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

/SIMPLEPLUS
Touch Displays

Specification

Module No. : GEA-121C01-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	Updated 3.Electrical Specifications Added 4.Optical Specifications Removed 5.General Precaution Updated 5.Reliability Test Added 6.1 Label&6.3 Firmware Version	2023/07/14	

CONTENTS

1. Overview

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 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	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	AUO G121EAN01.2

2.2 General Specifications

Item	Specifications	Remark
Display Active Area	261.12(H) × 163.20(V) mm	
Display Resolution	1280(H) × 3(RGB) × 800(V)	
Pixel Pitch	0.204 × 0.204 mm	
Pixel Arrangement	R.G.B. Vertical Stripe	
Display Colors	16.2M / 262K colors	
Display Brightness	1000 cd/m^2	Typ.
Display Mode	Normally Black	
Display Surface Treatment	Anti-glare, Hardness 3H	
Electrical Interface	Display: 1 channel 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	
Outline Dimension	298.00(H) × 204.00(V) × 12.89(Max) mm	

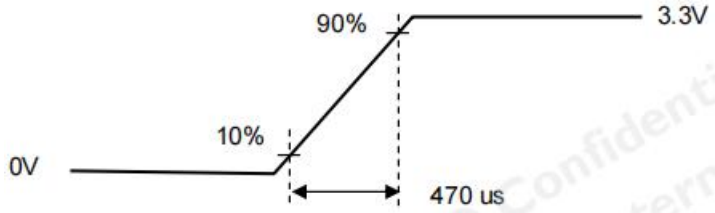
3. Electrical Specifications

3.1 Display Electrical Specifications

3.1.1 TFT LCD Module Electrical Specification

Symbol	Parameter		Min	Typ	Max	Units	Remark
VDD	Logic/LCD Input Voltage		3.0	3.3	3.6	[Volt]	
I_{VDD}	LCD Input Current		-	-	500	[mA]	VDD=3.3V at 60 HZ, all White Pattern
P_{VDD}	LCD Power comsumption		-	-	1.65	[Watt]	VDD=3.3V at 60 HZ, all White Pattern
$I_{rush\ LCD}$	LCD Inrush Current		-	-	1.5	[A]	VDD=3.3V at 60 HZ, all White Pattern Note 1 VDD rising time≧470us
VDD_{rp}	Allowable Logic/LCD Drive Ripple Voltage		-	-	100	[mV] p-p	VDD=3.3V at 60 HZ, all White Pattern
VIH	Control Signals Voltage	High Level	0.7* VDD	-	VDD	[Volt]	SEL68
VIL		Low Level	0	-	0.3* VDD	[Volt]	SEL68

Note 1: Measurement condition:



VDD rising time

3.1.2 Backlight Unit

Parameter guideline for LED

Following characteristics are measured under a stable condition using an inverter at 25℃ (Room Temperature):

Symbol	Parameter		Min.	Typ.	Max.	Unit	Remark
VLED	Input Voltage		10	12	15	[Volt]	
I_{VCC}	Input Current			0.633	0.734	[A]	VCC=12V & 100% PWM Duty
P_{VCC}	Power Consumption			7.6	8.8	[Watt]	VCC=12V & 100% PWM Duty
V_{EN}	EN Control Level	BL On	2.5	-	4	[Volt]	
		BL Off	0	-	0.5	[Volt]	
F_{PWM}	Dimming Frequency		200	-	20K	[Hz]	
D_{PWM}	Dimming Duty Cycle		1	-	100	%	1~5% with non-linear
V_{PWM}	Dimming Control Level	High Level	3	-	5.5	[Volt]	
		Low Level	0	-	0.5	[Volt]	
I_F	LED Forward Current		-	61		[mA]	Ta = 25°C
LED life time			50,000	70,000	-	Hrs	I_F = 61 mA, Ta = 25°C

Note 1: Ta means ambient temperature of TFT-LCD module.
Note 2: VCC, I_{VCC}, P_{VCC} are defined for LED backlight.(100% duty of PWM dimming)
Note 3: I_F are defined for one channel LED. There are four LED channel in back light unit.
Note 4: If display module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.
Note 5: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

