



TFT LCD MODULE
3.5 inch 320RGB*240DOTS

MODULE NUMBER: DW0350A3CZ

REVISION: V00

Customer Approval:

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- ☒ **Approved For Specifications**
- ☐ **Approved For Specifications & Sample**

Prepared by	Checked by	Approved by



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1. LCM Specification

1.1 Description

DW0350A3CZ is a transmissive type color active matrix liquid crystal display(LCD) which uses amorphous thin film transistor(TFT) as switching devices. This product is composed of a TFT LCD panel, a drive IC, a FPC and a LED-backlight unit. The active display area is 3.5 inches diagonally measured and the native resolution is 320*RGB*240.Features of this product are listed in the following table.

1.2 Functions & Features

Table 1.1 Module Functions & Features

Parameter	Value	Unit
LCD Mode	TFT/Transmissive	-
Color Depth	16.7M	-
Display Resolution	320RGB*240	pixels
Module Size	63.9(H)*76.9(W)*3.3(T)(Exclude FPC)	mm
Active Area (A.A)	52.56(H)*70.08(W)	mm
Pixel Arrangement	RGB-stripe	-
Viewing Direction	12 O' clock	
Display Mode	Normally white	
LCD Controller/Driver	HX8238D	-
IC Package Type	COG	-
Interface	24-Bit Parallel RGB / 8-Bit Seirial RGB	-
Power Supply Voltage	3.0~3.6	V
Back-light	White LED*6	PCS



3. Pin Descriptions

Pin No.	Symbol	I/O	Functional	Remark
1~2	LEDK	P	LED Power supply -	
3~4	LEDA	P	LED Power supply +	
5	TP_U	I	TOUCH PANEL CONTROL PIN (N.C)	
6	TP_R	I	TOUCH PANEL CONTROL PIN (N.C)	
7	N.C	-	No Connection	
8	RESET	I	System reset pin.	
9	CS	I	Chip select pin of serial interface	
10	CLK	I	Clock pin of serial interface.	
11	SDA	I	Data input pin in serial mode.	
12~19	B0~B7	I/O	BLUE Datas (Connect to GND when not used)	
20~27	G0~G7	I/O	GREEN Datas (Connect to GND when not used)	
28~35	R0~R7	I/O	RED Datas (Use these pins for 8-bits interface)	
36	HS	I	Horizontal synchronizing signal.	
37	VS	I	Vertical synchronizing signal.	
38	DCLK	I	Dot clock signal	
39~40	N.C	-	No Connection	
41~42	VCC	P	Power supply, 3.0~3.6V	
43	TP_D	I	TOUCH PANEL CONTROL PIN (N.C)	
44	TP_L	I	TOUCH PANEL CONTROL PIN (N.C)	
45~51	N.C	-	No Connection	
52	DE	I	Data ENABLE signal	
53~54	GND	P	System ground.	

说明： 1. 根据需要可设置为 24-Bit 并口 RGB 和 8-Bit 串口 RGB，默认为并口 RGB。



4. Electrical Units

4.1 Absolute Maximum Ratings

The absolute maximum ratings are list on Table 4.1. When used out of the absolute maximum ratings, the LCM may be permanently damaged. Using the LCM within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the LCM will malfunction and cause poor reliability.

Table 4.1 Module Absolute Maximum Ratings

Item	Symbol	Unit	Value	Note
Power Supply Voltage (1)	Vdd	V	-0.3 to +4.0	
Power Supply Voltage (2)	VGH ~ VSS	V	-0.3 to +17.0	
Power Supply Voltage (3)	VSS ~ VGL	V	0 to -12.0	
Operating Temperature	Top	°C	-10 to +60	
Storage Temperature	Tst	°C	-20 to +70	
Operating Humidity	Hop	%(RH)	10~85	

(VSS=0V)

4.2 Electrical characteristics (Ta=25°C)

Table 4.2:DC Characteristic (Vcc = 3.0 ~ 3.6V)

Item		Symbol	Condition	Min.	Type.	Max.	Unit
Supply Voltage	Logic	Vcc	---	3.0	3.2	3.6	V
Input Voltage	H level	V _{IH}	---	0.8V _{cc}	---	V _{cc}	V
	L level	V _{IL}		0	---	0.2V _{cc}	
Current Consumption		I _{DD}	With internal voltage generation; VCC=3.3V; Tamb=2 5°C;	---	11	13	mA



