承 认 编 码：CR_____

TFT LCD MODULE

2.4 inch　240RGB*320DOTS

MODULE NUMBER: PV0241F2CZ0

REVISION: V00

Customer Approval:

☐　Approved For Specifications

■　**Approved For Specifications & Sample**

Prepared by	Checked by	Approved by
李 东 洋		

KINGTECH Kingtech Group Co., Ltd. ---- *Lcd Touchscreen Expert*

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Document Revision History

Version	Date	Page	Description	Changed By
V00	2015-10-28	-	First issue	李 东 洋

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1. LCM Specification

1.1 Description

PV0241F2CZ0 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 2.4 inches diagonally measured and the native resolution is 240*RGB*320.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	262 K	-
Display Resolution	240RGB*320	pixels
Module Size	60.4(H)*42.72(W)*2.21(T)(Exclude FPC)	mm
Active Area (A.A)	48.96(H)*36.72(W)	mm
Pixel Arrangement	RGB-stripe	-
Viewing Direction	ALL O' clock	
Display Mode	Normally Black	
LCD Controller/Driver	ILI9341V	-
IC Package Type	COG	-
Interface	**16-bits MPU**	-
Power Supply Voltage	2.5~3.3	V
LCM Brightness	250	cd /㎡
Back-light	White LED*4	PCS

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2. Mechanical Specification

RoHS

Display Type	TFT/Normally Black
Display Resolution	240RGB*320
Viewing Angle	ALL
LCD Controller/Driver	ILI9341V
Logic Voltage	3.3V
Operation Temperature	-10°C ~ 60°C
Storage Temperature	-20°C ~ 70°C
Backlight Spec.	White LED (4 dies in parallel) I=60mA V=3.2V

240RGB*320
TFT/LCD 2.4"
IPS

30.53±0.5
60.40±0.2
56.60±0.1
55.96±0.1 TFT
52.16 CF
51.70±0.2 POL
48.96 LCD (A.A)
1.32
1.52
2.82
17.41
3.00
0.5±0.1
W 0.3
P0.5*(34-1)=16.5±0.1
8.64
9.17
36.72 LCD (A.A)
39.30±0.2 POL
39.72±0.1 (TFT&CF)
39.96±0.5
42.72±0.2
3.00
1.71
1.50

51.41
32.41
15.41
10-3.80
1-0.5
4-0.40
1.93
2.21±0.15
Stiffener
0.3±0.03

59.65±0.15
1.68
18.00
0.75
0.75
0.25
30.3±0.2
17.5±0.1
T=0.05mm
41.22±0.15
43.22±0.15
0.75
0.25

PV0241F2CZ0
KLD

16Bit MCU 接口

LED CIRCUIT DIAGRAM
LEDK1 LEDK3 LEDK2 LEDK3
LEDA

No	Assignment
1	DB0
2	DB1
3	DB2
4	DB3
5	GND
6	GND
7	VCC1
8	/CS
9	RS
10	/WR
11	/RD
12	GND
13	LED-A
14	LED-K1
15	LED-K2
16	LED-K3
17	LED-K4
18	DB4
19	DB5
20	DB6
21	DB7
22	DB11
23	DB12
24	DB13
25	DB14
26	DB15
27	/RESET
28	VCI
29	VCC2
30	GND
31	GND
32	GND
33	DB6
34	DB7

REV.	DESCRIPTION	DATE	APPROVE:	CHECK:	DRAWN:
1.0	新制订	2015.10.17	王加林		王加林

Kingtech Group Co., Ltd.

