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The LCD(M) Specialist

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FOR MESSRS. :

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龐誼科技
11.03.08
發行

ACCEPTED BY : _____ PROPOSED BY : _____

RECORD OF REVISION

DATE	PAGE	SUMMARY
2009/09/07	P4	Update LCM drawing
	P12	Add electro-optical characteristics
2010/02/25	P9	Update pin definition
	P10	Update initial code
2010/09/13	P4	Update LCM drawing
2011/02/14	P23	Add Standard of Tp Newton rings or interference line
2011/03/04	P10	Update initial code
2011/03/08	P4	Update LCM drawing & Reliability

◆ LCD MODULE PHYSICAL DATA

- **General Description**

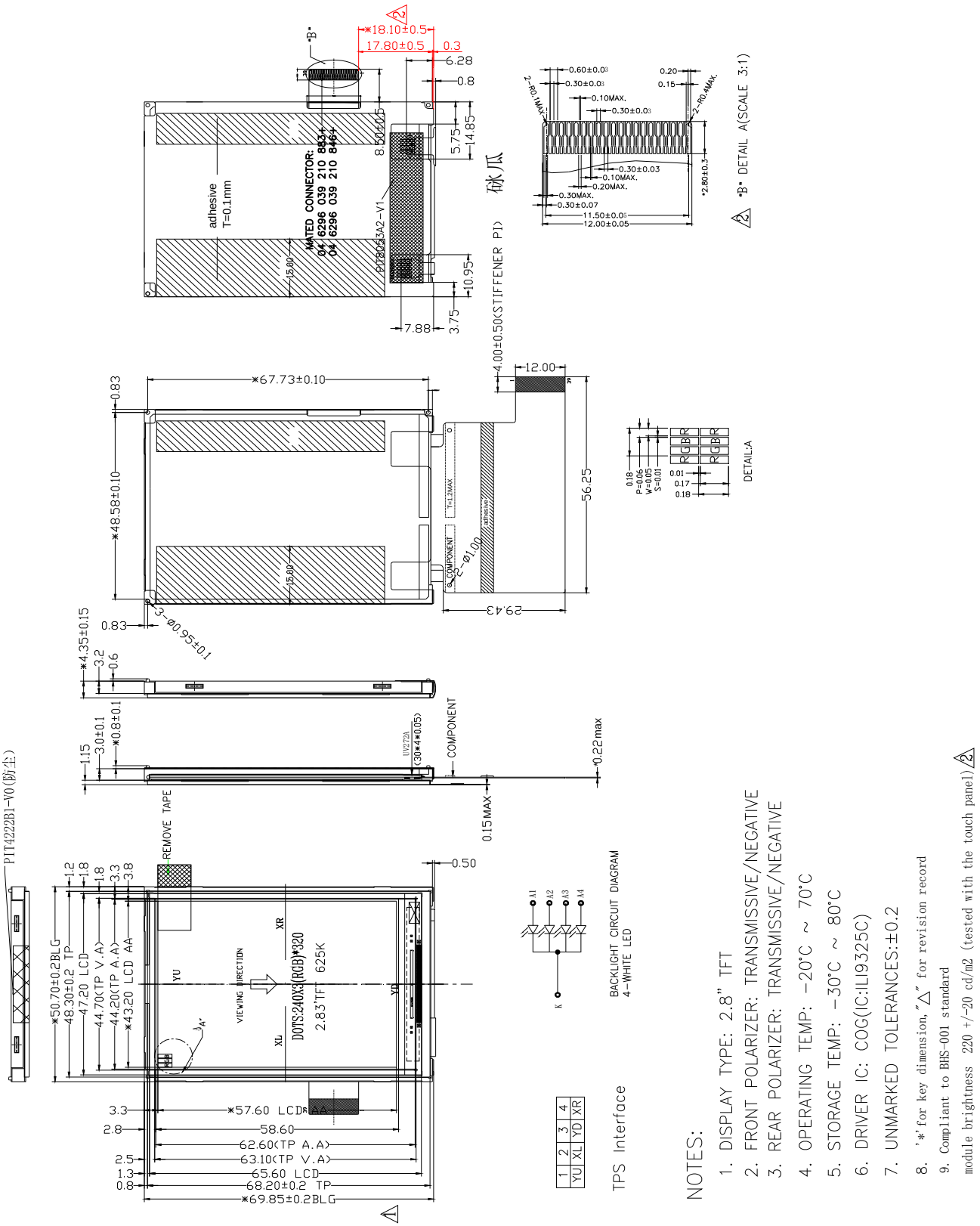
Size	**2.8"**
Display Type	**262K TFT**
Display Mode	**POSITIVE**
Viewing Direction	**12 o'clock**
Connection Type	**COG**
Operation temperature	**-20℃ ~70℃**
Storage temperature	**-30℃ ~80℃**
Driving IC	**ILI9325C**

- **Mechanical Description**

Item	Standard Value	Unit
Number of dots	**240RGB×320dots**	-
LCM dimension	**50.7(W)×69.85(H)×4.35(T)**	**mm**
TP outline	**48.30(W) X68.20(H)**	**mm**
TP Viewing area	**44.70(W) X63.10(H)**	**mm**
TP Active area	**44.20(W) X62.60(H)**	**mm**
Active area	**43.20(W)×57.60(H)**	**mm**
Dot size	**0.17(W)×0.17(H)**	**mm**
Dot pitch	**0.18(W)×0.18(H)**	**mm**
Backlight	**4-chip white LEDS Parallel**	/

