Thin-Film-Transistor LCD Module
Model: GDT-2.8M240320LA-01-CT

Acceptance

Approved and Checked by

Approved by	Checked by		Made by

XIAMEN OCULAR OPTICS CO., LTD

Address: 2/F, Building No.899, 2nd Tonglong Road, Torch High Technology Development Area, Xiamen 361106, China
Phone: +86-592-5715296/5650516 Fax: +86-592-5650695 Web: www.xmocular.com E-mail: lee@xmocular.com

Revise Records

Rev.	Date	Contents	Written	Approved
A	2016/04/21	Preliminary Specification	GAO	JACK

Special Notes

Note1.	
Note2.	
Note3.	
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Note5.	

1.General Description and Features

GDT-2.8M240320LA-01-CT is a Transmissive type color active matrix TFT (Thin Fil m Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switchi ng device. This model is composed of a TFT-LCD module, a driver circuits and a backl ight unit. The resolution of a 2.8" contains 240RGBx320 dots and can display up to 2 62K colors. The following table described the features of GDT-2.8M240320LA-01-CT .

LCD Module

Item	Specification	Unit
Screen Size	2.8inches	Diagonal
Dot arrangement	240RGB(H)x320(V)	Dot
Vision Area	44.2(W) x 58.6(H)	mm
Outline Dimension	50(W) x 69.2(H) x6.46MAX (T)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB-Vertical Stripe	--
Display Color	262K	--
Viewing Direction	6 o'clock	--
Gray viewing Direction	12 o'clock	--
Drive IC	ILI9341V	--

2.Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	50	--	mm	--
	Vertical (V)	--	69.2	--	mm	(1)
	Thickness (T)	--	6.46	--	mm	(2)
Weight		--	N/A	--	g	--

Note (1) Not include FPC.
Refer to the Outline Dimension for further information.

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 VSS)

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

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 TFT-LCD Module (DC Characteristics)

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Digital Voltage	VDDI	1.65	3.0	3.3	V	
Power Supply Logic Voltage	VCI	2.5	3.0	3.3	V	
Input High Threshold Voltage	V_{IH}	0.7 VDD	-	VDD	V	
Input Low Threshold Voltage	V_{IL}	0	-	0.3 VDD	V	
Power Supply Current	I_{CC}	-	5	--	mA	(1)
Power Consumption	P_L	-	-	-	mW	(1)

Note (1) The specified power consumption is under the conditions at VDD=3.3V , F_V=60Hz, whereas a Power dissipation check pattern below is displayed.

Black Pattern / 0 Gray

Active Area

5 Input Terminal Pin Assignment

5.1 Pin Assignment (LCD)

Pin No.	Symbol	I/O /P	Description
1	NC		Not connection
2	NC		Not connection
3	NC		Not connection
4	NC		Not connection
5	IM2	I	Select the MCU interface mode
6	IM1		
7	IM0		
8	LEDON	0	Output pin for enabling LED driving. If not used, open this pad.
9	LEDPWM	0	Output pin for PWM (Pulse Width Modulation) signal of LED driving. If not used, open this pad.
10	SDA	I/O	When IM[3] : Low, Serial in/out signal. When IM[3] : High, Serial input signal. The data is applied on the rising edge of the SCL signal.
11	SDO	0	Serial output signal. The data is outputted on the falling edge of the SCL signal. If not used, open this pin
12	D17	I/O	18-bit parallel bi-directional data bus for MCU system and RGB interface mode
13	D16		
14	D15		
15	D14		
16	D13		
17	D12		
18	D11		
19	D10		
20	D9		
21	D8		
22	D7		
23	D6		
24	D5		

25	D4		
26	D3		
27	D2		
28	D1		
29	D0		
30	RESX	I	This signal will reset the device and must be applied to properly initialize the chip. Signal is active low.
31	RDX	I	8080- Ⅰ/8080- Ⅱ system (RDX): Serves as a read signal and MCU read data at the rising edge.
32	WRX	I	- 8080- Ⅰ/8080- Ⅱ system (WRX): Serves as a write signal and writes data at the rising edge. - 4-line system (D/CX): Serves as command or parameter select.
33	DCX	I	This pin is used to select "Data or Command" in the parallel interface or 4-wire 8-bit serial data interface. When DCX = '1', data is selected. When DCX = '0', command is selected. This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface.
34	CSX	I	Chip select input pin ("Low" enable). This pin can be permanently fixed "Low" in MPU interface mode only.
35	GND	P	Prower Ground
36	VCI	I	High voltage power supply for analog circuits blocks
37	VDDI	I	Low voltage power supply for interface logic circuits .
38	LEDA	I	Power supply for backlight
39	LEDK1	I	Ground supply for backlight
40	LEDK2	I	Ground supply for backlight

