



晶發科技股份有限公司

GI FAR TECHNOLOGY CO., LTD.

No. 81, Dongfeng St, Shulin District, 238034, New Taipei City, Taiwan, R.O.C.



SPECIFICATIONS

CUSTOMER : _____
MODEL NO. : GFTO020BA176220
VERSION : A
DATE : 2024.04.08
CERTIFICATION : ROHS

Customer Sign	Approved By	Prepared By	Prepared By
			

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1. General Description and Features

GFTO020BA176220 is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit and a back-light unit. The resolution of a 2.0" contains 176RGBx220 dots and can display up to 262K colors. The following table described the features of GFTO020BA176220.

LCD Module

Item	Specification	Unit
Screen Size	2.0inches	Diagonal
Display Resolution	176RGB(H)x220(V)	Dot
Active Area	31.68 (H) x 39.6 (V)	mm
Outline Dimension	37.68(W) x 51.30(H) x 2.5 (D)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB-Vertical Stripe	--
Display Color	262K	--
Optimum viewing direction	12 o'clock	
Drive IC	ST7775R	--
Interface	SPI 3 LIN	

2. Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	37.68	--	mm	--
	Vertical (V)	--	51.30	--	mm	(1)
	Thickness (T)	--	2.5	--	mm	(2)
Weight		--	N/A	--	g	--

Note (1) Not include FPC.

Refer to the Outline Dimension for further information.

(2) Back-light unit are included.



3. Electrical Specifications

3.1 Absolute Max. Ratings

3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T _{STG}	-30	80	°C	(1)
Operating temperature	T _{OPR}	-20	70	°C	(1,2,3)

Note (1) 95 % RH Max. (40 °C ≥ Ta). Maximum wet-bulb temperature at 39 °C or less.
(Ta > 40 °C) No condensation.

Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.2 Electrical Absolute Rating

3.2.1 TFT-LCD Module

(Voltage Referenced to V_{SS})

Item	Symbol	Value		Unit	Condition
		Min.	Max.		
Digital Power Supply Voltage	VDD	V _{SS} -0.3	4.6	V	--

3.2.2 Back-Light Unit

(Ta=25±2°C)

Item	Symbol	Min.	Max.	Unit	Note
current	I _f	--	30	mA	(1)
voltage	V _R	--	5.0	V	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.



4 Electrical Characteristics

4.1 Backlight Unit

The back-light system is an edge-lighting type with two white LEDs (Light Emitting Diode).

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
LED Voltage	V _F	2.7	3.0	3.3	V	I _f =45mA
LED Current	I _F	-	60	-	mA	
Power Consumption	P _{BL}	-	180	-	mW	
Brightness through TFT	L _v	-	500	-	nit	I _f =60mA
Color coordinate(TFT Surface)	Y	0.26<x<0.36				
	X	0.26<x<0.36				
Uniformity(TFT Surface)		>=80%				

Note (1) P_{BL} = V_F × I_F



5 Input Terminal Pin Assignment

PIN.NO	SYMBOL	I/O/P	FUNCTI	MEMARK
1	GND	P	GROUND.	
2	DOTCK	I	DOT CLOCK SIGNAL FOR RGB INTERFACE OPERATION.	
3	GND	P	Ground.	
4	VSNC	I	FRAME SYNCHRONOUS SIGNAL FOR RGB INTERFACE OPERATION.	
5	HSNC	I	LINE SYNCHRONOUS SIGNAL FOR RGB INTERFACE OPERATION.	
6	ENABLE	I	DATA ENABLE SIGNAL FOR RGB INTERFACE OPERATION.	
7-12	R5-R0	I	RED DATA	
13	GND	P	GROUND.	
14-19	G5-G0	I	GREEN DATA	
20	GND	P	GROUND.	
21-26	B5-B0	I	BLUE DATA	
27	GND	P	GROUND.	
28	/CS	I	CHIP SELECTION SIGNAL PIN.	
29	SCL	I	SERIAL CLOCK SIGNAL.	
30	SDA	I	SERIAL DATA INPUT/OUTPUT PIN.	
31	/RESET	I	RESET SIGNAL INPUT PIN.	
32-33	VCI	P	POWER SUPPLY FOR LCD.	
34	GND	P	GROUND.	
35	LEDA	P	POWER SUPPLY FOR LED BACKLIGHT ANODE INPUT.	
36	LEDK1	P	POWER SUPPLY FOR LED BACKLIGHT CATHODE INPUT.	
37	LEDK2	P	POWER SUPPLY FOR LED BACKLIGHT CATHODE INPUT.	
38	LEDK3	P	POWER SUPPLY FOR LED BACKLIGHT CATHODE INPUT.	
39-40	GND	P	GROUND.	



