

Specification

Module No. : GEA-185E01-DC9521-G020

Version No. : A2

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Issue History

Version	History	Date	Remarks
A1	First Issue	2021/03/28	
A2	Updated 3.Electrical Specifications Added 4.Optical Specifications Removed 5.General Precaution Added 6.1 Label&6.3 Firmware Version	2023/04/13	

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1. Overview

This specification document is issued for the 18.5" 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 board
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	BOE DV185WHM-NM2

2.2 General Specifications

Item	Specifications	Remark
Display Active Area	409.80(H) × 230.40(V) mm	
Display Resolution	1366(H) × 768(V) pixels	
Pixel Pitch	0.1(H) × 0.3(V) mm	
Pixel Arrangement	R.G.B. Vertical Stripe	
Display Colors	16.7M Colors	
Display Brightness	500 cd/m ²	Typ.
Display Mode	Normally Black	
Display Surface Treatment	Haze 25%, 3H	
Electrical Interface	Display: LVDS	
	Touch: USB and I ² C	
Touch Activation	Multi-finger touch	
Touch Resolution	33X, 58Y	
Touch Controller	SIS9521	
Bonding Method	CG to touch sensor: optical bonding TP module to display: tape bonding	
Outline Dimension	452.00(H) × 275.00(V) × 14.35(Max) mm	

3. Electrical Specifications

3.1 Display Electrical Specifications

3.1.1 Electrical Specifications

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	4.5	5.0	5.5	V	Note 1
Power Supply Current	I_{DD}	-	500	720	mA	
In-Rush Current	I_{RUSH}	-	2	3	A	Note 2
Permissible Input Ripple Voltage	V_{RF}	-	-	300	mV	Note 1,3
High Level Differential Input Threshold Voltage	V_{IH}	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V_{IL}	-100	-	-	mV	
Differential input voltage	$ V_{ID} $	200	-	600	mV	
Differential input common mode voltage	V_{cm}	1.0	1.2	1.5		$V_{IH}=100mV$, $V_{IL}=-100mV$
LED Channel Voltage	V_L	17.4	18	19.8	V	
LED Channel Current	I_L	-	120	-	mA	
LED Lifetime		50,000	-	-	Hrs	
Power Consumption	P_D	-	2.5	3.6	W	@60Hz
	P_{BL}	-	8.6	9.2	W	$I_L=120\text{ mA}$, Note 4
	P_{total}	-	11.1	12.8	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 $V_{DD}=5.0V$, Frame rate=60Hz and Clock frequency = 75.4MHz. Test Pattern of power supply current

a) Typ: Color Bar pattern

b) Max: Gray Level 255

2. Duration of rush current is about 2 ms and rising time of V_{DD} is $520\mu s \pm 20\%$

3. Ripple Voltage should be covered by Input voltage Spec.

4. Calculated value for reference ($V_L \times I_L$) $\times 4$ (channel) excluding driver loss. (LED Light bar: 6S4P).

3.1.2 Backlight Unit

Parameter		Min.	Typ.	Max.	Unit	Remarks
LED Light Bar Input Voltage Per Input Pin	VPIN	17.4	18	19.8	V	Duty 100%
LED Light Bar Input Current Per Input Pin	IPIN	-	120	-	mA	Note1,2,
LED Power Consumption	P _{BL}	-	8.6	9.2	W	Note 3
LED Life-Time	-	50,000	-		Hrs	Note 4

LED bar consists of 24LED packages, 4 strings(parallel)*6packages(serial)

Note1: There is one light bar, and the specified current is input LED chip 100% duty current

Note2: The sense current of each input pin is 120mA

Note3: PBL=4 Input pins*VPIN ×IPIN

Note4: The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at IPIN=120mA on condition of continuous operating at 25 ±2 °C.