6 Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).
Measuring equipment: BM-5A, BM-7,

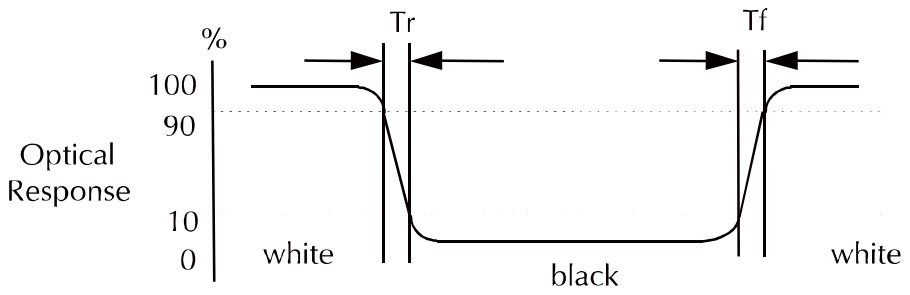
Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightness		B		195	220	--	cd/m^2	
Response time		$T_{r+}T_f$	θ=0° T=25°C	--	12	24	ms	.
Contrast ratio		CR		400	500	--	--	
Color Gamut		NTSC %	--	--	60	--	%	
Luminance Uniformity		ΔL		--	80	--	%	
Color Chromaticity (CIE 1931)	White	Wx	θ=0° Normal Viewing Angle	0.283	0.303	0.323	--	BM-7A
		Wy		0.305	0.325	0.345		
Viewing Angle	Hor.	θ_R	--	35	45	--	Degree	
		θ_L		35	45	--		
	Ver.	θ_U		40	50	--		
		θ_D		10	20	--		

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

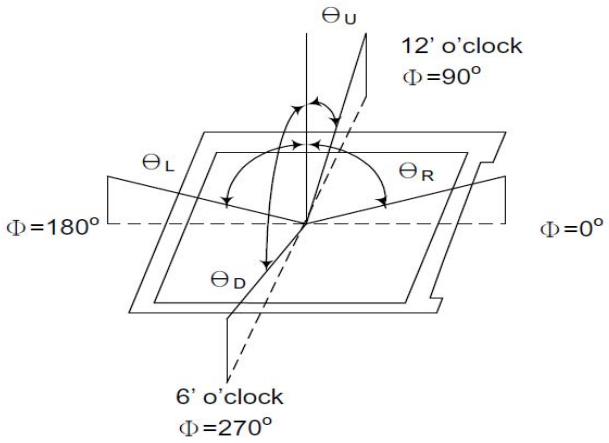


c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

e. View Angle



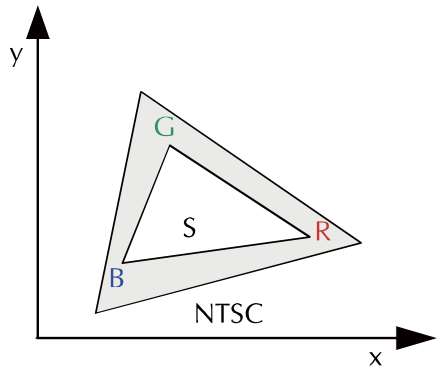
f. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

