SAMSUNG ELECTRONICS

Product Information

Issued Date : Aug 04, 2005

SAMSUNG TFT-LCD

MODEL NO. : LTA460HS-L02

Note : _____

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

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PREPARED BY : LCD Application Engineering 3, TCS Team

Samsung Electronics Co . , LTD.

wise view™ SAMSUNG TFT-LCD

Contents

Revision History

Date	Revision No.	Page	Summary
Aug.04, 2005	000	All	LTA460HS-L02 Model spec was issued first.

General Description

* Description

LTA460HS-L02 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 46.0" contains 1920 x 1080 pixels and can display up to 16.7 million colors with wide viewing angle of 89° or higher in all directions.

* Features

- High contrast ratio, high aperture structure
- S-PVA(Super Patterned Vertical Align) mode
- Wide viewing angle(±178°)
- High speed response
- WUXGA (1920 x 1080 pixels) resolution (16:9)
- Low Power consumption
- Direct Type 24 CCFTs(Cold Cathode Fluorescent Tube)
- 2 Ch LVDS (Low Voltage Differential Signal) interface. (2pixel/clock)

* Applications

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

* General information

Items	Specification	Unit	Note
Display area	1018.08(H) × 572.67(V)	mm	-
Driver element	a-Si TFT active matrix		-
Display colors	16.7M(8bits-true)	colors	-
Number of pixels	1920 x 1080	pixel	16:9
Pixel pitch	0.53025(H) × 0.53025(V)	mm	R,G,B Vertical Strip = 0.17675(H)
Display mode	Normally Black		-
Surface treatment	Haze 44%, Hard Coating(3H)		Anti-Glare

*** Mechanical information**

Item		Min.	Typ.	Max.	Note
Module size	Horizontal(H)	1082.0	1083.0	1084.0	mm
	Vertical(V)	626.0	627.0	628.0	mm
	Depth(D)	55.5	56.5	57.5	mm
Weight		16,000	17,000	18,000	g

1. Absolute Maximum Ratings

1.1 Absolute ratings of environment

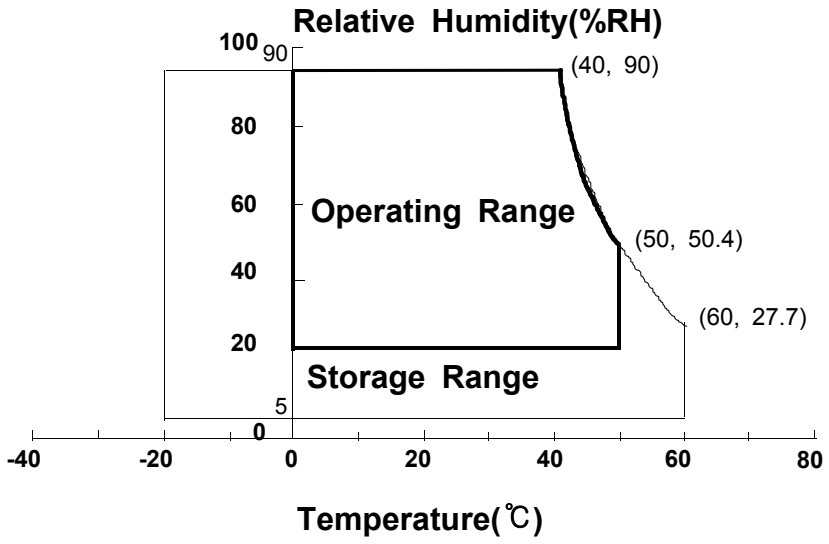
Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-20	60	℃	(1)
Operating temperature	T_{OPR}	0	50	℃	(1)
Shock (non - operating)	Snop	-	50	G	(2),(4)
Vibration (Non - operating)	Vnop	-	1.5	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.
93.8 % 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) 10~300Hz/1.5G (10min/cycle, 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 (Vss = GND = 0 V)

Item		Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	LCD Module	VDD	Vss-0.5	5.5	V	(1)
	Inverter	V_{CC}	TBD	TBD	V	

NOTE (1) Within Ta (25 ± 2 °C)

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 : SR-3, BM-7

* Ta = 25 ± 2°C, V_{DD} = 5V, fv = 60Hz, f_{DCLK} = 74.25 I_L=6.0mA

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R	Normal $\theta_{L,R}$=0 $\theta_{U,D}$=0 Viewing Angle	600	800	-		(3) SR-3
Response Time	Rising	Tr		-	3.5	10	msec	(4),(9) BM-7
	Falling	Tf		-	4.5	10		
Luminance of White (Center of screen)		YL		400	450	-	cd/m^2	(5) SR-3
Color Chromaticity (CIE 1931)	Red	Rx		TYP. -0.03	0.648	TYP. +0.03		(6) SR-3
		Ry			0.333			
	Green	Gx			0.271			
		Gy			0.592			
	Blue	Bx			0.141			
		By			0.066			
	White	Wx			0.280			
		Wy			0.290			
Color Temperature		k		-	10000	-		
Color Gamut		-		-	72	-	%	
Viewing Angle	Hor.	θ_L	C/R≥10	75	89	-	Degrees	(7) SR-3
		θ_R		75	89	-		
	Ver.	θ_U		75	89	-		
		θ_D		75	89	-		
Brightness Uniformity (9 points)		Buni		-	-	25	%	(8) SR-3

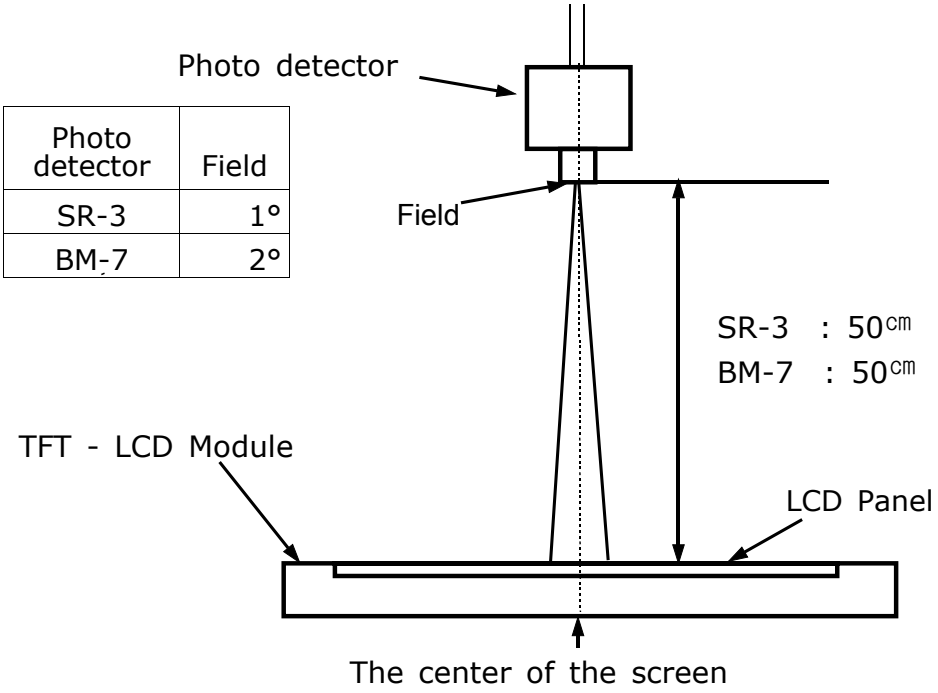
Note 1) Test Equipment Setup

The measurement should be executed in a stable, windless and dark room between 30min and 40min after lighting the back-light at the given temperature for stabilization of the back-light. This should be measured in the center of screen.