TITLE: PV0241F2CZ0
DOC. NO.
PART NO.
REV. 1.0   SHEET 1 OF 1   SCALE 1:1   UNITS: mm

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3. Pin Descriptions

Pin No.	Symbol	I/O	Functional	Remark
1~4	DB0~DB3	I/O	Data bus.	
5~6	GND	P	System ground.	
7	VCC1	P	Power supply, 2.5~3.3V.	
8	CS	I	80-system: Chip select pin.	
9	RS	I	Register select signal .	
10	WR	I	Serves Write signal.	
11	RD	I	Read strobe signal.	
12	GND	P	System ground.	
13	LEDA	P	LED Power supply +.	
14~17	LEDK1~ LEDK4	P	LED Power supply -.	
18	DB4	I/O	Data bus.	
19~26	DB8~DB15	I/O	Data bus.	
27	RESET	I	Reset signal pin.	
28	VCI	P	Power supply, 2.5~3.3V.	
29	VCC2	P	Logic Power supply: 1.65~3.3V.	
30~31	GND	P	System ground.	
32~34	DB5~DB7	I/O	Data bus.	

说明： 本屏为 16-bits 的 MPU 接口

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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 +4.5	
Power Supply Voltage (2)	VGH ~ VSS	V	-0.3 to +15.0	
Power Supply Voltage (3)	VSS ~ VGL	V	0 to -7.5	
Operating Temperature	Top	°C	-10 to +60	
Storage Temperature	Tst	°C	-20 to +70	
Operating Humidity	Hop	%(RH)	10~90	

(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	Power	VCI	---	1.65	2.8	3.3	V
	Logic	IOVCC	---	2.5	2.8	3.3	V
Input Voltage	H level	V_{IH}	---	$0.7V_{dd}$	---	V_{dd}	V
	L level	V_{IL}		0	---	$0.3V_{dd}$	
Current Consumption		I_{DD}	With internal voltage generation; VDD=2.8V Tamb=2 5℃;	---	10	--	mA

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4.3 Back-light Specification

Table 4.3 Back-light Characteristics

Item	Symbol	Conditions	Min.	Type.	Max.	Unit
Supply Voltage	VF	Only Backlight	2.9	3.2	3.4	V
Supply Current	IF			60		mA
Average Brightness	IV	Backlight Current IF=60mA	6000	6500	-	Cd/m^2
CIE Color Coordinate (Without LCD)	X	Backlight Current IF=60mA	0.25	0.28	0.30	–
	Y		0.26	0.28	0.31	
Uniformity	B	Backlight Current IF=60mA	60%	--	--	%
Color	White					

Note: 4 LEDs in parallel connection.

