

Specification

Module No. : GEA-101E02-DC9509-G020

Version No. : A2

Client Confirmation	Approved by	Prepared by
	Carl Chen	Dou Zhang

Issue History

Version	History	Date	Remarks
A1	First Issue	2021/04/03	
A2	Updated 3.Electrical Specifications Added 4.Optical Specifications Removed 5.General Precaution Added 6.1 Label&6.3 Firmware Version	2023/07/13	

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1. Overview

This specification document is issued for the 10.1" TFT Liquid Crystal Display bonded with Capacitive-Type Touch Panel delivered by General Electrical Touch Co., Limited. This document defined the general provisions for the specific module listed at the front page of this document. In the event of conflict between this document and other documents, this document including the attachments and drawing, is highest-level specification for this products.

2. Feature

2.1 Module Structure

Main Component	Materials	Remarks
Cover Glass	2mm chemical strengthened glass	black printed boarder
Adhesive	OCA	0.175 mm
Touch Sensor	0.55mm DITO glass + COF FPC	SIS9509 Controller
Air Bonding Tape	3M 4905	0.50 mm
Display	TFT LCD	BOE EV101WXM-N81

2.2 General Specifications

Item	Specifications	Remark
Display Active Area	216.96(H) × 135.60(V) mm	
Display Resolution	1280(H) × 800(V)	
Pixel Pitch	0.0565(H) × RGB × 0.1695(V) mm	
Pixel Arrangement	R.G.B. Stripe	
Display Colors	16.2M Colors	6 + FRC
Display Brightness	500 cd/m ²	Typ.
Display Mode	Normally Black	
Display Surface Treatment	Normal	
Electrical Interface	Display: LVDS	
	Touch: USB and I ² C	
Touch Activation	Multi-finger touch	
Touch Resolution	20X, 32Y	
Touch Controller	SIS9509	
Bonding Method	CG to touch sensor: optical bonding TP module to display: tape bonding	
Outline Dimension	248.20(H) × 170.00(V) × 13.33(Max) mm	

3. Electrical Specifications

3.1 Display Electrical Specifications

3.1.1 TFT LCD Module

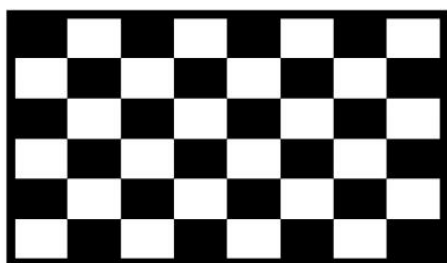
< LCD Module Electrical Specifications > [Ta=25±2℃]

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
Power Supply Voltage	VCC	3.0	3.3	3.6	V	Signal
Power Supply Current	I _{VCC}	-	250	330	mA	Note 1
Power Consumption	P _{LCD}	-	0.80	1.10	W	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VBAT=3.8V, Frame rate fV=60Hz
and Clock frequency = 156.8MHz. Test Pattern of power supply current

a) Typ : Mosaic 8 x 6 Pattern(L0/L255)

b) Max : L255



3.1.2 Back-Light Unit

< LED Driver Electrical Specifications >

[Ta=25±2℃]

Parameter		Symbol	Values			Unit	Notes
			Min.	Typ.	Max.		
BLU Supply Voltage		VDD	11.5	12	12.5	V	
BLU Forward Current		I _{VDD}	-	275	330	mA	
Power Consumption		P _{LED}	-	3.3	-	W	Note 1
BLU BRTC Level		BLU ON	3.0	3.3	3.6	V	
		BLU OFF	0		0.5	V	
PWMIN	Level	High Level	3.0	3.3	3.6	V	
		Low Level	0		0.5	V	
	Frequency	F _{PWM}	180	200	10K	Hz	
	Duty Ratio	D _{PWM}	5	-	100	%	
LED Life Time		TLED	50000	-	-	Hrs	Note 2/3

Notes:

1. PLED = VDD × IVDD (Without LED converter transfer efficiency)

2. The life time of LED, 50,000Hrs, is determined as the time at which luminance of the LED is 50% compared to that of initial value at the typical LED current on condition of continuous operating at 25±2℃.

3. Only under the above operating conditions could the life time of LED be guaranteed.

3.1.3 Input Terminal PIN Assignment

This LCD employs two interface connections, a 20 pin connector is used for the LCD module electronics interface and a 6 pin connector is used for the internal backlight system.

Pin assignment for LCD module

Connector : DF19G-20P-1H(HRS) or equivalent

< Pin Assignment for LCD Module Connector >

Pin No.	Symbol	Description	Remark
1	VCC	Power supply	
2	VCC	Power supply	
3	N.C.	Not connect	
4	GND	Ground	
5	D0-	Pixel data	
6	D0+	Pixel data	
7	GND	Ground	
8	D1-	Pixel data	
9	D1+	Pixel data	
10	GND	Ground	
11	D2-	Pixel data	
12	D2+	Pixel data	
13	GND	Ground	
14	CLK-	CLK data	
15	CLK+	CLK data	
16	GND	Ground	
17	SDA	Not connect	NC
18	SCL	Not connect	NC
19	D3-	Pixel data	
20	D3+	Pixel data	

Pin assignment for LED Driver

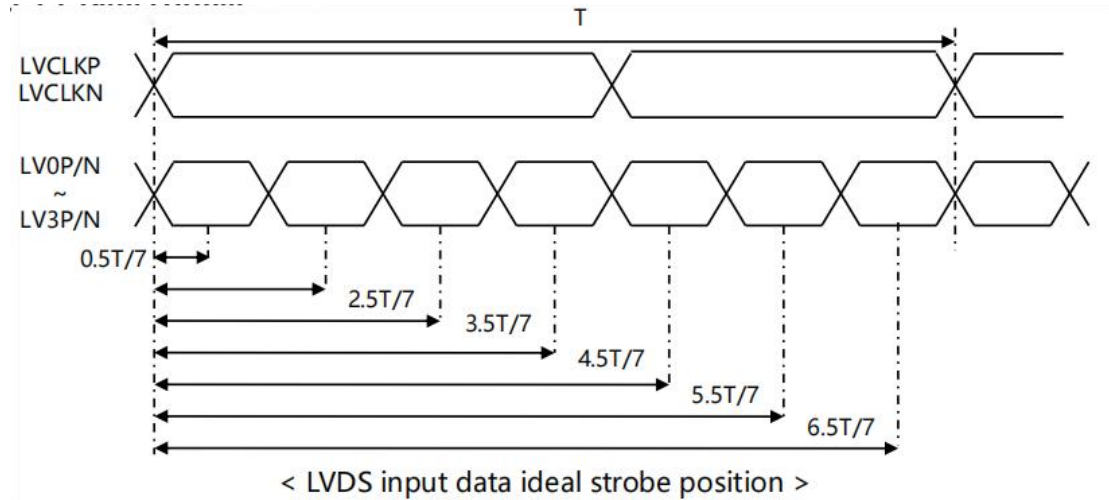
Connector : MSA24038P6 (STM) or equivalent

