General Electrical Touch Co., Limited
香港通用电子触控有限公司

/SIMPLEPLUS
Touch Displays

Specification

Module No. : GEA-121B01-DC9521-G020

Version No. : A2

Client Confirmation	Approved by	Prepared by
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Issue History

Version	History	Date	Remarks
A1	First Issue	2021/03/29	
A2	Added 2.1 Overview Added 4.Optical Specifications Removed 5.General Precaution Added 6.1 Label&6.3 Firmware Version	2023/03/09	

CONTENTS

1. Purpose

This specification document is issued for the 12.1” TFT Liquid Crystal Display bonded with Capacitive-Type Touch Panel delivered by General Electrical Touch Co., Limited. This document defined the general provisions (including structure, performance, characteristics and quality guarantee) 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 Overview

The touch part is a 12.1 inch DITO glass Capacitive-Type Touch Panel. It uses a SIS9521 touch controller with USB & I^2C communication.

The display part INNOLUX G121ICE-L01 is a 12.1" TFT Liquid Crystal Display module with LED Backlight unit LVDS interface. This module supports 1280 x 800 Wide-XGA AAS mode and can display 262k/16.7M colors . The LED converter for Backlight is built in control board.

2.2 Module Structure

Main Component	Materials	Remarks
Cover Glass	2mm chemical strengthened glass	black printed boarder
Adhesive	SCA	0.25 mm
Touch Sensor	0.55mm DITO glass + COF FPC	SIS9521 Controller
Air Bonding Tape	3M 4905	0.50 mm
Display	TFT LCD	INNOLUX G121ICE-L01

2.3 General Specifications

Item	Specifications	Remark
Display Active Area	261.12(H) × 163.20(V) mm	
Display Resolution	1280(H) × R.G.B. × 800(V)	
Pixel Pitch	0.204 × 0.204 mm	
Pixel Arrangement	R.G.B. Vertical Stripe	
Display Colors	262K/16.7M colors	
Display Brightness	600 cd/m^2	Typ.
Display Mode	Normally Black	
Display Surface Treatment	AG type, 3H hard coating	
Electrical Interface	Display: LVDS	
	Touch: USB and I^2C	
Touch Activation	Multi-finger touch	
Touch Resolution	29X, 46Y	
Touch Controller	SIS9521	
Bonding Method	CG to touch sensor: optical bonding TP module to display: tape bonding	
Absolute Ratings of Environment (See the figure below)	Operating Temperature: -30 to +80 °C Operating Humidity: 5 to 90 RH%	Non-Condensing
	Storage Temperature: -30 to +85 °C Storage Humidity: 5 to 90 RH%	Non-Condensing
Outline Dimension	298.00(H) × 204.00(V) × 13.30(Max) mm	