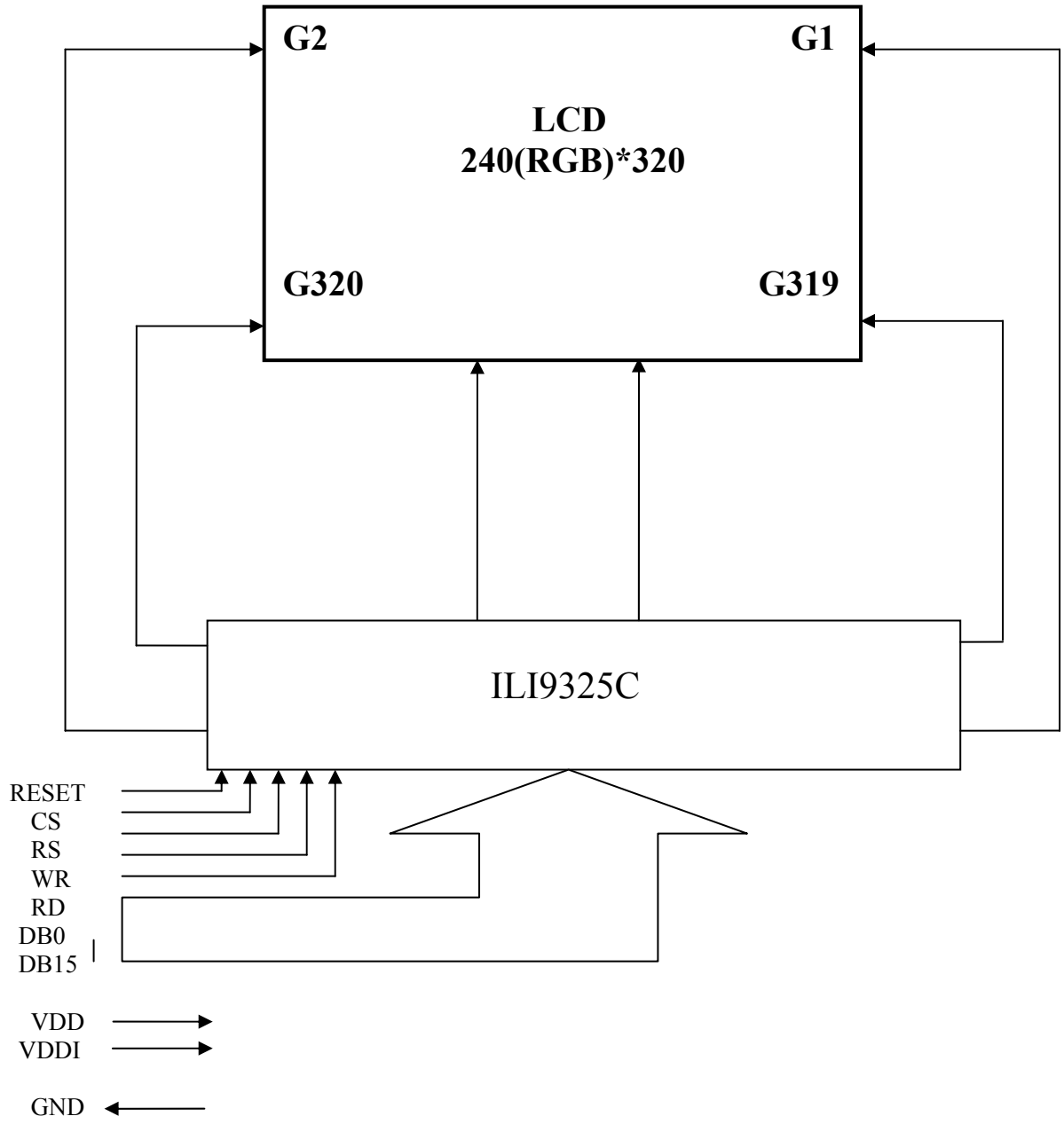
◆ EXTERNAL DIMENSIONS

No:	PIN NAME
1	VDD
2	VDDI
3	RESET
4	CS
5	RS
6	WR
7	RD
8	GND
9	IMO
10	IM1
11	DB0
12	DB1
13	DB2
14	DB3
15	DB4
16	DB5
17	DB6
18	DB7
19	DB8
20	DB9
21	DB10
22	DB11
23	DB12
24	DB13
25	DB14
26	DB15
27	DB16
28	DB17
29	LED_K
30	LED_A1
31	LED_A2
32	LED_A3
33	LED_A4
34	GND
35	X+
36	X-
37	Y+
38	Y-
39	NC

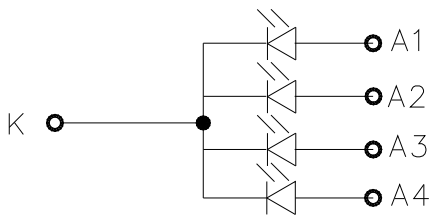


◆ BLOCK DIAGRAM

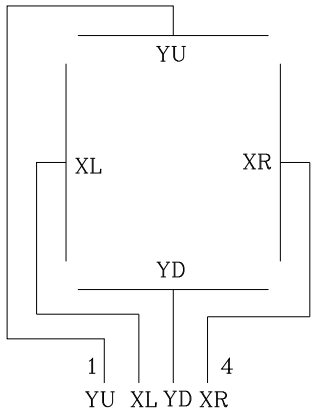
● **TFT-LCD Module (Interface System Structure)**



● **Back- Light Unit**



- **Touch Screen Panel(Top View)(The TP Supplier: Palm Tech)**



◆ ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Rating	Unit
Operating temperature	Top	-20 to 70	℃
Storage temperature	Tst	-30 to 80	℃
Input voltage	Vin	-0.3~VCC+0.3	V
Supply voltage for logic	VCC	~0.3~+4.6	V
Supply voltage for LCD	VGH – VSSA	~0.3~+18.5	V

NOTE:

1. **If the module is used above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.**
2. **VDD>GND must be maintained.**

◆ ELECTRICAL CHARACTERISTICS

● DC Characteristics

Vss= 0V, Ta= 25℃

Item	Symbol	Condition	Min	Typ	Max	Unit
Input high voltage	VIH	-	0.8*IOVCC	-	IOVCC	V
Input low voltage	VIL	-	-0.3	-	0.2*IOVCC	V
Output high voltage	VOH	-	0.8*IOVCC	-	-	V
Output low voltage	VOL	-	-	-	0.2*IOVCC	V
Operating voltage	VDD	Ta=25℃	-	2.8	-	V
Current consumption for LCD normal operation	IDD	VDD =2.8V	-	-	10	mA

● Back-Light unit

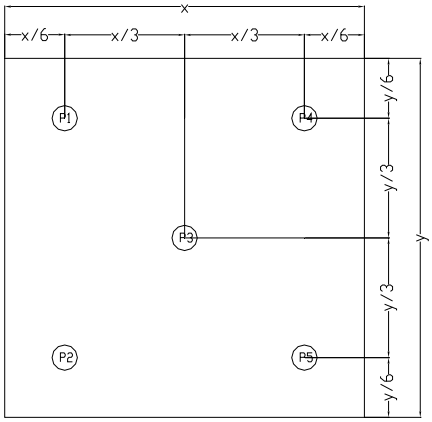
Item	Symbol	Min	Typ	Max	Unit	Remark
Current	I_{BL}	-	15	-	mA	1 LED
CIE	X	0.25	-	0.29	-	
	Y	0.24	-	0.28	-	
Brightness	-	3000	-	-	cd/m²	-
Luminance Uniformity Ratio	-	80	-	-	%	-
Bezel(BE) must be connected to ground of the main board						

Note:

1. Average Luminous Uniformity of P1 ~ P5（Using a luminance meter BM-7）

2. Luminous Uniformity Ratio = min/max * 100%

Measured Method (X*Y: Light Area).