< Pin assignment for LED Driver >

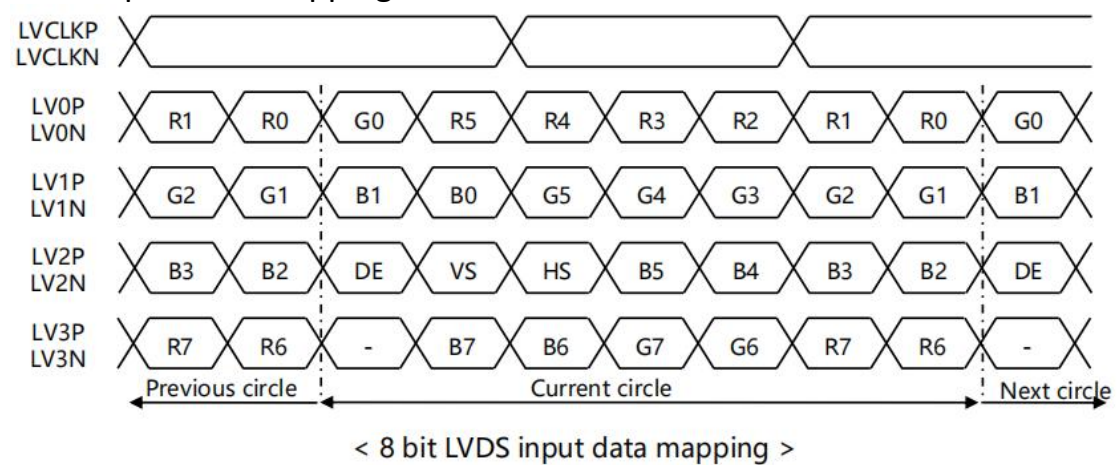
Pin No	Symbol	Description	Remarks
1	PWM	Luminance control	
2	BRTC	Backlight ON/OFF control	High : Backlight ON Low : Backlight OFF
3	GND	Ground	
4	GND	Ground	
5	VDD	Power supply	
6	VDD	Power supply	

