



ELECTRONICS

Samsung Secret

Product Information

DATE : 31. Jan. 2011**SAMSUNG TFT-LCD****MODEL : LTA320AP24**

The Information Described in this Specification is Preliminary and can be changed without prior notice

APPROVAED BY	DATE	PREPARED BY	DATE
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LCD Business**Samsung Electronics Co . , LTD.**

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**Samsung Secret***** Revision History**

Date	Rev. No	Page	Summary
Jan 31, 2010	000	all	First issued

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General Description

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Description

LTA320AP24 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 32.0" is 1366 * 768 and this model can display up to 16.7 Million colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV and High Definition TV.

Features

- RoHS compliance (Pb-free)
- High contrast & aperture ratio with wide color gamut
- PVA (Patterned Vertical Align) mode
- Wide viewing angle ($\pm 178^\circ$)
- High speed response
- Wide XGA resolution (16:9)
- Low Power consumption
- wLED B/L unit
- DE (Data Enable) mode
- 1Ch-LVDS (Low Voltage Differential Signaling) interface (1pixel/clock)

General Information

Items	Specification	Unit	Note
Module Size	734.4(H _{TYP}) × 430.3(V _{TYP})	mm	±1.0mm
	12.8 (D _{MAX})		
Weight	6500 (Max.)	g	
Pixel Pitch	0.51075 (H) × 0.51075 (V)	mm	
Active Display Area	697.6845 (H) × 392.256 (V)	mm	
Surface Treatment	Haze 2.2%, Hard-Coating (2H)	-	
Display Colors	16.7M (8 Bits-True)	Colors	
Number of Pixels	1,366 × 768	Pixel	
Pixel Arrangement	RGB vertical stripe	-	
Display Mode	Normally Black	-	
Luminance of White	380 (Typ.)	cd/m ²	

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1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	GND-0.5	13.2	V	(1)
Storage temperature	T_{STG}	-20	60	°C	(2)
Surface temperature	T_{SUR}	0	60	°C	(3)
Operation temperature	T_{OPR}	0	50	°C	(2)
Shock (non - operating)	S_{nop}	-	50	G	(4)
Vibration (non - operating)	V_{nop}	-	1.5	G	(5)

Note (1) $T_a = 25 \pm 2$ °C

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

a. 90 % RH Max. ($T_a \leq 39$ °C)

b. Relative Humidity is 90% or less. ($T_a > 39$ °C)

c. No condensation

(3) Although abnormal visual problems can be occurred in T_{sur} range, the polarizer is not damaged in this range.

(4) 11ms, sine wave, one time for $\pm X$, $\pm Y$, $\pm Z$ axis

(5) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

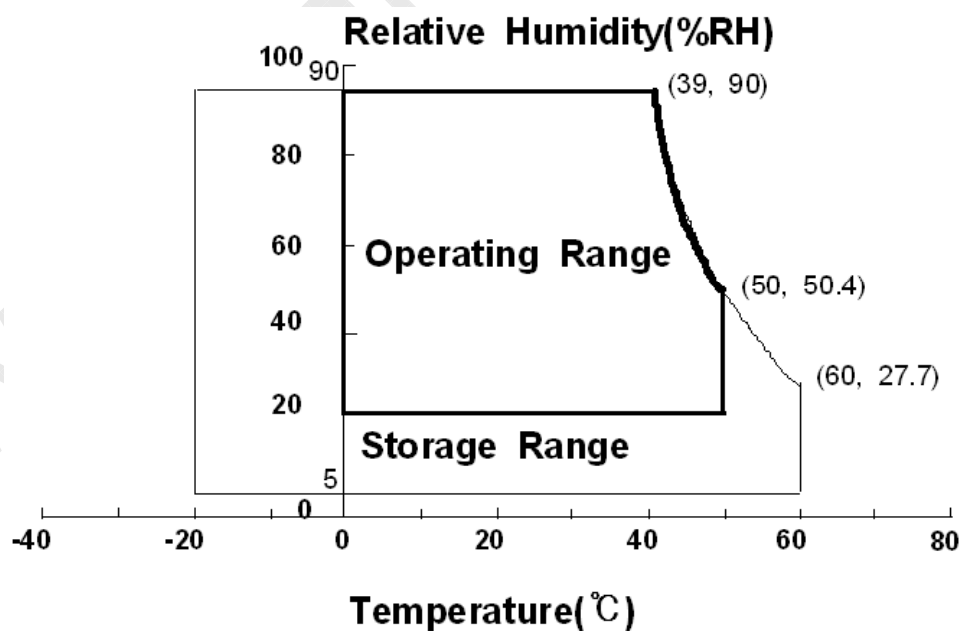


Fig. Temperature and Relative humidity range

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2. Optical Characteristics

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The optical characteristics should be measured in a dark room or equivalent.

Measuring equipment : TOPCON RD-80S, TOPCON SR-3 ,ELDIM EZ-Contrast

(Ta = 25 ± 2 °C, VDD=12.0V, fv= 60Hz, f_{DCLK}=75 MHz, LED bar Current = 130 mA)

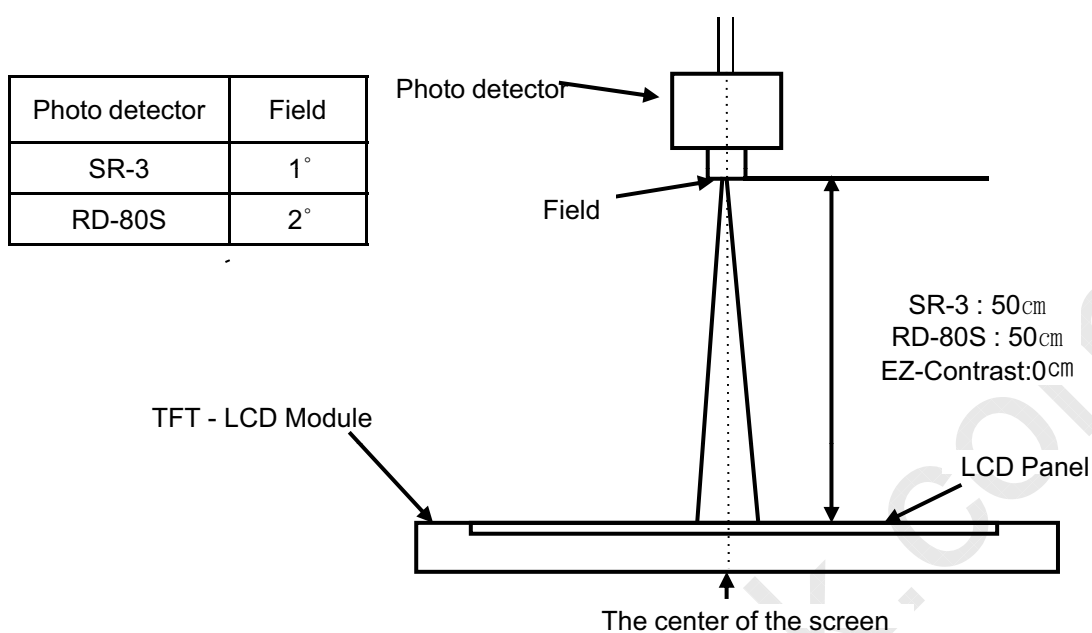
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R		3000	5000	-		(1) SR-3
Response Time	G-to-G	Tg	Normal q _{L,R} =0 q _{U,D} =0 Viewing Angle	-	20	-	msec	(3) RD-80S
Luminance of White (Center of screen)		Y _L		350	380	-	cd/m ²	(4) SR-3
Color Chromaticity (CIE 1931)	Red	Rx		TYP. -0.03	0.643	TYP. +0.03		(5),(6) SR-3
		Ry			0.334			
	Green	Gx			0.304			
		Gy			0.598			
	Blue	Bx			0.149			
		By			0.063			
	White	Wx			0.274			
		Wy			0.294			
Color Gamut		-		-	72	-	%	(5) SR-3
Color Temperature		-		7,000	10,000	13,000	K	
Viewing Angle	Hor.	q _L	C/R≥10	75	89	-	Degree	(6) EZ-Contrast
		q _R		75	89	-		
	Ver.	q _U		75	89	-		
		q _D		75	89	-		
White Brightness Uniformity (9 Points)		B _{uni}		-	-	25	%	(2) SR-3

