Product Information

ISSUE DATE   : 2003-04-17

MODEL   : LTM240W1-L03

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.

Contents

General Description

* Description

LTM240W1-L03 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 back-light system. The resolution of a 24.0" contains 1920 x 1200 pixels and can display up to 16.7 million colors with wide viewing angle of 85° or higher in all directions. (Vertical viewing angle : 170° , Horizontal viewing angle : 170°)

* Features

- High contrast ratio, high aperture structure
- APVA(Advanced Patterned Vertical Alignment) Mode
- Wide viewing angle(± 170°)
- High speed response
- WUXGA(1920 x 1200 pixels) resolution
- Low Power consumption
- Replaceable 6 CCFTs(Cold Cathode Fluorescent Tube)
- DE only mode
- Open LDI (LVDS Display Interface) : DS90CF388

* Applications

- Workstation & desktop monitors
- Display terminals for AV application products
- Monitors for industrial machine and medical appliances

* General information

Items	Specification	Unit	Note
Display area	518.4(H) x324(V)	mm	
Driver element	a-Si TFT active matrix		
Display colors	16.7M(true 8-bit)	colors	
Number of pixels	1920 x 1200	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.270H) x 0.270(W)	mm	
Display mode	Normally Black		
Surface treatment	Haze 25%, Hard - coating (3H)		conduction pol.

* Mechanical information

Item		Min.	Typ.	Max.	Note
Module size	Horizontal(H)	-	569.1	-	mm
	Vertical(V)	-	368.4	-	mm
	Depth(D)	-	-	(32.0)	mm
Weight		-	-	(5,550)	g

1. Absolute Maximum Ratings

1.1 Absolute ratings of environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	65	℃	(1)
Operating temperature (Glass surface temperature)	T_{OPR}	0	50	℃	(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.

90 % RH Max. (40 °C ≥ Ta)

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

(2) 11ms, sine wave, 1 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.

Relative Humidity (%RH)

Operating Range

Storage Range

(40℃, 90%)

(50℃, 50.4%)

(65℃, 27.7%)

(-20℃, 5%)

Temperature (℃)
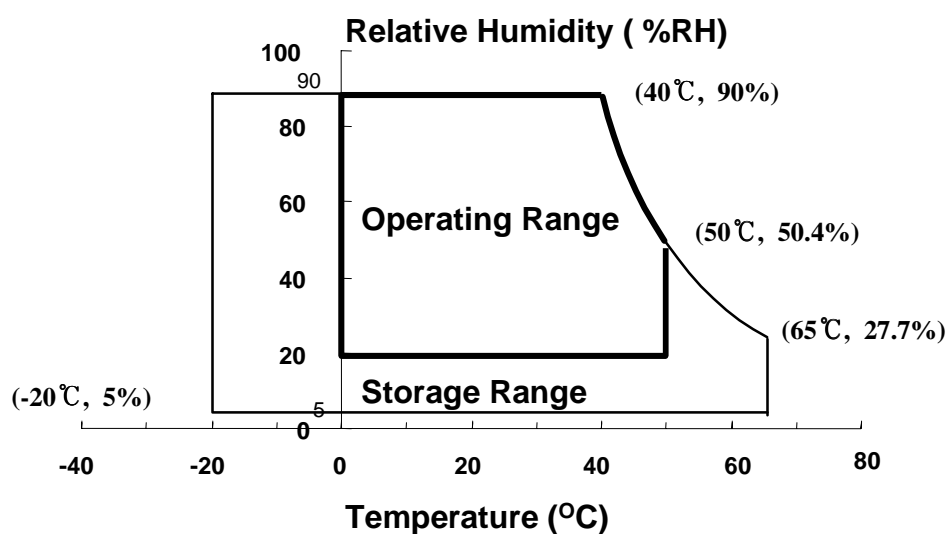
1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD Module   (Vss = GND = 0 V)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	Vss-0.5	6.5	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	I_L	(4.0)	(7.0)	mArms	(1),(2)
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)   Specified values are for a single lamp.
           (Refer to the Note (1) in the page 12 for further information)

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

(Inverter Freq. : 50kHz)　　　　　* Ta = 25 ± 2°C , V_{DD}=5V, f_V= 60Hz, f_{DCLK}= 90MHz, I_L = 6.5mArms
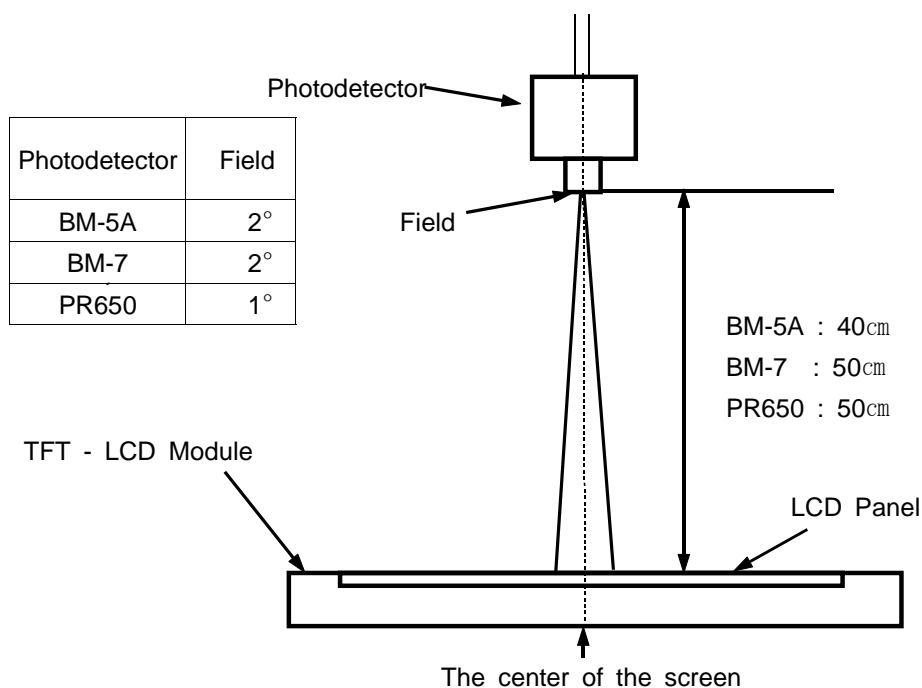
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R		-	(500)	-		(3) BM-5A
Response Time	Rising	Tr		-	(17)	-	msec	(4) BM-7
	Falling	Tf		-	(13)	-		
Luminance of White (Center of screen)		Y_L	Normal $\phi = 0$ $\theta = 0$ Viewing Angle	-	(300)	-	cd/m2	(5) BM-5A
Color Chromaticity (CIE 1931)	Red	Rx			(0.640)			(6) PR650
		Ry			(0.330)			
	Green	Gx			(0.300)			
		Gy			(0.608)			
	Blue	Bx		-	(0.150)	-		
		By			(0.060)			
	White	Wx			(0.313)			
		Wy			(0.329)			
Viewing Angle	Hor.	θ L	C/R≥10	-	(85)	-	Degrees	(7) BM-5A
		θ R		-	(85)	-		
	Ver.	φ H		-	(85)	-		
		φ L		-	(85)	-		
Brightness Uniformity (9 points)		Buni		-	-	(30)	%	(8) BM-5A

Note 1) Test Equipment Setup

After stabilizing and leaving the panel alone at a given temperature for 30 min, the measurement should be executed in a stable, windless, and dark room after lighting the back-light for 30 minutes. This should be measured in the center of screen.

