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

/SIMPLEPLUS
Touch Displays

Specification

Module No. : GEA-215B01-DC9521-G020

Version No. : A2

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Issue History

Version	History	Date	Remarks
A1	First Issue	2021/03/24	
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	2023/07/15	

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1. Overview

This specification document is issued for the 21.5” 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	0.7mm DITO glass + COF FPC	SIS9521 Controller
Air Bonding Tape	3M 4905	0.50 mm
Display	TFT LCD	INNOLUX G215HCJ-L01

2.2 General Specifications

Item	Specifications	Remark
Display Active Area	476.064(H) × 267.786(V) mm	
Display Resolution	1920(H) × R.G.B. × 1080(V)	
Pixel Pitch	0.24795 × 0.24795 mm	
Pixel Arrangement	R.G.B. Vertical Stripe	
Display Colors	16.7M(8bit) colors	
Display Brightness	400 cd/m^2	Typ.
Display Mode	Normally Black	
Display Surface Treatment	AG type, 3H hard coating, Haze 25	
Electrical Interface	Display: 2ch- LVDS	
	Touch: USB and I^2C	
Touch Activation	Multi-finger touch	
Touch Resolution	41X, 72Y	
Touch Controller	SIS9521	
Bonding Method	CG to touch sensor: optical bonding TP module to display: tape bonding	
Outline Dimension	518.00(H) × 309.70(V) × 16.97(Max) mm	

