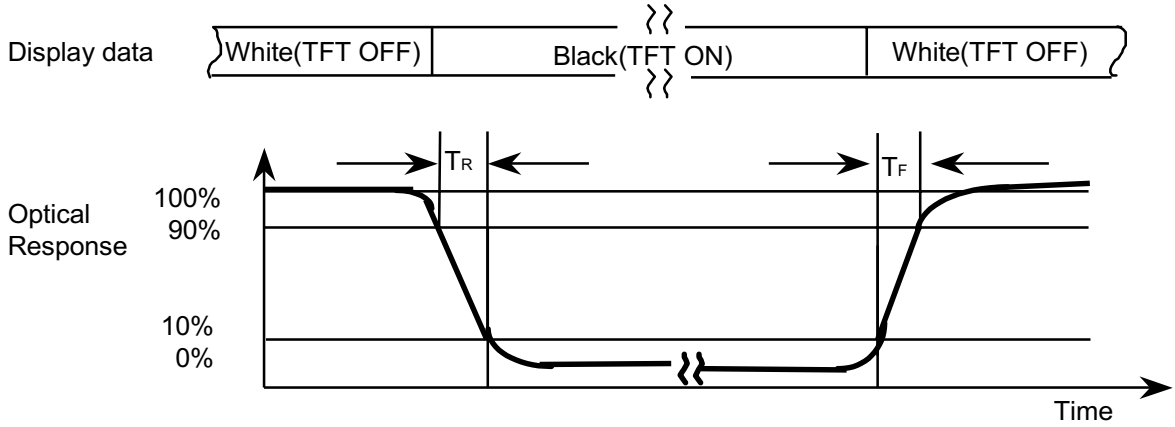
Note 1) Definition of Viewing Angle : Viewing angle range (10 ≤ CR)



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 :

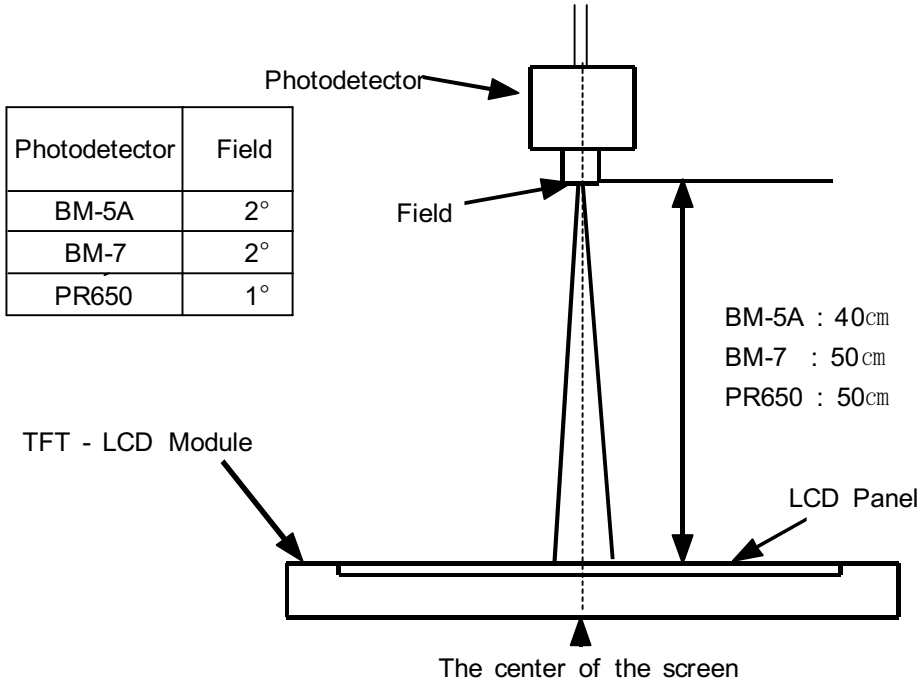


Note 4) Test Equipment Setup

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 back-light. This should be measured in the center of the screen.

Single lamp current : 7.0mA, Environment condition : Ta = 25 ± 2℃

Photodetector	Field
BM-5A	2°
BM-7	2°
PR650	1°



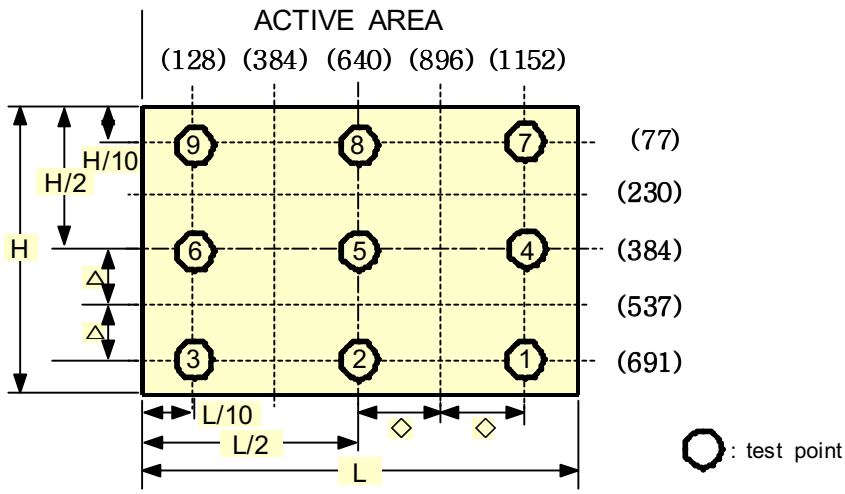
Optical Measuring Equipment Setup

Note 5) Definition of 9 points brightness uniformity

$$\text{Buni} = \left| 1 - \frac{B\,min}{B\,max} \right| \times 100$$

Bmax : Maximum Brightness

Bmin : Minimum Brightness



3. ELECTRICAL CHARACTERISTICS

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 Threshold Voltage	High	V_{IH}			+100	mV	VCM =1.2V
	Low	V_{IL}	-100			mV	
Current of Power Supply	White	I_{DD}	-	450	-	mA	(2)(4)*a
	Black		-	520	-	mA	(2)(4)*b
	Sub-pixel checker		-	550	700	mA	(2)(4)*c
Vsync Frequency		f_V	-	60	-	Hz	
Hsync Frequency		f_H	-	48.4	-	kHz	
Main Frequency		f_{DCLK}	-	68	80	MHz	(3)
Rush Current		I_{rush}	-	-	3.0	A	(5)