3.1.3 Interface Connection

LED connector: 3708K-Q06N-00R manufactured by Entry

Pin No	Symbol	Description
1	IRLED1	LED current sense for string1
2	IRLED2	LED current sense for string2
3	VLED	LED power supply
4	VLED	LED power supply
5	IRLED3	LED current sense for string3
6	IRLED4	LED current sense for string4

LVDS connector: IS100-300-C23. Manufacturer: UJU

Pin No	Symbol	Function	Remark
1	NC	No connection	
2	NC	No connection	
3	NC	No connection	
4	GND	GND Ground	
5	RX0-	Negative LVDS differential data input. Channel 0	
6	RX0+	Positive LVDS differential data input. Channel 0	
7	GND	Ground	Optical: Bist function
8	RX1-	Negative LVDS differential data input. Channel 1	
9	RX1+	Positive LVDS differential data input. Channel 1	
10	GND	Ground	
11	RX2-	Negative LVDS differential data input. Channel 2	
12	RX2+	Positive LVDS differential data input. Channel 2	
13	GND	Ground	
14	RXCLK-	Negative LVDS differential clock input.	
15	RXCLK+	Positive LVDS differential clock input.	
16	GND	Ground	
17	RX3-	Negative LVDS differential data input. Channel 3	
18	RX3+	Positive LVDS differential data input. Channel 3	
19	GND	Ground	
20	NC	Not connection, this pin should be open.	
21	NC	Not connection, this pin should be open.	
22	NC	Not connection, this pin should be open.	
23	GND	Ground	
24	GND	Ground	
25	GND	Ground	
26	VCC	5V Power supply	
27	VCC		
28	VCC		
29	VCC		
30	VCC		

3.1.4 Signal Timing Specification

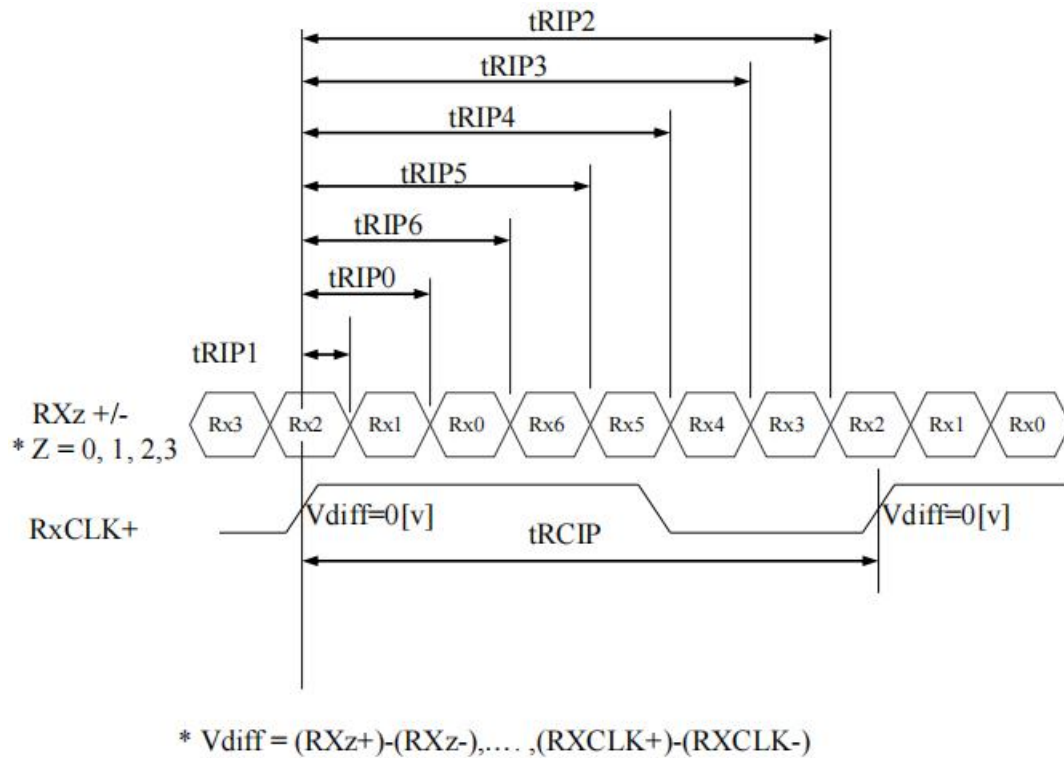
The TFT-LCD is operated by the DE only.