3.1.3 Electrical Interface Connection

The LVDS connector interface pin assignments are listed in below table.
Connector model number: 093G30-B0001A-1
Manufacturer: Starconn

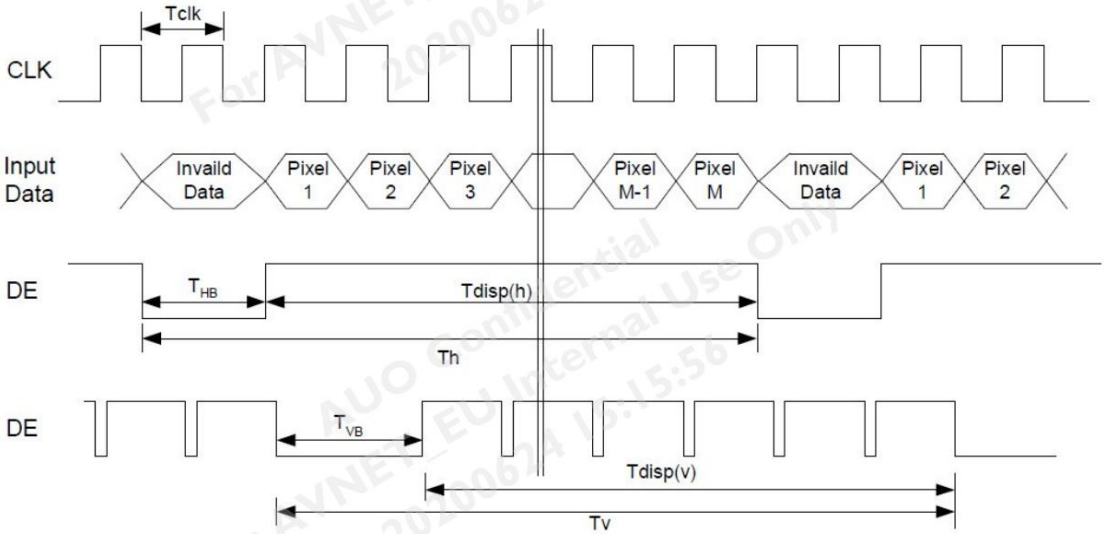
Pin NO	Signal Name	Description
1	VLED	LED Power Input
2	VLED	LED Power Input
3	VLED	LED Power Input
4	VLED	LED Power Input
5	EN	LED Driver Enable
6	PWM	LED Driver Backlight Adjust
7	GND	Ground
8	GND	Ground
9	VDD	Power supply:+3.3V
10	VDD	Power supply:+3.3V
11	GND	Ground
12	GND	Ground
13	RXin0N	-LVDS differential data (0N)
14	RXin0P	+LVDS differential data (0P)
15	GND	Ground
16	RXin1N	-LVDS differential data (1N)
17	RXin1P	+LVDS differential data (1P)
18	GND	Ground
19	RXin2N	-LVDS differential data (2N)
20	RXin2P	+LVDS differential data (2P)
21	GND	Ground
22	LVDS_RX_N	-LVDS differential clock input
23	LVDS_RX_P	+LVDS differential clock input
24	GND	Ground
25	RXin3N	-LVDS differential data (3N)
26	RXin3P	+LVDS differential data (3P)
27	GND	Ground
28	SEL 6/8	Low or NC-->6 bit input mode High-->8 bit input mode
29	GND	Ground
30	GND	Ground