- Test Equipment Setup

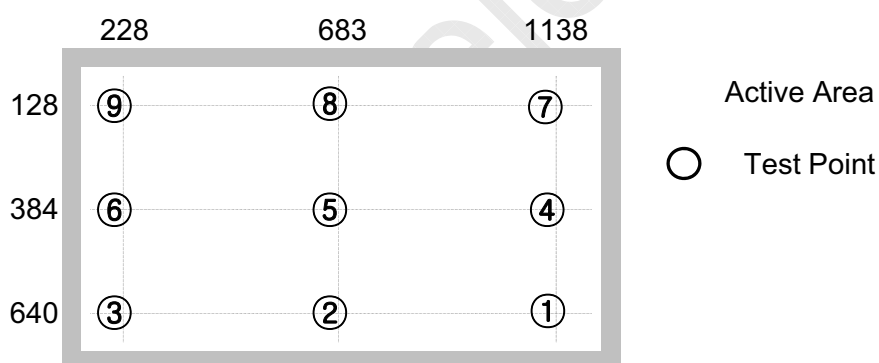
The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

Environment condition : Ta = 25 ± 2 °C

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- Definition of test point



Note (1) Definition of Contrast Ratio (C/R)

: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G_{\max}}{G_{\min}}$$

Gmax : Luminance with all pixels white

Gmin : Luminance with all pixels black

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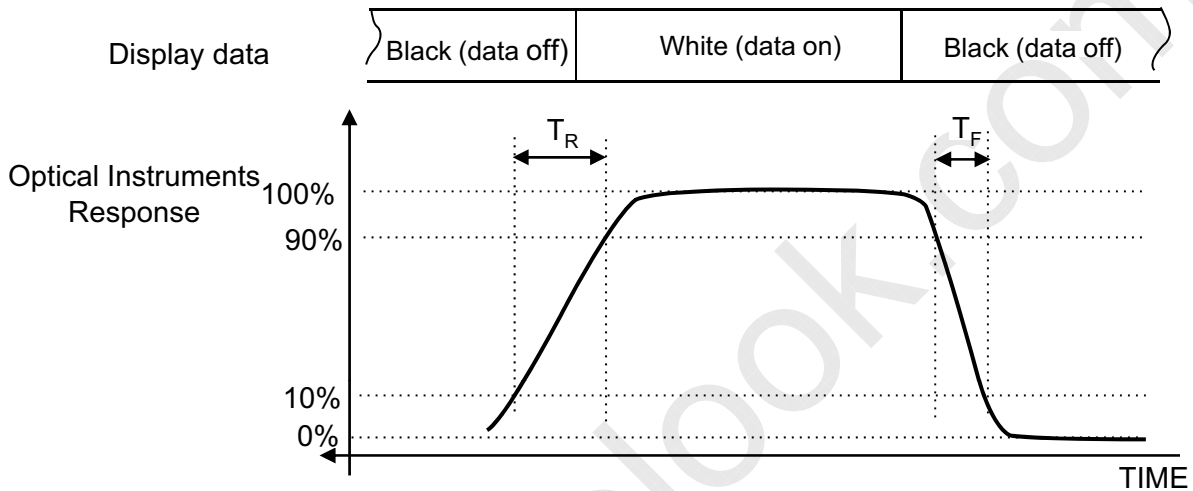
Note (2) Definition of 9 points brightness uniformity (Test pattern : Full White)

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

Bmax : Maximum brightness

Bmin : Minimum brightness

Note (3) Definition of Response time : Sum of Tr, Tf



※ G-to-G : Average response time between Gray to Gray (Scale)

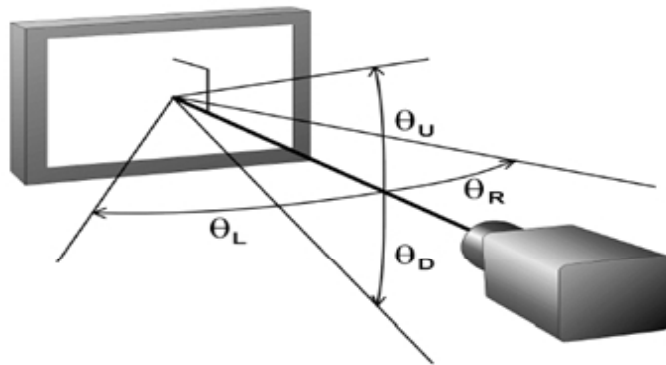
Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

Note (5) Definition of Color Chromaticity (CIE 1931)

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

Note (6) Definition of Viewing Angle

: Viewing angle range (C/R ≥ 10)



3. Electrical Characteristics

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3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

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

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V _{DD}	10.8	12	13.2	V	(1)
Current of Power Supply	(a) Black	I _{DD}	-	400	500	mA	(2),(3)
	(b) White		-	500	600	mA	
	(c) N-Pattern		-	650	750	mA	
Vsync Frequency		f _V	50	60	66	Hz	
Hsync Frequency		f _H	44	48	53	kHz	
Main Frequency		Fdclk	72	78	85	MHz	
Rush Current		I _{RUSH}	-	-	4	A	(4)

Note (1) The ripple voltage should be controlled under 10% of V_{DD} .

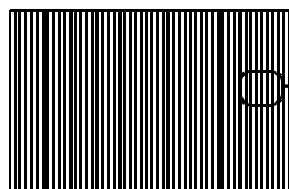
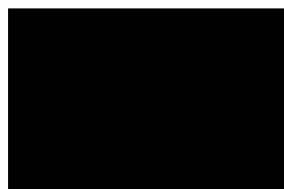
(2) $f_V=60\text{Hz}$, $f_{DCLK} = 75\text{MHz}$, $V_{DD} = 12.0\text{V}$, DC Current.

