



ELECTRONICS

Product Information

Issued Date : Mar. 4, 2004

SAMSUNG TFT-LCD
MODEL NO. : LTA320W2-L01

Note:

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

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*** Revision History**

No	Date	Page	Before change	After change	Remark
0.0	2003.9.19	All	First issued		
0.1	2003.11.20	6	Power Supply Voltage [Min, Max] = [V _{ss} -0.5, 17.5][V]	Power Supply Voltage [Min, Max] = [14.8, 18.2][V]	changed
			Lamp Current [Min, Max] = TBD	Lamp Current [Min, Max] = [4.0, 7.0][mA _{rms}]	changed
			Lamp Freq. [Min, Max] = TBD	Lamp Freq. [Min, Max] = [55, 65] [kHz]	changed
		7	I _L = 6.0mA _{rms}	I _L = 7.0mA _{rms}	changed
		13	Lamp Current [Min, Typ, Max] = [TBD, 6.0, TBD][mA _{rms}]	Lamp Current [Min, Typ, Max] = [4.0, -, 7.0][mA _{rms}]	changed
			Lamp Voltage = TBD	Lamp Voltage [Min, Typ, Max] = [1040, -, 1130][V _{rms}]	changed
			Lamp Frequency = TBD	Lamp Frequency [Min, Typ, Max] = [55, 60, 65][kHz]	changed
			Operating Life Time = TBD	Operating Life Time [Min] = [50,000][hrs]	changed
			Start up Voltage = TBD	Start up Voltage Max 1,840@0°C, 1,415@25°C	changed
				Note 2) Deleted	deleted
		20	Inverter Specification TBD	Updated Inverter Specification	changed
27	Packing Specification TBD	Updated Packing Specification	changed		
0.2	2004.3.4	6	Power Supply Voltage/ Inverter Max = 16.5 [V]	Power Supply Voltage/ Inverter Max = 24 [V]	changed
		19	PHR-14 (JST)	S14B-PH-SM3 (JST)	mistyped
			Inverter Input Pin Configuration Pin 1, 2, 3, 4, 5 Vin = 16.5 [V] Pin 11 A-DIM Pin 13 PWM-DIM Pin 14 GND	Inverter Input Pin Configuration Pin 1, 2, 3, 4, 5 Vin = 24 [V] Pin 11 N.C.[No Connection] Pin 13 A-DIM Pin 14 PWM-DIM	changed
			Inverter Input Voltage[Vin] [Min, Typ, Max = 14.8, 16.5, 18.2][V]	Inverter Input Voltage[Vin] [Min, Typ, Max = 21.6, 24, 26.4][V]	changed
		20	Input Current Max = 10[A]	Input Current Max = 7[A]	changed
			Open Lamp Voltage Min = 1900[V _{rms}]	Open Lamp Voltage Min = 1840[V _{rms}]	changed
19,20	Analog Dimming Voltage 3.3V → Minimum Lamp current 0V → Maximum Lamp current	Analog Dimming Voltage 0V → Minimum Lamp current 3.3V → Maximum Lamp current	changed		

General Description

* Description

LTA320W2-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 32.0" contains 1366 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
- APVA(Advanced Patterned Vertical Align) mode
- Wide viewing angle($\pm 170^\circ$)
- High speed response
- WXGA(1366 x 768 pixels) resolution (16:9)
- Low Power consumption
- Dyrect Type 16 CCFL(Cold Cathode Fluorescent Lamp)
- 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	697.6845(H) × 392.256(V)	mm	
Driver element	a-Si TFT active matrix		
Display colors	16.7M(true)	colors	
Number of pixels	1366 x 768	pixel	16:9
Pixel arrangement	RGB Vertical Stripe		
Pixel pitch	0.51075(H) × 0.51075(W)	mm	
Display mode	Normally Black		
Surface treatment	Haze 44% , Hard-Coating (3H)		

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

Item		Min.	Typ.	Max.	Note
Module size	Horizontal(H)	759.0	760.0	761.0	mm
	Vertical(V)	449.0	450.0	451.0	mm
	Depth(D)	49.0	50.0	51.0	mm
Weight		-	7500	-	g

1. Absolute Maximum Ratings

1.1 Absolute ratings of environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T _{STG}	-20	65	°C	(1)
Operating temperature (Ambient temperature)	T _{OPR}	0	50	°C	(1)
	T _{sur}	0	65	°C	(2)
Shock (non - operating)	Snop	-	50	G	(3),(5)
Vibration (Non - operating)	Vnop	-	1.5	G	(4),(5)

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.

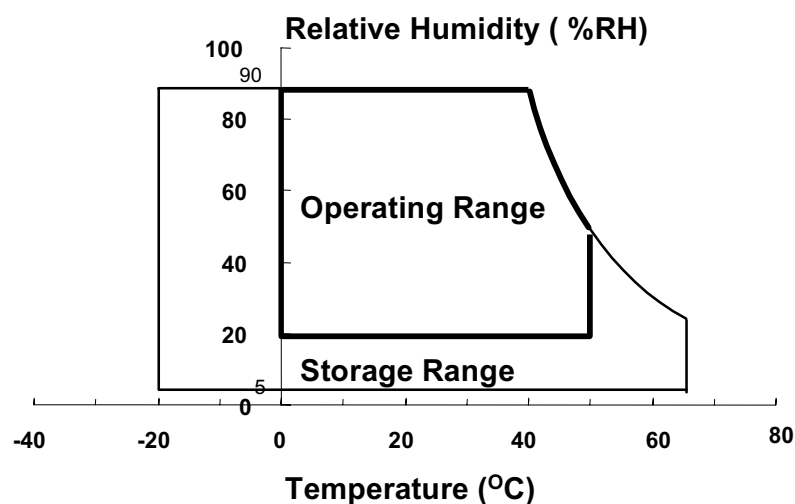
(2) Abnormal visual problems by panel surface temperature can be occurred in specific range. But materials(ex : polarizer) are not damaged permanently in this range, T_{sur}.

