

**Product Specification**



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**Model: GDT-3.2M240320NA-01**

Acceptance

Approved and Checked by


Approved by

Checked by

Made by

**XIAMEN OCULAR OPTICS CO., LTD**

## Product Specification

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### Revise Records

Rev.	Date	Contents	Written	Approved
A	2016/02/26	Preliminary Specification	OSCAR	JACK

### Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	

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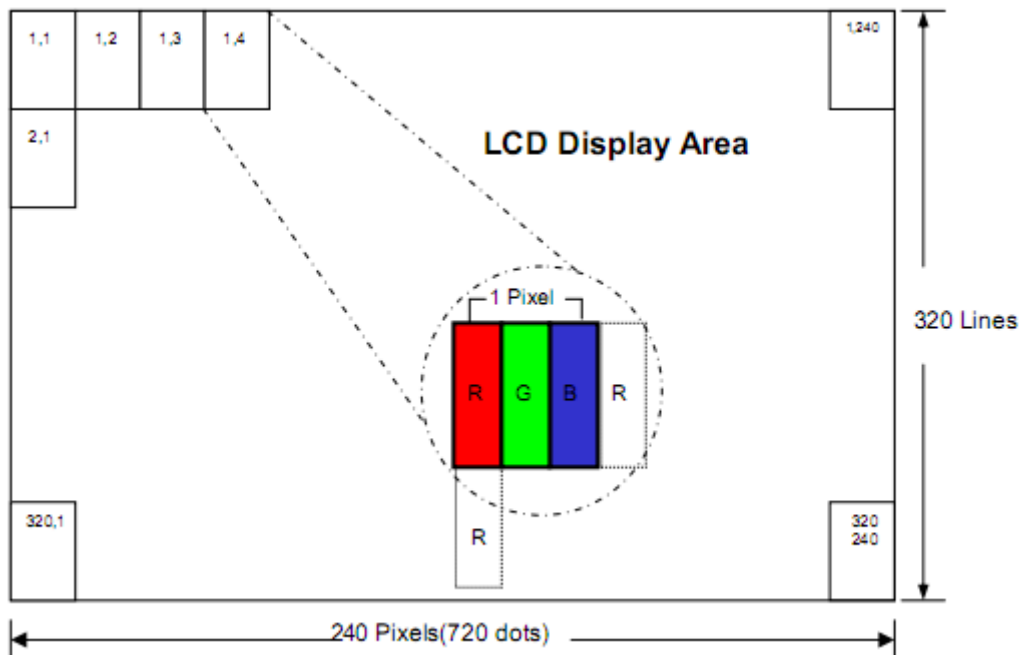
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### 1. General Description and Features


GDT-3.2M240320NA-01 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 3.2" contains 240RGBx320 dots and can display up to 262k colors. The following table described the features of GDT-3.2M240320NA-01.

#### 1.1 LCD Module

Item	Specification	Unit
Screen Size	3.2inches	Diagonal
Display Resolution	240 x RGB x 320	Dot
Dot Pitch	0.2025 (H) x 0.2025 (V)	mm
Active Area	48.6 (H) x 64.8 (V)	mm
Outline Dimension	56.64 (W) x 79.3 (H) x 2.45(D)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB-Stripe	--
Surface Treatment	Anti-glare (AG)	--
Display Color	262K	--
Optima View Direction	12 o'clock	--
Input Interface	MCU SPI/16-bits /8-bits/RGB	--
Color Gamut	NTSC 60%	--
Drive IC	ILI9341	--



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### 2. Mechanical Information

Item	Min.	Typ.	Max.	Unit	Note	
Module Size	Horizontal (H)	--	56.64	--	mm	--
	Vertical (V)	--	79.3	--	mm	(1)
	Thickness (T)	--	2.45	--	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<sub>SS</sub>=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T <sub>STG</sub>	-30	80	°C	(1)
Operating temperature	T <sub>OPR</sub>	-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 guaranteed 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	VSS-0.3	5.0	V	--

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### 3.2.2 Back-Light Unit

(Ta=25±2°C)

Item	Symbol	Min.	Max.	Unit	Note
Forward current	$I_f$	--	60	mA	(1)
Reverse 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.