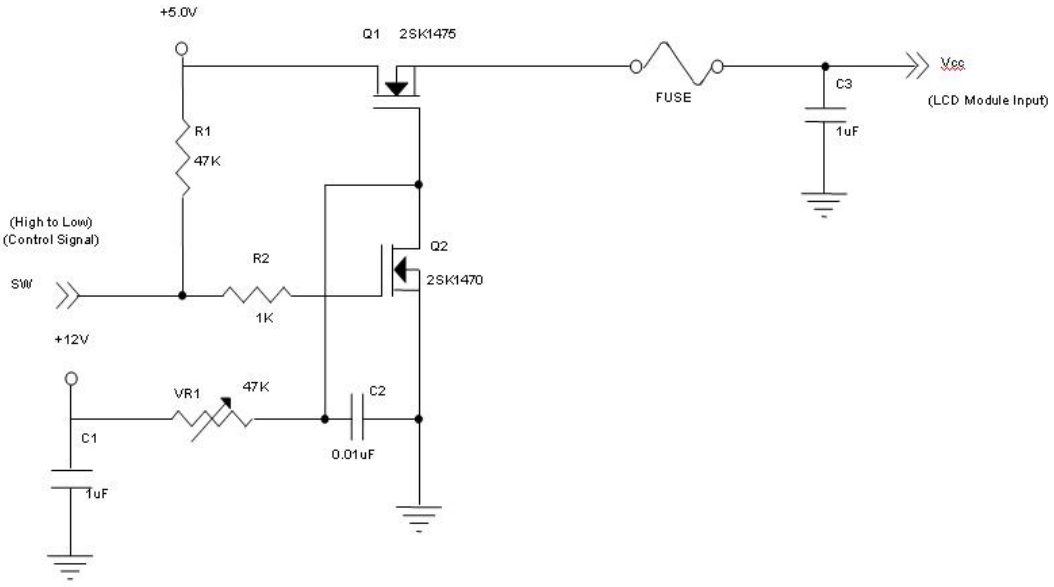
3. Electrical Specifications

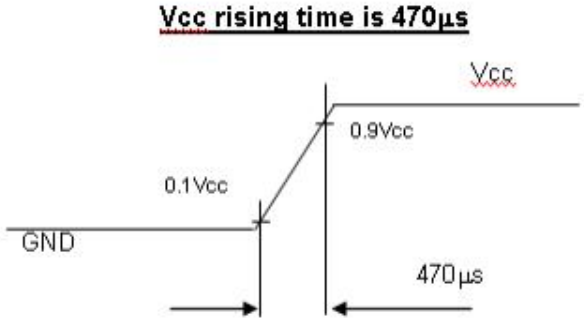
3.1 Display Electrical Specifications

3.1.1 LCD Electronics Specification

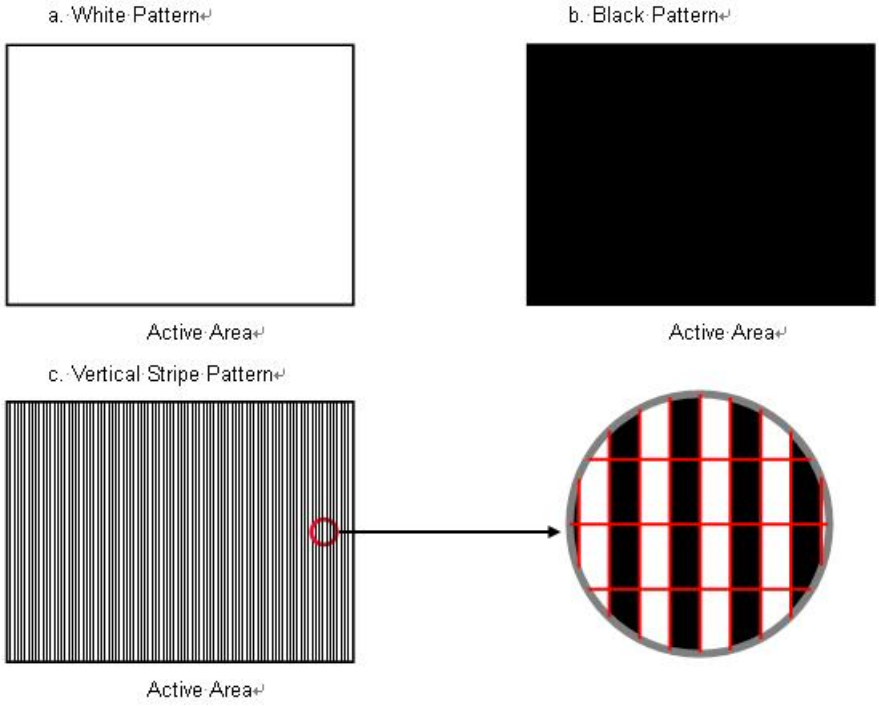
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	4.5	5.0	5.5	V	-
Ripple Voltage		V_{RP}	-	-	300	mV	-
Rush Current		I_{RUSH}	-	-	3	A	(2)
Power Supply Current	White	-	-	550	640	mA	(3)a
	Black	-	-	530	620	mA	(3)b
	Vertical Stripe	-	-	700	810	mA	(3)c
Power Consumption		PLCD	-	3.5	4.05	Watt	(4)
LVDS interface	Differential Input Voltage	V_{ID}	100	-	600	mV	
	Common Input Voltage	V_{CM}	1.0	1.2	1.4	V	
	Differential Input High Threshold Voltage	V_{TH}	-	-	+100	mV	
	Differential Input Low Threshold Voltage	V_{TL}	-100	-	-	mV	

Note (1) The ambient temperature is Ta = 25±2℃.
Note (2) Measurement Conditions:

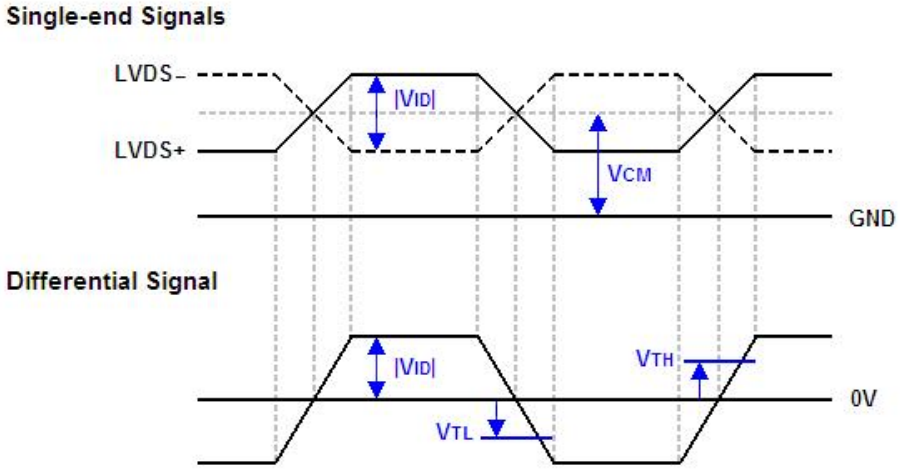




Note (3) The specified power supply current is under the conditions at V_{CC} = 5.0 V, Ta = 25±2℃, Fr = 60Hz, whereas a power dissipation check pattern below is displayed.



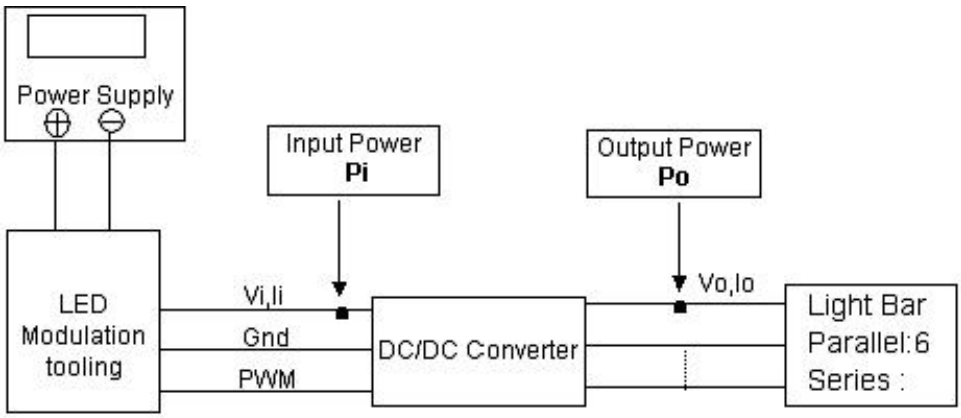
Note (4) The power consumption is specified at the pattern with the maximum current.
Note (5) The LVDS input characteristics are as follows:



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		Vi_{RP}	-	-	500	mV	
LED Converter input current		I_i	1.0	1.2	1.4	A_{DC}	@ Vi = 12V (Duty 100%)
LED Converter inrush current		I_{IRUSH}	-	-	5.0	A	@ Vi rising time=10ms (Vi=12V)
Input Power Consumption		P_i	-	14.4	16.8	W	(1)
EN Control Level	Backlight on	ENLED (BLON)	2.5	3.3	5.0	V	
	Backlight off		0	--	0.3		
PWM Control Level	PWM High Level	Dimming (E_PWM)	2.5	--	5.0	V	
	PWM Low Level		0	0	0.15		
PWM Noise Range		VNoise	-	-	0.1	V	
PWM Control Frequency		f_{PWM}	190	200	20k	Hz	(3)
PWM Control Duty Ratio		-	5		100	%	(3), @190Hz<f_{PWM} <1kHz
			20		100	%	(3), @1kHz≦f_{PWM} <20kHz
LED Life Time		L_L	50,000			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℃ 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 50% 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.

