



承认 编 码: CR \_\_\_\_\_

**TFT LCD MODULE**  
**3.5 inch 320RGB\*480DOTS**

**MODULE NUMBER: PV0350B2Z10**

**REVISION: V00**

Customer Approval:

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- Approved For Specifications
- Approved For Specifications & Sample**

Prepared by	Checked by	Approved by
王加林		





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## 1. LCM Specification

### 1.1 Description

**PV0350B2Z10** 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 RTP, a FPC and a LED-backlight unit. The active display area is 3.5 inches diagonally measured and the native resolution is 320\*RGB\*480. 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*480	pixels
Module Size	53.76(W)*84.18(H)*3.30(T)(Exclude FPC)	mm
Active Area (A.A)	48.96(W)*73.44(H)	mm
Pixel Arrangement	RGB-stripe	-
Viewing Direction	Wide View	
Display Mode	Normally Black	
LCD Controller/Driver	ILI9488	-
IC Package Type	COG	-
Interface	MPU 16-bit	-
Power Supply Voltage	2.8~3.3	V
LCM Brightness	200	cd /m <sup>2</sup>
Back-light	White LED*6	PCS



## 2. Mechanical Specification

Pin Assignment	
1	GND
2	IOVCC(1.8V)
3	VCC(2.8V)
4	WR
5	CS
6	RD
7	RS
8	RESET
9	FMARK
10~27	DB0~DB17
28	NC
29	K
30	NC
31	A
32	NC
33	YD
34	XR
35	TU
36	XL
37	GND
38	NC
39	NC
40	NC

MCU 16位

展开出货

LED CIRCUIT DIAGRAM

(默认6颗灯, 背光可兼容8个灯)

**NOTES:**

- 1、Display type: 3.5" HVGA
- 2、Viewing direction:
- 3、Drive IC: ILI9488
- 4、Backlight color: LED WHITE
- 5、Operation temperature: -20~70° C
- 6、Storage temperature: -30~80° C
- 7、LCM Operating Voltage: Vdd=2.8V
- 8、VAnds: 模块可视区域, 建议外壳可视区域比VAnds 单边小0.3以上

<b>Kingtech Group Co.,Ltd</b>	
DRAWN: 蒋雨吉	TITLE: PV0350B2Z10
CHECK: 王加林	DOC. NO: KLD3576GHTI
REV. 1.0	PART NO. SCALE 1:1
DESCRIPTION: 新制灯	DATE: 2016.11.04
APPROVE: 王加林	SHEET: 1 OF 1
DATE: 2016.11.04	UNITS: mm



### 3. Pin Descriptions

Pin No.	Symbol	I/O	Functional	Remark
1	GND	P	System ground.	
2	IOVCC	P	Power supply, 1.65~3.2V	
3	VCC	P	Power supply, 3.0~3.2V	
4	WR	I	bus interface operation.	
5	CS	I	Chip select input pin	
6	RD	I	bus interface operation.	
7	RS	I	Selects register.	
8	RESET	I	RESX pin	
9	FMARK	I	Tearing effect output.	
10~27	DB0~DB17	I/O	18-bit interface: DB0-DB15 are used	
28	NC	-	-	
29	LEDK	P	LED Power supply -	
30	NC	-	-	
31	LEDA	P	LED Power supply +	
32	NC	-	-	
33	TP_D	I	Down electrode – differential analog	
34	TP_R	I	Right electrode – differential analog	
35	TP_U	I	Up electrode – differential analog	
36	TP_L	I	Left electrode – differential analog	
37	GND	P	System ground.	
38	NC	-	-	
39	NC	-	-	
40	NC	-	-	

说明：模组默认设置为 MPU 16-Bit 接口



## 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
Input power supply	Vdd	V	-0.3 to +3.6	
Analog power supply	Avdd	V	-0.3 to +3.6	
Operating Temperature	Top	°C	-20 to +70	
Storage Temperature	Tst	°C	-30 to +80	
Operating Humidity	Hop	%(RH)	80	

(VSS=0V)

### 4.2 Electrical characteristics

**Table 4.2:DC Characteristic**

Item	Symbol	Condition	Min.	Type.	Max.	Unit	
Supply Voltage	Logic	IOVCC	---	1.65	1.8	3.2	V
Analog power supply	Logic	VCC	---	2.5	2.8	3.2	V
Input Voltage	H level	V <sub>IH</sub>	---	0.7IOVdd	---	IOVdd	V
	L level	V <sub>IL</sub>		DGND	---	0.3IOVdd	
Output Voltage	H level	V <sub>oH</sub>	---	0.8IOVdd	---	IOvdd	V
	L level	V <sub>oL</sub>		DGND	---	0.2IOVdd	



