



ELECTRONICS

TO : WORLD WIDE

Date : 2002. 08. 14.

SAMSUNG TFT-LCD
MODEL NO. : LTA170WP-L01

Note: _____

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

Samsung Electronics Co . , LTD.



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General Description

* Description

LTA170WP-L01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFTs 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 17.0" contains 1280 x 768 pixels and can display up to 16.2 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
- PVA(Patterned Vertical Alignment) mode
- Wide viewing angle($\pm 170^\circ$)
- High speed response (< 25ms)
- WXGA(1280 x 768 pixels) resolution
- Low Power consumption
- Dyrect Type 8 CCFT(Cold Cathode Fluorescent Tube)
- DE only mode
- LVDS(Low-Voltage Differential Signaling) interface.(1pixel/clock)

* Applications

Home-alone Multimedia TFT-LCD TV
 Display terminals for AV application products
 High Definition TV (HD TV)

* General information

Items	Specification	Unit	Note
Display area	370.560(H) x 222.336(V)	mm	
Driver element	a-Si TFT active matrix		
Display colors	16.2M	colors	
Number of pixels	1280 x 768	pixel	
Pixel arrangement	RGB Chevron		
Pixel pitch	96.5(H) x 289.5(W)	μm	
Display mode	Normally Black		
Surface treatment	Haze 25% , Hard-Coating (3H)		

*** Mechanical information (Panel Module Only)**

Item		Min.	Typ.	Max.	Note
Module size	Horizontal(H)	-0.5	401.7	+0.5	mm
	Vertical(V)		249.0		mm
	Depth(D)		26.5		mm
Weight		TBD	1300	-	g

1. Absolute Maximum Ratings

1.1 Absolute ratings of environment

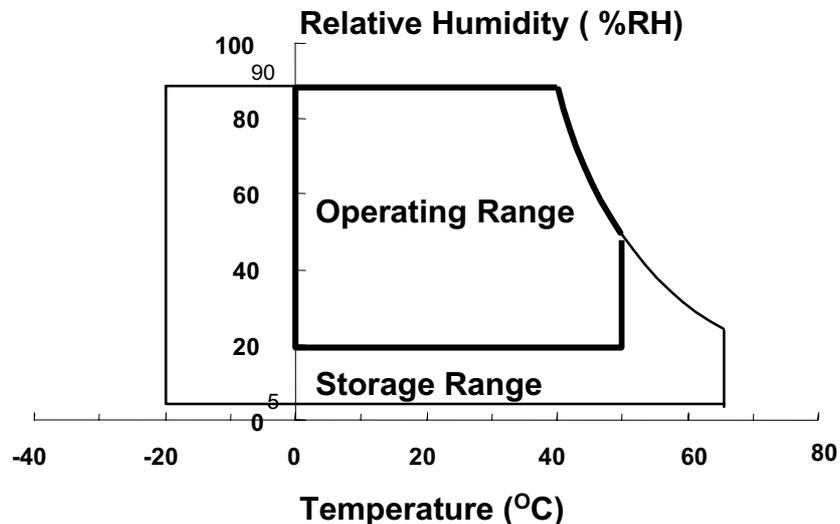
Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T _{STG}	-30	70	°C	(1)
Operating temperature (Ambient temperature)	T _{OPR}	0	50	°C	(1)
Shock (non - operating)	Snop	-	50	G	(2),(4)
Vibration (Non - operating)	Vnop	-	1.0	G	(3),(4)

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

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

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

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



1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD Module

(V_{SS} = GND = 0 V)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	V _{SS} -0.5	5.0	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	2.0	7.0	mArms	(1),(2)
Lamp Frequency	F _L	50	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.

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. : 45kHz/ 55kHz) * $T_a = 25 \pm 2^\circ\text{C}$, $V_{DD} = 5.0\text{V}$, $f_v = 60\text{Hz}$, $f_{DCLK} = 97.5\text{MHz}$, $I_L = \text{TBD mA}$