POWER CONNECTOR PIN ASSIGNMENT
CN1

Pin	Symbol	Description
1	GND	Ground
2	GND	Ground
3	GND	Ground
4	LED PWM	PWM Dimming HI 3.3V ; LOW 0V
5	LED EN	ENABLE 3.3V
6	NC	NC
7	VIN	12V Input Power
8	VIN	12V Input Power
9	VIN	12V Input Power

Note (1) Connector(wire type): STM(MS2409HJ) or equivalent.
Note (2) User's mating connector part No.: STM(P24049)

3.1.3 Electrical Interface Connection

PIN ASSIGNMENT

Pin	Name	Description
1	RXO0-	Negative LVDS differential data input. Channel O0 (odd)
2	RXO0+	Positive LVDS differential data input. Channel O0 (odd)
3	RXO1-	Negative LVDS differential data input. Channel O1 (odd)
4	RXO1+	Positive LVDS differential data input. Channel O1 (odd)
5	RXO2-	Negative LVDS differential data input. Channel O2 (odd)
6	RXO2+	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Ground
8	RXOC-	Negative LVDS differential clock input. (odd)
9	RXOC+	Positive LVDS differential clock input. (odd)
10	RXO3-	Negative LVDS differential data input. Channel O3(odd)
11	RXO3+	Positive LVDS differential data input. Channel O3 (odd)
12	RXE0-	Negative LVDS differential data input. Channel E0 (even)
13	RXE0+	Positive LVDS differential data input. Channel E0 (even)
14	GND	Ground
15	RXE1-	Negative LVDS differential data input. Channel E1 (even)
16	RXE1+	Positive LVDS differential data input. Channel E1 (even)
17	GND	Ground
18	RXE2-	Negative LVDS differential data input. Channel E2 (even)
19	RXE2+	Positive LVDS differential data input. Channel E2 (even)
20	RXEC-	Negative LVDS differential clock input. (even)
21	RXEC+	Positive LVDS differential clock input. (even)
22	RXE3-	Negative LVDS differential data input. Channel E3 (even)
23	RXE3+	Positive LVDS differential data input. Channel E3 (even)
24	GND	Ground
25	NC	For LCD internal use only, Do not connect
26	NC	For LCD internal use only, Do not connect
27	NC	For LCD internal use only, Do not connect
28	Vcc	+5.0V power supply
29	Vcc	+5.0V power supply
30	Vcc	+5.0V power supply

Note (1) Connector Part No.:
P-TWO:187098-30091 or FCN:WF13-422-3033 or Foxconn: GS23301-0321R-7H
Note (2) User's connector Part No:
Mating Wire Cable Connector Part No.: FI-X30H(JAE) or FI-X30HL (JAE)
Mating FFC Cable Connector Part No.: 217007-013001 (P-TWO) or JF05X030-1 (JAE).
Note (3) The first pixel is odd.
Note (4) Input signal of even and odd clock should be the same timing.

3.1.4 Interface Timing

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

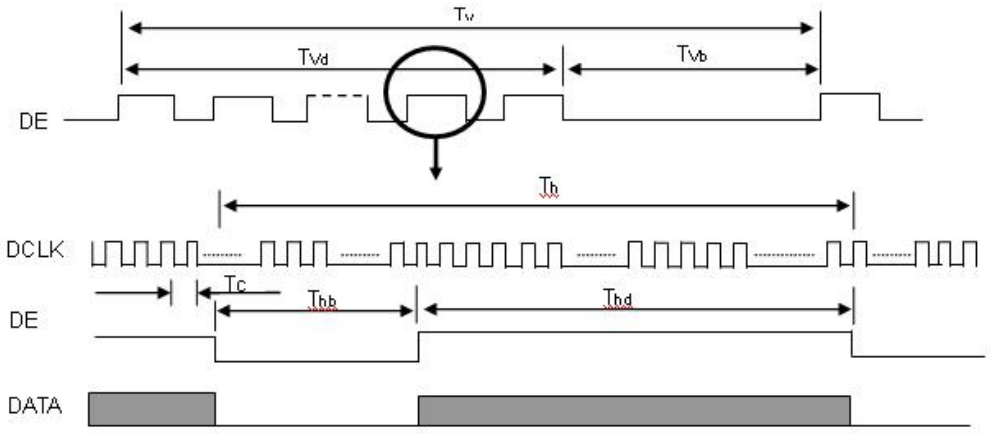
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	57.5	74.25	97.98	MHz	
	Period	Tc	-	13.47		ns	
	Input cycle to cycle jitter	T_{rcl}	-0.02*TC	-	0.02*TC	ns	(1)
	Input Clock to data skew	TLVCCS	-0.02*TC		0.02*TC		(2)
	Spread spectrum modulation range	Fclkin_mod	0.97*FC	-	1.03*FC	MHz	(3)
	Spread spectrum modulation frequency	F_{SSM}	-	-	100	KHz	
Vertical Display Term	Frame Rate	Fr	49	60	77	Hz	
	Total	Tv	1110	1125	1251	Th	Tv=Tvd+Tvb-
	Active Display	Tvd	1080	1080	1080	Th	-
	Blank	Tvb	Tv-Tvd	Tv-Tvd	Tv-Tvd	Th	(4)
Horizontal Display Term	Total	Th	1050	1100	1150	Tc	Th=Thd+Thb
	Active Display	Thd	960	960	960	Tc	-
	Blank	Thb	Th-Thd	Th-Thd	Th-Thd	Tc	-