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5. AC Characteristics

5.1   Parallel MPU interface operation
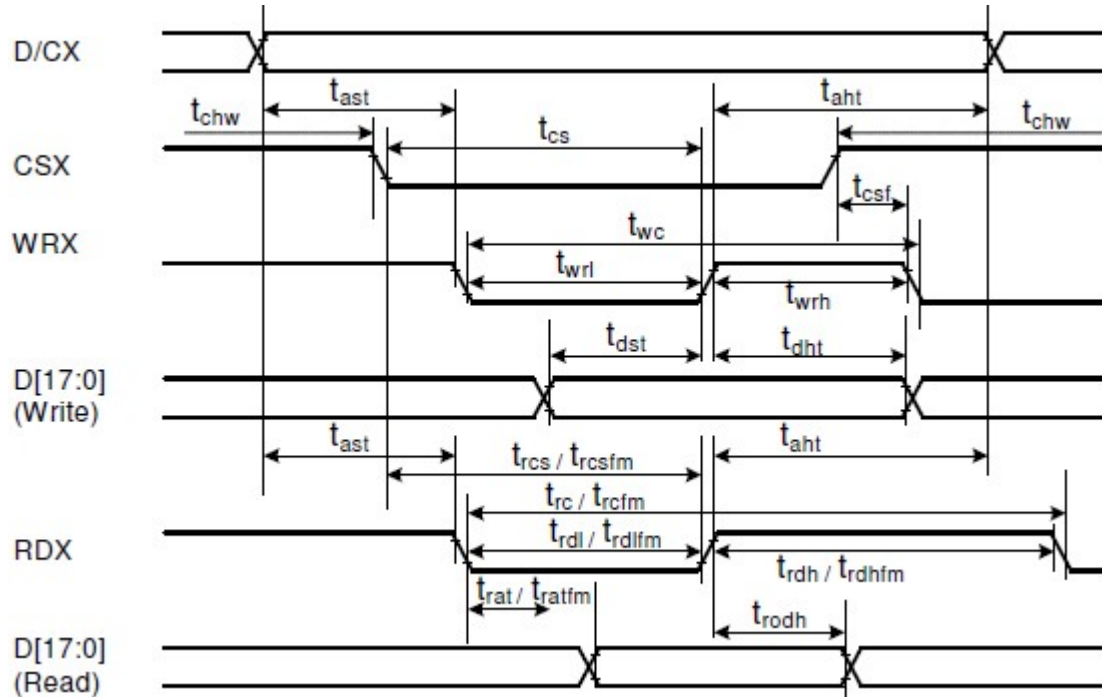
Signal	Symbol	Parameter	min	max	Unit
DCX	tast	Address setup time	0	-	ns
	taht	Address hold time (Write/Read)	0	-	ns
CSX	tchw	CSX "H" pulse width	0	-	ns
	tcs	Chip Select setup time (Write)	15	-	ns
	trcs	Chip Select setup time (Read ID)	45	-	ns
	trcsfm	Chip Select setup time (Read FM)	355	-	ns
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns
WRX	twc	Write cycle	66	-	ns
	twrh	Write Control pulse H duration	15	-	ns
	twrl	Write Control pulse L duration	15	-	ns
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns
	trdhfm	Read Control H duration (FM)	90	-	ns
	trdlfm	Read Control L duration (FM)	355	-	ns
RDX (ID)	trc	Read cycle (ID)	160	-	ns
	trdh	Read Control pulse H duration	90	-	ns
	trdl	Read Control pulse L duration	45	-	ns
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns
	tdht	Write data hold time	10	-	ns
	trat	Read access time	-	40	ns
	tratfm	Read access time	-	340	ns
	trod	Read output disable time	20	80	ns

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6. Power On/Off Sequence

VDDI and VCI can be applied in any order.

VCI and VDDI can be powered down in any order.

During power off, if LCD is in the Sleep Out mode, VCI and VDDI must be powered down minimum

120msec after RESX has been released. During power off, if LCD is in the Sleep In mode, VDDI or VCI can be powered down minimum 0msec after RESX has been released. CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

Note 1: There will be no damage to the display module if the power sequences are not met.

Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.

Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.

Note 4: If RESX line is not held stable by host during Power On Sequence as defined in Sections 12.1 and 12.2, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.

