



Samsung Secret

Product Information

Customer : General

DATE : Mar. 15. 2011

SAMSUNG TFT-LCD

MODEL : LTA400HM17-W

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

LCD Business

Samsung Electronics Co . , LTD.

MODEL

LTA400HM17

Doc. No

06-000-G-20110315

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*** Revision History**

Date	Rev. No	Page	Summary
Mar.15 .2011	000	all	First issued

General Description

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Description

LTA400HM17 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 40.0" is 1920 x 1080 and this model can display up to 1.07G 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 ratio, high aperture ratio, fast response time
- SPVA(Super Patterned Vertical Align) mode
- Wide viewing angle ($\pm 178^\circ$)
- FHD resolution (16:9)
- Low Power consumption
- 10 CCFTs (Cold Cathode Fluorescent Tube)
- LVDS (Low Voltage Differential Signaling) interface

General Information

Items	Specification	Unit	Note
Module Size	952(H) x 551(V)	mm	$\pm 1.0\text{mm}$
	61.2(Dmax)		
Weight	9400(Max)	g	
Pixel Pitch	0.15375(V) x 0.46125(H)*3	mm	
Active Display Area	885.6(H) X 498.15 (V)	mm	
Surface Treatment	Haze 5.5%, Hard-coating(2H)	-	
Display Colors	8bit +2bit FRC – 1.07G	Colors	
Number of Pixels	1920 x 1080	Pixel	
Pixel Arrangement	RGB vertical stripe	-	
Display Mode	Normally Black	-	
Luminance of White	420 (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-0.3	13	V	(1)
Storage temperature	T_{STG}	-20	65	°C	(2)
Operating Temperature	T_{OPR}	0	50	°C	(2), (3)
Panel surface temperature	T_{SUR}	0	65	°C	
Shock (non - operating)	S_{nop}	-	50	G	(4)
Vibration (non - operating)	V_{nop}	-	1.5	G	(5)

Note (1) $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$

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

a. 90 % RH Max. ($T_a \leq 39 \text{ }^{\circ}\text{C}$)

b. Relative Humidity is 90% or less. ($T_a > 39 \text{ }^{\circ}\text{C}$)

c. No condensation

(3) Polarizer will not be damaged in this range, even though abnormal visual problems occur in T_{SUR} 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

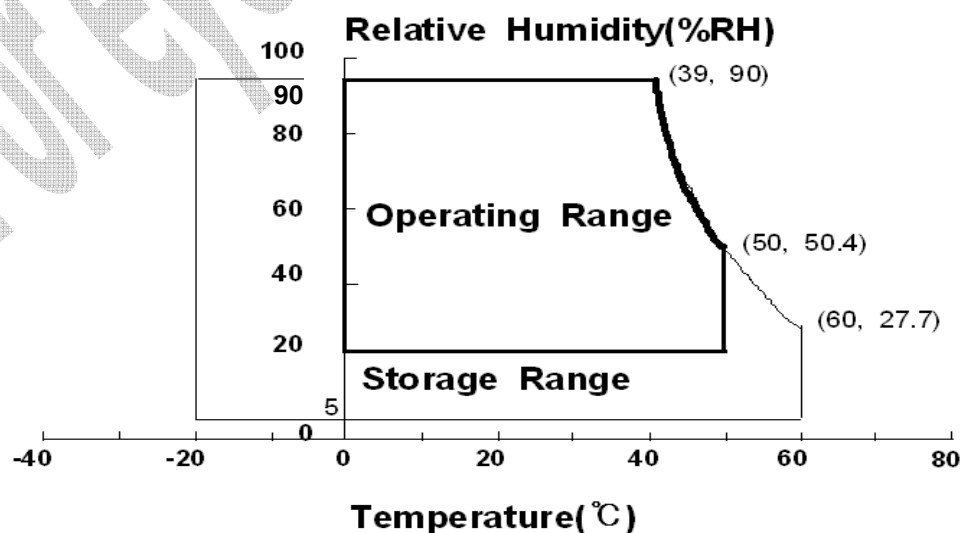
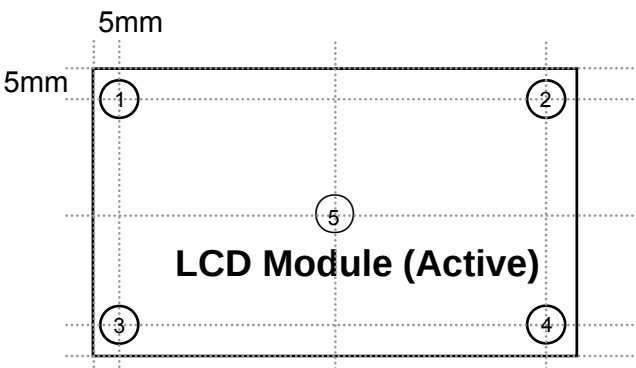


Fig. Temperature and Relative humidity range

(5) Definition of test point



ΔT should be less than $10\text{ }^{\circ}\text{C}$ ($\Delta T = |T_{\text{OPR}} - T_{\text{MAX}}|$)

T_{OPR} : Temperature of the center of the glass surface (Test point 5)

$T_1 \sim T_4$: Temperature of each edge of the glass surface

T_{MAX} : The highest temperature of the glass surface

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}=148.5 MHz, Dim= 100%)