(3) 20ms, sine wave, 1 time for ±X, ±Y, ±Z axis

(4) 10~300Hz/1.5G

(11min/cycle, 30min for X,Y,Z axis)

(5) 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	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
Power Supply Voltage/ Inverter	V _{CC}	V _{SS} -0.5	26.4	V	(1)
Lamp Current	I _L	3.0	7.0	mArms	(2),(3)
Lamp Frequency	F _L	40	60	kHz	(2)

NOTE (1) Inverter Input power

- (2) 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.
- (3) 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

* Ta = 25 ± 2°C , VDD=5.0V, fv= 60Hz, fdCLK=80 MHz, IL = 5.2mA_{rms}

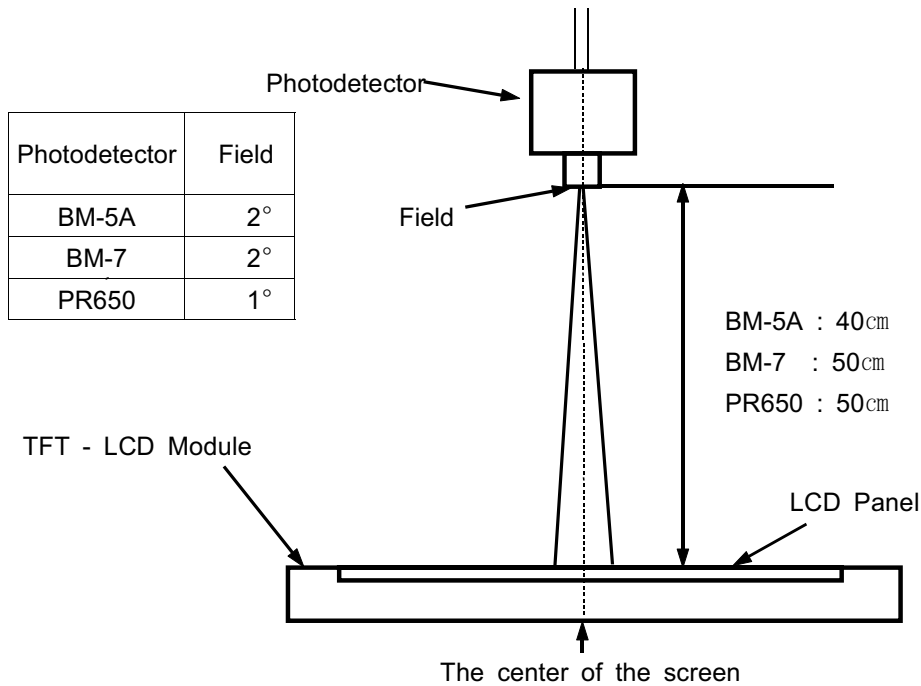
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio (Center of screen)	C/R		700	1000	-		(3) BM-5A	
Response Time	Rising	Tr	-	15	16.6	msec	(4) BM-7	
	Falling	Tf	-	8	11			
Luminance of White (Center of screen)	YL	Normal $\phi = 0$	400	450	-	cd/m ²	(5) BM-5A	
Color Chromaticity (CIE 1931)	Red	Rx	Viewing Angle	0.640	TYP. -0.03	TYP. +0.03	(6) PR650	
		Ry		0.330				
	Green	Gx		0.265				
		Gy		0.590				
	Blue	Bx		0.150				
		By		0.060				
	White	Wx		0.272				
		Wy		0.277				
Color Temperature	k		-	12000	-			
Viewing Angle	Hor.	θ L	C/R \geq 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		-	-	25	%	(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.

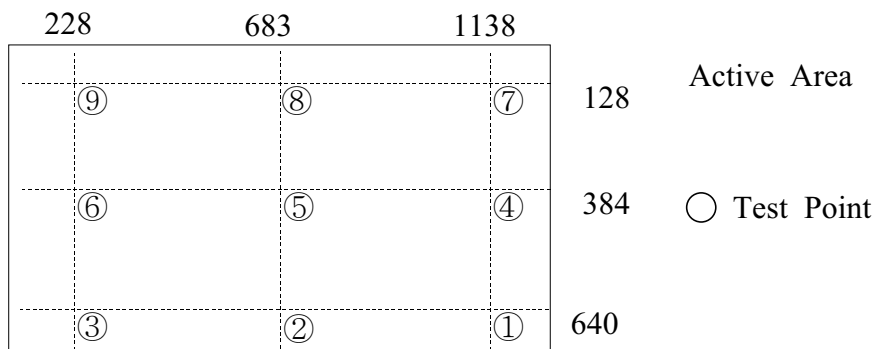
A single lamp current : 5.2mA

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



Optical Measuring Equipment Setup

Note 2) Definition of test point



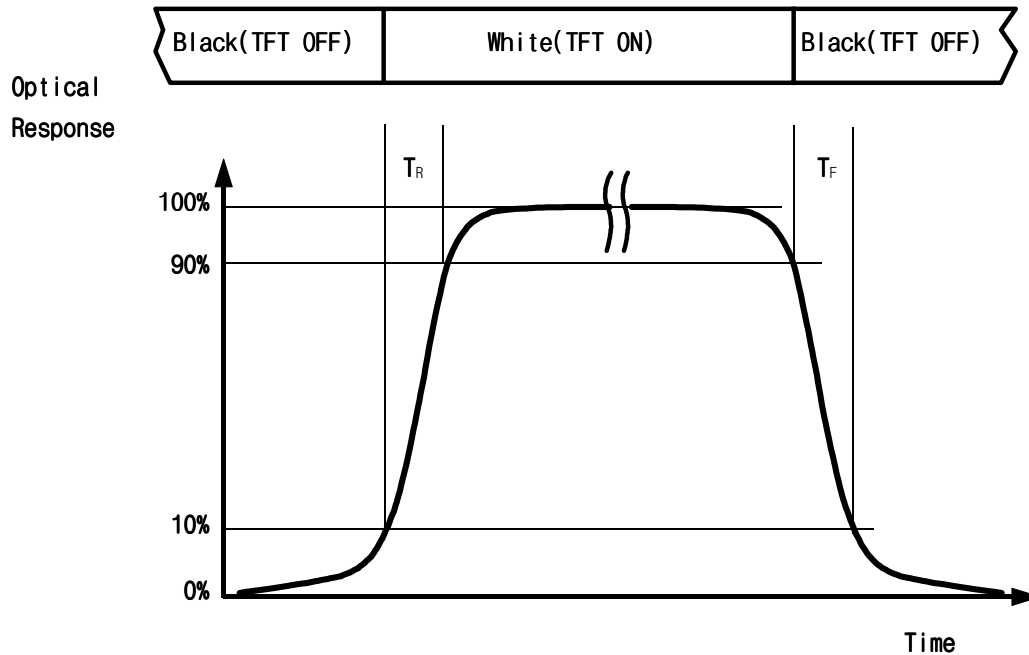
Note 3) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point(5) of the panel