Single lamp current : 6.5mA (Refer to the note(1) in the page 12 for more information.)
Environment condition : Ta = 25 ± 2 °C

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

Photodetector

Field

BM-5A : 40cm
BM-7 : 50cm
PR650 : 50cm

TFT - LCD Module

LCD Panel

The center of the screen

Optical Measuring Equipment Setup

Note 2) Definition of test point

Active Area

(192)   (960)   (1728)

⑨   ⑧   ⑦ ---- (120)

⑥   ⑤   ④ ---- (600)

③   ②   ① ---- (1080)

◯ : test point
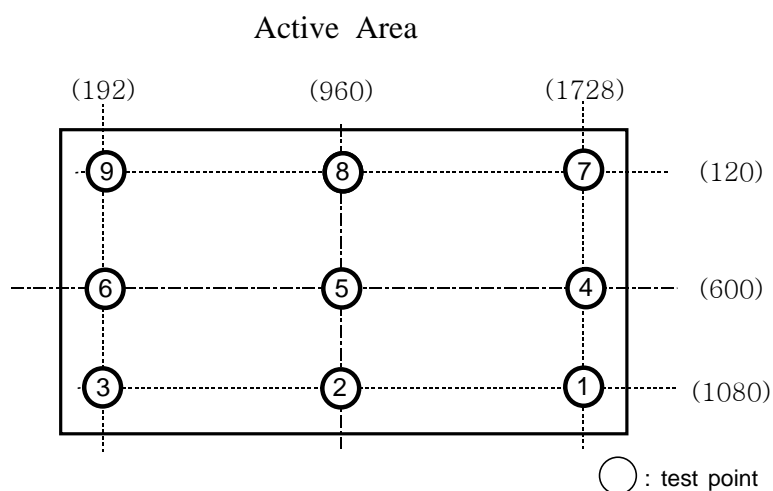
Note 3) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin)
at the center point⑤ of the panel

$$CR = \frac{G\max}{G\min}$$

Gmax : Luminance with all pixels white

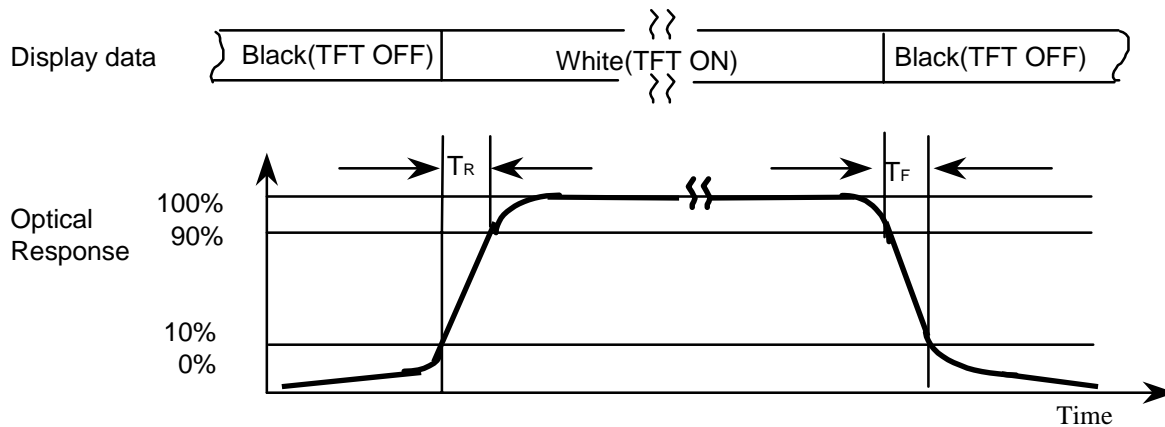Gmin : Luminance with all pixels black

Note 4) Definition of Response time : Sum of Tr ,Tf

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

Optical
Response

100%
90%

10%
0%

T_R T_F

Time

Note 5) Definition of Luminance of White : Luminance of white at center point⑤.

Note 6) Definition of Color Chromaticity (CIE 1931)
Color coordinate of Red , Green , Blue & White at center point⑤.

Note 7) Definition of Viewing Angle : Viewing angle range (CR≥ 10)

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 y′
direction
$\phi_L = 90°$

x′

$\theta_R = 90°$
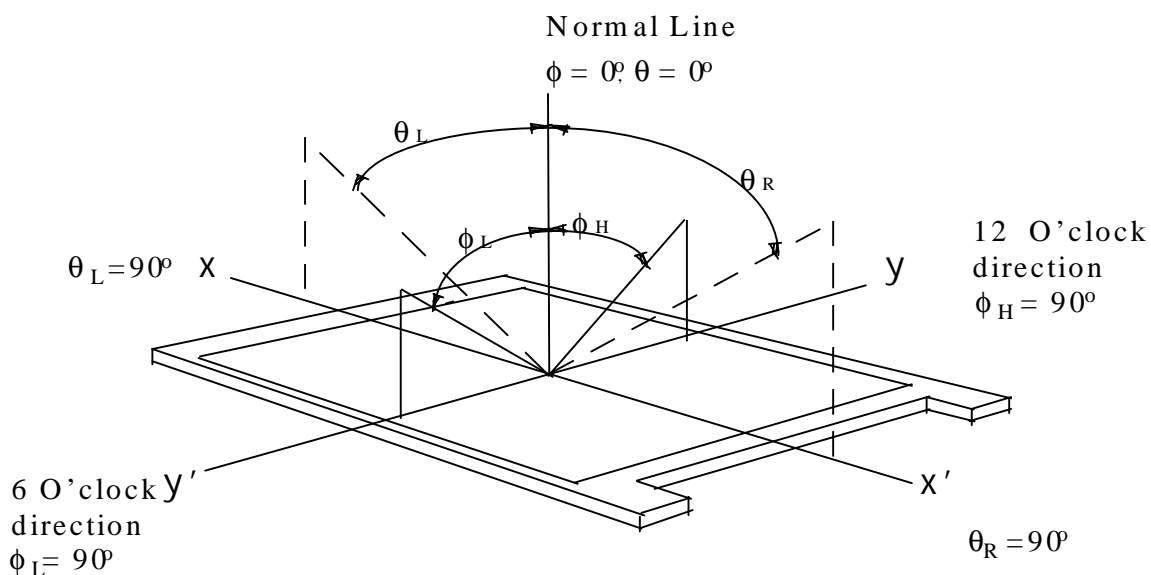
Note 8) Definition of 9 points brightness uniformity