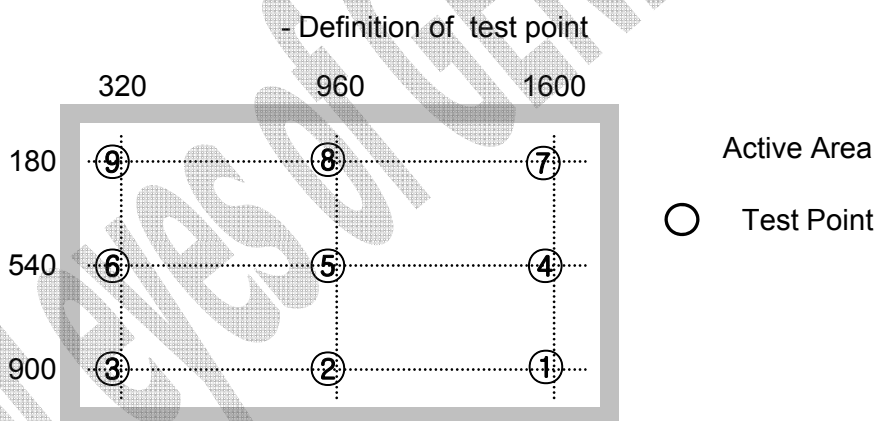
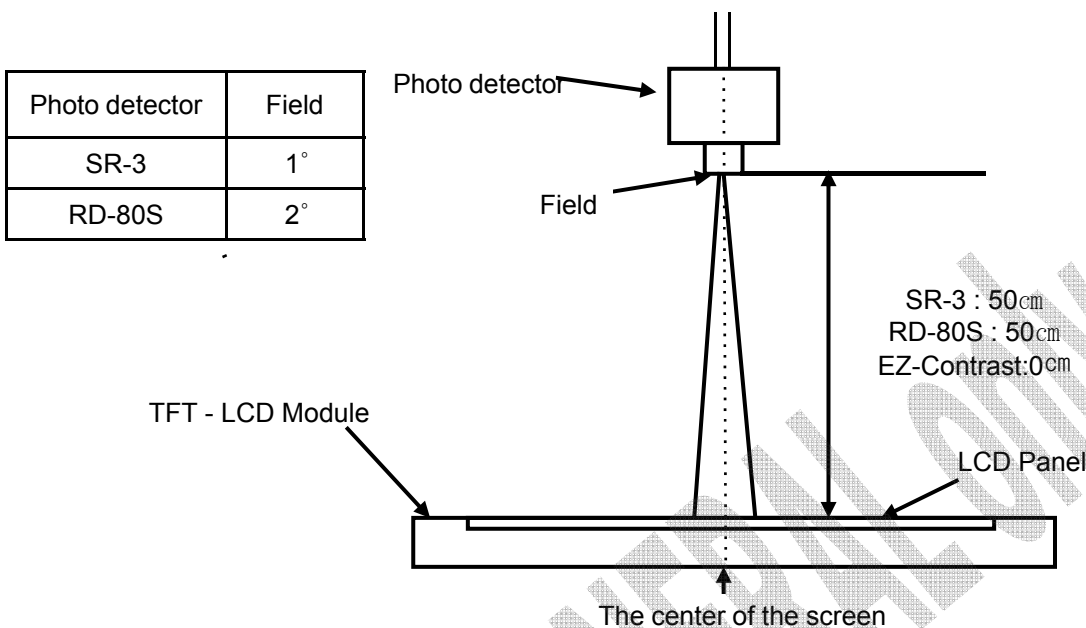
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R		2500	5000	-		(1) SR-3
Response Time	G-to-G	Tg	Normal q _{L,R} =0 q _{U,D} =0 Viewing Angle	-	8	-	msec	(3) RD-80S
Luminance of White (Center of screen)		Y _L		350	420	-	cd/m ²	(4) SR-3
Color Chromaticity (CIE 1931)	Red	R _x		TYP. -0.03	0.639	TYP. +0.03		(5),(6) SR-3
		R _y			0.329			
	Green	G _x			0.296			
		G _y			0.602			
	Blue	B _x			0.146			
		B _y			0.061			
	White	W _x			0.280			
		W _y			0.285			
Color Gamut		-	-	72	-	%	(5) SR-3	
Color Temperature		-	-	10,000	-	K		
Viewing Angle	Hor.	q _L	C/R≥10	79	89	-	Degree	(6) EZ-Contrast
		q _R		79	89	-		
	Ver.	q _U		79	89	-		
		q _D		79	89	-		
White Brightness Uniformity (9 Points)		B _{uni}		-	-	30	%	(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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Note (1) Definition of Contrast Ratio (C/R)
: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

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

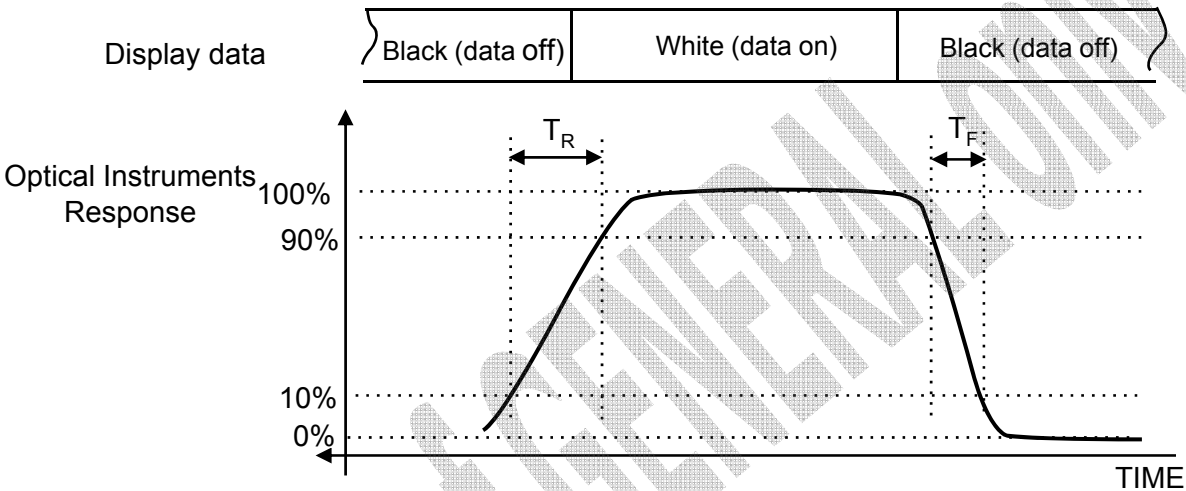
Gmax : Luminance with all pixels white
Gmin : Luminance with all pixels black

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)

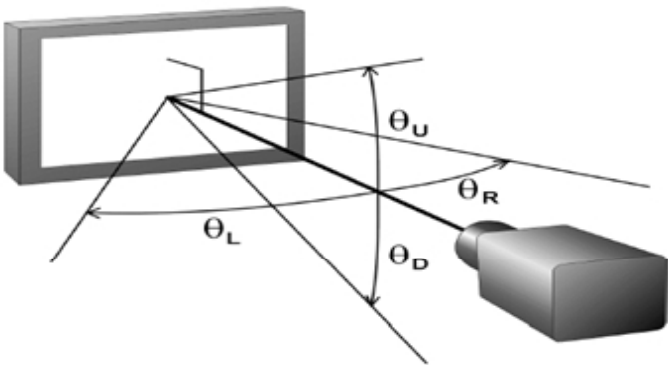
Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

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

3.1 TFT LCD Module

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

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

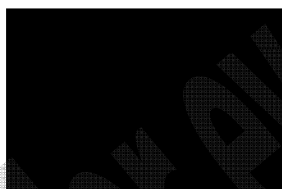
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V _{DD}	11	12	13	V	(1)
Current of Power Supply	(a) Black	I _{DD}	-	750	-	mA	(2),(3)
	(b) White		-	760	1100	mA	
	(c) N-Pattern		-	1000	1450	mA	
Vsync Frequency		f _V	47	60	62	Hz	
Hsync Frequency		f _H	50	67.5	73	kHz	
Main Frequency		Fdclk	130	148.5	155	MHz	
Rush Current		I _{RUSH}	-	-	5	A	(4)

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

(2) $f_V=60\text{Hz}$, $f_{DCLK} = 148.5\text{MHz}$, $V_{DD} = 12.0\text{V}$, DC Current.

