SAMSUNG
ELECTRONICS

Customer :
Date : Jan 29, 2004

SAMSUNG TFT-LCD

MODEL NO. : LTA170WP-L01

Approved by: _____

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

Senior Engineer : *J. H. Park.*

PREPARED BY : AMLCD Technical Customer Service Team

Samsung Electronics Co . , LTD.

wise view
SAMSUNG TFTLCD

Contents

* Revision History

No	Date	Page	Before change	After change	Remark
0.0	2004.01.29	All	First issued		

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 16.7 million colors with wide viewing angle of 85□ or higher in all directions.

* Features

  - High contrast ratio, high aperture structure
  - PVA(Patterned Vertical Align) mode
  - Wide viewing angle(±170°)
  - High speed response
  - WXGA(1280 x 768 pixels) resolution (15:9)
  - Low Power consumption
  - Direct Type 8 CCFT(Cold Cathode Fluorescent Tube)
  - DE only mode
  - LVDS(Low-Voltage Differential Signal) 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	370.56(H) x 222.336(V)	mm	
Driver element	a-Si TFT active matrix		
Display colors	16.7M(true)	colors	
Number of pixels	1280 x 768	pixel	15:9
Pixel arrangement	RGB Vertical Stripe		
Pixel pitch	0.2895 (H) × 0.2895 (W)	mm	
Display mode	Normally Black		
Surface treatment	Haze 25% , Hard-Coating (3H)		

* Mechanical information (Panel Module Only)

Item		Min.	Typ.	Max.	unit	Note
Module size	Horizontal(H)	-	401.7	-	mm	
	Vertical(V)	-	249.0	-	mm	
	Depth(D)	-	35.4	-	mm	(with inverter)
Weight		-	-	1900	g	(with inverter)

1. Absolute Maximum Ratings

1.1 Absolute ratings of environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	60	℃	(1)
Operating temperature (Ambient 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.
90.0%RH Max. (40 ℃ ≥ Ta)
Maximum wet-bulb temperature at 39 ℃ or less. (Ta > 40 ℃) 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)

Temperature (°C)
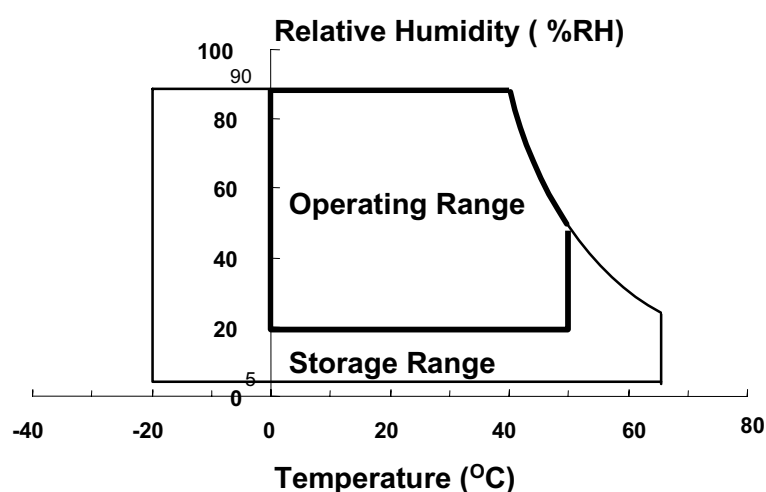
1.2 ELECTRICAL ABSOLUTE RATINGS

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

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	Vss-0.5	5.0	V	(1)

NOTE (1) Within Ta (25 ± 2℃)

(2) BACK-LIGHT UNIT   (Ta = 25 ± 2℃)

Item	Symbol	Min.	Max.	Unit.	Note
Lamp Current	I_L	2.7	7.0	mArms	(1),(2)
Lamp Frequency	F_L	25	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
EZ-Contrast (Eldim)

* Ta = 25 ± 2℃ , V_{DD}=3.3V, fv= 60Hz, f_{DCLK}=65MHz, I_L = 4.9mArms

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R	Normal ϕ = 0 θ = 0 Viewing Angle	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		400	450	-	cd/m2	(5) BM-5A
Color Chromaticity (CIE 1931)	Red	Rx		TYP. -0.03	0.642	TYP. +0.03		(6) PR650
		Ry			0.333			
	Green	Gx			0.279			
		Gy			0.592			
	Blue	Bx			0.144			
		By			0.066			
	White	Wx			0.280			
		Wy			0.290			
Viewing Angle	Hor.	θ L	C/R≥10	75	85	-	Degrees	(7) BM-5A
		θ R		75	85	-		
	Ver.	ϕ H		75	85	-		
		ϕ L		75	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