$$Buni = 100 * \frac{(B\max - B\min)}{B\max}$$

Bmax : Maximum brightness

Bmin : Minimum brightness

3. Electrical Characteristics

3.1 TFT LCD MODULE

Ta = 25°C

| Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	4.5	5.0	5.5	V	(1)
Interface type		LVDS	Open LDI (DS90C387 / 388 Pair)				
Current of Power Supply	(a)Black	I_{DD}	-	(1050)	-	mA	(2),(3)
	(b)Mosaic		-	(1350)	-	mA	
	(c)White		-	(1850)	(2050)	mA	
Vsync Frequency		f_V	-	60	-	Hz	2pxl/clk
Hsync Frequency		f_H	-	73	-	kHz	
Main Frequency		f_{DCLK}	-	80	-	MHz	
Rush Current		I_{RUSH}	-	-	(3.0)	A	(4)

Note   (1)   Main pixel clock frequency is the value which is measured at the input of LVDS transmitter.

        (2) f_V=60Hz, f_{DCLK} =80MHz, V_{DD} = 5.0V,   DC Current.

        (3)   Power dissipation check pattern(LCD Module only)
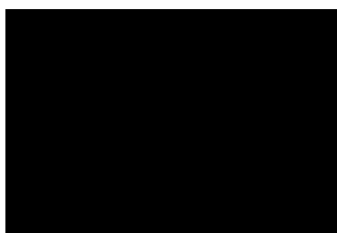
      a)Black Pattern   b)Mosaic Pattern   c)White Pattern
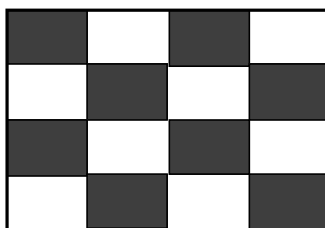
(4) Measurement Conditions

Note : Control Signal : High(+5V) -->Low(Ground)
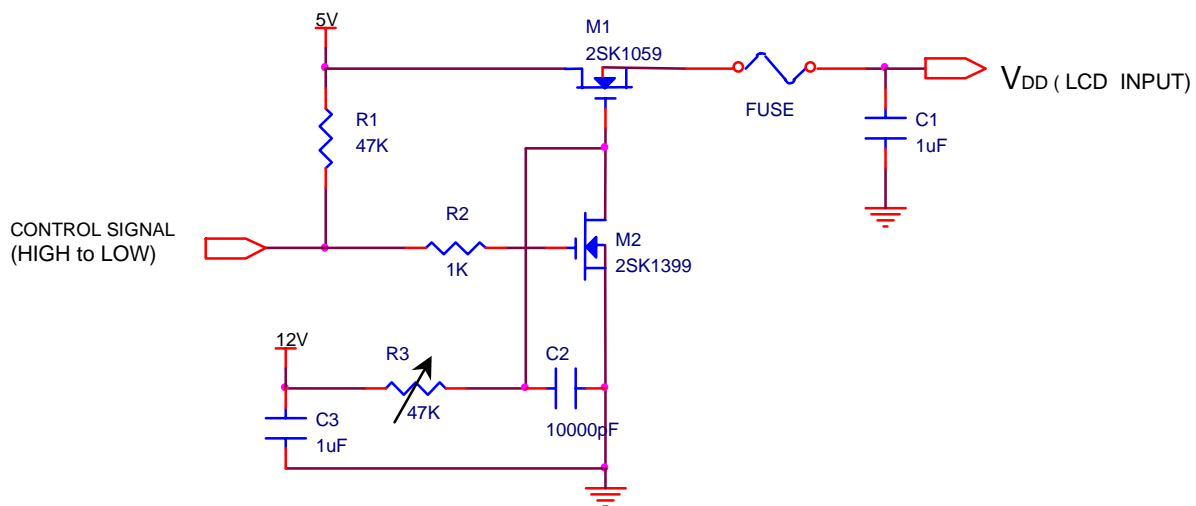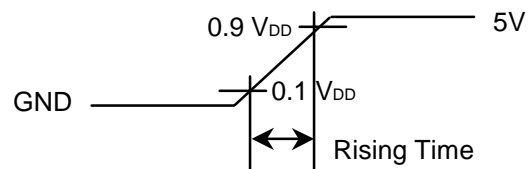
All Signal lines to panel except for power 5V : Ground

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 2 triple CCFTs (Cold Cathode Fluorescent Tube). The characteristics of two triple lamps are shown in the following tables.

Ta=25 ± 2°C

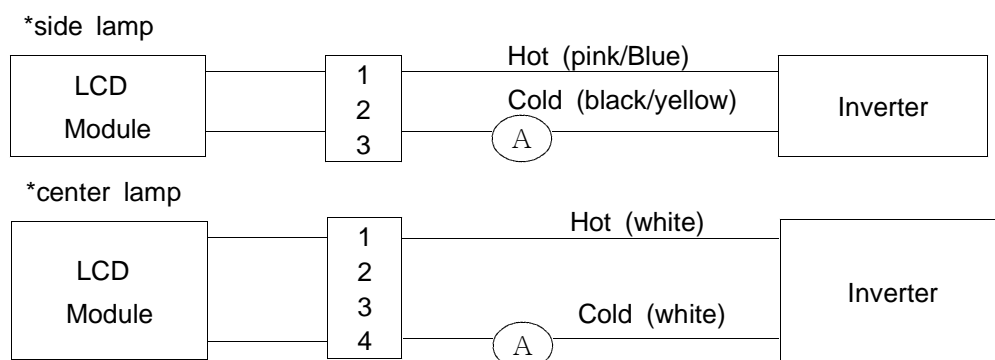| Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I_L	(4.0)	(6.5)	(7.0)	mArms	(1)
Lamp Voltage	V_L	-	(938)	-	Vrms	
Lamp Frequency	f_L	(40)	-	(60)	kHz	(2)
Start up Voltage	Vs	-	-	(0℃:2,200) (25℃:1,740)	Vrms	(3)

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) Triple lamp current is measured with current meter for high frequency as shown below.
Refer to the block diagram of the back-light unit in the next page for more information.
Specified values are for a single lamp.