● AC Characteristics

Refer to the SPEC of ILI9325C

◆ TOUCH SCREEN PANEL SPECIFICATIONS

1.Electrical Characteristics

Item	Min	Typ	Max	Unit	Note
Linearity	-	-	1.5	%	X-Axis,Y-Axis
Terminal Resistance	100	-	600	Ω	X(Glass side)
	300	-	900	Ω	Y(Film side)
Insulation Resistance	10	-	-	MΩ	DC 25V
Operating voltage	-	5	-	V	DC
Response Time	-	-	10	Ms	-
Transmittance	80	-	-	%	-

Note 1) : Do not operate it with a thing except a polyacetal pen(tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil

2.Mechanical & Durability Characteristics

Item	Min	Typ	Max	Unit	Note
Operating Force	–	-	80	G	(1)
Touch Test	1,000,000	-	-	Times	(2)
Handwriting Friction Test	100,000	-	-	Times	(3)
Surface hardness	3	-	-	H	(4)

Note (1) Pen : 0.8N or less (R0.8mm)
Finger : 0.8N or less (0.8mm)
(2) Measusuement for Center part of Panel
-Hitting Pad : Tip R8mm Silicon Rubber & Tip R0.8mm Stylus pen
-Lode :150gf
-Speed :2times/sec
-Electric lode :None
(3) Measuremenf for 2.0mm inside of transparent insulation
-Sliding Pen : Tip R0.8mm Stylus pen
-Lode :150gf
-Speed :60mm/sec
-Sliding Length :25mm
-Electric lode : None
(4) Pressure 500gf , 45deg

3. Integration Design Guide

- Avoid the design that Front-case overlap and press on the active area of the touch-panel.
- Give enough gap (over 0.5mm at compressed) between the front case and touch-panel to protect wrong operating.
- Use a buffer material(Gasket) between the touch-panel and Front-case to protect damage and wrong operating.
- Avoid the design that buffer material overlap and press on the inside of touch-panel viewing area.

◆ INTERFACE PIN CONNECTIONS

NO.	Symbol	Function
1	VDD	Power supply
2	VDDI	Power supply for I/O port
3	RESET	Reset signal
4	CS	Chip select
5	RS	Register select pin
6	WR	Write signal
7	RD	Read signal
8	GND	Ground
9	IM0	MPU interface select(NC)
10	IM1	MPU interface select(NC)
11	DB0	16-bit data bus
12	DB1	
13	DB2	
14	DB3	
15	DB4	
16	DB5	
17	DB6	
18	DB7	
19	DB8	
20	DB9	
21	DB10	
22	DB11	
23	DB12	
24	DB13	
25	DB14	
26	DB15	
27	DB16	NC
28	DB17	
29	LED_K	Backlight negative
30	LED_A1	Backlight positive
31	LED_A2	
32	LED_A3	
33	LED_A4	
34	GND	Ground
35	X+	TP pin
36	X-	
37	Y+	
38	Y-	
39	NC	No connection

◆ RECOMMEND INITIAL CODE

```
void initial()
{
 reset=1;
 delayms(1);
 reset=0;
 delayms(10);
 reset=1;
 delayms(50);

//************* Start Initial Sequence **********//
write_command(0x0001);write_data(0x0100);   // set SS and SM bit
write_command(0x0002);write_data(0x0700);   // set 1 line inversion
write_command(0x0003);write_data(0x1030);   // set GRAM write direction and BGR=1.
write_command(0x0004);write_data(0x0000);   // Resize register
write_command(0x0008);write_data(0x0202);   // set the back porch and front porch
write_command(0x0009);write_data(0x0000);   // set non-display area refresh cycle ISC[3:0]
write_command(0x000A);write_data(0x0000);   // FMARK function
write_command(0x000C);write_data(0x0000);   // RGB interface setting
write_command(0x000D);write_data(0x0000);   // Frame marker Position
write_command(0x000F);write_data(0x0000);   // RGB interface polarity
//*************Power On sequence ****************//
write_command(0x0010);write_data(0x0000);   // SAP, BT[3:0], AP, DSTB, SLP, STB
write_command(0x0011);write_data(0x0007);   // DC1[2:0], DC0[2:0], VC[2:0]
write_command(0x0012);write_data(0x0000);   // VREG1OUT voltage
write_command(0x0013);write_data(0x0000);   // VDV[4:0] for VCOM amplitude
write_command(0x0007);write_data(0x0001);
delay(200);       // Dis-charge capacitor power voltage
write_command(0x0010);write_data(0x1690);   // SAP, BT[3:0], AP, DSTB, SLP, STB
write_command(0x0011);write_data(0x0227);   // DC1[2:0], DC0[2:0], VC[2:0]
delay(50);       // Delay 50ms
write_command(0x0012);write_data(0x008e);   // Internal reference voltage   009d
delay(50);       // Delay 50ms
write_command(0x0013);write_data(0x1d00);   // Set VDV[4:0] for VCOM amplitude   1900
write_command(0x0029);write_data(0x0028);   // Set VCM[5:0] for VCOMH   0x0025
write_command(0x002B);write_data(0x000b);   // Set Frame Rate   000d
delay(50);       // Delay 50ms
write_command(0x0020);write_data(0x0000);   // GRAM horizontal Address
write_command(0x0021);write_data(0x0000);   // GRAM Vertical Address
// ----------- Adjust the Gamma Curve ----------//
write_command(0x0030);write_data(0x0007);
write_command(0x0031);write_data(0x0303);
write_command(0x0032);write_data(0x0003);
write_command(0x0035);write_data(0x0206);
write_command(0x0036);write_data(0x0008);
write_command(0x0037);write_data(0x0406);
write_command(0x0038);write_data(0x0304);
write_command(0x0039);write_data(0x0007);
write_command(0x003C);write_data(0x0602);
write_command(0x003D);write_data(0x0008);
//------------------ Set GRAM area ---------------//
write_command(0x0050);write_data(0x0000);   // Horizontal GRAM Start Address
```

```
write_command(0x0051);write_data(0x00EF);   // Horizontal GRAM End Address
write_command(0x0052);write_data(0x0000);   // Vertical GRAM Start Address
write_command(0x0053);write_data(0x013F);   // Vertical GRAM Start Address
write_command(0x0060);write_data(0xA700);   // Gate Scan Line
write_command(0x0061);write_data(0x0001);   // NDL,VLE, REV

write_command(0x006A);write_data(0x0000);   // set scrolling line
//-------------- Partial Display Control ---------//
write_command(0x0080);write_data(0x0000);
write_command(0x0081);write_data(0x0000);
write_command(0x0082);write_data(0x0000);
write_command(0x0083);write_data(0x0000);
write_command(0x0084);write_data(0x0000);
write_command(0x0085);write_data(0x0000);
//-------------- Panel Control -------------------//
write_command(0x0090);write_data(0x0010);
write_command(0x0092);write_data(0x0600);
write_command(0x0007);write_data(0x0133);   // 262K color and display ON

write_command(0x0020);write_data(0x0000);
write_command(0x0021);write_data(0x0000);
write_command(0x0022);


}

void LCD_ExitSleep_ILI9325C(void)
{
//*************Power On sequence ******************//
write_command(0x0010);write_data(0x0080);   // SAP, BT[3:0], AP, DSTB, SLP
write_command(0x0011);write_data(0x0000);   // DC1[2:0], DC0[2:0], VC[2:0]
write_command(0x0012);write_data(0x0000);   // VREG1OUT voltage
write_command(0x0013);write_data(0x0000);   // VDV[4:0] for VCOM amplitude
write_command(0x0007);write_data(0x0001);
delay(200);       // Dis-charge capacitor power voltage
write_command(0x0010);write_data(0x1690);   // SAP, BT[3:0], AP, DSTB, SLP, STB
write_command(0x0011);write_data(0x0227);   // DC1[2:0], DC0[2:0], VC[2:0]
delay(50);       // Delay 50ms
write_command(0x0012);write_data(0x008e);   //Inernal reference voltage =Vci;
delay(50);       // Delay 50ms
write_command(0x0013);write_data(0x1d00);   // VDV[4:0] for VCOM amplitude
write_command(0x0029);write_data(0x0028);   // VCM[5:0] for VCOMH
delay(50);       // Delay 50ms
write_command(0x0007);write_data(0x0133);   // 262K color and display ON
write_command(0x0022);
}

void LCD_EnterSleep_ILI9325C(void)
{
write_command(0x0007);write_data(0x0131);   // Set D1=0, D0=1
delay(10);
write_command(0x0007);write_data(0x0130);   // Set D1=0, D0=0
delay(10);
```

```
write_command(0x0007);write_data(0x0000);   // display OFF
//************* Power OFF sequence **************//
write_command(0x0010);write_data(0x0080);   // SAP, BT[3:0], APE, AP, DSTB, SLP
write_command(0x0011);write_data(0x0000);   // DC1[2:0], DC0[2:0], VC[2:0]
write_command(0x0012);write_data(0x0000);   // VREG1OUT voltage
write_command(0x0013);write_data(0x0000);   // VDV[4:0] for VCOM amplitude
delay(200);         // Dis-charge capacitor power voltage
write_command(0x0010);write_data(0x0082);   // SAP, BT[3:0], APE, AP, DSTB, SLP
}
```