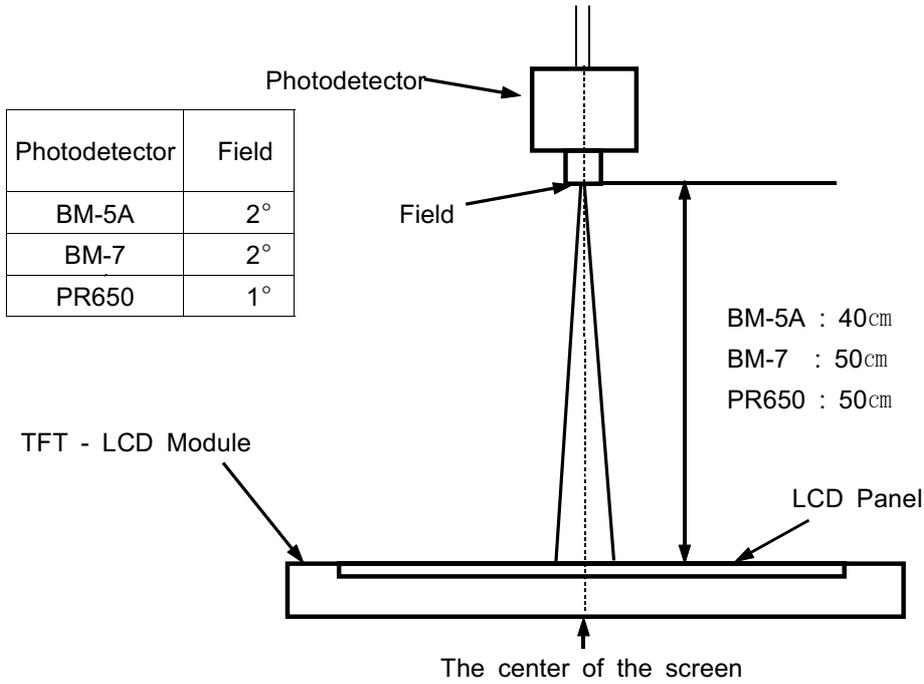
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)	C/R		500	600	-		(3) BM-5A
Response Time	Rising	Tr	-	15	19	msec	(4) BM-7
	Falling	Tf	-	10	13		
Luminance of White (Center of screen)	YL	Normal $\phi = 0$ $\theta = 0$	350	400	-	cd/m ²	(5) BM-5A
Color Chromaticity (CIE 1931)	Red	Rx	Viewing Angle	TBD	TYP. -0.025	TYP. +0.025	(6) PR650
		Ry		TBD			
	Green	Gx		TBD			
		Gy		TBD			
	Blue	Bx		TBD			
		By		TBD			
	White	Wx		280			
		Wy		290			
Viewing Angle	Hor.	θL	80	85	-	Degrees	(7) BM-5A
		θR	80	85	-		
	Ver.	ϕH	80	85	-		
		ϕL	80	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. 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 screen.

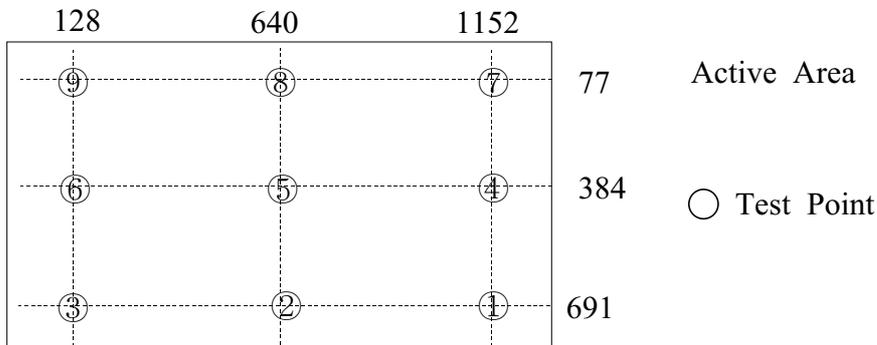
A single lamp current : TBD mA (Refer to the note(1) in the page 15 for more Information.)

Environment condition : $T_a = 25 \pm 2 \text{ } ^\circ\text{C}$



Optical Measuring Equipment Setup

Note 2) Definition of test point



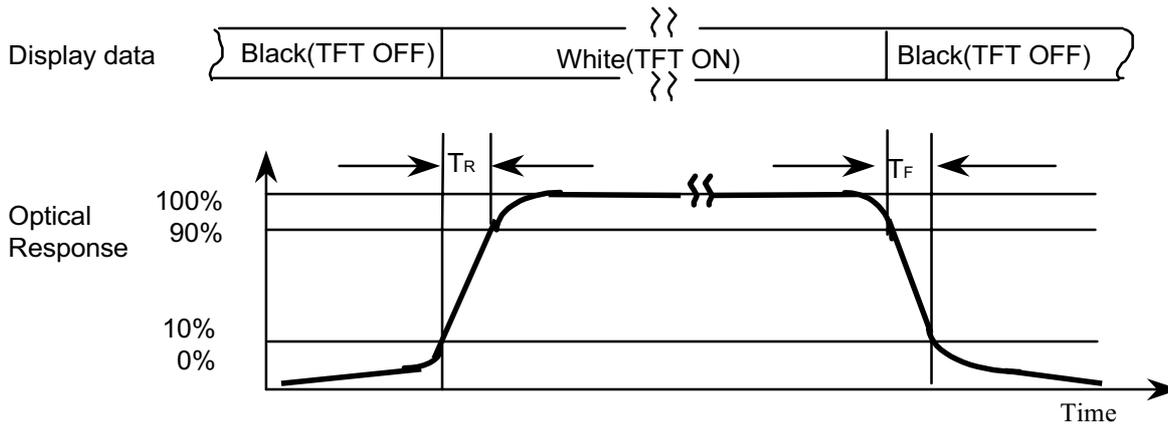
Note 3) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point(5) of the panel