3.1.4 LVDS Interface Characteristic

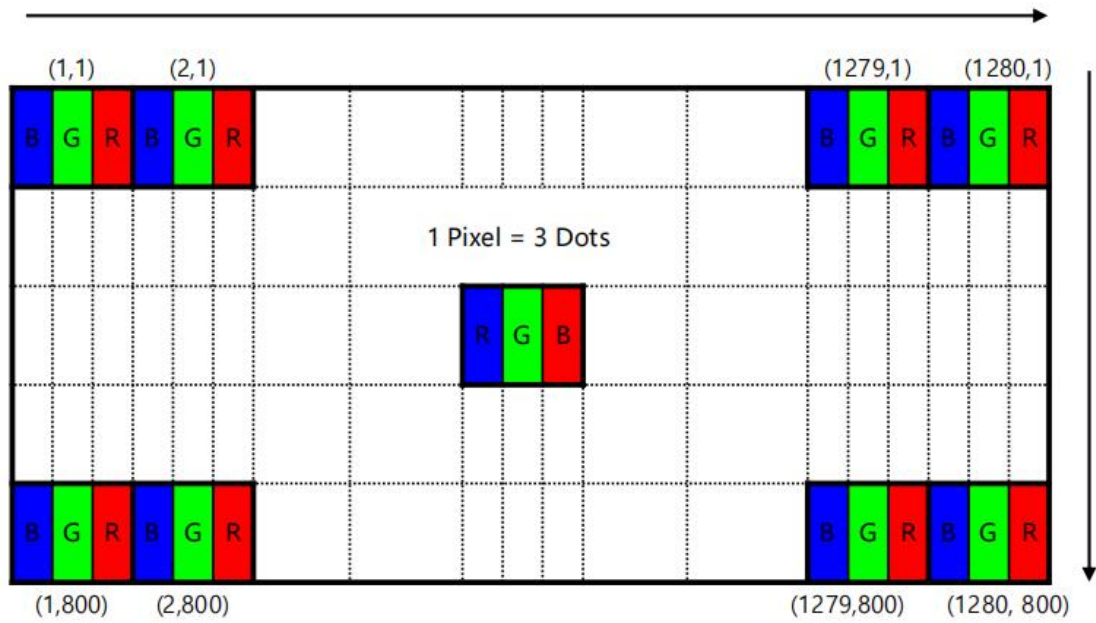
Data Format



LVDS input data mapping



Pixel Format

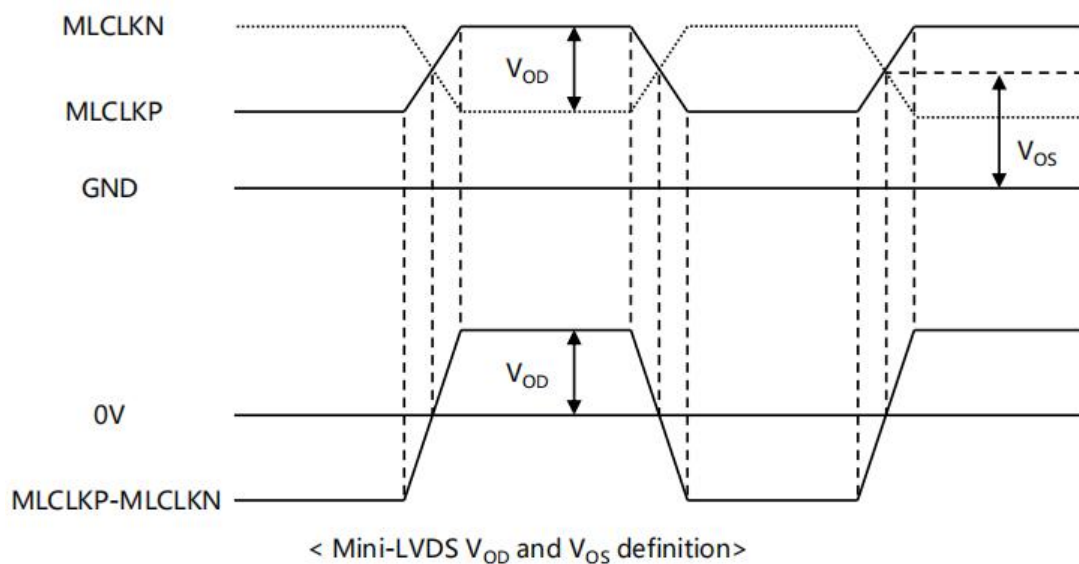
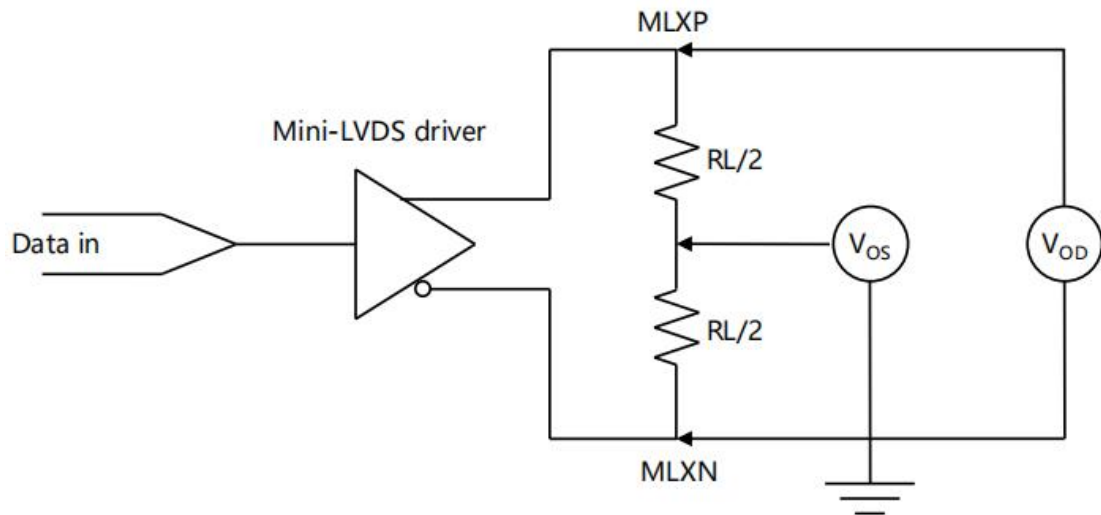
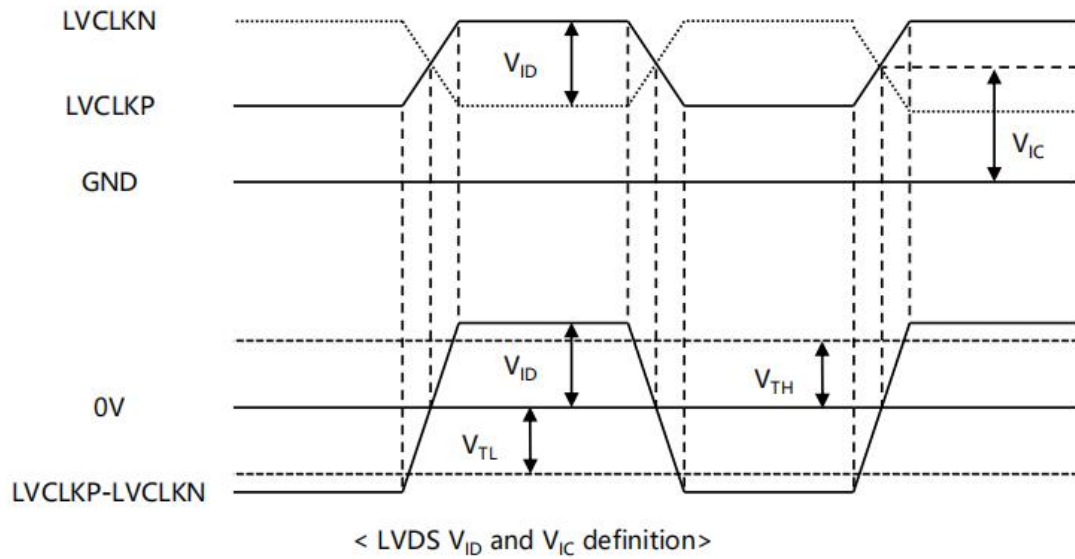


Display Position of Input Data (V-H)