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

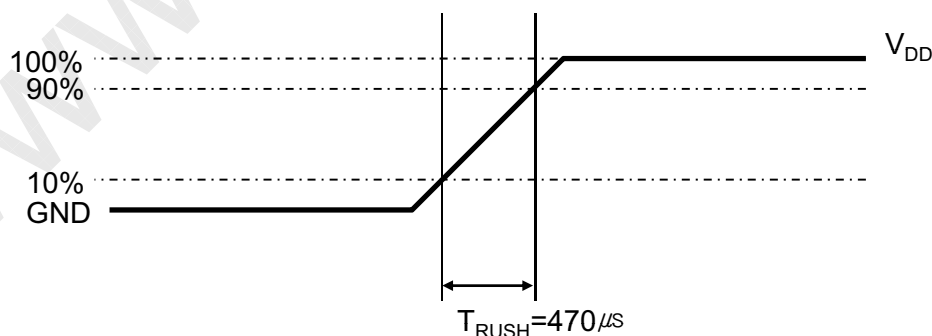
a) Black Pattern

b) White Pattern

c) N-Pattern



(4) Measurement Conditions



Rush Current I_{RUSH} can be measured when T_{RUSH} is $470\mu\text{s}$.

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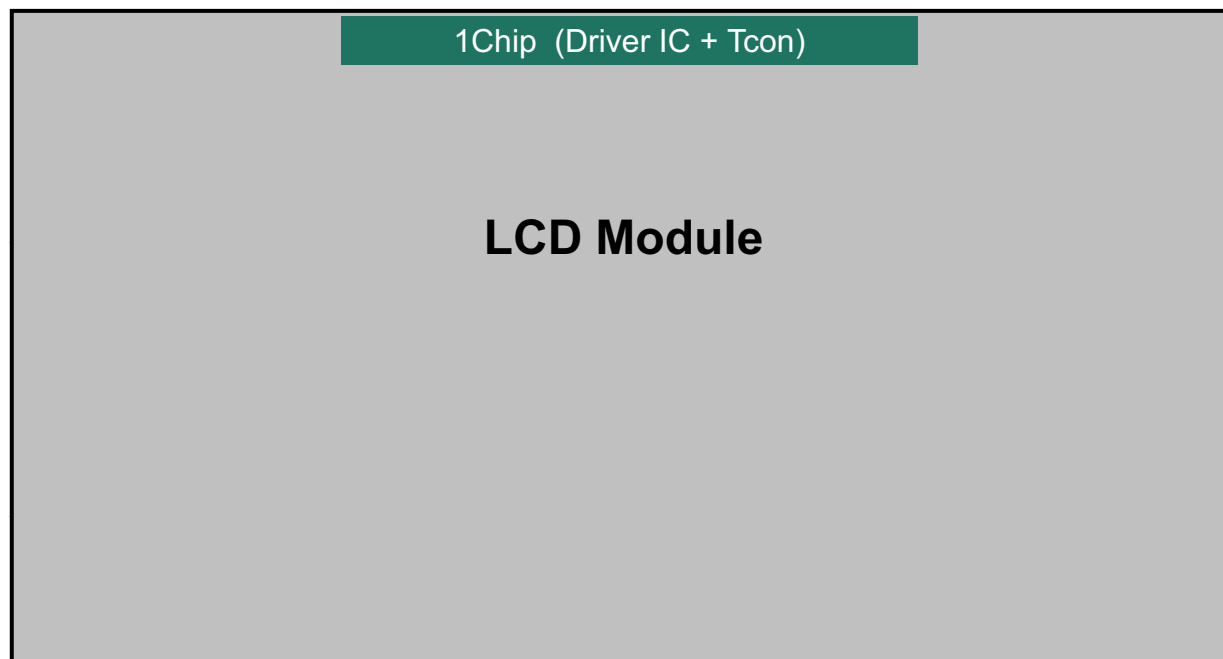
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3.2 Back Light Unit

The back light unit contains Edge type White LEDs (Light Emitting Diode)

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



Item	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Life Time	Hr	-	30,000	-	Hour	(1),(2)

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value. [Operating condition : $T_a = 25 \pm 2^\circ\text{C}$, For LED Package only.]

(2) Test Condition : $T_j 80^\circ\text{C}$, 140mA, 1,000Hr

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3.3 Converter Input Condition & Specification

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Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	V _{IN}	-	22	24	26	V	Ta=25±2 °C (2)
Input Current	I _{OVER}	V _{IN} =24.0V V _{dim} =3.3V	-	1.38	1.42	A	(1)
	I _{SAT}		-	1.34	1.38		(2)
LED Current	I _{O,MAX}	V _{dim} =3.3 V	125	130	135	mArms	(2)
Backlight On/Off	ON	V _{IN} =24.0 V	2.4	-	5.25	V	(3)
	OFF	V _{IN} =24.0 V	0	-	0.8		
Dimming Control	V _{DIM}	Max Lum	3.3	-	-	V	(3)
		Min. Lum	-	-	0		
PWM Voltage	V _{PWM}	Max	3.0	-	5.0	V	(3)
		Min	0.0	-	0.4		
PWM Frequency	F _{PWM}	V _{IN} =24.0 V	95	-	200	Hz	(5)
PWM Duty	Duty	V _{IN} =24.0 V	1	-	100	%	(4)

Note) Power Consumption is measured when 380 [cd/m] of luminance which is the typical luminance.

Lamp Current is measured at the point before Lamp.

(1) Max Value of the Power Consumption is measured during initial turn on time* of the backlight

(2) Max Value of the Power Consumption is measured after 60 min warm-up.

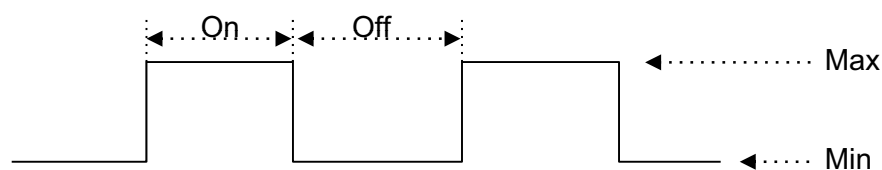
(3) The ripple voltage should be controlled under 10% of Input Signal

(4) Duty = On/(On+Off) * 100

(5) The FPWM is only the operating assurance frequency.

Unless the frequency is optimized whine the operating frequency, waterfall can be occurred.

* Initial turn-on time : From 0sec to 60min after turn-on



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4. Input Terminal Pin Assignment

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4.1. Input Signal & Power

Connector : IS100-L30O-C23(UJU,In-PCB Type)

PIN	Signal
1	NC
2	NC
3	NC
4	GND
5	LV0_N
6	LV0_P
7	GND
8	LV1_N
9	LV1_P
10	GND
11	LV2_N
12	LV2_P
13	GND
14	LVCLK_N
15	LVCLK_P
16	GND
17	LV3_N
18	LV3_P
19	GND
20	NC
21	LVDS_SEL
22	NC
23	GND
24	GND
25	NC
26	VCC
27	VCC
28	VCC
29	VCC
30	VCC

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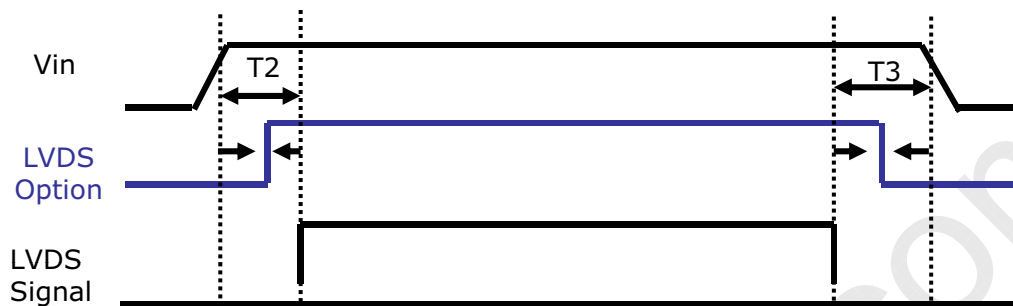
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Note) LVDS OPTION : If this PIN HIGH (3.3V) → Normal LVDS format