NOTE： The power on/off sequence must be followed, refer to the IC SPEC for details.

◆ ELECTRO-OPTICAL CHARACTERISTICS

Driving condition: VDD=2.8V, I_{BL}= 15mA, Temperature =23℃±5℃， Humidity=60%±20%RH

Item			Light angle (°)	Temp（°C）	Symbol	Specifications			Unit	Conditions	Note
						Min.	Typ.	Max.			
Transmittance			0	25	-	5.2	5.8	-	%	(Equipment :BM-7/CS200)	(1)
Contrast ratio			0	25	Cr	-	600	-	-		(2)
Brightness			0	25	-	-	220	-	cd/m²		-
Luminance uniformity (surface within panel)			0	25	Lu	80	-	-	%		(3)
Cross talk			0	25	CTV	-	-	20	%		(4)
Chromaticity	R x		0	25	Rx	0.5874	0.6374	0.6874	-		-
	R y				Ry	0.2911	0.3411	0.3911			
	G x				Gx	0.2850	0.3350	0.3850			
	G y				Gy	0.5390	0.5890	0.6390			
	B x				Bx	0.0938	0.1438	0.1938			
	B y				By	0.0438	0.0938	0.1438			
	W x				Wx	0.2280	0.2780	0.3280			
	W y				Wy	0.2592	0.3092	0.3592			
Color Reproduction Area(NTSC)			0	25	-	-	62	-	%	CIE1931(x,y)	(5)
Response time	Tr		0	25	-	-	10	-	ms	Viewing normal angle $\theta_X = \theta_Y = 0^0$	-
	Tf					-	15	-			
Viewing angle	Hor.	$\varnothing = 0^\circ$	θ	25	-	50	60	-	deg	Center CR≥10	-
		$\varnothing = 180^\circ$			-	45	55	-			
	Ver.	$\varnothing = 90^\circ$			-	40	50	-			
		$\varnothing = 270^\circ$			-	40	50	-			

Note:

(1) .Transmittance

Introduction

Transmittance (diffuse transmission factor) is a measure for the LCD panel transparency. The Light Source for this measurement is the accompanying LCD-module backlight system (LEDs, Lightguide…)

Measurement conditions:

Measuring Equipment	BM-7/CS-200
Measurement Point Diameter	3mm
Measurement Point Location	Active Area Center Point
Light source	LCD module backlight
Reflectance Plate	Reflectance Standard(cal. plate)
Test pattern	All pixels white
Contrast setting	Maximum

Measuring procedure:

Transmittance:

The light source is located at the backside of the panel.

1、 Measure the light source

2、 Place the LCD panel in front of the light source. Measure the luminance on the LCD panel surface

Definitions

$$\tau = \frac{Lv_{LCD-panel}}{Lv_{lightsource}} * 100\%$$

(2) Definition of Contrast Ratio (C/R): Ratio of gray max (Gmax) & gray min (Gmin) at the center point.

$$CR = \frac{G(Max)}{G(Min)}$$

Where

Gmax: Luminance with all pixels white

Gmin: Luminance with all pixels black

(3). Surface luminance uniformity within panel

Measurement conditions:

Measuring Equipment	CS-200 // BM-7
Measurement Point Diameter	3mm // 1mm
Measurement Point Location	Active Area
Light Source	Transmissive Mode: Internal (Backlight)
Test pattern	White

Measuring procedure:

Measure the luminance Li with the points in figure 1.

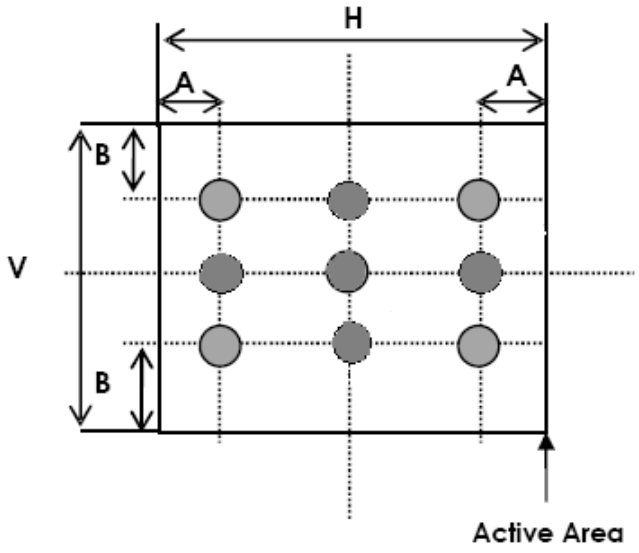


Figure 1

A: 5 mm B: 5 mm
H, V: Active Area

Uniformity value (Lu):