A single lamp current : 6.0 mA

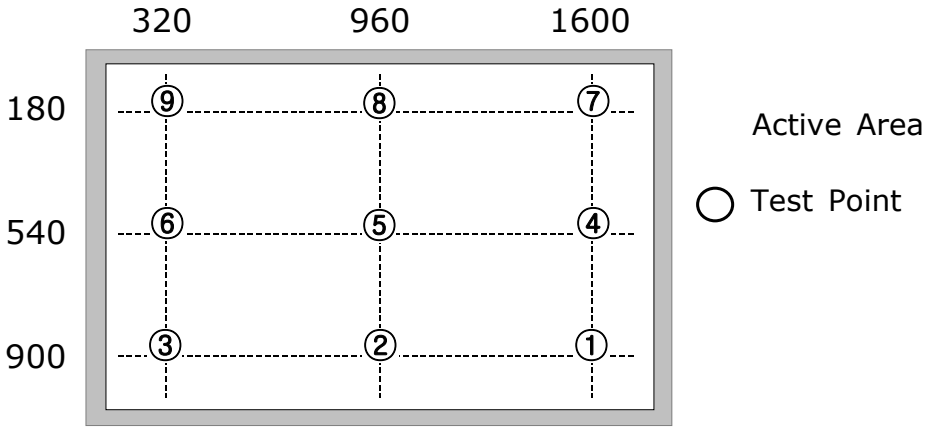
Environment condition : Ta = 25 ± 2 °C

Photo detector	Field
SR-3	1°
BM-7	2°



Optical Measuring Equipment Setup

Note 2) Definition of test point

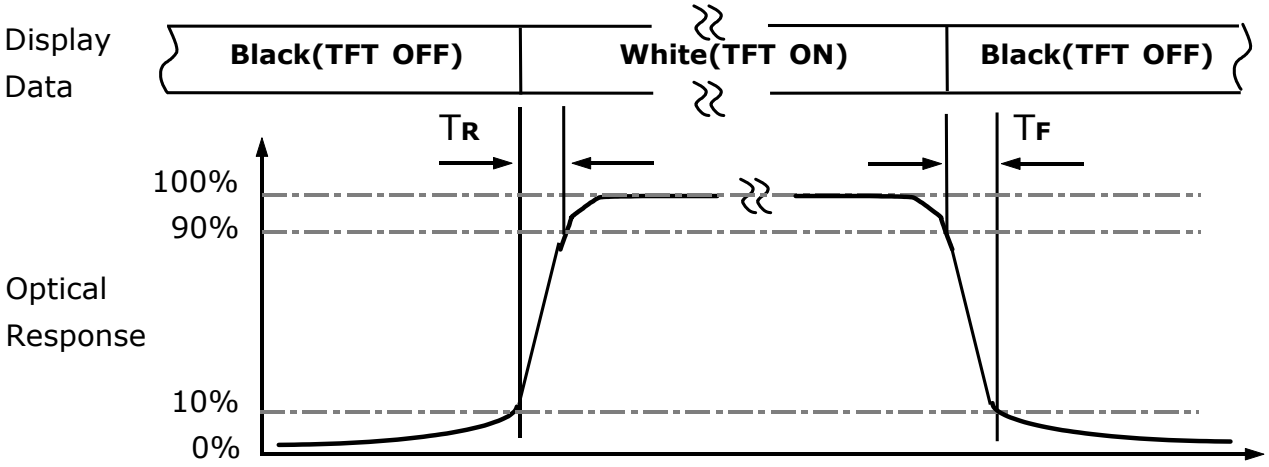


Note 3) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point(5) of the panel

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

Gmax : Luminance with all pixels white
Gmin : Luminance with all pixels black

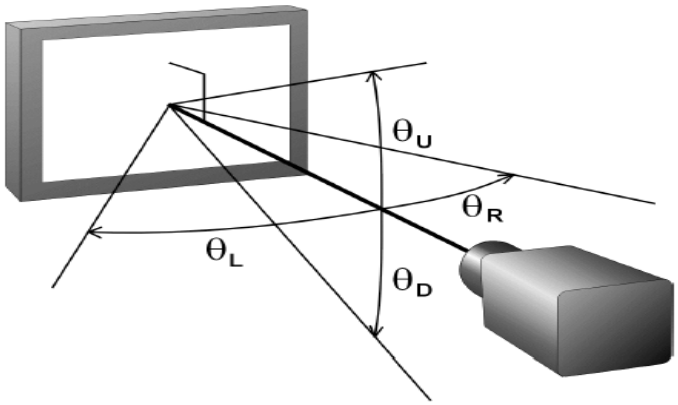
Note 4) Definition of Response time : Sum of T_R ,T_F



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≧10)



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)
Power Consumption	(a)Black	I_{DD}	-	2300	2600	mA	(2),(3)
	(b)White		-	2750	3200	mA	
	(c)N-Pattern		-	3600	4500	mA	
Vsync Frequency		f_V	-	60	-	Hz	
Hsync Frequency		f_H	65.5	67.5	69.5	kHz	
Main Frequency		f_{DCLK}	65.5	74.25	83.4	MHz	
Rush Current		I_{RUSH}	-	TBD	-	A	(4)

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

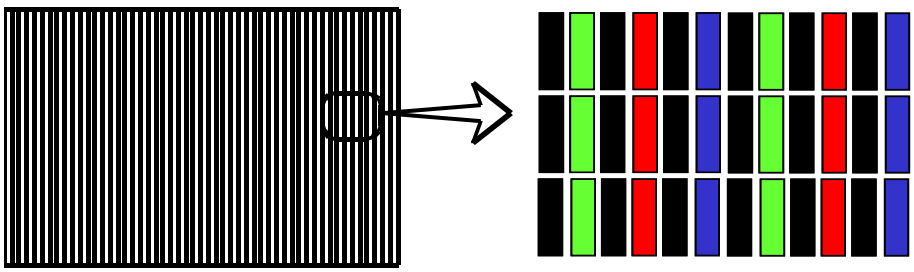
(2) f_V=60Hz, f_{DCLK} =74.25MHz, V_{DD} = 5.0V, DC Current.