 Environment condition : Ta = 25 ± 2℃

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

Photodetector

Field

BM-5A : 40㎝
BM-7 : 50㎝
PR650 : 50㎝

TFT - LCD Module

LCD Panel

The center of the screen
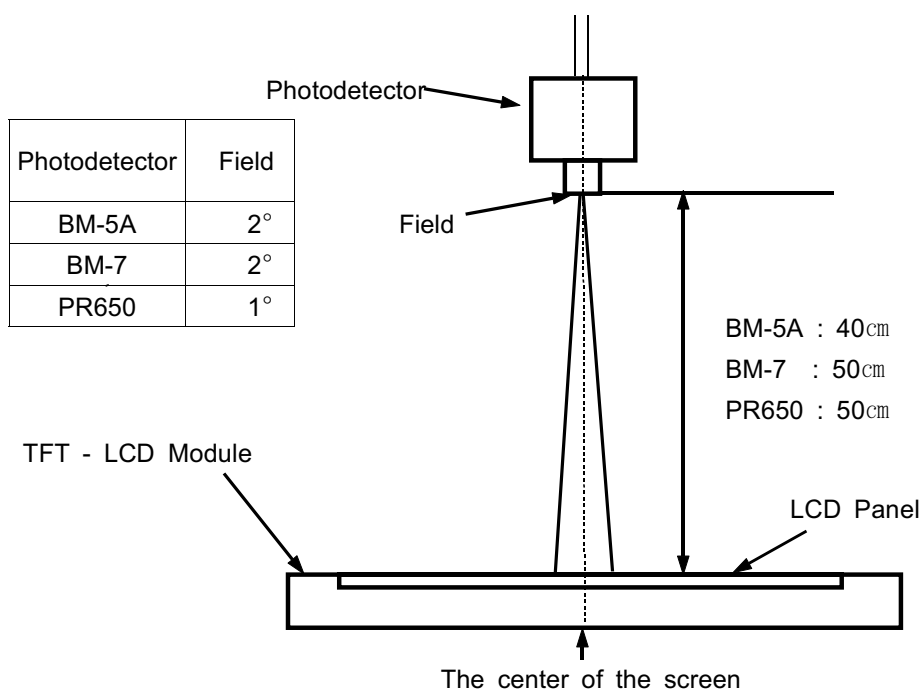
Optical Measuring Equipment Setup

Note 2) **Definition of test point**

ACTIVE AREA

(128)   (640)   (1152)

⑨ ⑧ ⑦ (77)

⑥ ⑤ ④ (384)

③ ② ① (691)

H/10
H/2
H
L/10
L/2
L

◯ : test point
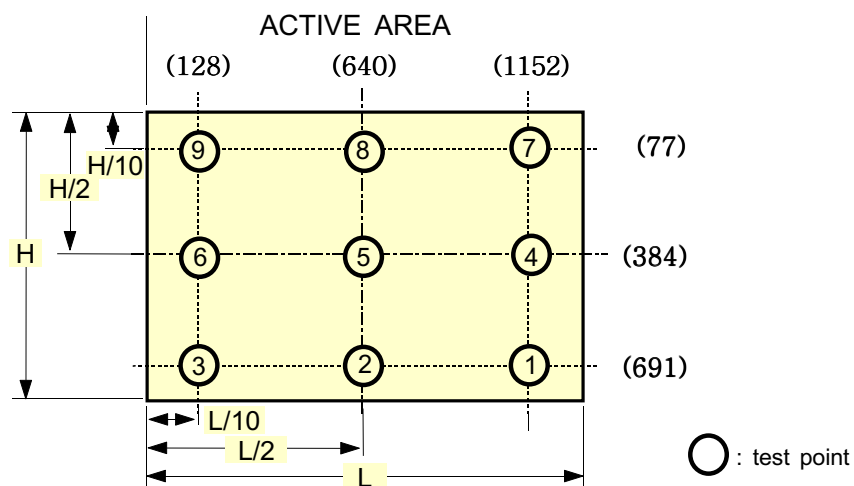
Note 3) Definition of Contrast Ratio (C/R)