LOW (GND) → JEIDA LVDS format

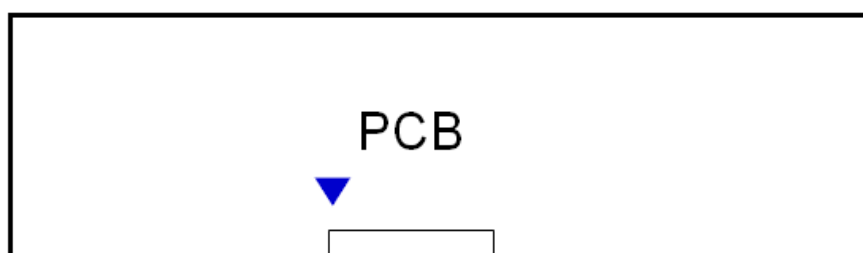
SEQUENCE : On = VDD(T1) → LVDS Option → Interface Signal(T2)

OFF = Interface Signal(T3) → LVDS Option → VDD



LVDS Option Sequence

Note) Pin number starts from Left side



Pin No. 1

Pin No. 30

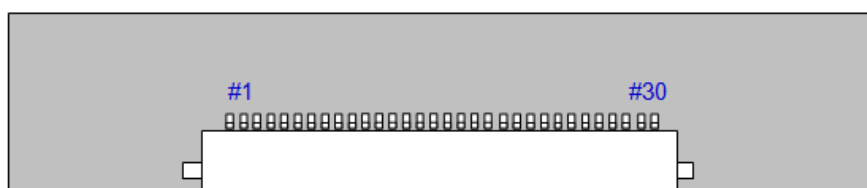


Fig. Connector diagram

- a. Power GND pins should be connected to the LCD's metal chassis.
- b. All power input pins should be connected together.
- c. All NC pin should be separated from other signal or power.

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4.2 Converter Input Pin Configuration

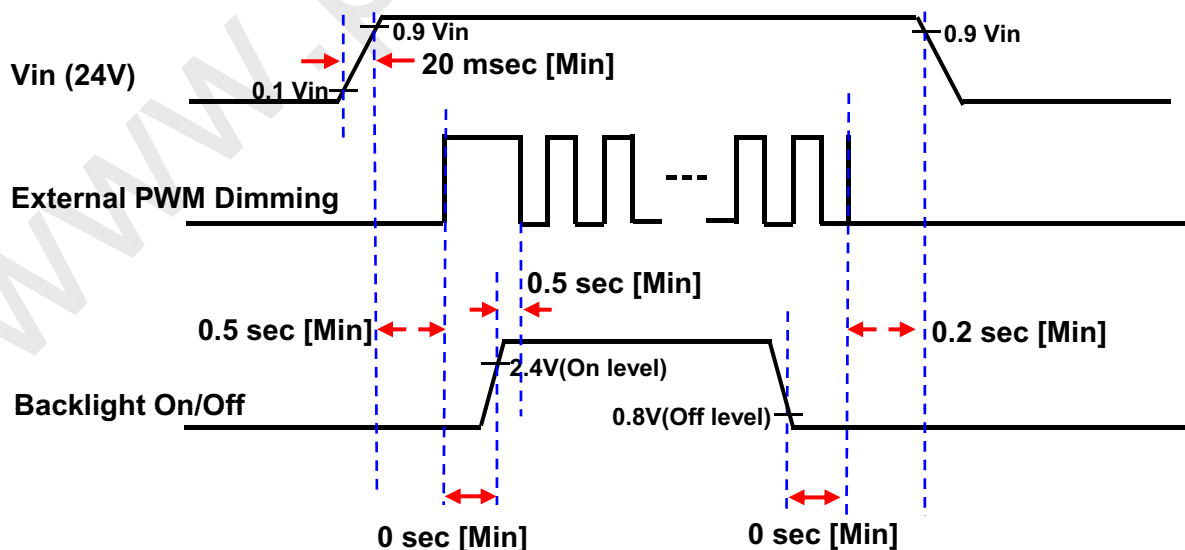
Connector : JST, S14B-PHA-SM-TB(LF)

Pin No.	Pin Configuration (FUNCTION)	
	Symbol	Remark
1 ~ 5	V_{IN}	Vin (24 V)
6 ~ 10	GND	GND
11	Error_out	Error Out Signal (Normal : GND, Abnormal : Open Collector)
12	ENA	Backlight On /Off [ON: 2.4 ~ 5.25 V, OFF: 0 ~ 0.8 V]
13	V_{dim}	No Connection
14	V_{ex-dim}	External Dimming Control Signal (0~100%)

Connector : YEONHO, 20037WR-07

Pin No.	Pin Configuration (FUNCTION)	
	Symbol	Remark
1	LED+	DC Voltage output for LED bar
2	LED4-	DC Current return from LED bar
3	LED3-	DC Current return from LED bar
4	NC	No Connection
5	LED+	DC Voltage output for LED bar
6	LED2-	DC Current return from LED bar
7	LED1-	DC Current return from LED bar

4.3. Converter Input Power Sequence



4.4 LVDS Interface

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

	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

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4.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

COLOR	DISPLAY (8bit)	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	-		
	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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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5. UL Specification

- This panel follows UL file – E252633
- This panel achieved UL60065

6. Interface Timing

6.1 Timing Parameters (DE mode)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	72	78	85	MHz	-
Hsync		F_H	44	48	53	KHz	-
Vsync		F_V	50	60	66	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	-	768	-	Lines	-
	Vertical Total	T_V	780	802	1200	Lines	-
Horizontal Display Term	Active Display Period	T_{HD}	-	1366	-	Clocks	-
	Horizontal Total	T_H	1460	1624	2000	Clocks	-