Item	Symbols		Min	Typ	Max	Unit
DCLK	Period	tCLK	10.6	13.26	15.91	ns
	Frequency	-	62.9	75.4	94.3	MHz
Horizontal Display Term	Period	tHP	1446	1560	1936	tCLK
	Horizontal Valid	tHV	1366	1366	1366	tCLK
	Horizontal Blank	tHB	80	194	570	tCLK
	Frequency	fH	40.3	48.36	60.45	KHz
Vertical Display Term	Period	tVP	778	806	888	tHP
	Vertical Valid	tVV	768	768	768	tHP
	Vertical Blank	tVB	10	38	120	tHP
	Frequency	fV	50	60	75	Hz
LVDS Receiver clock	Input spread spectrum ratio	SSr	-3	-	+3	%

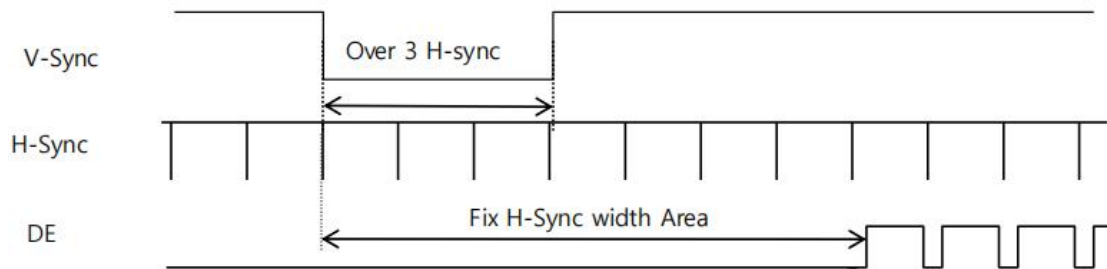
Note: The DCLK range at last line of V-blanking should be set in 0~987.

The specification of the LVDS Rx interface timing parameter is shown in below table.

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.60	13.26	15.91	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 × tRCIP/7-0.4	2 × tRCIP/7	2 × tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 × tRCIP/7-0.4	3 × tRCIP/7	3 × tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 × tRCIP/7-0.4	4 × tRCIP/7	4 × tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 × tRCIP/7-0.4	5 × tRCIP/7	5 × tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 × tRCIP/7-0.4	6 × tRCIP/7	6 × tRCIP/7+0.4	nsec	

