

Specification

Module No. : GEA-070B01-DC9509-G020

Version No. : A3

Client Confirmation	Approved by	Prepared by
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Issue History

Version	History	Date	Remarks
A1	First Issue	2021/03/20	
A2	Updated 3.Electrical Specifications Added 4.Optical Specifications Removed 5.General Precaution Added 6.1 Label&6.3 Firmware Version	2023/04/11	
A3	Updated 3.1.2 Backlight Unit Updated 3.1.3 Electrical Interface Connection Updated 3.1.5 Power ON/OFF Sequence Updated 5. Reliability Test Updated 7. Mechanical Drawing	2024/06/06	

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1. Overview

This specification document is issued for the 7" 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	1.1mm chemical strengthened glass	black print
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	INNOLUX G070ACE-L01

2.2 General Specifications

Item	Specifications	Remark
Display Active Area	152.40(H) × 91.44(V) mm	
Display Resolution	800(H) × 480 RGB(V)	
Pixel Pitch	0.1905(H) × 0.1905(V) mm	
Pixel Arrangement	R.G.B. Stripe	
Display Colors	16.7M/ 262K Colors	
Display Brightness	500 cd/m ²	Typ.
Display Mode	Normally Black	
Display Surface Treatment	AG type, 3H hard coating	
Electrical Interface	Display: LVDS	
	Touch: USB and I ² C	
Touch Activation	Multi-finger touch	
Touch Resolution	14X, 23Y	
Touch Controller	SIS9509	
Bonding Method	CG to touch sensor: optical bonding TP module to display: tape bonding	
Outline Dimension	185.00(H) × 116.80(V) × 11.18(Max) mm	

3. Electrical Specifications

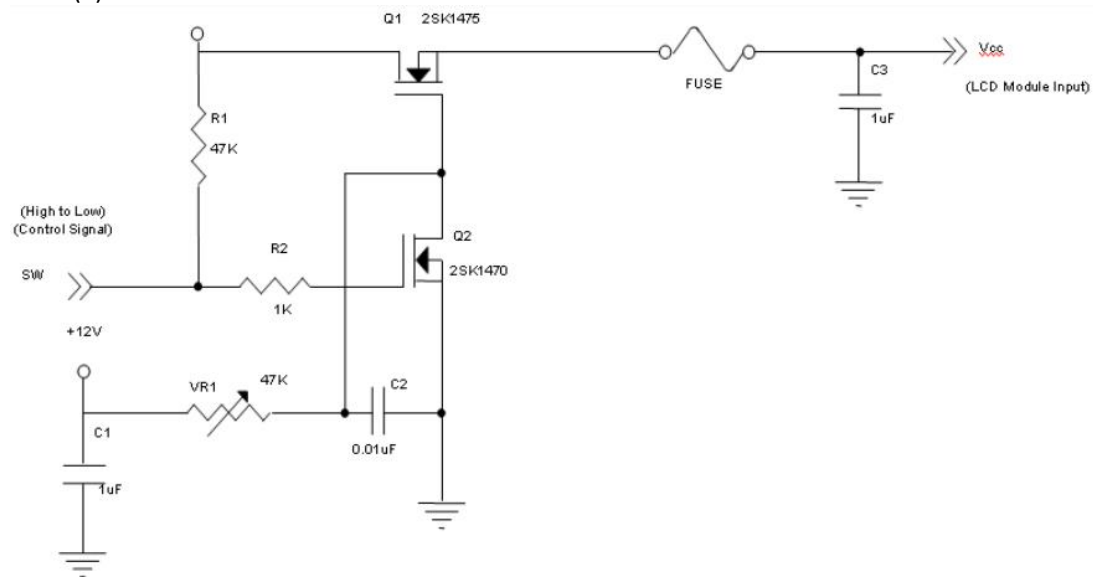
3.1 Display Electrical Specifications

3.1.1 LCD Electronics Specification

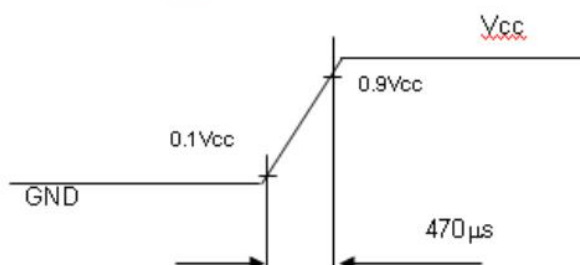
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V _{CC}	3.0	3.3	3.6	V	-
Ripple Voltage	V _{RP}	-	-	100	mVp-p	-
Rush Current	I _{RUSH}	-	-	2	A	(2)
Power Supply Current	White	-	135	200	mA	(3)a
	Black	-	85	135	mA	(3)b
	Vertical Stripe	-	145	220	mA	(3)c
Power Consumption	PLCD	-	0.48	0.73	W	
LVDS differential input voltage	V _{id}	200	-	600	mV	
LVDS common input voltage	V _{ic}	1.0	1.2	1.4	V	
LVDS terminating resistor	R _T	-	100	-	ohm	

Note (1) The ambient temperature is Ta = 25±2°C.