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

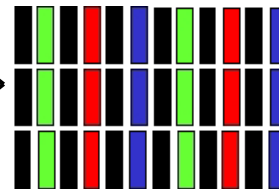
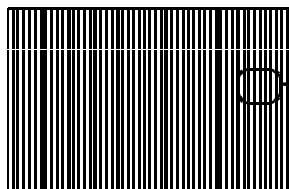
a) Black Pattern



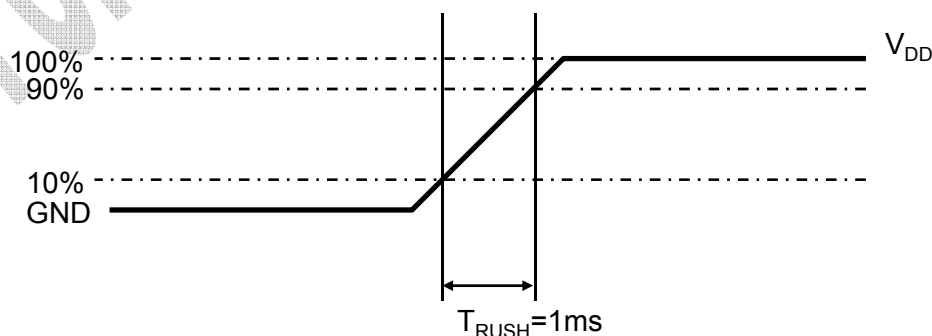
b) White Pattern



c) N-Pattern



(4) Measurement Conditions

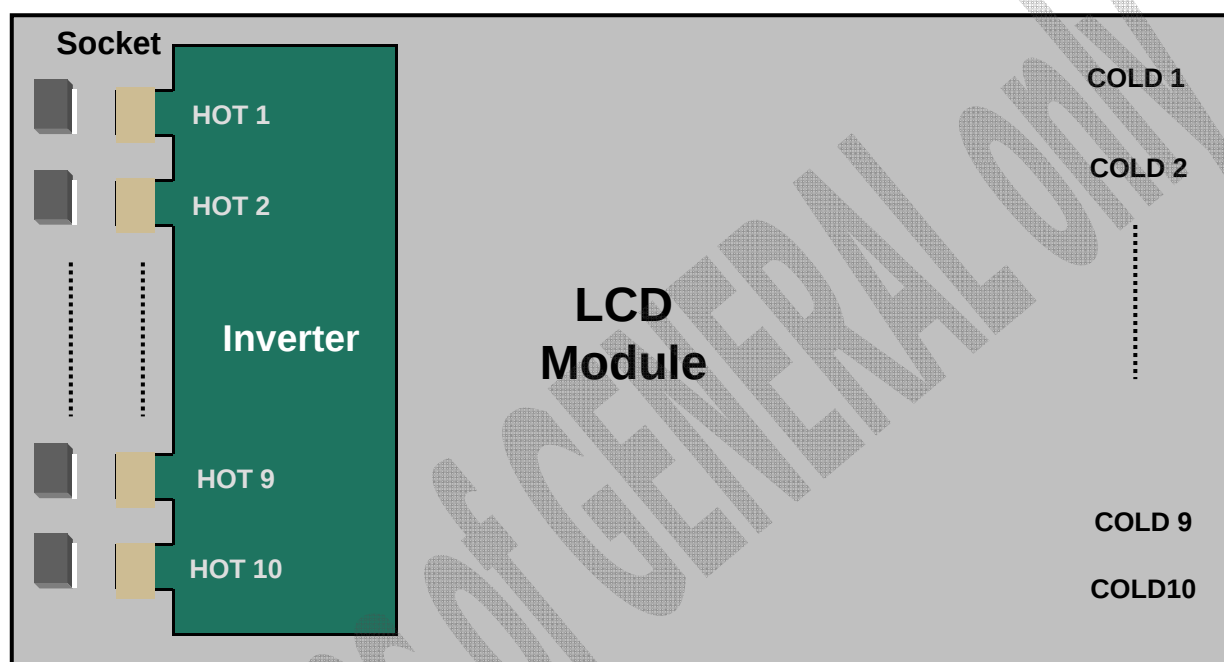


Rush Current I_{RUSH} can be measured when T_{RUSH} is 1ms

3.2 Back Light Unit

The back light unit contains 10 CCFTs (Cold Cathode Fluorescent Tube).
The characteristics of lamps are shown in the following tables.

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



Item	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Life Time	Hr	50,000	-	-	Hour	(1)

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value.

[Operating condition : $T_a = 25 \pm 2^\circ\text{C}$, $I_L = 14 \text{ mArms}$, For single lamp only.]

3.3 Inverter Input Condition & Specification

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	V _{in}	-	21.6	24	26.4	V	Ta=25±2 °C
Input Current	I _{RUSH}	V _{in} =24.0V V _{dim} =3.3V	-	-	5.50	A	Note (1)
Output Current	I _O	V _{in} = 24.0V V _{dim} =3.3 V	13.0	14.0	15.0	mArms	
Backlight On/Off	ON	V _{in} =24.0 V	2.4	-	5.25	V	
	OFF	V _{in} =24.0 V	0	-	0.8		
Dimming Range	V _{DIM}	V _{in} :22~26V	0	-	3.3	V	Note(2)
Dimming Duty Output	D max	V _{in} =24V Dim:3.3V	100	-	-	%	
	D min	V _{in} =24V Dim:0V	-	20	-		
Dimming Frequency	F _{PWM}	V _{in} =24.0 V	140	150	160	Hz	
External Dimming Duty Range	EX_Dim	V _{in} =22.0~26.0 V Dim Pin(#13):floting	20	-	100	%	
External Dimming Frequency Range	F _{EX_PWM}		120	150	180	Hz	
External Dimming Signal Level	V _{PWM}	High (ON)	2.4	-	5.25	V	
		Low (Off)	0	-	0.4		

Note) Power Consumption is measured when 400 [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 after 60 min warm-up.