*side lamp

```
              Hot  (pink/Blue)
┌─────────┐   ┌─┐  ───────────────  ┌─────────┐
│  LCD    │───│1│  Cold (black/yellow)│         │
│         │   │2│  ─────────(A)──────│ Inverter│
│ Module  │───│3│                     │         │
└─────────┘   └─┘                     └─────────┘
```

*center lamp

```
              Hot  (white)
┌─────────┐   ┌─┐  ───────────────  ┌─────────┐
│  LCD    │───│1│                    │         │
│         │   │2│                    │ Inverter│
│ Module  │───│3│  Cold (white)      │         │
│         │   │4│  ─────(A)──────────│         │
└─────────┘   └─┘                     └─────────┘
```

(2) Lamp frequency may produce interference with horizontal synchronous frequency which 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) If an inverter has shutdown function, it should keep its output for more than 1 second even if the lamp connector open. Otherwise the lamp may not be turned on.

(4) The inverter use high voltage. Therefore, power should be disconnected before the inverter is assembled or disassembled.

4. Block Diagram

4.1 TFT LCD MODULE
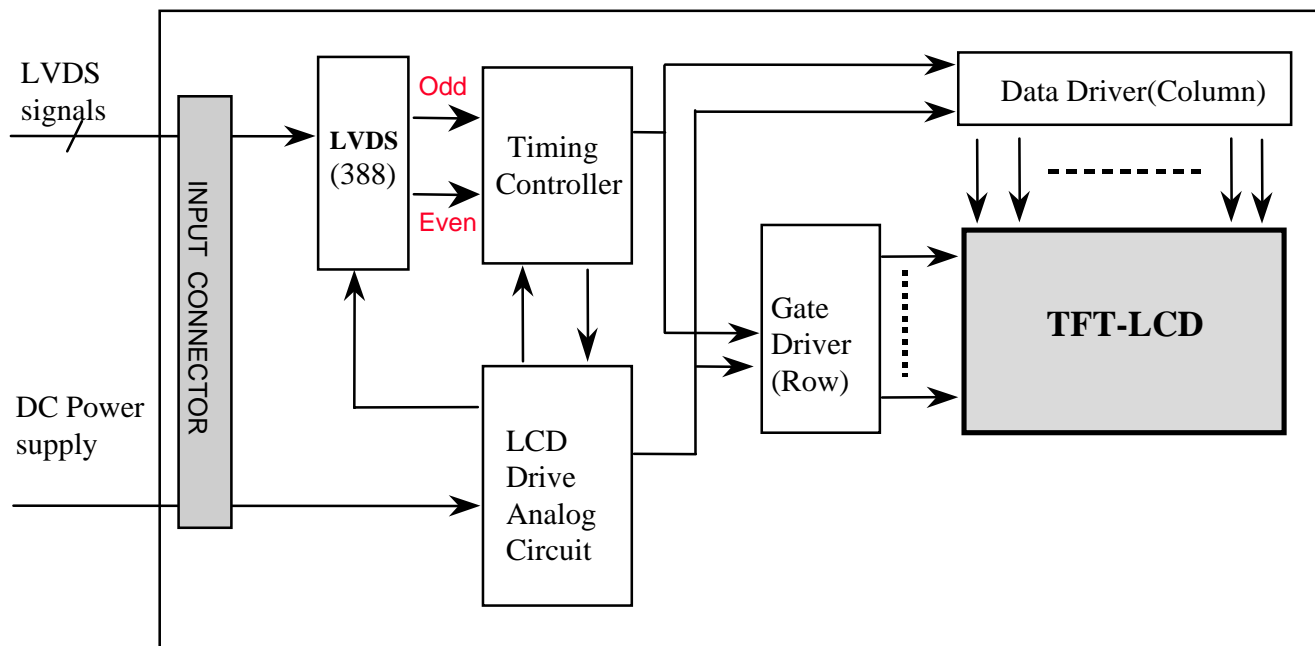
4.2 BACK-LIGHT UNIT

Connector: JST BHR-04VS-1, BHR-03VS-1

5. Input Terminal Pin Assignment

5.1. Input Signal (Connector : JAE FI-WE31P-HF)

(Mating Connector :JAE F1-WE31S-HF)