Note (2) Measurement Conditions:



V_{CC} rising time is 470μs



Note (3) The specified power supply current is under the conditions at $V_{cc}=3.3\text{ V}$, $T_a=25\pm 2\text{ }^{\circ}\text{C}$, $F_r=60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



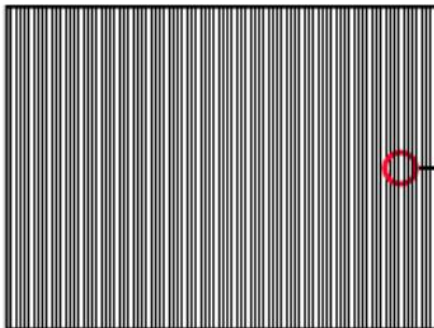
Active Area

b. Black Pattern

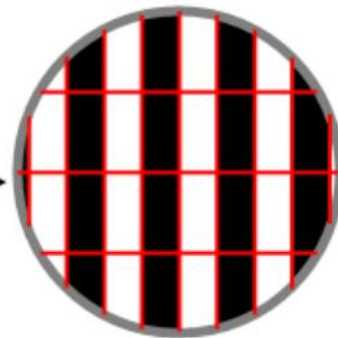


Active Area

c. Vertical Stripe Pattern

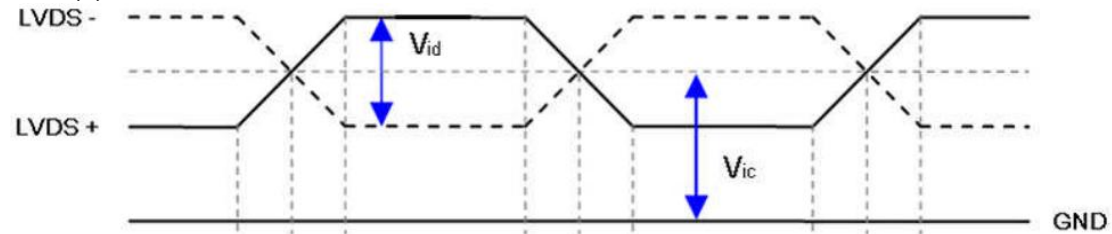


Active Area



Note (4) The power consumption is specified at the pattern with the maximum current.

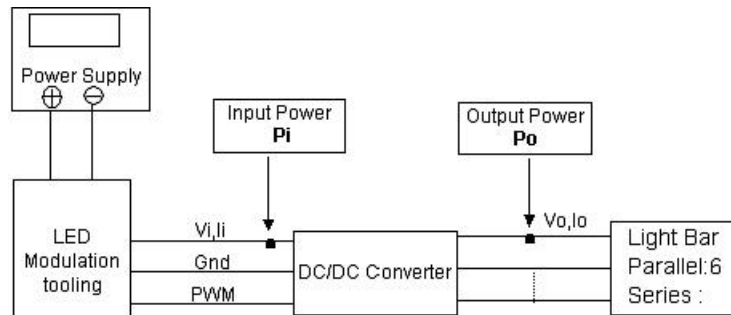
Note (5) VID waveform condition



3.1.2 Backlight Unit

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
(Converter input voltage)		V_i	10.8	12.0	13.2	V_{DC}	(Duty 100%)
(Converter input ripple voltage)		V_{IRP}	-	-	500	mV	
(Converter input current)		I_i	0.1	0.17	0.2	A_{DC}	@ $V_i = 12V$ (Duty 100%)
(Converter inrush current)		I_{IRUSH}	-	4.3		A	@ V_i rising time=10ms ($V_i=12V$)
Input Power Consumption		P_i	-	2.0	2.3	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 Noise Range		V_{Noise}	-	-	0.1	V	
PWM Control Frequency		f_{PWM}	190	200	300	Hz	(3)
PWM Control Duty Ratio		-	5		100	%	(3).@ 190Hz< f_{PWM} <1kHz
			20		100	%	(3).@ 1kHz≤ f_{PWM} <20kHz
LED Life Time		L_{LED}	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 $T_a = 25 \pm 2^\circ C$ and Duty 100% until the brightness becomes ≤ 50% of its original value. Operating LED under high temperature environment 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	-
6	Dimming	Backlight Adjust	-
7	NC	No Connction (Reserve for INX test)	(3)
8	NC	No Connction (Reserve for INX test)	(3)
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,	(2)
		Low → 6 bit Input Mode	
		High or NC → 8bit Input Mode	
29	GND	Ground	-
30	GND	Ground	-

Note (1) Connector Part No.: P-TWO 187114-30091 or equivalent.

Note (2) User's connector Part No.: JAE FI-X30H(L) or equivalent.

Note (3) "Low" stands for 0V. "High" stands for 3.3V.

Note (4) Pin7, Pin8 input signals should be set to no connection or ground, this module would operate normally.