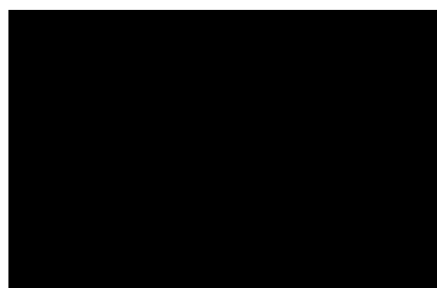
## 4 Electrical Characteristics

### 4.1 TFT-LCD Module (DC Characteristics)

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	$V_{DD}$	2.5	3.1	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	$I_{CC}$	-	(20)	(25)	mA	(1)
Power Consumption	$P_L$	-	(66)	(90)	mW	(1)


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

Black Pattern / 0 Gray



Active Area

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### 4.2 Backlight Unit

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

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
LED Voltage	V <sub>F</sub>	2.7	3.1	3.5	V	
LED Current	I <sub>F</sub>	-	100	-	mA	
Power Consumption	P <sub>BL</sub>	-	310	-	mW	

Note (1) Where  $P_{BL} = V_F \times I_F$

## 5 Input Terminal Pin Assignment

### 5.1 Pin Assignment

Pin No.	Symbol	Description
1	XL	The TP Signal
2	YU	The TP Signal
3	XR	The TP Signal
4	YD	The TP Signal
5	GND	Power Ground
6	IOVCC	Power supply
7	VCI	Power supply
8	FMARK	Tearing effect out pin synchronize MPU to frame writng
9	CS/SPI CS	<b>Chip select input pin ("Low" enable).</b>
10	DC/SPI SCL	Command/data selection selection in parallel

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11	WR/SPI DC	Write enable pin in parallel Serial data clock in serial bus system
12	RD	Read enable pin
13	SPI SDI/SDA	Serial data input signal
14	SPI SDO	Serial data output signal
15	RESET	System Reset
16	GND	Power Ground
17-32	DB0-DB15	Data Input/Output
33	A	B/L Anode
34-36	K-K	B/L Cathode
37	GND	Power Ground
38	IM0	Select interface mode
39	IM1	
40	IM2	

### 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,

(Ta=25±2°C)

Item	Symbol	Condition	Min	Type	Max	Unit	Note	
Brightness	--	θ=0° Normal Viewing Angle	--	350	--	cd/m <sup>2</sup>	--	
Response time	T <sub>R</sub>		--	15	20	ms	--	
	T <sub>F</sub>		--	35	50	ms		
Contrast ratio	CR		400	500	--	--	--	
Color Chromaticity (CIE1931)	Red		R <sub>X</sub>	0.606	0.626	0.646	--	--
			R <sub>Y</sub>	0.314	0.334	0.354		
	Green		G <sub>X</sub>	0.257	0.277	0.297	--	
			G <sub>Y</sub>	0.529	0.549	0.569		
	Blue		B <sub>X</sub>	0.122	0.142	0.162	--	
			B <sub>Y</sub>	0.102	0.122	0.142		
	White	W <sub>X</sub>	0.283	0.303	0.323	--		

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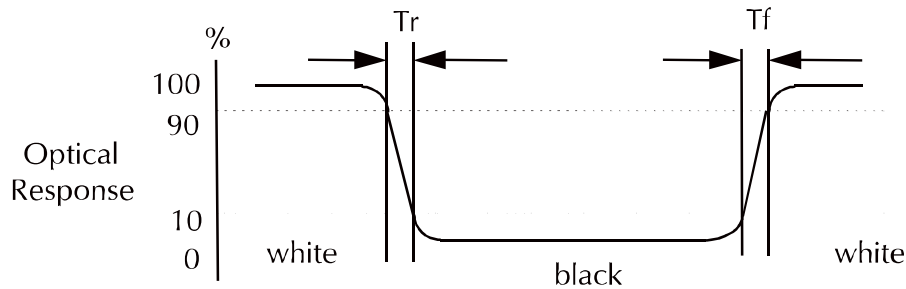
		Wy		0.305	0.325	0.345		
Viewing Angle (12H)	Hor.	$\theta_R$	CR $\geq$ 10	35	45	--	Degree	--
		$\theta_L$		35	45	--		
	Ver.	$\phi_H$		35	45	--		
		$\phi_L$		10	20	--		