6 LCD Optical Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	200	300	-	-	
Transmittance		Trans	4.95	5.5	-	%	
Response Time		Rising + Falling	-	20	40	ms	
Viewing Angle	Horizontal	$\Theta x+$	40	45	-	degree	
		$\Theta x-$	40	45	-		
	Vertical	$\Theta y+$	40	45	-		
		$\Theta y-$	15	20	-		
	White	X	+0.05	0.28	-0.05		
		Y		0.29			
Luminance (Center)		L	-	500	-	cd/m ²	

Note 1: Ambient temperature = 25°C.

Note 2: To be measured in dark room after LED backlight warm up 5 minutes.

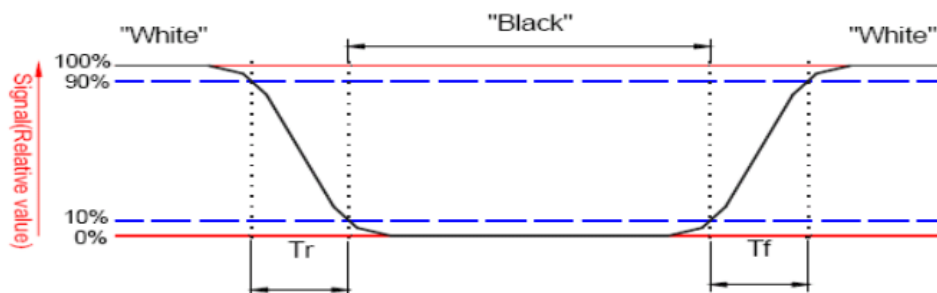
Note 3: To be measured with a viewing cone of 2° by Topcon luminance meter BM-5A.

Note 4: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure with C light

Note 5: CDY shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer

Note 6: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to "White" (falling time) and from "White" to "Black" (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.