3.1.4 Display Timing Specifications

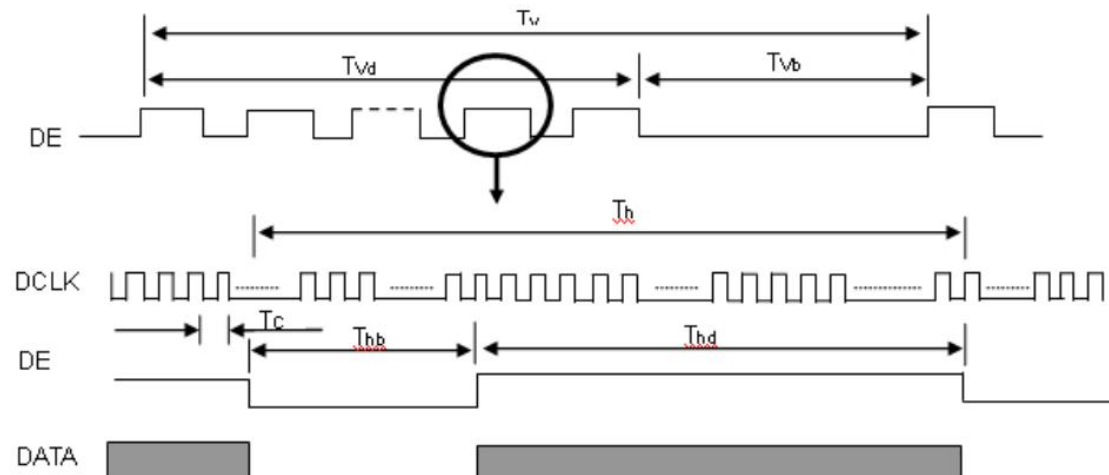
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	25.2	25.4	35.7	MHz	-
	Period	Tc		39.37		ns	
	Input cycle to cycle jitter	T _{rd}	-0.02*Tc	-	0.02*Tc	ns	(3)
	Input clock to data skew	TLVCCS	-0.02*Tc	-	0.02*Tc	ns	(4)
	Spread spectrum modulation range	F _{clkin_mod}	FC*98%	-	FC*102%	MHz	(5)
	Spread spectrum modulation frequency	F _{SSM}	23	-	93	KHz	
Vertical Display Term	Frame Rate	Fr	-	60	-	Hz	Tv=Tvd+Tvb
	Total	Tv	488	490	611	Th	-
	Active Display	Tvd	480	480	480	Th	-
	Blank	Tvb	8	10	131	Th	-
Horizontal Display Term	Total	Th	860	864	974	Tc	Th=Thd+Thb
	Active Display	Thd	800	800	800	Tc	-
	Blank	Thb	60	64	174	Tc	-

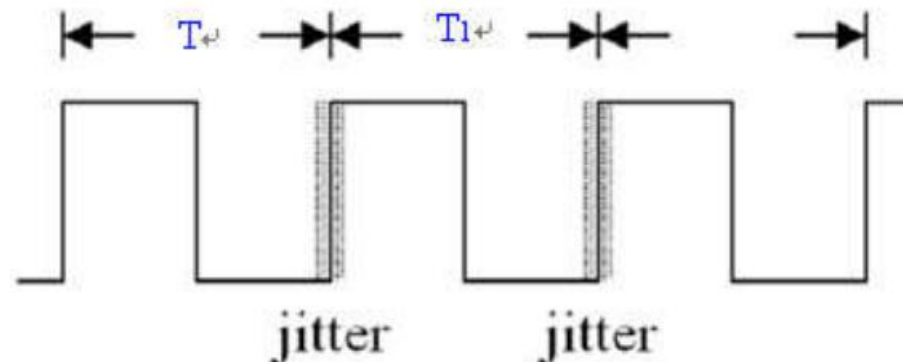
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