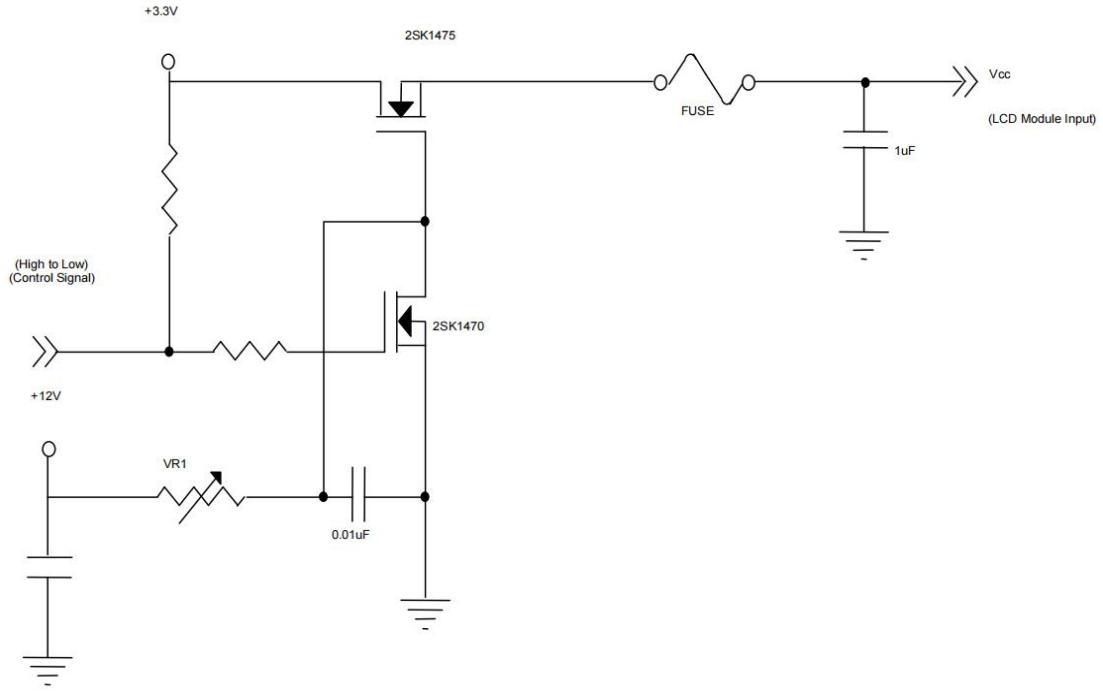
3. Electrical Specifications

3.1 Display Electrical Specifications

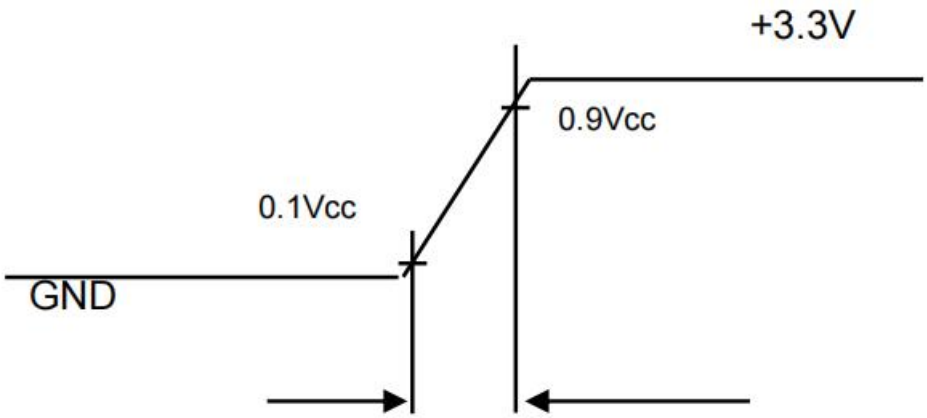
3.1.1 LCD Electronics Specification

Parameter		Symbol	Value			Unit	Note
			Min.	Typ	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Permissive Ripple Voltage		V_{RP}	-	50	-	mV	-
Rush Current		I_{RUSH}		1.5		A	(2)
Initial Stage Current		I_{IS}	-	-	1.0	A	(2)
Power Supply Current	White	-	400	440	480	mA	(3)a
	Black	-	260	290	320	mA	(3)b
LVDS Differential Input High Threshold		$V_{TH(LVDS)}$	+100	-	-	mV	V_{CM}=1.2V
LVDS Differential Input Low Threshold		$V_{TL(LVDS)}$	-	-	-100	mV	V_{CM}=1.2V
LVDS Common Mode Voltage		V_{CM}	1.125	-	1.375	V	
LVDS Differential Input Voltage		$\|V_{ID}\|$	100	-	600	mV	
Terminating Resistor		R_T	-	100	-	Ohm	

Note (1) The assembly should be always operated within above ranges.
Note (2) Measurement Conditions:



VCC rising time is 470us



Note (3)The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, fv = 60 Hz, whereas a power dissipation check pattern below is

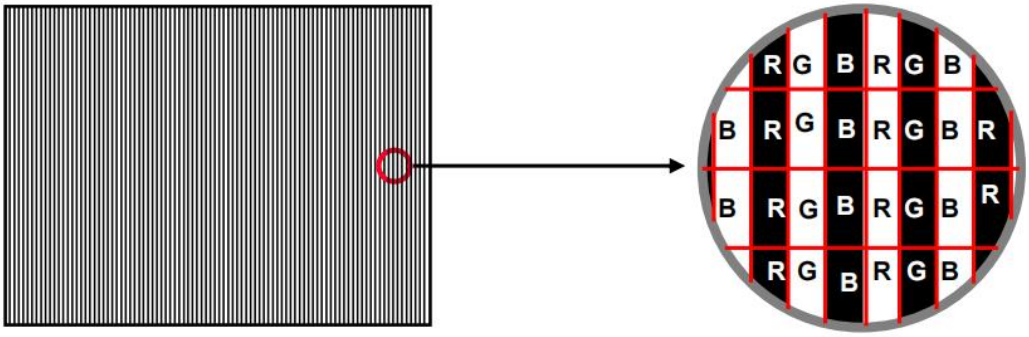
a. White Pattern

Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern

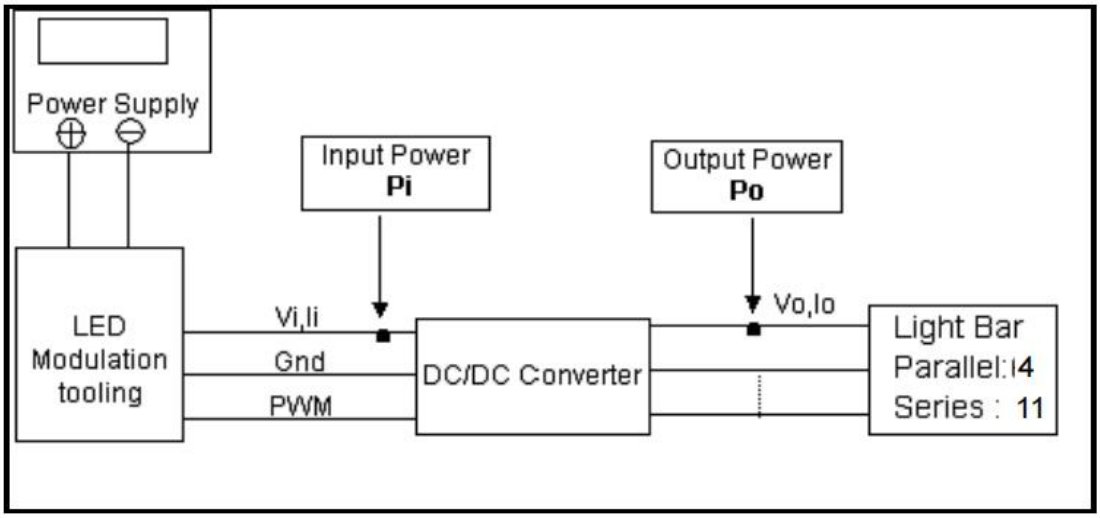


Active Area

3.1.2 Backlight Unit

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
(LED Converter input voltage)		V_i	10.8	12.0	13.2	V_{DC}	(Duty 100%)
(LED Converter input ripple voltage)		V_{iRP}	-	-	350	mV	
(LED Converter input current)		I_i	-	0.8	1.0	A_{DC}	@ Vi = 12V (Duty 100%)
(LED Converter inrush current)		I_{IRUSH}	-	-	3.0	A	@ Vi rising time=10ms (Vi=12V)
Input Power Consumption		P_i	-	9.6	-	W	(1)
EN Control Level	Backlight on	ENLED (BLON)	2.5	3.3	5.0	V	
	Backlight off		0	---	0.3	V	
PWM Control Level	PWM High Level	Dimming (E_PWM)	2.5	---	5.0	V	
	PWM Low Level		0	---	0.15	V	
PWM Control Frequency		f_{PWM}	190	200	20k	Hz	(3)
PWM Noise Range		VNoise	-	-	0.1	V	
PWM Control Duty Ratio		-	5		100	%	(3), Suggestion@ 190Hz≦f_{PWM}<1kHz
			20		100	%	(3), @ 1kHz≦f_{PWM}≦20kHz
LED Life Time		L_{BL}	50000	-	-	Hrs	(2)

Note (1)LED current is measured by utilizing a high frequency current meter as shown below:



Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at Ta = 25 ±2 °C and Duty 100% until the brightness becomes ≦ 50% of its original value. Operating LED at high temperature condition will reduce life time and lead to color shift.