4.3 Back-light Specification

Table 4.3 Back-light Characteristics

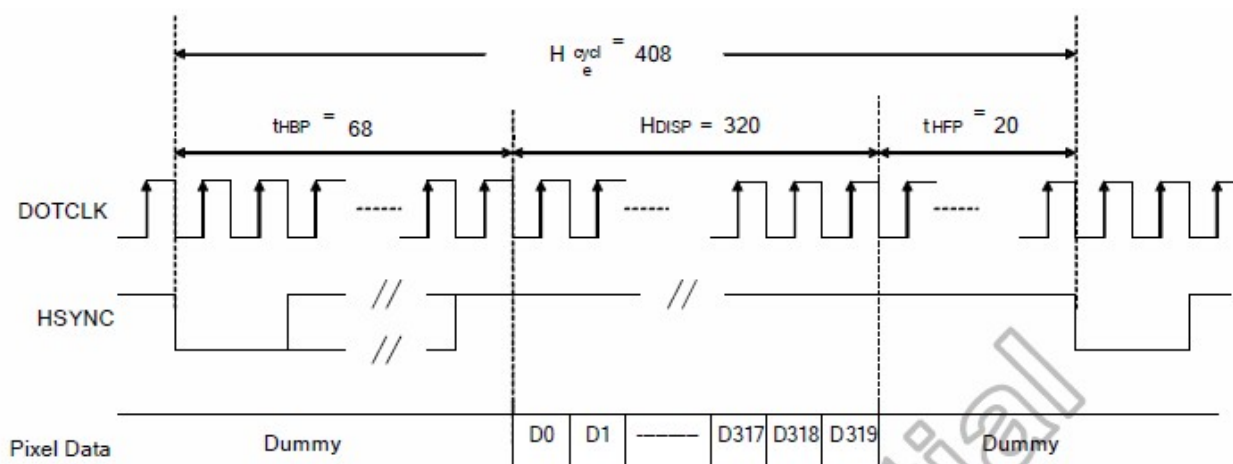
Item	Symbol	Conditions	Min.	Type.	Max.	Unit
Supply Voltage	VF	Only Backlight	18.0	19.2	21.0	V
Supply Current	IF		20			mA
Average Brightness	IV	Backlight Current IF=20mA	210	230	-	Cd/m ²
CIE Color Coordinate (Without LCD)	X	Backlight Current IF=20mA	--	0.26	--	—
	Y		--	0.32	--	
Uniformity	B	Backlight Current IF=20mA	--	80%	—	%
Color	White					

Note: 6 LEDs in series connection.