### 4.3 Back-light Specification

**Table 4.3 Back-light Characteristics**

Item	Symbol	Conditions	Min.	Type.	Max.	Unit
Supply Voltage	VF	Only Backlight	2.8	3.0	3.3	V
Supply Current	IF		120			mA
Average Brightness	IV	Backlight Current IF=120mA	5500	--	--	Cd/ m <sup>2</sup>
CIE Color Coordinate (Without LCD)	X	Backlight Current IF=120mA	0.220	--	0.260	-
	Y		0.220	--	0.260	
Uniformity	B	Backlight Current IF=120mA	--	80%	-	%
Color	White					

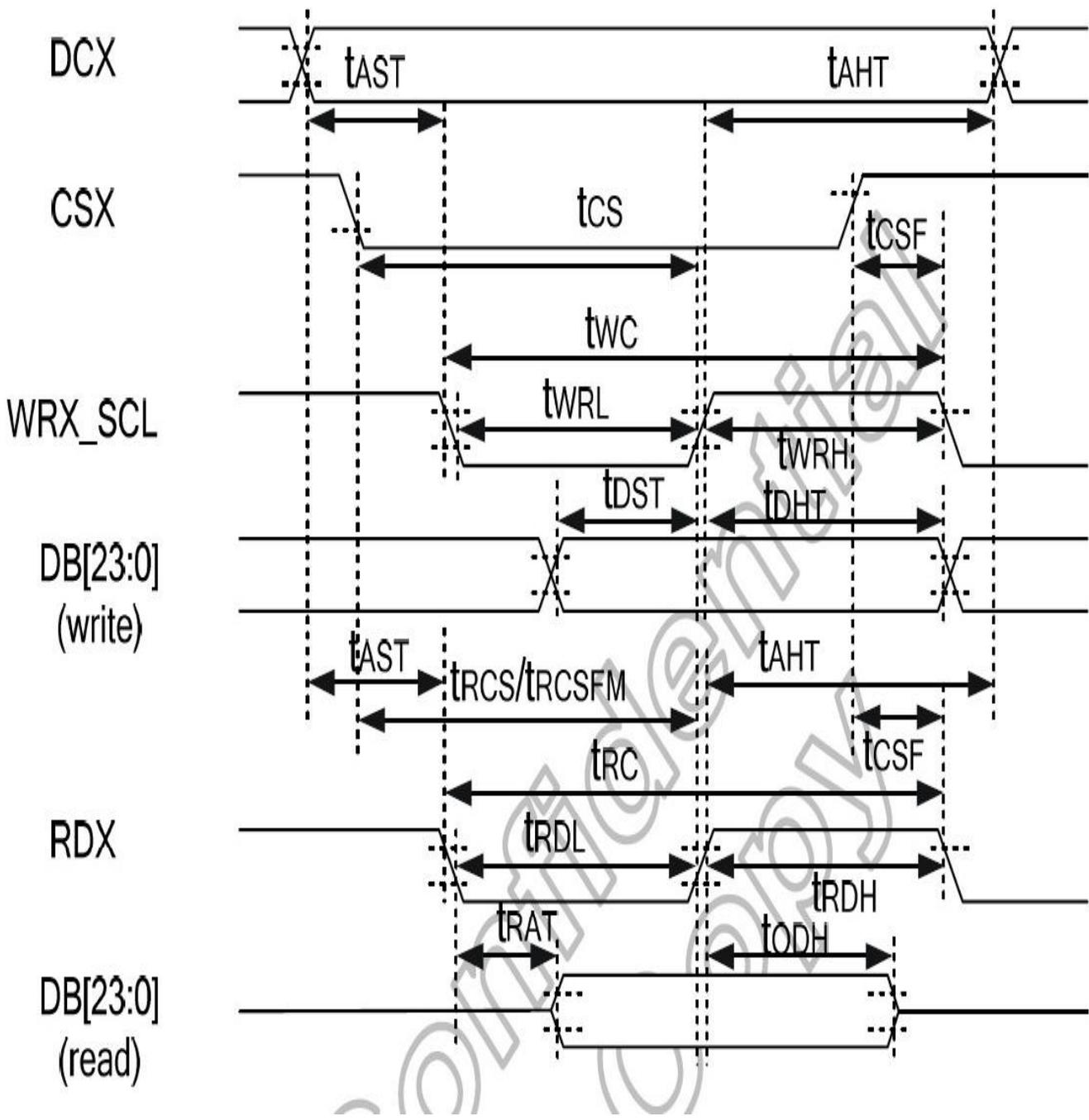
**Note:** 6 LEDs in Parallel connection.