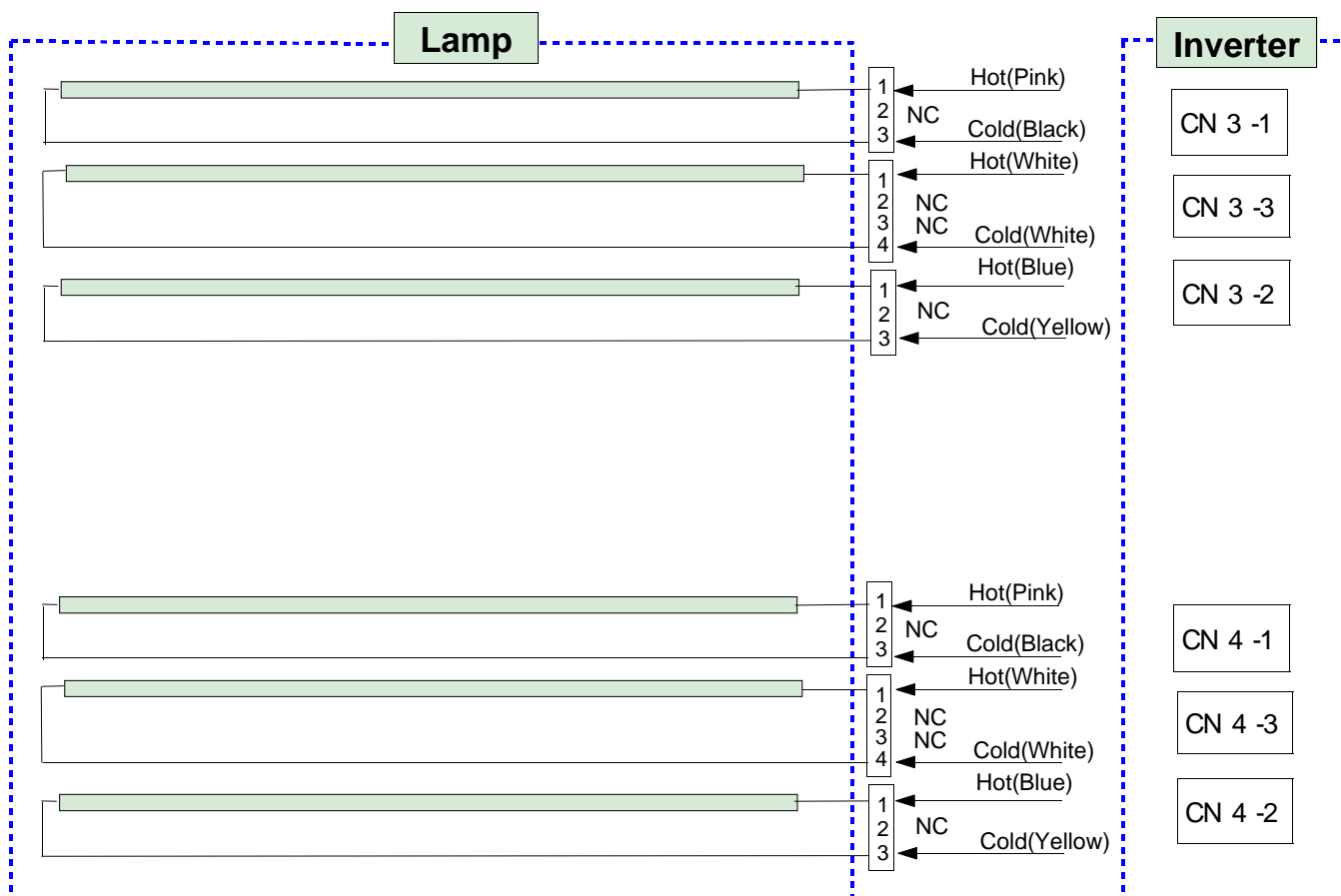| Pin No	Symbol	Function
1	GND	Ground
2		
3	A0M	Negative LVDS differential data output
4	A0P	Positive LVDS differential data output
5	A1M	Negative LVDS differential data output
6	A1P	Positive LVDS differential data output
7	A2M	Negative LVDS differential data output
8	A2P	Positive LVDS differential data output
9	GND	Ground
10		
11	CLKM	Negative LVDS differential clock output
12	CLKP	Positive LVDS differential clock output
13	A3M	Negative LVDS differential data output
14	A3P	Positive LVDS differential data output
15	GND	Ground
16		
17	A4M	Negative LVDS differential data output
18	A4P	Positive LVDS differential data output
19	A5M	Negative LVDS differential data output
20	A5P	Positive LVDS differential data output
21	A6M	Negative LVDS differential data output
22	A6P	Positive LVDS differential data output
23	GND	Ground
24		
25	A7M	Negative LVDS differential data output
26	A7P	Positive LVDS differential data output
27	N.C	Reserved
28		
29		
30		
31		

5.2 Open LDI Interface
- Receiver : NS DS90CF388
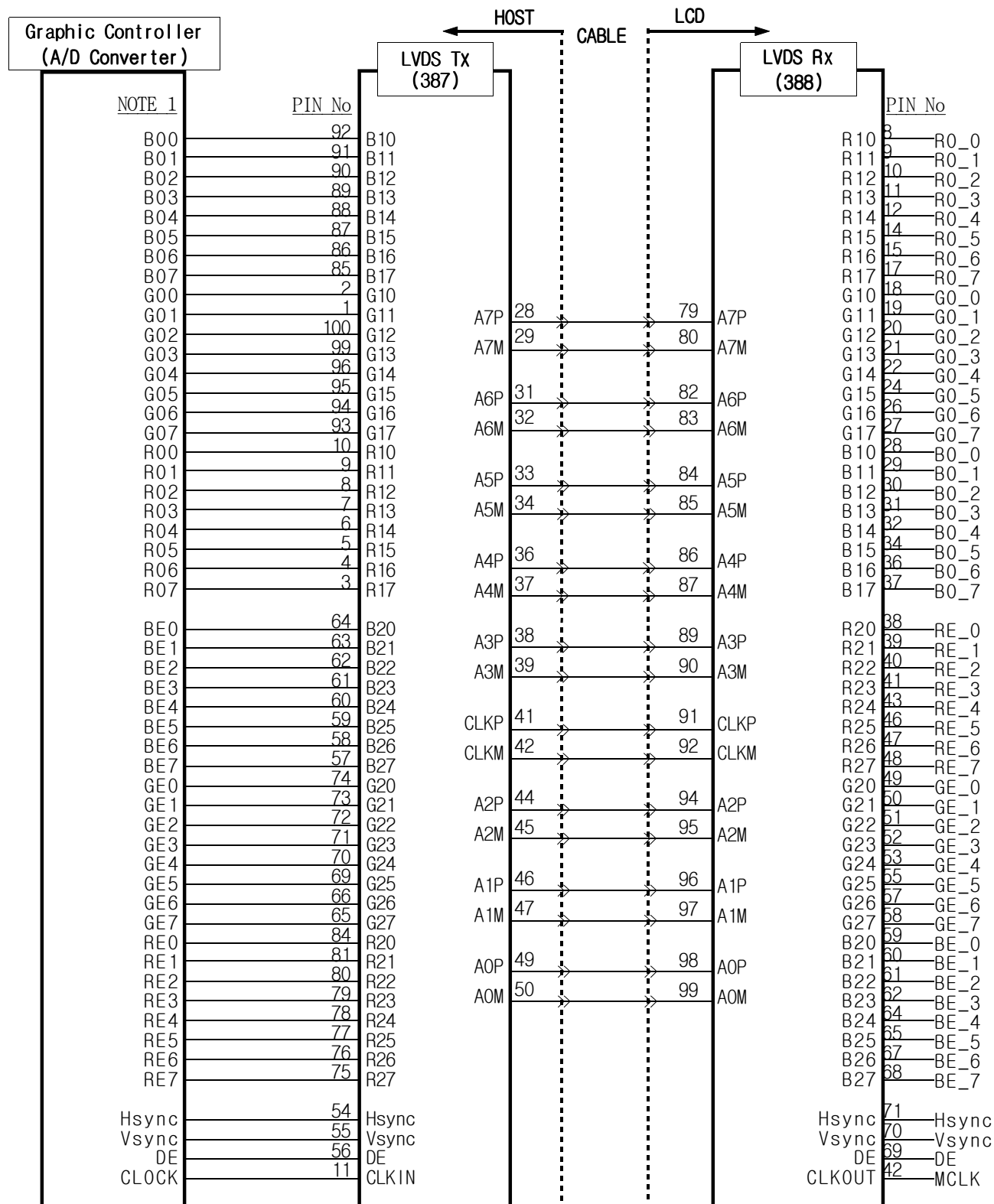
5.3 Input Power (Connector : Molex 53261-1290 (Matching Socket : 51021-1200))