Note: Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

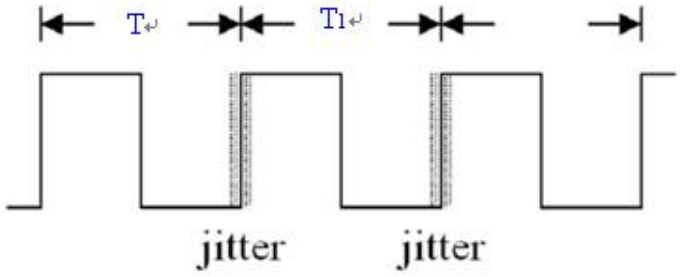
Fc = Fr X Tv X Th

Please make sure the range of pixel clock has follow the below equation and Fc, Fr, Tv , Th not allowed to get beyond the min or max spec.

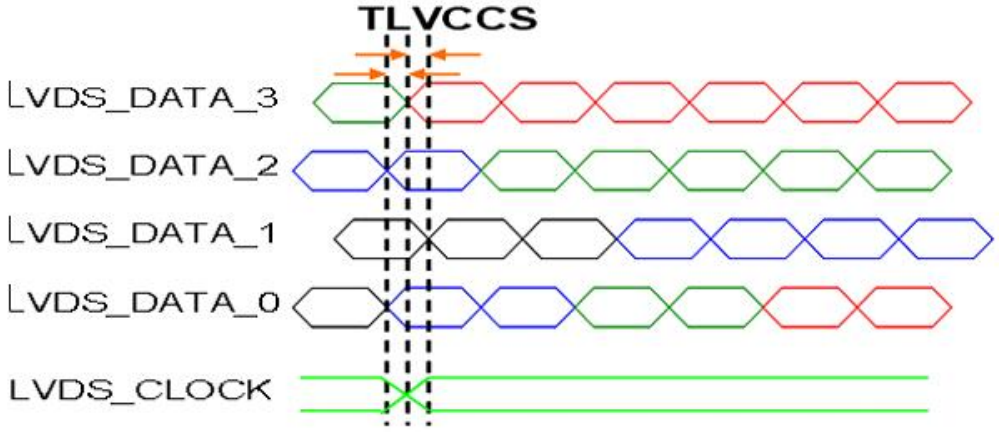
INPUT SIGNAL TIMING DIAGRAM



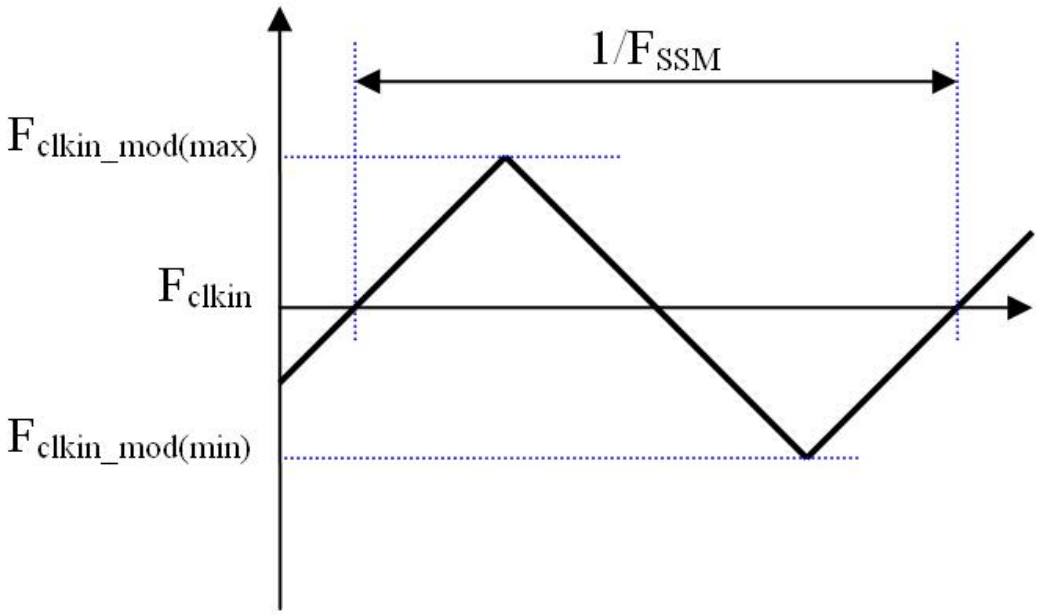
Note (1) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T1 – TI



Note (2) Input Clock to data skew is defined as below figures.



