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# **BYD LCM** **PRODUCT SPECIFICATIONS**



**MODULE NO.: BM1024600-8688FTGD**

**For Customer:** \_\_\_\_\_

**Approved by:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

Please sign the cover page of the spec for your approval and return it to our local sales **within a month** after your receipt of the spec from Byd. In the case Byd does not receive the signed spec even after one month later, in general we will consider that the spec was already accepted by your company.

Prepared	Checked	Approved	Date
Zhang Yunduan	Yang Jianfeng	Wang Huazu	2010-6-4



## History of Versions and Modifications

Version	Modifications	Date
A	Generation first version	2010-1-27
B	Update inspection specification	2010-5-12
C	Add current consumption & backlight driving conditions	2010-6-4



# **PRODUCT SPECIFICATIONS**

- ◆ **MODULE CLASSIFICATION INFORMATION**
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## ◆ MODULE CLASSIFICATION INFORMATION

**BM1024600-8688FTGD****B:** BYD Company Limited**M:** M: LCD Module    **P:** LCD Panel**1024600:** Display Capacity**8688:** Serial Number**F:** LCM**T:** TN**G:** STN Gray**E:** ECB LCD**H:** HTN**D:** DSTN**M:** MLCD**Y:** STN Yellow green**W:** FSTN**F:** TFT LCD**B:** STN Blue**C:** Color STN**O:** OLED**T:** Display Mode**T:** Transmissive**R:** Reflective**F:** Transflective**C:** Oled Color**M:** Oled Mono**G:** Connection Type or module Circuit Technique**P:** Pin connection**B:** COB**O:** Others**H:** Heat seal**T:** TAB**C:** FPC**G:** COG**Z:** Zebra**F:** COF**D:** Product Version:    From A to Z



## ◆ LCD MODULE PHYSICAL DATA

● General Description

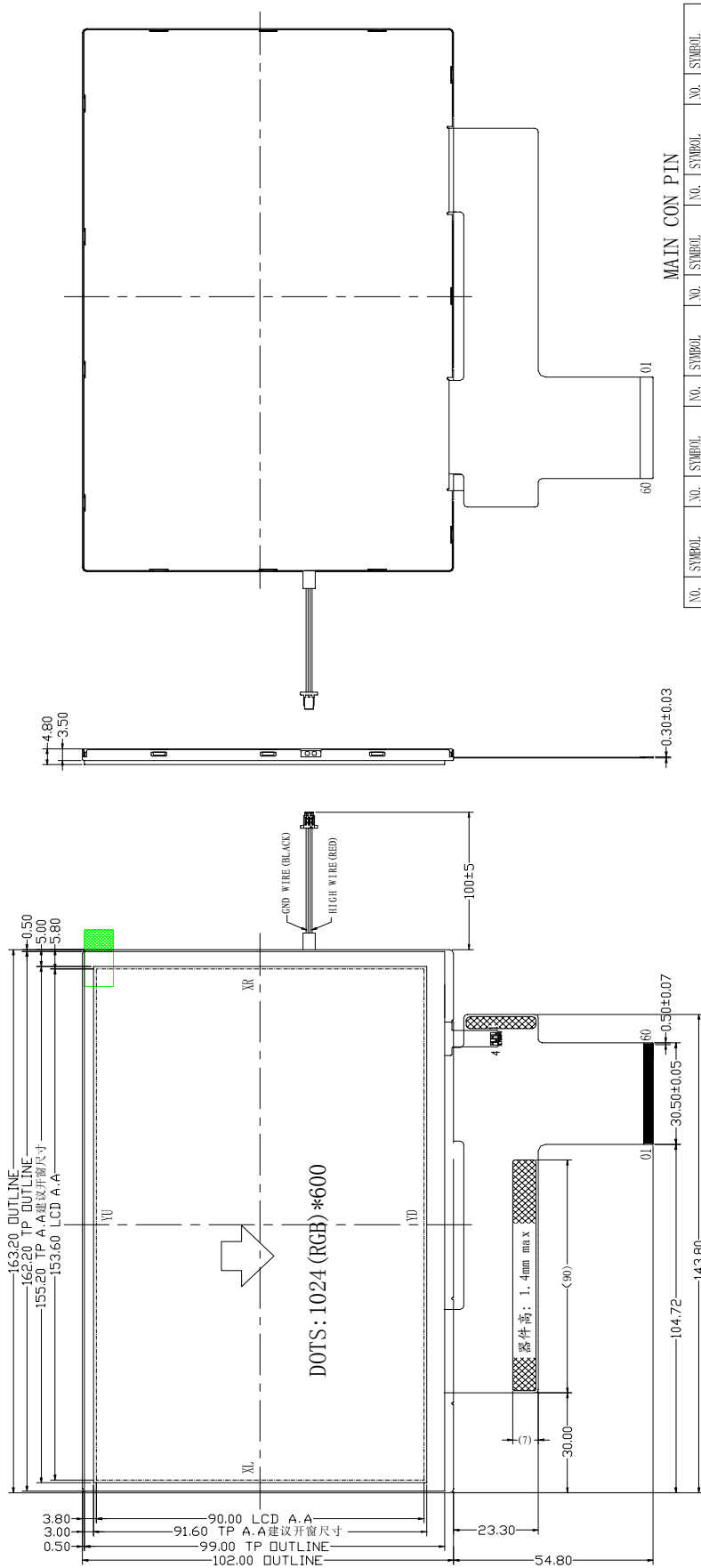
Size	7.0"
Display Type	16M TFT
Display Mode	TRANSMISSIVE
Viewing Direction	12 o'clock
Connection Type	COG
Operation temperature	-20℃ ~ 70℃
Storage temperature	-30℃ ~ 80℃
Driving IC	NT51008*2 & NT52002