g. The definition of Color Gamut -Color Chromaticity CIE 1931

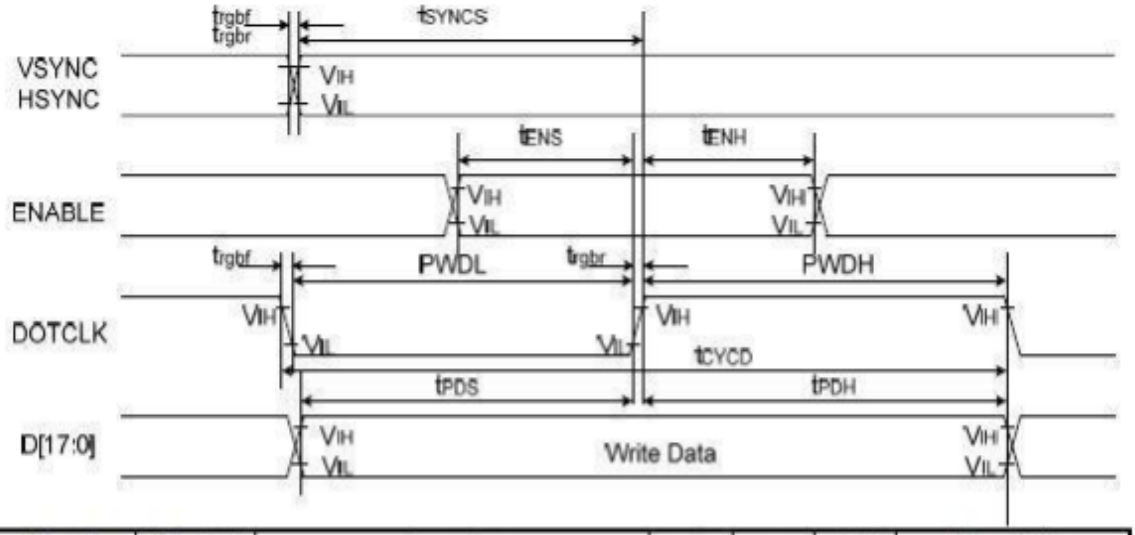
Color coordinate of white & red, green, blue at center point.

Color Gamut : NTSC(%) = (RGB Triangle Area / NTSC Triangle Area) x 100



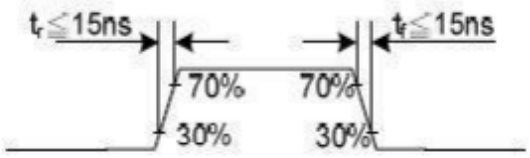
7 Interface Timing

Parallel 18/16-bit RGB Interface Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	15	-	ns	
	t_{ENH}	ENABLE hold time	15	-	ns	
DB[17:0]	t_{PDS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns	
	PWDL	DOTCLK low-level period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	66	-	ns	
	t_{rgbr}, t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

Note: Ta = -30 to 70 ℃, IOVCC=1.65V to 3.6V, VCI=2.5V to 3.3V, AGND=DGND=0V



Pixel Timing

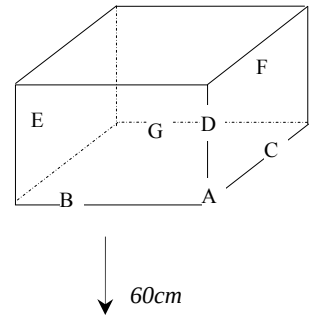
8 Reliability Condition for LCD

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±5°C Humidity: 65±5%RH

Tests will be not conducted under functioning state.