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

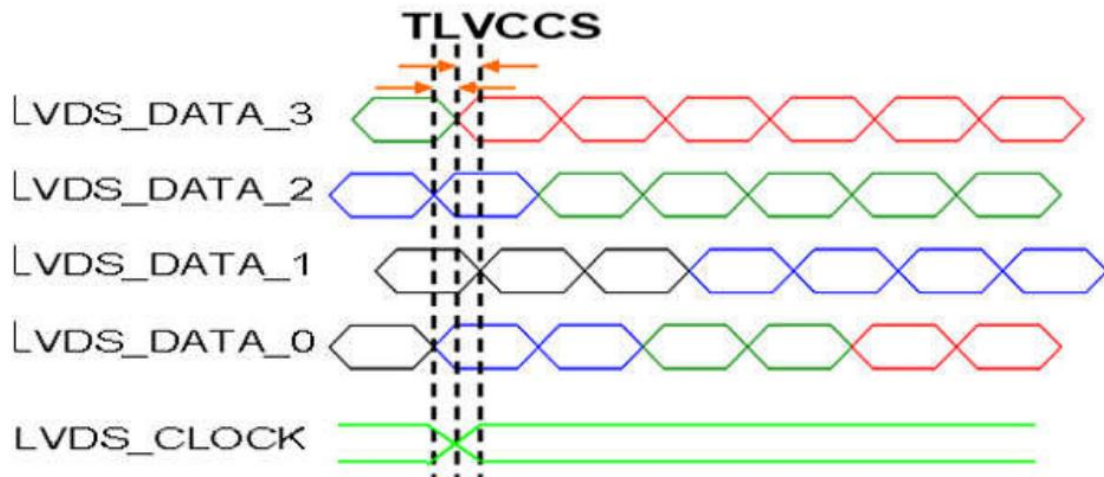
INPUT SIGNAL TIMING DIAGRAM



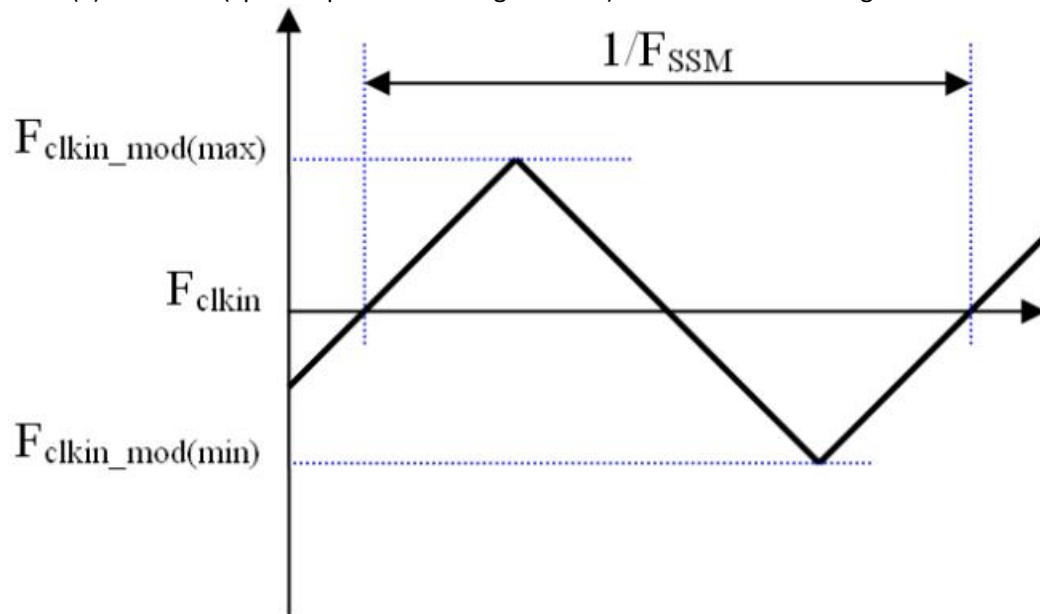
Note (3) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = |T1 - T1|$.



Note (4) Input Clock to data skew is defined as below figures.

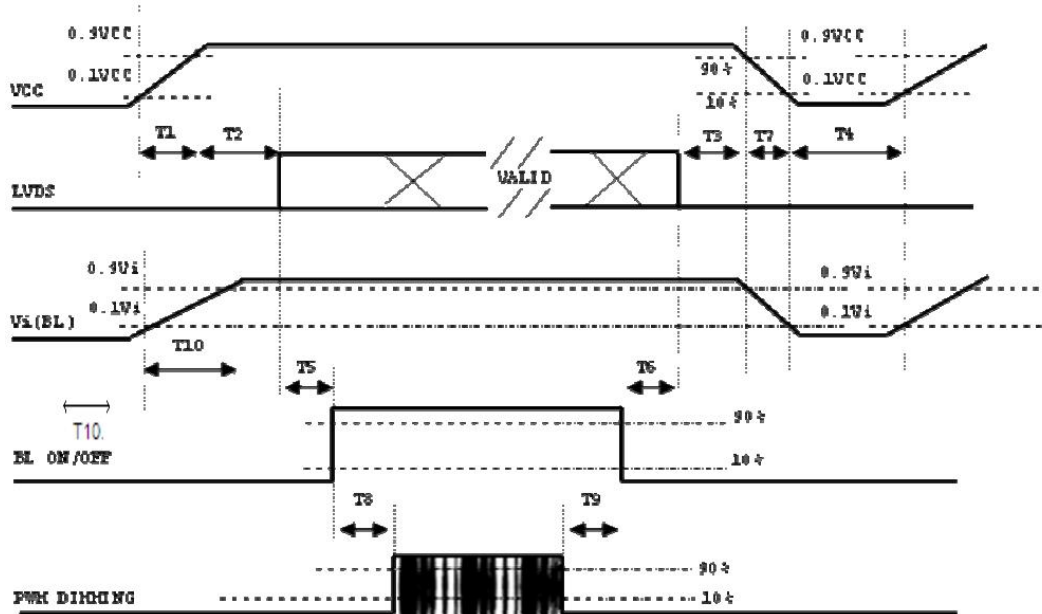


Note (5) The SSCG (Spread spectrum clock generator) is defined as below figures.



3.1.5 Power ON/OFF Sequence

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



Timing Specifications:

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

- (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) GET 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".