● Mechanical Description

Item	Standard Value	Unit
Number of dots	1024RGB×600dots	-
LCM dimension	163.2(W)×102.0(H)×4.8(T)	mm
TP outline	162.2(W)×99.0(H)	mm
TP active area	155.20(W)×91.60(H)	mm
Active area	153.60(W)×90.0(H)	mm
Dot size	0.14(W)×0.14(H)	mm
Dot pitch	0.15(W)×0.15(H)	mm
Backlight	24-chip white LEDS	/

The KEY and accessory materials of our product according with BHS-001 standard

## ◆ EXTERNAL DIMENSIONS



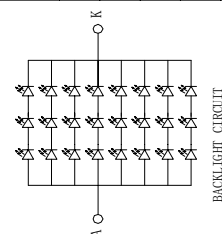
MAIN CON PIN											
NO.	SYMBOL	NO.	SYMBOL	NO.	SYMBOL	NO.	SYMBOL	NO.	SYMBOL	NO.	SYMBOL
01	AGND2	11	B7	21	B1	31	VSNC	41	VCOM	51	XL
02	AVDD2	12	G0	22	B2	32	SL	42	DIM0	52	YD
03	VDD0	13	G1	23	B3	33	SDA	43	DIM1	53	XB
04	VDD1	14	G2	24	B4	34	CSB	44	NC	54	YU
05	R1	15	G3	25	B5	35	STDVB	45	NC	55	NC
06	R2	16	G4	26	B6	36	VDD	46	NC	56	VGH
07	R3	17	G5	27	B7	37	RESET	47	NC	57	NC
08	R4	18	G6	28	DCLK	38	GND	48	NC	58	VGL
09	R5	19	G7	29	DE	39	AGND1	49	NC	59	GGND
10	R6	20	B0	30	ASVNC	40	AVDD1	50	NC	60	NC

## BYD COMPANY LIMITED

REVISION RECORD		DATE	BYD COMPANY LIMITED			
1			TITLE: LCM OUTLINE DIMENSION		D/N: BM86880	
2			FILE NAME: 86880 模组图	Rev: 0	P/N:	
3			FILE NO.: LCD-TE-000455		Ver: A	SCALE: N.T.S.
4			DRAWN BY: 刘瑛	DATE: 20100126	UNIT: mm	
5			CHECKED BY: 李跃闯	DATE: 20100126	PRO. (3): 	
6			APPROVED BY: 刘建新	DATE:	SHEET: 1/1	