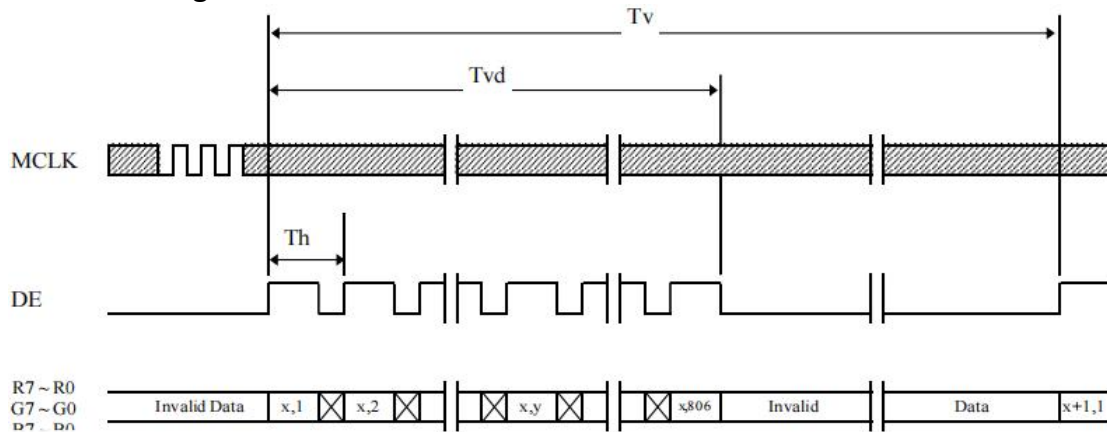


Sync Timing Waveform

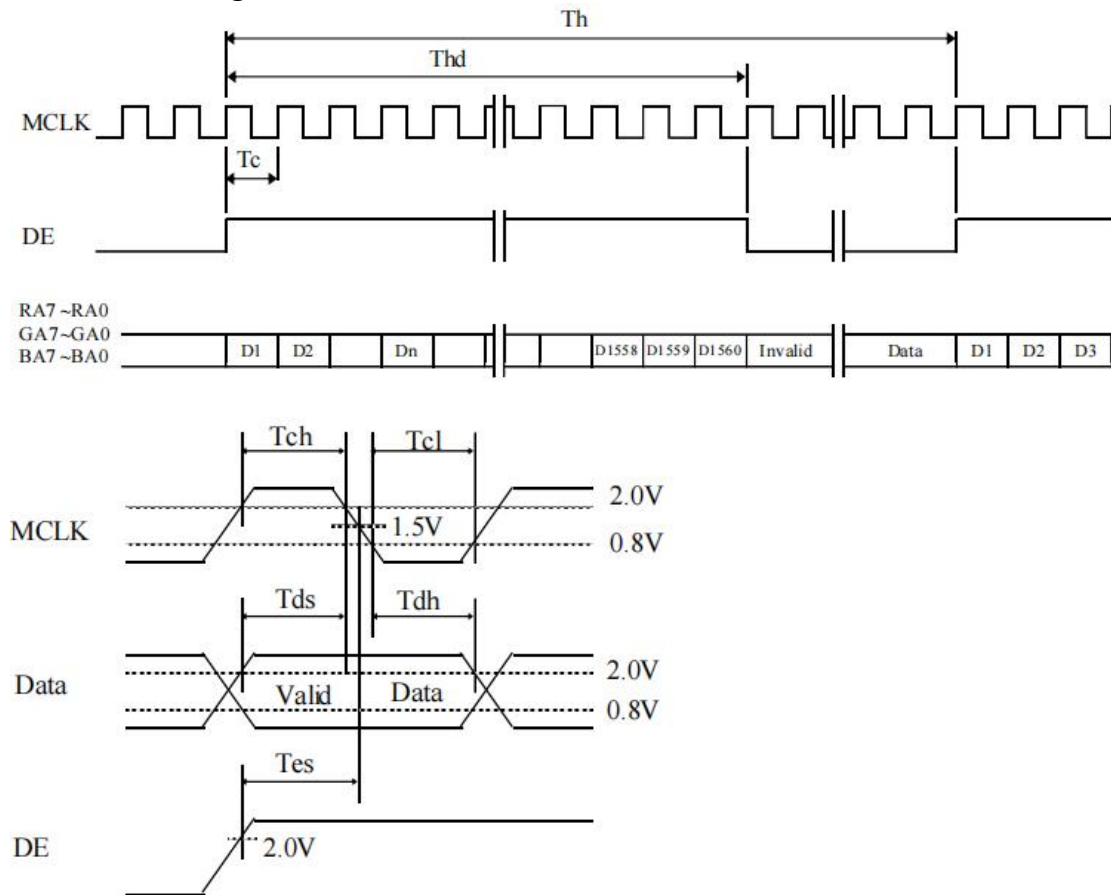


- 1) Need over 3 H-sync during V-Sync Low.
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge.