3.1.4 Display Timing Specifications

Timing Characteristics

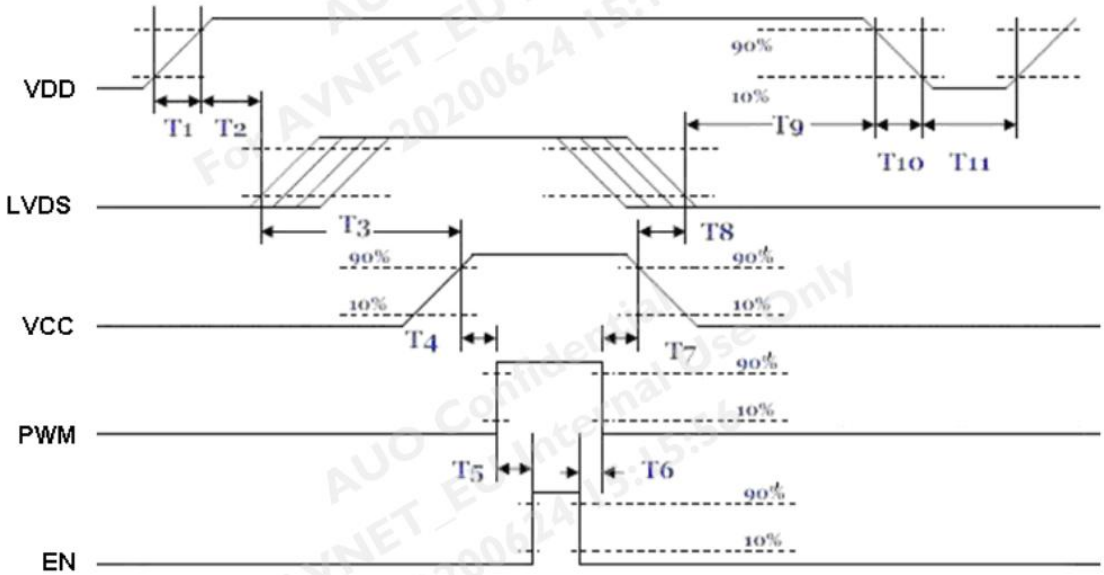
Signal	Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock Timing	Clock frequency		1/ T_{Clock}	60	74.4	90	MHz
Vsync Timing	Vertical Section	Period	T_V	808	838	900	Vsync Timing
		Active	T_{VD}	-	800	-	
		Blanking	T_{VB}	8	38	100	
Hsync Timing	Horizontal Section	Period	T_H	1350	1480	1680	Hsync Timing
		Active	T_{HD}	-	1280	-	
		Blanking	T_{HB}	70	200	400	
Frame Rate			F	50	60	75	Hz

Input Timing Diagram



3.1.5 Power ON/OFF Sequence

VDD power and backlight on/off sequence is as below. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	30	40	50	[ms]
T3	175	-	-	[ms]
T4	10	-	-	[ms]
T5	10	-	-	[ms]
T6	0	-	-	[ms]
T7	10	-	-	[ms]
T8	100	-	-	[ms]
T9	0	16	50	[ms]
T10	-	-	10	[ms]
T11	1000	-	-	[ms]

The above on/off sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

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^2C	

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^2C serial data
5	SCL	I^2C 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 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

The optical characteristics are measured under stable conditions at 25℃ (Room Temperature):

Item	Unit	Conditions	Min.	Typ.	Max.	Remark
White Luminance	[cd/m2]	I_{LED}= 61mA (center point)	850	1000	-	Note 1
Uniformity	%	5 Points	75	-	-	Note 2, 3
Contrast Ratio			800	1000	-	Note 4
Response Time	[msec]	Rising	-	-	-	Note 5
	[msec]	Falling	-	-	-	
	[msec]	Raising + Falling	-	25	-	
Viewing Angle	[degree]	Horizontal (Right) CR = 10	80	89	-	Note 6
	[degree]	(Left)	80	89	-	
	[degree]	Vertical (Upper) CR = 10	80	89	-	
	[degree]	(Lower)	80	89	-	
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.581	0.631	0.681	
		Red y	0.279	0.329	0.379	
		Green x	0.249	0.299	0.349	
		Green y	0.569	0.619	0.669	
		Blue x	0.105	0.155	0.205	
		Blue y	0.004	0.054	0.104	
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Color Gamut	%			72	-	

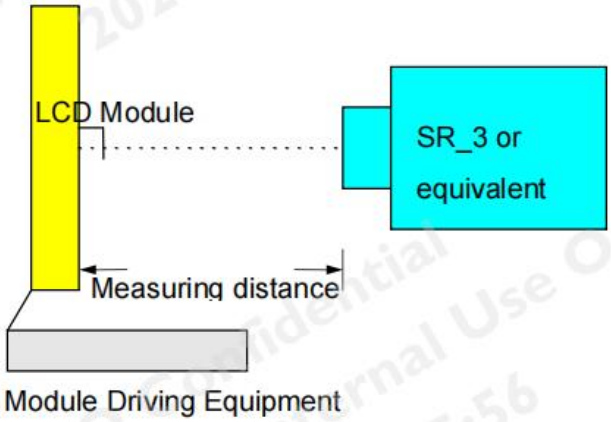
Note 1: Measurement method

Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)