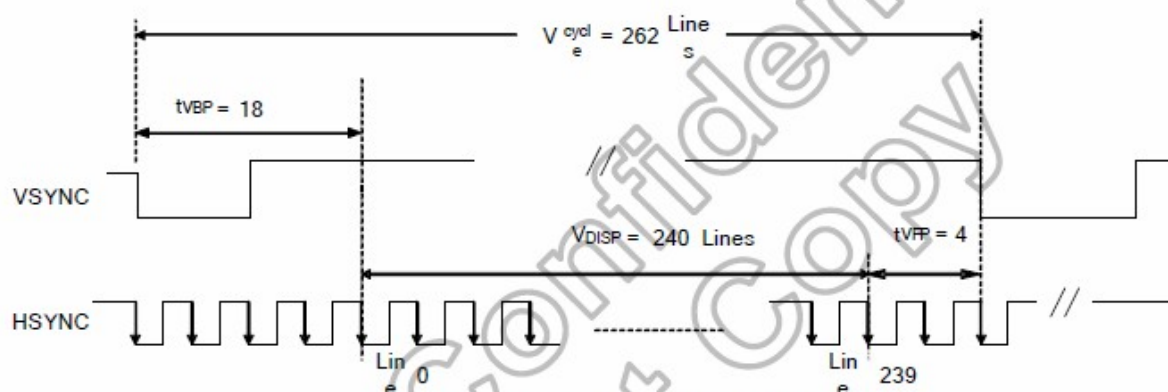


5. AC Characteristics

5.1 Parallel RGB interface operation



(a) Horizontal Data Transaction Timing

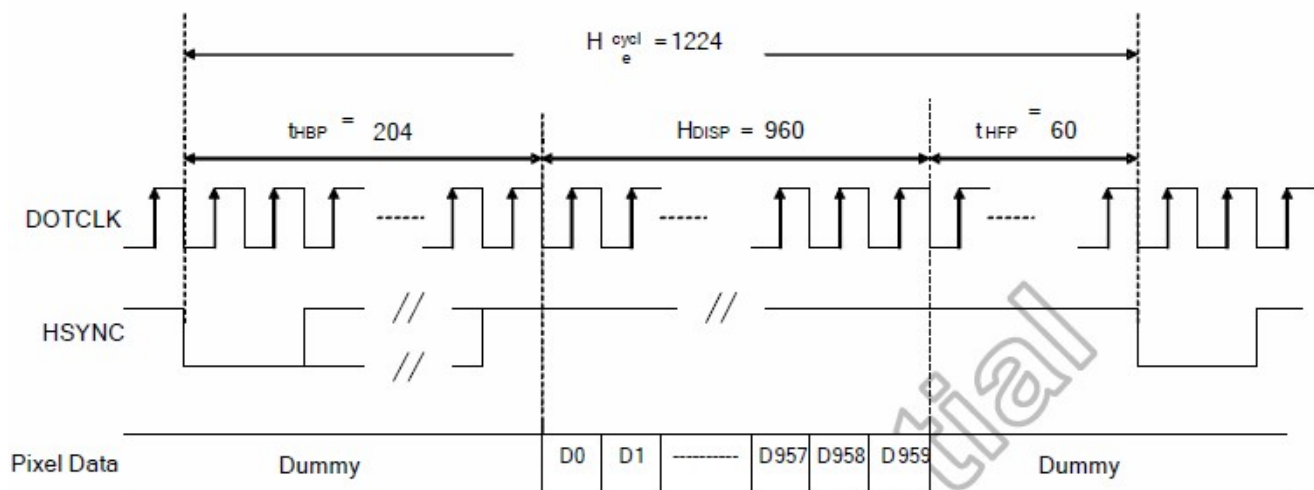


(b) Vertical Data Transaction Timing

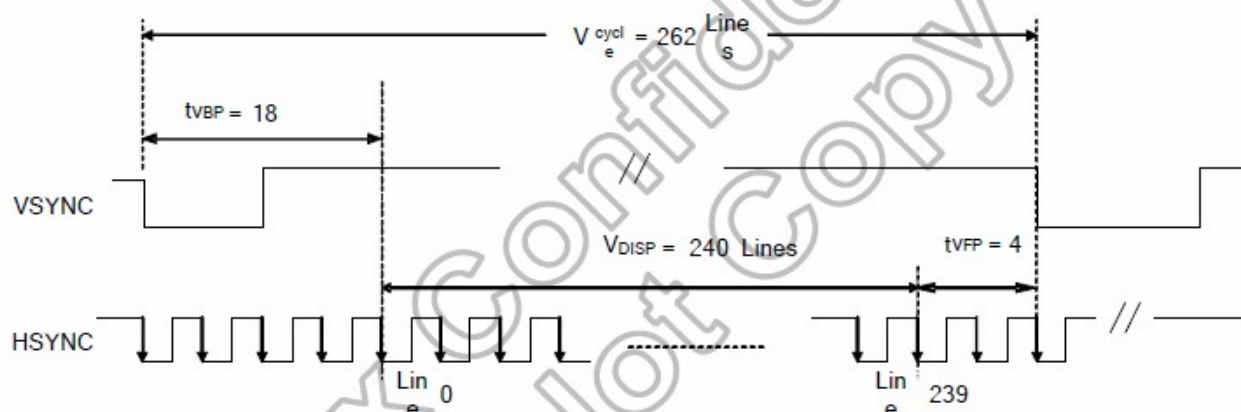
Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal Frequency (Line)	fH	-	-	14.9	-	22.35	-	KHz
Vertical Frequency (Refresh)	fV	-	-	60	-	90	-	Hz
Horizontal Back Porch	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Front Porch	tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal Data Start Point	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Blanking Period	tHBP + tHFP	-	-	88	264	-	-	tDOTCLK
Horizontal Display Area	HDISP	-	-	320	960	-	-	tDOTCLK
Horizontal Cycle	Hcycle	-	-	408	1224	450	1350	tDOTCLK
Vertical Back Porch	tVBP	-	-	18	-	-	-	Lines
Vertical Front Porch	tVFP	-	-	4	-	-	-	Lines
Vertical Data Start Point	tVBP	-	-	18	-	-	-	Lines
Vertical Blanking Period	tVBP + tVFP	-	-	22	-	-	-	Lines
Vertical Display Area	NTSC	-	-	240	-	-	-	Lines
	PAL			280(PALM=0)				
	PAL			288(PALM=1)				
Vertical Cycle	NTSC	-	-	262	-	350	-	Lines
	PAL			313				



5.2 Serial RGB interface operation



(1) Horizontal Data Transaction Timing



(2) Vertical Data Transaction Timing

Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal Frequency (Line)	fH	-	-	14.9	-	22.35	-	KHz
Vertical Frequency (Refresh)	fV	-	-	60	-	90	-	Hz
Horizontal Back Porch	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Front Porch	tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal Data Start Point	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Blanking Period	tHBP + tHFP	-	-	88	264	-	-	tDOTCLK
Horizontal Display Area	HDISP	-	-	320	960	-	-	tDOTCLK
Horizontal Cycle	Hcycle	-	-	408	1224	450	1350	tDOTCLK
Vertical Back Porch	tVBP	-	-	18	-	-	-	Lines
Vertical Front Porch	tVFP	-	-	4	-	-	-	Lines
Vertical Data Start Point	tVBP	-	-	18	-	-	-	Lines
Vertical Blanking Period	tVBP + tVFP	-	-	22	-	-	-	Lines
Vertical Display Area	NTSC	VDISP	-	240	-	-	-	Lines
	PAL			280(PALM=0)				
	PAL			288(PALM=1)				
Vertical Cycle	NTSC	Vcycle	-	262	350	-	-	Lines
	PAL			313				



6. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the TFT-LCD surface at a viewing angle of Φ and θ equal to 0° .