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

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

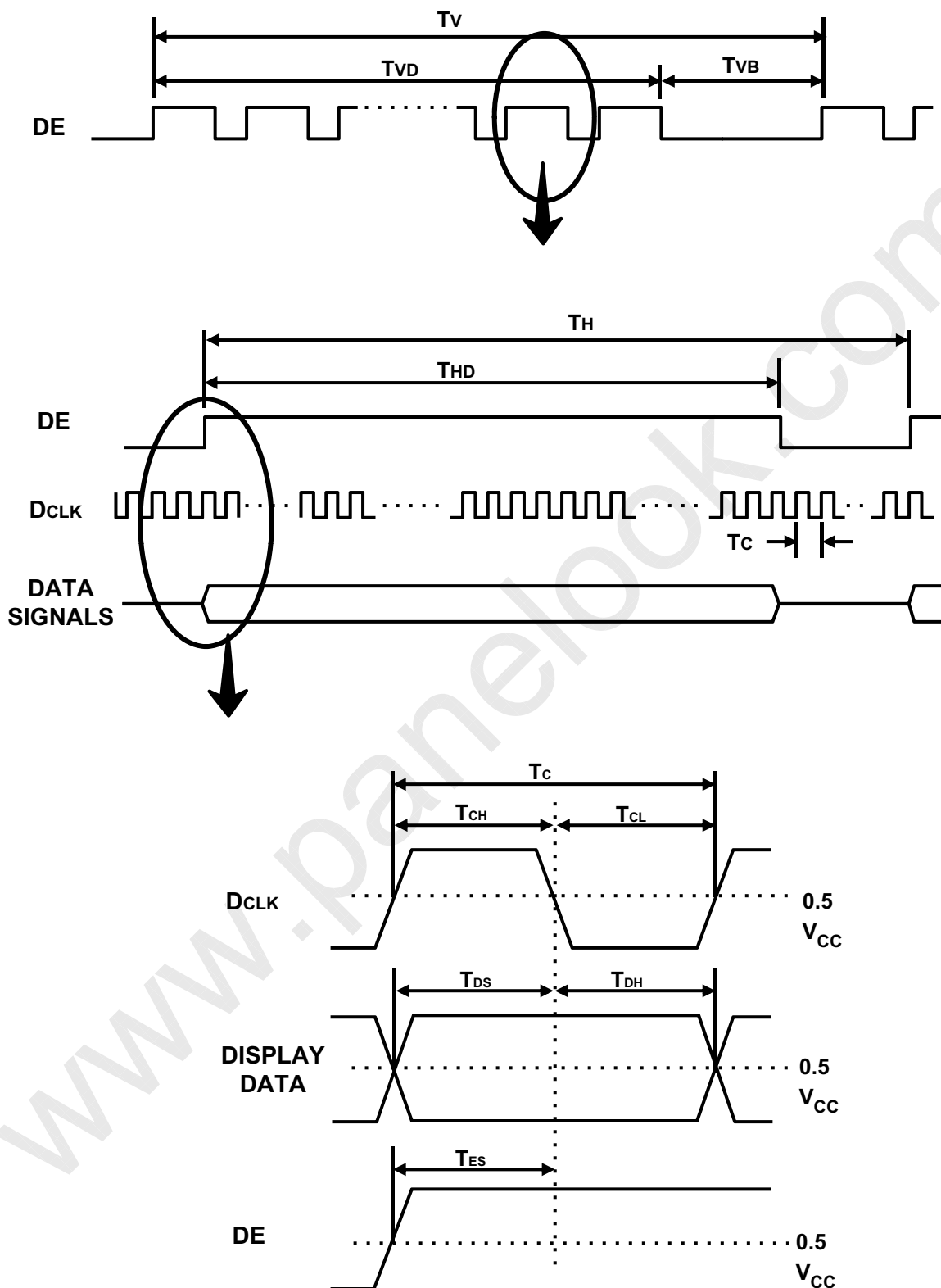
(2) Internal $V_{DD} = 3.3V$

(3) Spread spectrum

- Modulation rate (max) : $\pm 1.5 \%$

- Modulation Frequency : under 100KHz

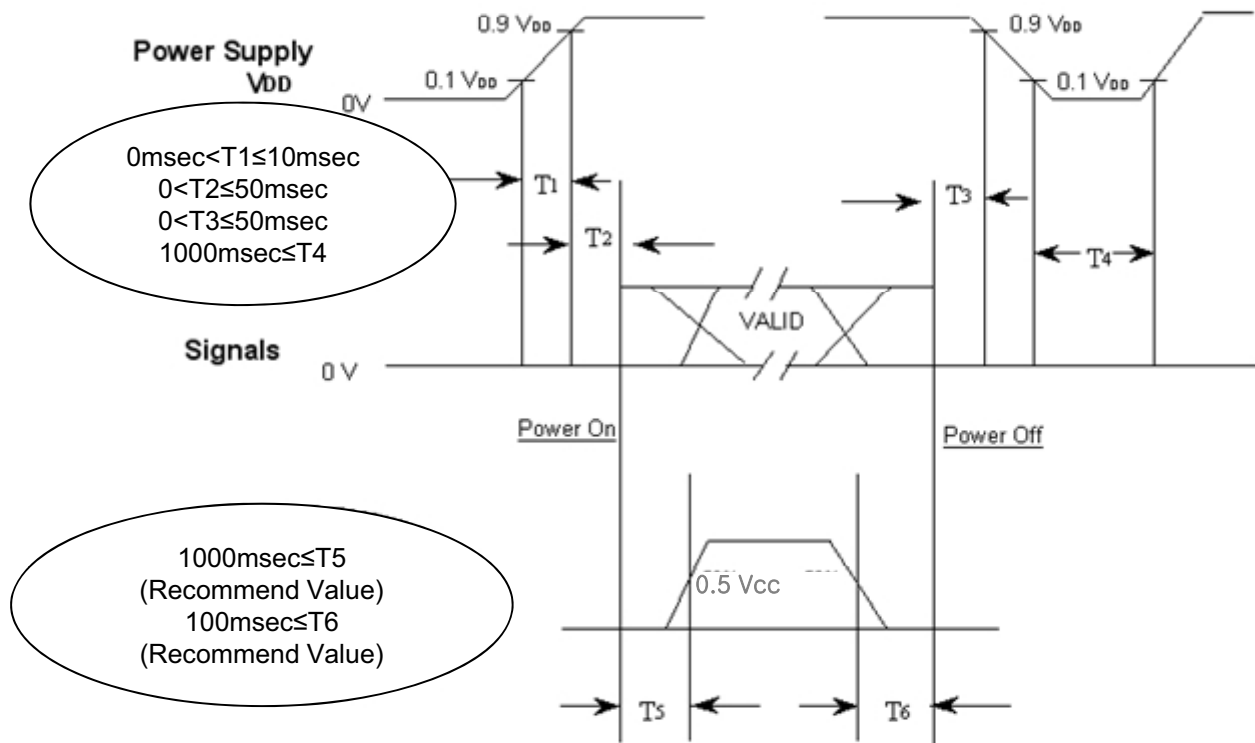
6.2 Timing diagrams of interface signal (DE mode)

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6.3 Power ON/OFF Sequence

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To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence should be as the diagram below.



T1 : V_{DD} rising time from 10% to 90%

T2 : The time from V_{DD} to valid data at power ON.