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

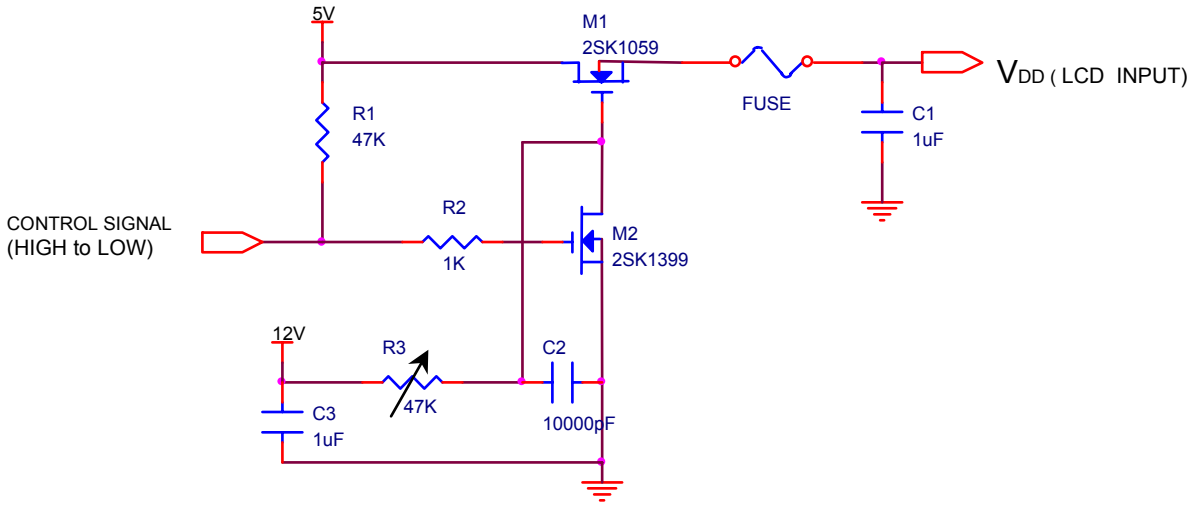
(a) Black Pattern

(b) White Pattern

(C) N-pattern



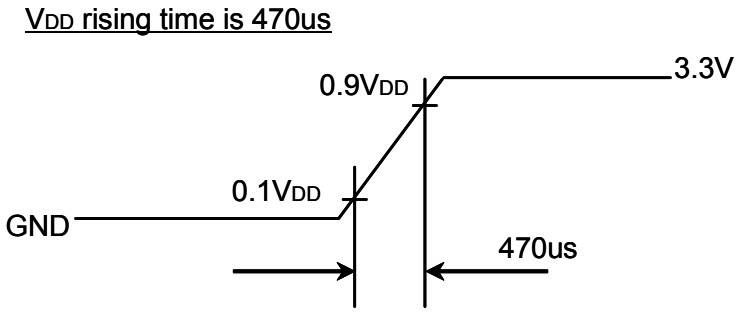
(4) Measurement Conditions



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.



3.2 BACK-LIGHT UNIT

The back-light system contains 24 direct-lighting type CCFTs (Cold Cathode Fluorescent Tube). Life time (Hr) of a lamp, 50,000 hours, is defined as the time in which it continues to operate under the condition of Ta = 25±2°C and typical luminance for a lamp until the brightness becomes 50% or lower than it's original value.

Parameter	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Lamp Current	I_L	4.0	6.0	7.0	mArms	**(1)**
Lamp Voltage	V_L	1700	1780	1870	Vrms	**(1)**
Lamp Frequency	f_L	30	40	100	kHz	**(2)**
Operating Life Time	Hr	50,000	-	-	Hour	**(3)**
Start Up Voltage	Vs	-	-	0℃:2830 25℃:2175	Vrms	**(4)**

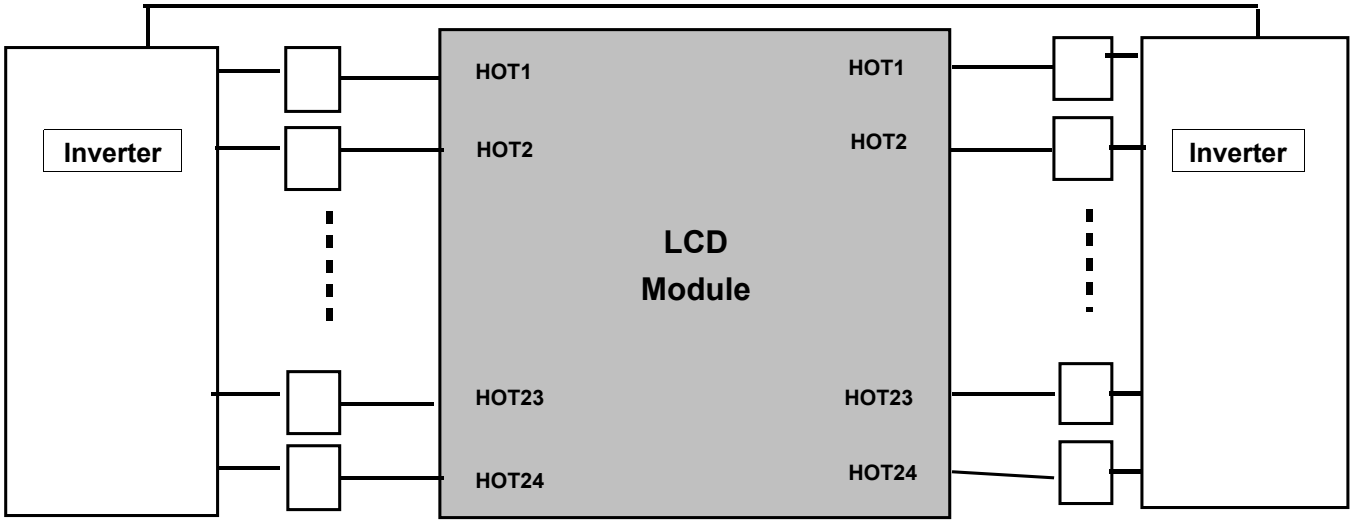
Note) The waveform of the inverter output voltage must be area symmetric and the design of the inverter must have specifications for the modularized lamp. Specified values are for a single lamp.

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.



(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 = 7.0 mArms(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.

