Samsung Secret

Approval Spec

Customer : Hisense **DATE : 26. Oct. 2011**

SAMSUNG TFT-LCD

MODEL : **LSC400HM03**

(TFT Panel + Driver Kit)

Any Modification of Specification is not allowed without SEC's Permission.

NOTE :

Customer's *Approval*	
SIGNATURE	DATE

APPROVAED BY	DATE
	26. Oct. 2011
PREPARED BY	DATE
	26. Oct. 2011

LCD Business

Samsung Electronics Co . , LTD.

Contents

Revision History

Date	Rev. No	Page	Summary
26. Oct. 2011	000	All	First issued

Description

LSC400HM03 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. The resolution of a 40.0“ is 1920 x 1080 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 ratio & aperture ratio with wide color gamut
- SPVA(Super Patterned Vertical Align) mode
- Wide viewing angle (±178°)
- High speed response
- FHD resolution (16:9)
- Low Power consumption
- DE (Data Enable) mode
- 2ch LVDS (Low Voltage Differential Signaling) interface (2pixel/clock)

General Information

Items	Specification	Unit	Note
Glass Size	906.4 X 518.0 (TFT) 906.4 X 515.4 (CF)	mm	±1.0mm
Polarizer Size	897.6 X 510.8	mm	
Weight	1900(Max)	g	
Pixel Pitch	0.46125 (H) × 0.46125 (V)	mm	
Active Display Area	885.6(H) X 498.15 (V)	mm	
Surface Treatment	Anti Glare		
Display Colors	8 bit – 16.7 M	colors	
Number of Pixels	1,920 × 1080	pixel	
Pixel Arrangement	RGB vertical stripe		
Display Mode	Normally Black		

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}	10.8	13.2	V	(1)
Storage temperature	T_{STG}	5	40	℃	(2), (5)
Operating temperature	T_{OPR}	0	50	℃	(2), (6)
Panel surface temperature	T_{SUR}	0	60	℃	(3)
Storage humidity	H_{STG}	35	75	%RH	(2), (6)
Operating humidity	H_{STG}	20	90	%RG	(2), (6)
Endurance on static electricity			150	V	(4)

Note (1) Ta= 25 ± 2 °C
(2) Temperature and relative humidity range are shown in the figure below.
a. 90 % RH Max. (Ta ≤ 39 °C)
b. Relative Humidity is 90% or less. (Ta > 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) Set the voltage on static electricity below 150V in the process to put the polarizer on glass.
(5) The storage condition with glass
(6) The operating condition with assembly

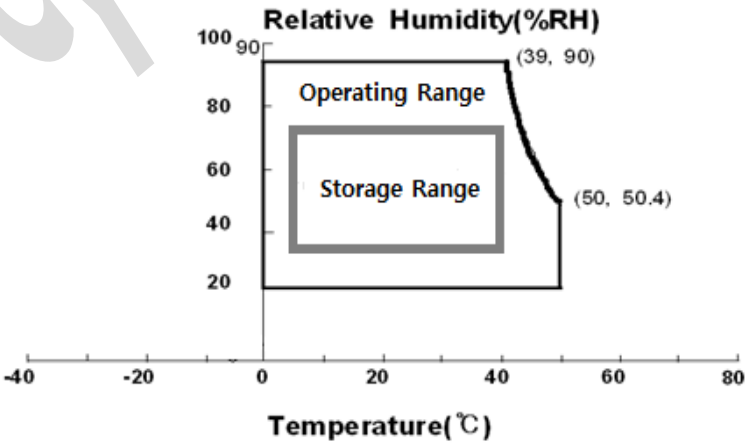


Fig. Temperature and Relative humidity range

2. Optical Characteristics

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}=148.5MHz, **Light source : D65 standard**)

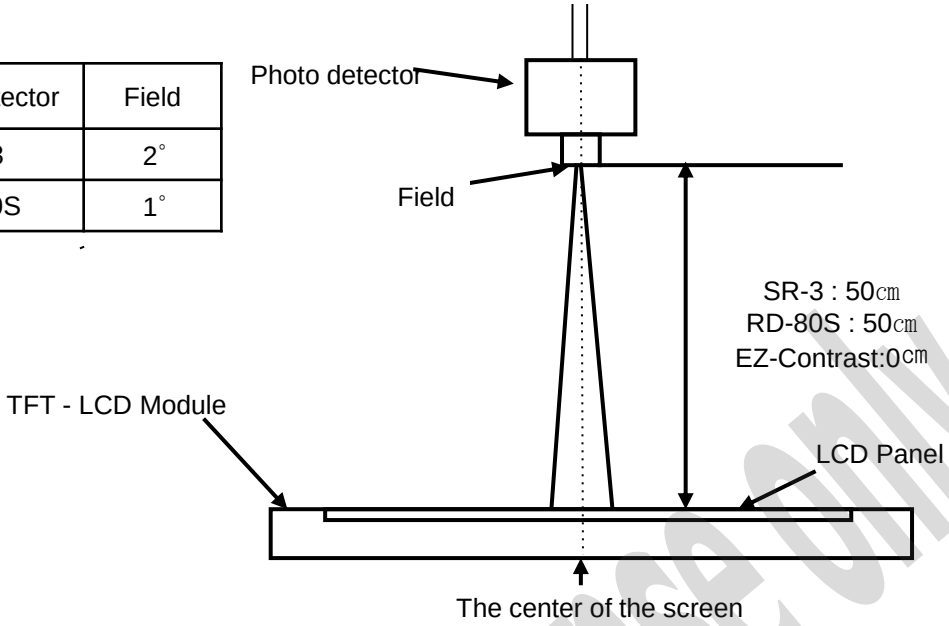
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R	Normal θ**L,R**=0 θ**U,D**=0 Viewing Angle	3,000	4,000	-		(1) SR-3
Response Time	G-to-G	Tg		-	8	-	msec	(3) RD-80S
Luminance of White (Center of screen)		Y_L		-	160	-	cd/m^2	(4) SR-3
Color Chromaticity (CIE 1931)	Red	Rx		TYP. -0.03	0.652	TYP. +0.03		(5),(6) SR-3
		Ry			0.330			
	Green	Gx			0.290			
		Gy			0.605			
	Blue	Bx			0.136			
		By			0.101			
	White	Wx			0.307			
		Wy			0.372			
Color Gamut		-		-	70	-	%	(5) SR-3
Color Temperature		-		-	6400	-	K	