Vertical Timing Waveform

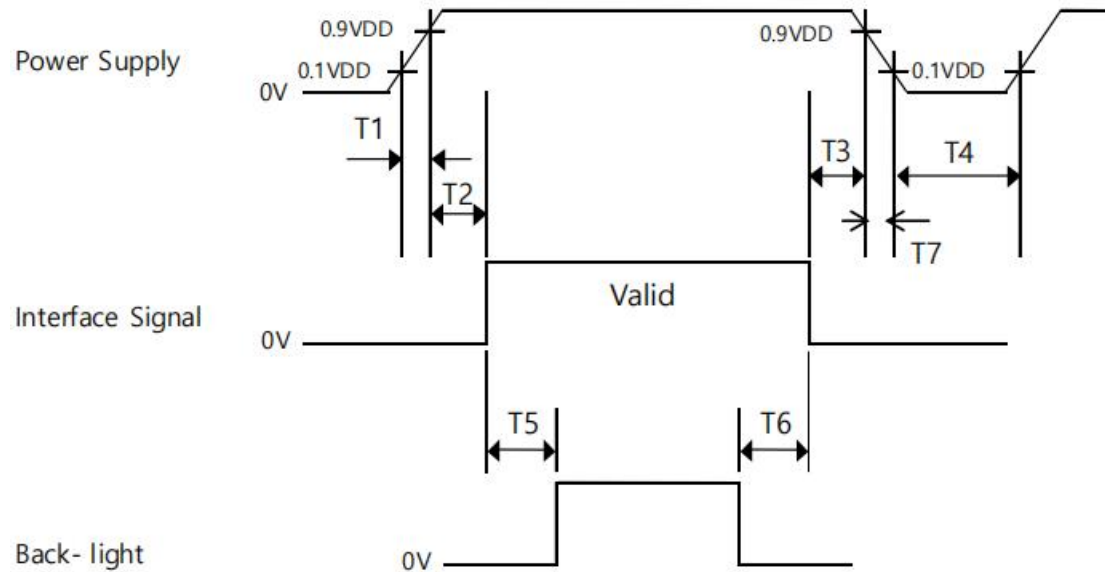


Horizontal Timing Waveform



3.1.5 Power ON/OFF Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below:



Back- light

- $0.5 \text{ ms} \leq T1 \leq 10 \text{ ms}$
- $0 \leq T2 \leq 50 \text{ ms}$
- $0 \leq T3 \leq 50 \text{ ms}$
- $1 \text{ sec} \leq T4$
- $200 \text{ ms} \leq T5$
- $200 \text{ ms} \leq T6$

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.
4. T7 decreases smoothly, there is none re-bouncing voltage.

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	3CDFF6F7-4267-4555-AD05-B30A3D8938DE
HID Descriptor address	0x0000

4. Optical Specifications

4.1 Display Optical Characteristics

4.1.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature $=25\pm 2^{\circ}\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCONE PR730) 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° . We refer to $\theta_{\phi=0} (= \theta_3)$ as the 3 o'clock direction (the "right"), $\theta_{\phi=90} (= \theta_{12})$ as the 12 o'clock direction ("upward"), $\theta_{\phi=180} (= \theta_9)$ as the 9 o'clock direction ("left") and $\theta_{\phi=270} (= \theta_6)$ as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , the center of the measuring spot on the display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be $5.0\text{V} \pm 10\%$ at 25°C . Optimum viewing angle direction is 6 o'clock.

4.1.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 75.4MHz, IBL = 480mA, Ta = $25\pm 2^{\circ}\text{C}$]

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	85	89	-	Deg.	Note 1
		Θ_9		85	89	-	Deg.	
	Vertical	Θ_{12}		85	89	-	Deg.	
		Θ_6		85	89	-	Deg.	
Luminance Contrast ratio		CR	$\Theta = 0^{\circ}$ (Center) Normal Viewing Angle	700	1000	-		Note 2
Luminance of White		Y_w		450	500	-	cd/m ²	Note 3
White luminance uniformity		ΔY		75	80	-	%	Note 4
Reproduction of color	White	W_x		0.283	0.313	0.343	-	Note 5
		W_y		0.299	0.329	0.359		
	Red	R_x		0.638	0.658	0.688		
		R_y		0.308	0.338	0.368		
	Green	G_x		0.267	0.297	0.327		
		G_y		0.627	0.657	0.687		
	Blue	B_x		0.122	0.152	0.182		
		B_y		0.040	0.070	0.100		
Response Time	GTG	T_g		-	14	25	ms	Note 6
Cross Talk		CT		-	-	2.0	%	Note 7

Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing 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.
2. Contrast measurements shall be made at viewing angle of $\theta=0^\circ$ 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 Figure 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. 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.
4. The White luminance uniformity on LCD surface is then expressed as $\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$ (See Figure 2).
5. The color chromatically coordinates specified in table above 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.
6. Response time T_g is the average time required for display transition by switching the input signal as below table and is based on Frame rate $f_v = 60\text{Hz}$ to optimize. Each time in below table is defined as Figure 3 and shall be measured by switching the input signal for "any level of gray(bright)" and "any level of gray(dark)".
7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark. (See Figure 4).