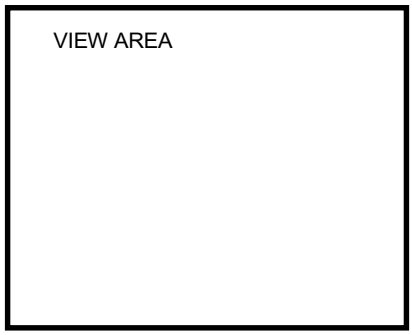
Note (1) Vss= 0V Input Power Max,Min = Ripple Max, Min

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

(3) 1 Pixel/clock

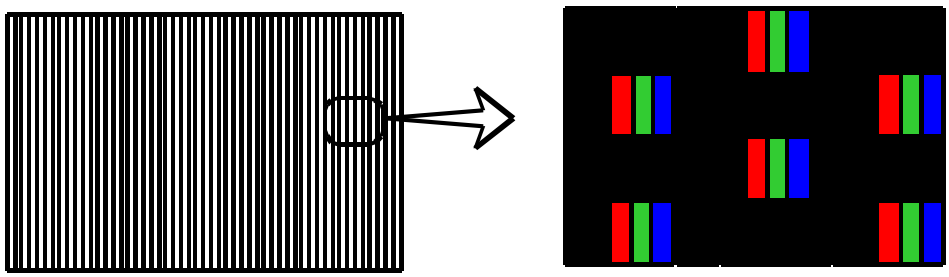
(4) Power dissipation check pattern

*a) White Pattern



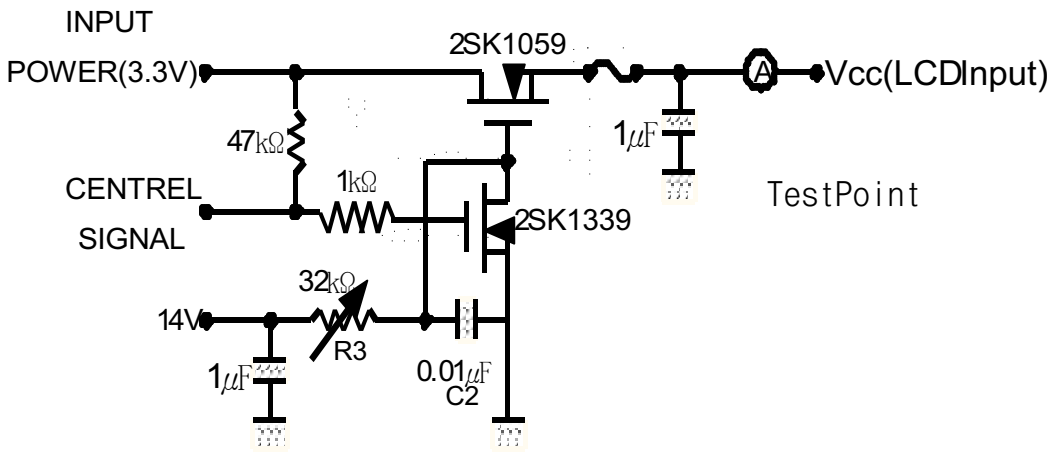
*b) Black Pattern

c) Sparse dot Morie Pattern



(5) Measurement Conditions

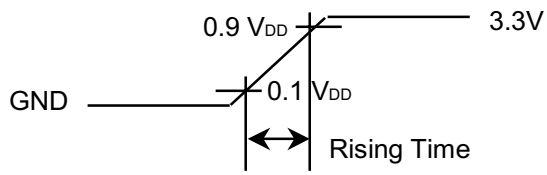
V_{DD} rising time : 470us



Note : Control Signal : High(+5V) -->Low(Ground)

All Signal lines to panel except for power 5V : Ground

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



3.2 BACK-LIGHT UNIT

The back-light system is an edge-lighting type with 4 CCFTs(Cold Cathode Fluorescent Tube).

The characteristics of four lamps are shown in the following tables.

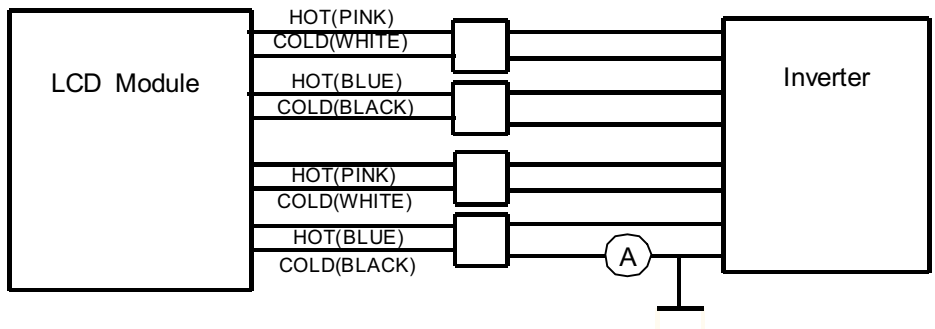
Ta= 25 ± 2 °C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Lamp Current	I_L	3.0	7.0	8.5	mA_{rms}	(1)
Lamp Voltage	V_L	-	665	-	V_{rms}	I_L=7.0 mArms
Lamp Frequency	F_L	40	-	60	kHz	(2)
Operating Life Time of Lamp	Hr	25,000	50,000	-	Hour	(3)
Startup Voltage	Vs	-	-	0°C :1430 25°C :1020	Vrms	(4)

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 current meter for high frequency as shown below.