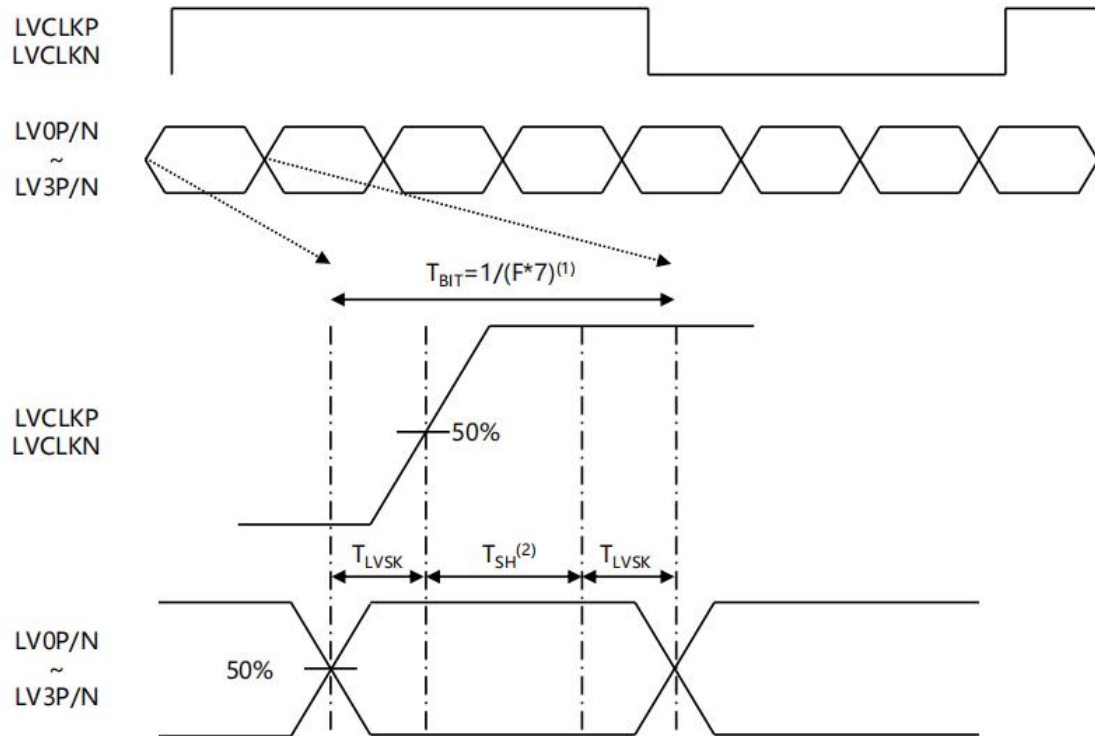
DC Specification

< DC Specification >

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply current	I_{DD}	-	100	-	mA	
LVDS DC specifications						
Differential input high threshold	V_{TH}	-	-	+100	mV	$V_{IC}=1.2V$
Differential input low threshold	V_{TL}	-100	-	-	mV	
LVDS common mode voltage	V_{IC}	0.9	-	1.4	V	
LVDS swing voltage	V_{ID}	± 100	-	± 600	mV	
Mini-LVDS DC specifications						
Output differential voltage range	V_{OD}	± 170	± 200	± 230	mV	$P_I=14K\Omega$ $R_L=100\Omega$ $(T_A=25^\circ C)$
Output differential voltage deviation		0.64	-	0.96	mV	
Output offset voltage range	V_{OS}	1.1	1.2	1.3	V	
Output offset voltage deviation		1.1	1.2	1.3	V	



AC Specification

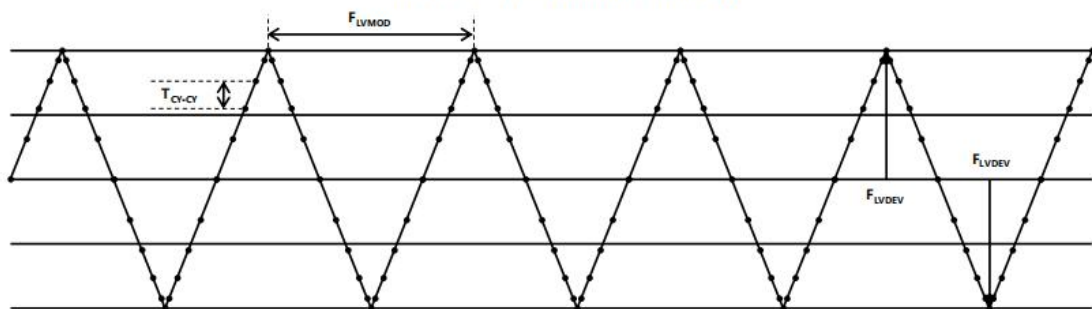


Note:

(1) TBIT: Data period

(2) Internal CLK sampling data window

< LVDS channel to channel skew >



< LVDS input SSC >

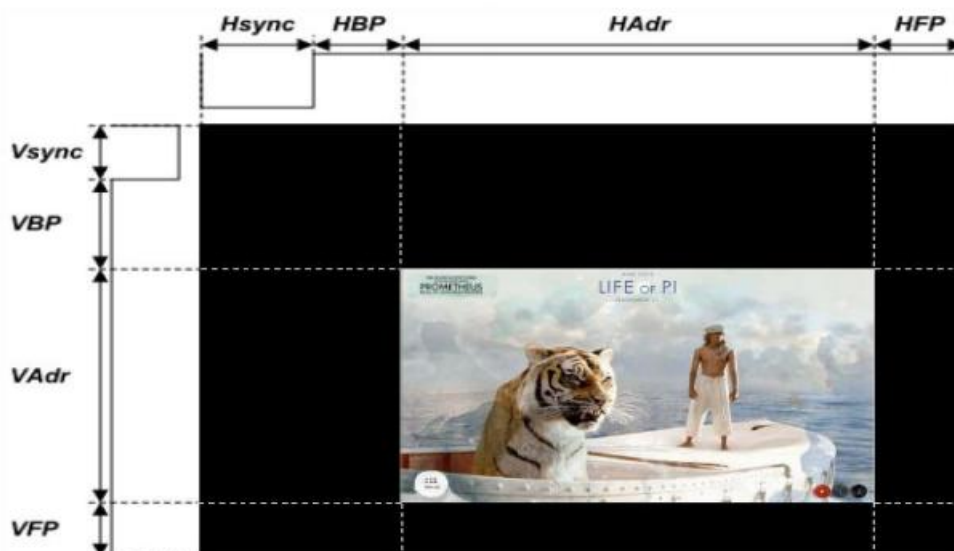
< AC Specification >

Description	Symbol	Condition	Min.	Typ.	Max.	Unit
LVDS Input frequency	F	-	68	-	74	MHz
LVDS channel to channel skew	T_{LVSK}	F=65MHz $V_{IC}=1.2V$ $V_{ID}=\pm 200mV$	-600	-	+600	ps
Modulating frequency of input clock during SSC	F_{LVMOD}	F=85MHz $V_{IC}=1.2V$ $V_{ID}=\pm 200mV$	10	-	300	KHz
Maximum deviation of input clock frequency during SSC	F_{LVDEV}		-3	-	+3	%
Cycle to cycle jitter	T_{CY-CY}		-	-	200	ps