　: 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 Tr ,Tf

Display data

Black(TFT OFF)　　White(TFT ON)　　Black(TFT OFF)
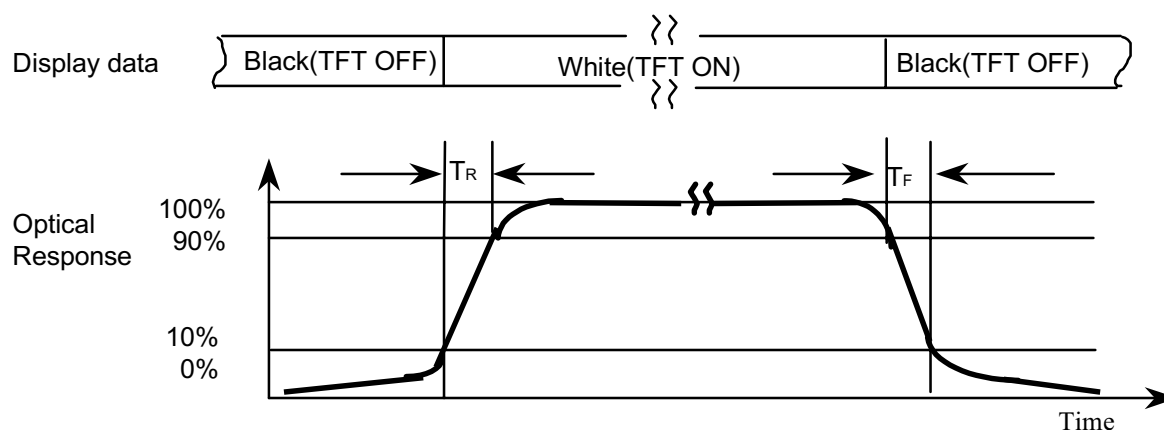
Optical
Response

100%
90%

10%
0%

T_R　　T_F

Time

Note 5) Definition of Luminance of White : Luminance of white at center 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≥10)

Normal Line
$\phi = 0°, \theta = 0°$

θ_L

θ_R

ϕ_L　ϕ_H

$\theta_L = 90°$　x

12 O'clock
direction
$\phi_H = 90°$

y

6 O'clock y′
direction
$\phi_L = 90°$

x′

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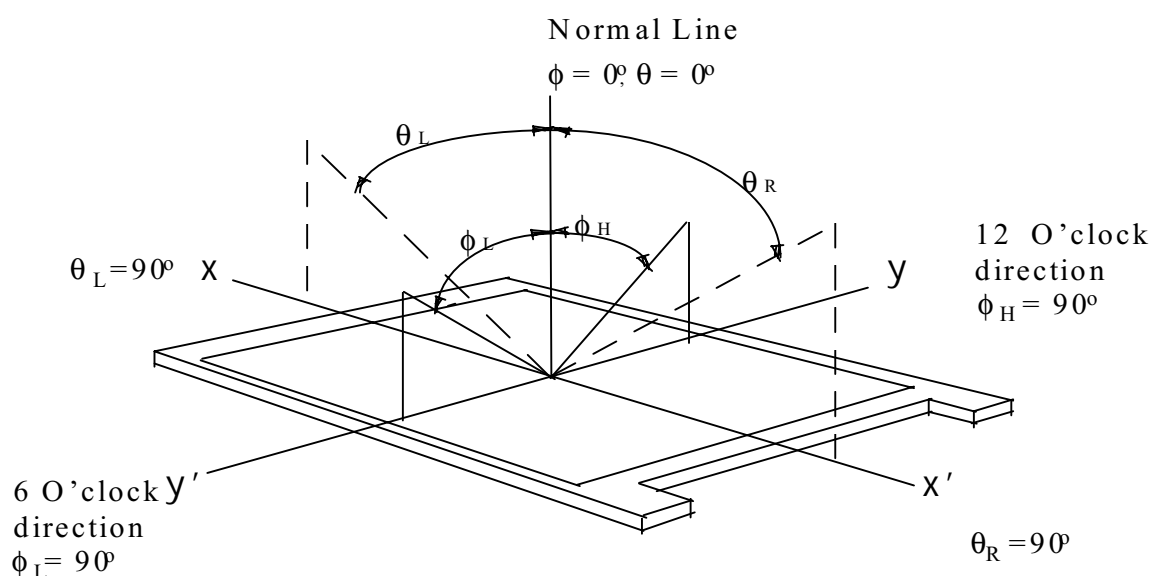
Note 8) Definition of 9 points brightness uniformity

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

Bmax : Maximum brightness
Bmin : Minimum brightness

3. Electrical Characteristics

3.1 TFT LCD MODULE

Ta = 25℃

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	3.0	3.3	3.6	V	(1)
Current of Power Supply	(a) Black		–	750	850	mA	(2),(3)
	(b) sub-checker		–	950	1100		
Vsync Frequency		f_V	–	60	–	Hz	
Hsync Frequency		f_H	–	48.4	–	kHz	
Main Frequency		f_{DCLK}	–	68	78	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} =65MHz, V_{DD} = 3.3V, DC Current.