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

* 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 : FI-RE51S-HF (JAE)

Pin	Symbol	Description	Pin	Symbol	Description
1	12V	DC power supply	26	RE[0]P	Even LVDS Signal +
2	12V	DC power supply	27	RE[1]N	Even LVDS Signal -
3	12V	DC power supply	28	RE[1]P	Even LVDS Signal +
4	12V	DC power supply	29	RE[2]N	Even LVDS Signal -
5	12V	DC power supply	30	RE[2]P	Even LVDS Signal +
6	NC	NOTE1	31	GND	Ground
7	GND	Ground	32	ROCLK-	Even LVDS Clock -
8	GND	Ground	33	ROCLK+	Even LVDS Clock +
9	GND	Ground	34	GND	Ground
10	RO[0]N	Odd LVDS Signal -	35	RE[3]N	Even LVDS Signal -
11	RO[0]P	Odd LVDS Signal +	36	RE[3]P	Even LVDS Signal +
12	RO[1]N	Odd LVDS Signal -	37	RE[4]N	Even LVDS Signal -
13	RO[1]P	Odd LVDS Signal +	38	RE[4]P	Even LVDS Signal +
14	RO[2]N	Odd LVDS Signal -	39	GND	Ground
15	RO[2]P	Odd LVDS Signal +	40	NC	NOTE1
16	GND	Ground	41	NC	
17	ROCLK-	Odd LVDS Clock -	42	NC	
18	ROCLK+	Odd LVDS Clock +	43	NC	
19	GND	Ground	44	NC	
20	RO[3]N	Odd LVDS Signal -	45	LVDS_SEL	NOTE2
21	RO[3]P	Odd LVDS Signal +	46	NC	NOTE1
22	RO[4]N	Odd LVDS Signal -	47	NC	
23	RO[4]P	Odd LVDS Signal +	48	NC	
24	GND	Ground	49	NC	
25	RE[0]N	Even LVDS Signal -	50	NC	
			51	NC	NOTE1

Note1) No Connection: These PINS are used only for SAMSUNG. (DO NOT CONNECT)

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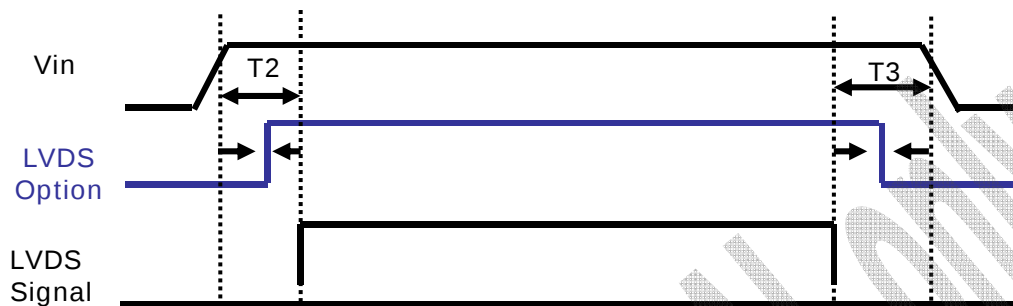
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Note(2) LVDS OPTION : If this PIN HIGH (3.3V) → Normal LVDS format

LOW (GND) → JEIDA LVDS format

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

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



LVDS Option Sequence

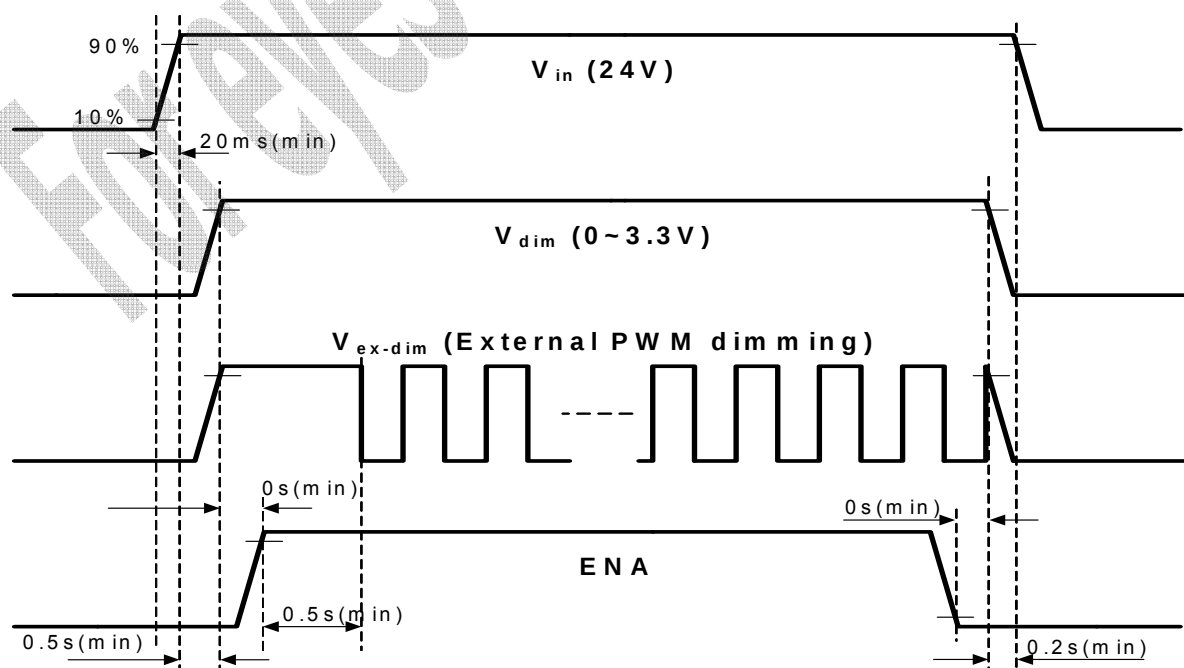
4.2 Inverter Input Pin Configuration

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

Pin No.	Pin Configuration (FUNCTION)
1	V _{in} (24 V)
2	V _{in} (24 V)
3	V _{in} (24 V)
4	V _{in} (24 V)
5	V _{in} (24 V)
6	GND
7	GND
8	GND
9	GND
10	GND
11	No Connection (DO NOT CONNECT)
12	Backlight On /Off [ON: 2.4 ~ 5.5 V, OFF: 0 ~ 0.8 V]
13	Dimming Control [0V: Min, 3.3V: Max]
14	External PWM signal

Note) Do not use pin 13. and pin14. at the same time.