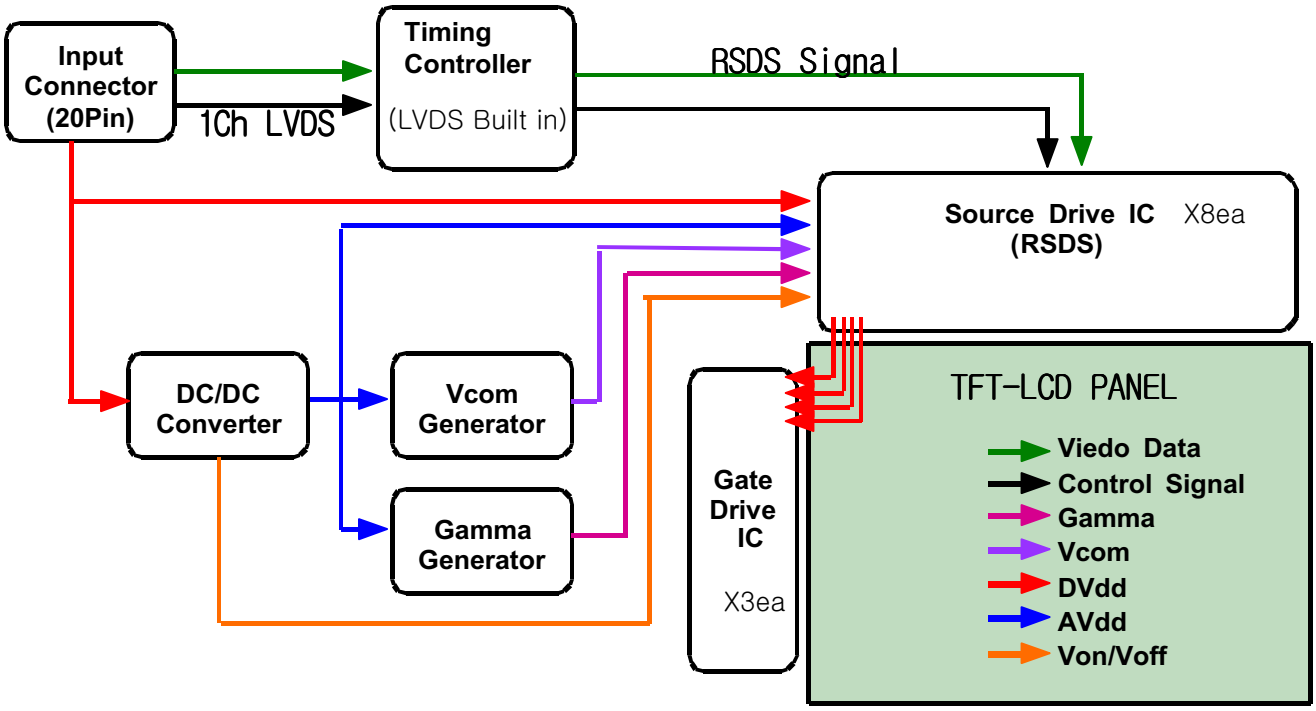
(2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

(3) Life time (Hr) of a lamp is defined
- as the time in which it continues to operate under the condition of Ta = 25 ± 2 °C and I_L = 7.0 mArms until the brightness becomes 50% or lower than it's original value.
- as the time in which maximum value of Vs(start up voltage) exceed 1700Vrms under condition of Ta= 0 °C

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

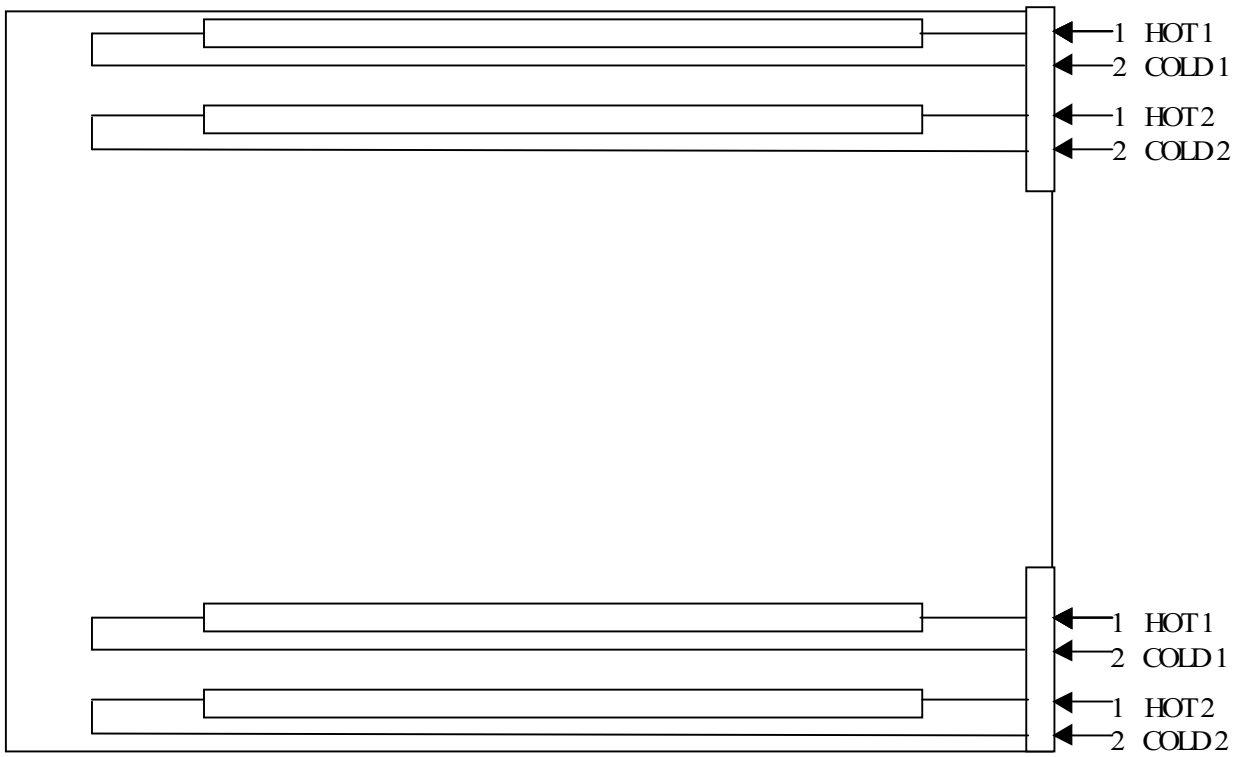
4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACK-LIGHT UNIT