(3) Power dissipation check pattern (LCD Module only)

(a) Black Pattern
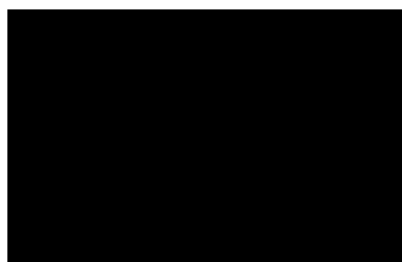
(b) Sub-Checker Pattern
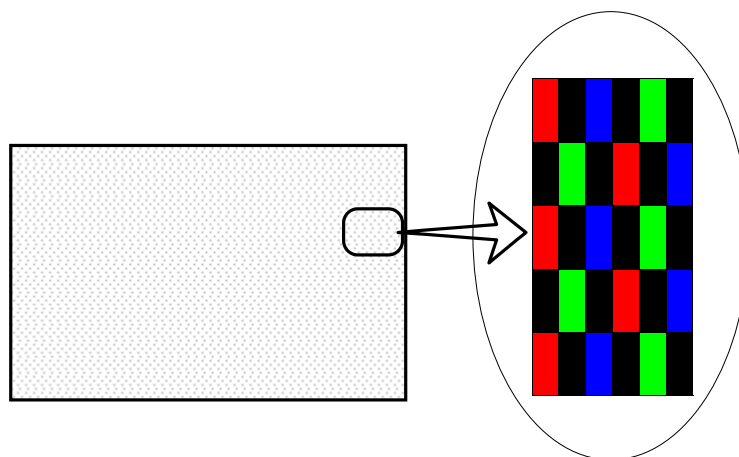
(4) Measurement Conditions (Rising time =470μs)
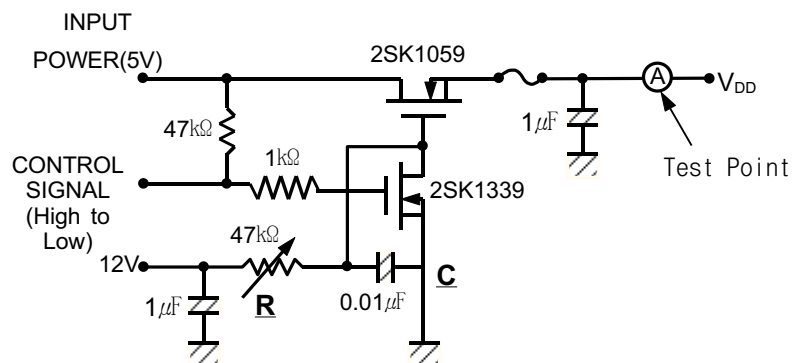
Note : Control Signal : High(+3.3V) -->Low(Ground)
All Signal lines to panel except for power 3.3V : Ground
The rising time of supplied voltage is controlled to 470us by R and C value.

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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

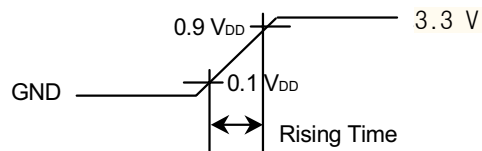| Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I_L	2.7	5.0	-	mArms	(1)
Lamp Voltage	V_L	-	770	-	Vrms	(1)
Lamp Frequency	f_L	(40)	-	(80)	kHz	(2)
Operating Life Time	Hr	50000	-	-	Hour	(3) 25℃, 7mA
Start up Voltage	Vs	-	-	1610	Vrms	(4) 0℃
				1070		(4) 25℃