6.1 Case 1 – RESX line is held High or Unstable by Host at Power ON

If RESX line is held High or unstable by the host during Power On, then a Hardware Reset must be applied after both VCI and VDDI have been applied – otherwise correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.
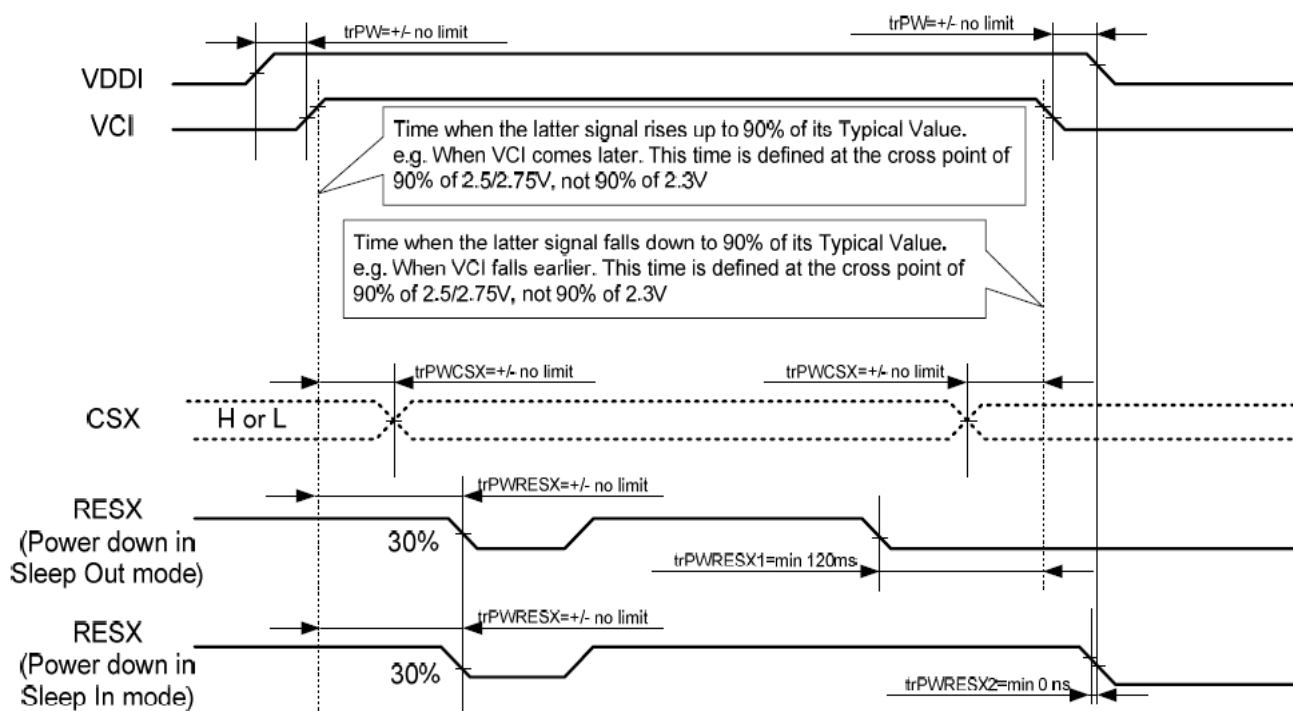
trPWRESX1 is applied to RESX falling in the Sleep Out Mode
trPWRESX2 is applied to RESX falling in the Sleep In Mode

6.2   Case 2 – RESX line is held Low by Host at Power ON

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

trPWRESX1 is applied to RESX falling in the Sleep Out Mode
trPWRESX2 is applied to RESX falling in the Sleep In Mode