Measurement condition: Refer to next pages (C-light source, Halogen Lamp)

*1): with Polarizer *2): without Polarizer *3): Only Color Filter glass

Item		Symbol	Conditions	Specifications			Unit
				Min.	Typ.	Max.	
Transmittance		T%	Viewing normal angle $\theta_X = \theta_Y = 0^\circ$		7.4		%
Contrast Ratio		CR		200	300		--
Response Time		T _R			15	30	ms
		T _F			35	50	ms
Chromaticity	Red	X _R		0.609	0.639	0.669	
		Y _R		0.314	0.344	0.374	
	Green	X _G		0.264	0.294	0.324	
		Y _G		0.557	0.587	0.617	
	Blue	X _B		0.102	0.132	0.162	
		Y _B		0.106	0.136	0.166	
	White	X _W		0.282	0.312	0.342	
		Y _W		0.319	0.349	0.379	
Viewing Angle	Hor.	θ_{X+}	Center CR≥10		45		deg.
		θ_{X-}			45		
	Ver.	θ_{Y+}			15		
		θ_{Y-}			35		

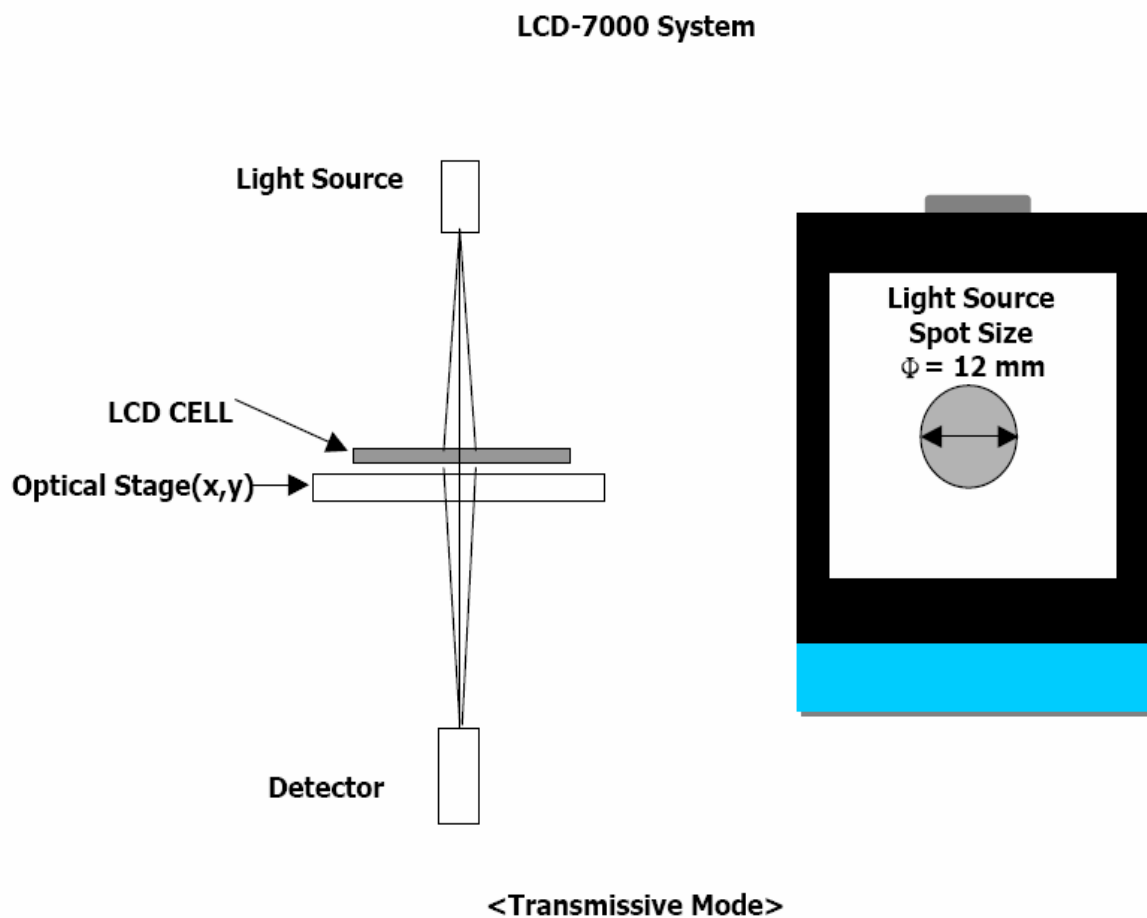


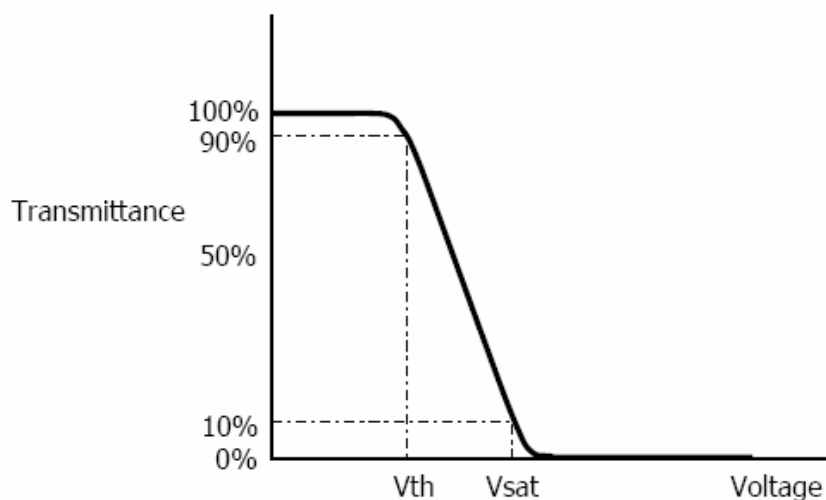
Notes : 1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

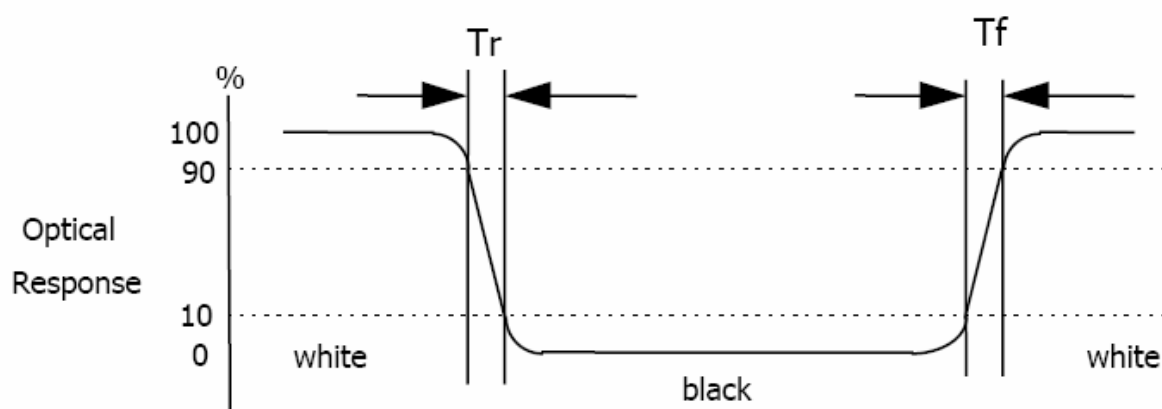
2. Surface luminance is the center point across the TFT-LCD surface 500mm from the surface with all pixels displaying white. For more information see FIG 1.
3. Response time is the time required for the display to transition from white to black(Rise Time, Tr) and from black to white(Falling Time, Tf). For additional information see FIG 3.
4. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the TFT-LCD surface. For more information see FIG 4.
5. Optimum contrast is obtained by adjusting the TFT-LCD Threshold voltage(Vth & Vsat)