### 4.4 RTP Specification

- ITO Glass: T=0.7mm 500Ω/□ ±200Ω
- ITO Film: T=0.188mm 270Ω/□ ±150Ω
- Surface Hardness: 3H-Pressure 200gf, 45deg
- Hitting Durability: 1,000,000 times ( Tip R8mm )
- Pen Sliding Durability: 100,000 times ( Tip R0.8mm )
- Insulation Impedance: DC 5V min, 20MΩ↑
- Light Transparency: 78% min
- Operating Voltage: 5V DC ; Max Voltage: 10V DC



### 5. AC Characteristics





\* (VSSA=0V, IOVCC=1.8V, VCI=2.8V, TA=25° C)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DCX	Tast	Address setup time	0	-	ns	
	Taht	Address hold time (Write/Read)	10	-		
CSX	Tcs	Chip select setup time (Write)	10	-	ns	
	Trcs	Chip select setup time (Read register)	45	-		
	Trcsfm	Chip select setup time (GRAM)	355	-		
	Tcsf	Chip select wait time (Write/Read)	10	-		
WRX	Twc	Write cycle (write register)	50	-	ns	
	Twc	Write cycle (write GRAM@SLPOUT)	47	-		
	Twc	Write cycle (write GRAM@SLPIN)	100	-		
	Twrh	Control pulse "H" duration	15	-		
	Twrl	Control pulse "L" duration	15	-		
RDX	Trc	Read cycle (read register)	160	-	ns	
	Trc	Read cycle (GRAM)	450	-		
	Trdh	Control pulse "H" duration	90	-		
	Trdl	Control pulse "L" duration(read register)	35	-		
	Trdl	Control pulse "L" duration(GRAM)	345	-		
DB[23:0]	Tdst	Data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	Tdht	Data hold time	10	-		
	Trat	Read access time(read register)	-	40		
	Trat	Read access time(GRAM)	-	340		
	Todh	Output disable time	20	80		