Figure 1. Measurement Set Up

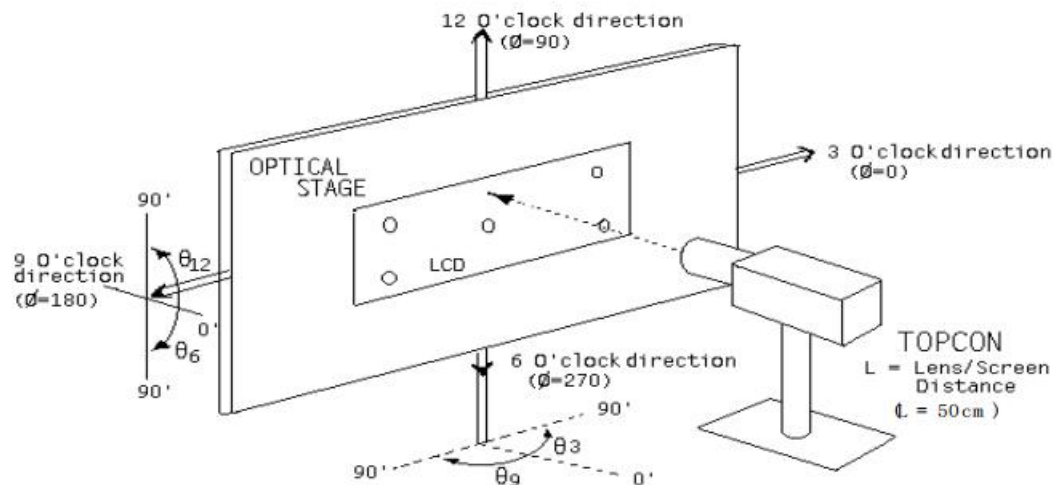


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

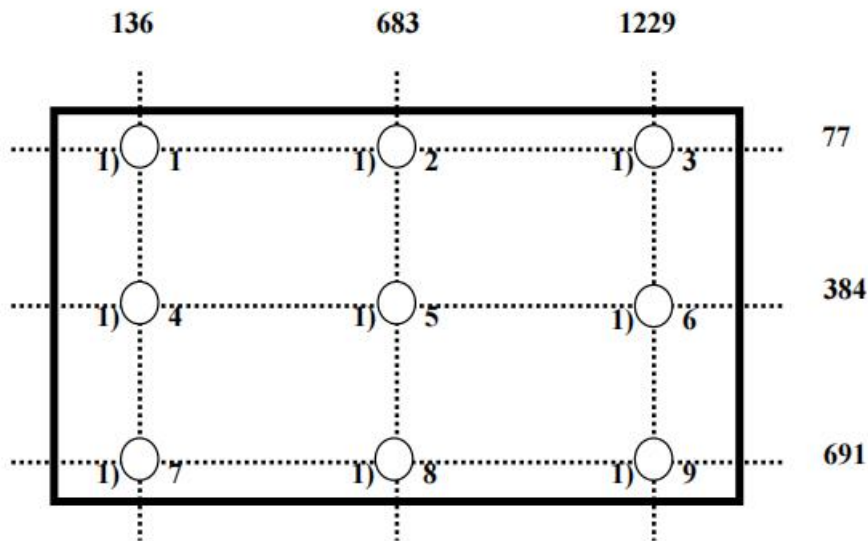
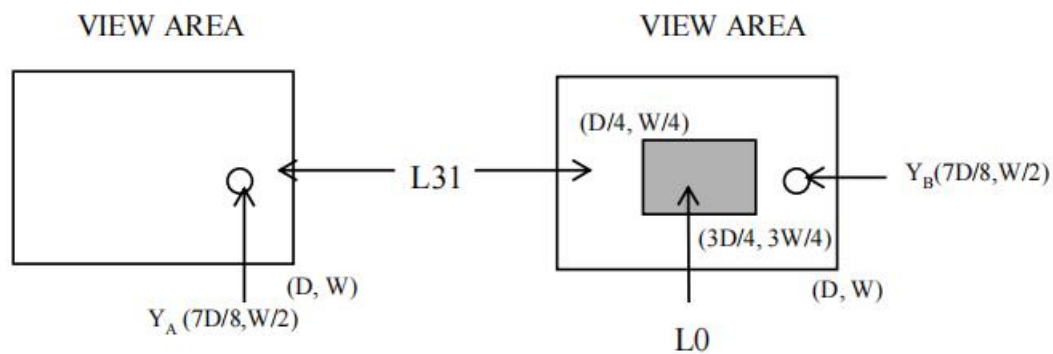