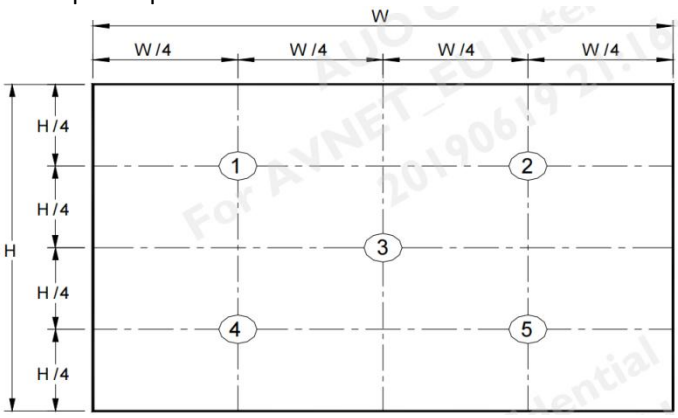
Aperture 1° with 50cm viewing distance

Test Point Center

Environment <1 lux



Note 2: Definition of 5 points position



Note 3: The luminance uniformity of 5 points is defined by dividing the minimum luminance values by the maximum test point luminance

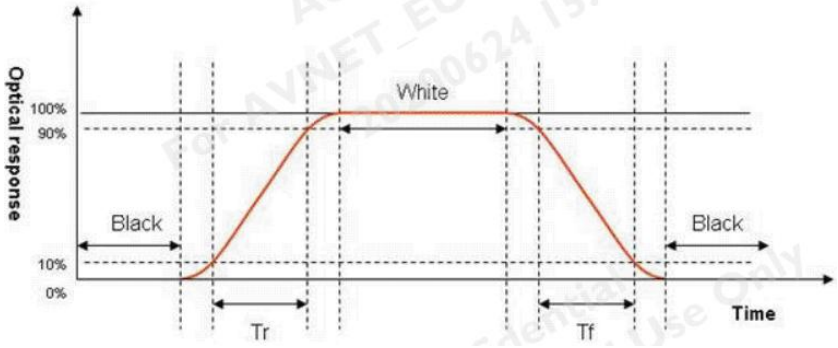
$$\delta_{W5} = \frac{\text{Minimum Brightness of five points}}{\text{Maximum Brightness of five points}}$$

Note 4: Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

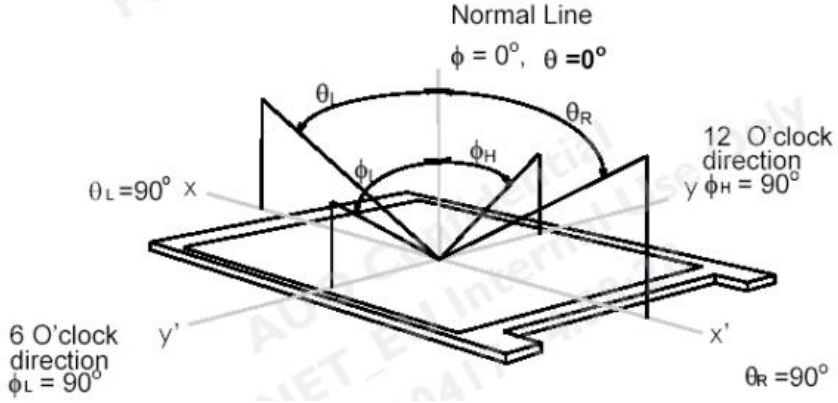
Note 5: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "White" to "Black"(falling time) and from"Black"to "White"(rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.