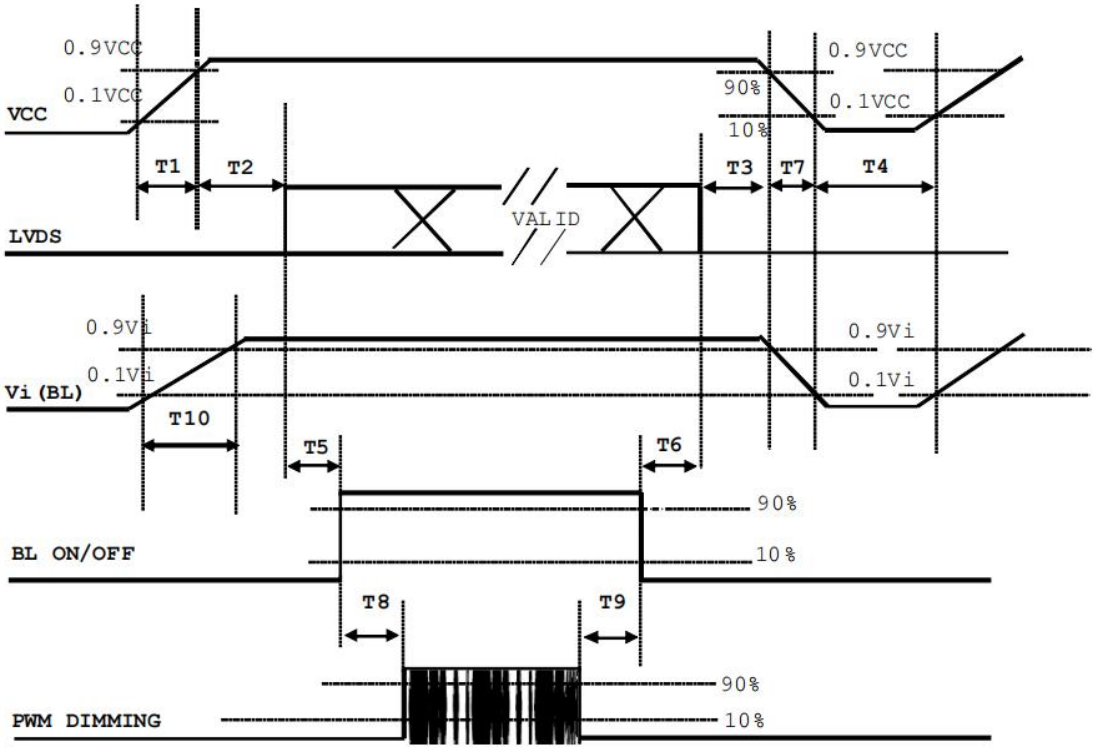
Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (4) The DCLK range at last line of V-blank should be set in 0 to Hdisplay/2.

3.1.5 Power ON/OFF Sequence

The power sequence specifications are shown as the following table and diagram.



Timing Specifications:

Parameters	Values			Units	Note
	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	

Note (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.
Note (2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.
Note (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.
Note (4) T4 should be measured after the module has been fully discharged between power off and on period.
Note (5) Interface signal shall not be kept at high impedance when the power is on.
Note (6) INX won’ t take any responsibility for the products which are damaged by the customers not following the Power Sequence.
Note (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". Note (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 "t6 spec".

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	
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

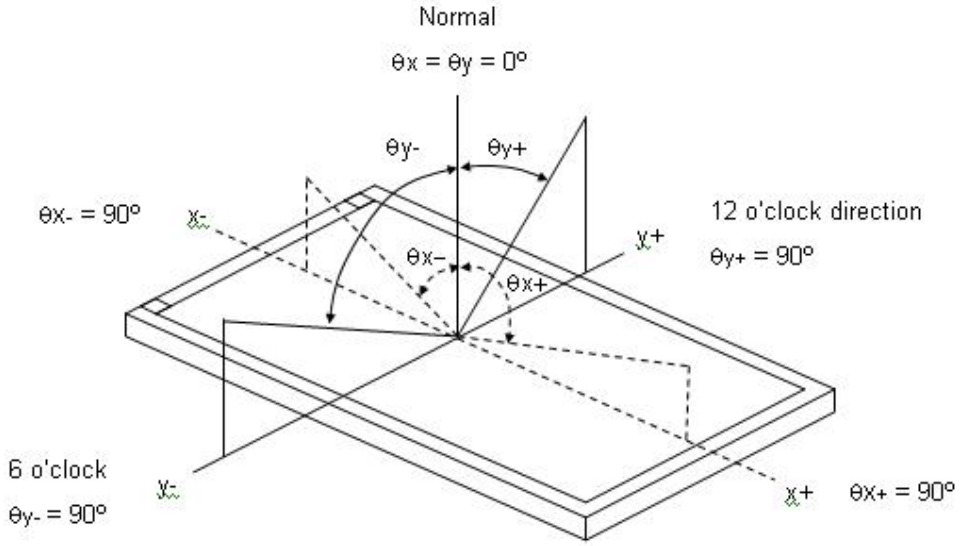
4.1.1 Test Conditions

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	According to typical value in "ELECTRICAL CHARACTERISTICS"		
Input Signal			
LED Light Bar Input Current Per Input			