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

Gmax : Luminance with all pixels white

Gmin : Luminance with all pixels black

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

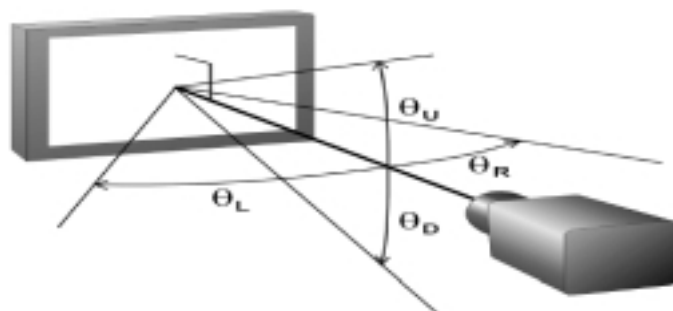


Note 5) Definition of Luminance of White : Luminance of white at center point(5).

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

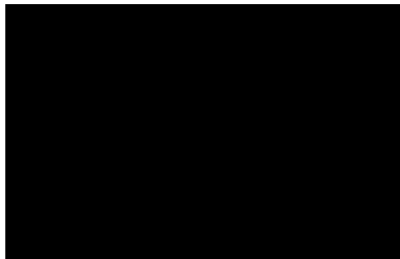
3.1 TFT LCD MODULE

Ta = 25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Note	
Voltage of Power Supply	V _{DD}	4.5	5.2	5.5	V	(1)	
Power Consumption	(a)Black	I _{DD}	900	1100	1300	mA	(2),(3), (5)
	(b)White		1300	1500	1700	mA	
	(c)N-Pattern		1600	1900	2100	mA	
Vsync Frequency	f _V	48	60	66	Hz		
Hsync Frequency	f _H	43	48	53	kHz		
Main Frequency	f _{DCLK}	60	80	82	MHz		
Rush Current	I _{RUSH}	-	-	4	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)

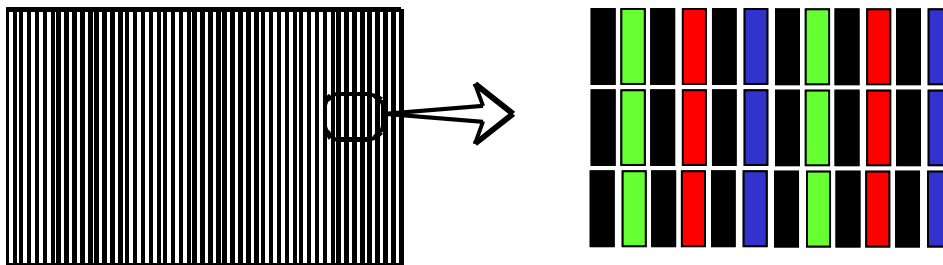
(a) Black Pattern



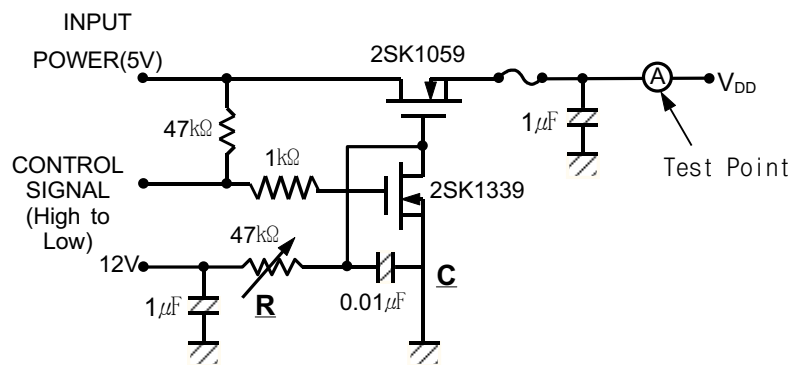
(b) White Pattern



(C) N-pattern



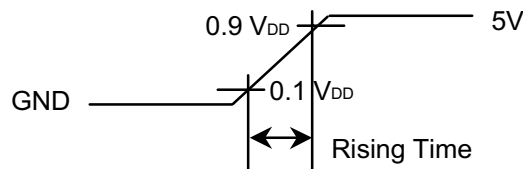
(4) Measurement Conditions (Rising time =470 μ s)



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 R and C value.



(5) Power Consumption → Except for Inverter power consumption

3.2 BACK-LIGHT UNIT

The back-light system is an direct - lighting type with 16 CCFTs (Cold Cathode Fluorescent Tube) The characteristics of 16 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	5.2	7.0	mArms	(1)
Lamp Voltage	V _L	1040	1100	-	Vrms	(1)
Lamp Frequency	f _L	-	58	-	kHz	(2)
Operating Life Time	Hr	50,000	-	-	Hour	(3) @5.2mA
Start up Voltage	Vs	-	-	1840@0°C	Vrms	(4)
				1415@25°C		

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.