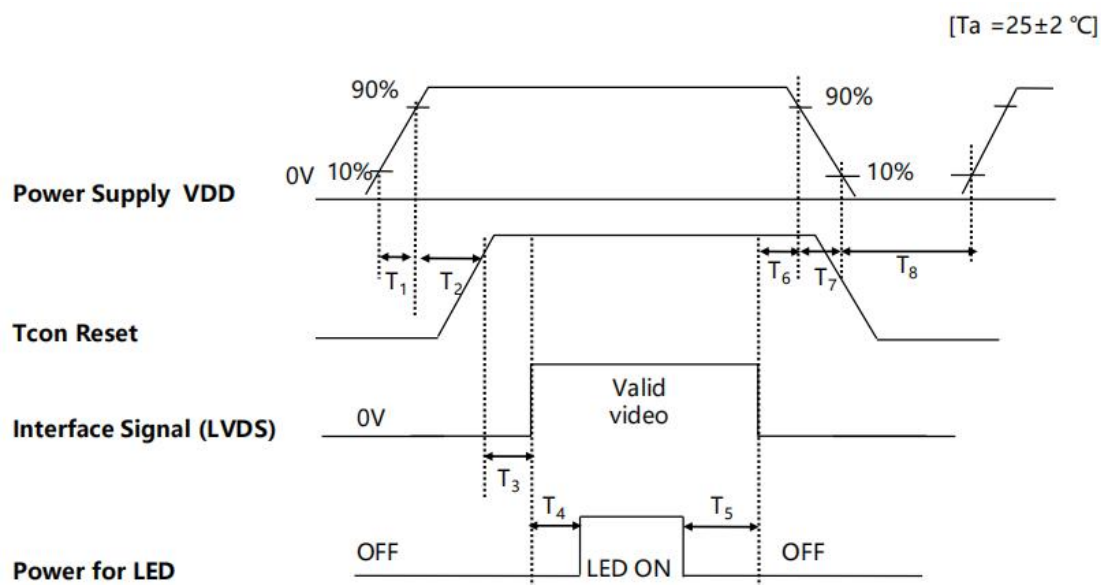
3.1.5 Interface timing Parameter

< Timing Parameter >

Item			Symbol	Min.	Typ.	Max.	Uuit
LCD	Frame Rate		-	59	60	61	Hz
	Pixels Rate		-	69.922	71	72.293	MHz
Timing	Horizontal	Horizontal total time	tHP	-	1440	-	t _{CLK}
		Horizontal Active time	tHadr	1280			t _{CLK}
		Horizontal Back Porch	tHBP		80		t _{CLK}
		Horizontal Front Porch	tHFP		48		t _{CLK}
	Vertical	Vertical total time	tvp		823		t _H
		Vertical Active time	tVadr	800			t _H
		Vertical Back Porch	tVBP		14		t _H
		Vertical Front Porch	tVFP		3		t _H
Lane				-	1	-	Lane



3.1.6 Power Sequence



< Sequence Table >

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.1	-	8	(ms)
T2	-	8	-	(ms)
T3	0	-	-	(ms)
T4	300	-	-	(ms)
T5	300	-	-	(ms)
T6	0	-	50	(ms)
T7	0	-	10	(ms)
T8	500	-	-	(ms)

3.2 Touch Panel Electrical Specifications

3.2.1 Interface Connection

Item	Specification	Remarks
FPC type	COF	
Connector	USB-MINI-B	
	Molex 53261-1071	or compatible
Communication	USB and I ² C	

3.2.2 Connector Pins Definition

<Molex 53261-1071 Pins Definition>

Pin	Definition	Description
1	Vcc	5V
2	USB Data+	
3	USB Data-	
4	SDA	I ² C serial data
5	SCL	I ² C serial clock
6	INT	Interrupt pin sending request to HOST
7	Reset	Low active power on reset signal
8	GPIO0	General purpose input/output port
9	GND	
10	GND-Shielding	

3.2.3 I²C Interface

Slaver address	0x5c(7-bits addressing, programmable)
Clock rate	@400 kHz(fast mode)
Interrupt mode	Default active low, level trigger
_CID	PNP0C50
_DSM	3CDFF6F7-4267-4555-AD05-B30A3D8938DE
HID Descriptor address	0x0000

4. Optical Specifications

4.1 Display Optical Specifications

4.1.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance $\leq 1\text{lux}$ and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . The center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement.

4.1.2 Optical Specifications

< Optical Specifications >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ3	CR>10	80	85	-	Deg.	Note1
		Θ9		80	85	-	Deg.	
	Vertical	Θ12		80	85	-	Deg.	
		Θ6		80	85	-	Deg.	
Contrast ratio		CR	Θ = 0°	700	900	-		Note2
Transmittance		Tr		4.6	5.4	-	%	Note3
Luminance of White		Yw		425	500		cd/m2	Note 4
White luminance uniformity		ΔY		65	75		%	Note 5
Color Gamut		CG		43	48	-	%	
Reproduction of color	Red	Rx	Θ = 0°	0.566	0.596	0.626		Note6 (Based on BLU)
		Ry		0.323	0.353	0.383		
	Green	Gx		0.280	0.310	0.340		
		Gy		0.542	0.572	0.602		

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
	Blue	Bx	0.123	0.153	0.183		
		By	0.086	0.116	0.146		
White Chromaticity	Wx	$\Theta = 0^\circ$	0.283	0.313	0.343		
	Wy		0.299	0.329	0.359		
Response Time (Rising + Falling)	$T_r + T_f$	$T_a = 25^\circ \text{C}$ $\Theta = 0^\circ$		30	40	ms	Note 7

Note:

1.Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2.Contrast measurements shall be made at viewing angle of $\theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGUR 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3.Transmittance is the Value without APF and without CG.

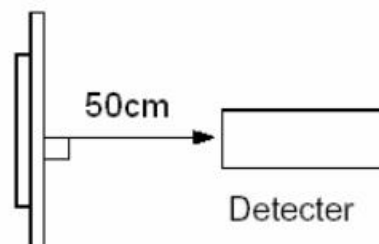
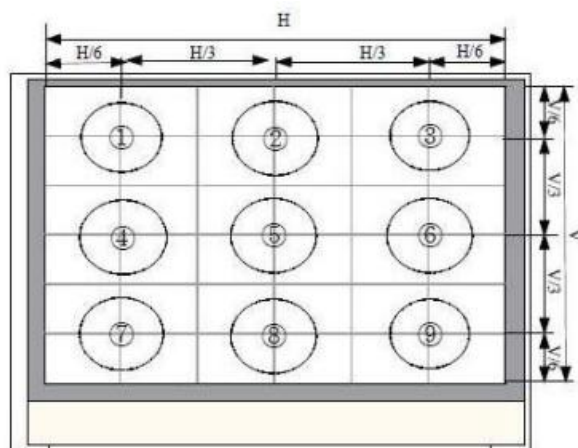
4.Center Luminance of white is defined as the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.