- Test Equipment Setup

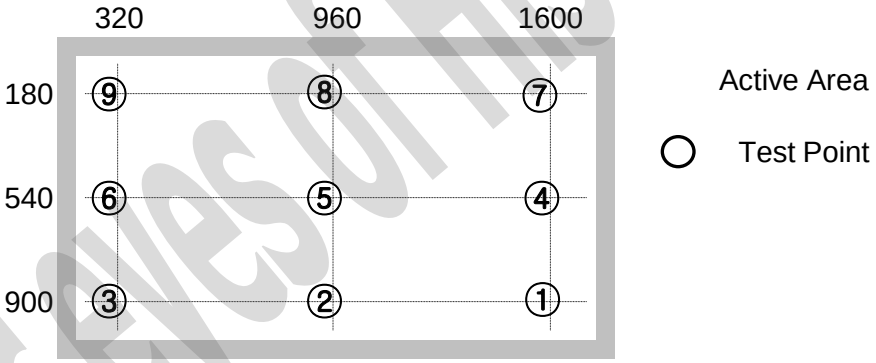
The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

Environment condition : Ta = 25 ± 2 °C

Photo detector	Field
SR-3	2°
RD-80S	1°



- Definition of test point

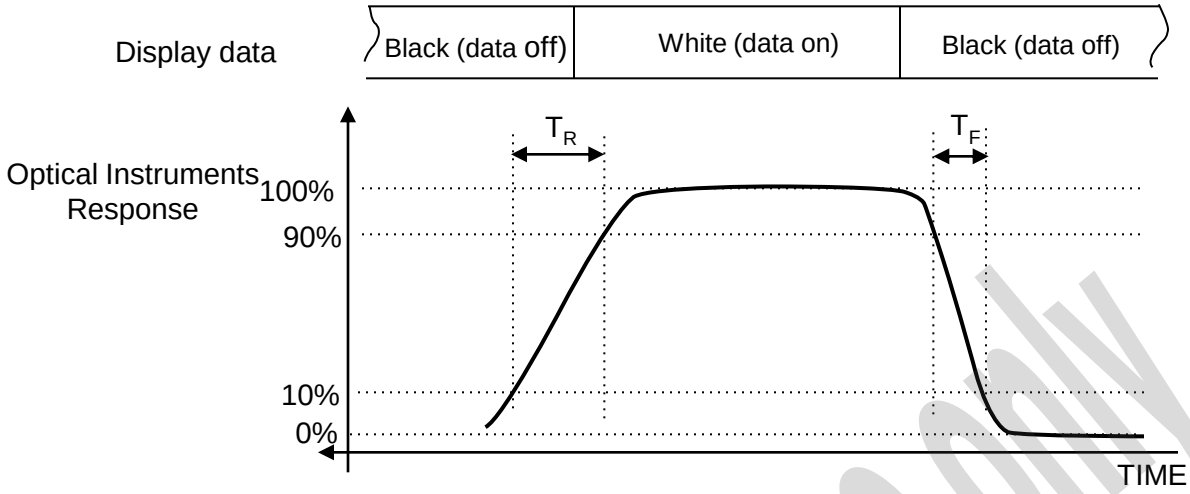


Note (1) Definition of Contrast Ratio (C/R)
: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

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

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

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

3. Electrical Characteristics

3.1 TFT LCD Module

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

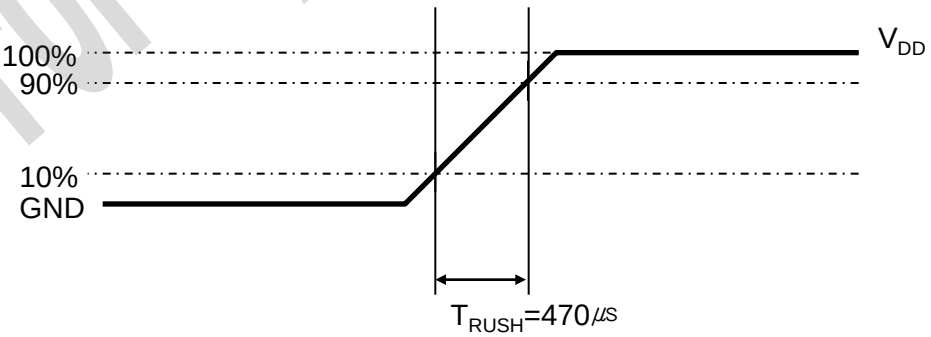
Ta = 25°C ± 2 °C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	10.8	12.0	13.2	V	(1)
Current of Power Supply	(a) Black	I_{DD}	-	900	1000	mA	(2),(3)
	(b) White		-	950	1050	mA	
	(c) H-STRIPE		-	1200	1320	mA	
Vsync Frequency		f_V	45	60	65	Hz	
Hsync Frequency		f_H	48	67.5	75	kHz	
Main Frequency		f_{DCLK}	130	148.5	155	MHz	
Rush Current		I_{RUSH}	-	-	4.5	A	(4)