$$Lu = \frac{\min(Li)}{\max(Li)} * 100\%$$

(4).CROSS-TALK

Introduction：

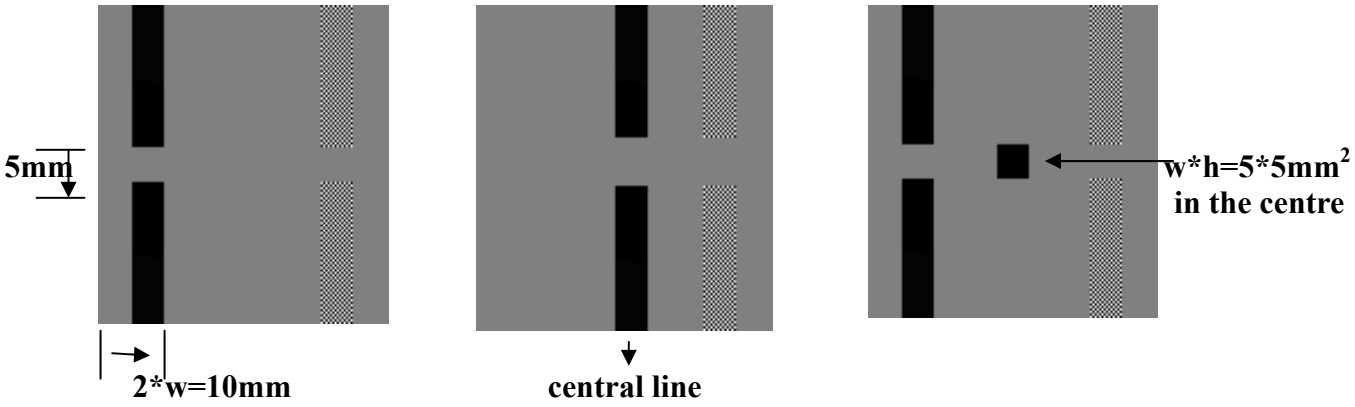
Crosstalk is an effect where the contrast of a display pixel is influenced by the state of the related pixels. A measure for this effect is the Cross Talk Value (CTV)

Measurement conditions:

Measuring Equipment	**CS-200 // BM-7**
Measurement Point Diameter	**3mm // 1mm**
Measurement Point Location	
Light Source	**Transmissive Mode: Internal (Backlight)**
Contrast setting	**Maximum**

●Test Pattern (valid for all greyscales):

W: The width of the rectangle in the following pictures;



Pattern A **Pattern B** **Pattern C**

● Definitions：

Cross Talk Value：

CTV = |LvA - LvB| / LvA * 100%

Where：

LvA: Luminance measured with the centre test point of pattern A

LvB: Luminance measured with the centre test point of pattern B.

● Measuring procedure：

Adaptation of the display to the highest contrast ratio (CR = LvA/LvC) as defined by the test patterns and a test area of 14 x 14 dots.

Measurement of Luminance with test point A, B.

Determination of Crosstalk value (CTV)

(5). NTSC

Measurement conditions:

Measuring Equipment	LCD-5200
Measuring Point Diameter	3mm//1mm
Measuring point location	Active Area center point
Light source	Transmissive Mode: internal(Backlight)
Test pattern	All Pixels White Red.Green.Blue.White: Maximum colour saturation (maximum gradation level)
Contrast setting	Maximum

Definitions

Panel colour coordinates according the CIE colour system (CIE 1931). In general, It is always requested to measure the X, Y and Z values.

Here u´, v´ and L* are according CIE 1931:

$$x' = \frac{4 \cdot X}{X + 15 \cdot Y + 3 \cdot Z}$$

$$y' = \frac{9 \cdot Y}{X + 15 \cdot Y + 3 \cdot Z}$$

$$L^* = 116 \cdot \left(\frac{Y}{Y_n} \right)^{1/3} - 16$$

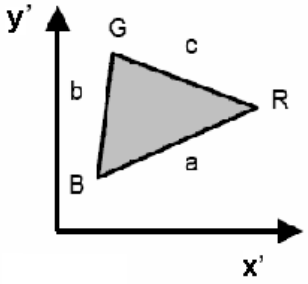
Colour distance definition (maximum allowed colour distance to specified typical colour coordinate):

$$\Delta x'y' = \sqrt{\Delta x'^2 + \Delta y'^2}$$

Where:

$$\Delta x' = Max\left\{ \left| x'_{typ} - x'_{\max} \right|, \left| x'_{typ} - x'_{\min} \right| \right\}$$

$$\Delta y' = Max\left\{ \left| y'_{typ} - y'_{\max} \right|, \left| y'_{typ} - y'_{\min} \right| \right\}$$



Color Gamut definition:

$$F = \sqrt{s(s-a)(s-b)(s-c)} * 1000$$

Where

$$s = \frac{(a+b+c)}{2}$$

$$a = \sqrt{\left(x'_{blue} - x'_{red} \right)^2 + \left(y'_{blue} - y'_{red} \right)^2}$$

$$b = \sqrt{\left(x'_{blue} - x'_{green} \right)^2 + \left(y'_{blue} - y'_{green} \right)^2}$$

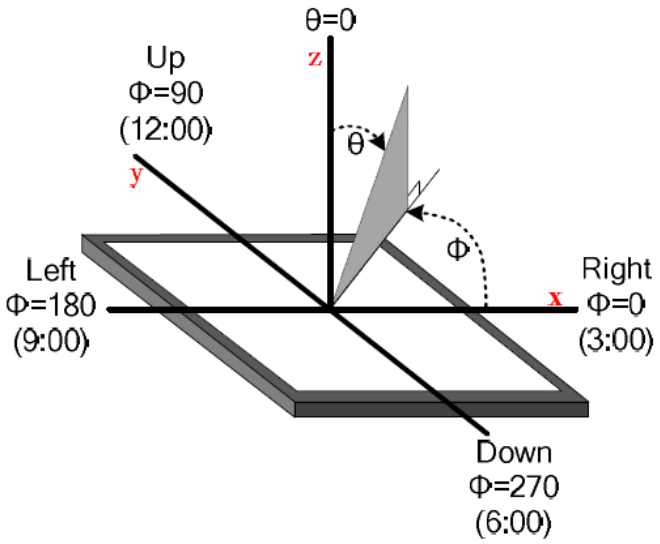
$$c = \sqrt{\left(x'_{red} - x'_{green} \right)^2 + \left(y'_{red} - y'_{green} \right)^2}$$

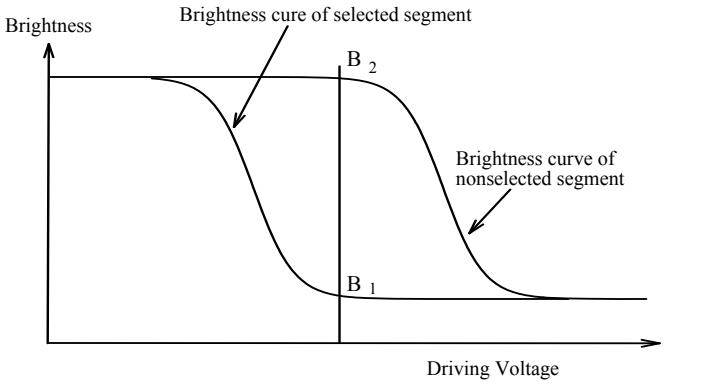
Color Gamut Ratio (NTSC) related to NTSC':
NTSC: =F (display)/F (NTSC')
NTSC' primaries:

	x'	y'
Red	0.67	0.33
Green	0.21	0.71
Blue	0.14	0.08

F (NTSC') =74.42

The definition of viewing angle





Perpendicular line (θ=90°)

◆ SPECIFICATION OF QUALITY ASSURANCE

- **Summary**

The customer should check and accept the products of Palm Tech within one month after reception. This standard for quality assurance should affirm the quality of LCD products to supply to purchaser by Palm Technology Co., Ltd. Entire process is controlled according to ISO9001.