5:Luminance measurement

The test condition is at ILED=30mA and measured on the surface of LCD module at 25 °C.

- The data are measured after LEDs are lighted on for more than 5 minutes and LCM displays are fully white. The brightness is the average value of 9 measured spots. Measurement equipment CS2000 or similar equipment (Field of view:1deg, Distance:50cm)
- Measuring surroundings: Dark room.
- Measuring temperature: $T_a = 25^\circ \text{C}$.
- Adjust operating voltage to get optimum contrast at the center of the display.
- Measured value at the center point of LCD panel must be after more than 5 minutes while backlight turning on.

$$\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$$



6.The color chromaticity coordinates specified in the above table shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

7.The electro-optical response time measurements shall be made as FIGURE 2 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_f .

Figure1 Measurement Set Up

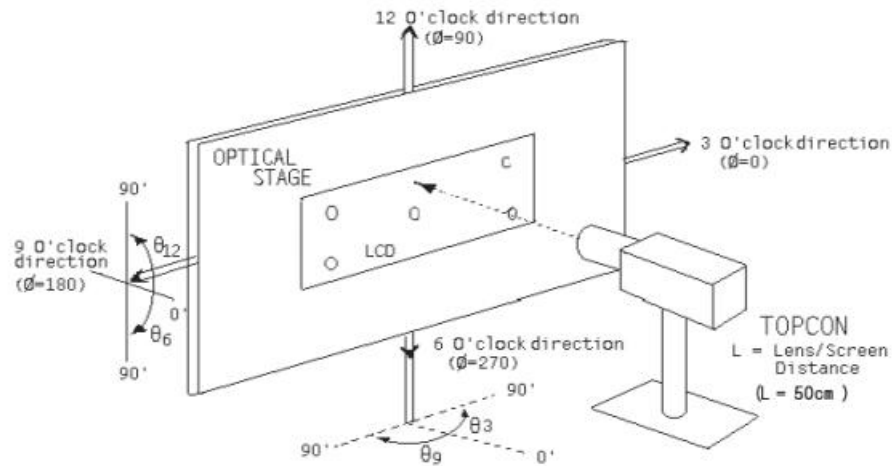
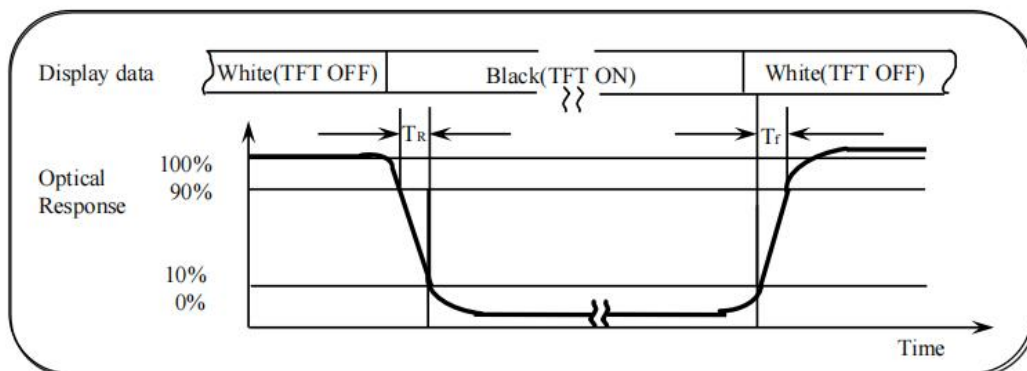
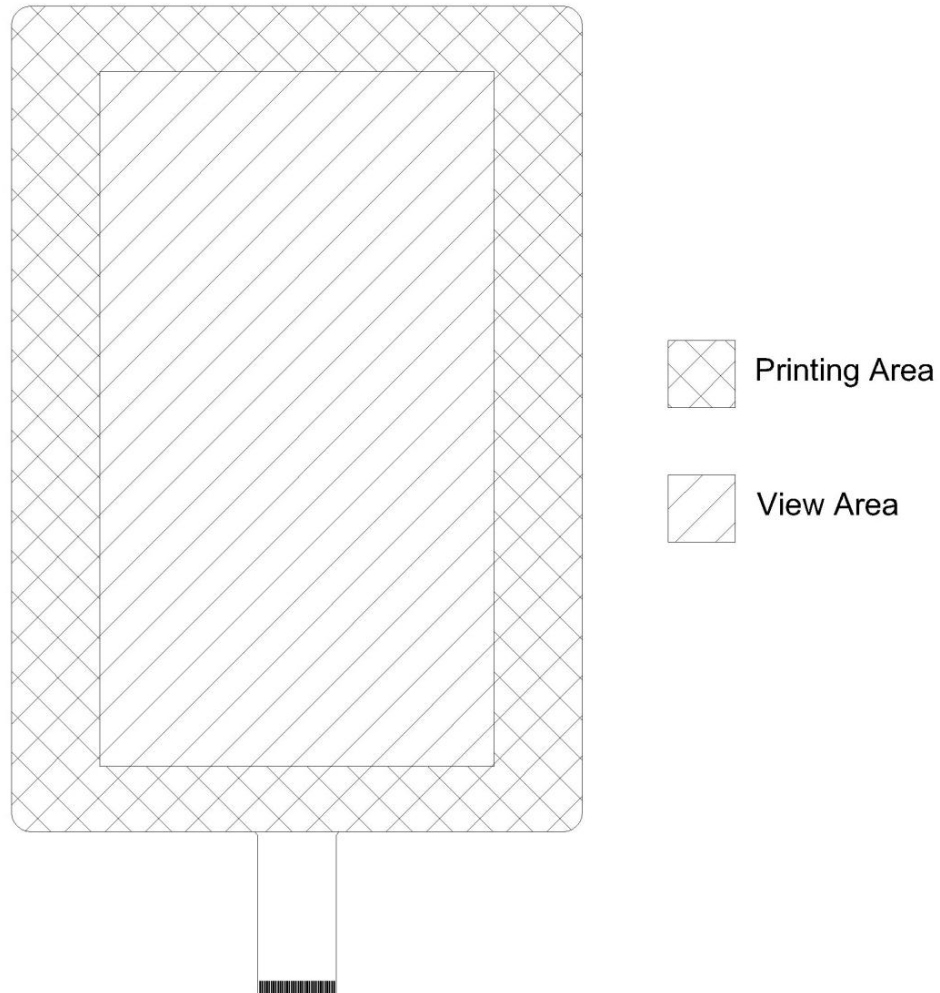