Pin No	Symbol	Function
1		
2		
3	+5V	Module Input Vcc
4		
5		
6		
7		
8		
9	GND	Power Ground
10		
11		
12		

5.4 Back-light Unit (Connector: JST BHR-04VS-1, BHR-03VS-1)

Pin No	Input [ch1],[ch2]	Color	Function
3-1-1	HOT	Pink	High Voltage
3-1-2	N.C	-	-
3-1-3	Cold	Black	Ground
3-2-1	HOT	Blue	High Voltage
3-2-2	N.C		
3-2-3	Cold	Yellow	Ground
3-3-1	HOT	White	High Voltage
3-3-2	N.C	-	-
3-3-3			
3-3-4	Cold	White	Ground
4-1-1	HOT	Pink	High Voltage
4-1-2	N.C		
4-1-3	Cold	Black	Ground
4-2-1	HOT	Blue	High Voltage
4-2-2	N.C	-	-
4-2-3	Cold	Yellow	Ground
4-3-1	HOT	White	High Voltage
4-3-2	N.C	-	-
4-3-3			
4-3-4	Cold	White	Ground
Connector Part No	JST BHR-03VS-1, JST BHR-04VS-1		

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

COLOR	DISPLAY	RED								GREEN								BLUE								GRAY SCALE LEVEL
		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~
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R252
	↓ LIGHT	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	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	R255
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~
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G252
	↓ LIGHT	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G254
	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	G255
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~
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B252
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B254
	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	B255

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 only mode)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/TC	-	80	-	MHz	(2)
	High Time	TCH	3.5	-	-	nsec	
	Low Time	TCL	4.5	-	-	nsec	
Data	Setup Time	TDS	2.4	-	-	nsec	
	Hold Time	TDH	3.4	-	-	nsec	
Data Enable	Setup Time	TES	4.0	-	-	nsec	
Frame Frequency	Cycle	Tv	-	16.7	-	msec	
			1209	1216	1250	lines	
Vertical Active Disply Term	Display Period	TVD	1200	1200	1200	lines	
	Vertical Blank Period	TVB	9	-	50	lines	
One Line Scanning Time	Cycle	TH	1056	1096	1120	clocks	2pixel/clock (3)
Horizontal Active Display Term	Display Period	THD	960	960	960	clocks	