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

Gmax : Luminance with all pixels white

Gmin : Luminance with all pixels black

Note 4) Definition of Response time : Sum of T_r , T_f

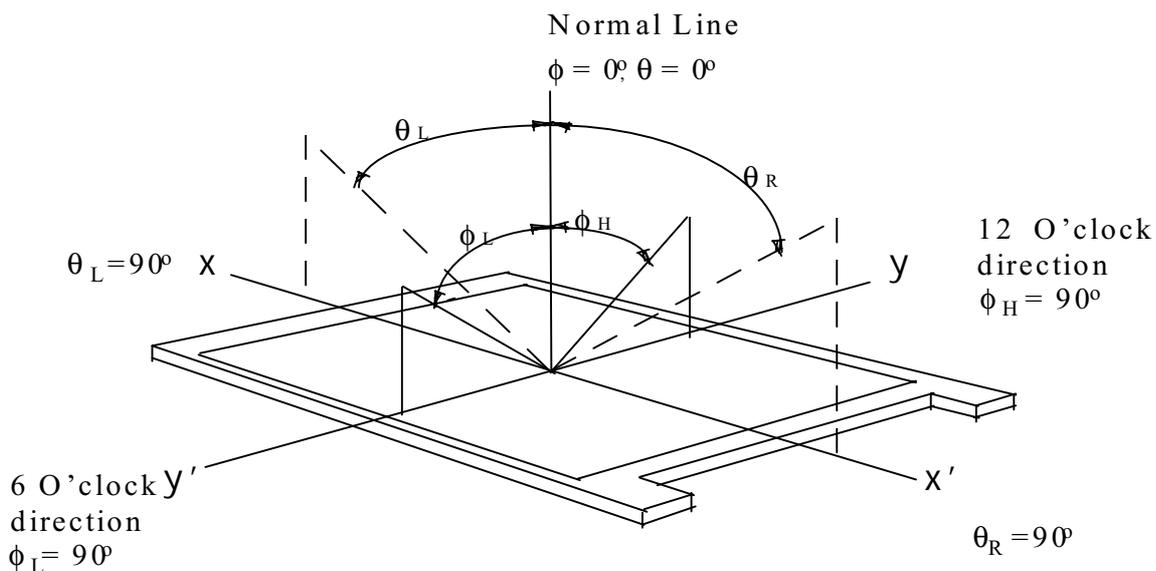


Note 5) Definition of Luminance of White : Luminance of white at center point(5).

Note 6) Definition of Color Chromaticity (CIE 1931)

Color coordinate of Red , Green , Blue & White at center point(5).

Note 7) Definition of Viewing Angle : Viewing angle range ($CR \geq 10$)



Note 8) Definition of 9 points brightness uniformity

$$B_{uni} = 100 * \frac{(B_{max} - B_{min})}{B_{max}}$$

B_{max} : Maximum brightness

B_{min} : Minimum brightness

3. Electrical Characteristics

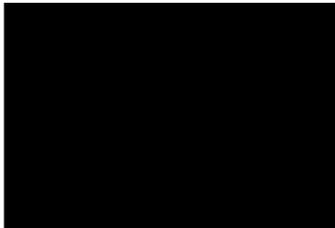
3.1 TFT LCD MODULE

Ta = 25°C

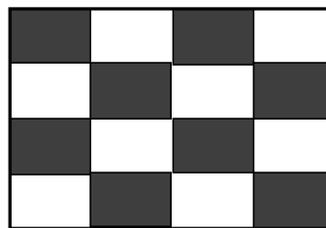
Item	Symbol	Min.	Typ.	Max.	Unit	Note	
Voltage of Power Supply	V _{DD}	3.0	3.3	3.6	V	(1)	
Interface type	LVDS	DS90C385 / DS90C386 Pair					
Current of Power Supply	(a)Black	-	1.0	-	mA	(2),(3)	
	(b)Mosaic	-	1.2	1.5	mA		
	(c)2 Line Stripe	-	TBD	TBD	mA		
	(d)White	-	1.1	-	mA		
Vsync Frequency	f _V	-	60	60	Hz	1 pixel/clock	
Hsync Frequency	f _H	-	TBD	45	kHz		
Main Frequency	f _{DCLK}	-	64	(70)	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} =64MHz, V_{DD} = 3.3V, DC Current.
 (3) Power dissipation check pattern(LCD Module only)