Figure2 Response Time Testing

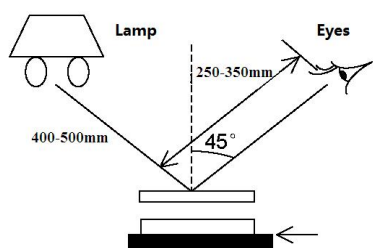
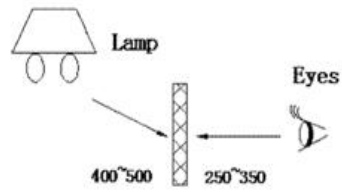


4.2 Appearance Specifications

4.2.1 Terms Definition



4.2.2 Inspection Conditions

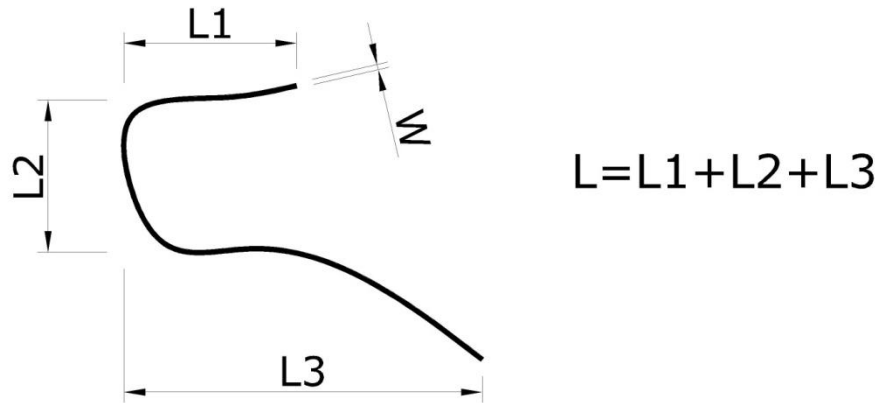
Items	Conditions	Remarks
Inspection Lamp	Florescent Cool White Lamp, 1000~1200Lux	
Inspection with Reflect Light (RL)	*Normal eyes level 1.0 (with Glasses accepted); *Distance between Lamp and product:40-50cm; *Distance between Eyes and Product:25-35cm; *Angle of view: 45°; *Black background; *Inspection time no more than 10s.	
Inspection with Through Light (TL)	*Normal eyes level 1.0 (with Glasses accepted); *Distance between Lamp and Product: 40-50cm; *Distance between Eyes and Product: 25-35cm; *Angle of view: 45°; *Black background; *Inspection time no more than 10s.	

4.2.3 Printing Area Appearance Inspection Criteria

Items	Conditions	Inspection Criteria	Method
Light Transparent Hole/Light Leakage	TL	Not Allowed (Repaired with black marker pen at the back side can be accepted.)	Eye view
Ink Off	TL	Not Allowed	Eye view
Stain and Dirty Mark	RL	*Stain and dirty mark refer to visible sheet contamination; the non-cleanable stain should be inspected as "Dot-like Defects". *Contamination cannot be cleaned by soft cloth and alcohol, Not Allowed; *Contamination can be cleaned by soft cloth and alcohol, Accept; but if the ratio of such contamination defected products is more than 10% of all the inspected products, Not Allowed;	Eye view
Liner-like Defects	RL	Refer to 4.2.4 Liner-like Defects.	Eye view, dot/wire gauge
Dot-like Defects	RL	Refer to 4.2.4 Dot-like Defects.	Eye view, dot/wire gauge
Logo/ Letter	RL	*Logo Break; Not Allowed *within a shaping printing < 120 mm: ± 0.10 ≥ 120 mm < 400 mm: ± 0.15 ≥ 400 mm: ± 0.25 *between shaping printing(offset to 2nd, 3rd, etc. color) < 400 mm: ± 0.30 ≥ 400 mm: ± 0.50	Eye view, dot/wire gauge

4.2.4 View Area Appearance Inspection Criteria

(W=Width, L=Length)



<Liner-like Defects>

Condition	Width(mm)	Length(mm)	Criteria
RL	$W \leq 0.03$	Not limited	*Accept QTY: not limited.
	$0.03 < W \leq 0.06$	$L \leq 10$	*Accept QTY: not more than 6; *Not allowed if the distance between 2 objects is less than 20 mm.
	$0.06 < W \leq 0.10$	$L \leq 10$	*Accept QTY: not more than 4; *Not allowed if the distance between 2 objects is less than 20 mm.
	$W > 0.10$	$L > 10$	*Not allowed.
	Liner-like Defects including: Liner Foreign Object/Scratch.		

< Dot-like Defects>

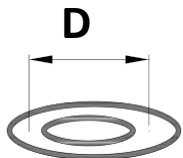
(D=Diameter)

Condition	Average Diameter(mm)	Criteria
RL	$D \leq 0.20$	*Not limited.
	$0.20 < D \leq 0.30$	*Accept Qty: not more than 10; *Not allowed if the distance between 2 defects is less than 20mm.
	$0.30 < D \leq 0.40$	*Accept Qty: not more than 5; *Not allowed if the distance between 2 defects is less than 20mm.
	$D > 0.40$	*Not allowed.
	Dot-like Defects including: Foreign Objects/Stab.	

< Stain and Dirty Mark>

Condition	Criteria
RL	* Stain and Dirty Mark refer to the visible contamination in mass, Dot-like contamination should be inspect as “Dot-like Defects”; *Contamination cannot be clean by soft cloth and alcohol, Not Allowed; *Contamination can be clean by soft cloth and alcohol, Accept; but if the ratio of such defected products are more than 10% of all the inspected products, Not Allowed.