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:

Brightness measured when LCD is at "white state"

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

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



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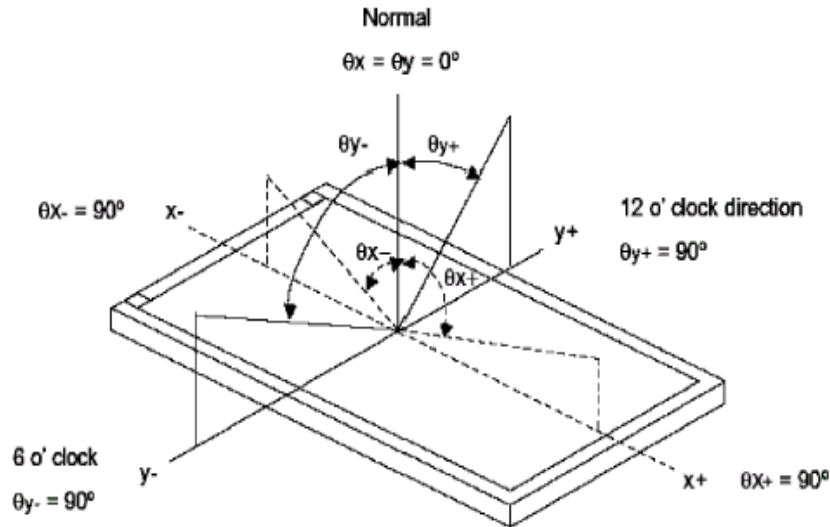
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Note 1 : Definition of Viewing Angle  $\theta_x$  and  $\theta_y$  :



f. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type
---------------------------------	----------

g. Definition of White Uniformity

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

h. 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

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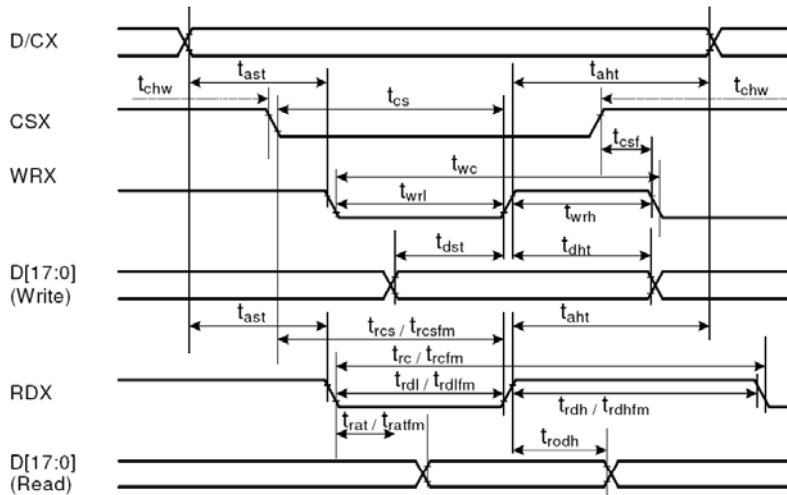
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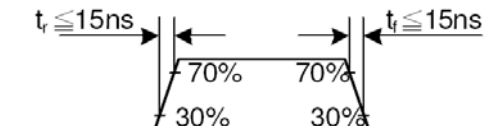
## 7 Interface Timing

### Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080- I system)