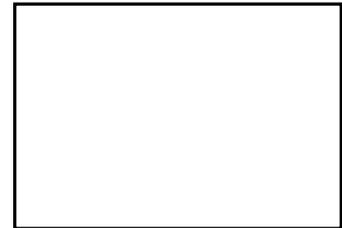
a)Black Pattern



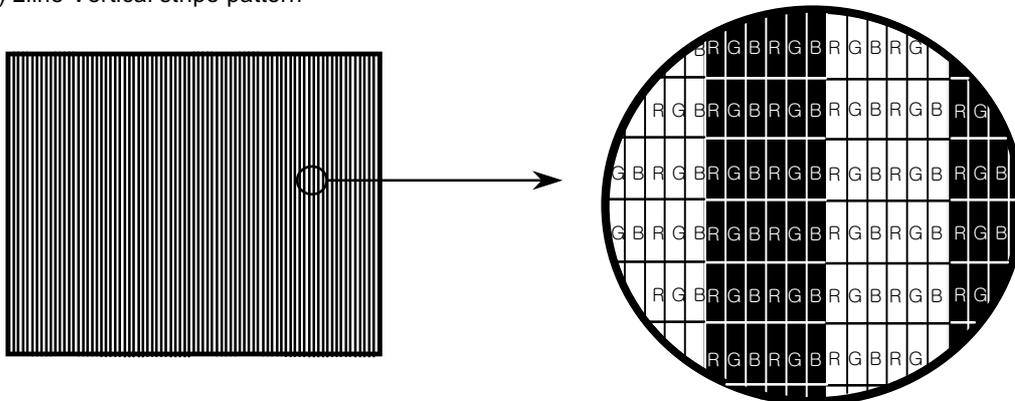
b)Mosaic Pattern



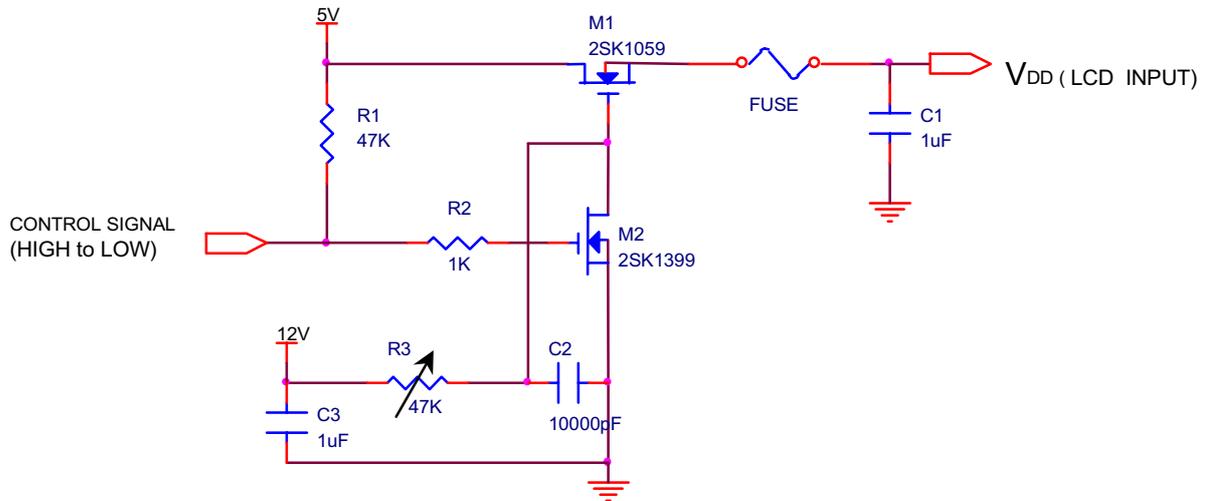
d)White Pattern



*c) 2line Vertical stripe pattern



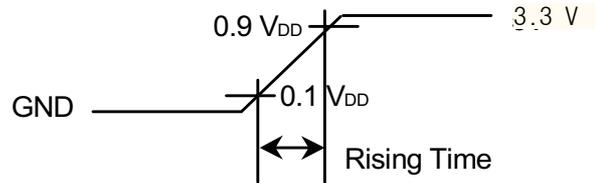
(4) Measurement Conditions



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.



3.2 BACK-LIGHT UNIT

The back-light system is an direct - lighting type with 8 CCFTs (Cold Cathode Fluorescent Tube) The characteristics of 8 direct lamps are shown in the following tables.

Ta=25 ± 2°C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I _L	3.0	4.5	6.0	mArms	(1)
Lamp Voltage	V _L	TBD	-	TBD	Vrms	(1)
Lamp Frequency	f _L	(50)		(80)	kHz	(2)
Operating Life Time	Hr	TBD	TBD	TBD	Hour	(3)
Start up Voltage	V _s	TBD	-	0°C:(TBD)	Vrms	(4)
				25°C:(TBD)		

**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.
Specified values are for a single 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.