Note (1) The ripple voltage should be controlled under 10% of V_{DD}.
(2) fV=60Hz, fDCLK = 148.5MHz, V_{DD} = 12.0V, DC Current.
(3) Power dissipation check pattern (LCD Module only)

a) Black Pattern b) White Pattern c) H-STRIPE

(4) Measurement Conditions



Rush Current I_{RUSH} can be measured when T_{RUSH}. is 470㎲.

4. Input Terminal Pin Assignment

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	NC	NOTE1
13	RO[1]P	Odd LVDS Signal +	38	NC	
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	NC	NOTE1	47	NC	
23	NC		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)

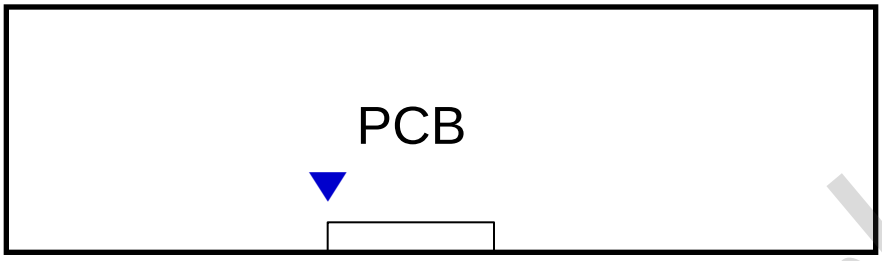
Note2) LVDS OPTION : If this PIN is HIGH (3.3 V) → Normal LVDS format

LOW (GND) → JEIDA LVDS format

SEQUENCE : On = V_{DD}(T1) ≥ LVDS Option ≥ Interface Signal(T2)

OFF = Interface Signal(T3) ≥ LVDS Option ≥ V_{DD}

Note(3) Pin number starts from Left side



Pin No. 1 Pin No. 51

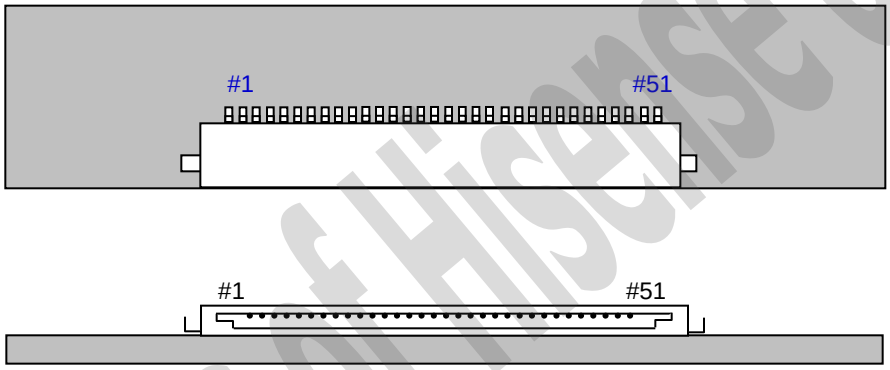


Fig. Connector diagram

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.

4.2 LVDS Interface

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

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

4.3 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~ 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

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	75	KHz	-
Vsync		F_V	48	60	62	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	-	1080	-	Lines	-
	Vertical Total	T_V	1092	1125	1380	Lines	-
Horizontal Display Term	Active Display Period	T_{HD}	-	1920	-	Clocks	-
	Horizontal Total	T_H	2090	2200	2350	clocks	-

Note) This product is DE mode. But the Hsync & Vsync signal must be inputted

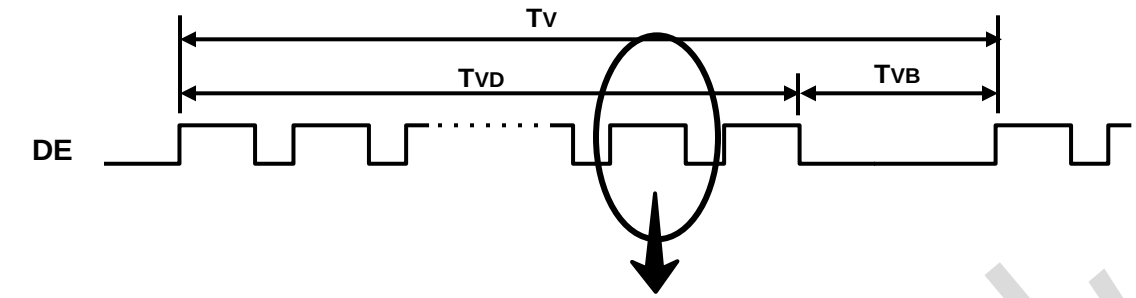
(1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system