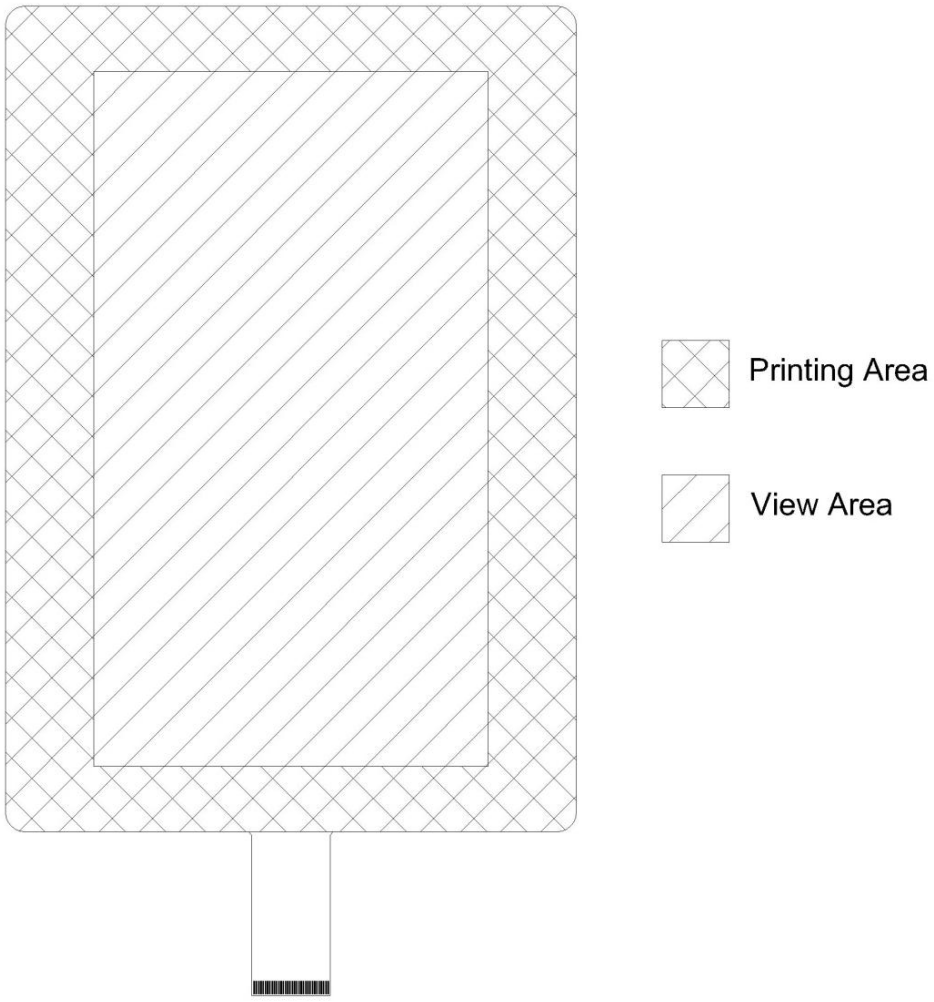
Note 6: Definition of viewing angle

Viewing angle is the measurement of contrast ratio≥10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as below: 90° (θ) horizontal left and right, and 90° (Φ) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.

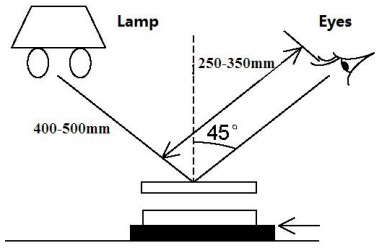
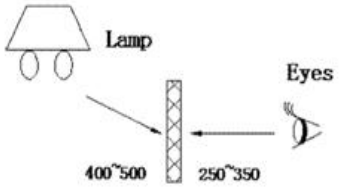