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 We synchronized the lamp frequency to horizontal frequency.
  (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 = 5.0[mArms] for a lamp until the brightness becomes 50% or lower than it's 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
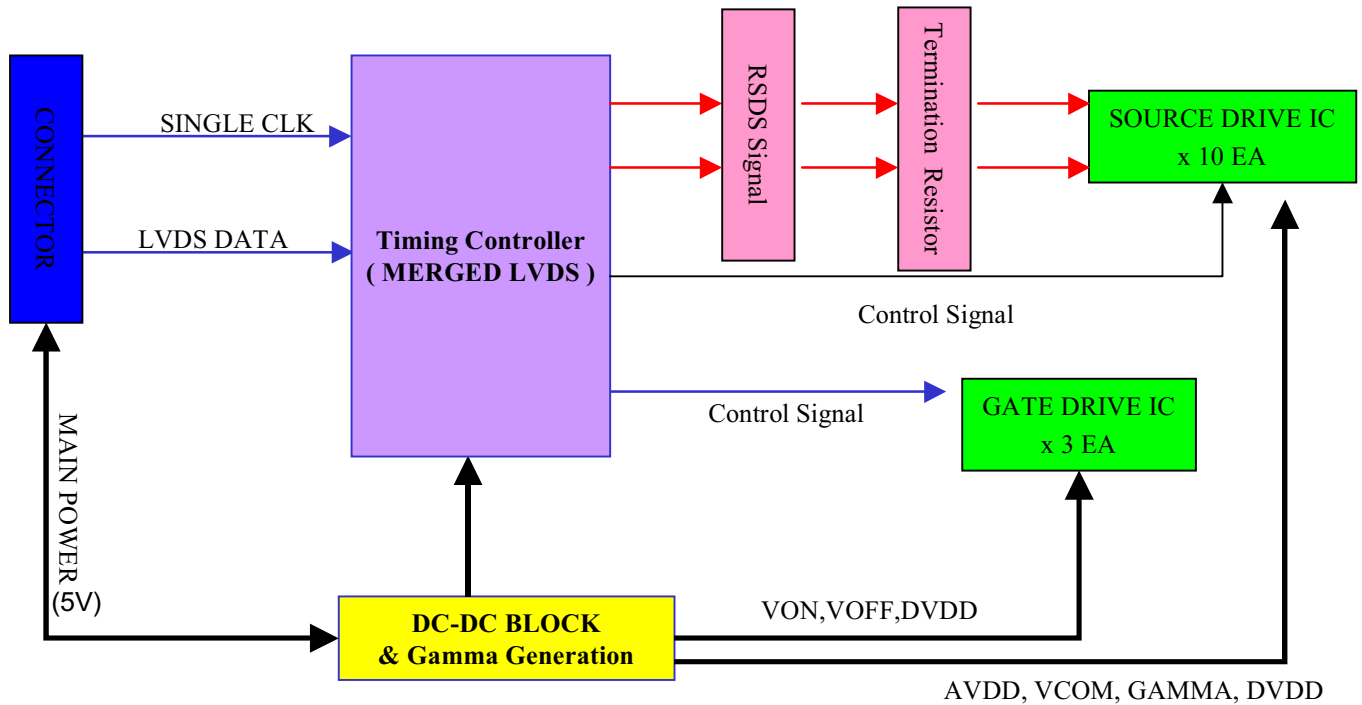
4.2 BACL-LIGHT UNIT

HOT : HIGH VOLTAGE (Part NO. : BHR-04VS-1 (JST))

COLD : GROUND (Part NO. : BHSR-02VS-1 (JST))

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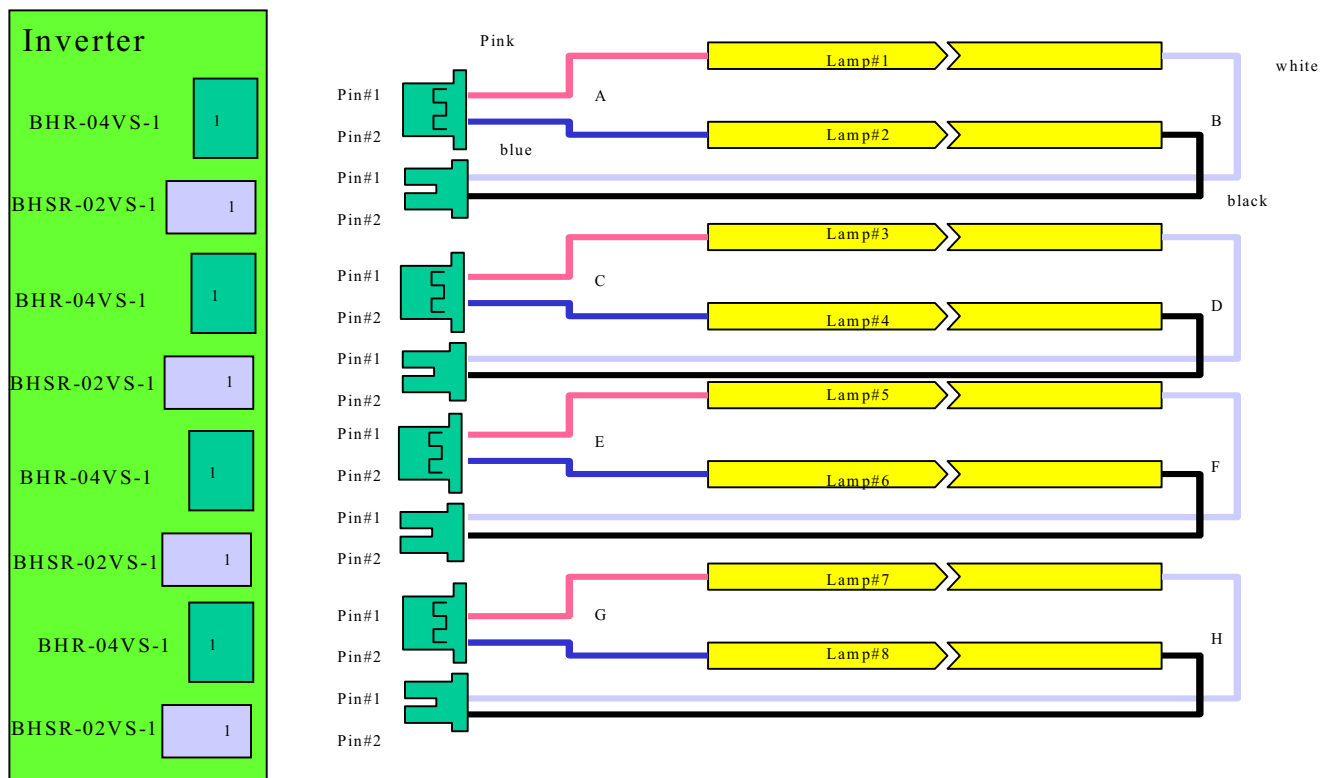
5. Input Terminal Pin Assignment