**Note:** The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

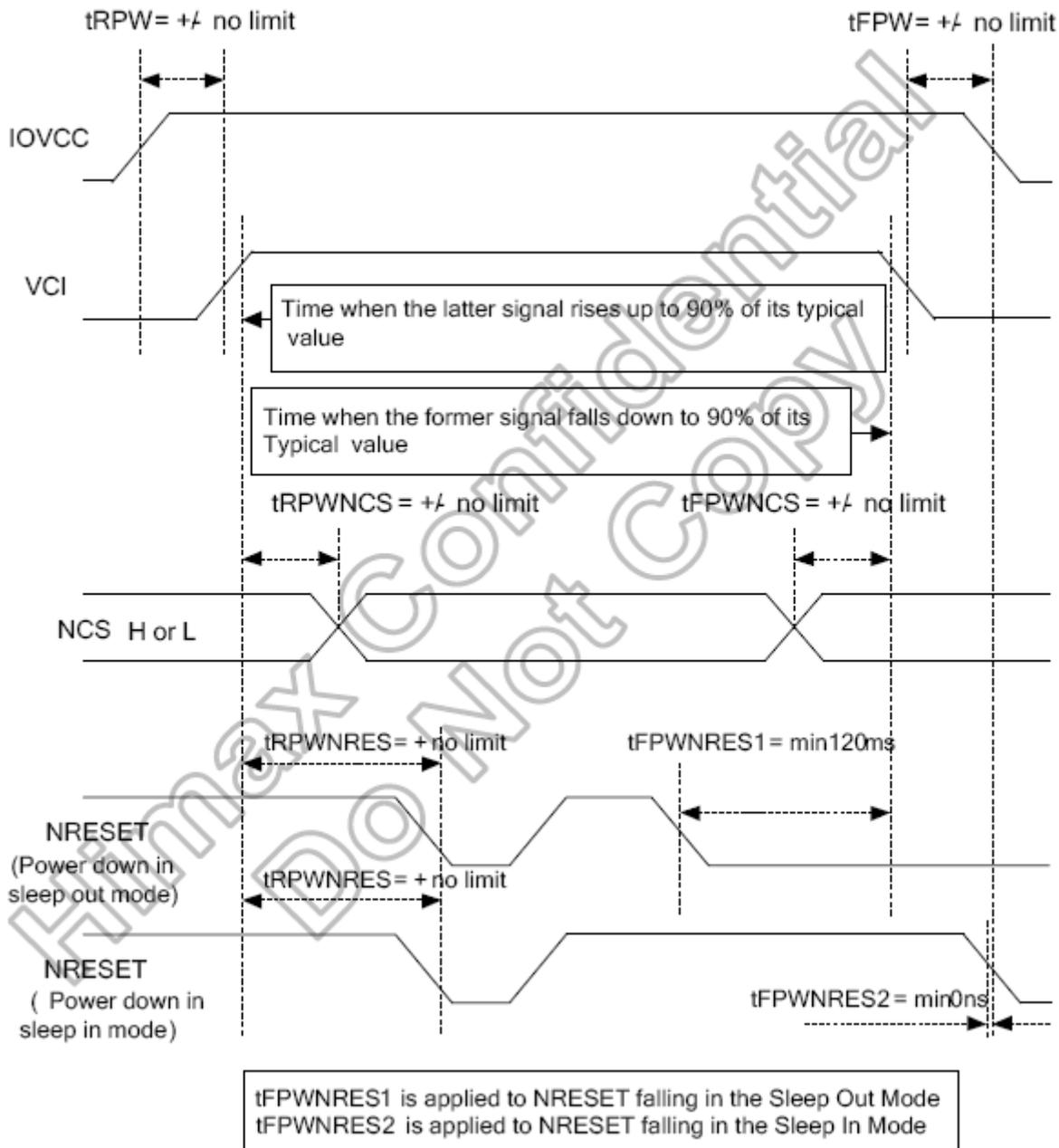
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.



## 6. Power On/Off Sequence

### 6.1 Case 1 – NRESET line is held high or unstable by host at power on

If NRESET line is held high or unstable by the host during Power On, then a Hardware Reset must be applied after both IOVCC, VCI have been applied, otherwise correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.



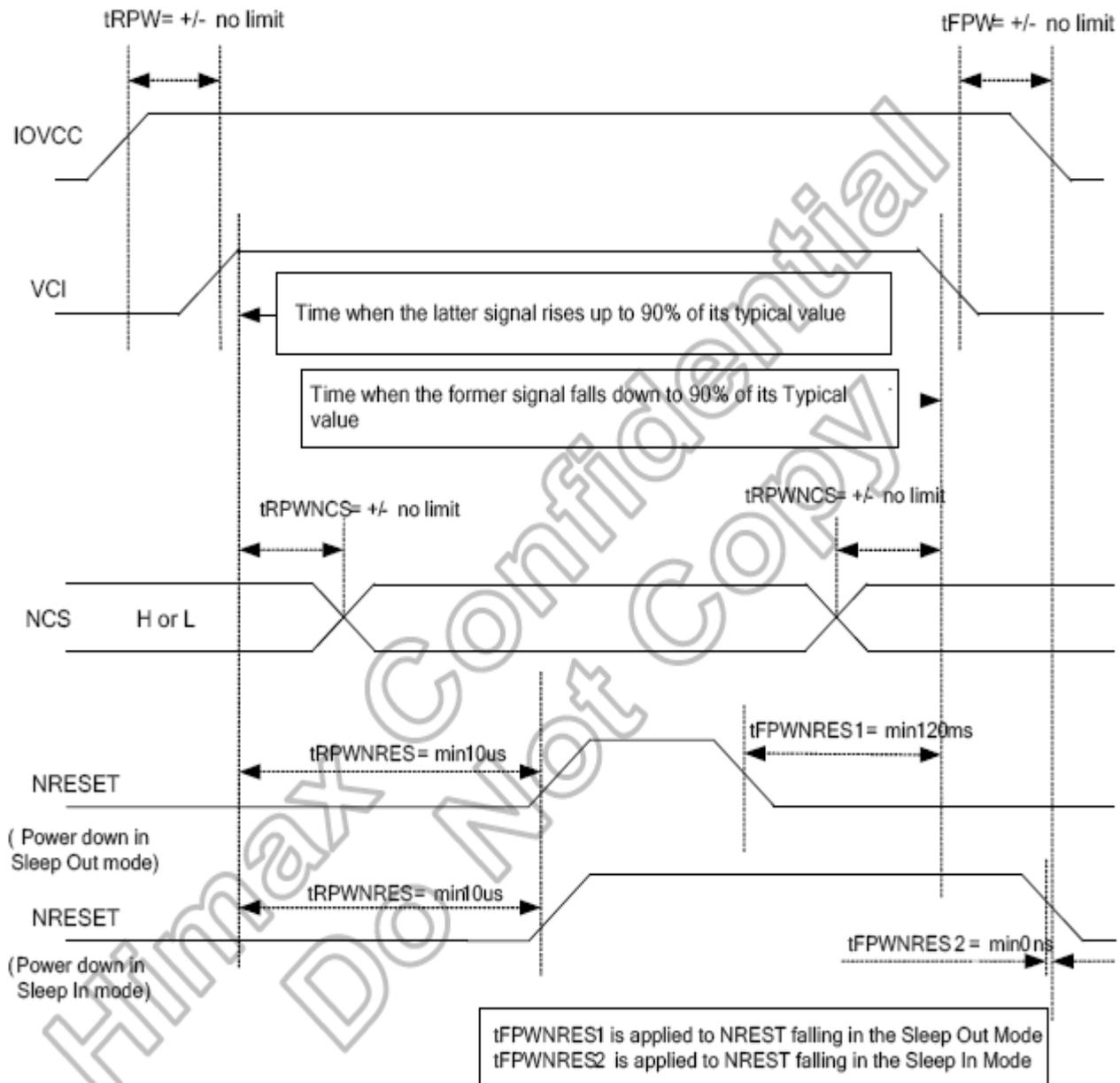
**Note:** Unless otherwise specified timings herein show cross point at 50% of signal/power level