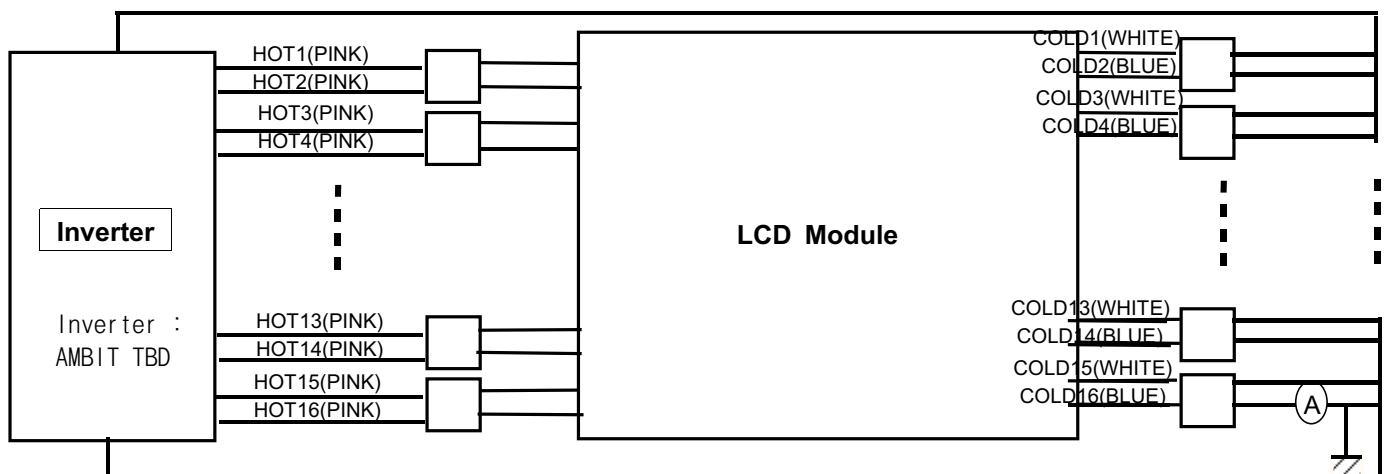
When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the back-light and the inverter(miss lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

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

Refer to the following block diagram of the back-light unit for more information.

Lamp Voltage Min : Lamp Current 7.0 mArms

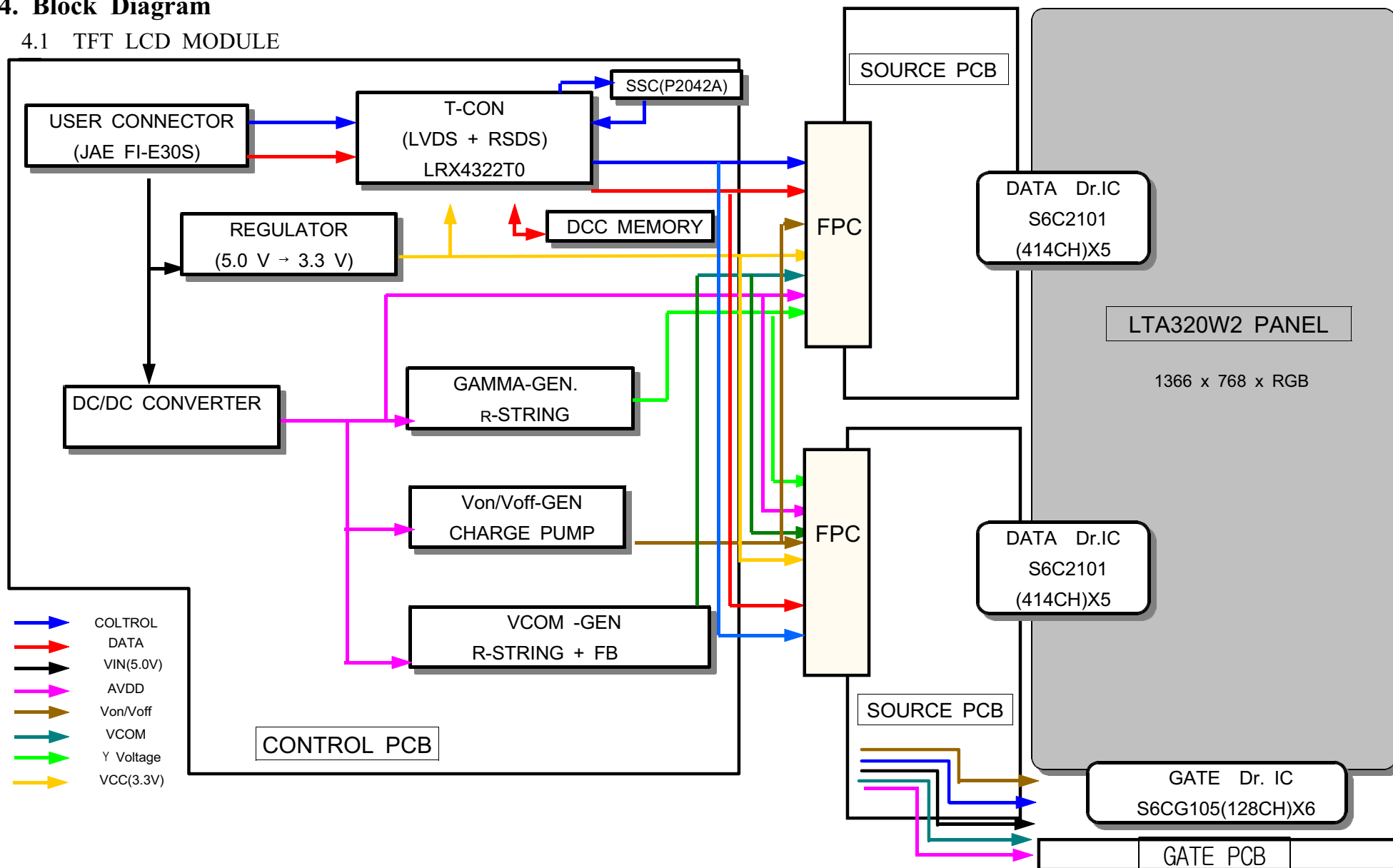
Lamp Voltage Min : Lamp Current 4.0 mArms



- (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 $T_a = 25 \pm 2^\circ\text{C}$ and $IL = 7.0\text{mA rms(max)}$ 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