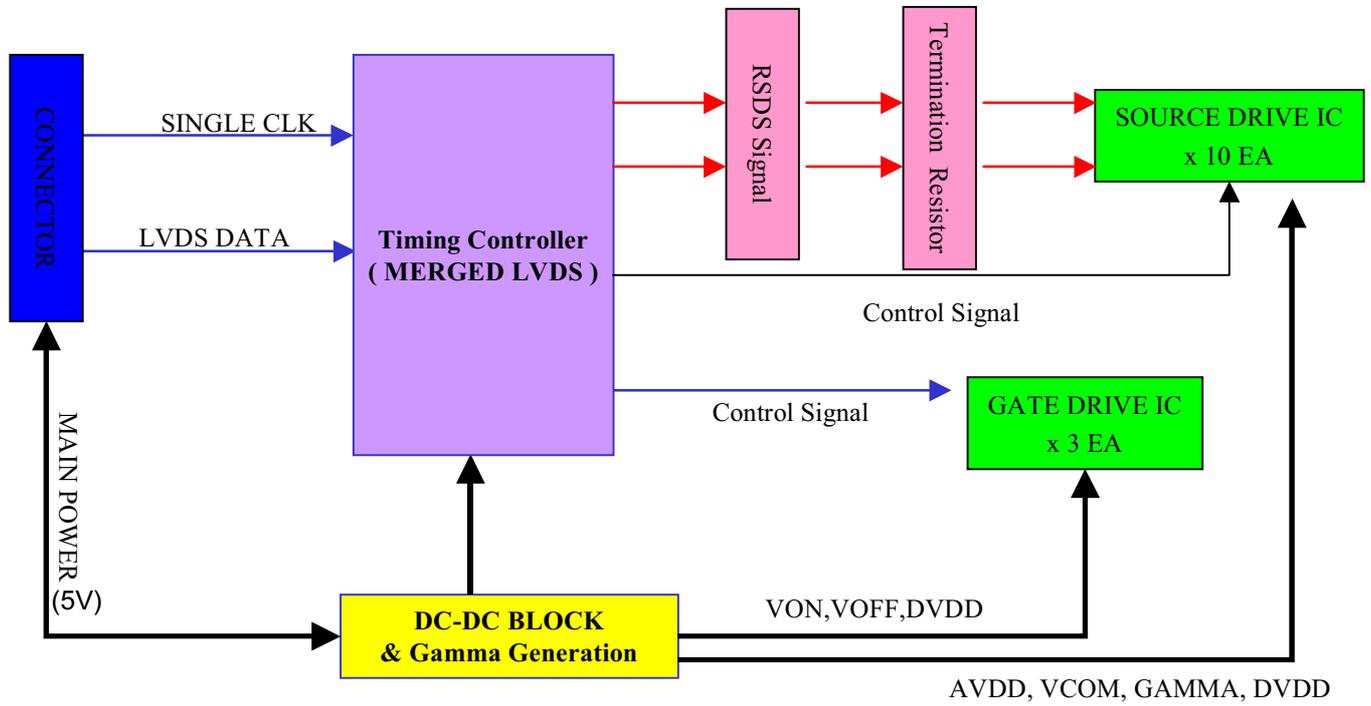
Note (1) lamp current is measured with current meter.

Refer to the block diagram of the back-light unit in the next page for more information.

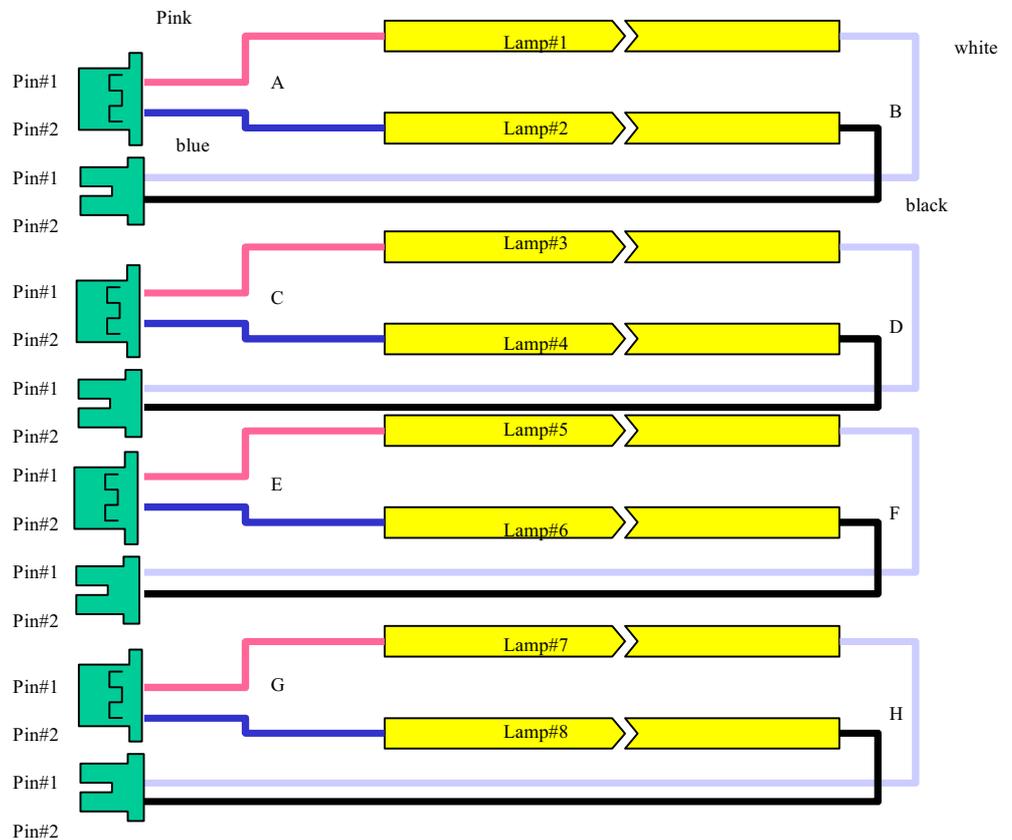
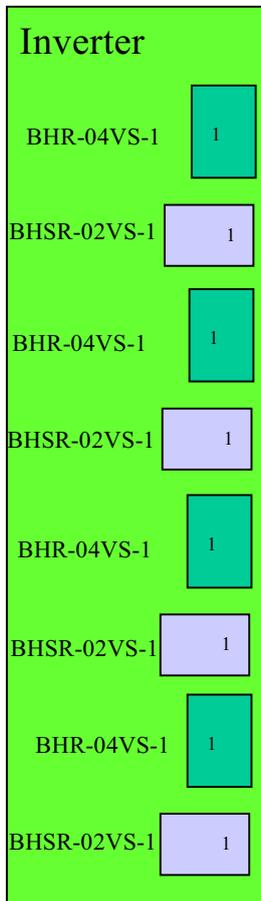
- (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.
- (3) Life time (Hr) of a lamp is defined as the time in which it continues to operate under the condition of Ta = 25±2°C and IL = 4.5mArms for a lamp until the brightness becomes 50% or lower than its original value.
- (4) If an inverter has shutdown function it should keep its output for more than 1 second even if the lamp connector open. Otherwise the lamps may not to be turned on.