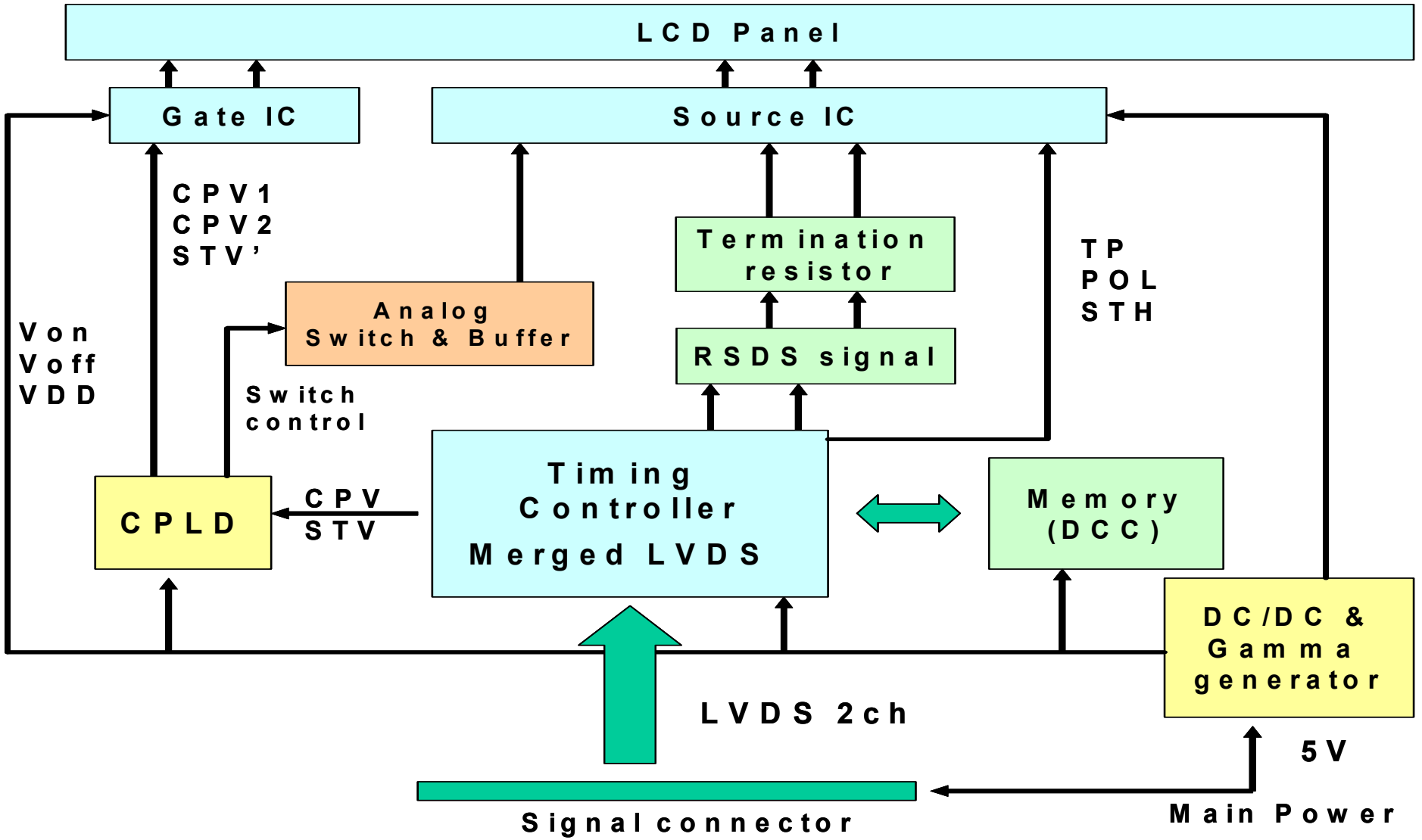
3.3 Inverter Input Condition & Specification

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	Vin	-	21.6	24	26.4	V	Ta=25℃
Input Current	Iin	Vin=24.0V, Vdim=3.3 V	8.19	9.1	10.01	Adc	After 120 min Warm-up @ Vin=24V (1)
Lamp Current	Io,max	Vdim=3.3 V	5.5	6.0	6.5	mArms	
	Io,min	Vdim= 0 V		PWM duty : 30%			
Frequency	FL	Vin=24 V Adim=3.3V	47.5	50	52.5	kHz	
Backlight On/Off	ON	Vin=24	2.4	-	5.25	V	
	OFF	Vin=24	0	-	0.8		
Dimming Control	Max Lum	Vdim	-	3.3	-	V	DC input
	Min. Lum	Vdim	-	0	-		

Note (1) Power Consumption is measured when 450[cd/m^2] of luminance which is the typ. luminance. Max Value of the Power Consumption is measured at initial turn on of the backlight.

4. Block Diagram

4.1 TFT LCD MODULE



5. Input Terminal Pin Assignment

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

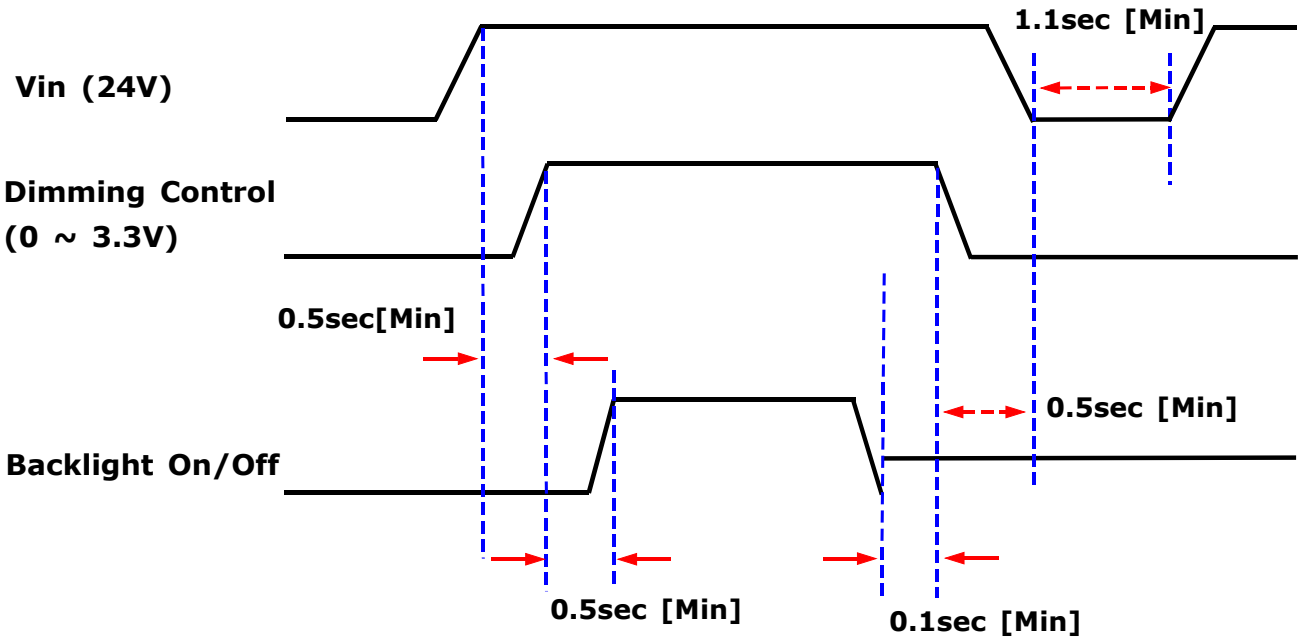
No	Signal	No	Signal
1	RxInO0-	16	RxInE2+
2	RxInO0+	17	RxInECLK-
3	RxInO1-	18	RxInECLK+
4	RxInO1+	19	RxInE3-
5	RxInO2-	20	RxInE3+
6	RxInO2+	21	GND
7	RxInOCLK-	22	GND
8	RxInOCLK+	23	GND
9	RxInO3-	24	GND
10	RxInO3+	25	GND
11	RxInE0-	26	V_{DD}(=+5[V])
12	RxInE0+	27	V_{DD}(=+5[V])
13	RxInE1-	28	V_{DD}(=+5[V])
14	RxInE1+	29	V_{DD}(=+5[V])
15	RxInE2-	30	V_{DD}(=+5[V])

5.2. Inverter Input Pin Configuration

Connector : 20022WR-14(L)(Yeonho)

Pin No.	Pin Configuration(FUNCTION)
1	24 V
2	24 V
3	24 V
4	24 V
5	24 V
6	GND
7	GND
8	GND
9	GND
10	GND
11	ERROR DETECTION (NORMAL : GND / ABNORMAL : FLOATING)
12	Backlight On /Off
13	Analog Dimming Control
14	Do not connect*