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

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)

-Pixel data (single 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

System   **LCD**

| |
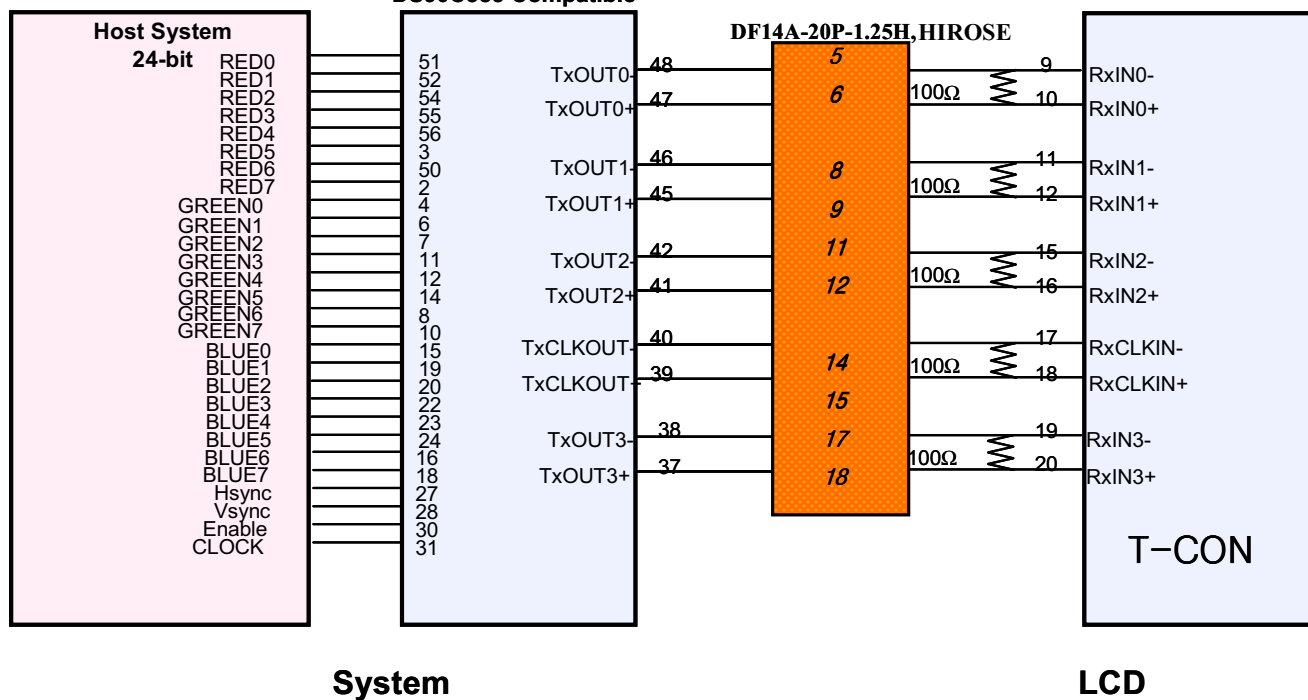
5.3 INVERTER UNIT : Inverter input pin configuration

Connector : 12505WS-15A00(YEONHO

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)	Vin (14V)	Vin (14V)	Vin (14V)	Vin (14V)	Vin (14V)

5.4 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	-
	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
		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
	↓ 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	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
		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
	↓ 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	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
		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
	↓ 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	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