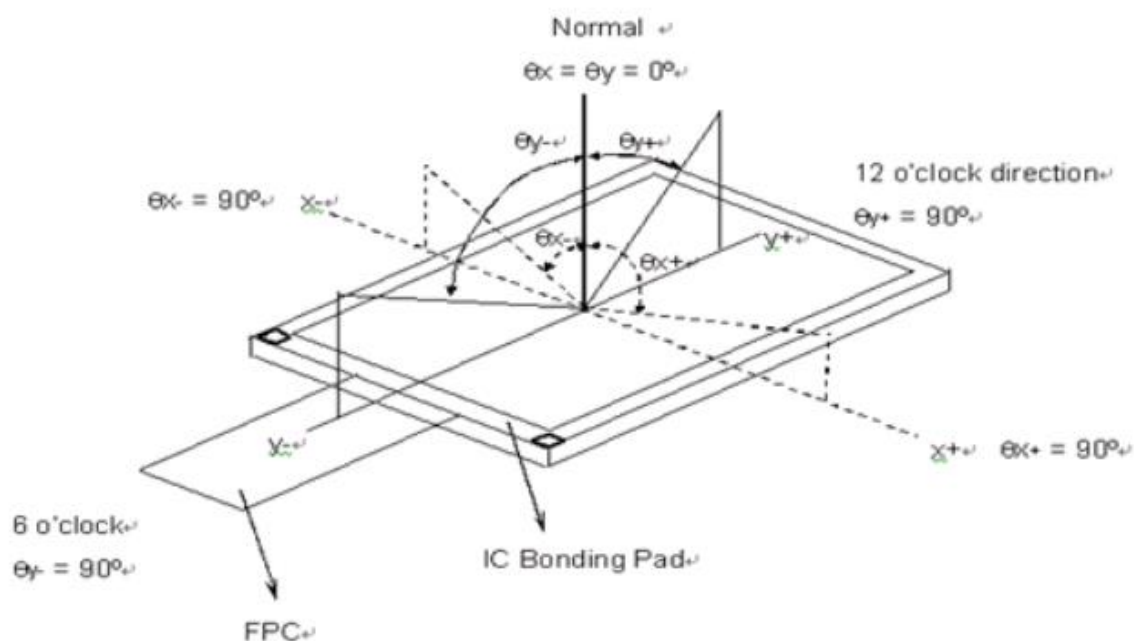


Note 7: Definition of contrast ratio:

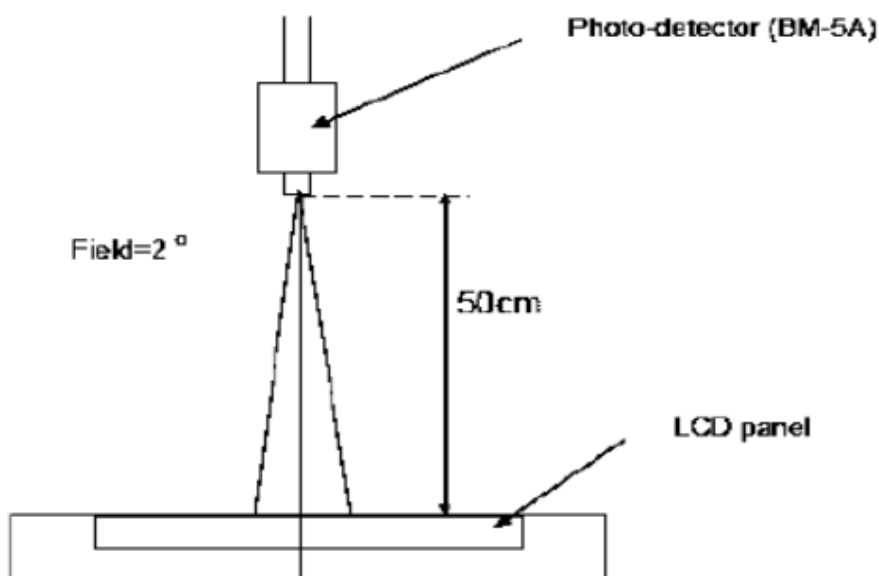
Contrast ratio is calculated by the following formula.

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

Note 8: Definition of viewing angle



Note 9: Optical characteristic measurement setup.





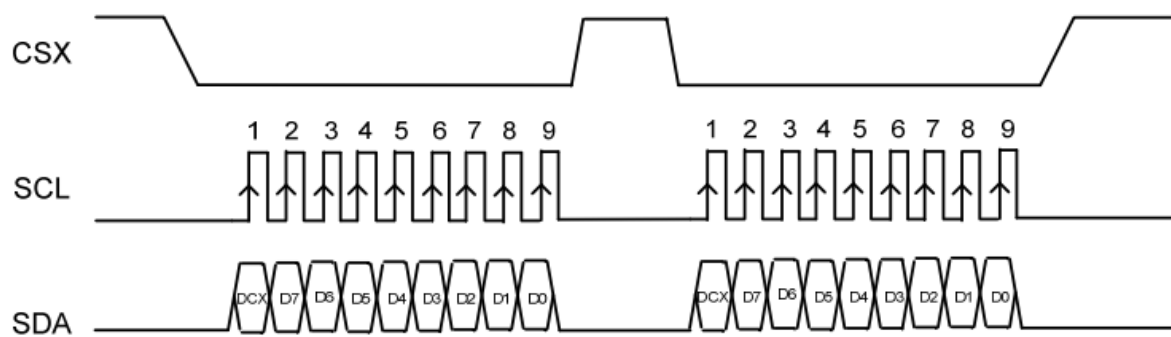
7 Interface Timing

9-bit Serial Peripheral Interface (9-bit SPI)

This SPI mode uses a 3-wire 9-bit serial interface. The chip-select CSX (active low) enables and disables the serial interface. SCL is the serial data clock and SDA is serial data.