* Module-Side Connector : JST BHSR-02VS-1



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 Input Signal & Power

Connector 20 pin : DF 14H-20P-1.25H / HIROSE

Pin No.	Symbol	Function	Remark
1	VDD	Power Supply 3.3V	
2	VDD	Power Supply 3.3V	
3	GND	Ground	
4	GND	Ground	
5	RX0-	Receiver Signal(-)	
6	RX0+	Receiver Signal(-)	
7	GND	Ground	
8	RX1-	Receiver Signal(-)	
9	RX1+	Receiver Signal(-)	
10	GND	Ground	
11	RX2-	Receiver Signal(-)	
12	RX2+	Receiver Signal(-)	
13	GND	Ground	
14	RXCLK-	Receiver Clock Signal(-)	
15	RXCLK+	Receiver Clock Signal(-)	
16	GND	Ground	
17	RX3-	Receiver Signal(-)	
18	RX3+	Receiver Signal(-)	
19	GND	Ground	
20	GAMMA CONTROL INPUT	OPEN(High Impedance) → γ = 2.2 Ground (0V) ~1.6V → γ > 2.2 1.6V → γ = 2.2 1.6V ~ 3.2V → γ < 2.2	User Controllable

Note (1) Display data is sampled at the falling edge of data clock

5.2 Inverter Output Pin Assignment

	Pin No	OUTPUT	Connector Part No.
UP	1, 3	HOT (High)	SM02B-BHSS-1-TB
	2, 4	COLD (Ground)	
DOWN	1, 3	HOT (High)	
	2, 4	COLD (Ground)	

5.3 Input Signal,Basic Display Colors and Gray Scale of Each Colors

COLOR	DISPLAY (8bit)	DATA SIGNAL																								GRAY SCALE LEVEL
		RED								GREEN								BLUE								
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	
BASIC COLOR	BLACK	0	0	0	0	0	0	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	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	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	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	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	0	0	0	0	0	0	R2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			R3~
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			R249
	↓	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R250
	LIGHT	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R251
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R252
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	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	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
	↑	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			G3~
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			G249
	↓	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G250
	LIGHT	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G251
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G252
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	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	0	0	0	0	1	0	0	0	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			B3~
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			B249
	↓	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B250
	LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B251
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B252

Note) ✓ Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

✓ Input Signal : 0 = Low level voltage, 1 = High level voltage

6. INTERFACE TIMING

6.1 Timing Parameters (DE mode)

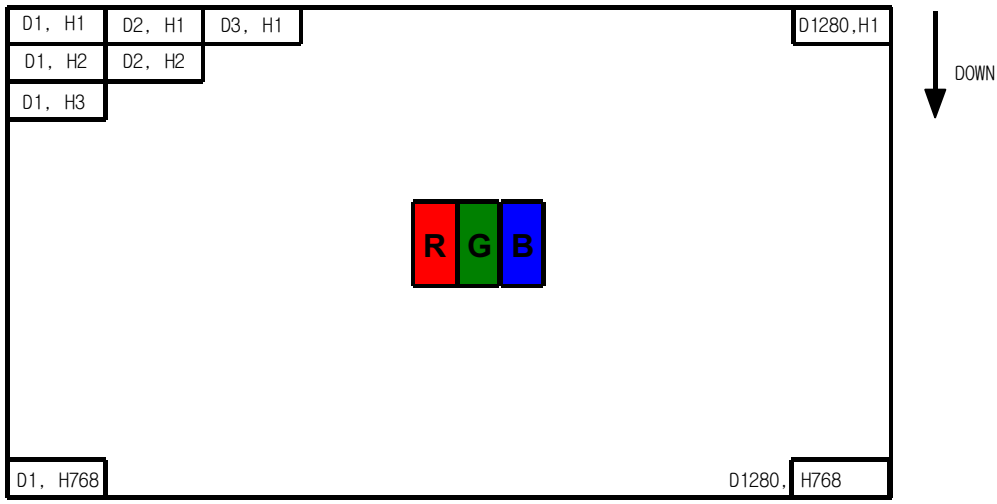
Signal	Item	Symbol	MIN	TYP	MAX	Unit	Note
Clock	Frequency	1 / Tc	-	68	80	MHz	
	High Time	Tch	2	-	-	nsec	
	Low Time	Tcl	2	-	-	nsec	
Data	Setup Time	Tds	2	-	-	nsec	
	Hold Time	Tdh	0	-	-	nsec	
Data Enable	Setup Time	Tes	2	-	-	nsec	(1)
Frame Frequency	Cycle	Tv	772	16.7 | 806	1000	msec | lines	
Vertical Active Display Term	Display Period	Tvd	768	768	768	lines	
One Line Scanning Time	Cycle	Th	1350	1408	1688	clocks	
Horizontal Active Display Term	Display Period	Thd	1280	1280	1280	clocks	

Note (1) When LTM170W1-L01 model is operated by DE only mode,

Hsync and Vsync input signals should be fixed to "Low" for stable operation.

Otherwise, the module could operate abnormally.