- **Warranty period**

Warranty period of this product is 12 months from manufacture code.

- **Standard for quality test**

1、 Inspection

Before delivering, the supplier should take the following test, and confirm the quality of product.

2、 Electro-Optical Characteristics

According to the individual specification to test the product.

3、 Test of Appearance Characteristics:

According to the individual specification to test the product.

4、 Test of Reliability Characteristics

According to the definition of reliability on specification for test product.

5、Delivery Test

Before delivering, the supplier should take the delivery test

6、Sampling Method: GB/T2828.1-2003, Level II

7、The defects classify of AQL as following

Major defect : AQL=0.4

Minor defect:: AQL= 1.0

- **Nonconforming Analysis & Deal With Manners**

✧ Nonconforming Analysis

1、 Purchaser should supply the detail data of nonconforming sample and the non-suitable state.

2、 After accepting the detail data from purchaser ,the analysis of nonconforming should be finished in two weeks.

3、 If supplier can not finish analysis on time ,must announce purchaser before two weeks.

✧ Disposition of nonconforming

1、 If find any supplier defect during assembly line, supplier must change the good product for every defect after recognition.

2、Both supplier and customer should analysis the reason and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

- **Agreement items.**

Both sides should discuss together when the following problems happen:

1、There is any problem of standard of quality assurance, and both sides think that must be modifier.

2、There is any argument item which does not record in the quality assurance.

3、Any other special problem.

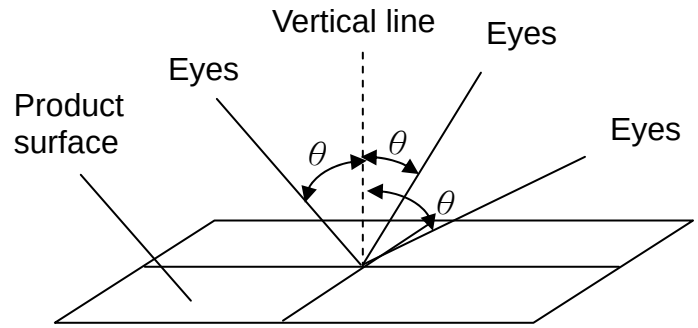
- **Standard of the Product Appearance Test**

■ Manner of appearance test

1、 The test must be under 20W*2 or 40W fluorescent light ,and the distance of view must be at 30±5 cm;

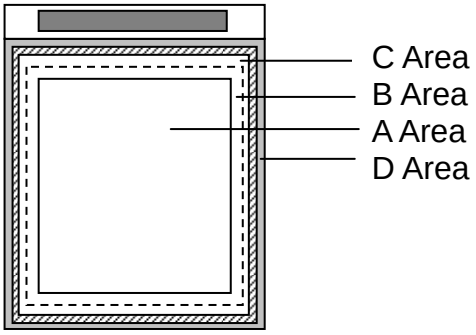
2、 When test the model of Transmissive product must add the reflective plate.

3、 The test direction is base on about around 30 degree(within θ range)of vertical line, and the test time is below 5s.



4、Definition of Area:

A Area: Active area
B Area: Viewing area
C Area: Out of viewing area
D Area: Seal area



Note:
A: Active Area is drawn in the drawing
B: Viewing Area border is 2mm from Active Area border

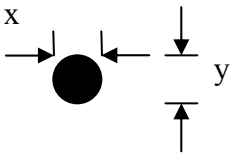
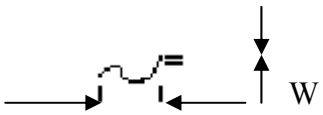
■ Basic principle:

1、 It will accord to the AQL when the standard can not be described.

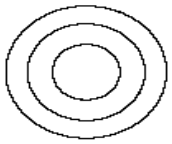
2、 The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

3、 Must add new item on time when it is necessary.

■ **Inspection specification**

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>01</td><td>Electrical Testing</td><td>1.1 Missing vertical, horizontal segment, segment contrast defect.
1.2 Missing character, dot or icon.
1.3 Display malfunction.
1.4 No function or no display.
1.5 Current consumption exceeds product specifications.
1.6 LCD viewing angle defect.
1.7 Contrast defect</td><td>0.4</td></tr>
<tr><td>02</td><td>LCM black spots, white spots, bright spots , contamination (display/non-display)</td><td>Φ=(x+y)/2
x
 
y
<table>
<tr><th></th><th>Size</th><th>Acceptable QTY</th><th>Remark</th></tr>
<tr><td rowspan="4">Common dots defect</td><td>Φ≦0.10</td><td>Ignore</td><td>/</td></tr>
<tr><td>0.10<Φ≦0.20</td><td>2</td><td>No more than 2 spots within 10mm</td></tr>
<tr><td>0.20<Φ≦0.25</td><td>1</td><td>/</td></tr>
<tr><td>0.25<Φ</td><td>0</td><td>/</td></tr>
</table></td><td rowspan="2">1.0</td></tr>
<tr><td>03</td><td>Scratches/line type contamination (display/non-display)</td><td>As following drawing
 
W
L
<table>
<tr><th>Length</th><th>Width</th><th>Acceptable QTY</th><th>Remark</th></tr>
<tr><td>---</td><td>W≦0.02</td><td>Ignore</td><td>/</td></tr>
<tr><td>L≦3.0</td><td>0.02< W≦0.03</td><td>3</td><td rowspan="2">More than 10mm between two defects</td></tr>
<tr><td>L≦2.5</td><td>0.03< W≦0.05</td><td>3</td></tr>
<tr><td>---</td><td>0.05< W</td><td>0</td><td>/</td></tr>
</table>
The LCD with extensive crack is not acceptable.</td></tr>
</table>

<table>
<tr><td>04</td><td>Polarizer bubbles</td><td>If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.<table><tr><th>Size</th><th>Acceptable QTY</th><th>Remark</th></tr><tr><td>Φ≦0.2 0</td><td>ignore</td><td>/</td></tr><tr><td>0.20<Φ≤0.50</td><td>2</td><td>More than 10mm between two defects</td></tr><tr><td>0.50<Φ</td><td>0</td><td>/</td></tr></table></td><td>1.0</td></tr>
<tr><td>05</td><td>Backlight elements</td><td>5.1 Illumination source flickers when lit.
5.2 Spots or scratches that appear when lit must be judged using LCD spot, lines and contamination standards.
5.3 Backlight doesn’t light or color is wrong</td><td>0.4
1.0
0.4</td></tr>
<tr><td>06</td><td>Soldering</td><td>6.1 No unmelted solder paste may be present on the PCB.
6.2 No cold solder joints, missing solder connections, oxidation or icicle.
6.3 No residue or solder balls on PCB.
6.4 No short circuits in components on PCB.</td><td>0.4
0.4
1.0
0.4</td></tr>
<tr><td>07</td><td>General appearance</td><td>7.1 No oxidation, contamination, curves or, bends on interface pin (OLB) of FPC
7.2 No cracks on interface pin(OLB) of FPC
7.3 NO contamination, solder residue or solder balls on product.
7.4 The IC on the FPC may not be damaged, circuits.
7.5 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.
7.6 Sealant on top of the ITO circuit has not hardened
7.7 Pin type must match type in specification sheet.
7.8 LCD pin loose or missing pins.
7.9 Product packaging must the same as specified on packaging specification sheet.
7.10 Product dimension and structure must conform to product specification sheet.</td><td>1.0
0.4
1.0
0.4
1.0
1.0
1.0
0.4
1.0
1.0</td></tr>
</table>