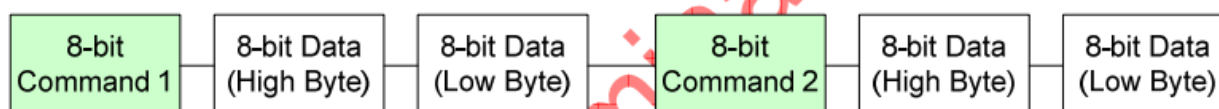
Serial data must be input to SDA in the sequence DCX, D7 to D0. The ST7775R reads the data at the rising edge of SCL signal. The first bit of serial data DCX is data/command flag. When DCX = "1", D7 to D0 bits are DRAM data or command parameters. When DCX = "0" D7 to D0 bits are commands.

Register Write Mode:



DCX=0: Register Index

DCX=1: Register data or DRAM data





8 Reliability Condition for LCD

No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: $20 \pm 5^{\circ}\text{C}$

Humidity: $65 \pm 5\% \text{RH}$

Tests will be not conducted under functioning state.

No.	Parameter	Condition	Notes
1	High Temperature Operating	$70^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 48hrs (Operation state)	--
2	Low Temperature Operating	$-20^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 48hrs (Operation state)	--
3	High Temperature Storage	$80^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 48hrs	--
4	Low Temperature Storage	$-30^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 48hrs	--
5	High Temperature and High Humidity Operation Test	$60^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 90%, 48hrs	--
6	Vibration Test	Total fixed amplitude: 1.5mm Vibration Frequency: 10~55Hz One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	--
7.	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state. Dropping method corner dropping A corner: once Edge dropping B, C, D edge: once Face dropping E, F, G face: once 60cm Concrete Surface	--

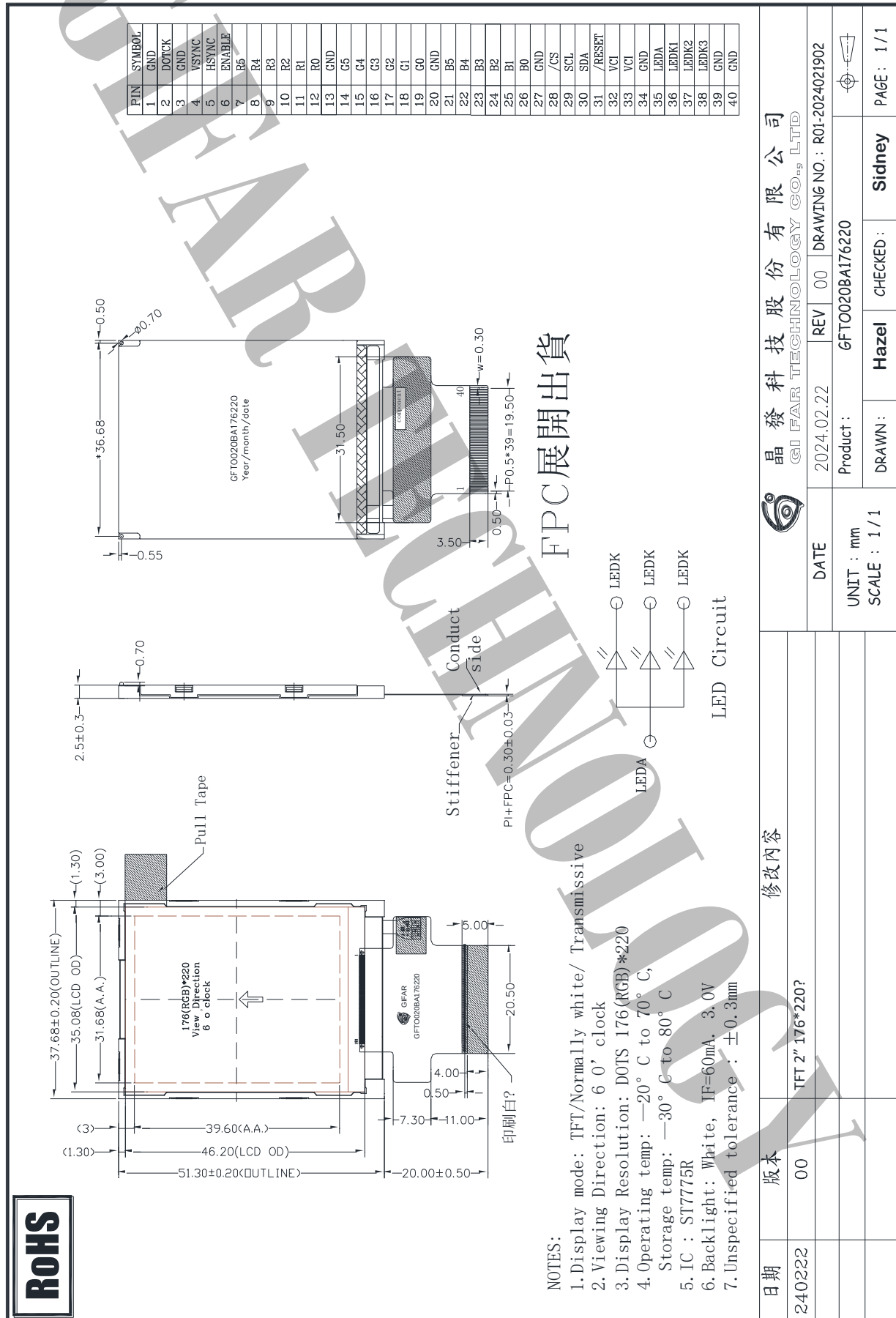
Notes: 1. No dew condensation to be observed.