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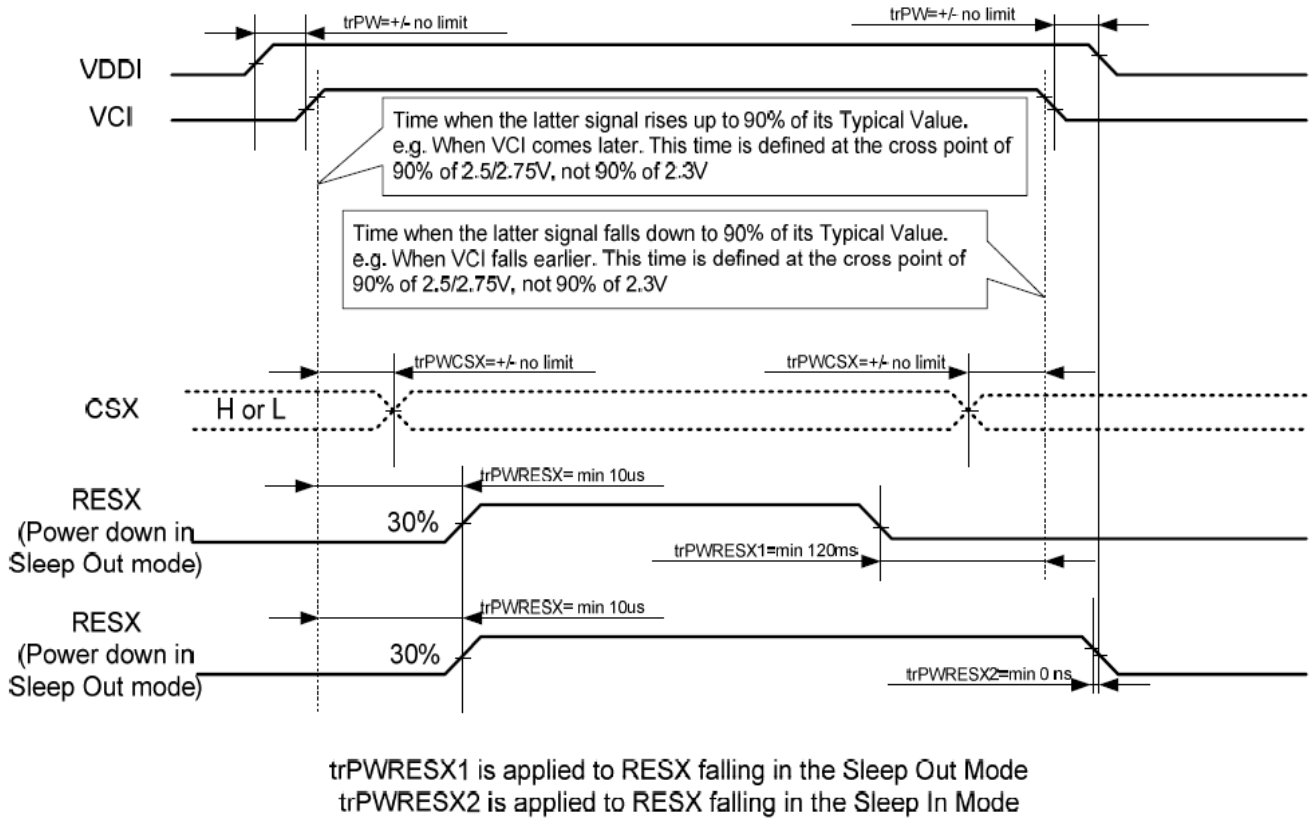
7. Optical Specifications

7.1 Optical Specifications

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)		T (%)		—	4.65	—	%	Measuring with Polarizer，Reference Only
Transmittance (without Polarizer)		T (%)		—	14.6	—	%	
Contrast		CR		640	800	—	—	(1)(2)
Response time	Rising	T_R		—	16	21	msec	(1)(3)
	Falling	T_F	$\Theta=0$ Normal viewing angle	—	19	24		
Color gamut	(%)			—	70	—	%	C-light
Color chromaticity (CIE1931)	White	W_x		0.290	0.310	0.330	—	(1)(4) CF glass
		W_y		0.316	0.336	0.356	—	
	Red	R_x		0.627	0.647	0.667	—	
		R_Y		0.297	0.317	0.337	—	
	Green	G_x		0.255	0.275	0.295	—	
		G_Y		0.562	0.582	0.602	—	
	Blue	B_x		0.120	0.140	0.160	—	
		B_Y		0.068	0.088	0.108	—	
Viewing angle	Hor.	Θ_L	CR>10	—	80	—	—	(1)(4) Measuring with Polarizer，Reference Only
		Θ_R		—	80	—		
	Ver.	Θ_U		—	80	—		
		Θ_D		—	80	—		
Optima View Direction			Free					(5)

7.2 Measuring Condition

■ Measuring surrounding：dark room

■ Ambient temperature：25±2oC

■ 15min. warm-up time.