Note (3) At 190 ~1kHz PWM control frequency, duty ratio range is restricted from 5% to 100%.

1K ~20kHz PWM control frequency, duty ratio range is restricted from 20% to 100%.

If PWM control frequency is applied in the range from 1KHz to 20KHZ, The “non-linear” phenomenon on the Backlight Unit may be found. So It’ s a suggestion that PWM control frequency should be less than 1KHz.

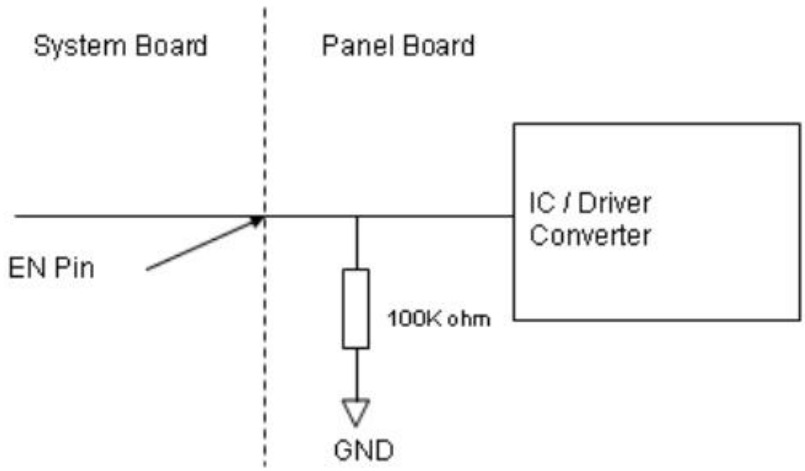
3.1.3 Electrical Interface Connection

PIN ASSIGNMENT

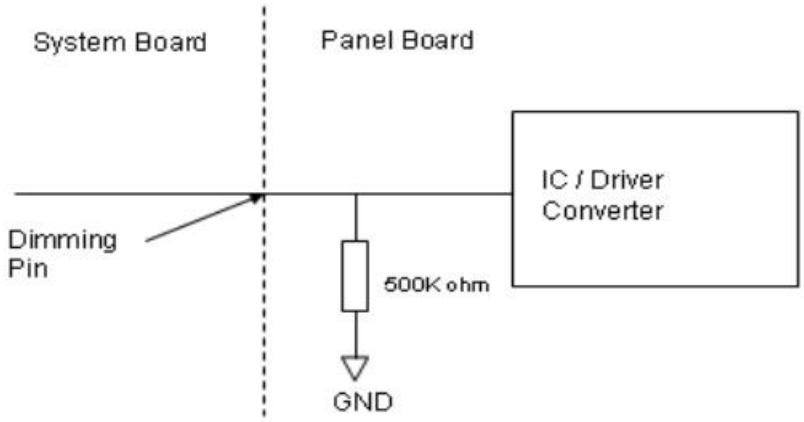
Pin No.	Symbol	Description	Note
1	12V	LED power	-
2	12V	LED power	-
3	12V	LED power	-
4	12V	LED power	-
5	ENLED	Enable pin	(3)
6	Dimming	Backlight Adjust	(3)
7	NC	No Connection or Ground	-
8	NC	No Connection or Ground	-
9	VCC	Power supply: +3.3V	
10	VCC	Power supply: +3.3V	-
11	GND	Ground	-
12	GND	Ground	-
13	RX0-	Negative transmission data of pixel 0	-
14	RX0+	Positive transmission data of pixel 0	-
15	GND	Ground	-
16	RX1-	Negative transmission data of pixel 1	-
17	RX1+	Positive transmission data of pixel 1	-
18	GND	Ground	-
19	RX2-	Negative transmission data of pixel 2	-
20	RX2+	Positive transmission data of pixel 2	-
21	GND	Ground	-
22	RXCLK-	Negative of clock	-
23	RXCLK+	Positive of clock	-
24	GND	Ground	-
25	RX3-	Negative transmission data of pixel 3	-
26	RX3+	Positive transmission data of pixel 3	-
27	GND	Ground	-
28	SEL6/8	LVDS 6/8 bit select function control, Low → 6 bit Input Mode High → 8bit Input Mode	(2) (3)
29	GND	Ground	-
30	NC	No Connection or Ground	-

Note (1) Connector Part No.: P2 187114-30091
Note (2) “Low” stands for 0V. “High” stands for 3.3V
Note (3) ENLED(BLON), Dimming(E_PWM), SEL6/8 as shown below:

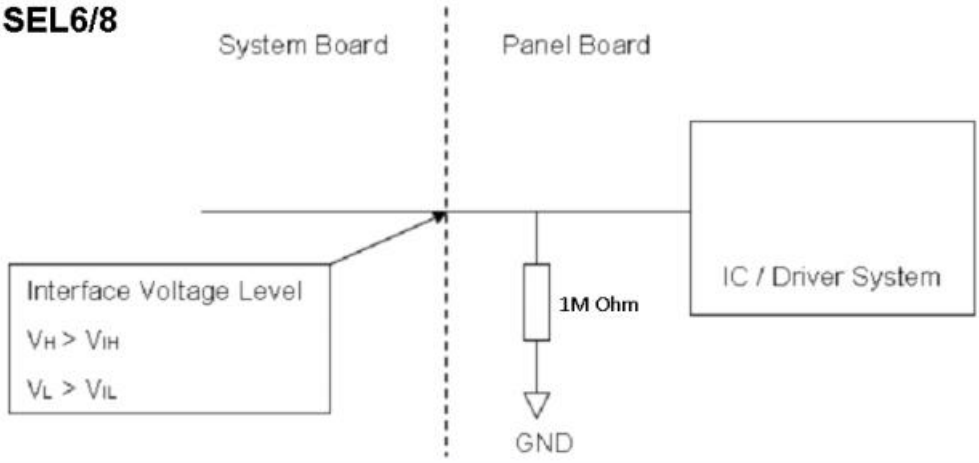
BLON Pin



E_PWM Pin



SEL6/8



3.1.4 Interface Timing

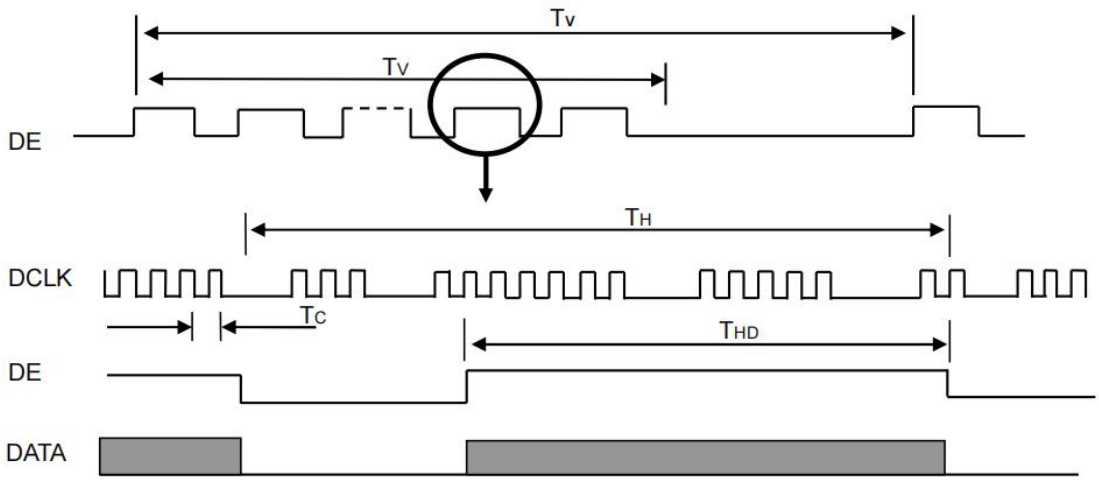
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	66.1	71	74.7	MHz	-
	Period	Tc	13.4	14.1	15.1	ns	
	Input cycle to cycle jitter	T_{rd}	---	---	200	ns	(a)
	Input Clock to data skew	TLVCCS	-0.02*Tc	---	0.02*Tc	ps	(b)
	Spread spectrum modulation range	F_{dkin_mod}	---	---	1.02*Fc	MHz	(c)
	Spread spectrum modulation frequency	F_{SSM}	---	---	200	KHz	
	High Time	T_{ch}	---	4/7	---	T_{ch}	
	Low Time	T_{cl}	---	3/7	---	T_{ch}	
Vertical Display Term	Frame Rate	Fr	---	60	---	Hz	Tv=Tvd+Tvb
	Total	Tv	810	823	830	Th	-
	Active Display	Tvd	800	800	800	Th	-
	Blank	Tvb	10	23	30	Th	-
Horizontal Display Term	Total	Th	1360	1440	1500	Tc	Th=Thd+Thb
	Active Display	Thd	1280	1280	1280	Tc	-
	Blank	Thb	80	160	220	Tc	-

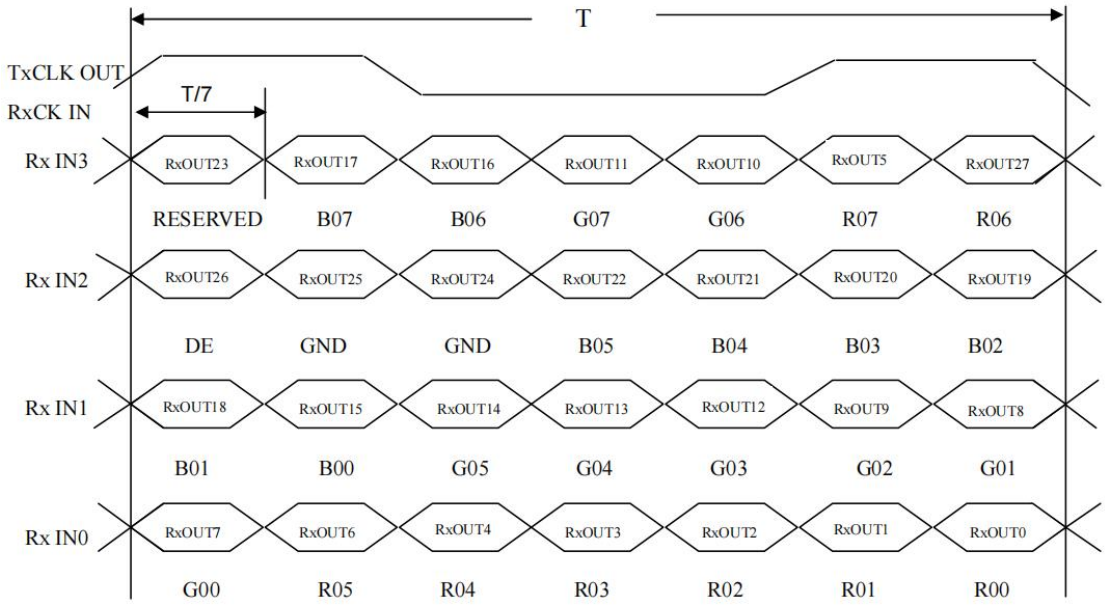
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

Note (2) The Tv(Tvd+Tvb) must be integer, otherwise, the module would operate abnormally.