Figure 5.31: Case 1 – NRESET line is held high or unstable by host at power on



## 6.2 Case 2 – NRESET line is held low by host at power on

If NRESET line is held Low (and stable) by the host during Power On, then the NRESET must be held low for minimum 10µsec after VCI have been applied.



**Note:** Unless otherwise specified timings herein show cross point at 50% of signal/power level

Figure 5.32: NRESET line is held low by host at power on



## 7. Optical Specification

### 7.1 Optical Specification

Light Source: C-light

(With UP Polarizer: APCFH4CVT, Down Polarizer: NPFCVT1764FCUARC9)

Ta=25°C

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angle	$\theta T$	$CR \geq 10$	80	-	-	Degree	Note 2
	$\theta B$		80	-	-		
	$\theta L$		80	-	-		
	$\theta R$		80	-	-		
Contrast Ratio	CR	$\theta=0^\circ$	400	800	--		Note1 Note3
Response Time	$T_{ON}$	25°C	-	25	35	ms	Note1 Note4
	$T_{OFF}$	$\theta=0^\circ$					
Color Filter Chromaticity	White	x	0.27	0.31	0.35		
		y	0.28	0.32	0.36		
	Red	x	-	-	-		
		y	-	-	-		
	Green	x	-	-	-		
		y	-	-	-		
	Blue	x	-	-	-		
		y	-	-	-		
NTSC	-	$\theta=0^\circ$	-	72.8	-	%	Note 5
Transmittance	T	$\theta=0^\circ$	-	4.4	-	%	Note1 Note5

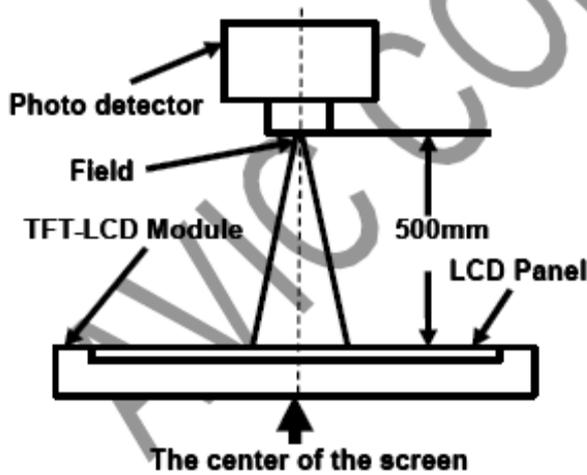
Test Conditions:

1. The ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.
3. The Transmittance and NTSC are the emulated values base on the panel with normal polarizer and C-Light, and when using LED back light they will be to decrease about 0.3%.