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6. Interface Timing

6.1 Timing Parameters (DE only mode)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Clock	Frequency	1/T$_C$	58	68	78	MHz	(1),(2)
	Hgh Time	T$_{CH}$	5	-	-	nsec	
	Low Time	T$_{CL}$	5	-	-	nsec	
Data	Setup Time	T$_{DS}$	2	-	-	nsec	
	Hold Time	T$_{DH}$	0	-	-	nsec	
Data Enable	Setup Time	T$_{ES}$	4	-	-	nsec	
Frame Frequency	Cycle	T$_V$	-	16.7	-	msec	
			774	806	968	lines	
Vertical Active Display Term	Display Period	T$_{VD}$	768	768	768	lines	
	Vertical Blank Period	T$_{VB}$	4	38	200	lines	
Horizontal Active Display Term	Display period	T$_{HD}$	1280	1280	1280	clocks	
One Line Scanning Time	Cycle	T$_H$	1318	1350	1400	clocks	

Note

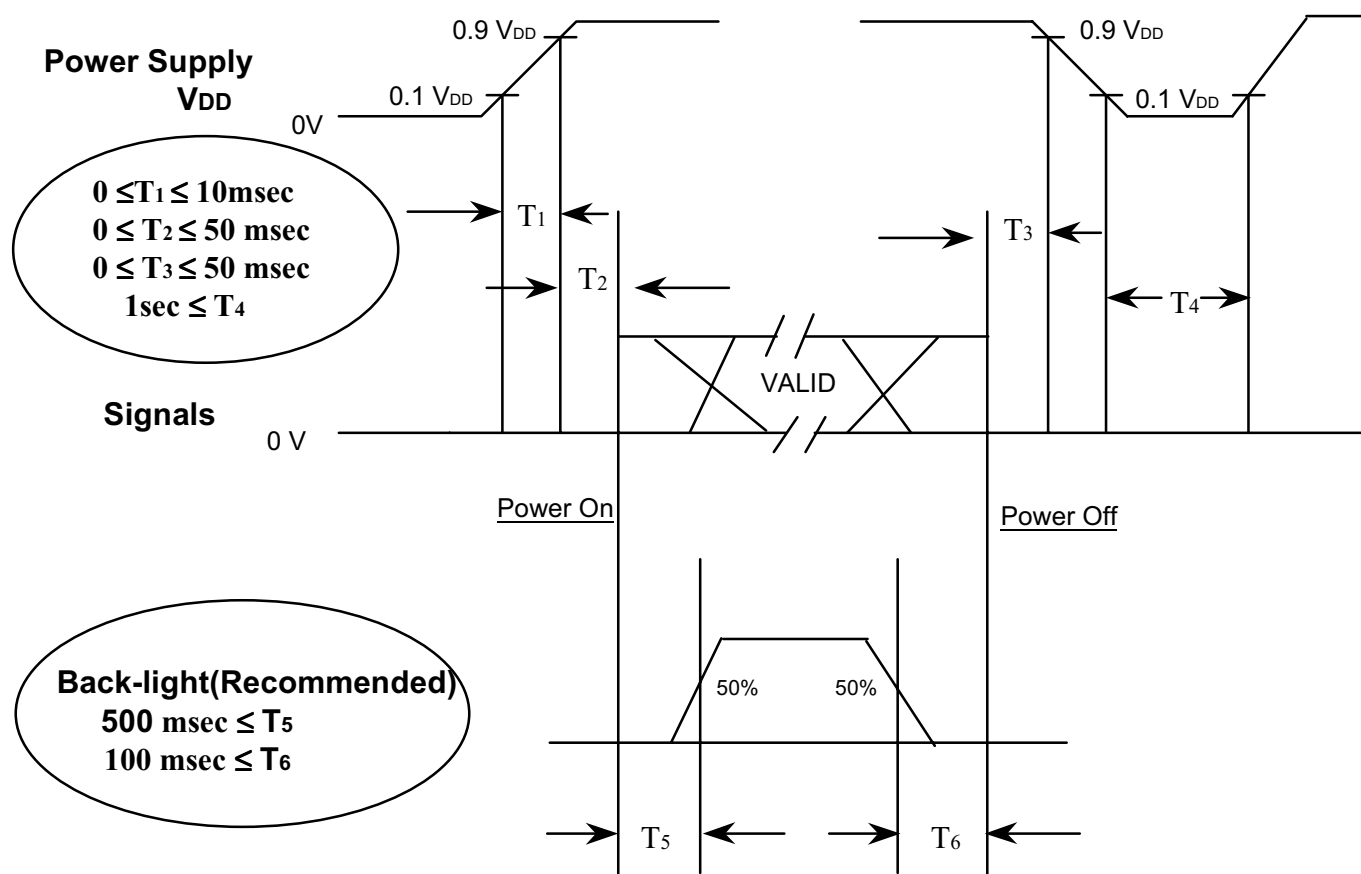(1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system