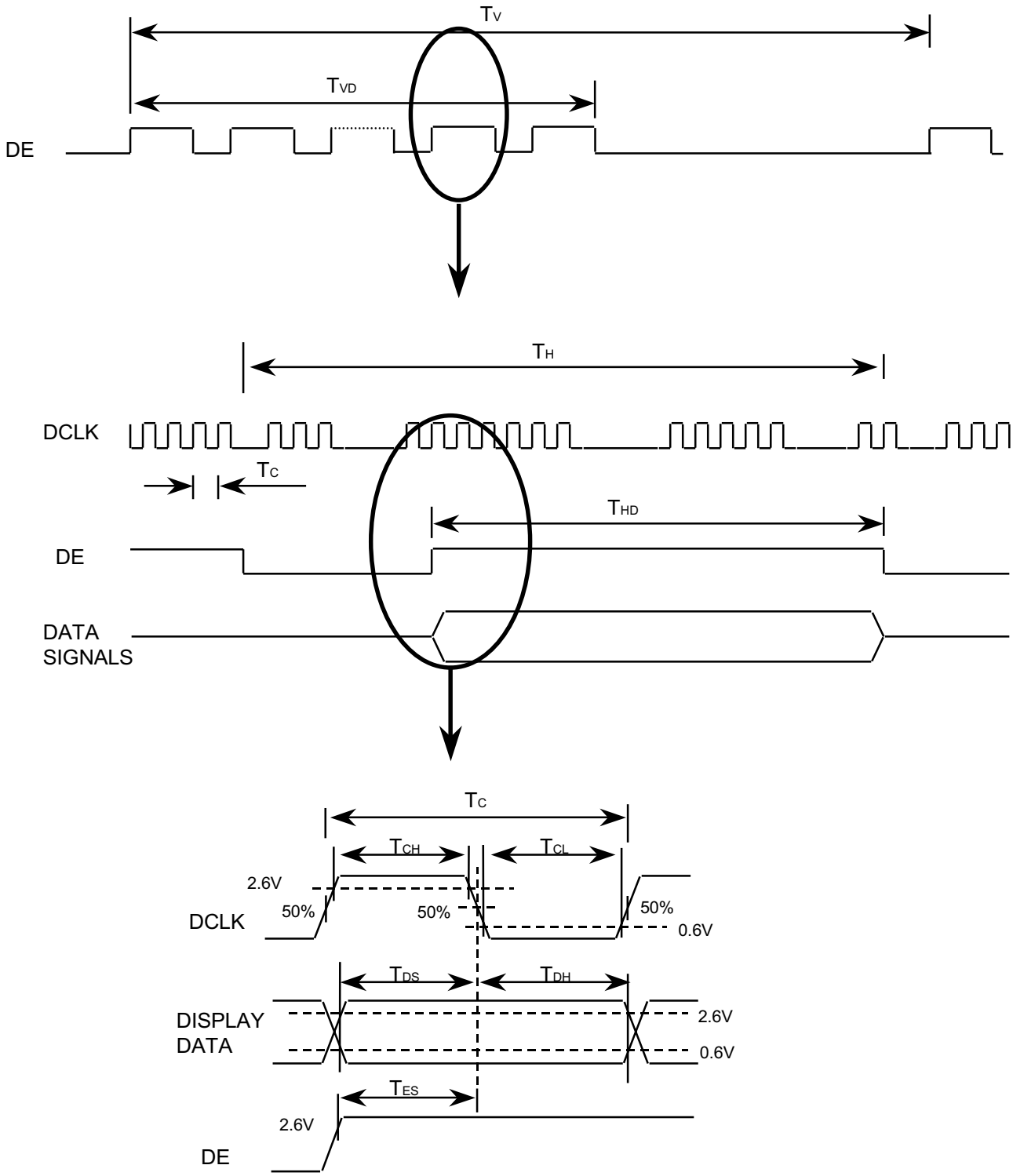
6.2 PIXEL FORMAT



NOTE

(Dn, Hm) = # n, # m Pixel

6.3 Timing diagrams of interface signal (DE only mode)

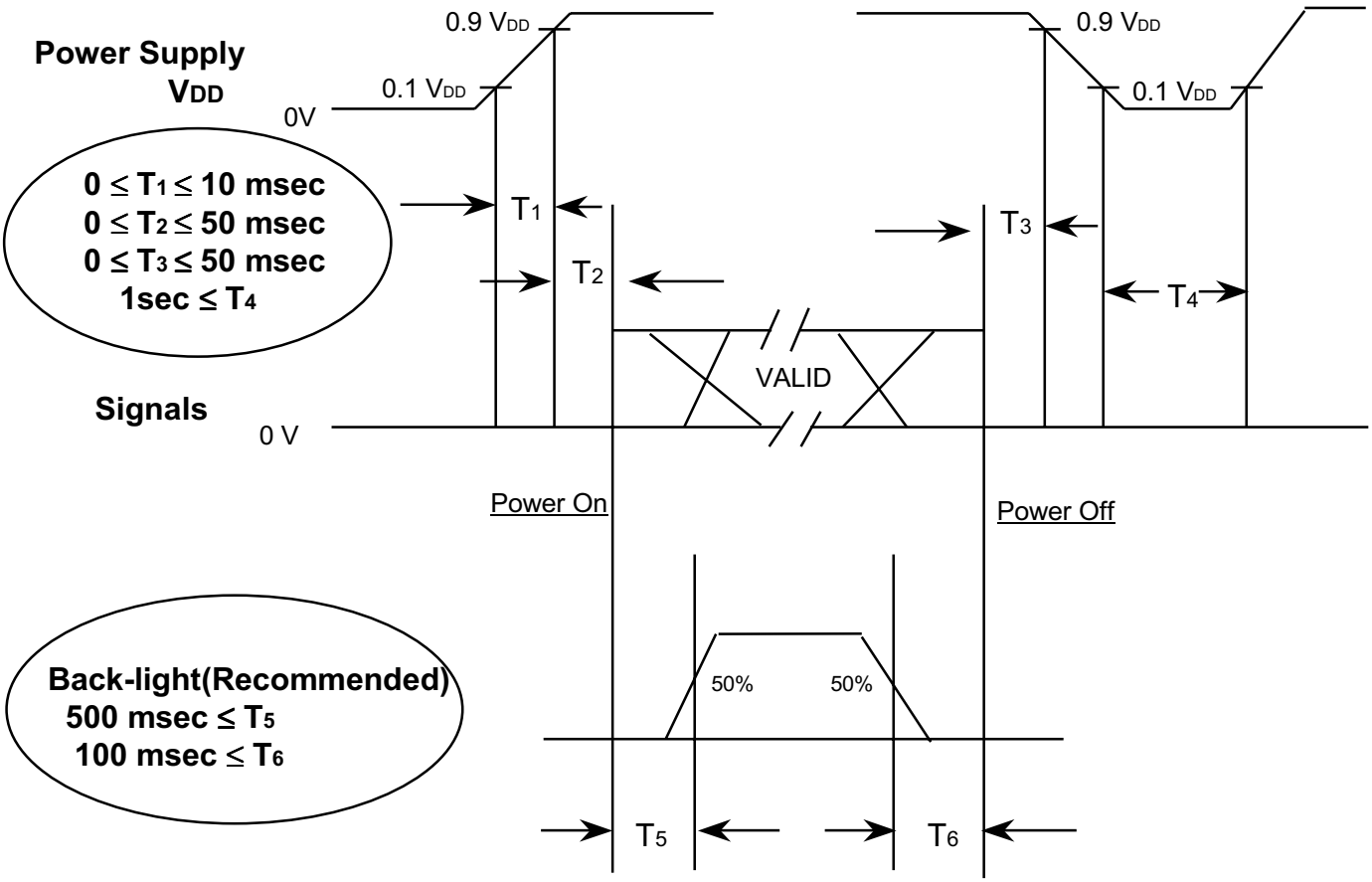


6.4 LVDS PIN MAPPING

LVDS Transmitter (***DS90C385***) Signal Interface						
Device Input Pin		Device Input Signal		Output Signal	To LTM170W1	
No	Symbol	Symbol	Function		Terminal	Symbol
51	TXIN0	RO0	Red Pixel Data (LSB)	TXOUT0- TXOUT0+	No. 5 No. 6	RX0- RX0+
52	TXIN1	RO1	Red Pixel Data			
54	TXIN2	RO2	Red Pixel Data			
55	TXIN3	RO3	Red Pixel Data			
56	TXIN4	RO4	Red Pixel Data			
2	TXIN5	RO7	Red Pixel Data (MSB)	TXOUT3- TXOUT3+	No. 17 No. 18	RX3- RX3+
3	TXIN6	RO5	Red Pixel Data	TXOUT0- TXOUT0+	No. 5 No. 6	RX0- RX0+
4	TXIN7	GO0	Green Pixel Data (LSB)			
6	TXIN8	GO1	Green Pixel Data	TXOUT1- TXOUT1+	No. 8 No. 9	RX1- RX1+
7	TXIN9	GO2	Green Pixel Data			
8	TXIN10	GO6	Green Pixel Data	TXOUT3- TXOUT3+	No. 17 No. 18	RX3- RX3+