4.2 Appearance Specifications

4.2.1 Terms Definition



4.2.2 Inspection Conditions

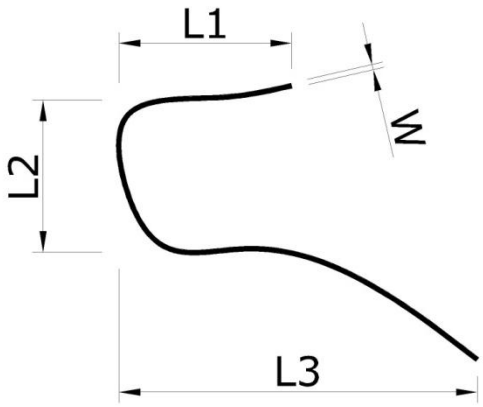
Items	Conditions	Remarks
Inspection Lamp	Florescent Cool White Lamp, 1000~1200Lux	
Inspection with Reflect Light (RL)	*Normal eyes level 1.0 (with Glasses accepted); *Distance between Lamp and product:40-50cm; *Distance between Eyes and Product:25-35cm; *Angle of view: 45°; *Black background; *Inspection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



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.		

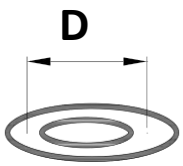
< Dot-like Defects> (D=Diameter)

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.

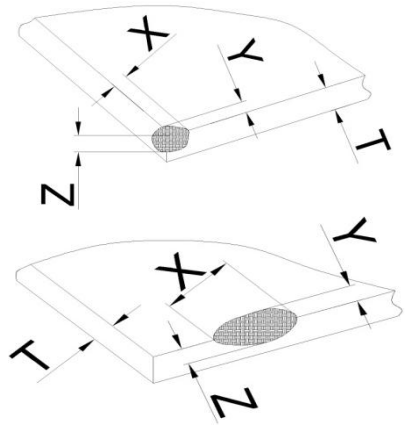
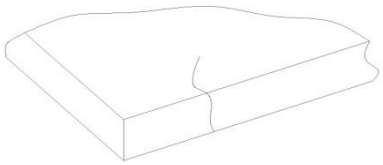
< Surface Fisheye>

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 =85℃, 300 hrs
2	Low temperature storage test	Ta =-30℃, 300 hrs
3	High temperature & high humidity operation test	Ta =60℃, 90%RH, 300hrs
4	High temperature operation test	Ta =85℃, 300hrs
5	Low temperature operation test	Ta =-30℃, 300hrs
6	Thermal shock	Ta = -20℃↔60℃(0.5hr), 100 cycle
7	Vibration test	1.5G, (10~200Hz, Sine wave), 30 mins / axis (X, Y, Z), non-operation
8	ESD test	Air Voltage: ±15KV Contact Voltage: ±8KV
9	Impact Resistance	Steel ball: 64 g Height: 30 cm

Note1: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost Self-recoverable. No hardware failures.
Note2:

- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24hours at least in advance.
- In the standard condition, there is not display function NG issue occurred.

6. Label, Package and Firmware Version

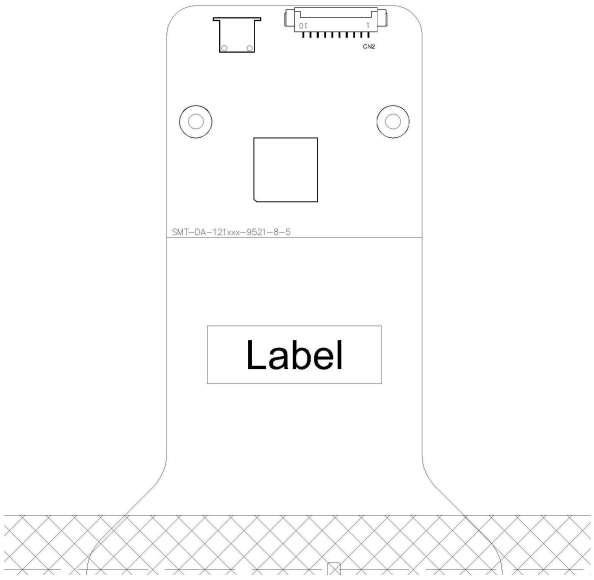
6.1 Label

6.1.1 Product Label Information

GEA-121C01-DC9521-G020
Product code.
SMT-DA-121N000-SU9521-8-5
Touch sensor type for test.
12123280001CDC2
121: product active area size 2328: YYWW 0001: series number CDC2: 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

fw_9521_D_12_1_S+_8_5.bin

fw_9521_D_12_1_S+_8_5.bin

7. Mechanical Drawing