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7.3 Measuring Equipment

■ FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

Note (1) Definition of Viewing Angle:
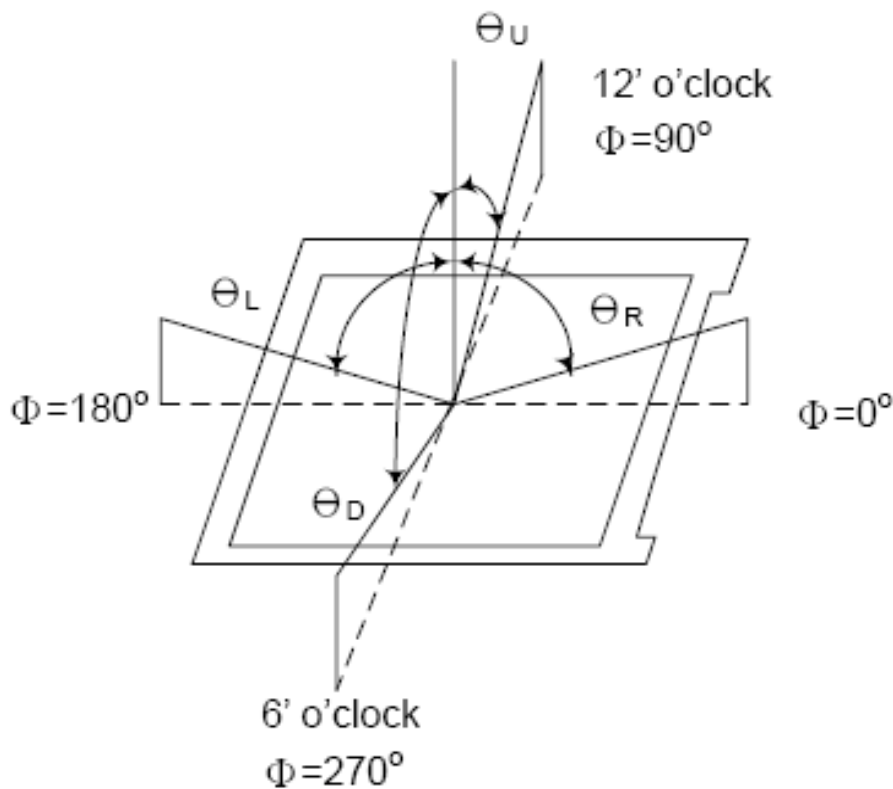
Note (2) Definition of Contrast Ratio (CR) :
        measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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Note (3) Definition of Response Time : Sum of T_R and T_F
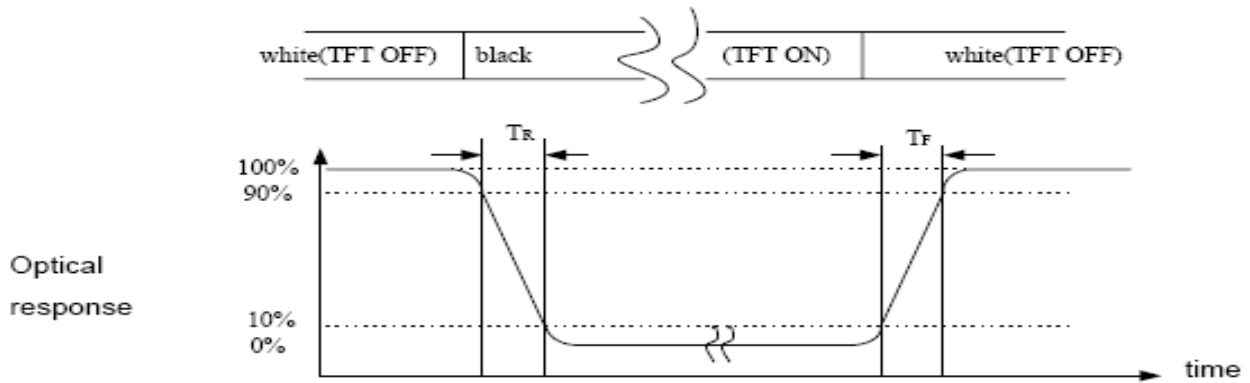
Note (4) Definition of optical measurement setup
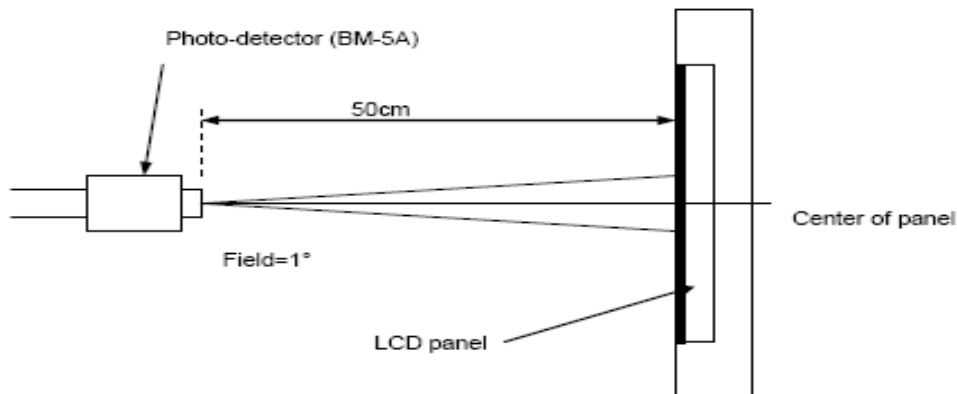
Note (5) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.