10	TXIN11	GO7	Green Pixel Data (MSB)			
11	TXIN12	GO3	Green Pixel Data	TXOUT1- TXOUT1+	No. 8 No. 9	RX1- RX1+
12	TXIN13	GO4	Green Pixel Data			
14	TXIN14	GO5	Green Pixel Data			
15	TXIN15	BO0	Blue Pixel Data (LSB)			
16	TXIN16	BO6	Blue Pixel Data	TXOUT3- TXOUT3+	No. 17 No. 18	RX3- RX3+
18	TXIN17	BO7	Blue Pixel Data (MSB)			
19	TXIN18	BO1	Blue Pixel Data	TXOUT1- TXOUT1+	No. 8 No. 9	RX1- RX1+
20	TXIN19	BO2	Blue Pixel Data	TXOUT2- TXOUT2+	No. 11 No. 12	RX2- RX2+
22	TXIN20	BO3	Blue Pixel Data			
23	TXIN21	BO4	Blue Pixel Data			
24	TXIN22	BO5	Blue Pixel Data			
50	TXIN27	RO6	Red Pixel Data	TXOUT3- TXOUT3+	No. 17 No. 18	RX3- RX3+

6.5 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 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.

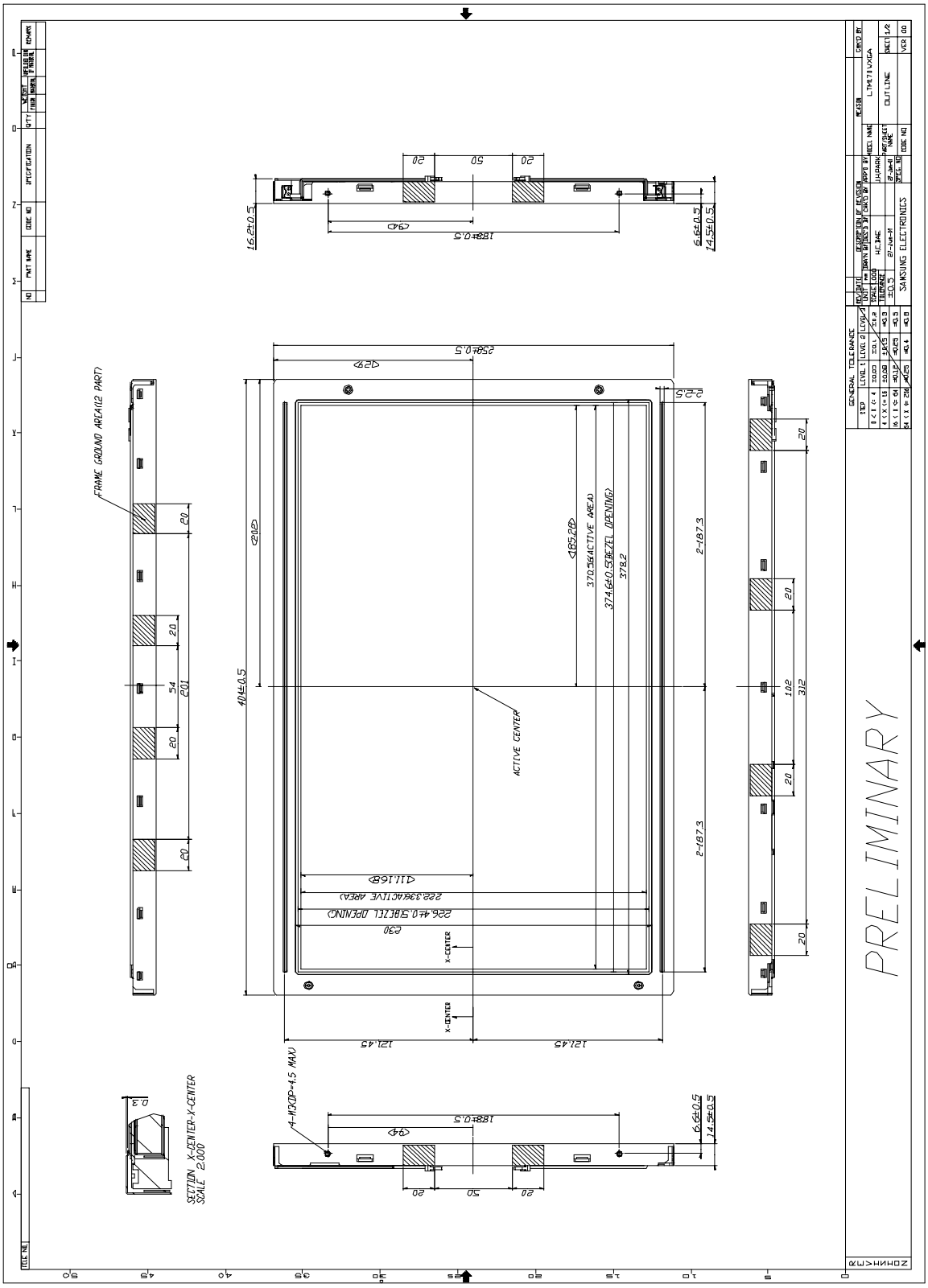
(3) In case of V_{DD} = off level, please keep the level of input signals on the low or keep a high impedance.