**Note 1: Definition of optical measurement system.**

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Chromaticity		
Response Time	BM-7A	2°

**Note 2: Definition of viewing angle range and measurement system, viewing angle is measured at the center point of the LCD by CONOSCOPE (ergo-80).**

Viewing angle is measured With EWV Polarizer.

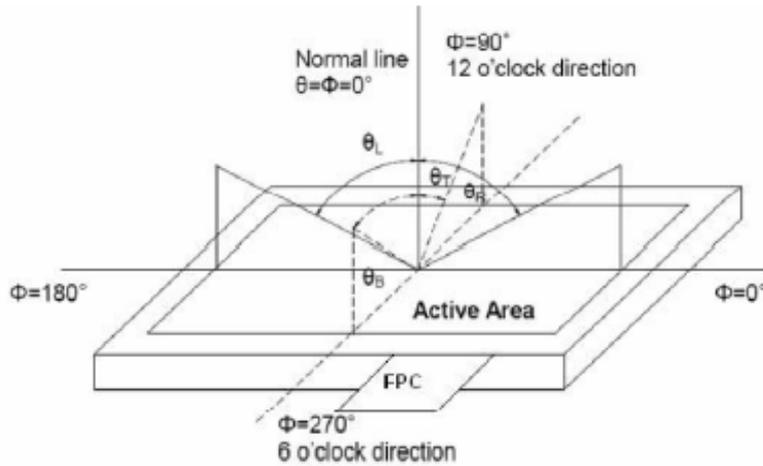


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

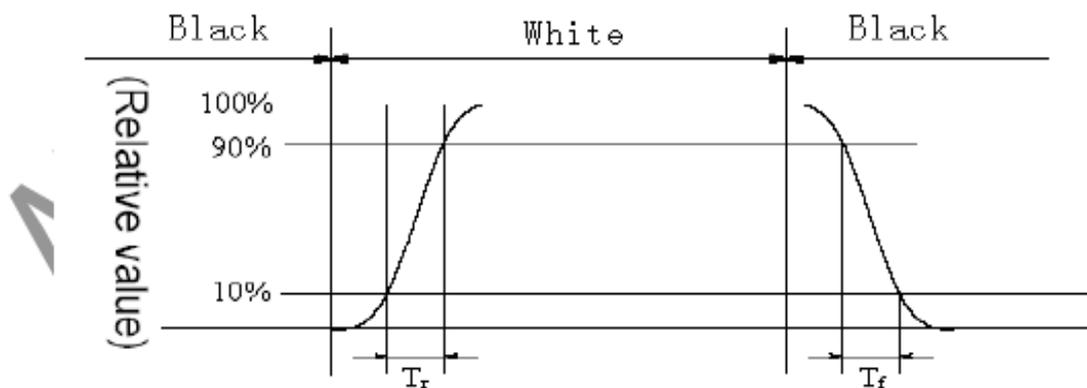
"White state ": The state is that the LCD should driven by  $V_{white}$ .

"Black state": The state is that the LCD should driven by  $V_{black}$ .

$V_{white}$ : To be determined  $V_{black}$ : To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time ( $T_{ON}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{OFF}$ ) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE 1931)



## 8. Reliability Test Items

No.	Test Item	Test Condition	Remarks
1	High Temperature Operation	Ts = +70℃, 240 hours (Note1)	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	Ts = -20℃, 240 hours (Note1)	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta = +80℃, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta = -30℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity	Ta = +50℃, 90% RH max,240hours	IEC60068-2-78:2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 20 Cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:1984, G B2423.22-2002
7	Package Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 1 hour for each direction of X.Y.Z. (3 hours for total)	IEC60068-2-6:1982 GB/T2423.10—1995
8	Package Drop Test	Height:60cm, 1corner,3edges,6surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of samples.

Note3: In the standard condition, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.