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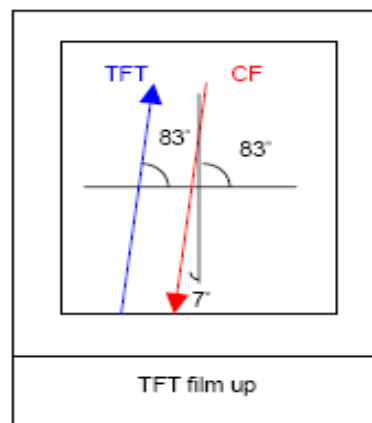
8. Reliability Test Items

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=60℃ H=90%	72Hrs

Reliability Test Criteria:

Display function should be no change under normal operating condition.

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9.Handling Precautions

9.0 GENERAL PRECAUTION

9.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

9.2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. HannStar does not warrant the module, if customers disassemble or modify the module.

9.3 Breakage of LCD Panel

9.3.1.If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

9.3.2. If liquid crystal contacts mouth or eyes, rinse out with water immediately.

9.3.3. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

9.3.4. Handle carefully with chips of glass that may cause injury, when the glass is broken.

9.4 Electric Shock

9.4.1. Disconnect power supply before handling LCD module.

9.4.2. Do not pull or fold the LED cable.

9.4.3. Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

9.5 Absolute Maximum Ratings and Power Protection Circuit

9.5.1. Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.

9.5.2. Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

9.5.3. It's recommended to employ protection circuit for power supply.

9.6 Operation

9.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

9.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

9.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.

9.6.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.

9.6.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

9.7 Mechanism

Please mount LCD module by using mounting holes arranged in four corners tightly.

9.8 Static Electricity

9.8.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

9.8.2 Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

9.9 Strong Light Exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

9.10 Disposal

When disposing LCD module, obey the local environmental regulations.

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10. QC

10.1 Purpose

To ensure the stability of our product and standardize our inspection

10.2 Application Range

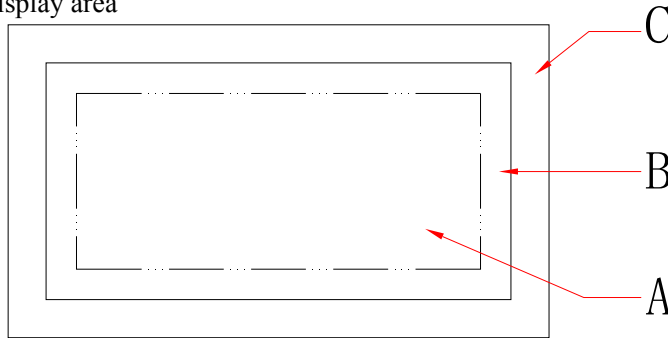This standard is applied to all 3.5 inch and smaller sized LCM product from Elsun Technology Co.Ltd