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 ² C	

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 ² C serial data
5	SCL	I ² C 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 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	3CDF6F7-4267-4555-AD05-B30A3D8938DE
HID Descriptor address	0x0000

4. Optical Specifications

4.1 Display Optical Characteristics

4.1.1 Test Conditions

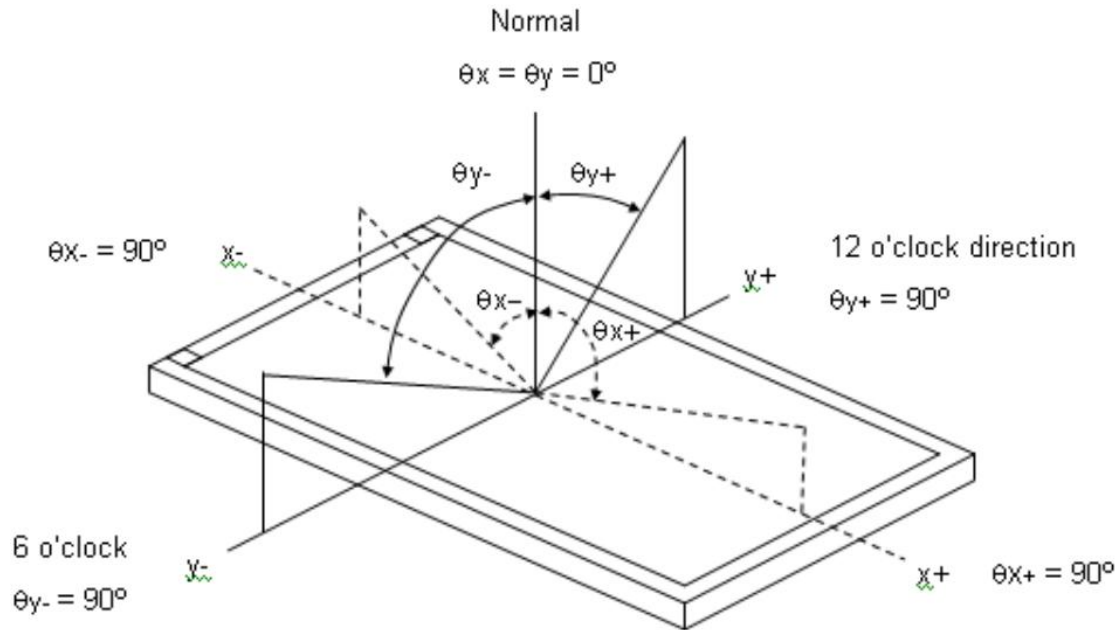
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	According to typical value in "ELECTRICAL CHARACTERISTICS"		
Input Signal			
LED Light Bar Input Current Per Input Pin			

4.1.2 Optical Specifications

The relative measurement methods of optical characteristics are shown in 4.1.2 and all items are measured at the center point of screen except white variation. The following items should be measured under the test conditions described in 4.1.1 and stable environment shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	R _x	$\theta_x=0^\circ, \theta_y=0^\circ$ CS-2000 R=G=B=255 Gray scale	Typ – 0.05	0.625	Typ + 0.05	-	(1), (5)
		R _y			0.303			
	Green	G _x			0.307			
		G _y			0.630			
	Blue	B _x			0.150			
		B _y			0.050			
	White	W _x			0.313			
		W _y			0.315			
	Center Luminance of White				L _C			
Contrast Ratio		CR	600	800	-	-	(2), (5)	
Response Time		T _R	$\theta_x=0^\circ, \theta_y=0^\circ$	-	13	-	ms	(3)
		T _F		-	12	-		
White Variation		W	$\theta_x=0^\circ, \theta_y=0^\circ$	70	-	-	%	(5), (6)
Viewing Angle	Horizontal	θ_{x+}	CR ≥ 10	80	89	---	Deg.	(1), (5)
		θ_{x-}		80	89	---		
	Vertical	θ_{y+}		80	89	---		
		θ_{y-}		80	89	---		

Note (1) Definition of Viewing Angle (θ_x, θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

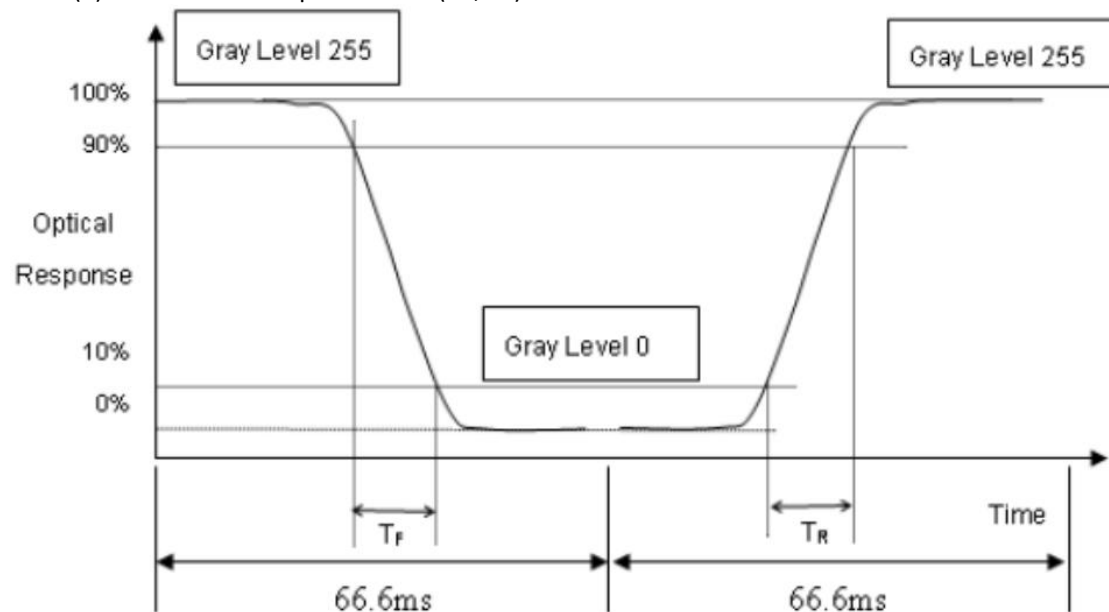
L255: Luminance of gray level 255

L0: 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):