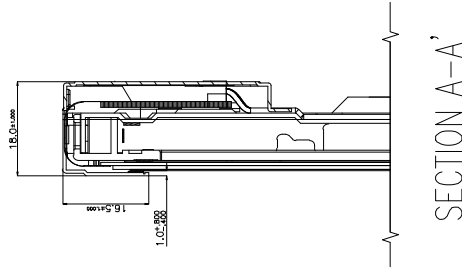
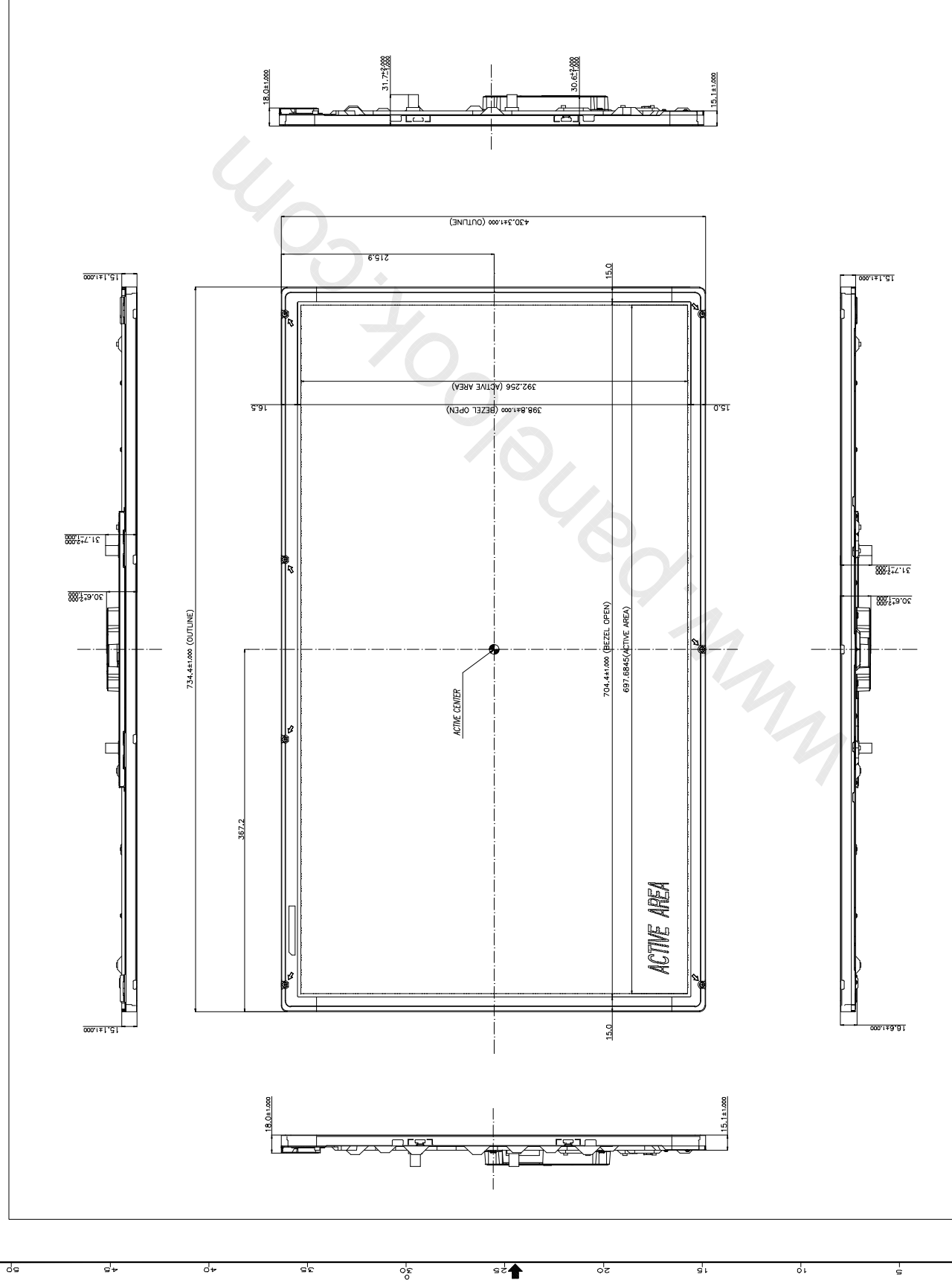
T3 : The time from valid data off to V_{DD} off at power Off.

T4 : V_{DD} off time for Windows restart

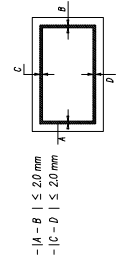
T5 : The time from valid data to B/L enable at power ON.

T6 : The time from valid data off to B/L disable at power Off.

- The supply voltage of the external system for the Module input should be the same as the definition of V_{DD}.
- 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 show abnormal screen.
- In case of V_{DD} = off level, please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off and on period.
- Interface signal should not be kept at high impedance when the power is on.
- In Case T5 is less than 1000msec and T6 is less than 100msec, Garbage Display can be seen. (It is not related to electrical function issue, Just for recommendation to prevent Garbage Display)