FIG. 1 Optical Characteristic Measurement Equipment and Method



**FIG. 2 The definition of V_{th} and V_{sat}** **FIG. 3 The definition of Response Time**

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



* Voltage conditions for Response time

V_{gate} : 19V DC

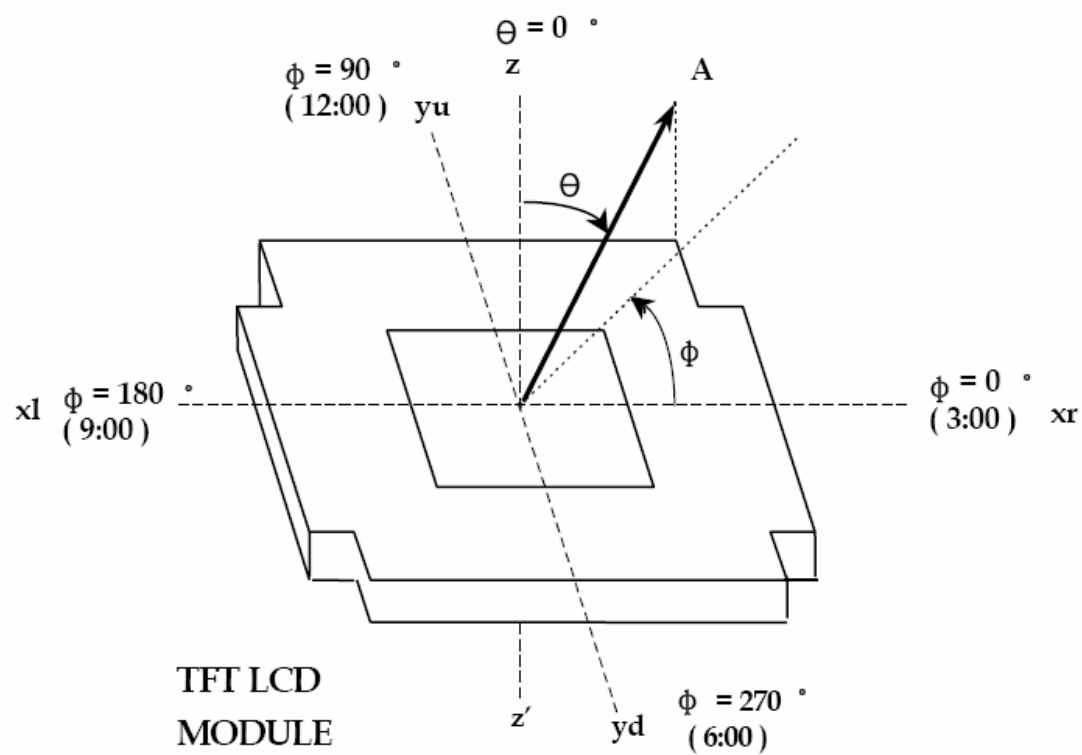
V_{data} : 0V~3.3V DC

V_{com} : 0V (Ground)



FIG. 4 The definition of viewing angle

<dimension of viewing angle range>





7. Reliability Test Items

No.	Test Item	Test Condition	Check Time
1	High temp storage	T=70℃	72Hrs
2	Low temp storage	T=-20℃	72Hrs
3	High temp operation	T=60℃	72Hrs
4	Low temp operation	T=-10℃	72Hrs
5	High temp & high humidity	T=50℃ H=85%	72Hrs

Reliability Test Criteria:

Display function should be no change under normal operating condition.



8. Package(TBD)

9. Handling Precautions

9.1 Safety

The liquid crystal in the LCD is poisonous. Keep away from your mouth and eyes. If the liquid crystal contacts with your skin, mouse or clothes, use soap to wash it off immediately.

9.2 Handling

- i. The LCD panel is made of very thin glass. Mechanical impact or extrusion to the surface should be prevented.
- ii. The polarizer attached on the display is very easy to be damaged, handle it with special attention.
- iii. To avoid contamination on the display surface, do not touch the display surface with bare hands.
- iv. The transparent electrodes may be disconnected if you use the LCD panel under dew-condensing environment.
- v. The characteristics of the semiconductor devices may be affected when they are exposed to light, possibly resulting in malfunctioning of the ICs. To prevent such malfunctioning of the ICs, make sure the application and the mounting of the panel are designed so that the IC is not exposed to light.

9.3 Static Electricity

Ground soldering iron tips, tools and testers when you operate. Also ground your body when handling the products and store the products in an anti-electrostatic container.

9.4 Storage

Store the products in a dark place where the temperature is within the range of $25\pm 10^{\circ}\text{C}$ and with low humidity (60%RH or less). Do not store the LCD product in an atmosphere containing organic solvents or corrosive gases.

9.5 Cleaning

Do not wipe the polarizer with dry cloth, as it might cause scratching. Wipe the polarizer with a soft cloth soaked with petroleum IPA. Other chemical might damage the panel.



10. QC

10.1 Purpose

To ensure the stability of our product and standardize our inspection

10.2 Application Range

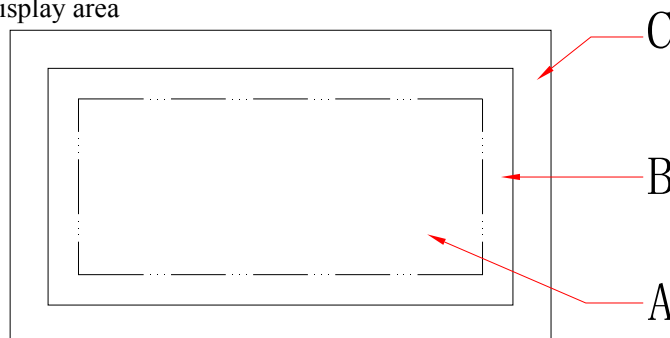
This standard is applied to all 3.5 inch and smaller sized LCM product from Elsun Technology Co.Ltd

10.3 Definition of inspection area

C area: The area covered after installation

B area: visible area

A area: display area

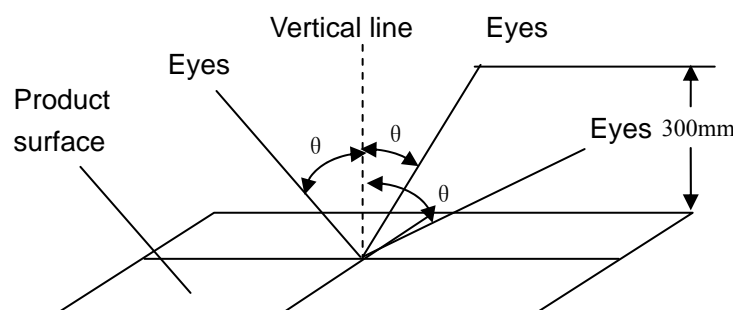


10.4 The environmental condition of inspection

Lighting conditions should be 20 ~ 40W fluorescent lamp (illumination at 1000 ± 200 lux)