4.3. Inverter Input Power Sequence



4.4 LVDS Interface

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	LVDS pin	ODD -DATA	EVEN -DATA
TxOUT/RxIN0	TxIN/RxOUT0	R0	R0
	TxIN/RxOUT1	R1	R1
	TxIN/RxOUT2	R2	R2
	TxIN/RxOUT3	R3	R3
	TxIN/RxOUT4	R4	R4
	TxIN/RxOUT6	R5	R5
	TxIN/RxOUT7	G0	G0
TxOUT/RxIN1	TxIN/RxOUT8	G1	G1
	TxIN/RxOUT9	G2	G2
	TxIN/RxOUT12	G3	G3
	TxIN/RxOUT13	G4	G4
	TxIN/RxOUT14	G5	G5
	TxIN/RxOUT15	B0	B0
	TxIN/RxOUT18	B1	B1
TxOUT/RxIN2	TxIN/RxOUT19	B2	B2
	TxIN/RxOUT20	B3	B3
	TxIN/RxOUT21	B4	B4
	TxIN/RxOUT22	B5	B5
	TxIN/RxOUT24	HSYNC	HSYNC
	TxIN/RxOUT25	VSYNC	VSYNC
	TxIN/RxOUT26	DEN	DEN
TxOUT/RxIN3	TxIN/RxOUT28	R6	R6
	TxIN/RxOUT29	R7	R7
	TxIN/RxOUT30	G6	G6
	TxIN/RxOUT31	G7	G7
	TxIN/RxOUT32	B6	B6
	TxIN/RxOUT33	B7	B7
	TxIN/RxOUT34	RESERVED	RESERVED
TxOUT/RxIN4	TxIN/RxOUT35	R8	R8
	TxIN/RxOUT36	R9	R9
	TxIN/RxOUT37	G8	G8
	TxIN/RxOUT38	G9	G9
	TxIN/RxOUT39	B8	B8
	TxIN/RxOUT40	B9	B9
	TxIN/RxOUT41	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	-		
	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~ R1020		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:			
	↓ 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	R1021	
		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	R1022	
	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	R1023	
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~ G1020		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:			
	↓ 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	G1021	
		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	G1022	
	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	G1023	
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~ B1020		
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:			
	↓ 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	B1021	
		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	B1022	
	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	B1023	

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

5. Interface Timing

5.1 Timing Parameters (DE mode)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	130	148.5	155	MHz	-
Hsync		F_H	50	67.5	73	KHz	-
Vsync		F_V	47	60	62	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	-	1080	-	Lines	-
	Vertical Total	T_V	1100	1125	1480	Lines	-
Horizontal Display Term	Active Display Period	T_{HD}	-	1920	-	Clocks	-
	Horizontal Total	T_H	2154	2200	2350	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