Note 1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system
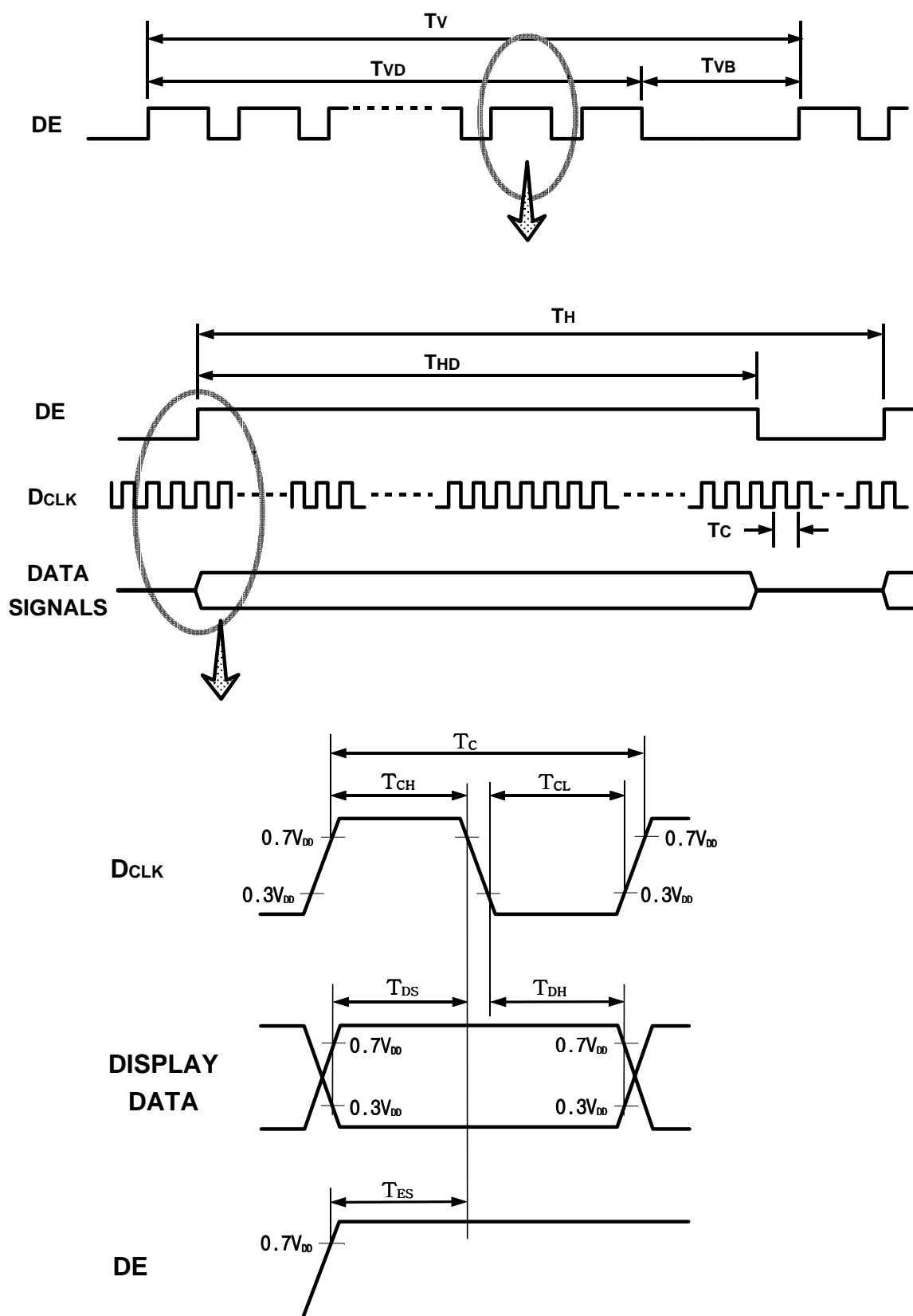
* Interfacing timing check point
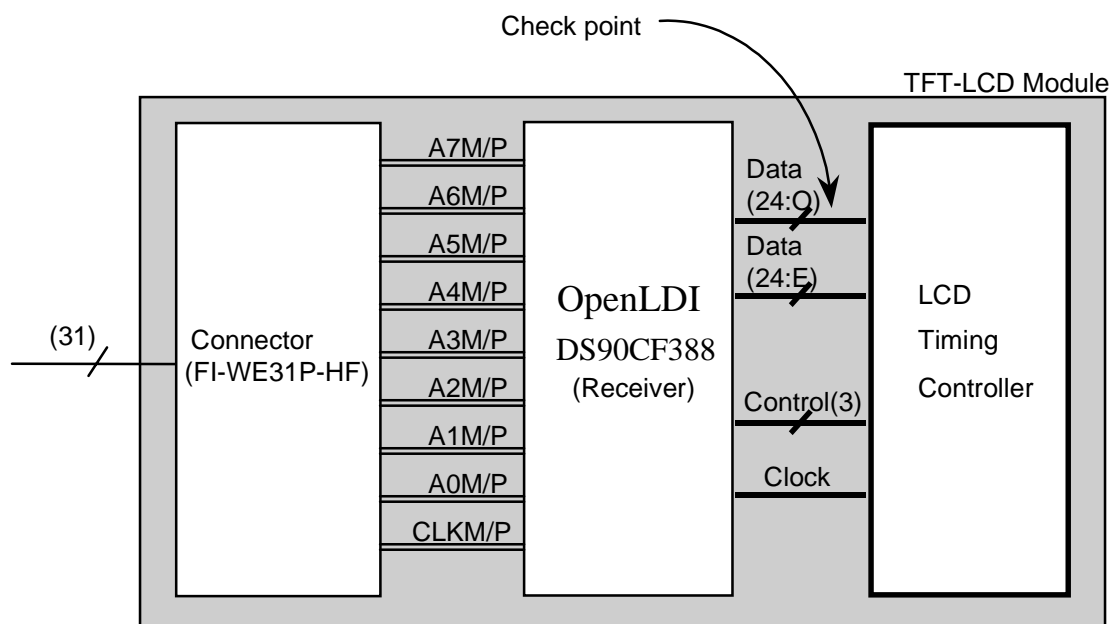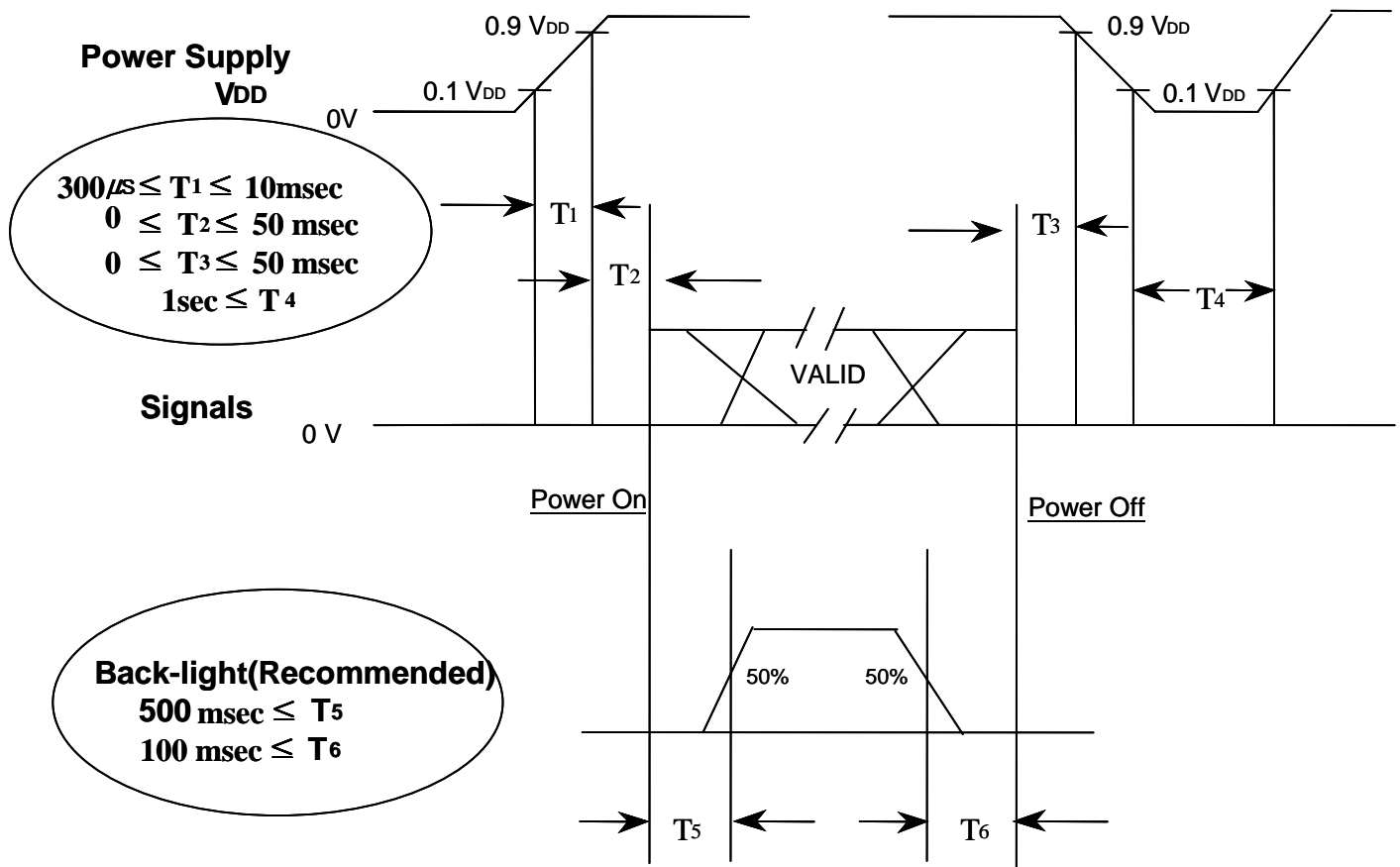

2) Internal Vcc = 3.3V

3) When operating, the DE signal should have the same period.