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

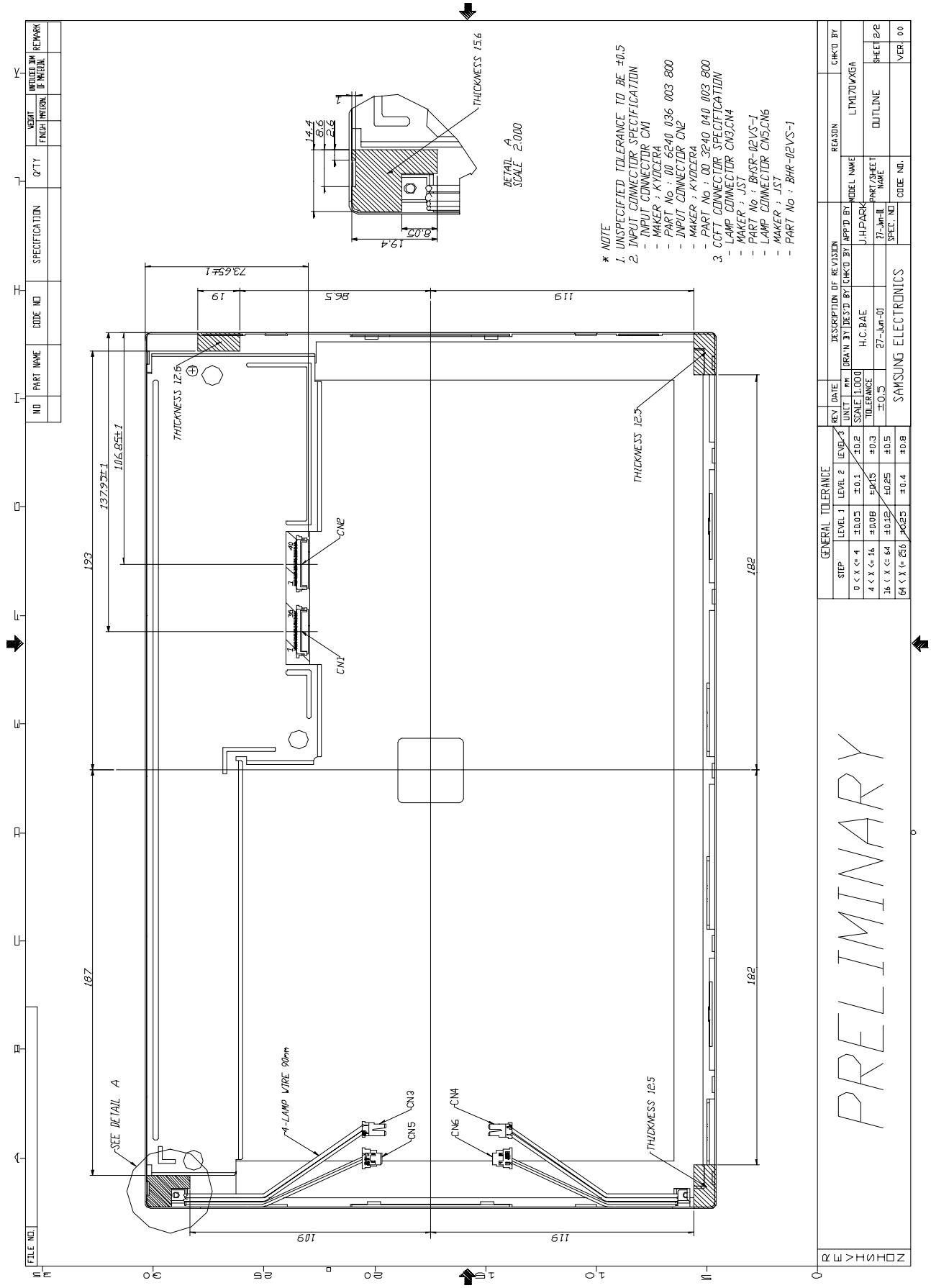
(5) Interface signal shall not be kept at high impedance when the power is on.

7. OUTLINE DIMENSION

FRONT VIEW (PANEL SID)



BACK VIEW (BLU SIDE)