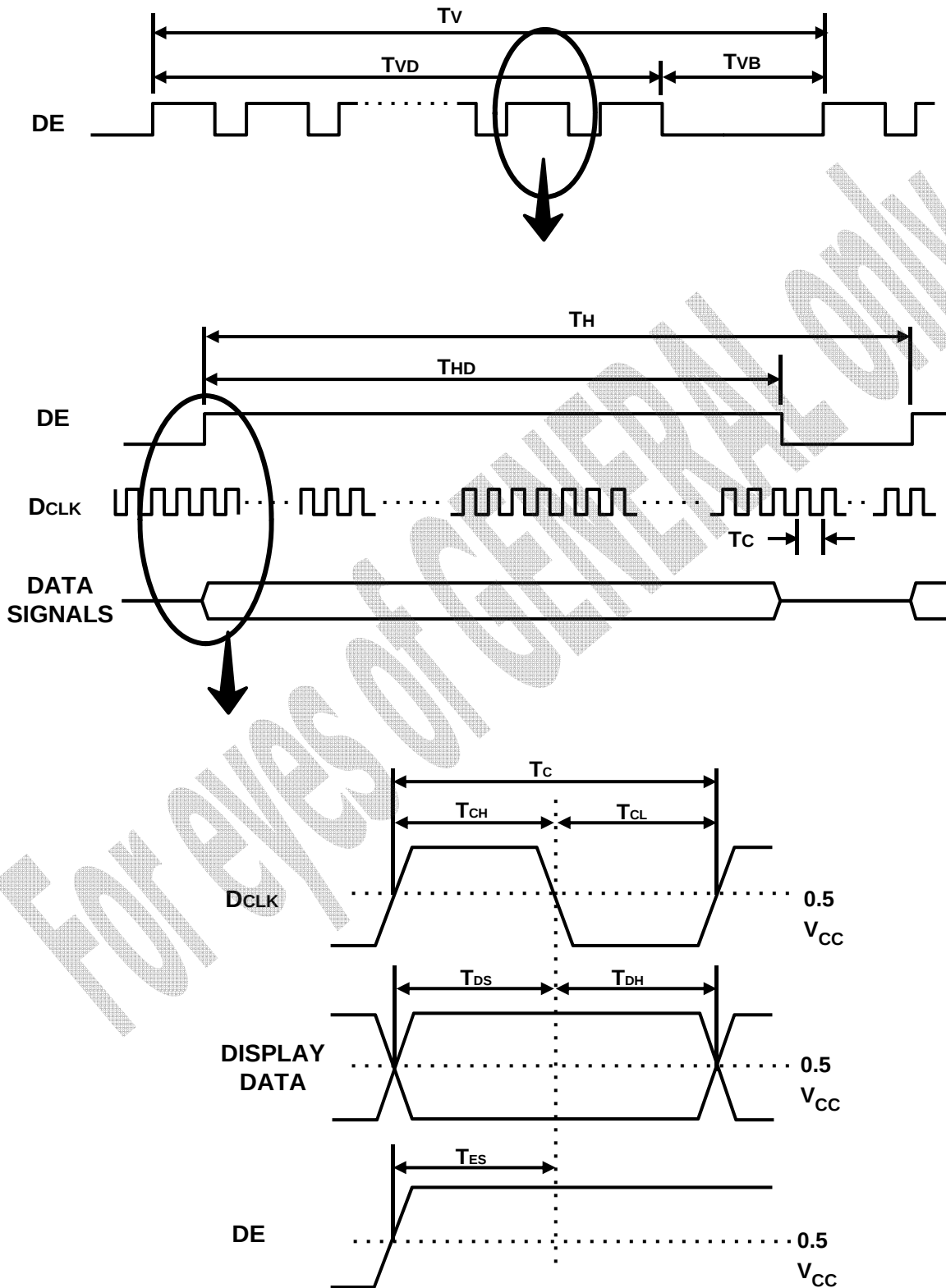
(2) Internal $V_{DD} = 3.3V$

(3) Spread spectrum

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

- Modulation Frequency : under 100KHz

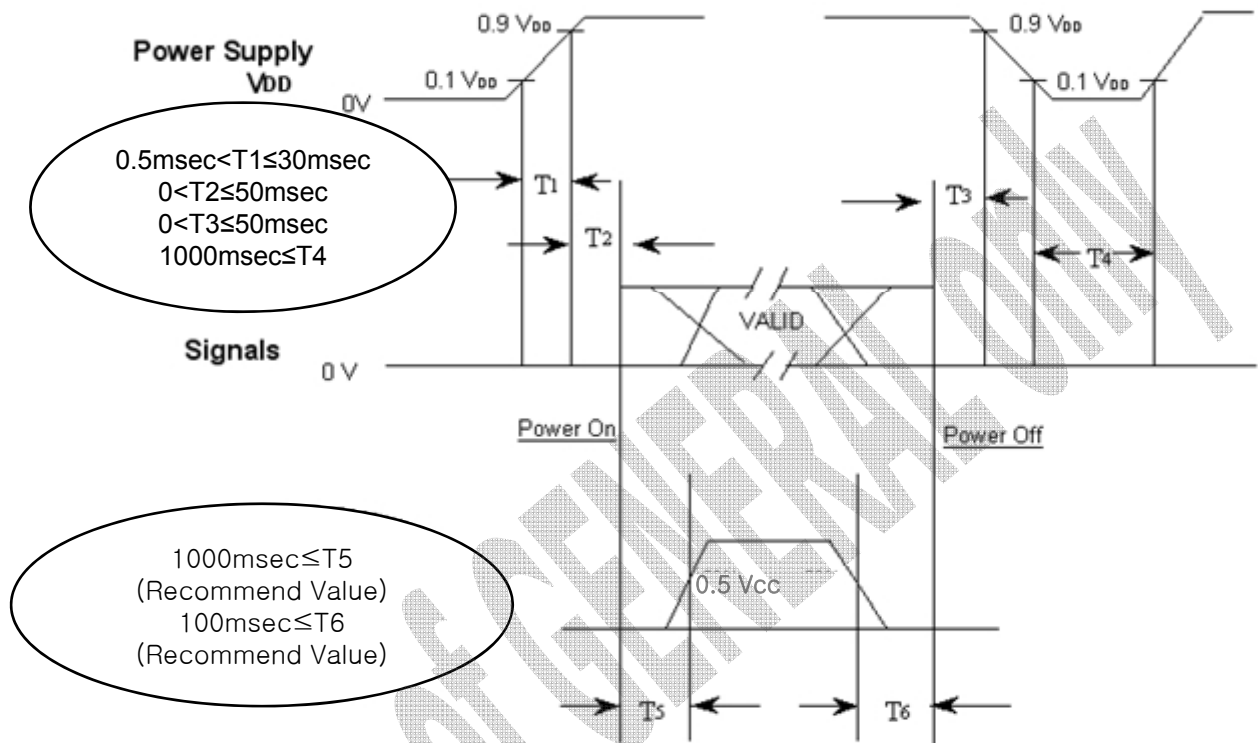
5.3 Timing diagrams of interface signal (DE mode)



5.4 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

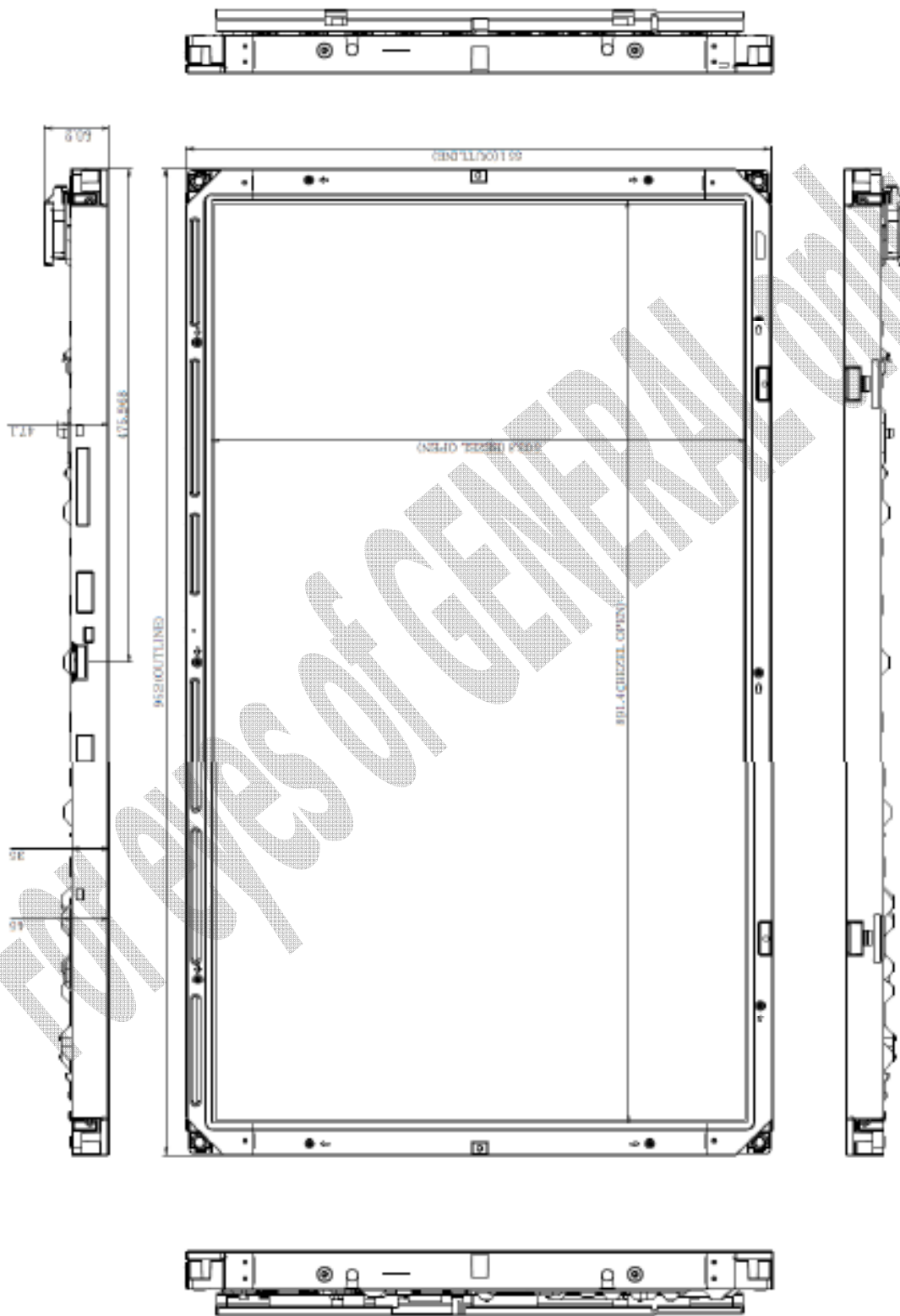
$T5$: The time from valid data to B/L enable at power ON.