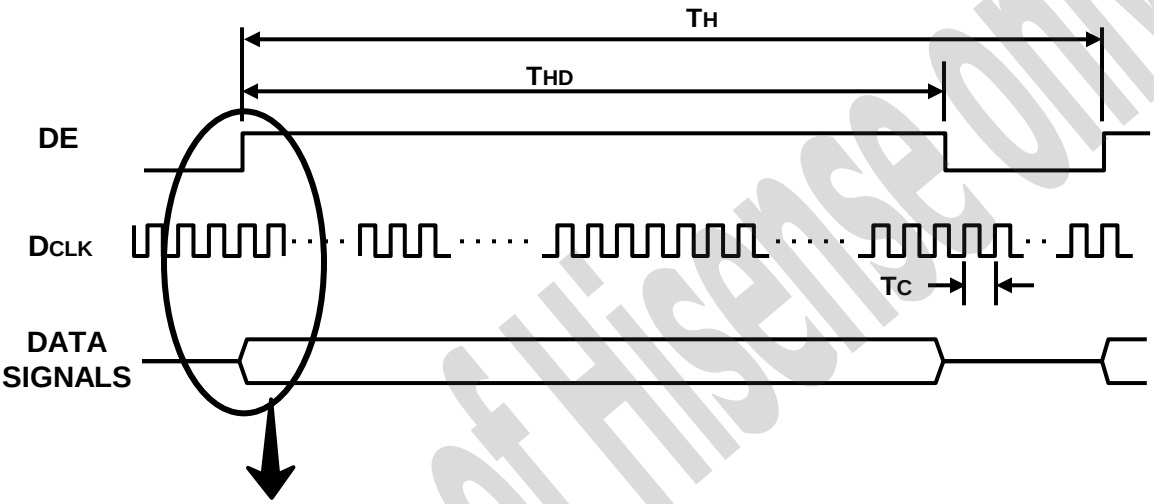
(2) Internal VDD = 3.3V

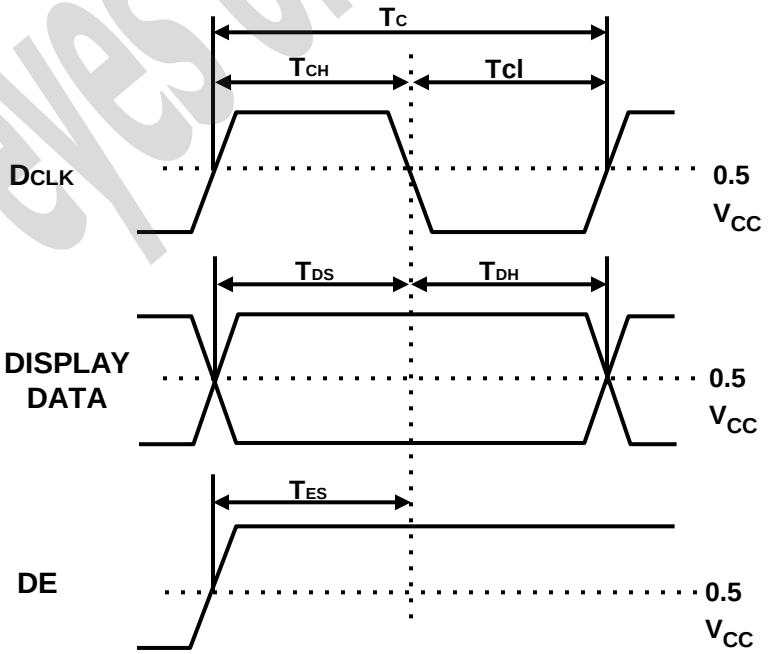
(3) Spread spectrum

- Modulation rate (max) : ± 1.5 % , Modulation Frequency : under 100KHz

5.2 Timing diagrams of interface signal (DE mode)



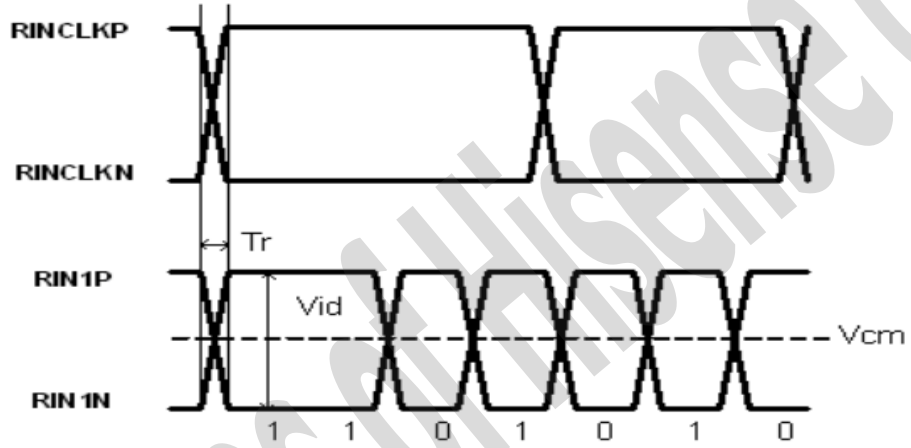


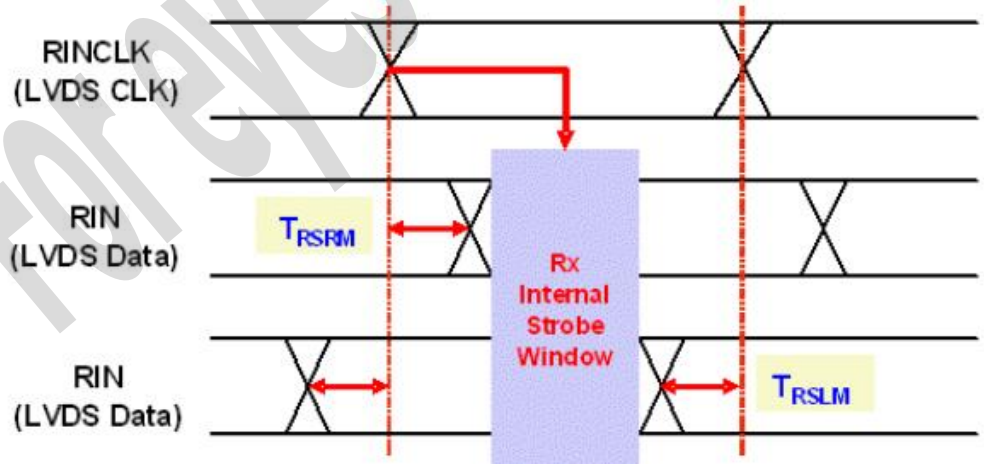


5.3 LVDS Input Data Characteristics