Figure 3. Response Time Testing



Figure 4. Cross Modulation Test Description



$$\text{Cross - Talk}(\%) = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

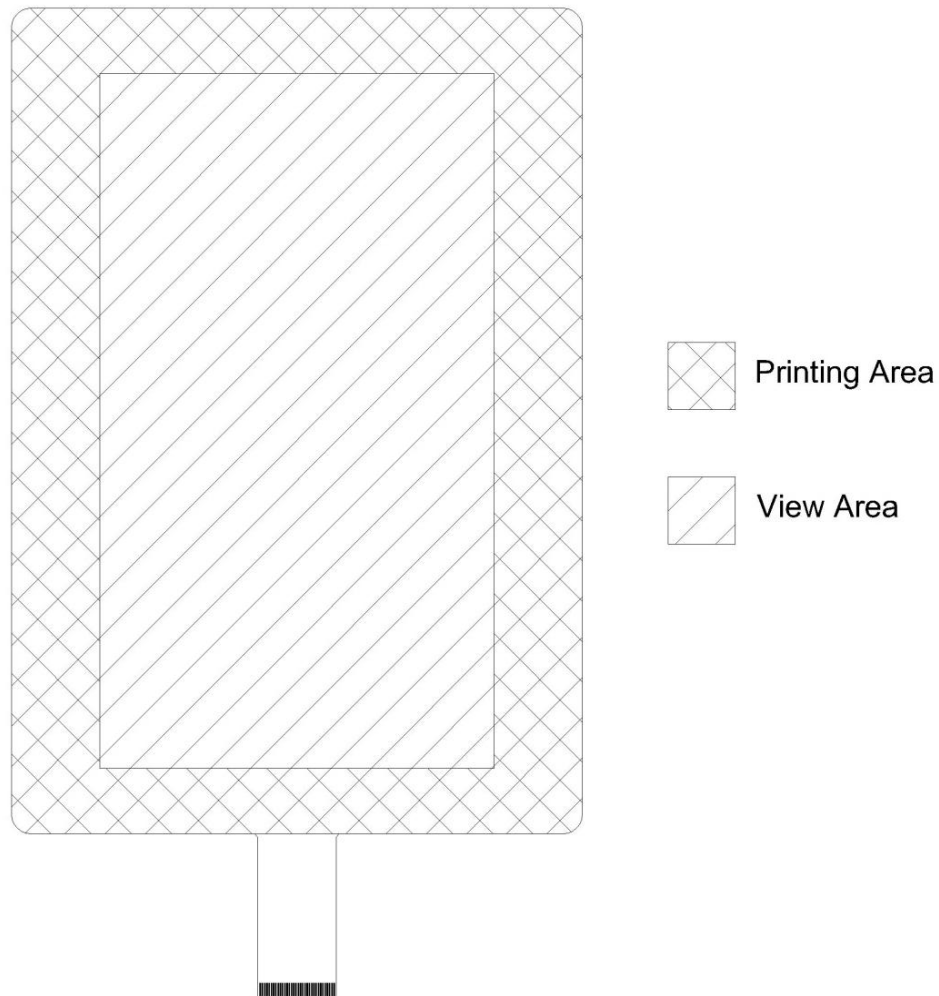
Where: Y_A =Initial luminance of measured area (cd/m^2)

Y_B =Subsequent luminance of measured area (cd/m^2)

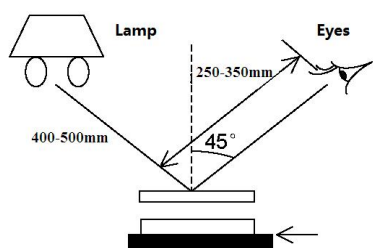
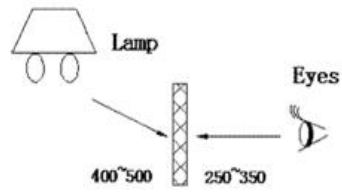
The location measured will be exactly the same in both patterns.

4.2 Module Appearance Specifications

4.2.1 Terms Definition



4.2.2 Inspection Conditions

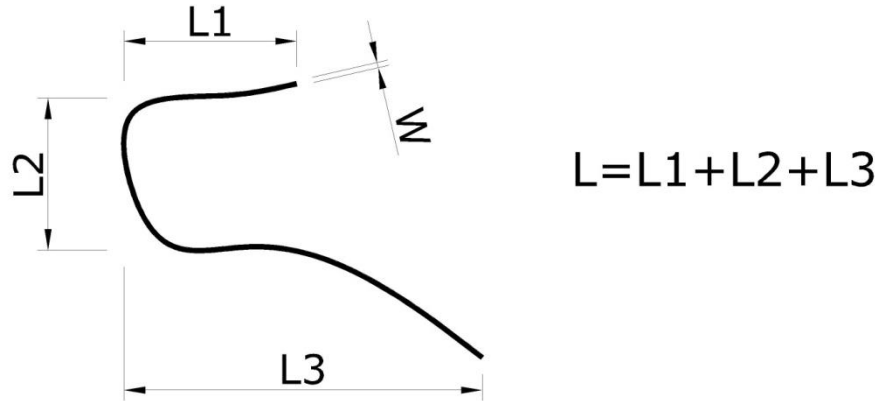
Items	Conditions	Remarks
Inspection Lamp	Florescent Cool White Lamp, 1000~1200Lux	
Inspection with Reflect Light (RL)	*Normal eyes level 1.0 (with Glasses accepted); *Distance between Lamp and product:40-50cm; *Distance between Eyes and Product:25-35cm; *Angle of view: 45°; *Black background; *Inspection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