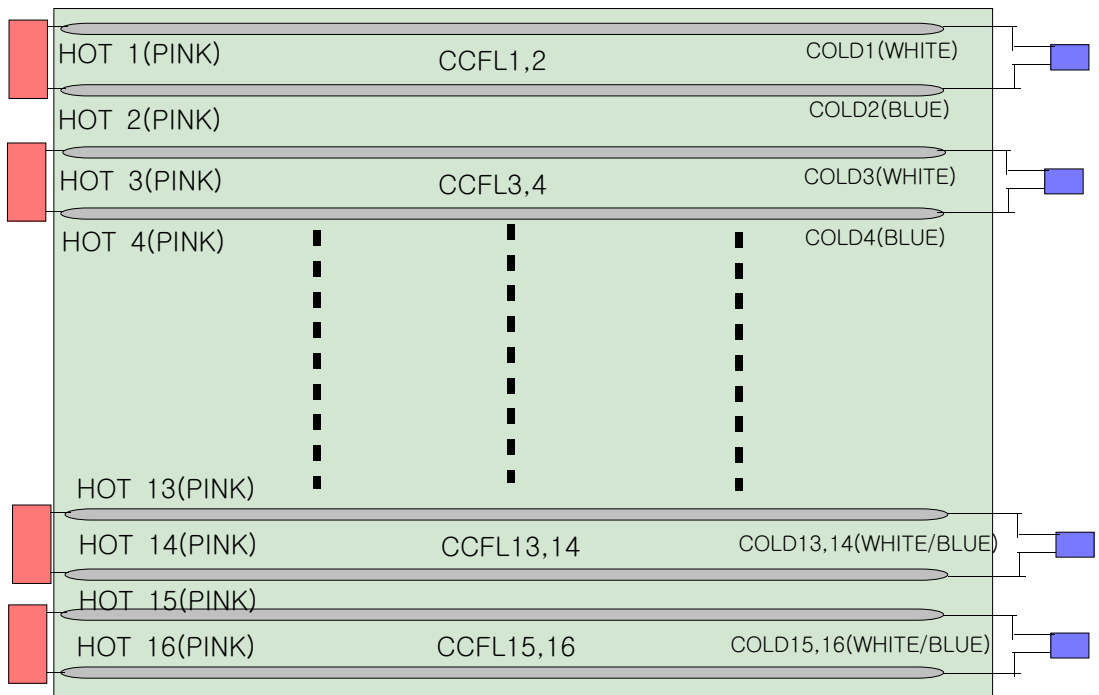
4.1 TFT LCD MODULE



4.2 BACL-LIGHT UNIT

HOT : HIGH VOLTAGE (Part NO. : BHCR-02VS-2 (JST))

COLD : GROUND (Part NO. : C-1612472 (AMP))



5. Input Terminal Pin Assignment

5.1. Input Signal & Power : Connector FI-E30S (JAE)

No	Signal	No	Signal
1	N.C	16	GND
2	N.C	17	Rx3-
3	N.C	18	Rx3+
4	GND	19	GND
5	Rx0-	20	N.C
6	Rx0+	21	LVDS OPTION **
7	GND	22	N.C
8	Rx1-	23	GND
9	Rx1+	24	GND
10	GND	25	GND
11	Rx2-	26	Vdd (+5Vdc)
12	Rx2+	27	Vdd (+5Vdc)
13	GND	28	Vdd (+5Vdc)
14	RxCCLK-	29	Vdd (+5Vdc)
15	RxCCLK+	30	Vdd (+5Vdc)

* NOT CONNECTED : THIS PINS ARE ONLY USED FOR SEC INTERNAL OPERATIONS.

** LVDS OPTION : IF THIS PIN : HIGH (3.3 V) → NORMAL NS LVDS FORMAT

OTHERWISE : LOW (GND) OR OPEN(NC) → JEIDA LVDS FORMAT

Sequence : On = Vdd(T1) ≥ LVDS Option ≥ Interface Signal(T2)

OFF = Interface Signal(T3) ≥ LVDS Option ≥ Vdd

5.2 LVDS Interface

-LVDS Receiver : Tcon (LVDS Rx merged)

-Pixel data (single data)

	LVDS pin	JEIDA -DATA	Normal -DATA
TxOUT/RxIN0	TxIN/RxOUT0	R2	R0
	TxIN/RxOUT1	R3	R1
	TxIN/RxOUT2	R4	R2
	TxIN/RxOUT3	R5	R3
	TxIN/RxOUT4	R6	R4
	TxIN/RxOUT6	R7	R5
	TxIN/RxOUT7	G2	G0
TxOUT/RxIN1	TxIN/RxOUT8	G3	G1
	TxIN/RxOUT9	G4	G2
	TxIN/RxOUT12	G5	G3
	TxIN/RxOUT13	G6	G4
	TxIN/RxOUT14	G7	G5
	TxIN/RxOUT15	B2	B0
	TxIN/RxOUT18	B3	B1
TxOUT/RxIN2	TxIN/RxOUT19	B4	B2
	TxIN/RxOUT20	B5	B3
	TxIN/RxOUT21	B6	B4
	TxIN/RxOUT22	B7	B5
	TxIN/RxOUT24	HSYNC	HSYNC
	TxIN/RxOUT25	VSYNC	VSYNC
	TxIN/RxOUT26	DEN	DEN
TxOUT/RxIN3	TxIN/RxOUT27	R0	R6
	TxIN/RxOUT5	R1	R7
	TxIN/RxOUT10	G0	G6
	TxIN/RxOUT11	G1	G7
	TxIN/RxOUT16	B0	B6
	TxIN/RxOUT17	B1	B7
	TxIN/RxOUT23	RESERVED	RESERVED

5.3 INVERTER UNIT : Inverter input pin configuration

Power INPUT CONNECTOR : S14B-PH-SM3 (JST)