4. Block Diagram

4.1 TFT LCD MODULE



4.2 BAEL-LIGHT UNIT



5. Input Terminal Pin Assignment

5.1. Input Signal & Power (Connector : DF14H-20P-1.25H / HIROSE)

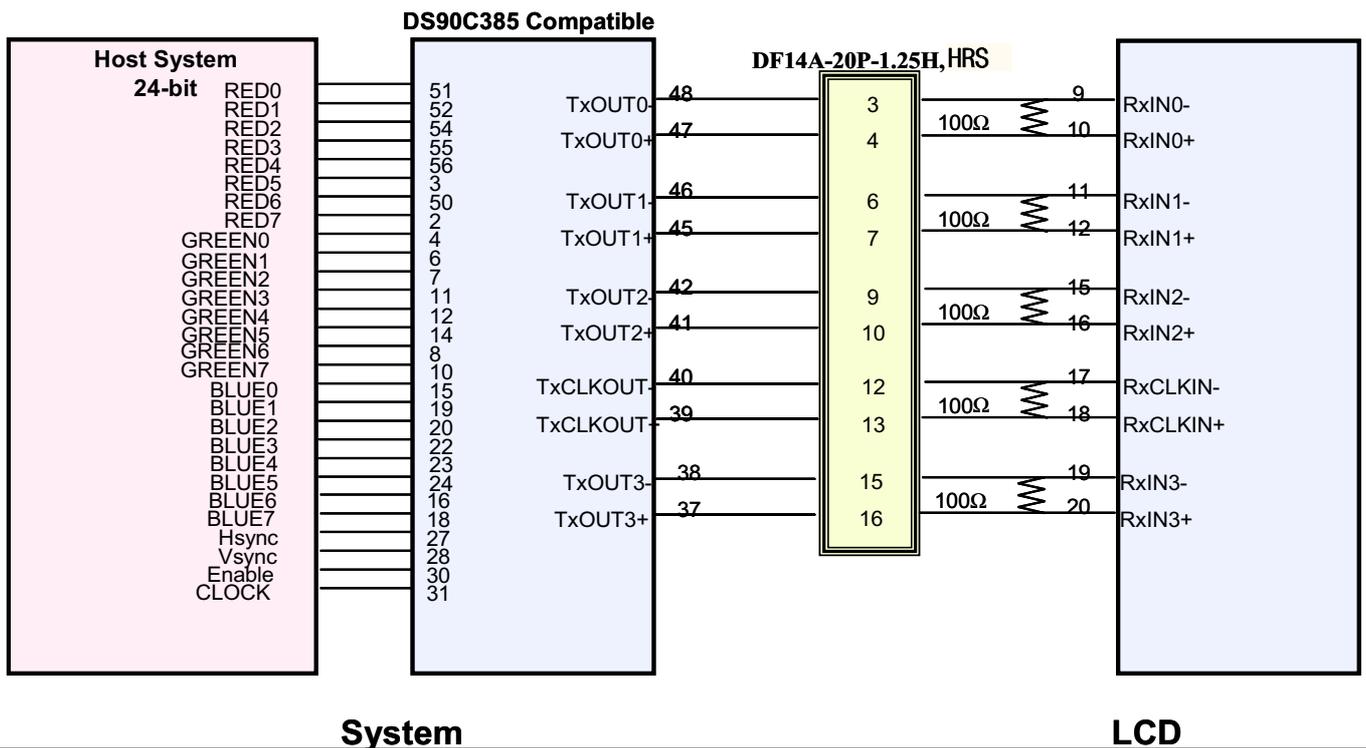
Pin No.	Symbol	Function	Remark
1	VDD	Power Supply 3.3V	
2	VDD	Power Supply 3.3V	
3	GND	Ground	
4	GND	Ground	
5	RX0-	Receiver Signal(-)	
6	RX0+	Receiver Signal(+)	
7	GND	Ground	
8	RX1-	Receiver Signal(-)	
9	RX1+	Receiver Signal(+)	
10	GND	Ground	
11	RX2-	Receiver Signal(-)	
12	RX2+	Receiver Signal(+)	
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	NC	Not Connected	

5.2 LVDS Interface

-LVDS Receiver : Tcon (LVDS Rx merged)