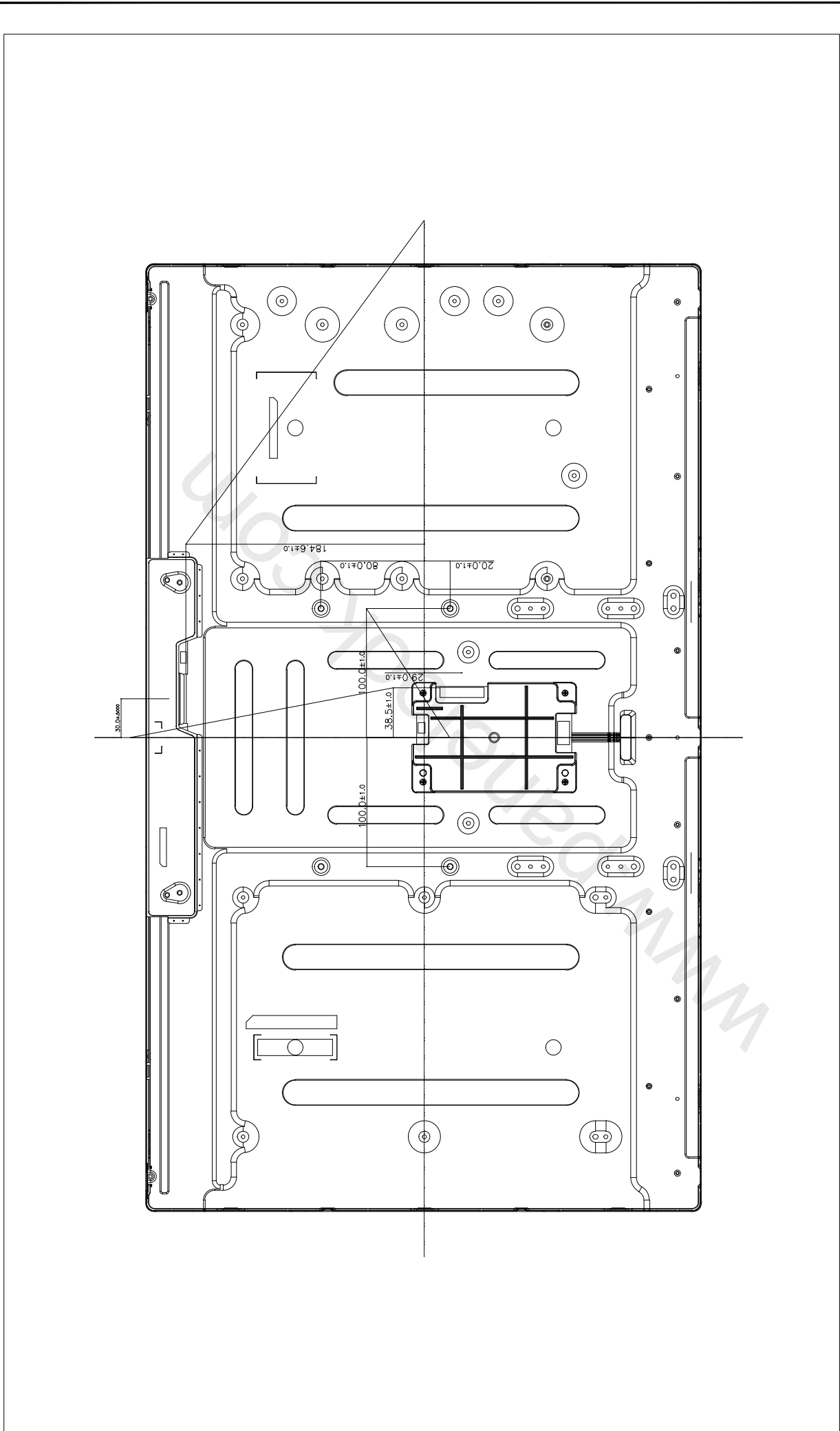


- * NOTE
1. BACKLIGHT : WLED
 2. CONNECTION SCHEMATIC :
 - POWER CONNECTOR
 - MAKER : YEONHO
 - PART NO. : 20022WR-14B1
 - LVDS INPUT CONNECTOR
 - PART NO. : HFT100-L30N-N23
 3. USERHOLE
 - TAP SIZE & TOLERANCE DESIGNED FOR GENERAL PURPOSE METRIC
 - SCREW THREAD ACCORDING TO GENERAL GRADE OF "KS B 0211"
 - ALL DIMENSIONS ARE IN mm
 - > M3 TAP : 6.0 kgf/cm MAX
 - > M4 TAP : 13.0 kgf/cm MAX
 - (SCREW) REPEATED INSERTION WARRANTY : 5TIMES
 4. GAP BETWEEN TOP CHASSIS AND GLASS IS 1.2mm(MAX).
 5. WEIGHT : 1.650g(MAX)
 6. BLACK MATRIX SPEC



GENERAL TOLERANCE				DESCRIPTION OF REVISION				REASON		CHK'D BY	
STEP	LEVEL 1	LEVEL 2	LEVEL 3	DATE	DRWN BY	DESIG BY	APP'D BY	MODEL NAME	REASON	DATE	VER.
0 < X ≤ 4	±0.05	±0.1	±0.2					LTA320AP24			
4 < X ≤ 16	±0.08	±0.15	±0.3					PART SHEET NAME			
16 < X ≤ 64	±0.12	±0.25	±0.5					OUTLINE DIM.(FRONT)			
64 < X ≤ 256	±0.25	±0.5	±1.0					SPEC. NO.			
				SAMSUNG ELECTRONICS				CODE NO.			
								VER.			

NO	PART NAME	CODE NO	SPECIFICATION	QTY	SPEC NO	REMARK
	OUTLINE DIMENSION	-	LTA320AP24	1		



GENERAL TOLERANCE				REASON			
STEP	LEVEL 1	LEVEL 2	LEVEL 3	REV	DATE	DESCRIPTION OF REVISION	CHK'D BY
0 < X ≤ 4	±0.05	±0.1	±0.2	UNIT	mm	DES'D BY	APP'D BY
4 < X ≤ 16	±0.08	±0.15	±0.3	SCALE	1 / 2	YJMM	
16 < X ≤ 64	±0.12	±0.25	±0.5	TOLERANCE		10.1.15	
64 < X ≤ 256	±0.25	±0.4	±0.8				
SAMSUNG ELECTRONICS				CHK'D BY			
				MODEL NAME			
				LTA320AP24			
				PART/SHEET NAME			
				OUTLINE DIM.(REAR)			
				CODE NO.			
				VER.			
				001			

Samsung Secret**8. Reliability Test**

Item	Test condition	Quantity
TSS	0℃ ~ 50℃, 10cycle determination	4EA
HTOL	50℃, 500hr determination	8EA
LTOL	0℃, 500hr determination	4EA
HTS	70℃, 500hr determination	4EA
LTS	-30℃, 500hr determination	4EA
THB	40℃ / 95%RH, 500hr determination	4EA
T/C	-20℃ ~ 60℃, 100cycle determination	4EA
ESD (non-operation)	C D M : ± 10 kV, 150pF/330 Ω, 9Point, 3times/Point	3EA
ESD (operation)	contact : ± 8 kV, 150pF/330Ω, 100Point, 1 time/Point non-contact : ± 15 kV, 200pF/100Ω, 100Point, 1 time/Point	6EA
POWER ON/OFF	30sec (on) / 30sec(off) : 12,000 times	4EA
Vibration	10 ~ 300Hz/1.5G/10minSR, XYZ, 30min/axis	3EA
Shock	Half Sine, 50G, 11msec, ±XYZ 1time/axis	3EA
PALLET Vibration	1.05Grms, Random, z-axis, 30min	1PALLET
PALLET Drop	20cm, 1Angle, 3Edge, 6Face	1PALLET

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these should be no change which may affect practical display functions.

* HTOL/ LTOL : High/Low Temperature Operating Life

** THB : Temperature Humidity Bias

*** HTS/LTS : High/Low Temperature Storage

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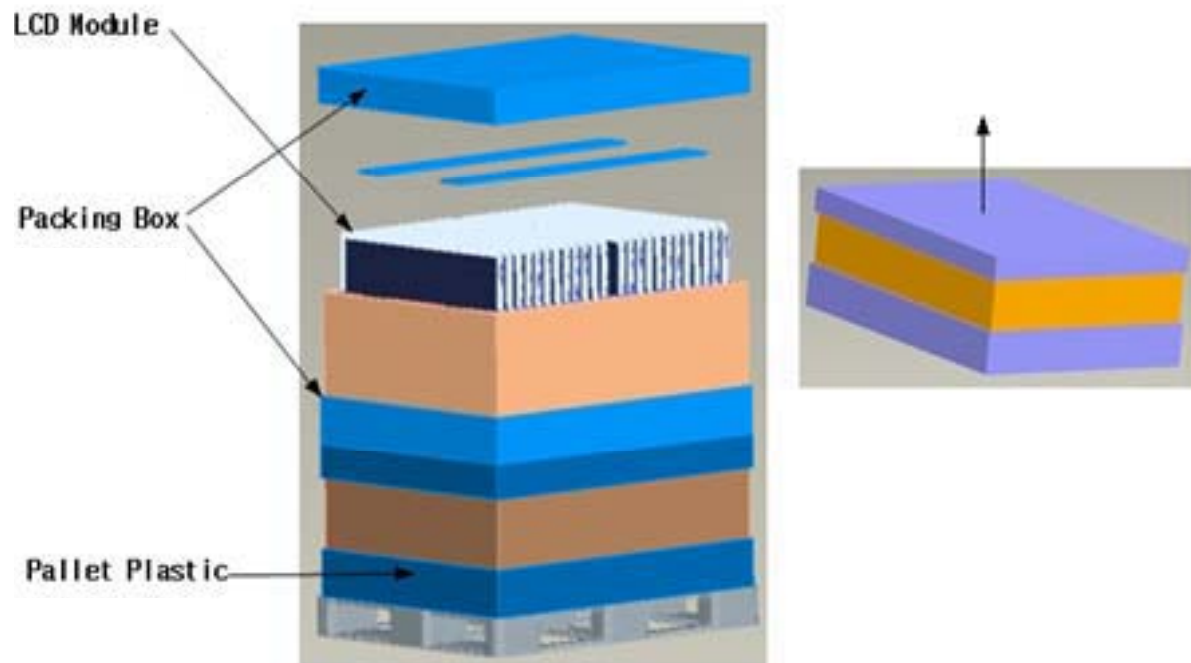
9. PACKING