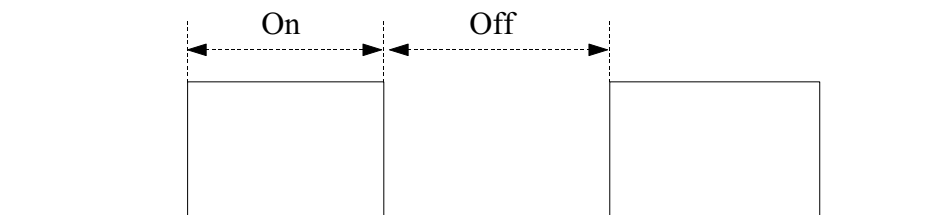
PIN NO.	PIN Configuration (FUNCTION)
1	AWG24 24 V
2	AWG24 24 V
3	AWG24 24 V
4	AWG24 24 V
5	AWG24 24 V
6	AWG24 GND
7	AWG24 GND
8	AWG24 GND
9	AWG24 GND
10	AWG24 GND
11	N.C
12	BACKLIGHT ON ~ OFF / ON:2.4 - 5.0 V, OFF: 0 - 1 V
13	Analog Dimmer / Min : 0V, Max : 3.3V
14	PWM Dimmer

5.4 Inverter specification

	Symbol	Conditon	Min	Typ	Max	Unit	Note
Input Voltage	V _{in}		21.6	24	26.4	V	(1)
Input Current	I _{in}	V _{in} = 24V ADIM:0V,PWM:100%			7	A	
Output Current	I _{omax}	V _{in} =24V, ADIM:3.3V after 30 minutes aging	6.5	7	7.5	mArms	
	I _{omin}	V _{in} =24V, ADIM:0V after 30 minutes aging	3.5	4	4.5		
Lamp Frequency	f _L	V _{in} =24V, PWM:100%	55	60	65	kHz	
Backlight ON/OFF Control	On		2.4	-	5.0	V	
	Off		0	-	0.8		
Open Lamp Voltage	V _{open}	V _{in} =24V, PWM:100%	1840	-	-	V _{rms}	
PWM Dimming Duty	D _{pwm}	V _{in} =24V	20	-	100	%	(2)
PWM Frequency	f _{pwm}	V _{in} =24V	-	180	-	Hz	
PWM Dimmer Volatage	V _{pwm}	High(on)	2.4	-	5.0	V	
		Low(off)	0	-	0.8		
Analog Dimming	A _{DIM}	0V : Min Current 3.3V : Max Current	0	-	3.3	V	(3)

Note(1) Controlled by Analog or PWM dimming

Note(2) High-duty = On/(On+ Off) * 100



Note(3) - Controlled by Analog dimming only

- Analog dimming 0V (Minimum Lamp current)
- Analog dimming 3.3V (Maximum Lamp current)

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	-
	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	-
	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	-
	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	-
	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	-
	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	-
	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	-
	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	-
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 ↑	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	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