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Input common mode voltage		V_{CM}	0.4	-	2.4	V	-
Differential Input Voltage		$\|V_{ID}\|$	100	-	600	mV	
Input Data Position	F_{IN}=80MHz	t_{RSRM}	-	-	400	ps	
		t_{RSLM}	-400	-		ps	

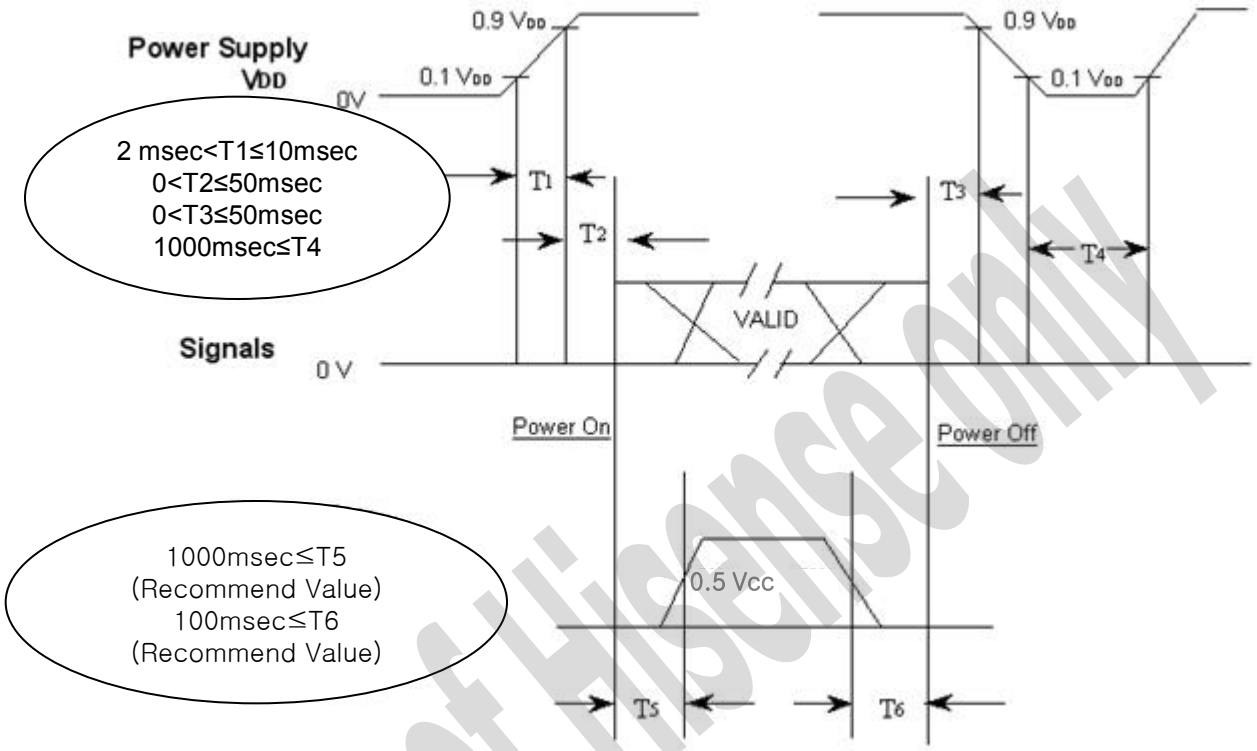
Note) When the skew is measured the Spread Spectrum should be 0%





5.4 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.