## 9.Handling Precautions

### 9.1 Handling Precautions

- 9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 9.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 9.1.4 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

- 9.1.5 Do not attempt to disassemble the LCD.
- 9.1.6 If the logic circuit power is off, do not apply the input signals.
- 9.1.7 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - 9.1.7.1 Be sure to ground the body when handling the LCD.
  - 9.1.7.2 Tools required for assembly, such as soldering irons, must be properly ground.
  - 9.1.7.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

### 9.2 Storage precautions

- 9.2.1 When storing the LCD, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 9.2.2 The LCD should be stored under the storage temperature range. If the LCD will be stored for a long time, the recommend condition is:  
Temperature : 0°C ~ 40°C Relatively humidity: ≤80%
- 9.2.3 The LCD should be stored in the room without acid, alkali and harmful-gas.

### 9.3 Transportation Precautions:

The LCD should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.



## 10. QC

### 10.1 Purpose

To ensure the stability of our product and standardize our inspection

### 10.2 Application Range

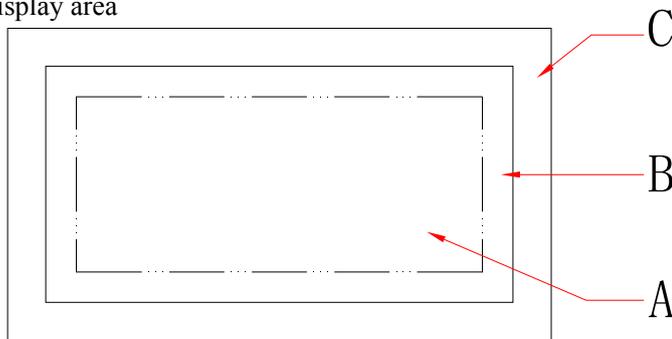
This standard is applied to all 4.3 inch and smaller sized LCM product from Elsun Technology Co.Ltd

### 10.3 Definition of inspection area

C area: The area covered after installation

B area: visible area

A area: display area

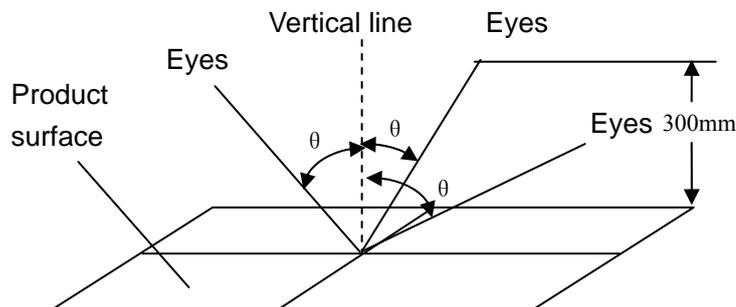


### 10.4 The environmental condition of inspection

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

Test ambient temperature should be  $23 \pm 5$  °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

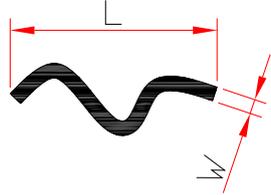
### 10.6.2 Appearance defect

No	Inspection item	inspection criteria	defect grade
10.6.2.1	Dot defect black dot, white dot, dirt on surface, stain, bubble	1. dot defect identification:	Minor defect
		2. inspection criteria range	

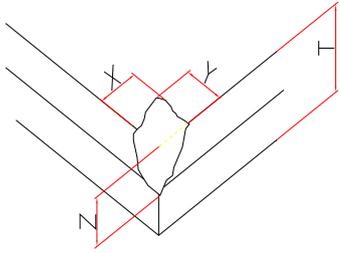
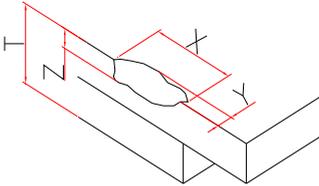
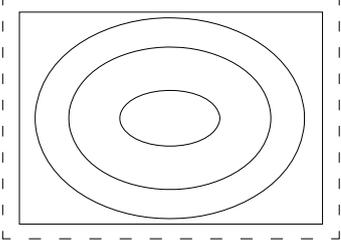
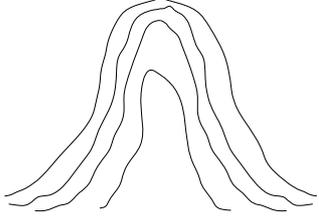
$$\Phi = \frac{(\chi + \gamma)}{2}$$