Signal	Symbol	Parameter	min	max	Unit	Description
DCX	t <sub>ast</sub>	Address setup time	0	-	ns	
	t <sub>ah</sub>	Address hold time (Write/Read)	0	-	ns	
CSX	t <sub>ch</sub>	CSX "H" pulse width	0	-	ns	
	t <sub>cs</sub>	Chip Select setup time (Write)	15	-	ns	
	t <sub>rcs</sub>	Chip Select setup time (Read ID)	45	-	ns	
	t <sub>rcsfm</sub>	Chip Select setup time (Read FM)	355	-	ns	
WRX	t <sub>wc</sub>	Write cycle	66	-	ns	
	t <sub>wrh</sub>	Write Control pulse H duration	15	-	ns	
	t <sub>wrl</sub>	Write Control pulse L duration	15	-	ns	
RDX (FM)	t <sub>rcfm</sub>	Read Cycle (FM)	450	-	ns	
	t <sub>rdhfm</sub>	Read Control H duration (FM)	90	-	ns	
	t <sub>rdlfm</sub>	Read Control L duration (FM)	355	-	ns	
RDX (ID)	t <sub>rc</sub>	Read cycle (ID)	160	-	ns	
	t <sub>rdh</sub>	Read Control pulse H duration	90	-	ns	
	t <sub>rdl</sub>	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	t <sub>dst</sub>	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	t <sub>dht</sub>	Write data hold time	10	-	ns	
	t <sub>rat</sub>	Read access time	-	40	ns	
	t <sub>ratfm</sub>	Read access time	-	340	ns	
	t <sub>rodh</sub>	Read output disable time	20	80	ns	

Note: T<sub>a</sub> = -30 to 70 °C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, VSS=0V



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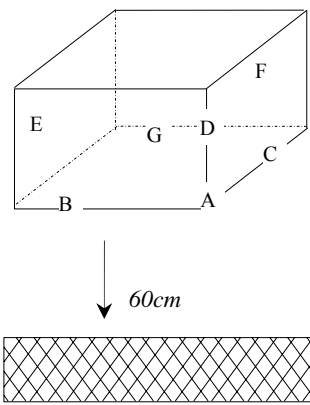
### 8 Reliability Condition for LCD

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	60°C±2°C, 240hrs (Operation state)	--
2	Low Temperature Operating	-10°C±2°C, 240hrs (Operation state)	--
3	High Temperature Storage	70°C±2°C, 240hrs	--
4	Low Temperature Storage	-20°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. <div style="text-align: center; margin-top: 10px;">  <p style="margin-left: 20px;"> <i>Dropping method corner dropping</i>  <i>A corner: once</i>  <i>Edge dropping</i>  <i>B, C, D edge: once</i>  <i>Face dropping</i>  <i>E, F, G face: once</i> </p> <p style="text-align: center; margin-top: 5px;"><i>Concrete Surface</i></p> </div>	--

- 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.