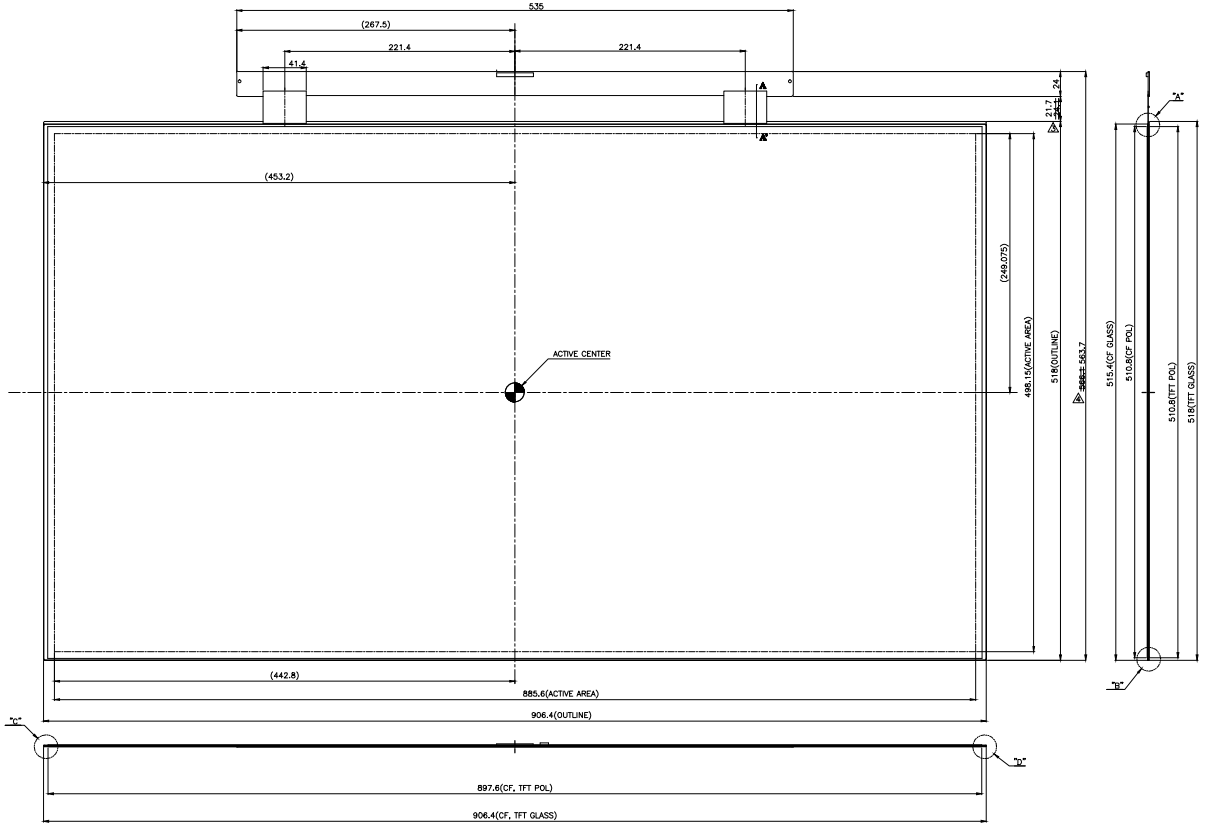
T1 : V_{DD} rising time from 10% to 90%
T2 : The time from V_{DD} to valid data at power ON.
T3 : The time from valid data off to V_{DD} off at power Off.
T4 : V_{DD} off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L disable at power Off.

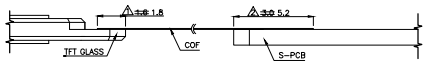
- The supply voltage of the external system for the Module input should be the same as the definition of V_{DD}.
- Apply the lamp voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily 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)

NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	SPEC NO	REMARK
1	OUTLINE DIMENSION	–	LSC400HM03	1		

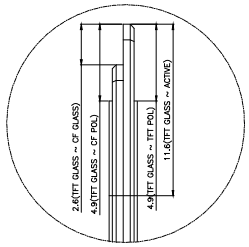
<DRAWING CHANGES>

⚠ (2011.10.20) Modify the wrong dimension : 1.6->1.8
⚠ (2011.10.20) Modify the wrong dimension : 3.0->5.2
⚠ (2011.10.20) Modify the wrong dimension : 24.1->21.7
⚠ (2011.10.20) Modify the wrong dimension : 566.1->563.7

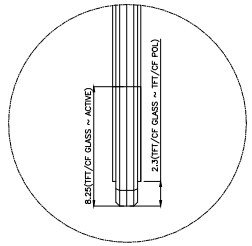




SECTION A-A'



DETAIL "A"



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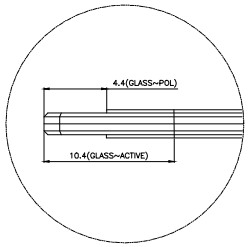
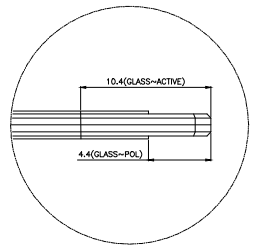


DETAIL "C"



DETAIL "D"

**** NOTE***
1. PANEL : TFT-LCD
2. REFER TO "PRODUCT INFORMATION" OR "PRODUCT SPECIFICATION" DOCUMENTS
- TOLERANCE
- FFC CABLE INFORMATION
- CONNECTOR INFORMATION
- HEIGHT OF CIRCUIT COMPONENTS