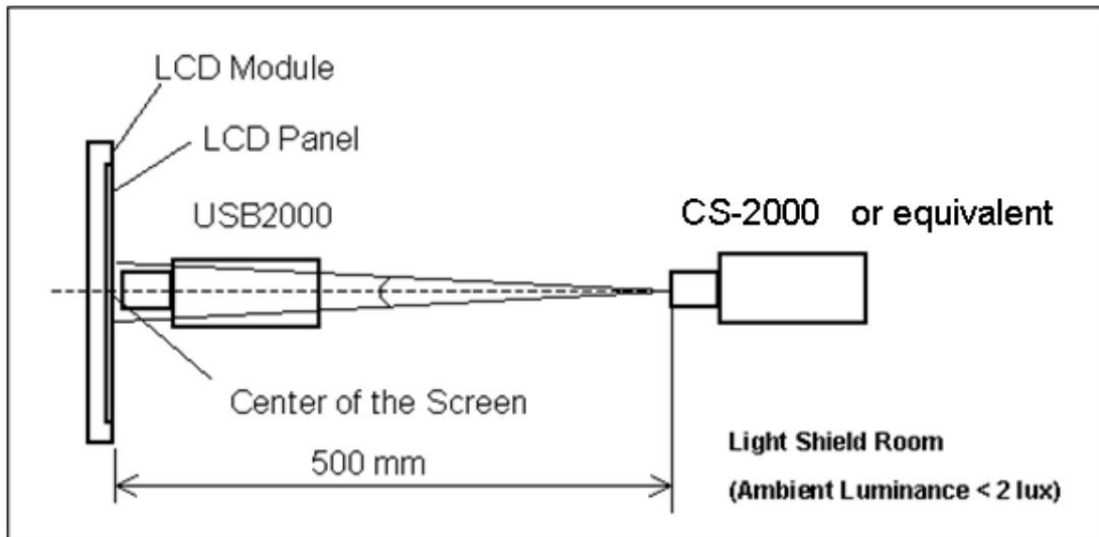
Measure the luminance of gray level 255 at center point

LC = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

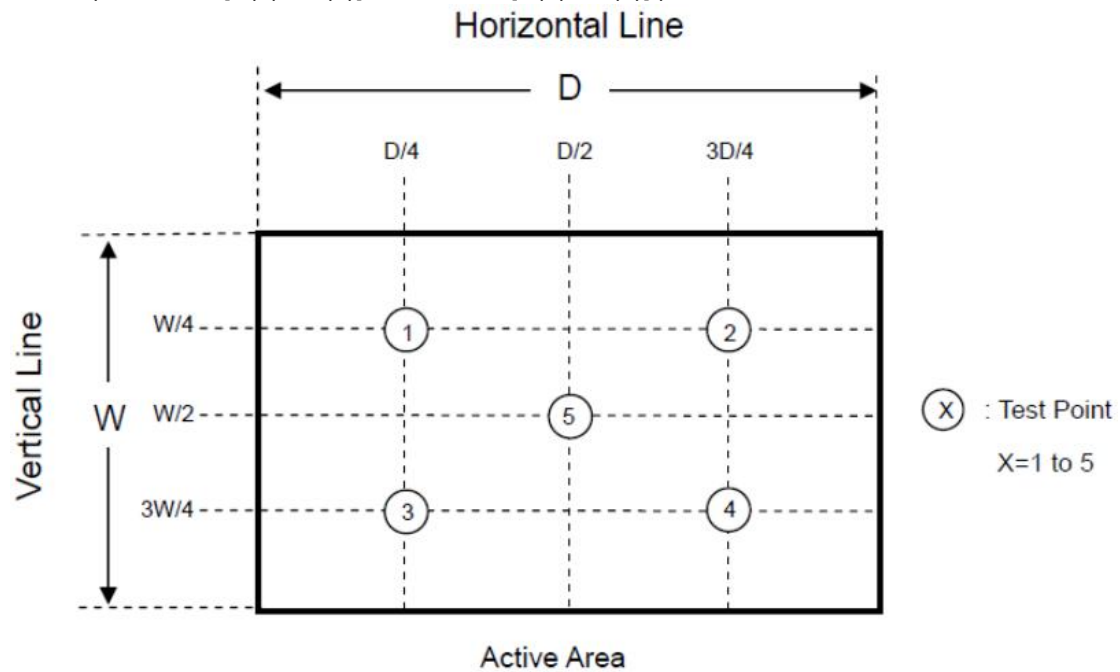
The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