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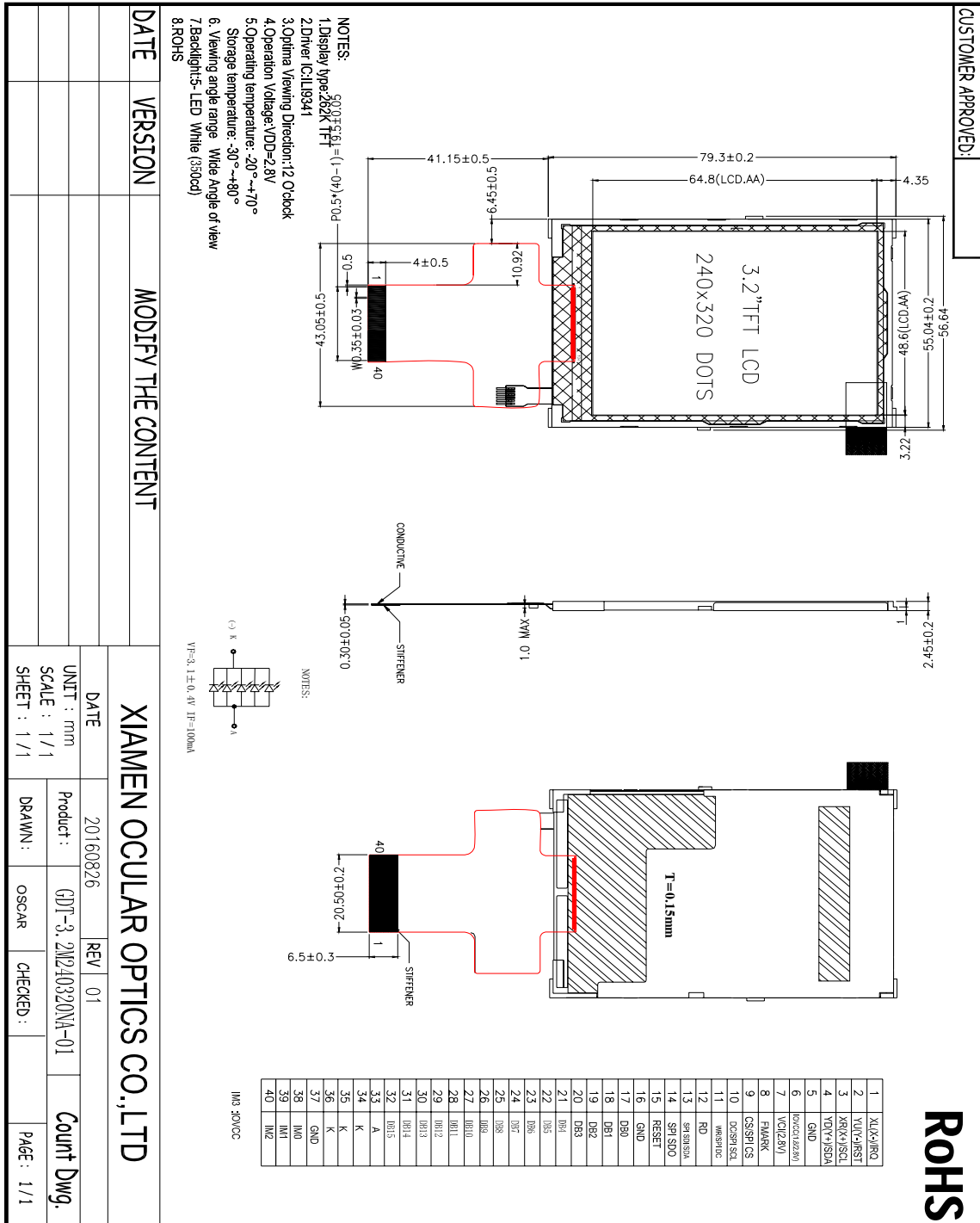
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## 9 Dimensional outlines



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### 10 Incoming Inspection Standards

#### 11.1 VISUAL & FUNCTION INSPECTION STANDARD

##### 11.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

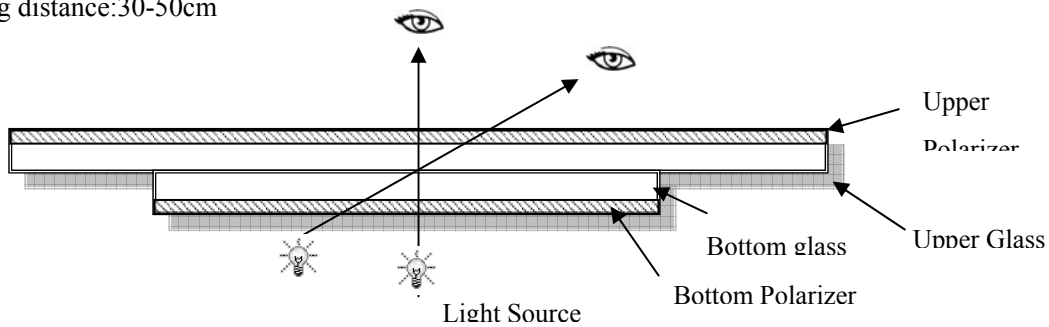
Temperature :  $25 \pm 5^{\circ}\text{C}$