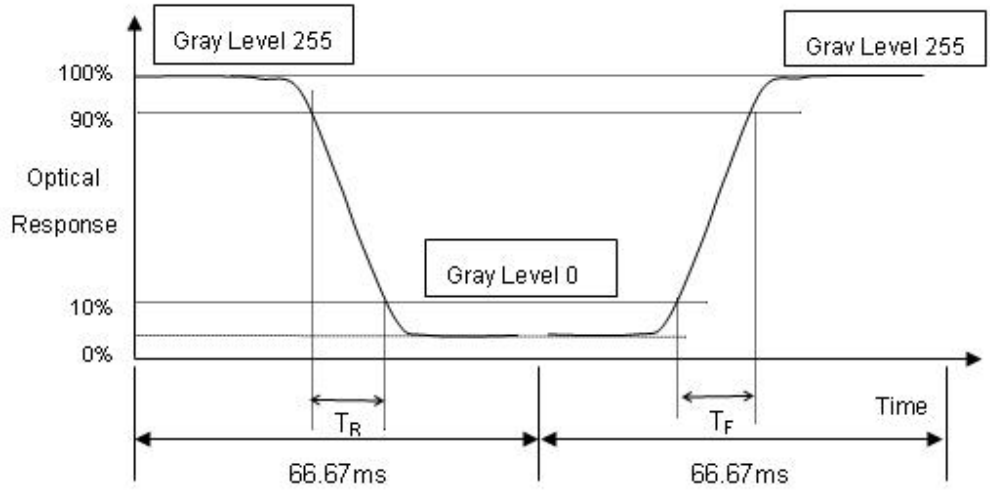
4.1.2 Optical Specifications

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx	θ_x=0°, θ_Y =0° CS-2000 R=G=B=255 Gray scale	Typ – 0.03	0.650	Typ + 0.03	-	(1), (5)
		Ry			0.339			
	Green	Gx			0.324			
		Gy			0.613			
	Blue	Bx			0.157			
		By			0.049			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White (Center of Screen)		L_C		320	400	-	cd/m^2	(4), (5)
Contrast Ratio		CR		700	1000	-	-	(2), (5)
Response Time		T_R	θ_x=0°, θ_Y =0°	---	8	---	ms	(3)
		T_F		---	7	---		
White Variation		W	θ_x=0°, θ_Y =0°	75	---	---	%	(5), (6)
Viewing Angle	Horizontal	x- + x+	CR ≧ 10	170	178	---	Deg.	(1), (5)
	Vertical	y- + y+		170	178	---		
Viewing Angle	Horizontal	x- + x+	CR ≧ 5	170	178	---	Deg.	(1), (5)
	Vertical	y- + y+		170	178	---		

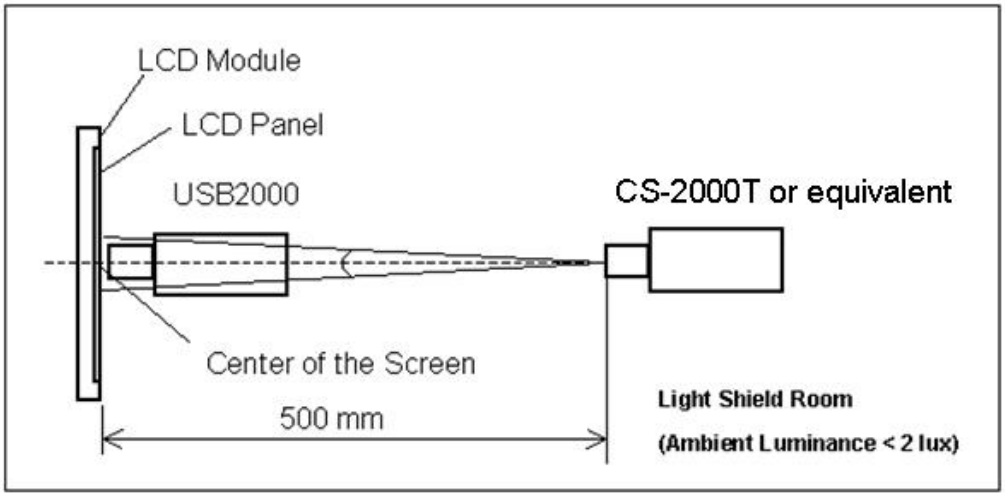
Note (1) Definition of Viewing Angle (θx, θy):



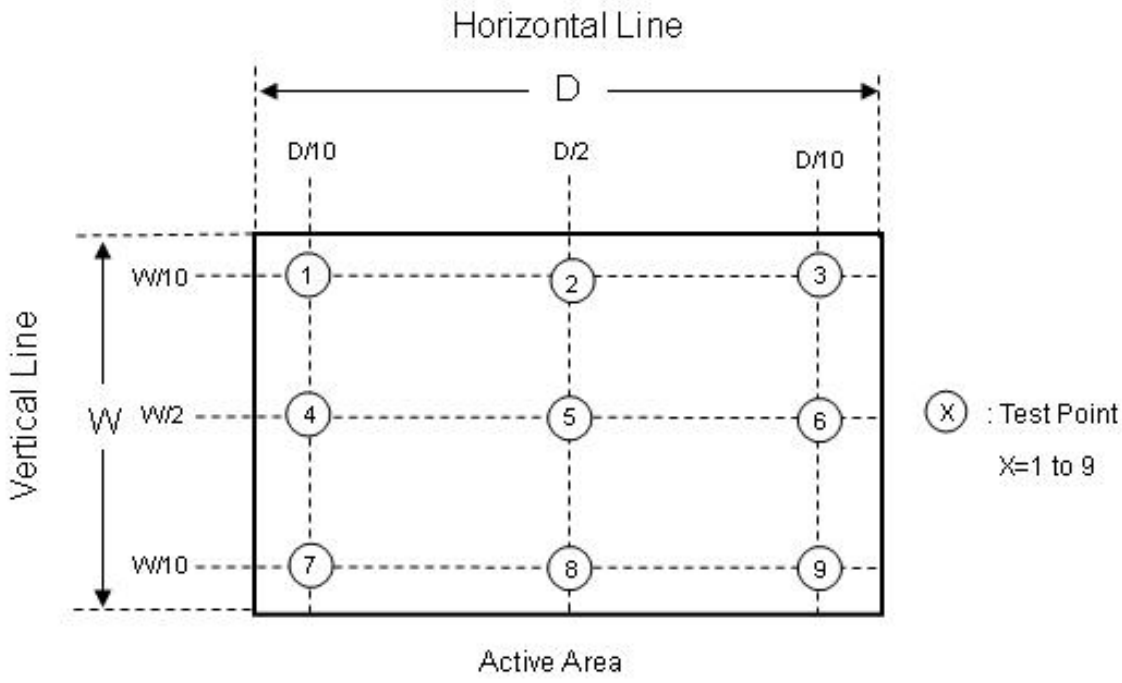
Note (2) Definition of Contrast Ratio (CR):
The contrast ratio can be calculated by the following expression.
Contrast Ratio (CR) = L255 / L0
L255: Luminance of gray level 255
L 0: Luminance of gray level 0
CR = CR (5)
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).
Note (3) Definition of Response Time (TR, TF):