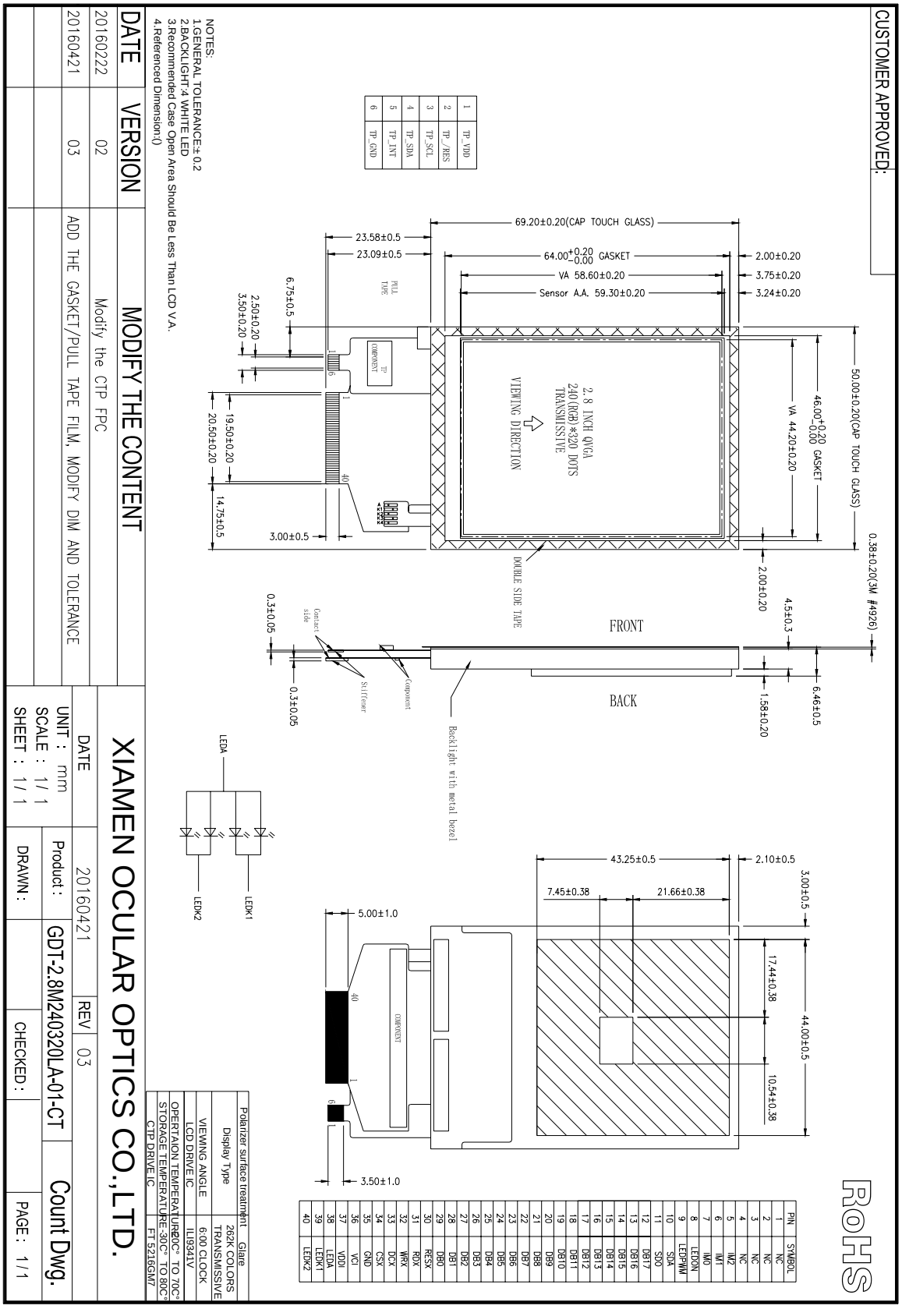
No.	Parameter	Condition	Notes
1	High Temperature Operating	70°C±2°C, 240hrs (Operation state)	--
2	Low Temperature Operating	-20°C±2°C, 240hrs (Operation state)	--
3	High Temperature Storage	80°C±2°C, 240hrs	--
4	Low Temperature Storage	-30°C±2°C, 240hrs	--
5	High Temperature and High Humidity Operation Test	60°C±2°C, 90%, 240hrs	--
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*	--

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



Address: 2/F, Building No.899, 2nd Tonglong Road, Torch High Technology Development Area, Xiamen 361106, China
Phone: +86-592-5715296/5650516 Fax: +86-592-5650695 Web: www.xmocular.com E-mail: lee@xmocular.com