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

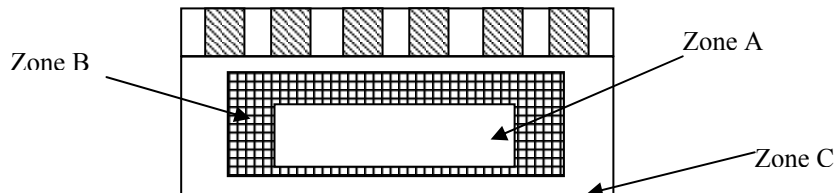
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30-50cm



##### 11.1.2 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.

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### 11.1.3 Sampling Plan

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

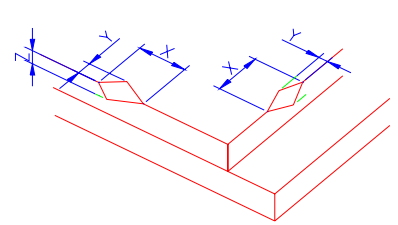
AQL:

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.	

### 11.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken  NOTE: X: Length Y: Width	(1) The edge of LCD broken	 <table border="1" style="margin: 20px auto; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 33%;">X</td> <td style="width: 33%;">Y</td> <td style="width: 33%;">Z</td> </tr> <tr> <td>≤3.0mm</td> <td>&lt;Inner border line of</td> <td>≤T</td> </tr> </table>	X	Y	Z	≤3.0mm	<Inner border line of	≤T
X	Y	Z						
≤3.0mm	<Inner border line of	≤T						

the seal

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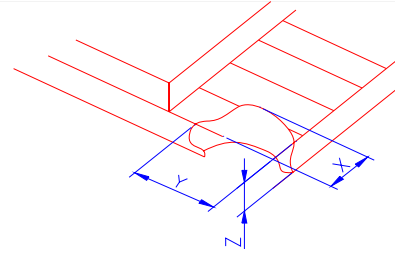
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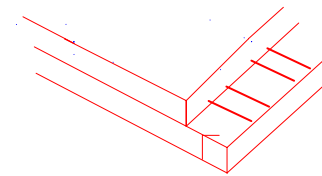
Z: Height  
L: Length of ITO,  
T: Height of LCD