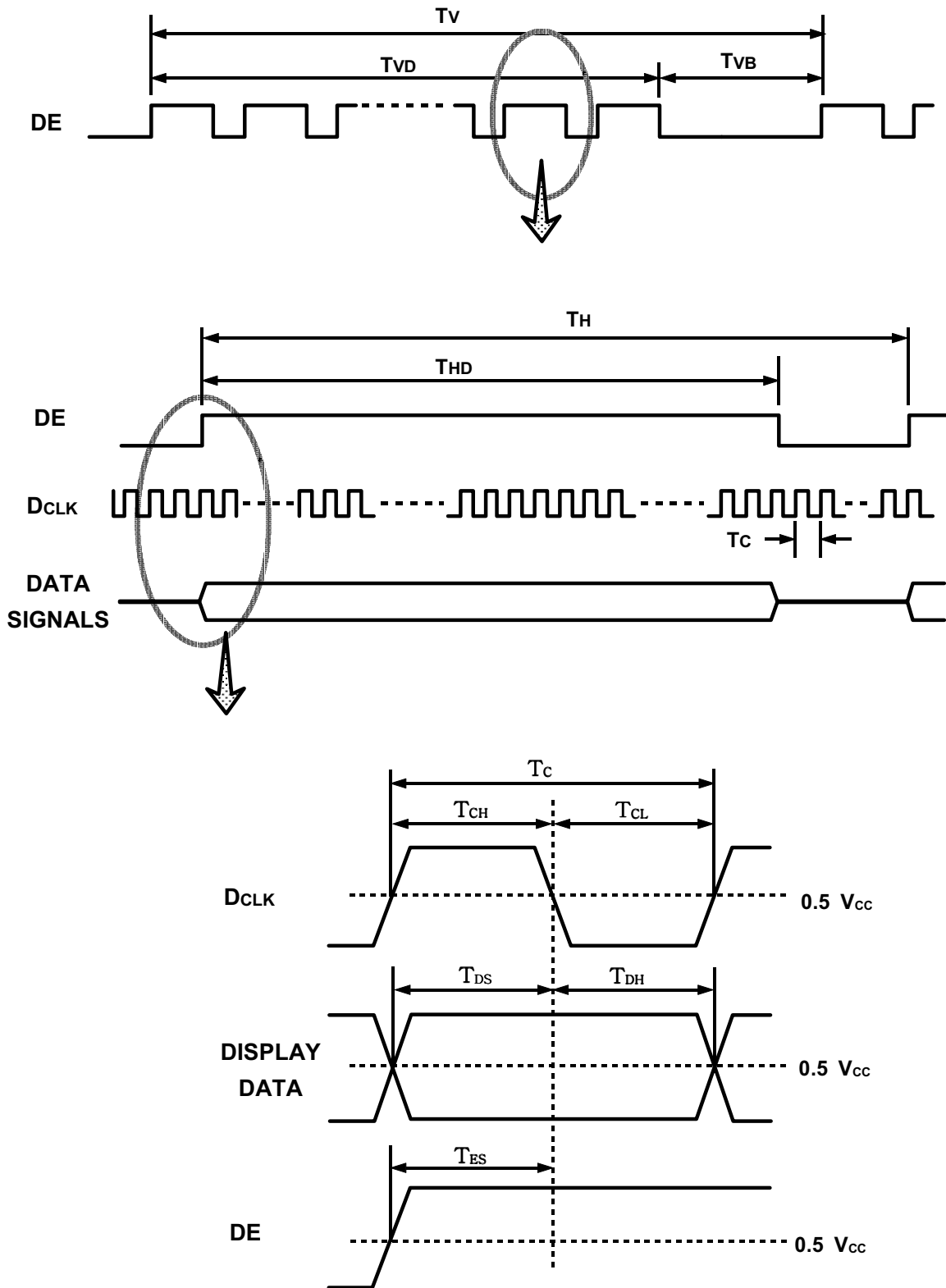
6. Interface Timing

6.1 Timing Parameters (DE only mode)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Clock	Frequency	1/TC	60	80	82	MHz	
Hsync		Fh	43	48	53	KHz	
Vsync		Fv	48	60	66	Hz	
Vertical Active Display Term	Display Period	TVD	-	768	-	lines	
	Vertical Total	TVB	785	810	1200	lines	
Horizontal Active Display Term	Display Period	THD	-	1366	-	clocks	
	Horizontal Total	TH	1420	1648	2040	clocks	

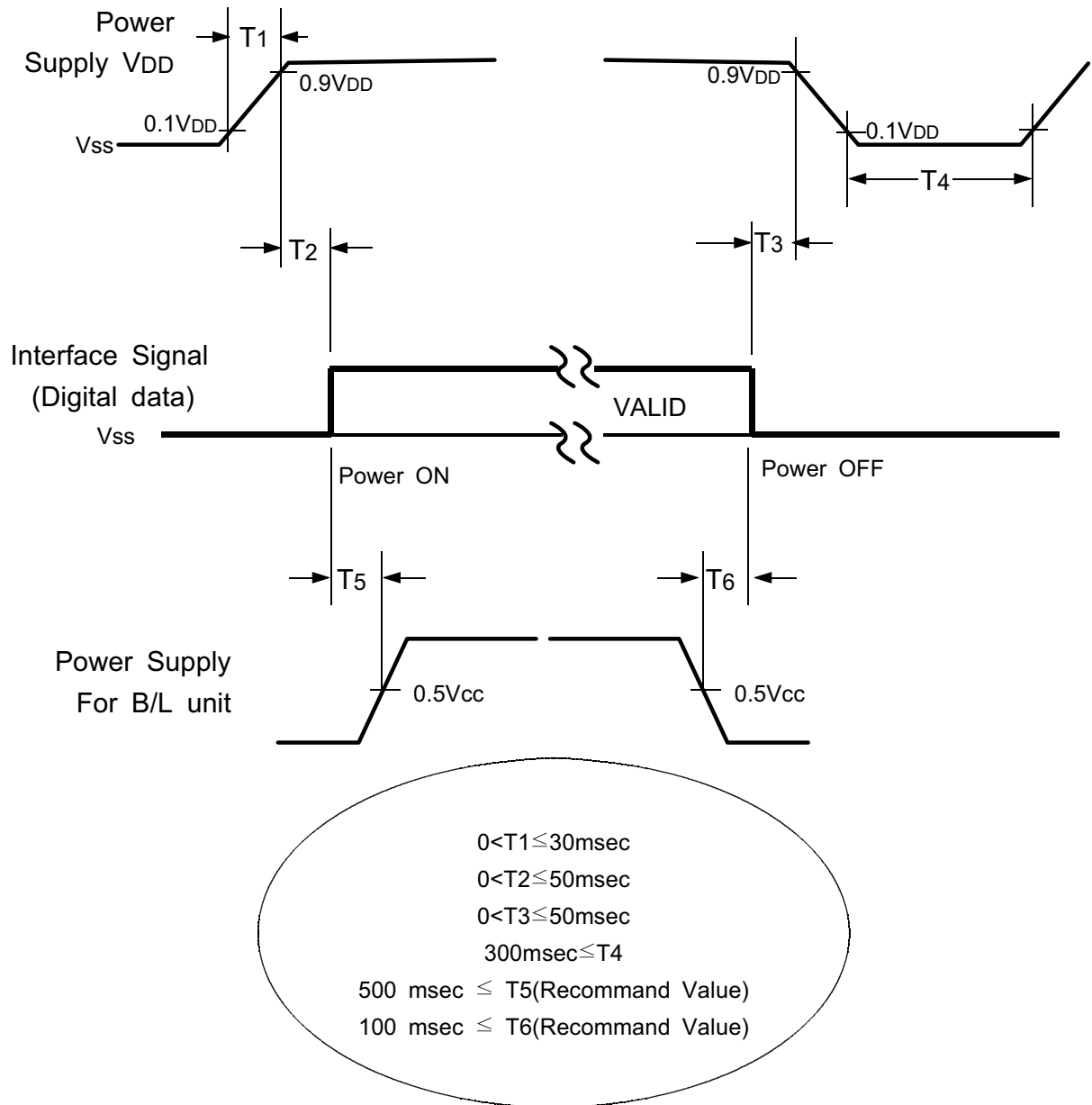
Note) This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

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.