Note (4) Definition of Luminance of White (LC):
Measure the luminance of gray level 255 at center point
LC = L (5)
L (x) is corresponding to the luminance of the point X at Figure in Note (6).
Note (5) Measurement Setup:
The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.

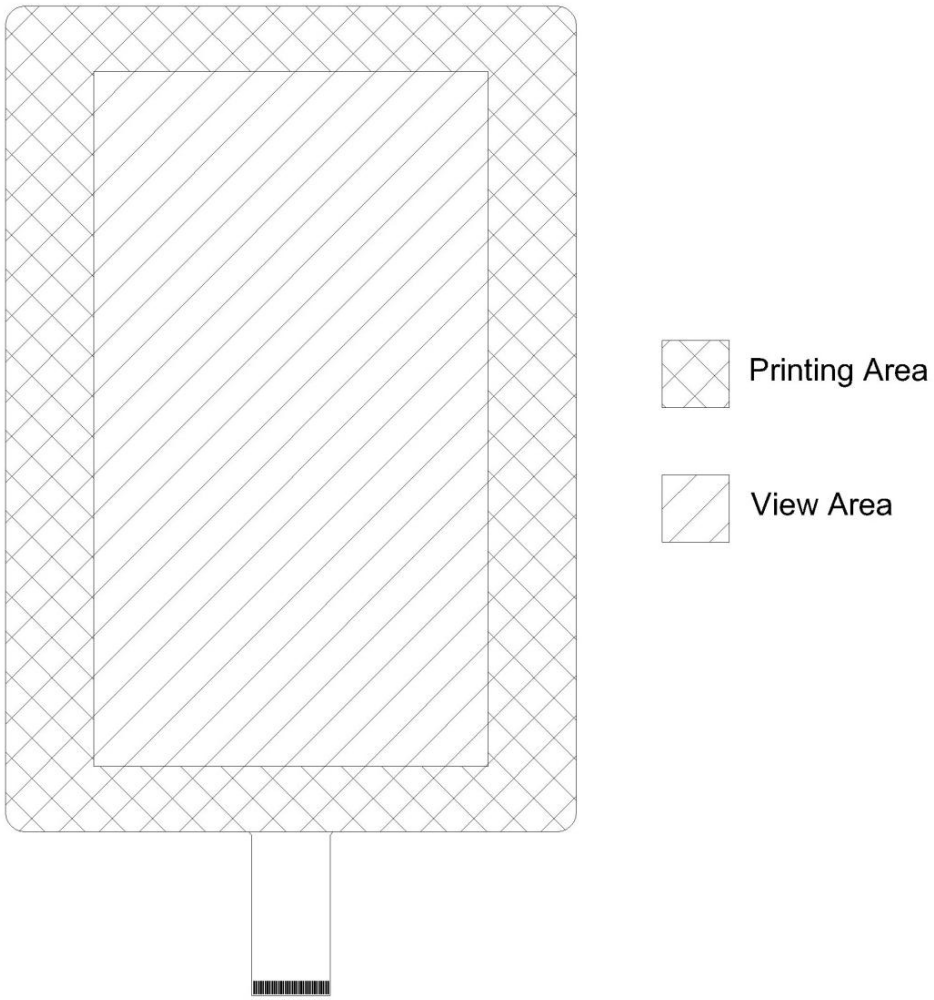


Note (6) Definition of White Variation (W):
Measure the luminance of gray level 255 at 9 points
W = (Minimum [L (1) ~ L (9)] / Maximum [L (1) ~ L (9)]) *100%

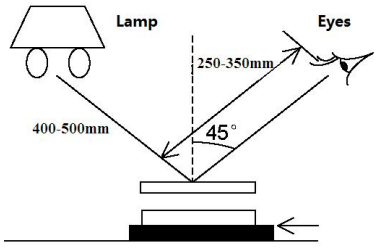
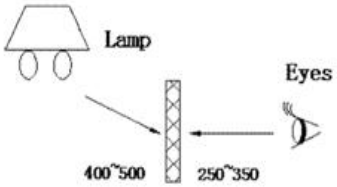