## NOTES:

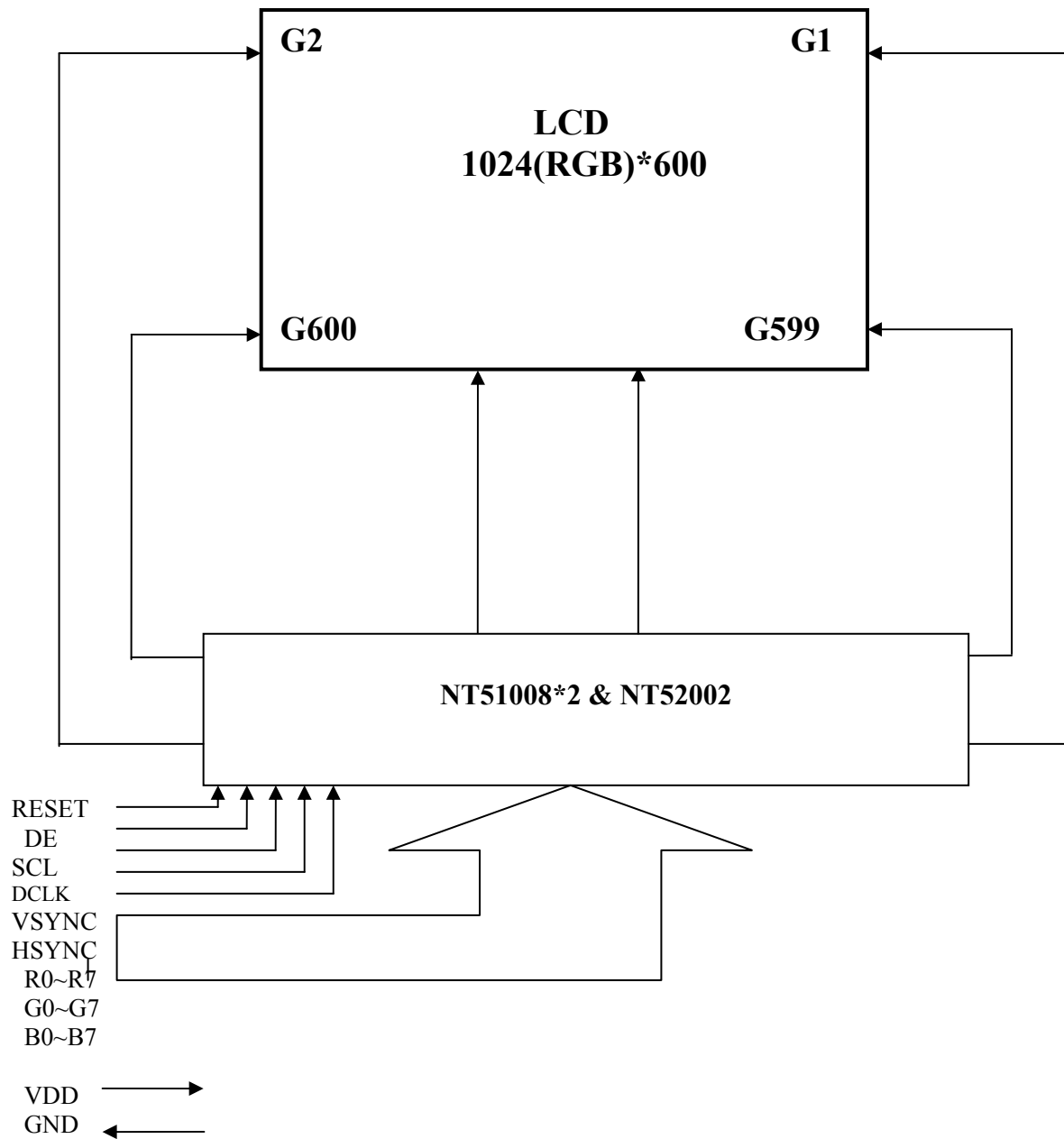
1. DISPLAY TYPE: TFT 16.2M/T
2. VIEWING DIRECTION: 12 O'CLOCK
3. OPERATING TEMP: -20° C--70° C
4. STORAGE TEMP: -30° C--80° C
5. DRIVER: COG(1C; NT51008\*2+NT52002)
6. CONNECTOR: 0.5mm Pitch兼容连接器
7. BACKLIGHT: 24 WHITE LEDS, 表面亮度: 300cd/m<sup>2</sup>
8. \*号为重点符号, △号为修改记录。
9. GENERAL TOLERANCE: ±0.3



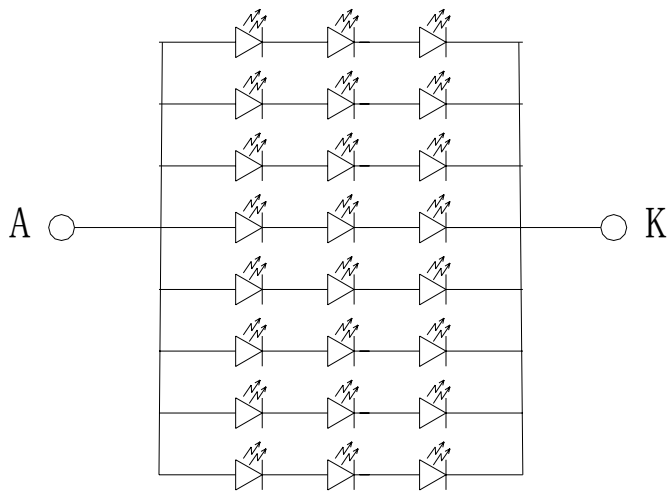
表格编码: FMLCD-MA-000010-02 A

## ◆ BLOCK DIAGRAM

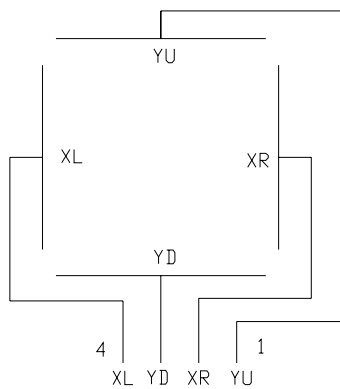
### ● TFT-LCD Module (Interface System Structure)