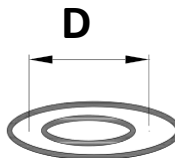
(D=Diameter)

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

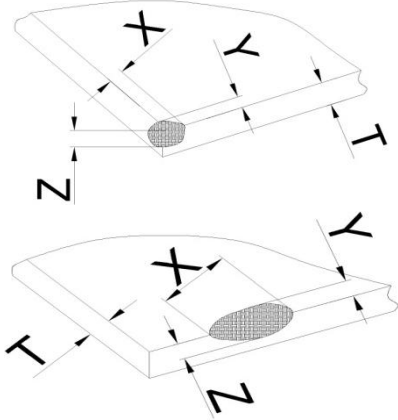
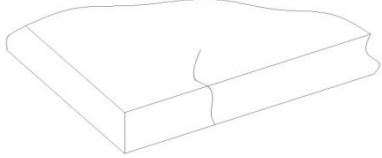
< Surface Fisheye>

Condition	Average Diameter(mm)	Criteria	Remarks
RL	$D \leq 0.15$	*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 =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 =50℃, 240hrs
5	Low temperature operation test	Ta =0℃, 240hrs
6	Thermal shock	Ta = -20℃↔60℃ (0.5hr), 100 cycle
7	Vibration test (non-operating)	Frequency: 10~300 Hz, Sweep rate 30 min Gravity/AMP: 1.5G Period: X, Y, Z 30min
8	Shock test (non-operating)	Gravity: 50G Pulse width: 11m sec, sine wave Direction: ±X, ±Y, ±Z Once for each
9	ESD test	Air: 150pF, 330Ω, 15KV Contact: 150pF, 330Ω, 8KV
10	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-185E01-DC9521-G020

Product code.

SMT-DA-185N000-SI9521-7-4

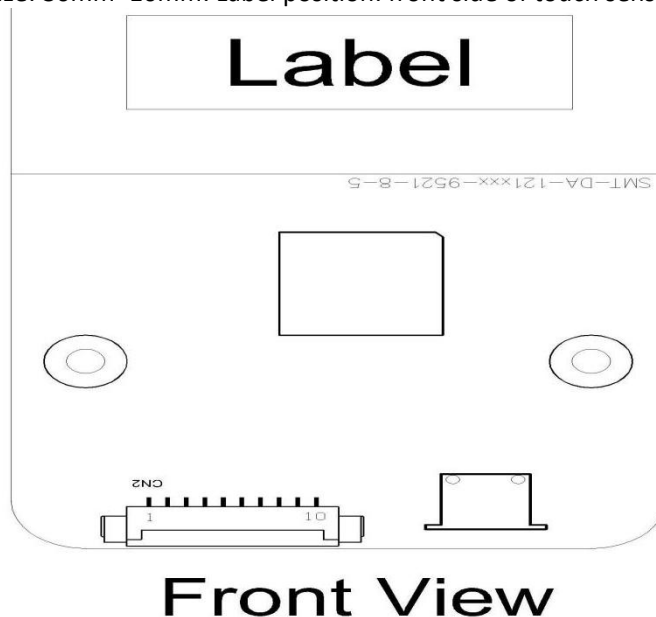
Touch sensor type for test.

18523150001EDC2

185: product active area size 2315: 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

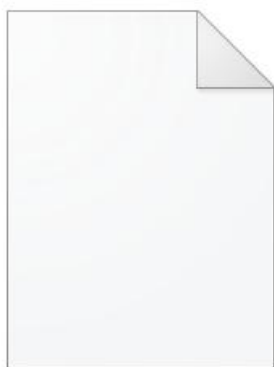
TBC

6.2.2 Carton Information:

Size	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

18_5_USB_COF_DITO.bin



18_5_USB_COF_DITO.bin

7. Mechanical Drawing