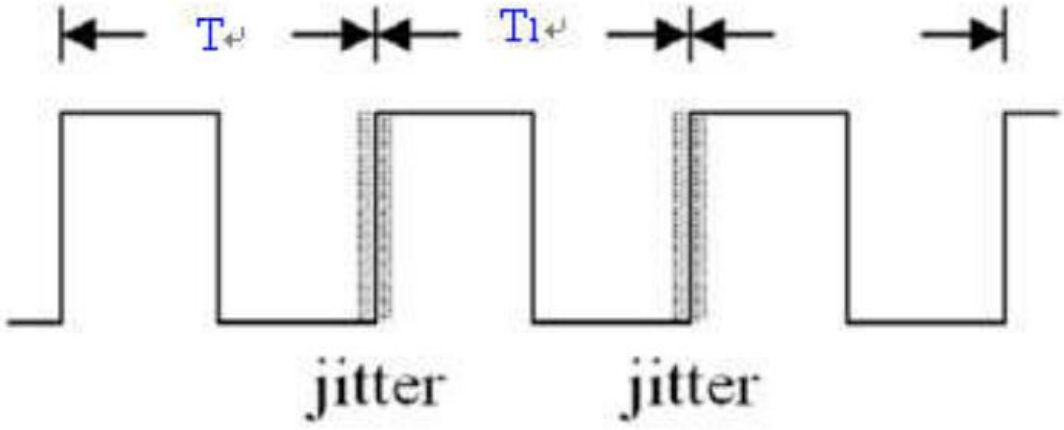
INPUT SIGNAL TIMING DIAGRAM



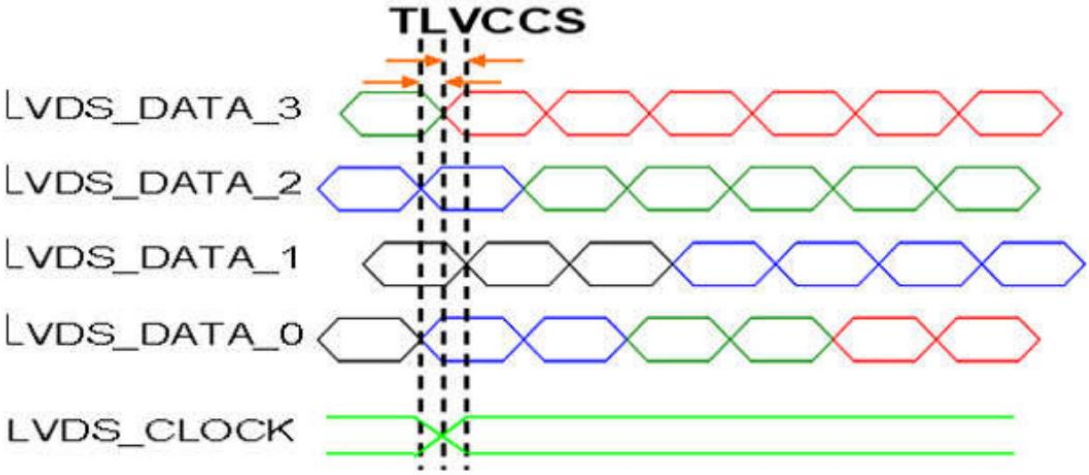
TIMING DIAGRAM of LVDS



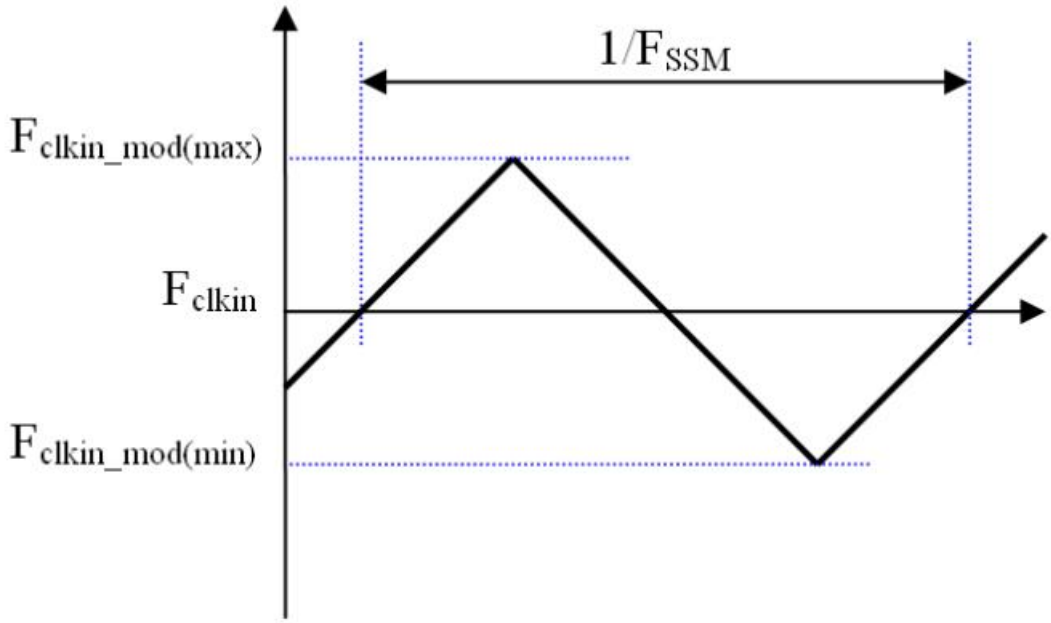
Note (a) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T1 - TI



Note (b) Input Clock to data skew is defined as below figures.