2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

3. Vibration test will be conducted to the product itself without putting I in a container.



9. Dimensional outlines





10. Incoming Inspection Standards

10.1 VISUAL & FUNCTION INSPECTION STANDARD

10.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

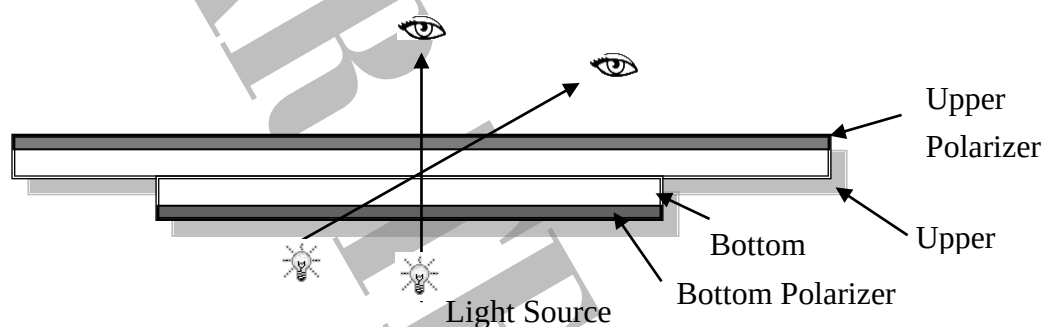
Temperature : $25 \pm 5^{\circ}\text{C}$

Humidity : $65\% \pm 10\% \text{RH}$

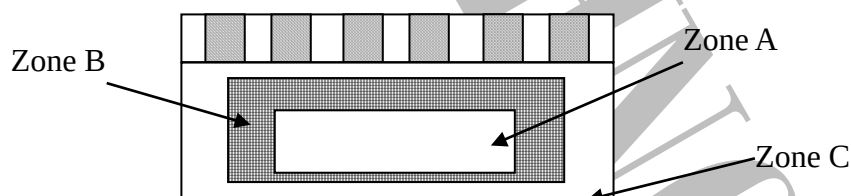
Viewing Angle : Normal viewing Angle.

Illumination : Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30-50cm



10.1.2 Definition



Zone A : Effective Viewing Area (Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note: As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.