Test ambient temperature should be 23 ± 5 °C, humidity at $50 \pm 20\%$ RH

The tested products should be placed 300mm away from the examiner's eye, and 30 degrees in the vertical direction observed within the region



10.5 Identification

10.5.1 Bright dot: dots appearing bright and unchanged in size when the LCD panel is under black pattern.

10.5.2 Dark dot: dots appearing dark and unchanged size when the LCD panel is under RGB picture.

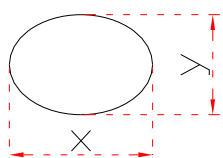
10.6 Inspection items and criteria



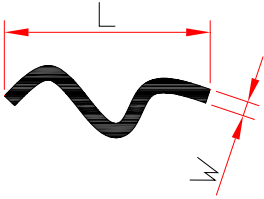
10.6.1 Serious defect

No	inspection item	inspection criteria	defect grade
10.6.1.1	function failure	1) Non-display not allowed 2) Line missing not allowed 3) Invalid touch and drift not allowed (if need)	main defect
10.6.1.2	break	broken display not allowed	main defect
10.6.1.3	dimension	Dimension tolerance out of specified in the drawing not allowed.	main defect

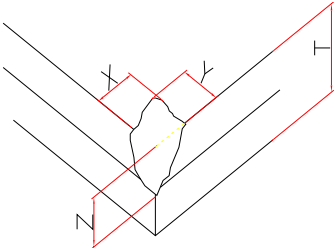
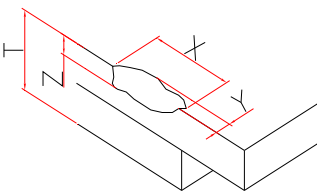
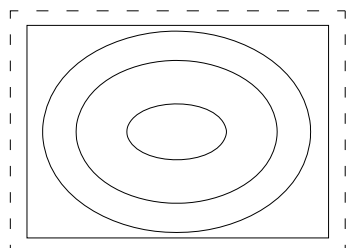
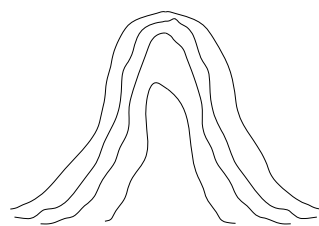
10.6.2 Appearance defect

No	Inspection item	inspection criteria	defect grade																				
10.6.2.1	Dot defect black dot, white dot, dirt on surface, stain, bubble	<p>1. dot defect identification:</p> $\Phi = \frac{(\chi + \gamma)}{2}$  <p>2. inspection criteria range</p> <table border="1"> <thead> <tr> <th rowspan="2">Area and quantity dimension(mm)</th><th colspan="3">quantity allowed</th></tr> <tr> <th>A area</th><th>B area</th><th>C area</th></tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.15$</td><td colspan="2">ignore</td><td rowspan="4">ignore</td></tr> <tr> <td>$0.15 < \Phi \leq 0.2$</td><td colspan="2">2 (spacing $\geq 10\text{mm}$)</td></tr> <tr> <td>$0.2 < \Phi \leq 0.25$</td><td colspan="2">1</td></tr> <tr> <td>$\Phi > 0.25$</td><td colspan="2">0</td></tr> </tbody> </table>	Area and quantity dimension(mm)	quantity allowed			A area	B area	C area	$\Phi \leq 0.15$	ignore		ignore	$0.15 < \Phi \leq 0.2$	2 (spacing $\geq 10\text{mm}$)		$0.2 < \Phi \leq 0.25$	1		$\Phi > 0.25$	0		Minor defect
Area and quantity dimension(mm)	quantity allowed																						
	A area	B area	C area																				
$\Phi \leq 0.15$	ignore		ignore																				
$0.15 < \Phi \leq 0.2$	2 (spacing $\geq 10\text{mm}$)																						
$0.2 < \Phi \leq 0.25$	1																						
$\Phi > 0.25$	0																						