$T6$: 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)

6. Outline Dimension- Front

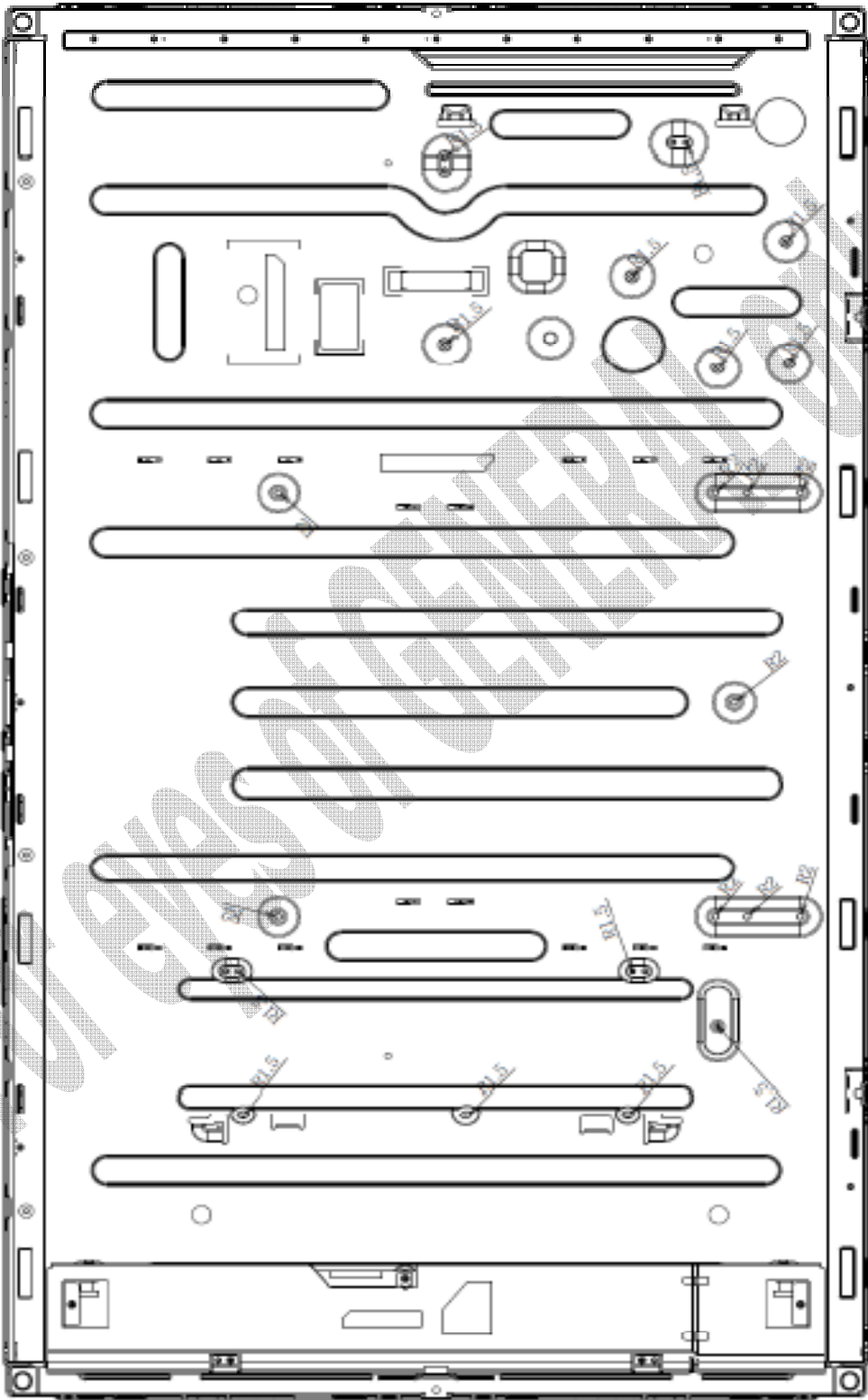
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6. Outline Dimension- Rear

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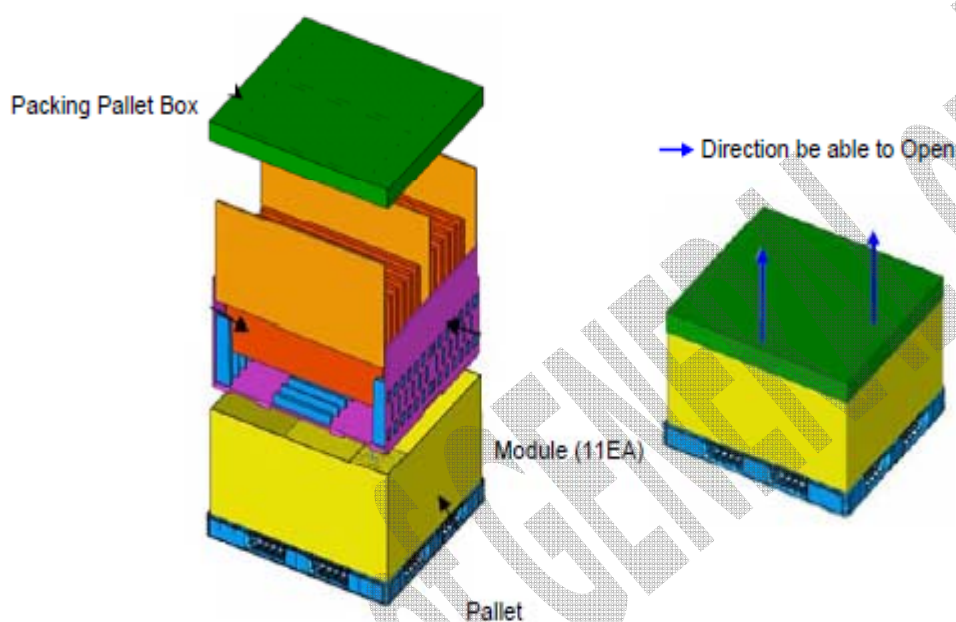
7. PACKING