5.2.1 Pixel data

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
51	TxIN0	R0	8	TxIN10	G6
52	TxIN1	R1	10	TxIN11	G7
54	TxIN2	R2	15	TxIN15	B0
55	TxIN3	R3	19	TxIN18	B1
56	TxIN4	R4	20	TxIN19	B2
3	TxIN6	R5	22	TxIN20	B3
50	TxIN27	R6	23	TxIN21	B4
2	TxIN5	R7	24	TxIN22	B5
4	TxIN7	G0	16	TxIN16	B6
6	TxIN8	G1	18	TxIN17	B7
7	TxIN9	G2	27	TxIN24	Hsync
11	TxIN12	G3	28	TxIN25	Vsync
12	TxIN13	G4	30	TxIN26	DE
14	TxIN14	G5	31	TxCLKIN	Clock



5.3 BACK-LIGHT UNIT

(1) BHR-04VS-1

Pin No.	Input	Color	Fucntion
1	Hot1	Pink	High Voltage
2	Hot2	Blue	High Voltage
Connector Part No.	JST BHR-04VS-1		

(2) BHSR-02VS-1

Pin No.	Input	Color	Fucntion
1	Cold1	White	Ground
2	Cold2	Black	Ground
Connector Part No.	JST BHSR-02VS-1		

5.4 INVERTER UNIT

5.4.1. Inverter input pin configuration

Pin No.	1	2	3	4	5	6	7
Function	Gnd	Brt_Adj	Gnd	On/Off	Gnd	Gnd	NC
8	9	10	11	12	13	14	15
Gnd	Gnd	Vin (14V)					

5.5 Input Signal, 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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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)