4.2 Appearance Specifications

4.2.1 Terms Definition



4.2.2 Inspection Conditions

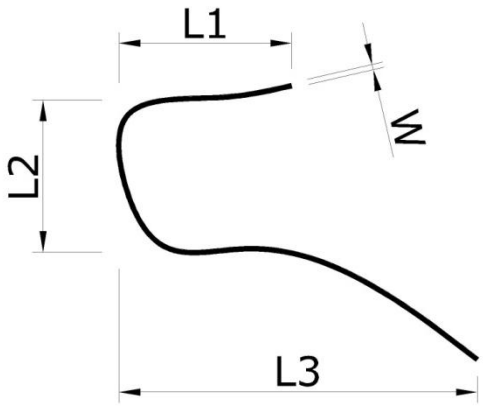
Items	Conditions	Remarks
Inspection Lamp	Florescent Cool White Lamp, 1000~1200Lux	
Inspection with Reflect Light (RL)	*Normal eyes level 1.0 (with Glasses accepted); *Distance between Lamp and product:40-50cm; *Distance between Eyes and Product:25-35cm; *Angle of view: 45°; *Black background; *Inspection 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≤0.05	Not limited	*Accept QTY: not limited.
	0.05<W≤0.08	L≤10	*Accept QTY: not more than 6; *Not allowed if the distance between 2 objects is less than 30 mm.
	0.08<W≤0.15	L≤10	*Accept QTY: not more than 4; *Not allowed if the distance between 2 objects is less than 30 mm.
	W>0.15	L>10	*Not allowed.
	Liner-like Defects including: Liner Foreign Object/Scratch.		

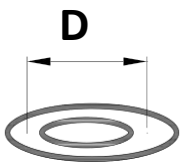
< Dot-like Defects> (D=Diameter)

Condition	Average Diameter(mm)	Criteria
RL	D≤0.25	*Not limited.
	0.25<D≤0.35	*Accept Qty: not more than 10; *Not allowed if the distance between 2 defects is less than 30mm.
	0.35<D≤0.50	*Accept Qty: not more than 5; *Not allowed if the distance between 2 defects is less than 30mm.
	D>0.50	*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.

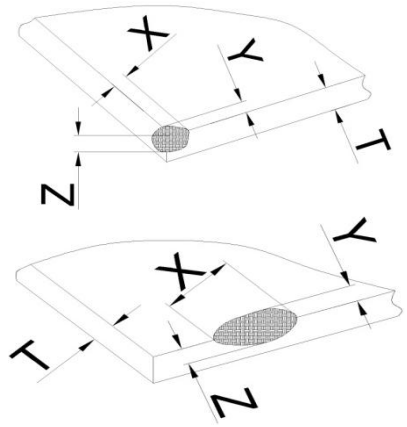
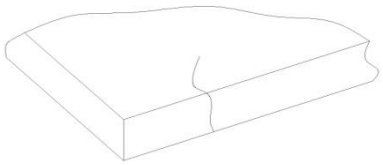
< Surface Fisheye>

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 =60℃, 240 hrs
2	Low temperature storage test	Ta =-20℃, 240 hrs
3	High temperature & high humidity operation test	Ta =50℃, 80%RH, 240hrs
4	High temperature operation test	Ta =60℃, 240hrs
5	Low temperature operation test	Ta =0℃, 240hrs
6	Thermal shock	Ta = -20℃↔60℃(0.5hr), 100 cycle
7	Vibration test (Non-Operating)	Acceleration: 1.5 G Wave: sine Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)
8	Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis)
9	ESD test	Air Voltage: ±15KV 150pF(330Ω) Contact Voltage: ±8KV 150pF(330Ω)
10	Impact Resistance	Steel ball: 64 g Height: 30 cm

Note (1) There should be no condensation on the surface of panel during test.
Note (2) In the standard conditions, there is no function failure issue occurred. All the cosmetic Specification is judged before reliability test.
Note (3) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

6. Label, Package and Firmware Version

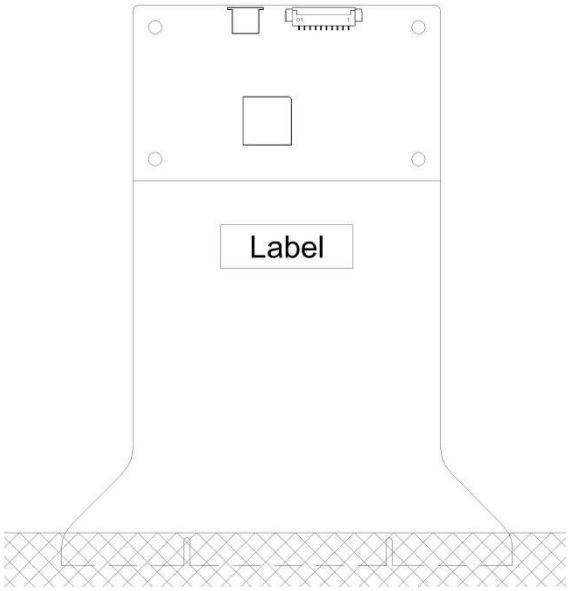
6.1 Label

6.1.1 Product Label Information

GEA-215B01-DC9521-G020
Product code.
SMT-DA-215N000-SU9521-7-4
Touch sensor type for test.
21523280001BDC2
215: product active area size 2328: 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

6.2.1 Packaging Steps

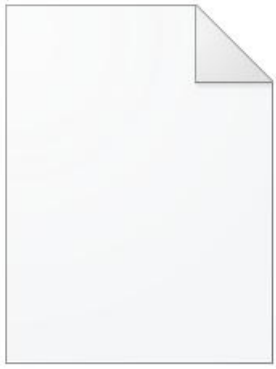
TBC

6.2.2 Carton Information

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

6.3 Firmware Version

21_5_USB_COF_DITO.bin



21_5_USB_COF_DITO.bin

7. Mechanical Drawing