5.3 Inverter Input Power Sequence



5.4 LVDS Interface

- LVDS Receiver : Tcon (merged)
- JEIDA & Normal Data Format

LVDS Transmitter (ex : ***DS90C385***) Signal Interface					
Device Input Pin	Device Input Signal		Output Signal	To LTA460H2 Interface	
Symbol	Symbol	Function		Terminal	Symbol
TXIN0	R0	Red Pixel Data (LSB)	TXOUT0- TXOUT0+	No. 1,11 No. 2,12	RX0- RX0+
TXIN1	R1	Red Pixel Data			
TXIN2	R2	Red Pixel Data			
TXIN3	R3	Red Pixel Data			
TXIN4	R4	Red Pixel Data			
TXIN5	R7	Red Pixel Data (MSB)	TXOUT3- TXOUT3+	No. 9,19 No. 10,20	RX3- RX3+
TXIN6	R5	Red Pixel Data	TXOUT0- TXOUT0+	No. 1,11 No. 2,12	RX0- RX0+
TXIN7	G0	Green Pixel Data (LSB)			
TXIN8	G1	Green Pixel Data	TXOUT1- TXOUT1+	No. 3, 13 No. 4, 14	RX1- RX1+
TXIN9	G2	Green Pixel Data			
TXIN10	G6	Green Pixel Data	TXOUT3- TXOUT3+	No. 9,19 No. 10,20	RX3- RX3+
TXIN11	G7	Green Pixel Data (MSB)			
TXIN12	G3	Green Pixel Data	TXOUT1- TXOUT1+	No. 3, 13 No. 4, 14	RX1- RX1+
TXIN13	G4	Green Pixel Data			
TXIN14	G5	Green Pixel Data			
TXIN15	B0	Blue Pixel Data (LSB)			
TXIN16	B6	Blue Pixel Data	TXOUT3- TXOUT3+	No. 9,19 No. 10,20	RX3- RX3+
TXIN17	B7	Blue Pixel Data (MSB)			
TXIN18	B1	Blue Pixel Data	TXOUT1- TXOUT1+	No. 3, 13 No. 4, 14	RX1- RX1+
TXIN19	B2	Blue Pixel Data	TXOUT2- TXOUT2+	No. 5, 15 No. 6, 16	RX2- RX2+
TXIN20	B3	Blue Pixel Data			
TXIN21	B4	Blue Pixel Data			
TXIN22	B5	Blue Pixel Data			
TXIN24	Hsync	Horizontal Sync (Don't care)			
TXIN25	Vsync	Vertical Sync (Don't care)			
TXIN26	DE	Data Enable (Mandatory)			
TXIN27	R6	Red Pixel Data	TXOUT3- TXOUT3+	No. 9,19 No. 10,20	RX3- RX3+

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	-
	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

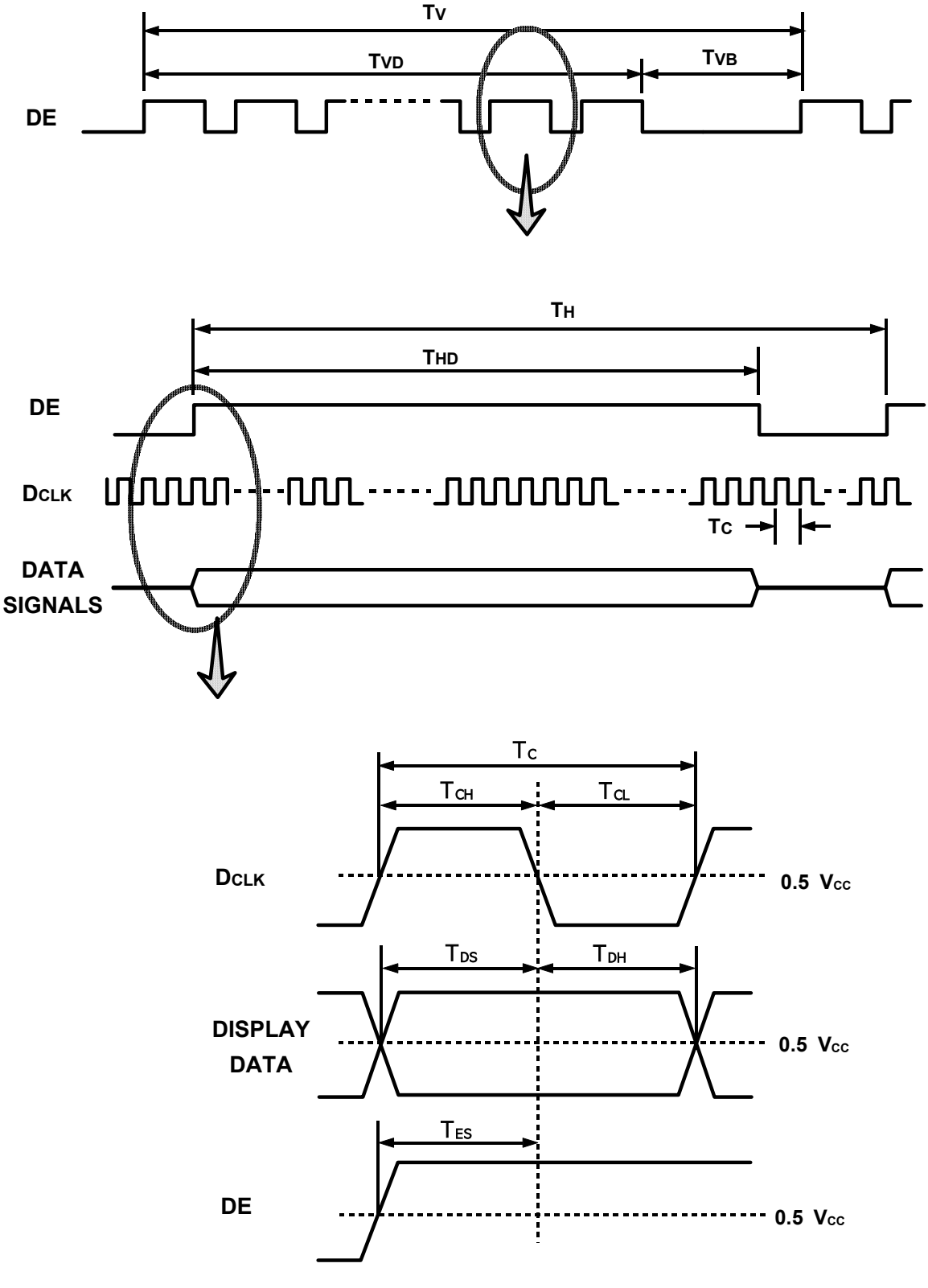
6. Interface Timing

6.1 Timing Parameters (DE only mode)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Clock	Frequency	1/Tc	65.5	74.25	83.4	MHz	-
Hsync		Fh	65.5	67.5	69.5	KHz	-
Vsync		Fv	-	60	-	Hz	-
Vertical Active Disply Term	Display Period	TVD	-	1080	-	lines	-
	Vertical Total	TVB	1092	1125	1158	lines	-
Horizontal Active Display Term	Display Period	THD	-	1920	-	clocks	-
	Horizontal Total	TH	2000	2200	2400	clocks	-