10 Incoming Inspection Standards

10.1 VISUAL & FUNCTION INSPECTION STANDARD

10.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

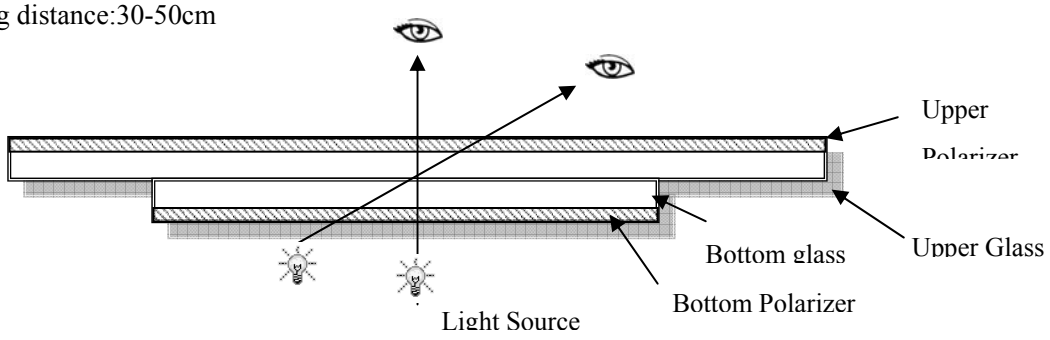
Temperature : 25±5℃

Humidity : 65%±10%RH

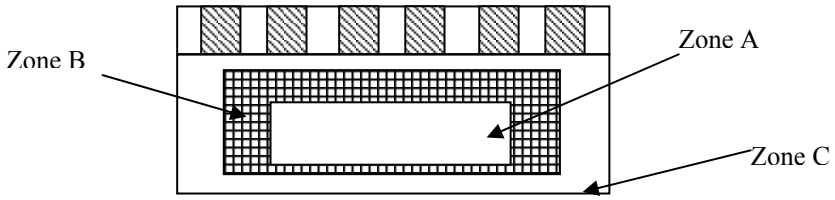
Viewing Angle : Normal viewing Angle.

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

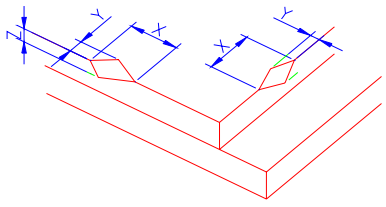
AQL:

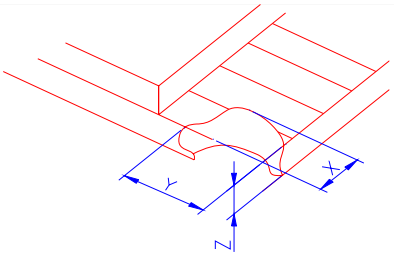
Major defect	Minor defect
0.65	1.5

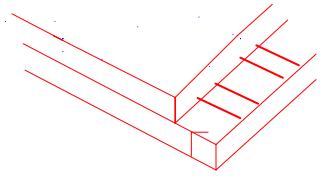
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

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 NOTE: X: Length	(1) The edge of LCD broken	 X | Y | Z

<table>
<tr>
<td rowspan="3">Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td>
<td></td>
<td>
<table>
<tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr>
</table>
</td>
</tr>
<tr>
<td>(2)LCD corner broken</td>
<td>


<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>
</td>
</tr>
<tr>
<td>(3) LCD crack</td>
<td>

Crack
Not allowed
</td>
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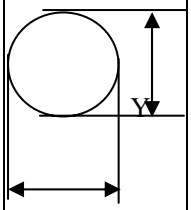
</table>

Number	Items	Criteria (mm)

2.0 Spot defect



X

Φ=(X+Y)/2

① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）

Zone / Size (mm)	Acceptable Qty A	B	C
Φ≤0.10	Ignore		
0.10<Φ≤0.15	3(distance≧10mm)		Ignore
0.15<Φ≤0.2	1		
0.2<Φ	0		

②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）

Zone / Size (mm)	Acceptable Qty A	B	C
Φ≤0.1	Ignore		
0.1<Φ≤0.2	2(distance≧10mm)		Ignore
0.2<Φ≤0.3	1		
Φ＞0.3	0		

③ Polarizer accidented spot

Zone / Size (mm)	Acceptable Qty A	B	C
Φ≤0.2	Ignore		
0.2<Φ≤0.5	2(distance≧10mm)		Ignore
Φ>0.5	0		

Line defect (LCD/TP /Polarizer black/white line, scratch, stain)

Width(mm)	Length(mm)	Acceptable Qty A	B	C
Φ≤0.03	Ignore	Ignore		
0.03<W≤0.05	L≤3.0	N≤2		Ignore
0.05<W≤0.08	L≤2.0	N≤2		
0.08<W	Define as spot defect			

<table>
<tr>
<td>3.0</td>
<td>Polarizer Bubble</td>
<td>
<table>
<tr><td rowspan="2">Zone
Size (mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.2<Φ≤0.4</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>0.4<Φ≤0.6</td><td colspan="2">1</td></tr>
<tr><td>0.6<Φ</td><td colspan="2">0</td></tr>
</table>
</td>
</tr>
<tr>
<td>4.0</td>
<td>SMT</td>
<td>According to IPC-A-610C class Ⅱ standard . Function defect and missing part are major defect ,the others are minor defect.</td>
</tr>
</table>