Note (6) Definition of White Variation (δW):

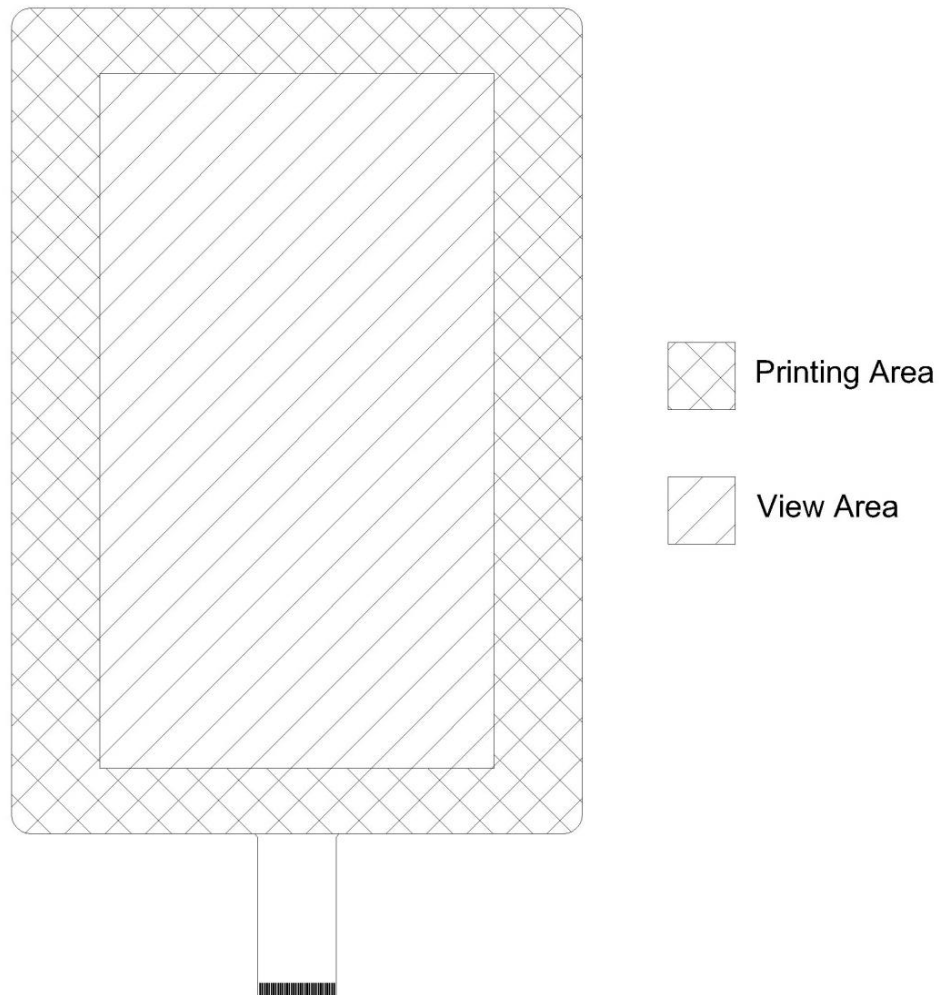
Measure the luminance of gray level 255 at 5 points

$$\delta W = (\text{Minimum} [L(1) \sim L(5)] / \text{Maximum} [L(1) \sim L(5)]) * 100\%$$

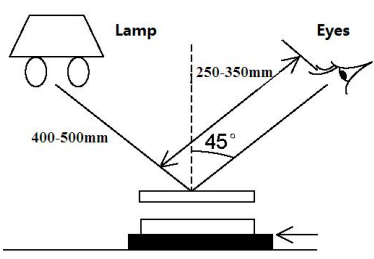
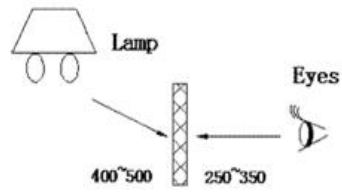