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	REASON	CHK'D BY

UNIT	mm	DRA'N BY	DES'D BY	CHK'D BY	APP'D BY
SCALE	1:1		H.K.J.O		
TOLERANCE			11.09.22		

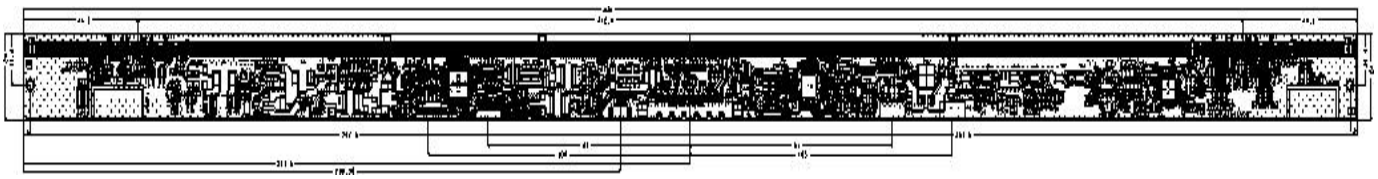
SAMSUNG ELECTRONICS

SPEC. NO

MODEL NAME	LSC400HM03		
PART/SHEET NAME	OUTLINE DIMENSION	SHEET	1/1
CODE NO.	–	VER.	001

REVISION

<Source PCB>



7. Reliability Test

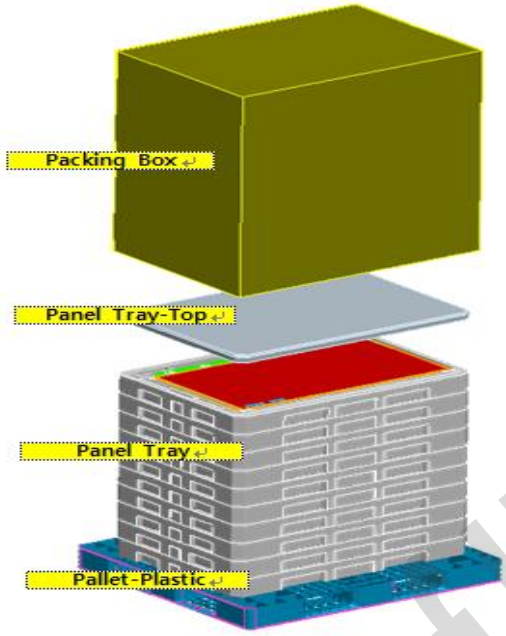
Item	Test Condition	Quantity
HTOL	60℃	8EA
LTOL	-5℃	4EA
THB	50℃/ 90%RH	10EA
ESD (operation)	contact : ±10 kV ,210Point,1time/Point	3EA
	non-contact : ±20 kV,210Point,1time/Point	3EA
TSS	-20℃~65℃	4EA
Image sticking	25℃ Mosaic Pattern(9x10) 12hrs Rolling pattern 12hrs , 3cycles	8EA
Electric sound	Overall below 23dB	2EA
Immersion	WHTS(2hr)/LTS(-5℃,1hr) 4 cycle → Immersion/ Pressure (50℃100mb) → THB(50℃90%RH) 48hr	4EA
ASG margin	Max. frequency 25℃~-40℃	Each cell
	Min. frequency 60℃, 96hr	
Frame spot	WHTS 70℃ 90%RH 168hr storage → HTOL 50℃ 96hr Dynamic	4EA
Decompression	-40~50℃, 0m(0ft) ~ 13,700m(45,000ft), 72.5Hr	4EA
Complex test	-20℃~65℃, 0~90%RH, 2cycle	4EA
	HTS(70℃) : HTS → HTOL(50℃) 48hr	8EA
	LTS(-25℃) : LTS → HTOL(50℃) 48hr	8EA
Distribution environment	Drop(20cm) → -30~60℃, 90%RH → Pressure → Vibration (5~200Hz 1.05Grms, 2hr) → Drop (20cm)	1pallet

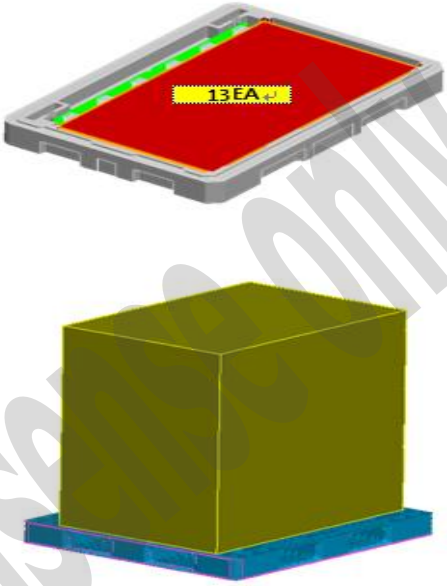
[Result Evaluation Criteria]
Under the display quality test conditions with normal operation state, these should be no change which may affect practical display functions.

* HTOL/ LTOL : High/Low Temperature Operating Life
* THB : Temperature Humidity Bias