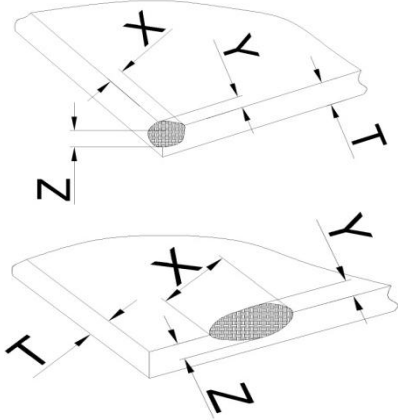
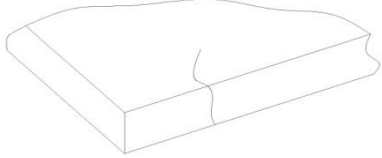
< Surface Fisheye>

Condition	Average Diameter(mm)	Criteria	Remarks
RL	$D \leq 0.15$	*Accept QTY: not more than 3; * Not allowed if the distance between 2 objects is less than 50 mm.	
	$0.15 < D \leq 0.30$	*Accept Qty: not more than 2; * Not allowed if the distance between 2 objects is less than 50 mm.	
	$0.30 < D \leq 0.50$	*Accept Qty: not more than 1.	
	$D > 0.50$	*Not allowed.	

<Defects of back side, locates outside the View Area>

The Appearance defects, such as Scratch, Foreign Object, Stain and Dirty-mark, on the backside of Module not lead to the performance failure	Accept
FPC and sensor pin bonding migration not more than pin width 1/2	Accept
Scratches on bonding area on silver	Not Allowed
Mechanical damages on FPC(dent/kink)	Not Allowed
Glue residue, broken and oxidation on gold fingers	Not Allowed

4.2.5 Glass Breakage

Items	Criteria	Remarks
Corner/ Edge Breakage	$*(X+Y)/2 < 0.3 \text{ mm}$, $Z < 1/3T \text{ mm}$; distance between 2 defects more than 5 mm; *Accept QTY: not more than 3.	
Crack	Not Allowed.	

5. Reliability Test

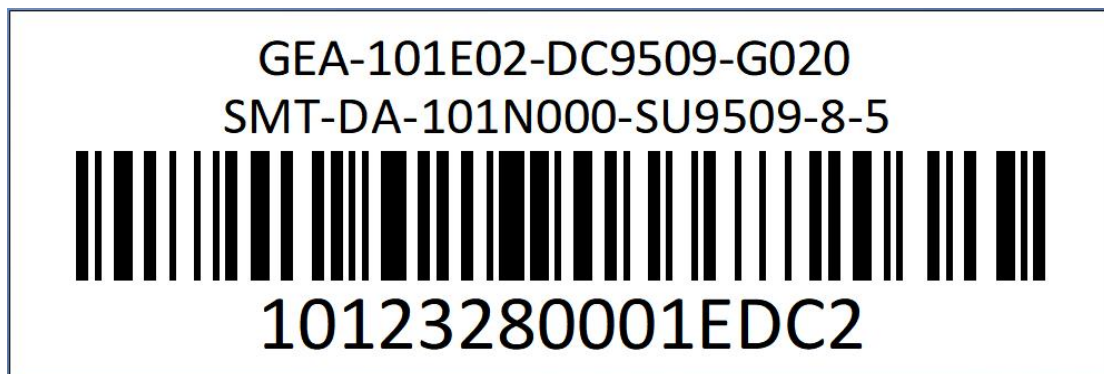
The reliability test items and its conditions are shown in below.

No	Test Items	Conditions
1	High temperature storage test	Ta =80℃, 240 hrs
2	Low temperature storage test	Ta =-30℃, 240 hrs
3	High temperature & high humidity operation test	Ta =60℃, 90%RH, 240hrs
4	High temperature operation test	Ta =70℃, 240hrs
5	Low temperature operation test	Ta =-20℃, 240hrs
6	Thermal shock	Ta = -30℃ ↔ 80℃ (0.5hr), 100 cycle
7	ESD test	Air Voltage: ±15KV Contact Voltage: ±8KV
8	Impact Resistance	Steel ball: 64 g Height: 30 cm

6. Label, Package and Firmware Version

6.1 Label

6.1.1 Product Label Information



GEA-101E02-DC9509-G020

Product code.

SMT-DA-101N000-SU9509-8-5

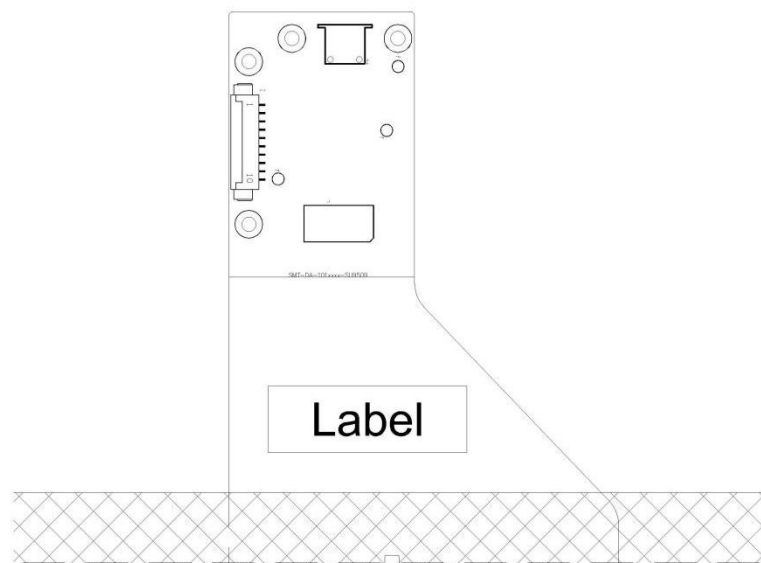
Touch sensor type for test.

10123280001EDC2

101: product active area size 2328: YYWW 0001: series number EDC2: internal code

6.1.2 Product Label Size and Position

Label size: 30mm*10mm. Label position: front side of touch sensor FPC.



6.2 Package

6.2.1 Packaging Steps

TBC

6.2.2 Carton Information

Size	55*40*25 (L*W*H)	cm
Product QTY of full box	TBC	PCS
Total weight	TBC	kg
Single product weight	TBC	kg

6.3 Firmware Version

10_1_USB_HERMAN.bin



10_1_USB_HERMAN.bin

7. Mechanical Drawing