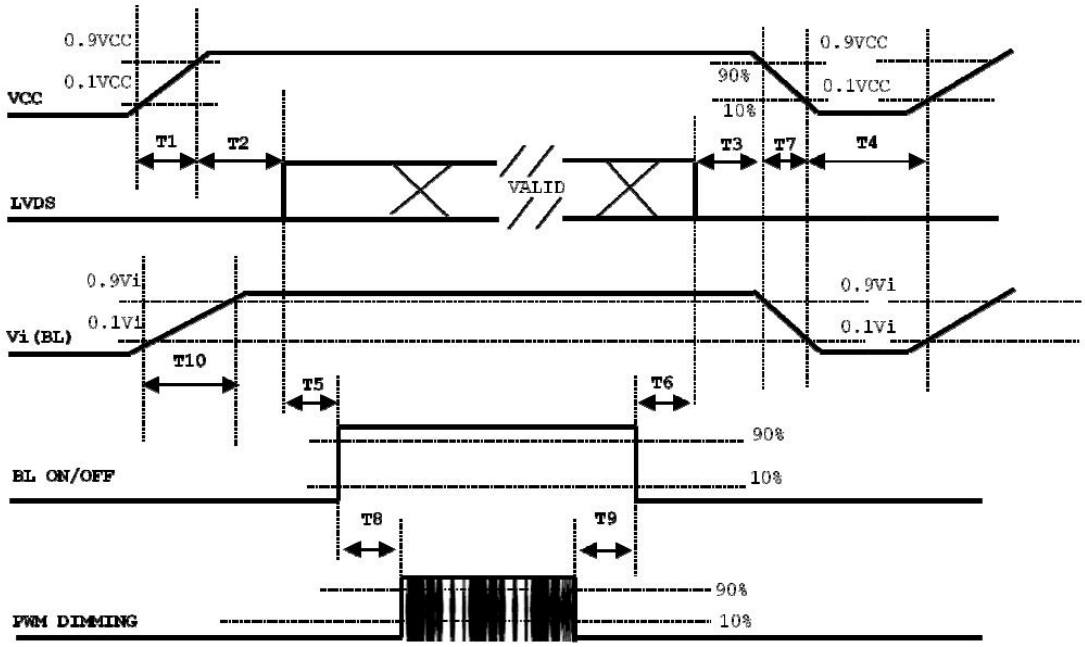


Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.



3.1.5 Power ON/OFF Sequence

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

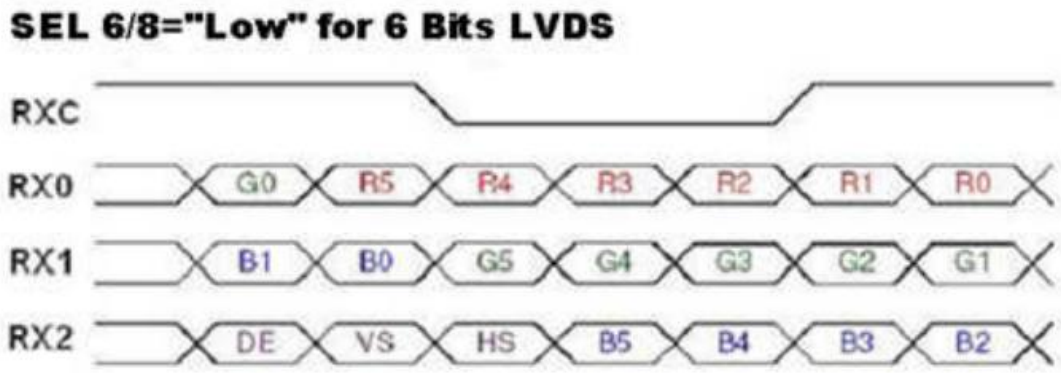


Note:
(1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.
(2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.
(3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.
(4) T4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.
(6) INX won’ t take any responsibility for the products which are damaged by the customers not following the Power Sequence.
(7) There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "T7 spec".

Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	---	10	ms
T2	0	---	50	ms
T3	0	---	50	ms
T4	500	---	---	ms
T5	450	---	---	ms
T6	200	---	---	ms
T7	10	---	100	ms
T8	10	---	---	ms
T9	10	---	---	ms
T10	20	---	50	ms

The Input Data Format



Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB
Note (2) Please follow PSWG

Signal Name	Description	Remark
R7 R6 R5 R4 R3 R2 R1 R0	Red Data 7 (MSB) Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB)	Red-pixel Data Each red pixel's brightness data consists of these 8 bits pixel data.
G7 G6 G5 G4 G3 G2 G1 G0	Green Data 7 (MSB) GreenData 6 GreenData 5 GreenData 4 GreenData 3 GreenData 2 GreenData 1 GreenData 0 (LSB)	Green-pixel Data Each green pixel's brightness data consists of these 8 bits pixel data.
B7 B6 B5 B4 B3 B2 B1 B0	Blue Data 7 (MSB) Blue Data 6 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0 (LSB)	Blue-pixel Data Each blue pixel's brightness data consists of these 8 bits pixel data.
RXCLKIN+ RXCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync	
HS	Horizontal Sync	

3.2 Touch Panel Interface Connection

3.2.1 Interface Connection

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

3.2.2 Connector Pins Definition

<Molex 53261-1071 Pins Definition>

Pin	Definition	Description
1	V_{CC}	5V
2	USB Data+	
3	USB Data-	
4	SDA	I^2C serial data
5	SCL	I^2C serial clock
6	INT/CHG	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 I^2C Interface