(2)LCD corner broken



X	Y	Z
≤3.0mm	≤L	≤T

(3) LCD crack



Crack  
Not allowed

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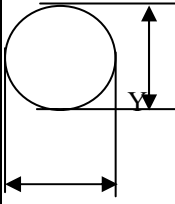
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Number	Items	Criteria (mm)																																																																	
2.0	<p>Spot defect</p>  <p style="text-align: center;"><math>\Phi = (X+Y)/2</math></p>	<p>① light dot (LCD/TP/Polarizer black/white spot, light dot, pinhole, dent, stain)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\Phi \leq 0.10</math></td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.10 &lt; \Phi \leq 0.15</math></td> <td colspan="3" style="text-align: center;">3( distance <math>\geq 10\text{mm}</math>)</td> </tr> <tr> <td style="text-align: center;"><math>0.15 &lt; \Phi \leq 0.2</math></td> <td colspan="3" style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;"><math>0.2 &lt; \Phi</math></td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> <p>② Dim spot (LCD/TP/Polarizer dim dot, light leakage, dark spot)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\Phi \leq 0.1</math></td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.1 &lt; \Phi \leq 0.2</math></td> <td colspan="3" style="text-align: center;">2( distance <math>\geq 10\text{mm}</math>)</td> </tr> <tr> <td style="text-align: center;"><math>0.2 &lt; \Phi \leq 0.3</math></td> <td colspan="3" style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;"><math>\Phi &gt; 0.3</math></td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> <p>③ Polarizer accidented spot</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\Phi \leq 0.2</math></td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.2 &lt; \Phi \leq 0.5</math></td> <td colspan="3" style="text-align: center;">2( distance <math>\geq 10\text{mm}</math>)</td> </tr> <tr> <td style="text-align: center;"><math>\Phi &gt; 0.5</math></td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.10$	Ignore			$0.10 < \Phi \leq 0.15$	3( distance $\geq 10\text{mm}$ )			$0.15 < \Phi \leq 0.2$	1			$0.2 < \Phi$	0			Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.1$	Ignore			$0.1 < \Phi \leq 0.2$	2( distance $\geq 10\text{mm}$ )			$0.2 < \Phi \leq 0.3$	1			$\Phi > 0.3$	0			Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.2 < \Phi \leq 0.5$	2( distance $\geq 10\text{mm}$ )			$\Phi > 0.5$	0		
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$\Phi \leq 0.10$	Ignore																																																																		
$0.10 < \Phi \leq 0.15$	3( distance $\geq 10\text{mm}$ )																																																																		
$0.15 < \Phi \leq 0.2$	1																																																																		
$0.2 < \Phi$	0																																																																		
Zone Size (mm)	Acceptable Qty																																																																		
	A	B	C																																																																
$\Phi \leq 0.1$	Ignore																																																																		
$0.1 < \Phi \leq 0.2$	2( distance $\geq 10\text{mm}$ )																																																																		
$0.2 < \Phi \leq 0.3$	1																																																																		
$\Phi > 0.3$	0																																																																		
Zone Size (mm)	Acceptable Qty																																																																		
	A	B	C																																																																
$\Phi \leq 0.2$	Ignore																																																																		
$0.2 < \Phi \leq 0.5$	2( distance $\geq 10\text{mm}$ )																																																																		
$\Phi > 0.5$	0																																																																		



## Product Specification



Model: GDT-3.2M240320NA-01

Rev. No.

Issued Date.

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	Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <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> </thead> <tbody> <tr> <td><math>\Phi \leq 0.03</math></td> <td>Ignore</td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.03 &lt; W \leq 0.05</math></td> <td><math>L \leq 3.0</math></td> <td colspan="2"><math>N \leq 2</math></td> <td rowspan="2">Ignore</td> </tr> <tr> <td><math>0.05 &lt; W \leq 0.08</math></td> <td><math>L \leq 2.0</math></td> <td colspan="2"><math>N \leq 2</math></td> </tr> <tr> <td><math>0.08 &lt; W</math></td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table>	Width(mm)	Length(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.03$	Ignore	Ignore			$0.03 < W \leq 0.05$	$L \leq 3.0$	$N \leq 2$		Ignore	$0.05 < W \leq 0.08$	$L \leq 2.0$	$N \leq 2$		$0.08 < W$	Define as spot defect			
Width(mm)	Length(mm)	Acceptable Qty																											
		A	B	C																									
$\Phi \leq 0.03$	Ignore	Ignore																											
$0.03 < W \leq 0.05$	$L \leq 3.0$	$N \leq 2$		Ignore																									
$0.05 < W \leq 0.08$	$L \leq 2.0$	$N \leq 2$																											
$0.08 < W$	Define as spot defect																												
3.0	Polarizer Bubble	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <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> </thead> <tbody> <tr> <td><math>\Phi \leq 0.2</math></td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.2 &lt; \Phi &lt; 0.4</math></td> <td colspan="3">2(distance <math>\geq 10</math>mm)</td> </tr> <tr> <td><math>0.4 &lt; \Phi \leq 0.6</math></td> <td colspan="3">1</td> </tr> <tr> <td><math>0.6 &lt; \Phi</math></td> <td colspan="3">0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.2 < \Phi < 0.4$	2(distance $\geq 10$ mm)			$0.4 < \Phi \leq 0.6$	1			$0.6 < \Phi$	0						
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4.0	SMT	According to IPC-A-610C class II standard . Function defect and missing part are major defect ,the others are minor defect.																											