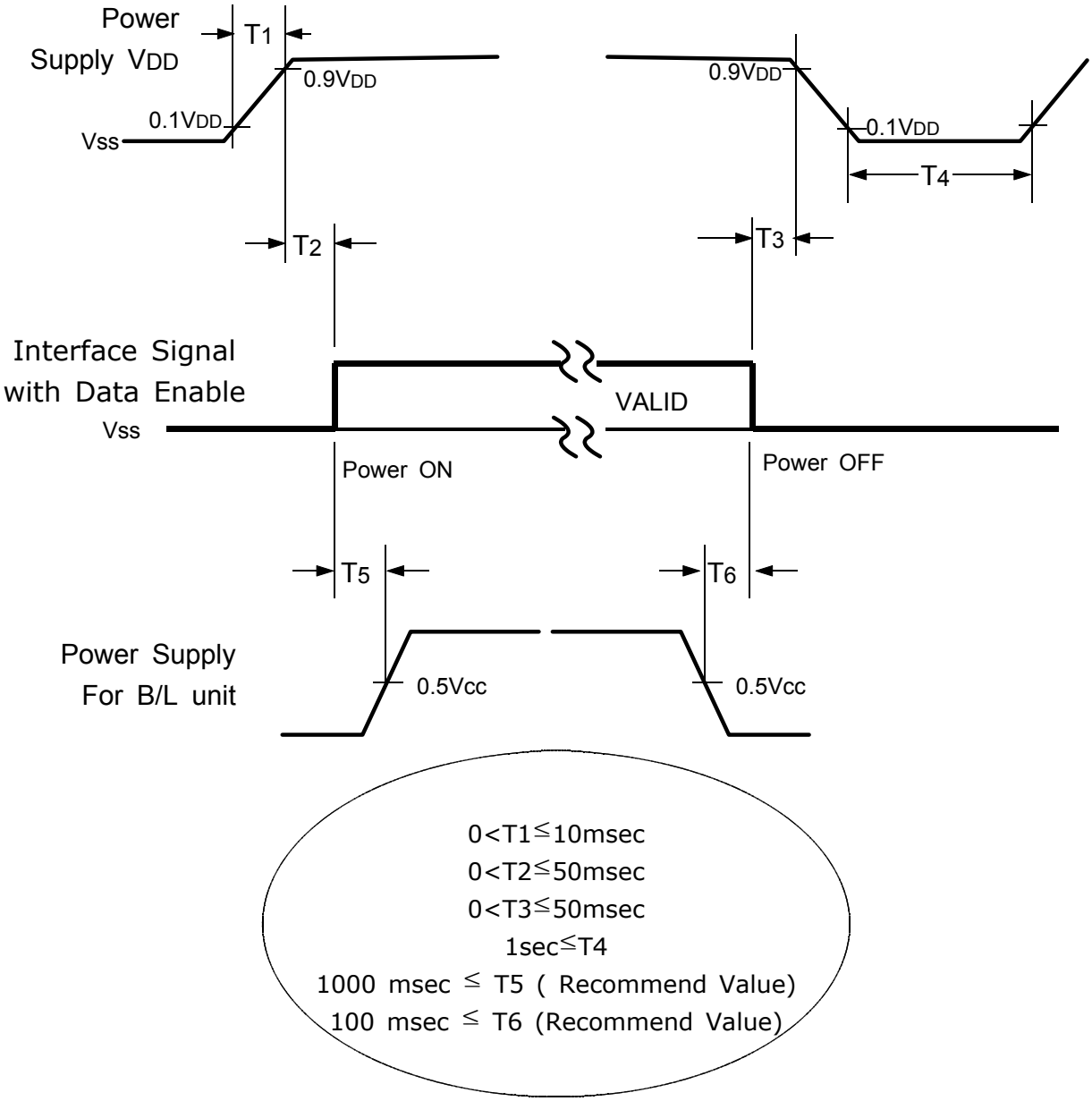
Note) This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

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.

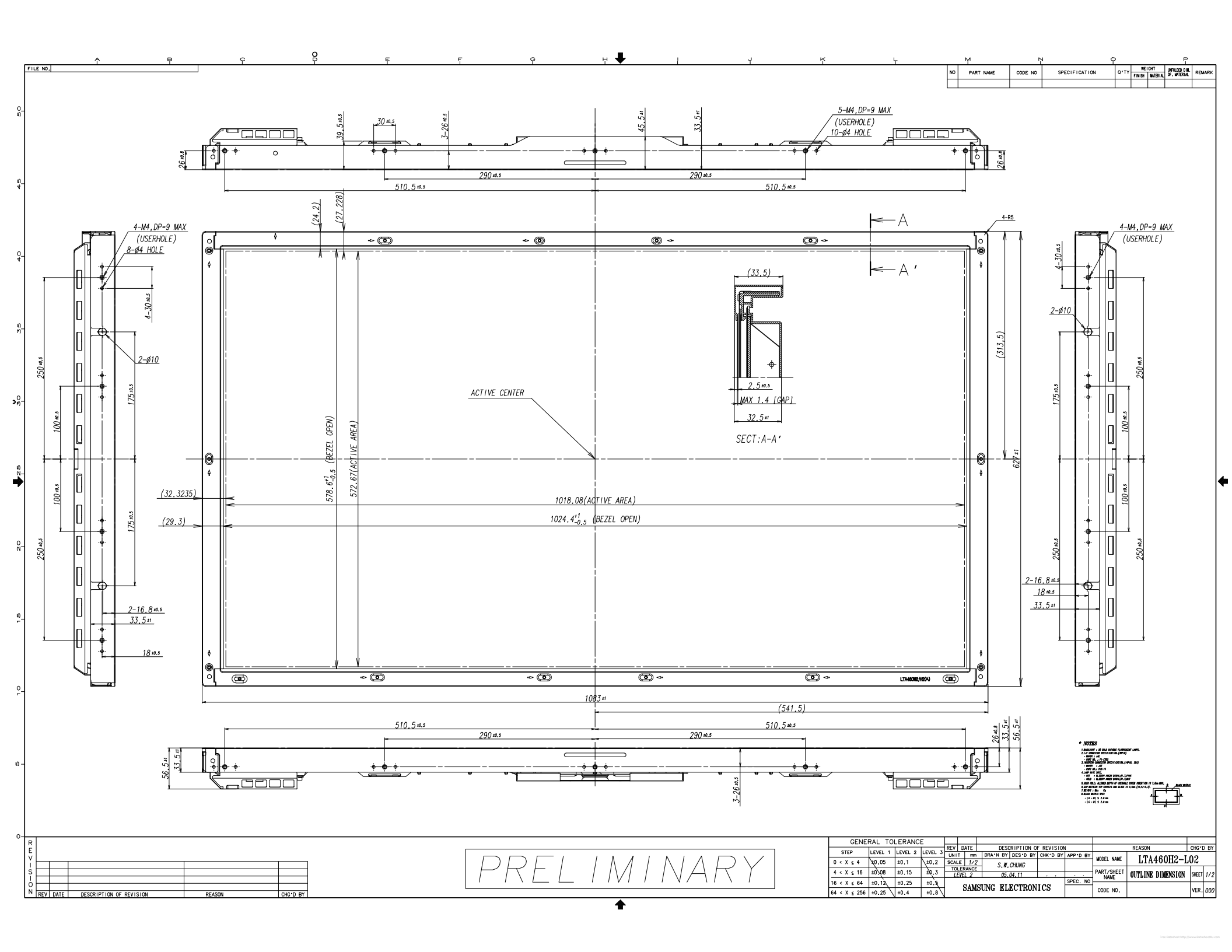
(1) The supply voltage of the external system for the module input should be the same as the definition of VDD.