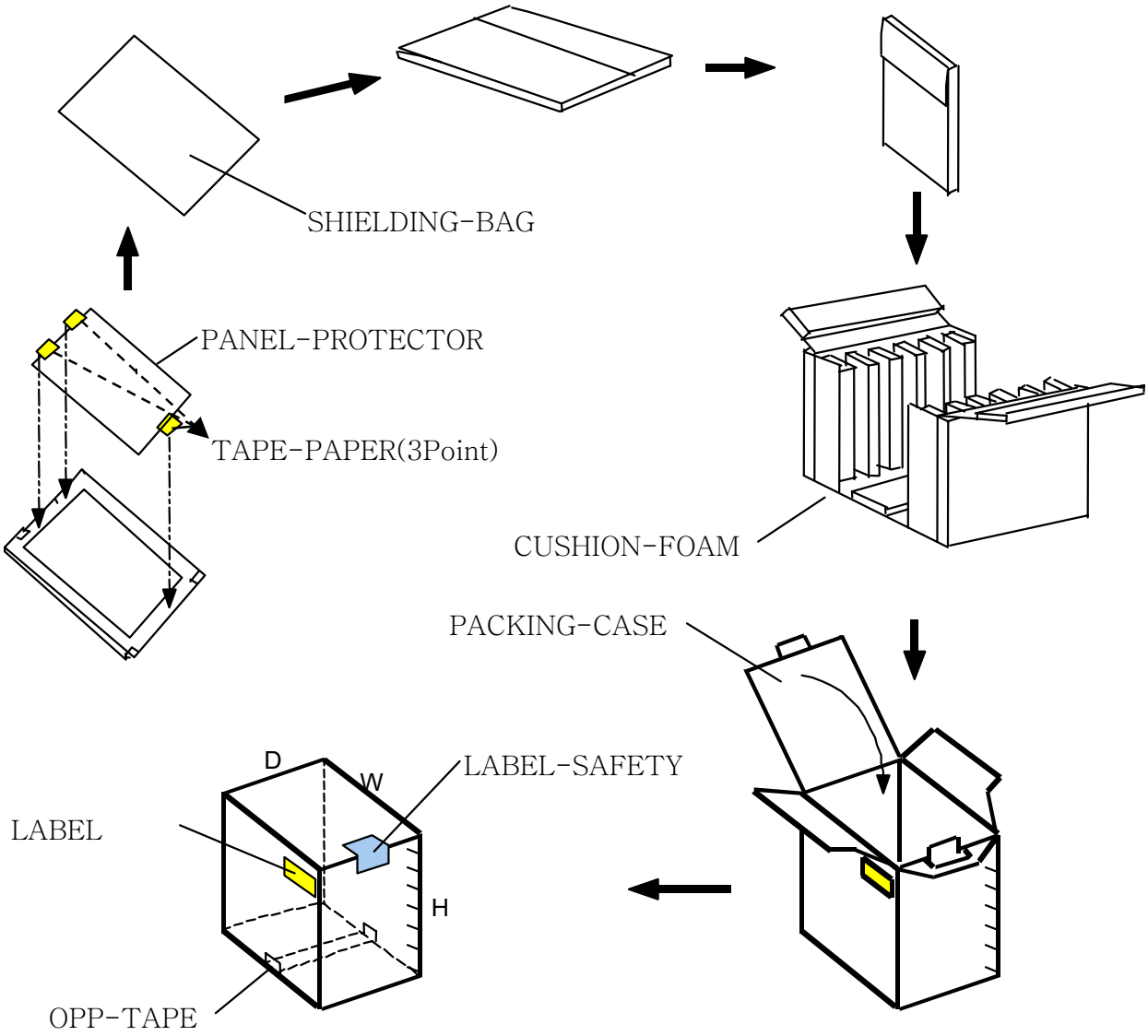
8. PACKING

10.1 CARTON(Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method



NOTE) 1) TOTAL : Approx. 10㎏

2) Acceptance number of piling : 5sets

3) Carton size :450(W) X 348(D) X 440(H)

4) MAX accumulation quantity : 5 cartons

(3) Packing Material

No	Part name	Quantity	No	Part name	Quantity
1	PROTECTOR-PANEL	1	6	SHIELDING-BAG	1
2	TAPE-PAPER	0.2MT	7	OPP-TAPE	0.2MT
3	PACKING-CASE	0.2	8	LABEL-PAPER	1
4	CUSHION-FOAM(U)	0.2	9	LABEL-SAFETY	1
5	CUSHION-FOAM(L)	0.2	10	LABEL-BARCODE	1

9.MARKING **& OTHERS**

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

(1) Parts number : LTM170W1-L01

(2) Revision : One letter

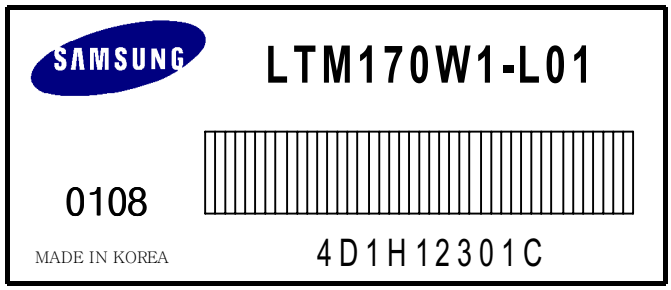
(3) Control : One letter

(4) Lot number : 4 D 1 H 123 01 C

1 2 3 4 5 6 7

① 4 : Line
② D : Device
③ 1 : Year
④ H : Month
⑤ 123 : LOT NO
⑥ 01 : GLASS NO
⑦ C : CELL NO

(5) Nameplate Indication



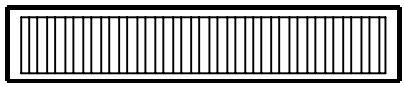
(6) Bar code marking for Customer

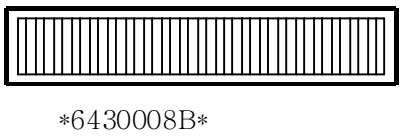
The bar code marking is attached to module backside.

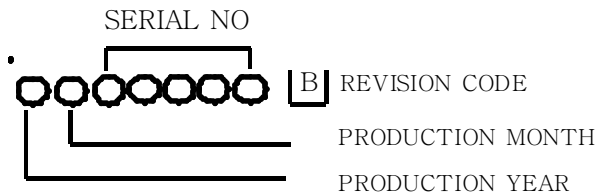
1) MODEL NAME : LTM170W1-L01
2) SAMSUNG
3) MADE IN KOREA
4) PRODUCTION NUMBER
5) USER MODEL NAME

Bar codeshows

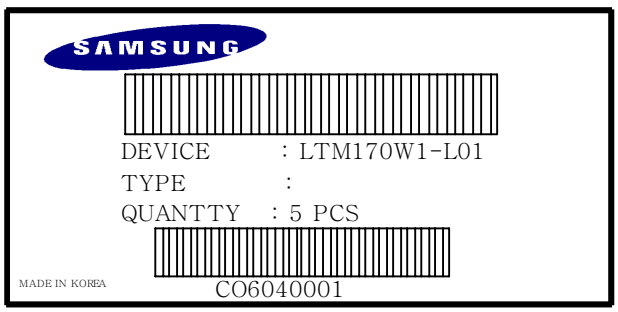
a) User model name
LTM170W1-L01







(7) Packing box attach



(8) Others
1.After service part

Part Name	Description
ASS'Y-LAMP(U)	ASS'Y 170W1-LAMP(U)
ASS'Y-LAMP(L)	ASS'Y 170W1-LAMP(L)

10. General Precautions

10.1 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) Pins of I/F connector shall 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 shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

10.3. 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 6.6 " 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).

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. (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.