7.1 CARTON (Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method



7.2 Packing Specification

Item	Specification	Remark
LCD Packing	11ea / (Packing-Pallet Box)	1. 110Kg / LCD (11ea) 2. 15.5 Kg/ Packing –Pallet Box (1ea) 3. Packing Pallet Box Material :PAPER
Pallet	1Box / Pallet	1. Pallet weight = 8kg
Desiccant (Driver)	2ea/LCD	10g/ea, Cobalt-dichloride-free
Packing Direction	Vertical	
Total Pallet Size	H x V x height	1150mm(H) x 985mm(V) x 719mm(Height)
Total Pallet Weight	133.72 kg	Pallet(8 kg) + Module(10 kg*11ea=110 kg) + Packing Pallet Box (15.5kg) + Desiccant (0.02kg*11=0.22kg)

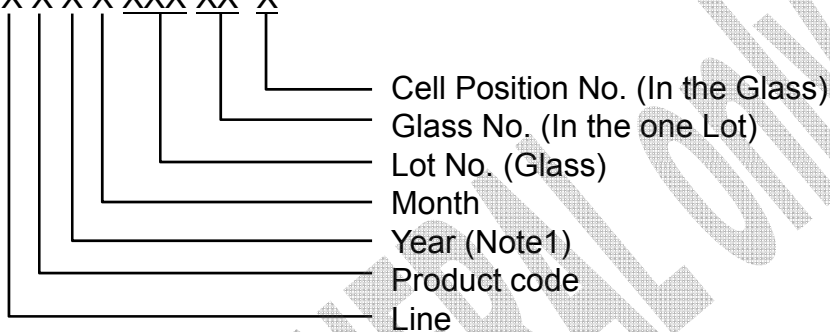
8. MARKING & OTHERS

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

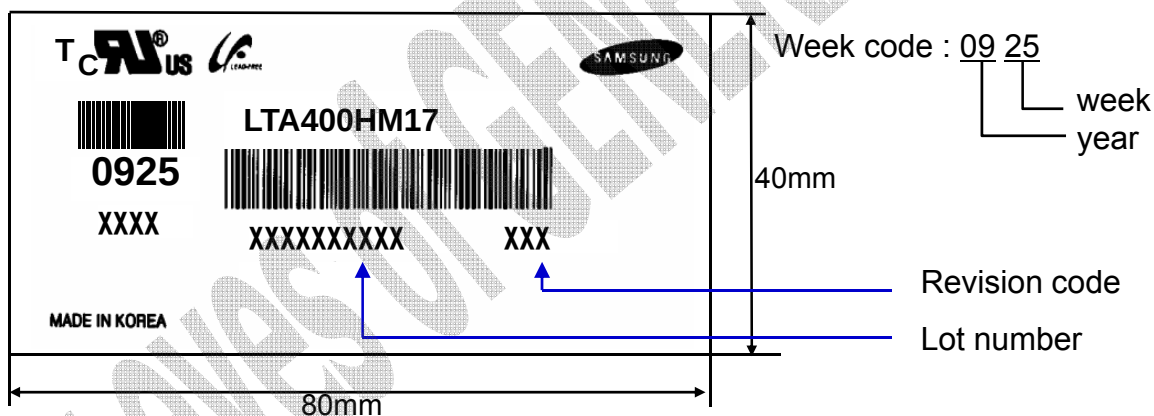
(1) Part number : LTA400HM17-WXX

(2) Revision: One letter

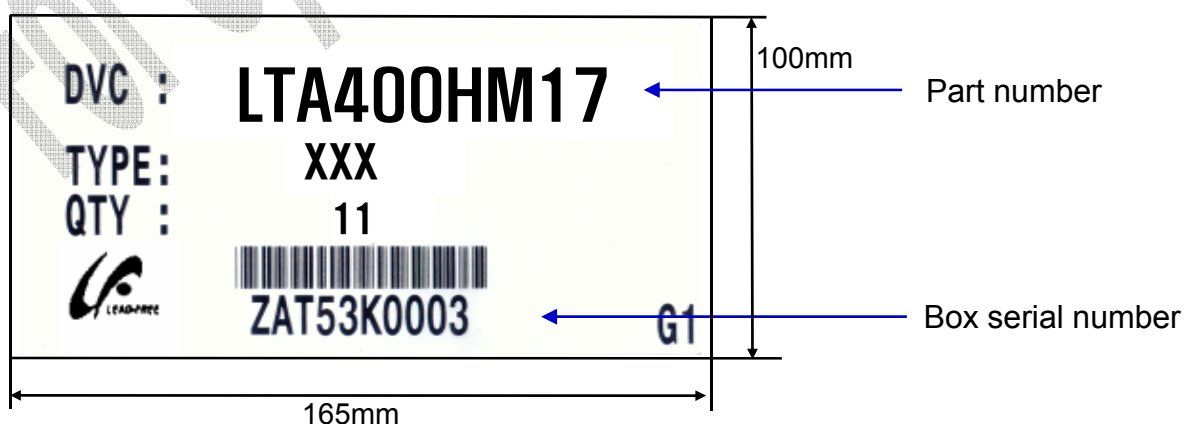
(3) Lot number : X X X X XXX XX X



(4) Nameplate Indication



(5) Packing box attach



(6) Others

1. After service part

Lamps cannot be replaced because of the narrow bezel structure.

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9. General Precautions

9.1 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 inverter 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 CCFT 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 inverter & 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.

9.2 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 5 to 40 °C 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.
- (d) Storage condition of Packing

ITEM	UNIT	Min.	Max.
Storage Temperature	(°C)	5	40
Storage Humidity	(%rH)	35	75
Storage Life	12 months		
Storage Condition	-Prohibit direct sunlight -Ventilation in storehouse and control changing temperature is within limits of environment -Put it on pallet and store them with removing from wall. -Don't wet Out-BOX and avoid rain. -Without condensation. -Etc. Avoid harmful Condition		
Long-term Storage Process	-More than 3 months Storage or Low temp. Delivery/under 5°C storage →On the 20°C, 50%rH Condition, more than 10hr release.		

9.3 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 inverter power supply should be connected directly with a minimized length. A longer cable between the back light and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).

9.4 Operation Condition Guide

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- (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.

9.5 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. (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.