(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 trns 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.



PRELIMINARY

REVISION	REV	DATE	DESCRIPTION OF REVISION	REASON	CHG'D BY

GENERAL TOLERANCE			
STEP	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 4	±0.05	±0.1	±0.2
4 < X ≤ 16	±0.08	±0.15	±0.3
16 < X ≤ 64	±0.12	±0.25	±0.5
64 < X ≤ 256	±0.25	±0.4	±0.8

REV	DATE	DESCRIPTION OF REVISION	CHG'D BY

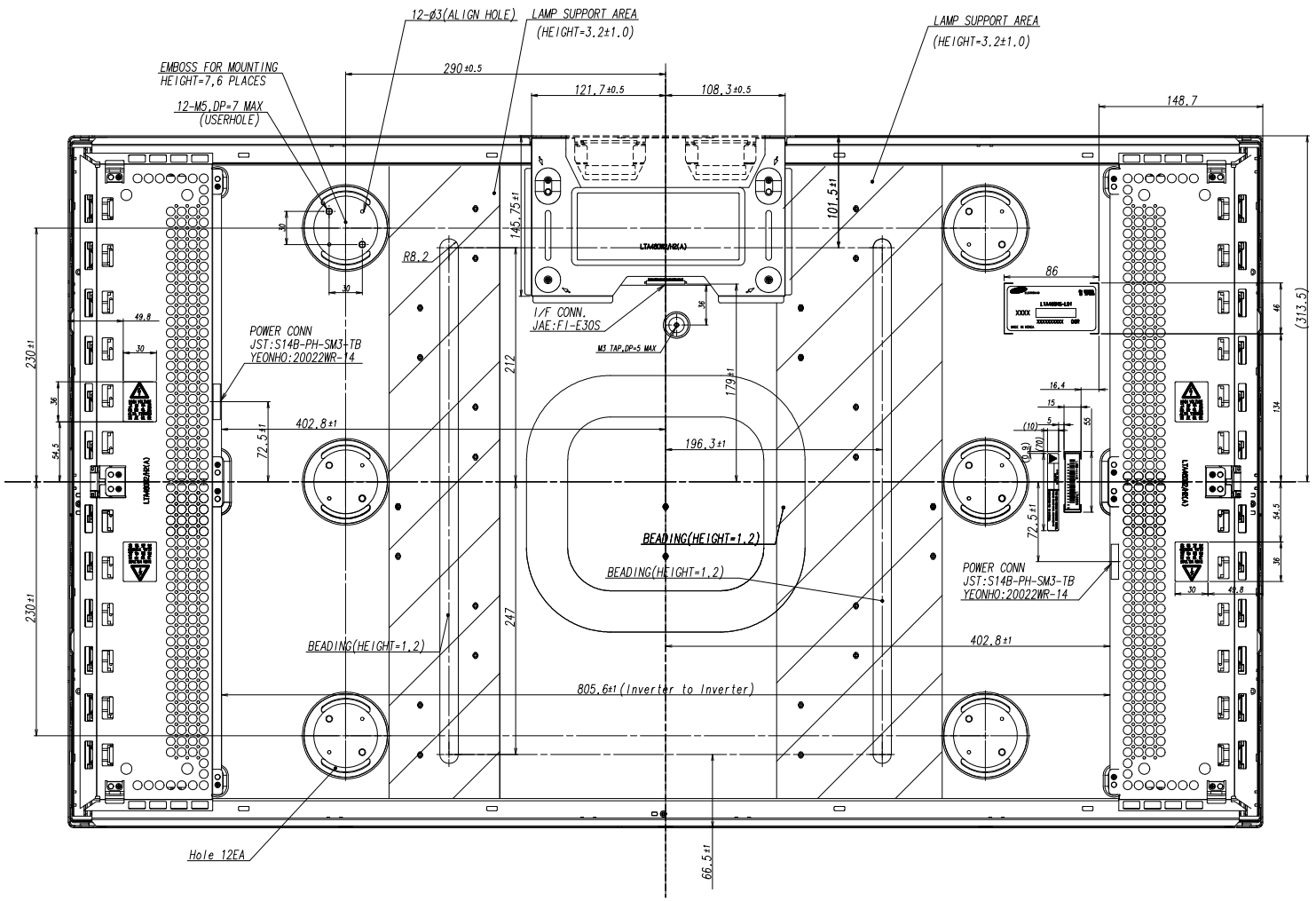
UNIT	mm	DRA'N BY	DES'D BY	CHK'D BY	APP'D BY
SCALE	1/2	S.W.CHUNG			
TOLERANCE LEVEL 2		05.04.11			

SAMSUNG ELECTRONICS

REASON	CHG'D BY
MODEL NAME	LTA460H2-L02
PART/SHEET NAME	OUTLINE DIMENSION
SHEET	1/2
CODE NO.	VER. 000

FILE NO.

NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	WEIGHT FINISH	WEIGHT MATERIAL	UNFOLDED DIM. OF. MATERIAL	REMARK



REVISION

LTA460H2-L02

PRELIMINARY

GENERAL TOLERANCE			
STEP	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 4	±0.05	±0.1	±0.2
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REV	DATE	DESCRIPTION OF REVISION				REASON	CHG'D BY

UNIT	mm	DRA'N BY	DES'D BY	CHK'D BY	APP'D BY
SCALE	1/2	S.W.CHUNG			
TOLERANCE LEVEL 2		05.04.11	. .	. .	. . .