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

6.2 Timing diagrams of interface signal (DE only mode)

DE

T_V
T_{VD}
T_{VB}

T_H
T_{HD}

DE

D_{CLK}

T_C

DATA
SIGNALS

T_C
T_{CH} T_{CL}

D_{CLK} 0.5 V_{CC}

T_{DS} T_{DH}

DISPLAY
DATA   0.5 V_{CC}

T_{ES}

DE   0.5 V_{CC}

TTL TIMING DIAGRAM
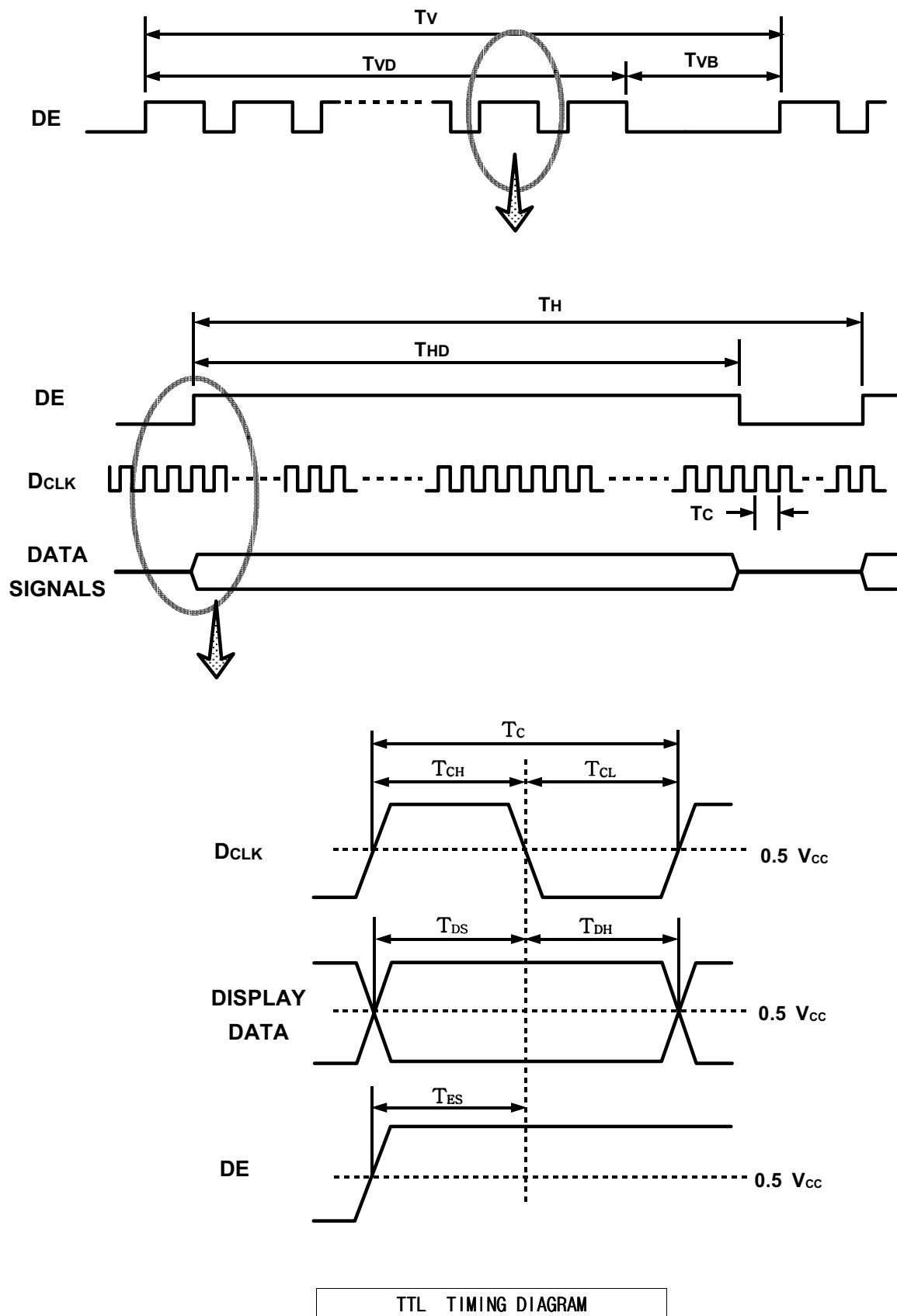
6.3   Power ON/OFF Sequence

  : 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
V$_{DD}$

0.9 V$_{DD}$ 0.9 V$_{DD}$

0.1 V$_{DD}$ 0.1 V$_{DD}$
0V

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

T_1 T_3

T_2 T_4

VALID

Signals

0 V

Power On   Power Off

Back-light(Recommended)
500 msec $\leq$ T$_5$
100 msec $\leq$ T$_6$

50%   50%

T_5 T_6

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 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

: Refer to another file

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.