8. PACKING

8.1 CARTON of the product





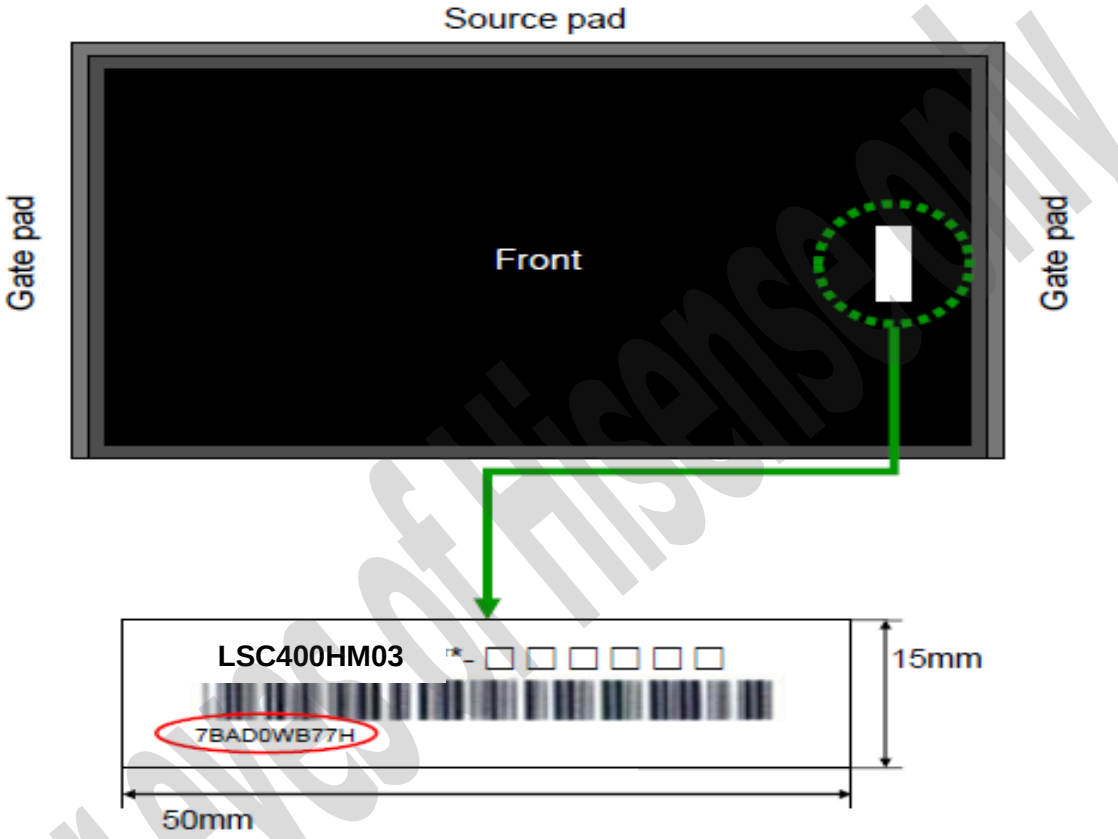
8.2 Packing Specification

Item	Specification	Remark
Total Pallet Size	W×V×Height [mm]	1475 X 1150 X 1150
Tray	13 [Panel/Tray]	-. Panel : 24.7kg (1.9 kg/Panel, 13ea/Tray)) -. Middle Sheet : 0.9kg (0.05 kg/ea, 18ea/Tray) -. Panel Tray : 1.7kg (EPS) -. Silica Gel : 4ea/Tray
Pallet	20 [Tray/Pallet]	-. Pallet 21kg (High-Density Polyethylene) -. 20ea(10 tray X 2 array) + 2ea(Top tray)
Total Weight	571.6 [kg]	-. Packing Box : 3kg (Paper)

9. MARKING & OTHERS

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

(1) Cell Label



Lot number : X X X X XXX XX X

- Cell Position No. (In the Glass)
- Glass No. (In the one Lot)
- Lot No. (Glass)
- Month
- Year (Note1)
- Product code
- Line

(2) Box Label

BOX Serial : X X X X X X XXXX XX XX

- Week
- Year
- Box No.
- Day
- Month
- Year
- Site
- Module Line
- Product Type

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 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.

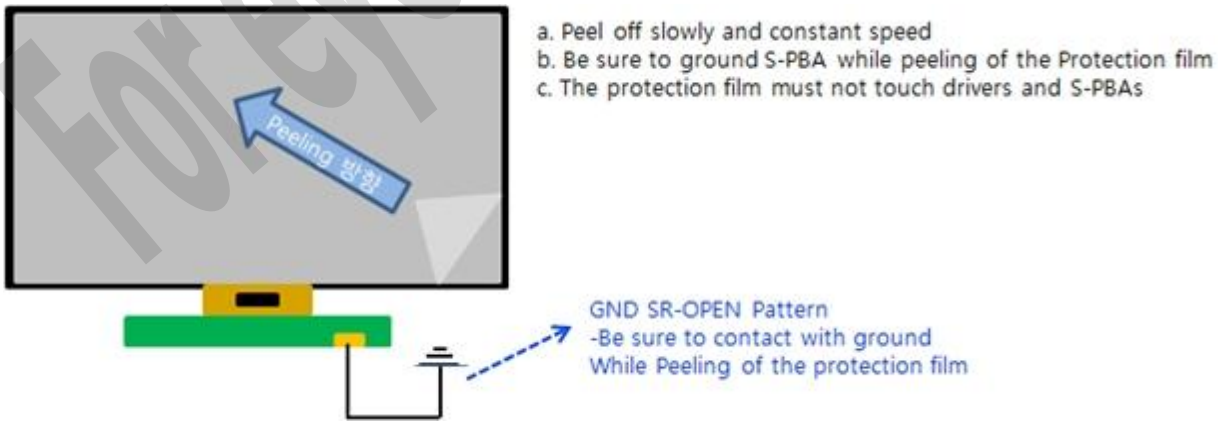
(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(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) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(j) Pins of I/F connector shall not be touched directly with bare hands.

*Process Control Standard

	Item	Management standard value and performance standard
1	Anti-static mat (shelf)	1 to 50 [Mohm]
2	Anti-static mat (floor, desk)	1 to 100 [Mohm]
3	Ionizer	Attenuate from ± 1,000V to ± 100V within 2 sec
4	Anti-static wrist band	0.8 to 10 [Mohm]
5	Anti-static wrist band entry and ground resistance	Below 1,000 [ohm]
6	Temperature	0 ~ 35℃
7	Humidity	60 to 70 [%RH]

9.2 Storage

ITEM	Unit	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage life	6 months		
Storage Condition	(1) The storage room should provide good ventilation and temperature control. (2) Products should not be placed on the floor, but on the Pallet away from a wall. (3) Prevent products from direct sunlight, moisture nor water; Be cautious of a build up of condensation. (4) Avoid other hazardous environment while storing goods. (5) If products delivered or kept in conditions of the recommended temperature or humidity, we recommend you leave them at a circumstances which is shown in the following table.		

After	1 month	2 month	3 month	4month	5 month	6month
Baking	No backing		50℃ 10% 24Hr	40℃ 10% 48Hr		

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/converter may cause lower luminance of CCFL/LED 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 : 55±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) 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.