08	Tp Newton rings or interference line	inerratic  anomalous 	1.over AA area 1/3；NG 2. effect of transmittance or distortion under light；NG	Minor defect	/	1.0

◆ RELIABILITY

1. Environmental Test

No	Test Item	Test Condition& Criteria	Sample Size	Determinant Stand.
1-1	High Temperature Operation	Temperature:70±3℃; Humidity: Except; Test method: Operation Duration: 96Hrs	Sample Do:≥2PCS On Going:≥3PCS/ LOT	TS-01 TS-02
1-2	Low temperature Operation	Temperature:-20±3℃; Humidity: Except; Test method: Operation Duration: 96Hrs	Sample Do:≥2PCS On Going:≥3PCS/ LOT	TS-01 TS-02
1-3	High Temperature / High Humidity Operation	Temperature:50±3℃; Humidity: 90%±3%RH; Test method: Operation Duration: 96Hrs	Sample Do:≥2PCS On Going:≥3PCS/ LOT	TS-01 TS-02
1-4	Temperature Cycle	-20±2℃~25~70±2℃×10cycles (30min.) (5min.) (30min.)	Sample Do:≥2PCS On Going:≥3PCS/ LOT	TS

Item	FAULT JUDGMENT CRITERIA
TS-01	1. Contrast ratio must be at least 50% of initial value. 2. R, G and B color area must be at least 0.5 times initial value. 3. Current consumption must not exceed 2 times initial value.
T -02	1. No clearly visible defects or deterioration of display quality allowed. 2. No function – related abnormalities.

NOTE：

1. When temperature moves, LCD’s valve voltage will be influenced by it, which leads to LCD's contrast and chroma change.
2. In high temperature operation and storage tests in MQE test will make LCD's power consumption increase. The reason is that a few crystal molecules are apart because of high temperature when there is a long time storage and operation in high temperature, which leads to decrease of gross resistance ratio of crystal molecules. Hence, LCD’s power consumption goes up than that of before test.

2. Mechanical Reliability Test

No.	Test Item	Test Condition& Criteria	Sample Size	Determinant Spec.
2-1	ESD test	Discharge modality: Contact voltage: ±1KV、±2KV; Air voltage: ±2KV、±4KV、±6KV; (Discharge R=330Ω;C=150PF)	2 PCS	No software error
2-2	LCM monomer drop test	Drop high:60cm~80cm； Drop to ground: marble Drop direction /times:3 times each obverse and inverse	2 PCS	The inspection of appearance,the whole structure no error
2-3	Static compression test	Pressed area: at the panel center; Diameter:4mm，Length:50mm; press speed:V≤30mm/Min.	10 PCS	The minimum and average of all Static compression value according with corresponding Standard.
2-4	Low temperature knock test	-20±3℃,Storage:24H, Steel ball (Ø=10±1mm,G=5.5±0.5g) knock:10cm to ground and knock 5 times.	2 PCS	The inspection of appearance, capability and the whole structure no error

3. FPC cable flexing and bending test

Number of Bending / Flexing Cycles:	<10 times
Radius of the Bend Mandrels:	>0.4 mm
Degree of Bend:	<180°

◆ SUGGESTIONS FOR USING LCD MODULES

- **Handling of LCM**

(1) The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.

(2) If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.

(3) Don't apply excessive force on the surface of the LCM.

(4) If the surface is contaminated ,clean it with soft cloth. If the LCM is severely contaminated , use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer . The following solvents is especially prohibited: water , ketone Aromatic solvents etc.

(5) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(6) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(7) Don't disassemble the LCM.

(8) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

(9) Do not alter, modify or change the the shape of the tab on the metal frame.

(10) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(11) Do not damage or modify the pattern writing on the printed circuit board.

(12) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector

(13) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(14) Do not drop, bend or twist LCM.

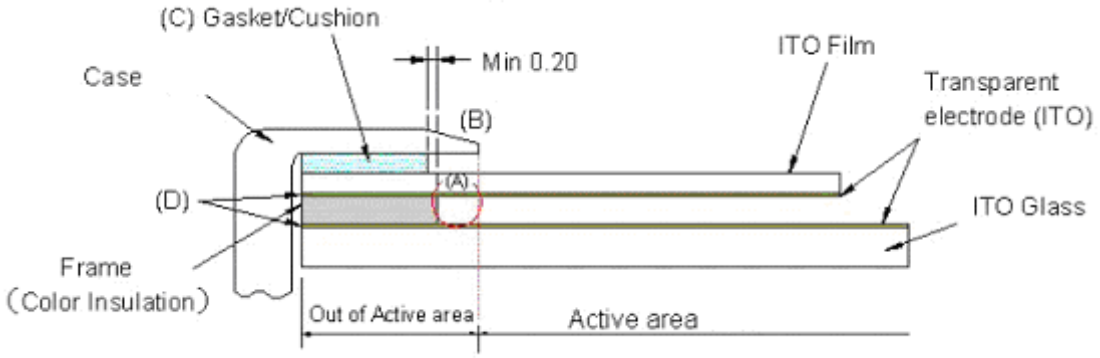
(15) If the LCM is assembled with touch panel, pay more attention to using touch panel.

* Please wear clean finger sacks, gloves and mask to protect the products from fingerprint or stain attach, and also hold the portion outside the view area when handling the panel.

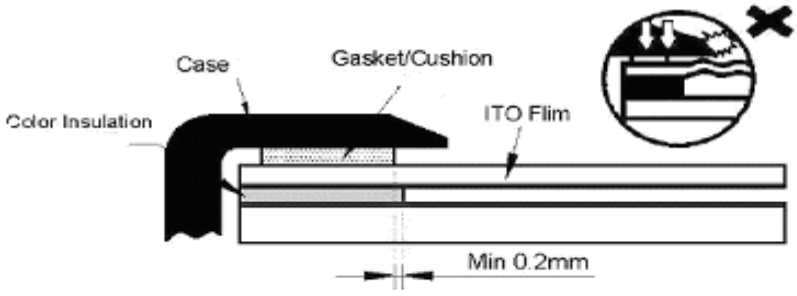
* Please use finger sacks or gloves to avoid injuries by sharp edges when handling the Film-Glass type touch panel because a glass edges are not chamfered.