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 ℃, humidity at 50 ± 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
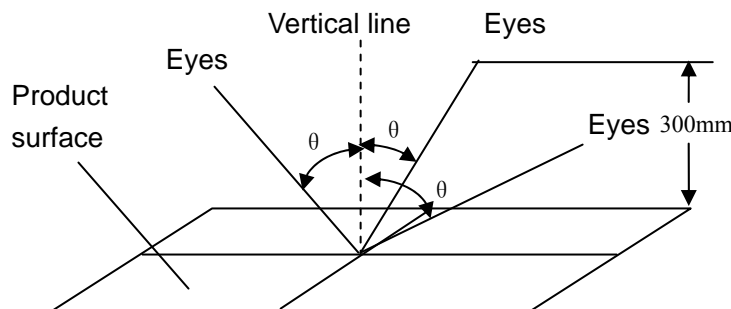
10.5 Identification

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

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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
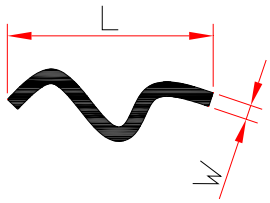
10.6.2 Appearance defect

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: $$\Phi = \frac{(\chi + \gamma)}{2}$$ 2. inspection criteria range	Minor defect
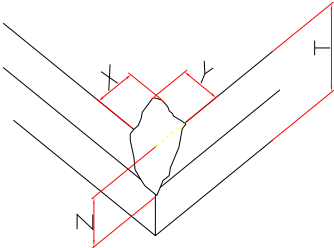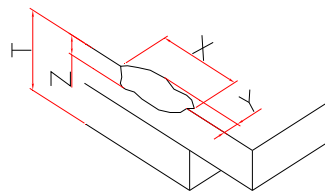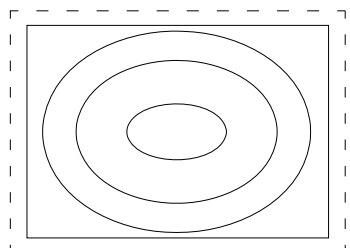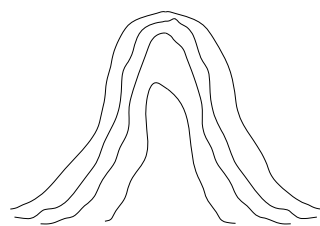
Area and quantity / dimension(mm)	quantity allowed		
	A area	B area	C area
$\Phi \leqslant 0.15$	ignore		
$0.15 < \Phi \leqslant 0.2$	2 （spacing>=10mm ）		ignore
$0.2 < \Phi \leqslant 0.25$	1		
$\Phi > 0.25$	0		

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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 2. inspection criteria					Minor defect

1. identification of line dimension

L: length
W: width

2. inspection criteria

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		ignore
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 |

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

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		ignore
L≤5.0	0.05＜W≤0.08	1		
	W＞0.08	Not allowed		

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No	Inspection item	inspection criteria	defect grade
10.6.2.4	Glass defect	1. broken angle X 不计　Y≤2.0mm 　　or X≤2.0mm　Y 不计 Meanwhile Z＜T ignore 2. other broken part X≤5.0mm　Y≤0.8mm Meanwhile Z≤T ignore	Minor defect
10.6.2.5	Newton ring	1.regular Newton ring ① Newton ring area>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 2. Non-regular Newton ring 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≤1/2 T/P area, and doesn't affect the display result and witouth line distortion; acceptable	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

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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	1. one dot is acceptable. 2. Under bright status, 2 dark dots with more than 5mm distance is allowed. 3. Totally 2 bright or dark dots are acceptable. 4. The other defect under bright status refers to 10.6.2.1 Note: Electric bright/dark dot means one pixel; less than 1/2 of 1 pixel can be ignored.	Minor defect
10.6.3.4	connected dot/line defect	1．Two continuous defect pixel connected dots are not allowed. 2．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	1. Backlight off are not allowed. 2. Uneven light, dead light, flicker light, dark angle, light leakage are not allowed. 3. Brightness should comply with drawing	main defect

end.