Area and quantit y dimension(mm)	quantity allowed		
	A area	B area	C area
$\Phi \leq 0.15$	ignore		ignore
$0.15 < \Phi \leq 0.20$	2 (spacing $\geq 10\text{mm}$ )		
$0.20 < \Phi \leq 0.3$	1		
$\Phi > 0.3$	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 border="1"> <thead> <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> </thead> <tbody> <tr> <td>ignore</td> <td><math>W \leq 0.03</math></td> <td colspan="3">ignore</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="3">2</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.05 &lt; W \leq 0.08</math></td> <td colspan="3">1</td> </tr> <tr> <td></td> <td><math>W &gt; 0.08</math></td> <td colspan="3">count according to dot defect</td> </tr> </tbody> </table>		dimension(mm)		quantity allowed ( total 3 pcs )			L ( length )	W ( width )	area			A area	B area	C area	ignore	$W \leq 0.03$	ignore			$L \leq 3.0$	$0.03 < W \leq 0.05$	2			$L \leq 3.0$	$0.05 < W \leq 0.08$	1				$W > 0.08$	count according to dot defect		
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	$W > 0.08$	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  <table border="1"> <thead> <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> </thead> <tbody> <tr> <td>ignore</td> <td><math>W \leq 0.03</math></td> <td colspan="3">ignore</td> </tr> <tr> <td><math>5.0 &lt; L \leq 10.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="3">2</td> </tr> <tr> <td><math>L \leq 5.0</math></td> <td><math>0.05 &lt; W \leq 0.08</math></td> <td colspan="3">1</td> </tr> <tr> <td></td> <td><math>W &gt; 0.08</math></td> <td colspan="3">Not allowed</td> </tr> </tbody> </table>	dimension ( mm )		Quantity allowed			L ( length )	W ( width )	area			A	B	C	ignore	$W \leq 0.03$	ignore			$5.0 < L \leq 10.0$	$0.03 < W \leq 0.05$	2			$L \leq 5.0$	$0.05 < W \leq 0.08$	1				$W > 0.08$	Not allowed			Minor defect
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	$W > 0.08$	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 ≤ 2.0mm or X ≤ 2.0mm Y 不计 Meanwhile Z &lt; T ignore</p>  <p>2. other broken part</p> <p>X ≤ 5.0mm Y ≤ 0.8mm Meanwhile Z ≤ T ignore</p> 	Minor defect
10.6.2.5	Newton ring	<p>1.regular Newton ring</p>  <p>① Newton ring area &gt; 1/3 T/P area; not acceptable. ② Newton ring area ≤ 1/3 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 &gt; 1/2 T/P area, or no matter how big as long as it affects the display result; not acceptable Newton ring area ≤ 1/2 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	<ol style="list-style-type: none"> <li>1. copper foil off, warping, crack and oxidation are not allowed</li> <li>2. FPC crack, break, serious scratch and crease are not allowed</li> </ol>	main defect
		<ol style="list-style-type: none"> <li>3. if no special requirements, no release paper on double-sided adhesive FPC is not allowed.</li> <li>4. Slight creases and scratches not exposed from the copper foil and with no affect to appearance and function are allowed.</li> <li>5. if no special requirements, no insulating tape at welding part on backlight and touch-screen is not allowed..</li> <li>6. Parts off, breakage and deform are not allowed.</li> <li>7. print on the surface should be clear and correct.</li> </ol>	Minor defect
10.6.2.7	basic appearance requirements	<ol style="list-style-type: none"> <li>1. clean appearance, no dirt, fingerprints and other traces.</li> <li>2. ITO circuit on COG coating area should not be exposed.</li> <li>3. Rust, sever scratch, deformation, obvious burrs and color dirt are not allowed.</li> <li>4. Mis-assembly, part missing are not allowed.</li> <li>5. Bubble caused by mis-pasted polaroid refers to 10.6.2.1</li> <li>6. For watermark, the criteria is upon agreed by both parties.</li> </ol>	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"> <li>1. one dot is acceptable.</li> <li>2. Under bright status, 2 dark dots with more than 5mm distance is allowed.</li> <li>3. Totally 2 bright or dark dots are acceptable.</li> <li>4. The other defect under bright status refers to 10.6.2.1</li> </ol> <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"> <li>1. Two continuous defect pixel connected dots are not allowed.</li> <li>2. Line defect refers to 10.6.2.2</li> </ol>	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"> <li>1. Backlight off are not allowed.</li> <li>2. Uneven light, dead light, flicker light, dark angle, light leakage are not allowed.</li> <li>3. Brightness should comply with drawing</li> </ol>	main defect