10.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II AQL:

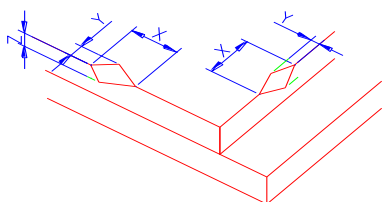
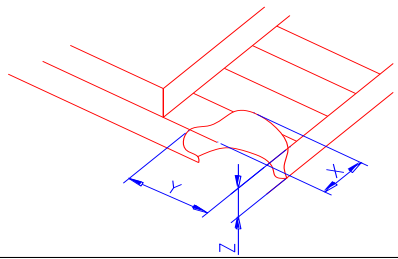
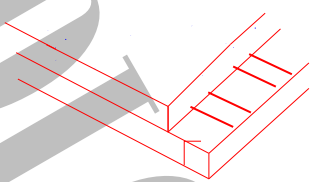
Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

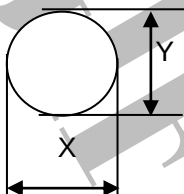
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	



10.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken								
	(1) The edge of LCD broken	<table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
								
	(2)LCD corner broken	<table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	≤L	≤T
X	Y	Z						
≤3.0mm	≤L	≤T						
	(3) LCD crack	 Crack Not allowed						



Number	Items	Criteria (mm)																																																									
2.0	Spot defect  Φ=(X+Y)/2	① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain) <table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.10<Φ≤0.15</td><td colspan="2">3(distance ≥ 10mm)</td></tr><tr><td>0.15<Φ≤0.2</td><td colspan="2">1</td></tr><tr><td>0.2<Φ</td><td colspan="2">0</td></tr></table> ②Dim spot (LCD/TP/Polarizer dim dot, light leakage 、 dark spot) <table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.1<Φ≤0.2</td><td colspan="2">2(distance ≥ 10mm)</td></tr><tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr><tr><td>Φ > 0.3</td><td colspan="2">0</td></tr></table> ③ Polarizer accidented spot <table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>0.2<Φ≤0.5</td><td colspan="2">2(distance ≥ 10mm)</td></tr><tr><td>Φ>0.5</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.10	Ignore		Ignore	0.10<Φ≤0.15	3(distance ≥ 10mm)		0.15<Φ≤0.2	1		0.2<Φ	0		Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.1	Ignore		Ignore	0.1<Φ≤0.2	2(distance ≥ 10mm)		0.2<Φ≤0.3	1		Φ > 0.3	0		Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.2	Ignore		Ignore	0.2<Φ≤0.5	2(distance ≥ 10mm)		Φ>0.5	0	
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Φ>0.5	0																																																										



	Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	<table><tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\Phi \leq 0.03$</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.03 < W \leq 0.05$</td><td>$L \leq 3.0$</td><td colspan="2">$N \leq 2$</td></tr><tr><td>$0.05 < W \leq 0.08$</td><td>$L \leq 2.0$</td><td colspan="2">$N \leq 2$</td></tr><tr><td>$0.08 < W$</td><td colspan="4">Define as spot defect</td></tr></table>	Width(mm)	Length(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.03$	Ignore	Ignore		Ignore	$0.03 < W \leq 0.05$	$L \leq 3.0$	$N \leq 2$		$0.05 < W \leq 0.08$	$L \leq 2.0$	$N \leq 2$		$0.08 < W$	Define as spot defect			
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$0.08 < W$	Define as spot defect																											
3.0	Polarizer Bubble	<table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\Phi \leq 0.2$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.2 < \Phi \leq 0.4$</td><td colspan="2">2(distance $\geq 10\text{mm}$)</td></tr><tr><td>$0.4 < \Phi \leq 0.6$</td><td colspan="2">1</td></tr><tr><td>$0.6 < \Phi$</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore		Ignore	$0.2 < \Phi \leq 0.4$	2(distance $\geq 10\text{mm}$)		$0.4 < \Phi \leq 0.6$	1		$0.6 < \Phi$	0							
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$0.4 < \Phi \leq 0.6$	1																											
$0.6 < \Phi$	0																											
4.0	SMT	According to IPC-A-610C class II standard . Function defect and missing part are major defect, the others are minor defect.																										