6.2 Timing diagrams of interface signal (DE only mode)

6.3 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
VDD

$300\mu s \leq T_1 \leq 10msec$
$0 \leq T_2 \leq 50 \ msec$
$0 \leq T_3 \leq 50 \ msec$
$1sec \leq T_4$

Signals

Back-light(Recommended)
$500 \ msec \leq T_5$
$100 \ msec \leq T_6$

0.9 VDD
0.1 VDD
0V

T1
T2

VALID

0.9 VDD
0.1 VDD

T3
T4

Power On

Power Off

50%   50%

T5   T6
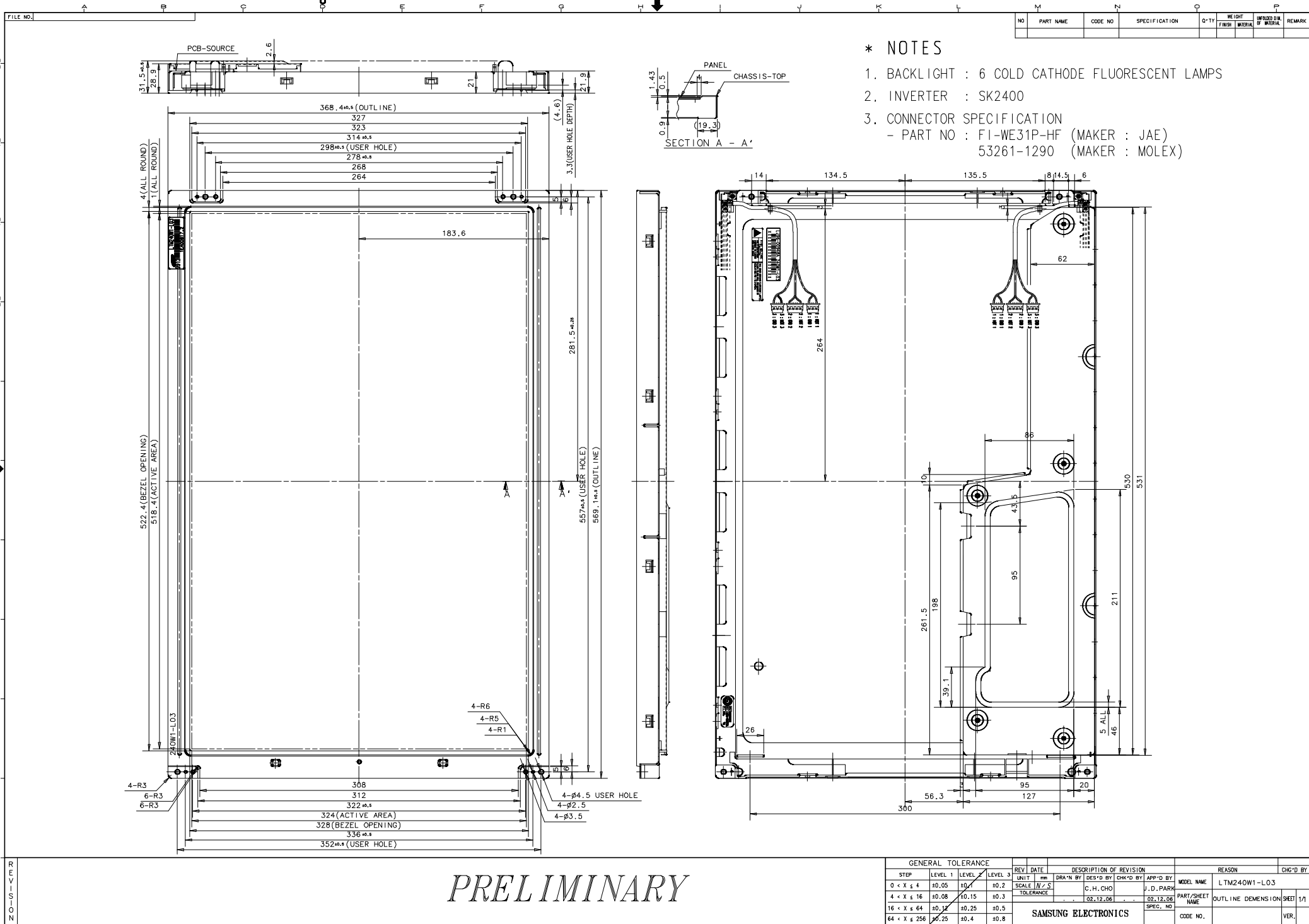
Power ON/OFF Sequence

NOTE.

(1) The supply voltage of the external system for the module input should be the
same as the definition of 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 abnormal screen.

(3) In case of VDD = off level, please keep the level of input signals 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 should not be kept at high impedance when the power is on.

7. Outline Dimension
 (**Refer to next page**)

FILE NO.

PCB-SOURCE

* NOTES

1. BACKLIGHT : 6 COLD CATHODE FLUORESCENT LAMPS

2. INVERTER : SK2400

3. CONNECTOR SPECIFICATION
   - PART NO : FI-WE31P-HF (MAKER : JAE)
     53261-1290 (MAKER : MOLEX)

PANEL
CHASSIS-TOP
SECTION A - A'

368.4±0.5 (OUTLINE)
327
323
314 ±0.5
298±0.5 (USER HOLE)
278±0.5
268
264

3.3(USER HOLE DEPTH)

183.6

281.5 ±0.25

522.4(BEZEL OPENING)
518.4(ACTIVE AREA)
557±0.5 (USER HOLE)
569.1±0.5 (OUTLINE)

240W1-L03

4(ALL ROUND)
1(ALL ROUND)

4-R6
4-R5
4-R1

4-R3
6-R3
6-R3

4-Ø4.5 USER HOLE
4-Ø2.5
4-Ø3.5

308
312
322 ±0.5
324(ACTIVE AREA)
328(BEZEL OPENING)
336±0.5
352±0.5 (USER HOLE)

14   134.5   135.5   8 14.5 6

62

264

86

530
531

43.5

95

211

261.5
198

39.1

26

5 ALL
46

56.3   95   20
127
300

PRELIMINARY

REVISION

8. General Precautions

8.1 Handling

(a) When the module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist nor bend the modules.

(b) Because the inverter use high voltage, it should be disconnected from power before it 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 easily damaged. Do neither press nor scratch the surface using the 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) 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.

(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 thoroughly with soap.

(i) Protect the module from static which may cause damage to the CMOS Gate Array IC.

(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 neither pull nor fold the lamp wire.

(m) Do not adjust the variable resistor 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.

8.2 Storage

(a) Do not leave the module in high temperature, high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃
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 in storage.

8.3 Operation

(a) Do neither connect nor disconnect the module in the "Power On" condition.

(b) Power supply should always be turned on/off by 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) The cable between the back-light connector and its inverter power supply should
be connected directly with a minimized length. A longer cable between
the back-light and the inverter may cause lower luminance of lamp(CCFT) and
may require higher startup voltage(Vs).

8.4 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water which 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 keeps displaying the same pattern for a long period of time,
the image may "stick" 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.