SPEC. NO

SAMSUNG ELECTRONICS

MODEL NAME	LTA460H2-L02
PART/SHEET NAME	OUTLINE DIMENSION
SHEET	2/2
CODE NO.	
VER.	000

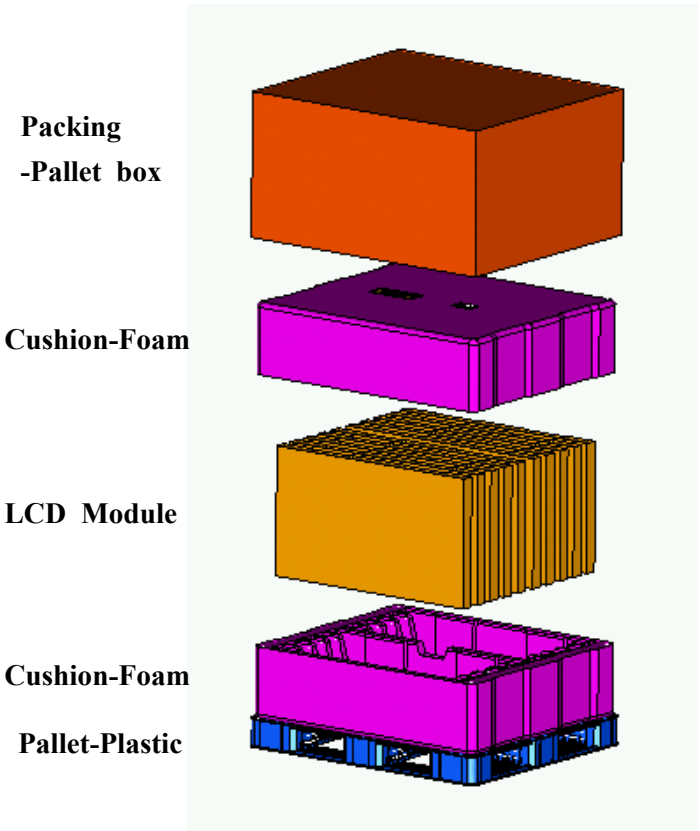
8. PACKING

8.1 Carton

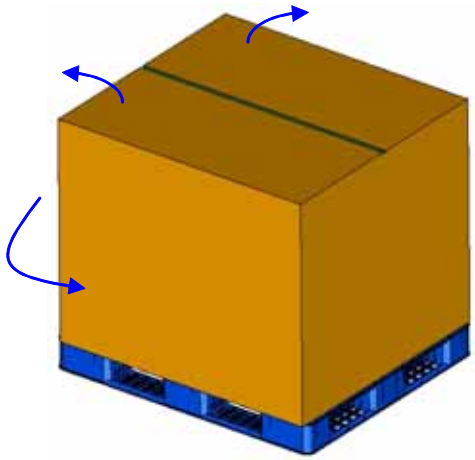
1) Packing Form

Corrugated fiberboard box and EPS cushion as shock absorber

2) Packing Method



→ Direction be able to open it



8.2 Packing Specification

ITEM	Specification	Remark
LCD Packing	10ea / Box (Packing-Pallet Box)	1. 170 Kg / LCD (10ea) 2. 10 Kg / Cushion-Foam (2ea) 3. 8 Kg / Packing-Pallet Box (1ea) 4. Cushion-Foam Material : EPS 5. Packing-Pallet Box Material : DW4
Pallet-Plastic	1Box / Pallet (PE,W1150,L985,H125, BLUE)	1. Pallet weight = 8.8kg 2. 8.8 Kg / Pallet
Packing Direction	Vertical	-
Pallet size	H x V x height	1270mm(H) x 1150mm(V) x 844mm(height)
Pallet weight	197kg	Pallet (8.8kg) + Cushion-Foam (10kg) + Module (170kg) + Packing-Pallet Box (8kg)

10. MARKING & OTHERS

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

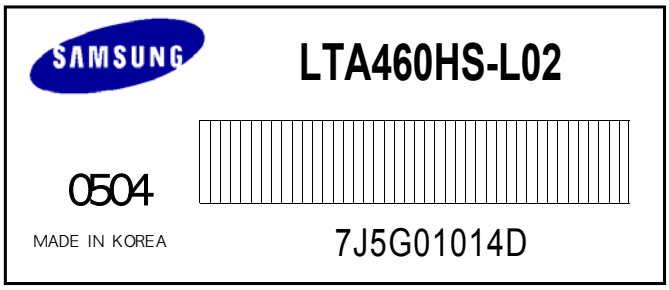
(1) Parts number : LTA460HS-L02-XXXX
1 2 3 4 5 6 7 8 9

① LTA : AV model
② 460 : Panel Size
③ H : WXGA
④ S : Generation
⑤ L : LVDS
⑥ 02 : Derivation No.
⑦ X : Customer Code
⑧ XX : Revision No.
⑨ X : Line

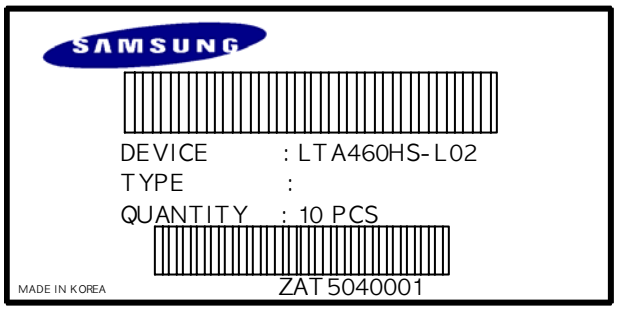
(2) Lot number : 7 J 5 G 010 14 D
1 2 3 4 5 6 7

① 7 : Line
② J : Device
③ 5 : Year
④ G : Month
⑤ 010 : LOT No.
⑥ 14 : GLASS No.
⑦ D : CELL No.

(3) Nameplate Indication



(4) Packing Pallet Label



Z A T 5 0 4 0 0 0 1
1 2 3 4 5 6

① Z : PALLET
② A : LINE
③ T : CITE CODE
④ 5 : YEAR
⑤ 04 : WEEK
⑥ 0001 : SERIAL No.

10. General Precautions

10.1 Handling

(a) When the module is assembled into a system, it should be attached firmly using all 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 CCFL back-light.

(c) Note that polarizers are very fragile and can 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 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 may cause permanent polarizer damage due to the chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes and mouth. In case of contact with skin or clothes, thoroughly wash it away with soap and water.

(h) Protect the module from static electricity. It may cause damage to the C-MOS Gate Array IC.

(i) Use finger-stalls with soft gloves to keep display clean during the incoming inspection and the assembly process.

(j) Do not disassemble the module.

(k) Do not pull or fold the lamp wire.

(l) Do not adjust the variable resistor located on the back side.

(m) I/F connector pins should not be touched directly with bare hands.

10.2 Storage

(a) Do not expose the module in high temperature, and/or high humidity for a long time. It is highly recommended to store the module within the temperature from 0 to 35°C and relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight. The module shall be stored in a dark place. Prolonged exposure to sunlight or fluorescent light during the storage will damage the module.

10.3 Operation

(a) Do not connect or disconnect the module in the "Power On" condition.

(b) Power supply should always be turned on/off by following item 6.3 " Power on/off sequence ".

(c) The 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 should be at the minimum length possible to be connected directly. The longer cable between the back-light and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).

10.4 Operation Condition Guide

(a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
- Temperature : 20±15℃
- Humidity : 65±20%
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc.., It is strongly recommended to contact SEC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

10.5 Others

(a) Use Ultra-violet light filters if outdoor operation is necessary.

(b) Avoid water condensation. Moisture may penetrate sensitive electrical connections resulting in improper operation.

(c) Do not exceed the absolute maximum rating values. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, etc..) Otherwise, the module may be damaged.

(d) If the module displays the same pattern continuously for a long period of time, it can result in the situation where the image "sticks" (remains) on the screen. We recommend that you should discuss SEC when you want the module to be operated in displaying the same pattern for a long time.

(e) The module has sensitive PCB circuitry on the back side and should be handled carefully in order prevent stress and possible failure.