No	Inspection item	inspection criteria	defect grade																																	
10.6.2.2	line defect visible black/white line	1. identification of line dimension L: length W: width 	Minor defect																																	
		2. inspection criteria																																		
		<table><tr><th colspan="2">dimension(mm)</th><th colspan="3">quantity allowed (total 3 pcs)</th></tr><tr><th rowspan="2">L (length)</th><th rowspan="2">W (width)</th><th colspan="3">area</th></tr><tr><th>A area</th><th>B area</th><th>C area</th></tr><tr><td>ignore</td><td>W≤0.03</td><td colspan="3">ignore</td></tr><tr><td>L≤3.0</td><td>0.03<W≤0.05</td><td colspan="3">2</td></tr><tr><td>L≤3.0</td><td>0.05<W≤0.08</td><td colspan="3">1</td></tr><tr><td></td><td>W>0.08</td><td colspan="3">count according to dot defect</td></tr></table>		dimension(mm)		quantity allowed (total 3 pcs)			L (length)	W (width)	area			A area	B area	C area	ignore	W≤0.03	ignore			L≤3.0	0.03<W≤0.05	2			L≤3.0	0.05<W≤0.08	1				W>0.08	count according to dot defect		
		dimension(mm)		quantity allowed (total 3 pcs)																																
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L≤3.0	0.05<W≤0.08	1																																		
	W>0.08	count according to dot defect																																		
10.6.2.3	scratch	1-If the scratch is visible after installation or at work, refer to 10.6.2.2 2-If the scratch is visible at special angel or at non-working status, refer to the following standards	Minor defect																																	
		<table><tr><th colspan="2">dimension (mm)</th><th colspan="3">Quantity allowed</th></tr><tr><th rowspan="2">L (length)</th><th rowspan="2">W (width)</th><th colspan="3">area</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>ignore</td><td>W≤0.03</td><td colspan="3">ignore</td></tr><tr><td>5.0<L≤10.0</td><td>0.03<W≤0.05</td><td colspan="3">2</td></tr><tr><td>L≤5.0</td><td>0.05<W≤0.08</td><td colspan="3">1</td></tr><tr><td></td><td>W>0.08</td><td colspan="3">Not allowed</td></tr></table>		dimension (mm)		Quantity allowed			L (length)	W (width)	area			A	B	C	ignore	W≤0.03	ignore			5.0<L≤10.0	0.03<W≤0.05	2			L≤5.0	0.05<W≤0.08	1				W>0.08	Not allowed		
		dimension (mm)		Quantity allowed																																
		L (length)		W (width)	area																															
A	B		C																																	
ignore	W≤0.03	ignore																																		
5.0<L≤10.0	0.03<W≤0.05	2																																		
L≤5.0	0.05<W≤0.08	1																																		
	W>0.08	Not allowed																																		



No	Inspection item	inspection criteria	defect grade
10.6.2.4	Glass defect	<p>1. broken angle</p> <p>X 不计 Y\leq2.0mm or X\leq2.0mm Y 不计 Meanwhile Z<T ignore</p>  <p>2. other broken part</p> <p>X\leq5.0mm Y\leq0.8mm Meanwhile Z\leqT ignore</p> 	Minor defect
10.6.2.5	Newton ring	<p>1.regular Newton ring</p>  <p>① Newton ring area>1/3 T/P area; not acceptable. ② Newton ring area\leq1/3 T/P area and doesn' t affect the display result and no line distortion; acceptable</p> <p>2. Non-regular Newton ring</p>  <p>① Newton ring area>1/2 T/P area, or no matter how big as long as it affects the display result; not acceptable Newton ring area\leq1/2 T/P area, and doesn' t affect the display result and without line distortion; acceptable</p>	Minor defect



NO	Inspection item	inspection criteria	defect grade
10.6.2.6	FPC	1. copper foil off, warping, crack and oxidation are not allowed 2. FPC crack, break, serious scratch and crease are not allowed	main defect
		3. if no special requirements, no release paper on double-sided adhesive FPC is not allowed. 4. Slight creases and scratches not exposed from the copper foil and with no affect to appearance and function are allowed. 5. if no special requirements, no insulating tape at welding part on backlight and touch-screen is not allowed.. 6. Parts off, breakage and deform are not allowed. 7. print on the surface should be clear and correct.	Minor defect
10.6.2.7	basic appearance requirements	1. clean appearance, no dirt, fingerprints and other traces. 2. ITO circuit on COG coating area should not be exposed. 3. Rust, sever scratch, deformation, obvious burrs and color dirt are not allowed. 4. Mis-assembly, part missing are not allowed. 5. Bubble caused by mis-pasted polaroid refers to 10.6.2.1 6. For watermark, the criteria is upon agreed by both parties.	Minor defect



10.6.3 electric defect

No	Inspection item	inspection criteria	defect grade
10.6.3.1	picture defect	Non-display, more or less image and display defect are not allowed.	main defect
10.6.3.2	bright/dark line	Not allowed.	main defect
10.6.3.3	display dot defect	<ol style="list-style-type: none">one dot is acceptable.Under bright status, 2 dark dots with more than 5mm distance is allowed.Totally 2 bright or dark dots are acceptable.The other defect under bright status refers to 10.6.2.1 <p>Note: Electric bright/dark dot means one pixel; less than 1/2 of 1 pixel can be ignored.</p>	Minor defect
10.6.3.4	connected dot/line defect	<ol style="list-style-type: none">Two continuous defect pixel connected dots are not allowed.Line defect refers to 10.6.2.2	Minor defect
10.6.3.5	wrong view direction	Wrong view directions, such as opposite view angle, are not allowed.	main defect
10.6.3.6	back light defect	<ol style="list-style-type: none">Backlight off are not allowed.Uneven light, dead light, flicker light, dark angle, light leakage are not allowed.Brightness should comply with drawing	main defect

end.