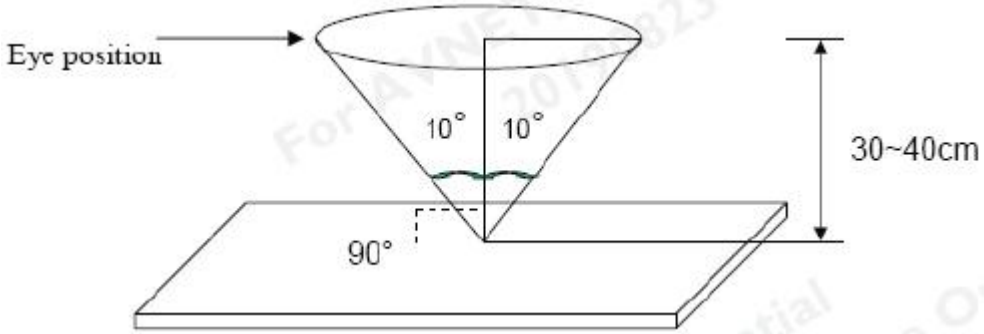
Slaver address	0x5c(7-bits addressing, programmable)
Clock rate	@400 kHz(fast mode)
Interrupt mode	Default active low, level trigger
_CID	PNP0C50
_DSM	3CDFF6F7-4267-4555-AD05-B30A3D8938DE
HID Descriptor address	0x0000

4. Optical Specifications

4.1 Display Optical Specifications

4.1.1 Instruments & Environment Conditions

Instruments:
Pattern generator: LD-2000 or equivalent model.
Video board: AU video board or equivalent. The output of the signal should comply with the specification provided by AU.
Luminance colorimeter: Topcon BM-7 or equivalent model
Environment conditions:
Room temperature: 20 ~ 25 °C.
Humidity: 65±5% RH.
Illumination: Fluorescent light (Day-Light Type) display surface illumination to be 300~700lux. (Standard 500lux)
To be a distance about 35 ± 5 cm in front of LCD unit, viewing line should be perpendicular to the surface of the module judge the visual appearance with human's eyes. (±10° viewing edge will be allowed)
Take off the protector of polarizer while judging the display area.
If there is any question while judging, check the panel again while operating.



4.1.2 Electrical Inspection Specification

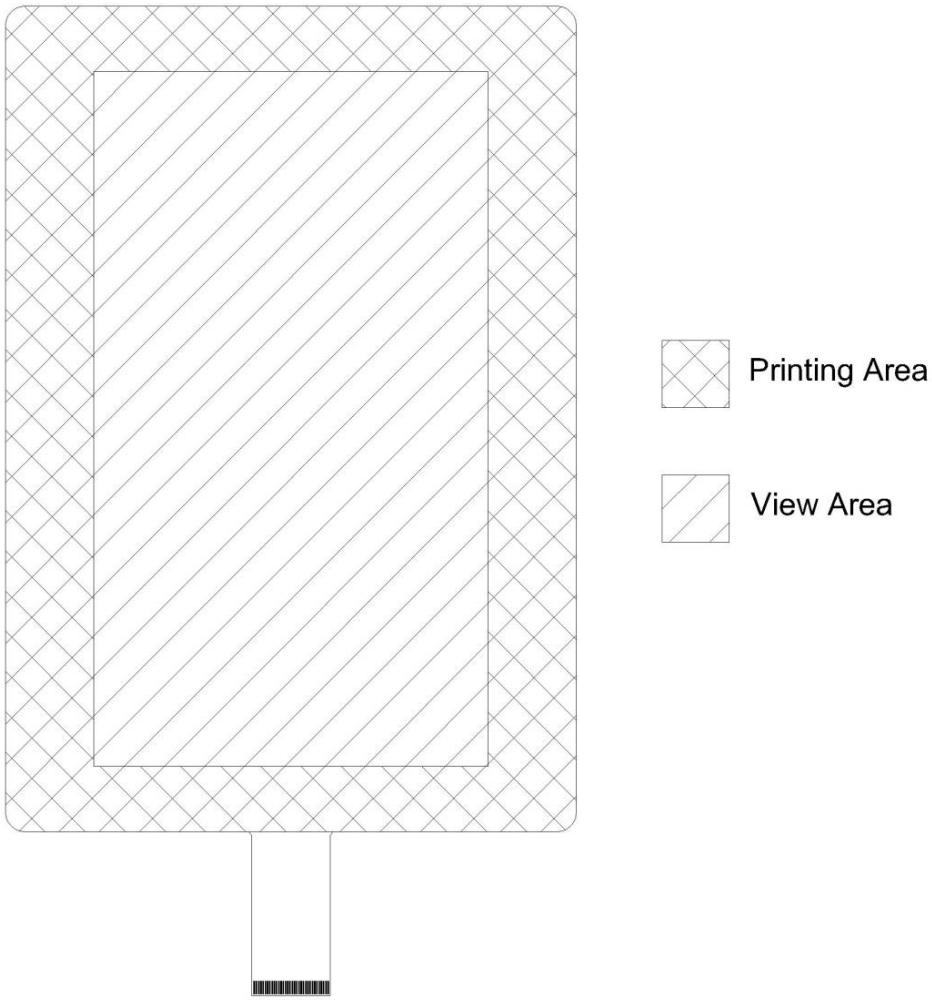
TBD

4.1.3 Appearance inspection specification

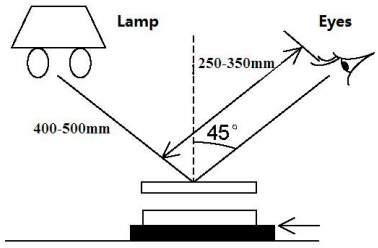
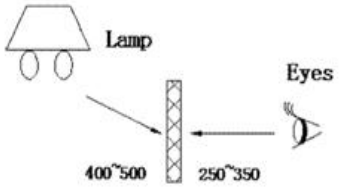
TBD