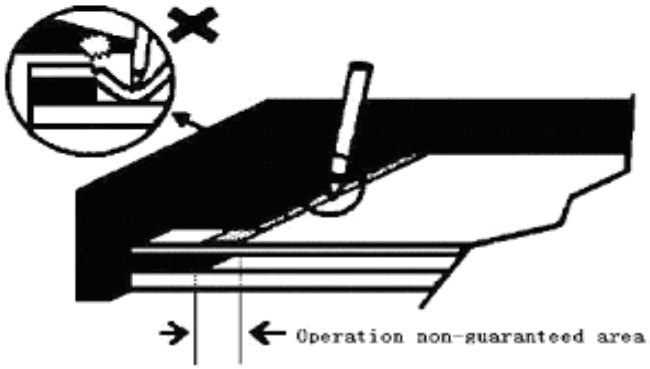
* Cautions for installing and assembling

- Do not give excessive strain to the product.
- Flexible pattern cable is connected to the TP body by heat-seal(thermal pressure) method. So, do not apply excessive forces to the flexible pattern.
- In order not to apply load on the surface of the touch panel, please keep a clearance of 0.2mm-0.5mm between product and case.
- Pressing inside of boundary of the frame(part(A) as shown in below) may cause fault operation, so please design to avoid pressing of touch panel at part (A) such as having gasket/cushion at part (C). Particularly the area (B) shall be free from burr. The gasket/cushion material at the part (C) should not be exceeded to inside of the boundary of the frame.

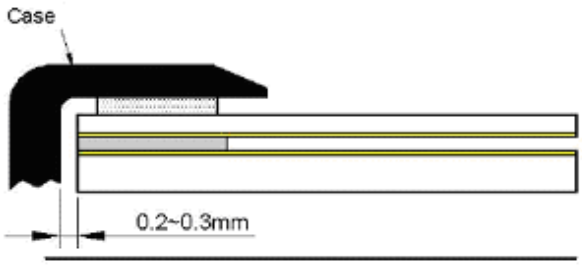


Do not make the following mistakes:

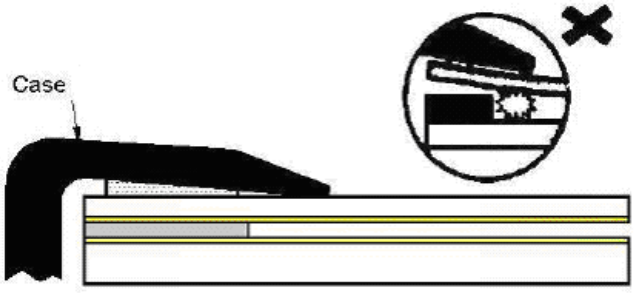




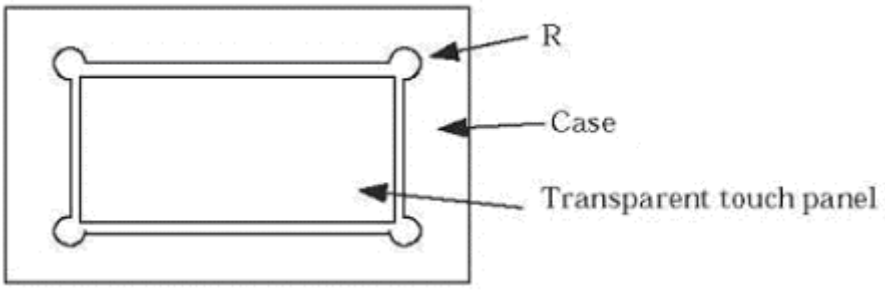
- When designing installment of case and touch panel, you would better consider to keep clearance of 0.2-0.3mm between touch panel and inside boundary of case.



- Please keep your case flat in order not to touch with touch panel directly which causes serious damage of a transparent electrode.



- Do not use any organic solvent or detergent other than ethanol.
- The corners of the product are not chamfered. When positioning and fixing the product on the case, we suggest that you would provide a R part on the corner of the case so as net to apply load on the corner of the transparent touch panel.



- Please confirm its characteristic in advance whether any damage is given to this product when attaching a protection sheet on this product at customer side. Some changes may arise in the characteristics of this product by the protection sheet attachment such as operation, cosmetic, etc.. However, those changes are out of our guarantee.
-

- **Storage**

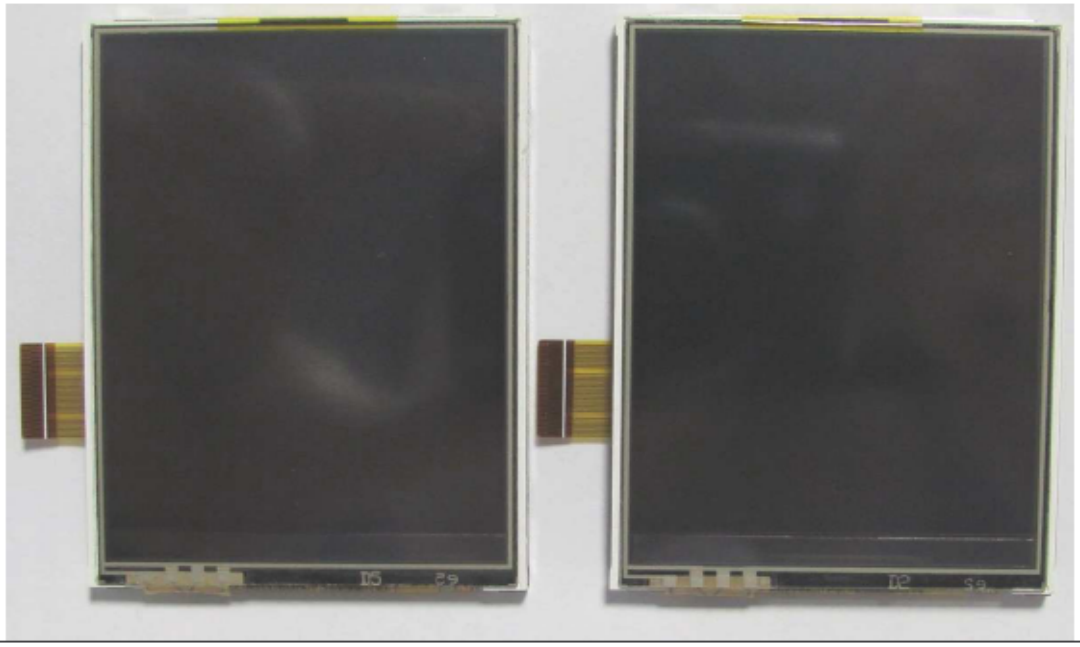
(1) Store in an ambient temperature of 5 to 45 °C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.

(2) Storage in a clean environment, free from dust, active gas, and solvent.

(3) Store in antistatic container.

- **the pictures of different versions' product**

PGO4274B_LF / PGO4274BB_LF / PGO8617G_LF



PGO8617I_LF

PGO8617G_LF (new TP)