9.1 CARTON (Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method



9.2 Packing Specification

Item	Specification	Remark
LCD Packing	24 ea / Box 48 ea / Pallet (Packing-Pallet Box)	1. 5.5 kg/LCD (48 ea) : 264Kg (Typ) 2. 15 kg / Packing Set : 30kg (Typ) 3. Packing Material : Paper
Desiccant (Drier)	3	10g/EA, Cobalt-dichloride-free
Pallet	2Box / Pallet	1. Pallet weight = 5.3kg
Packing Direction	Vertical	
Total Pallet Size	H x V x height	1150mm(H) x 850mm(V) x 1083mm(Height)
Total Pallet Weight	300.74 kg	Module (5.5 * 48) + Pallet (5.3kg) + Packing SET(15)*2 + Desiccant(0.03x48=1.44kg)

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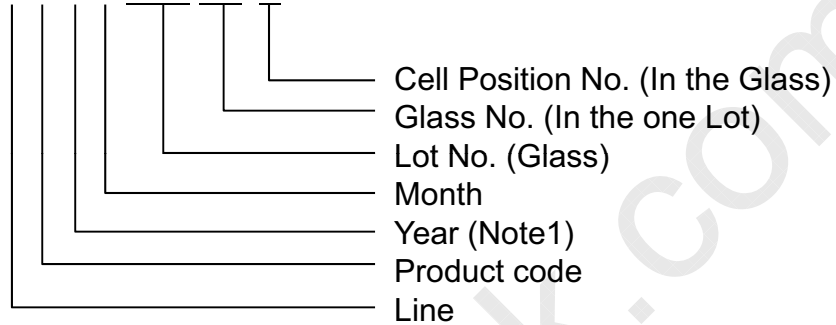
Samsung Secret**10. MARKING & OTHERS**

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

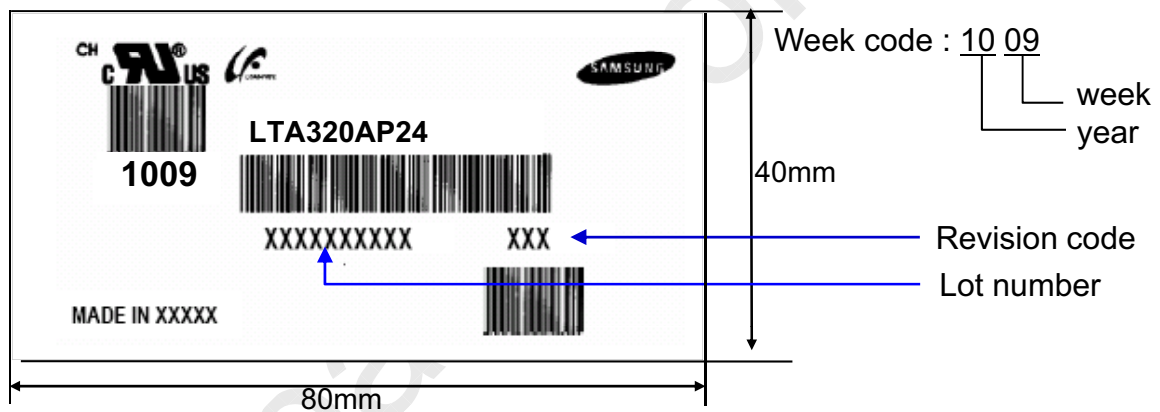
(1) Part number : LTA320AP24

(2) Revision: Three letters

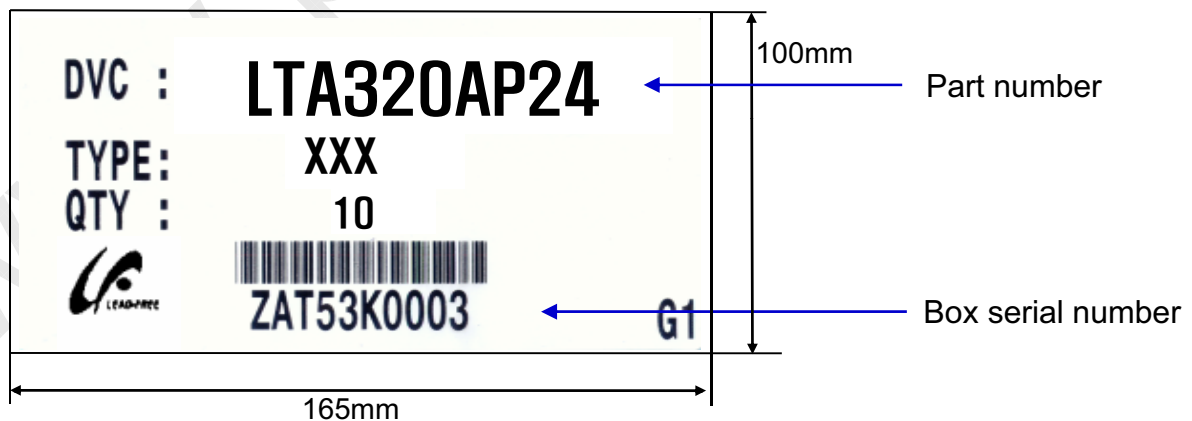
(3) Lot number : X X X X XXX XX X



(4) Nameplate Indication



(5) Packing box attach



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11. General Precautions

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11.1 Handling

- (a) When the Module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the Module.
- (b) Because the Converter use high voltage, it should be disconnected from power before it is assembled or disassembled.
- (c) Refrain from strong mechanical shock and / or any force to the Module.
In addition to damage, this may cause improper operation or damage to the Module and back light.
- (d) Note that polarizers are very fragile and could be damage easily.
Do not press or scratch the surface harder than a HB pencil lead.
- (e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.
- (f) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.
- (g) Desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane.
Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (h) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away with soap thoroughly.
- (i) Protect the module from Electrostatic discharge. Otherwise the ASIC IC or semiconductor would be damaged.
- (j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (k) Do not disassemble the Module.
- (l) Do not disassemble shield case of Converter & LVDS board
- (m) Do not connect N.C pins. (Samsung internal use only)
- (n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized. Must put on antistatic glove while handling a module
- (o) Pins of I/F connector should not be touched directly with bare hands.

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11.2 Storage

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- (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 5 to 40℃ and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD Module in direct sunlight.
- (c) The Module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storing.
- (d) Storage period is recommended not to exceed 1 year.

11.3 Operation

- (a) Do not connect or disconnect the Module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the "Power on/off sequence"
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (d) The cable between the back light connector and its Converter power supply should be connected directly with a minimized length. A longer cable between the back light and the Converter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).

11.4 Operation Condition Guide

- (a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
 - Temperature : $20 \pm 15^{\circ}\text{C}$
 - Humidity : $55 \pm 20\%$
 - 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.

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11.5 Others

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- (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. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the Module may be damaged.
- (d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.
To avoid image sticking, it is recommended to use a screen saver.
- (e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.
- (f) Please contact SEC in advance when you display the same pattern for a long time.

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