4.2 Module Appearance Specifications

4.2.1 Terms Definition



4.2.2 Inspection Conditions

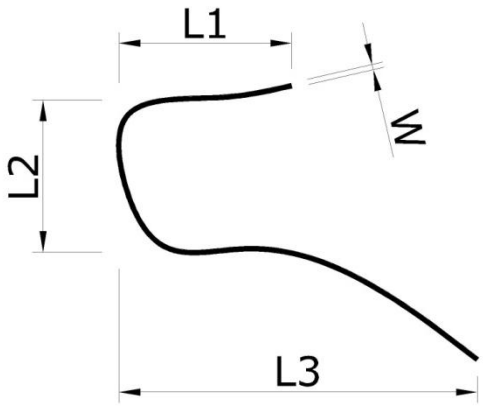
Items	Conditions	Remarks
Inspection Lamp	Florescent Cool White Lamp, 1000~1200Lux	
Inspection with Reflect Light (RL)	*Normal eyes level 1.0 (with Glasses accepted); *Distance between Lamp and product:40-50cm; *Distance between Eyes and Product:25-35cm; *Angle of view: 45°; *Black background; *Inspection 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)



L=L1+L2+L3

<Liner-like Defects>

Condition	Width(mm)	Length(mm)	Criteria
RL	W≤0.03	Not limited	*Accept QTY: not limited.
	0.03<W≤0.06	L≤10	*Accept QTY: not more than 6; *Not allowed if the distance between 2 objects is less than 20 mm.
	0.06<W≤0.10	L≤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.		

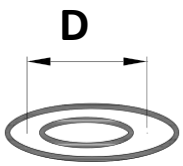
< Dot-like Defects> (D=Diameter)

Condition	Average Diameter(mm)	Criteria
RL	D≤0.20	*Not limited.
	0.20<D≤0.30	*Accept Qty: not more than 10; *Not allowed if the distance between 2 defects is less than 20mm.
	0.30<D≤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.

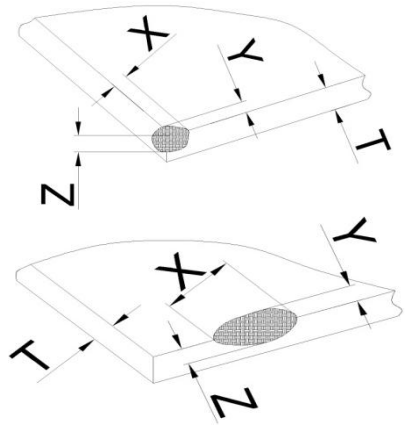
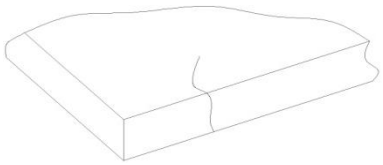
< Surface Fisheye>

Condition	Average Diameter(mm)	Criteria	Remarks
RL	D≤0.15	*Accept QTY: not more than 3; * Not allowed if the distance between 2 objects is less than 50 mm.	
	0.15<D≤0.30	*Accept Qty: not more than 2; * Not allowed if the distance between 2 objects is less than 50 mm.	
	0.30<D≤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 mm, Z< 1/3T 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	Vibration test	Frequency: 10~50 Hz Stoke: 1.5mm Sweep: 10~55~10 Hz
8	Impact Resistance	Steel ball: 64 g Height: 30 cm

6. Label, Package and Firmware Version

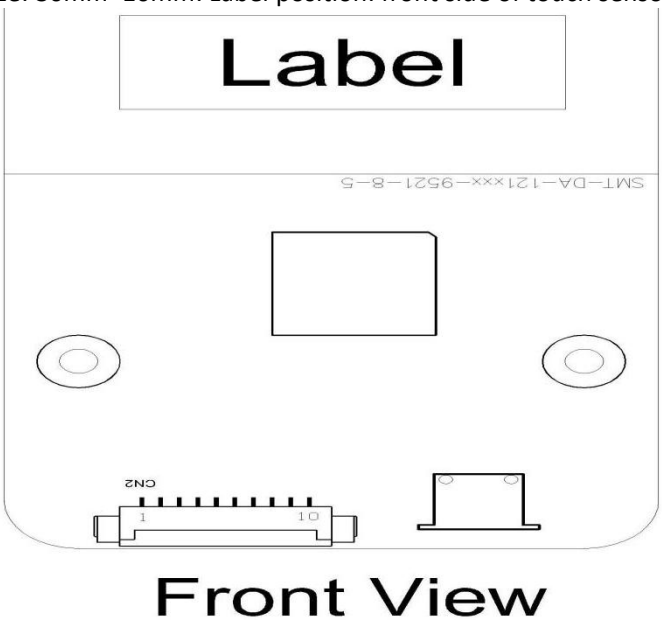
6.1 Label

6.1.1 Product Label Information

GEA-121B01-DC9521-G020
Product code.
SMT-DA-121N000-SU9521-8-5
Touch sensor type for test.
12123110001BDC2
121: product active area size 2311: YYWW 0001: series number BDC2: internal code

6.1.2 Product Label Size and Position

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

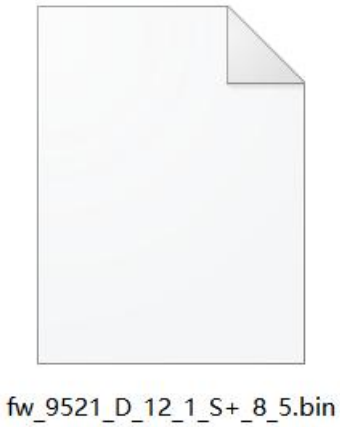


6.2 Package

TBD

6.3 Firmware Version

fw_9521_D_12_1_S+_8_5.bin



fw_9521_D_12_1_S+_8_5.bin

7. Mechanical Drawing