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

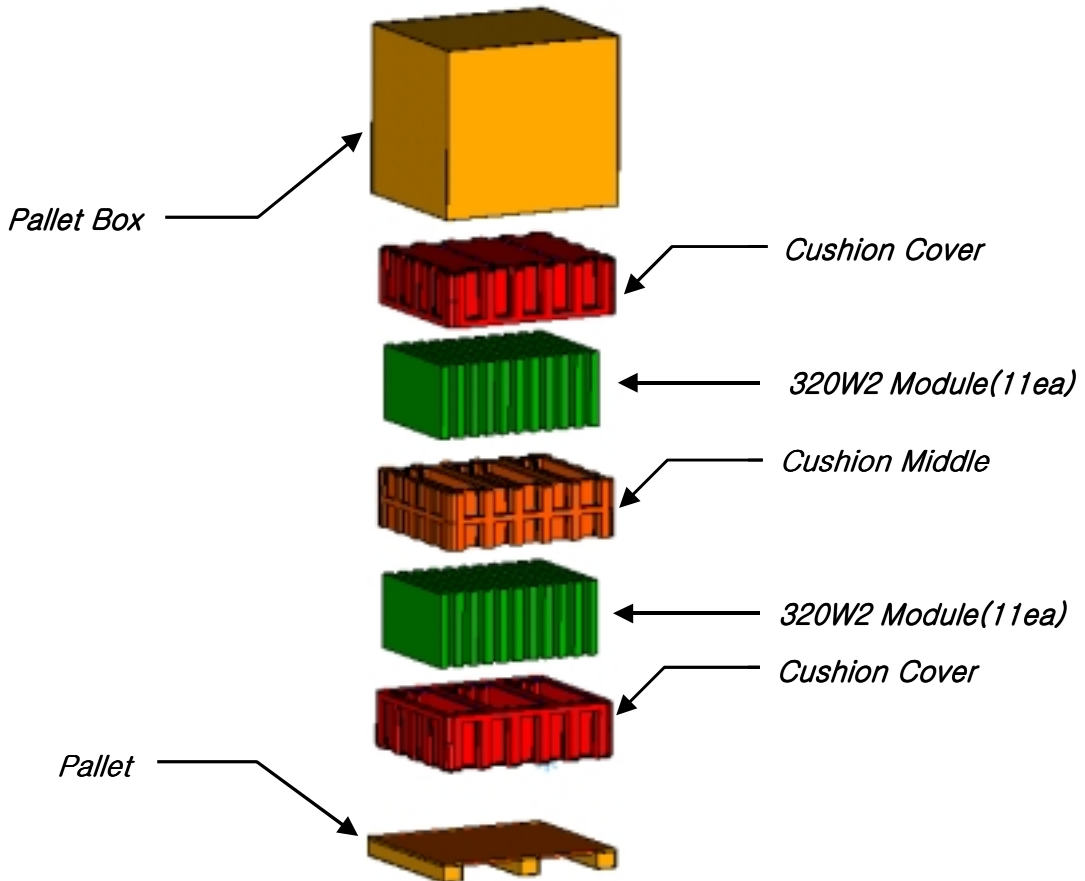
8. PACKING

8.1 CARTON(Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method



8.2 Packing Specification

ITEM	Specification	Remark
LCD Packing	22ea / Box	1. Pallet weight = TBD kg 2. TBDkg / Pallet → TBDkg/ Pallet

9. MARKING & OTHERS

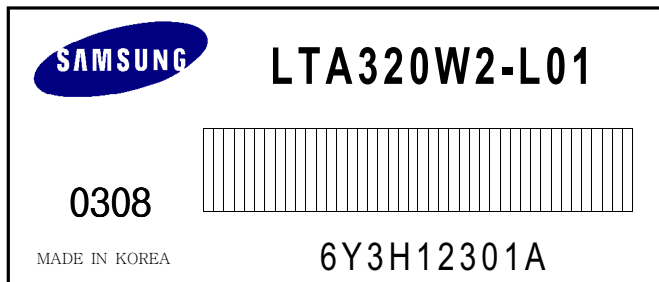
A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

- (1) Parts number : LTA320W2-L01-00R5
- (2) Revision : One letter
- (3) Control : One letter
- (4) Lot number :

6	Y	3	H	123	01	A
1	2	3	4	5	6	7

- ① 6 : Line
- ② Y : Device
- ③ 3 : Year
- ④ H : Month
- ⑤ 123 : LOT NO
- ⑥ 01 : GLASS NO
- ⑦ A : CELL NO

(5) Nameplate Indication



(6) Bar code marking for Customer

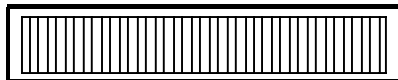
The bar code marking is attached to module backside.

- 1) MODEL NAME : LTA320W2-L01-00R5
- 2) SAMSUNG
- 3) MADE IN KOREA
- 4) PRODUCTION NUMBER
- 5) USER MODEL NAME

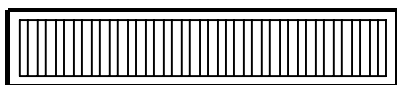
Bar codeshows

a) User model name

LTA320W2-L01-00R5

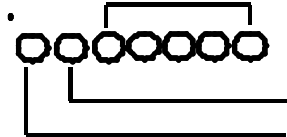


SAMSUNG
MADE IN KOREA



6430008B

SERIAL NO

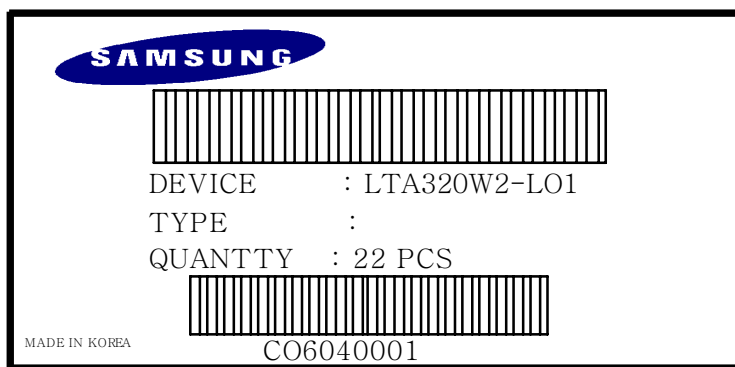


REVISION CODE

PRODUCTION MONTH

PRODUCTION YEAR

(7) Packing box attach



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 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.

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 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.

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 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).

Operation Condition Guide

- (a) LCD product supposed to be operated under circumstance of normal condition. **Normal condition** is defined as below;
 - Temperature : $20 \pm 15^{\circ}\text{C}$
 - Humidity : $65 \pm 20\%$
 - Display pattern : continually changing pattern (Not stationary)
- (b) When the product is used for special application where operates LCD products in a special condition - sever then normal temperature or humidity or operation time or display pattern -that may happen at Airport, Transit Station, Stock market, Bank, and Controlling system Etc, please contact SEC and take application AMLCD engineers advice. Otherwise, it may not be guaranteed its life time and function.

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, 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.