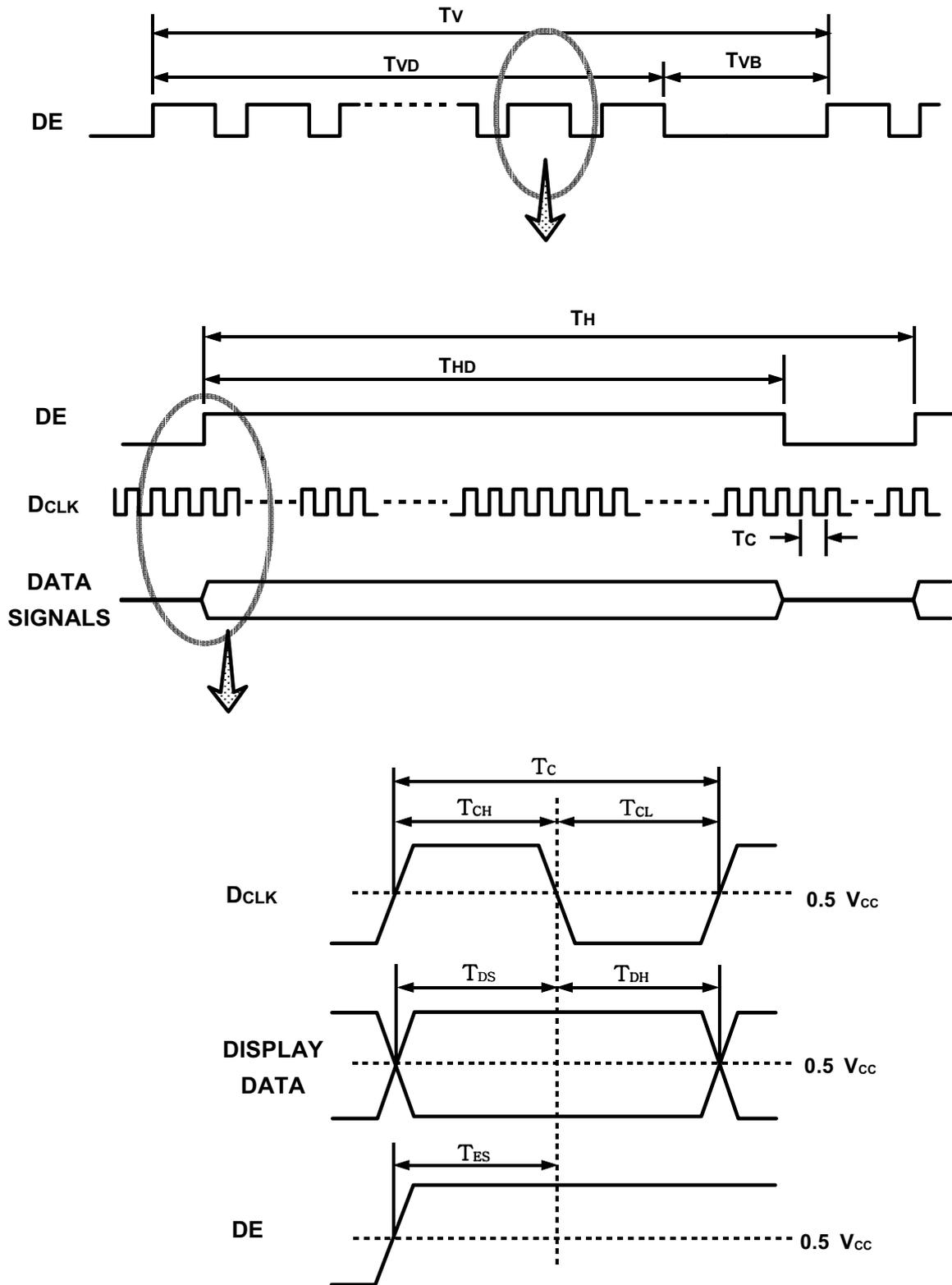
1pxl/clock

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Clock	Frequency	1/Tc	58	64	70	MHz	(1),(2)
	Hgh Time	TCH	4	-	-	nsec	
	Low Time	TCL	4	-	-	nsec	
Data	Setup Time	TDS	4	-	-	nsec	
	Hold Time	TDH	4	-	-	nsec	
Data Enable	Setup Time	TES	4	-	-	nsec	
Frame Frequency	Cycle	Tv	-	16.7	16.7	msec	
			739	790	829	lines	
Vertical Active Disply Term	Display Period	TvD	768	768	768	lines	
	Verticle Blank Period	TvB	19	-	-	lines	
One Line Scanning Time	Cycle	TH	1308	-	1407	clocks	
Horizontal Active Display Term	Display Period	THD	1280	1280	1280	clocks	

Note 1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system

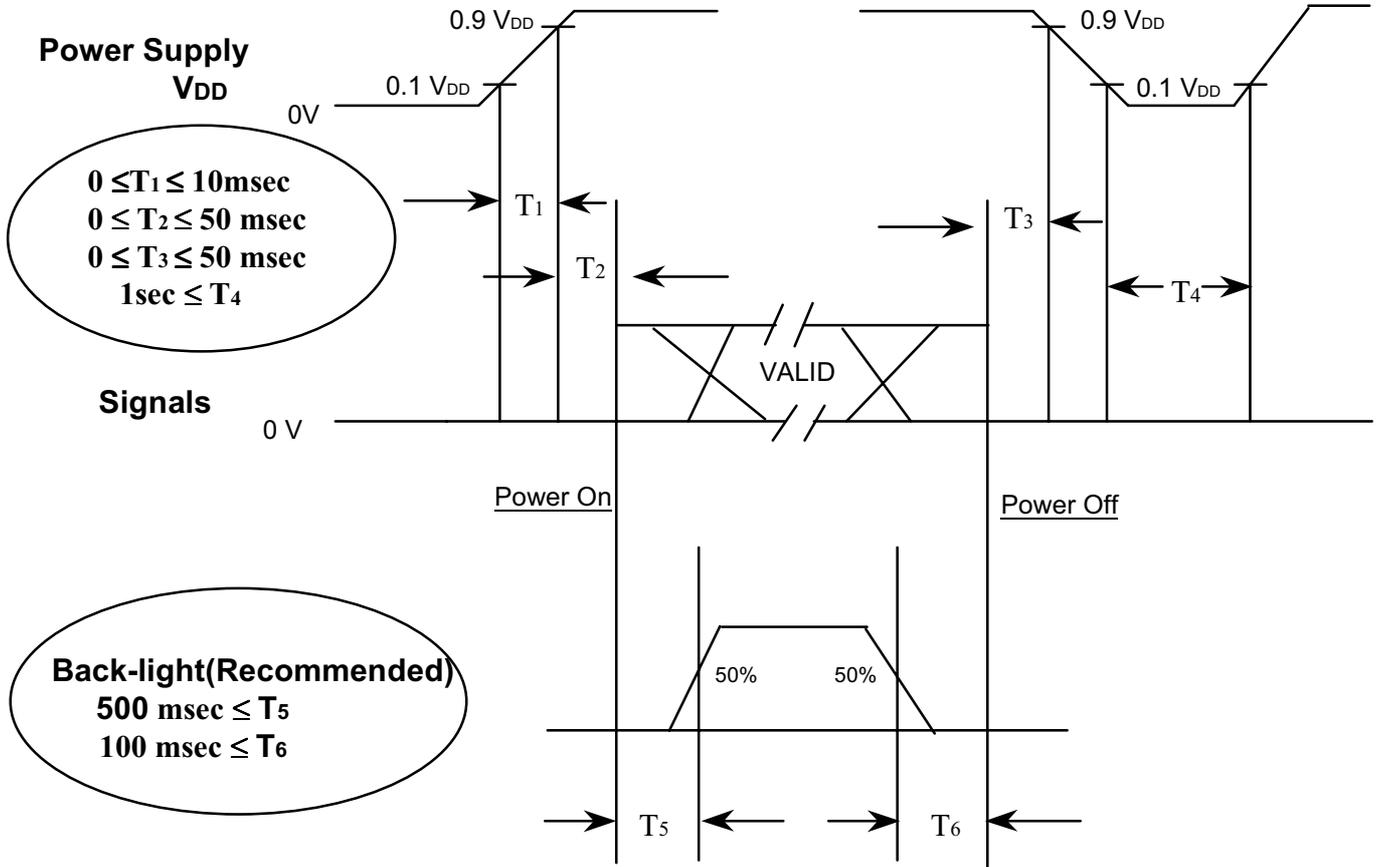
2) Internal Vcc = 3.3V, Frame rate = 60Hz

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 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 abnormal screen.
- (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.

8. General Precautions

8.1 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 CMOS 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 module.
- (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.

8.2 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 35C 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.

8.3 Operation

- (a) Do not connect,disconnect the module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the item 6.3 "Power on/off sequence"
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (d) The cable between the 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).

8.4 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, and 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.