4.2 Module Appearance Specifications

4.2.1 Terms Definition



4.2.2 Inspection Conditions

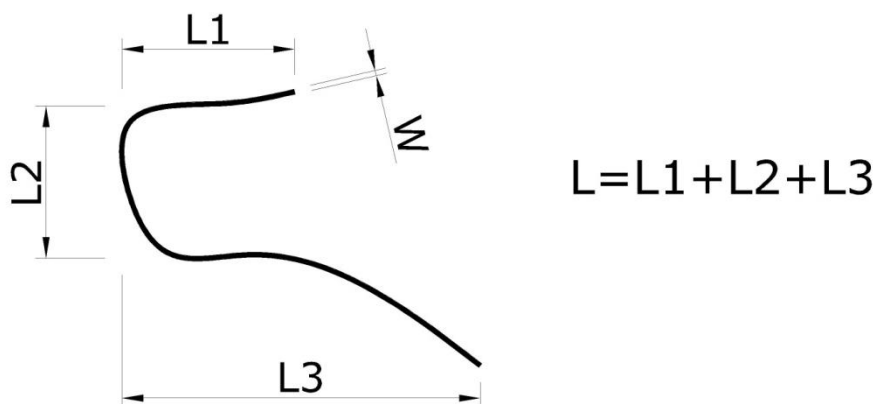
Items	Conditions	Remarks
Inspection Lamp	Florescent Cool White Lamp, 1000~1200Lux	
Inspection with Reflect Light (RL)	*Normal eyes level 1.0 (with Glasses accepted); *Distance between Lamp and product:40-50cm; *Distance between Eyes and Product:25-35cm; *Angle of view: 45°; *Black background; *Inspection 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 $< 120 \text{ mm}: \pm 0.10$ $\geq 120 \text{ mm} < 400 \text{ mm}: \pm 0.15$ $\geq 400 \text{ mm}: \pm 0.25$ *between shaping printing(offset to 2nd, 3rd, etc. color) $< 400 \text{ mm}: \pm 0.30$ $\geq 400 \text{ mm}: \pm 0.50$	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.
	$0.03 < W \leq 0.05$	$L \leq 10$	*Accept QTY: not more than 4; *Not allowed if the distance between 2 objects is less than 20 mm.
	$0.05 < W \leq 0.08$	$L \leq 10$	*Accept QTY: not more than 2; *Not allowed if the distance between 2 objects is less than 20 mm.
	$W > 0.08$	$L > 10$	*Not allowed.
	Liner-like Defects including: Liner Foreign Object/Scratch.		

< Dot-like Defects>

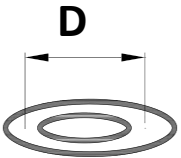
(D=Diameter)

Condition	Average Diameter(mm)	Criteria
RL	$D \leq 0.15$	*Not limited.
	$0.15 < D \leq 0.20$	*Accept Qty: not more than 8; *Not allowed if the distance between 2 defects is less than 20mm.
	$0.20 < D \leq 0.30$	*Accept Qty: not more than 3; *Not allowed if the distance between 2 defects is less than 20mm.
	$D > 0.30$	*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.

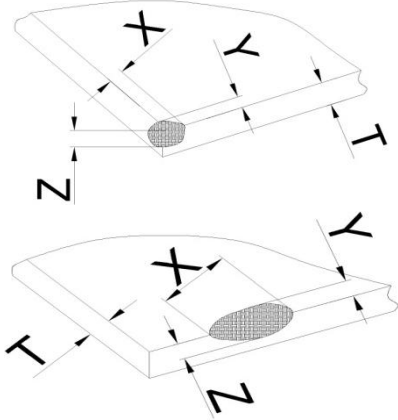
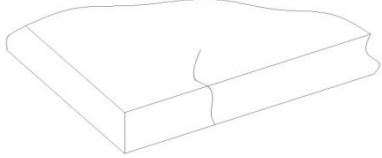
< Surface Fisheye>

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 =90℃, 240 hrs
2	Low temperature storage test	Ta =-40℃, 240 hrs
3	High temperature & high humidity operation test	Ta =60℃, 90%RH, 240hrs
4	High temperature operation test	Ta =85℃, 240hrs
5	Low temperature operation test	Ta =-30℃, 240hrs
6	Thermal shock	Ta = -30℃ ↔ 80℃ (0.5hr), 100 cycle
7	Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z
8	Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for ± X, ± Y, ± Z.
9	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) Temperature of panel display surface area should be 85 °C Max.

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

Note (4) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

Note (5) Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note (6) 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-070B01-DC9509-G020

Product code.

SMT-DA-070N000-SU9509-5-3

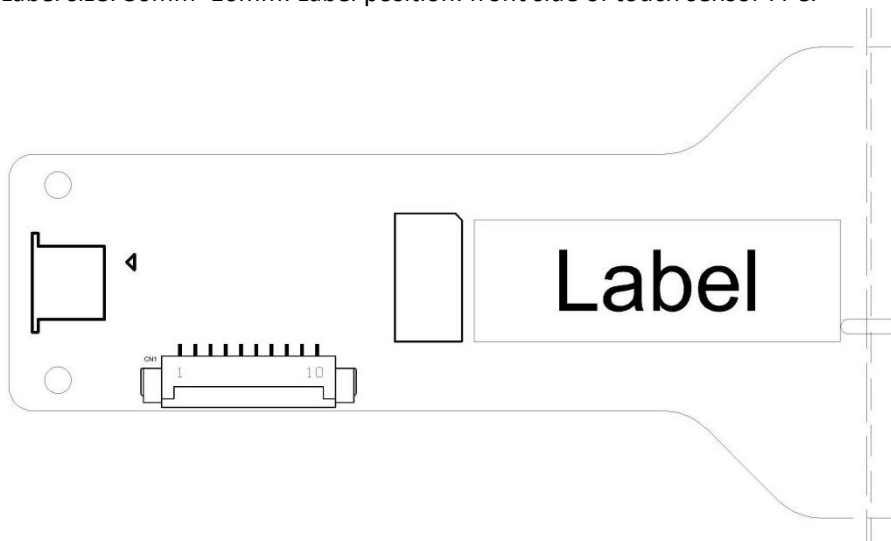
Touch sensor type for test.

07023110001BDC2

070: 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

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_7_dual.bin



Fw_7_dual.bin

7. Mechanical Drawing