● **Backlight Circuit**



● **Touch Screen Panel(Top View)**





**◆ ABSOLUTE MAXIMUM RATINGS**

Item	Symbol	Rating	Unit
Operating temperature	Top	-20 to 70	°C
Storage temperature	Tst	-30 to 80	°C
Input voltage	Vin	-0.3 to VCC+0.3	V
Supply voltage for logic	VCC	-0.3 ~ + 3.3	V
Power supply voltage	IOVCC	-0.3 ~ +3.3	V
Supply voltage for LCD	VGH – VSSA	-0.3 to 16	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

V<sub>SS</sub>= 0V, Ta= 25℃

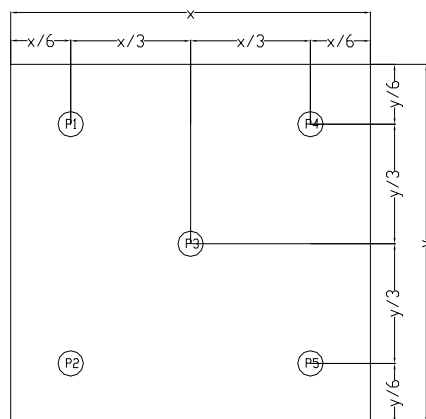
Item	Symbol	Condition	Min	Typ	Max	Unit
Input high voltage	V <sub>IH</sub>	-	0.7* VDD	-	VDD	V
Input low voltage	V <sub>IL</sub>	-	0	-	0.3* VDD	V
Output high voltage	V <sub>OH</sub>	-	0.7* VDD	-	-	V
Output low voltage	V <sub>OL</sub>	-	-	-	0.3* VDD	V
Operating voltage	AVDD	Ta=25℃	-	12	-	V
Current consumption for LCD normal operation	I <sub>DD</sub>	AVDD =12V	-	-	45	mA

### ● Back-Light unit

Item	Symbol	Min	Typ	Max	Unit	Remark
Current	I <sub>BL</sub>	-	160	-	mA	24 LEDS
CIE	X	0.25	-	0.29	-	-
	Y	0.24	-	0.28	-	
Brightness	-	-	4500	-	cd/m	-
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 =(The Lvmin/Lvmax) \* 100%
- Measured Method (X\*Y: Light Area).





## ◆ TOUCH SCREEN PANEL SPECIFICATIONS

### 1. Electrical Characteristics

Item	Min	Typ	Max	Unit	Note
Linearity	-	-	1.5	%	X-Axis,Y-Axis
Terminal Resistance	-	TBD	-	$\Omega$	X(Glass side)
	-	TBD	-	$\Omega$	Y(Film side)
Insulation Resistance	20	-	-	M $\Omega$	DC 25V
Operating voltage	-	TBD	-	V	DC
Response Time	-	-	TBD	Ms	-
Transmittance	75	-	-	%	-

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	50	-	200	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) Measurementf 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	AGND2	GND
2	AVDD2	+12V
3	VDD	Power supply (TYP: +3.3V)
4	R0	RED Data bus
5	R1	
6	R2	
7	R3	
8	R4	
9	R5	
10	R6	
11	R7	
12	G0	GREEN Data bus
13	G1	
14	G2	
15	G3	
16	G4	
17	G5	
18	G6	
19	G7	
20	B0	BLUE Data bus
21	B1	
22	B2	
23	B3	
24	B4	
25	B5	
26	B6	
27	B7	
28	DCLK	Dot clock signal
29	DE	Data enable signal in RGB I/F mode
30	HSYNC	Horizon sync signal
31	VSNC	Vertical sync signal
32	SCL	Serial clock input pin
33	SDA	Serial data input pin
34	CSB	Lcd chip select
35	STBYB	Standby mode, Normally pulled high. STBYB = "1", normal operation STBYB = "0", timing controller, source driver will turn off, all output are High-Z
36	VDD	Power supply (TYP: +3.3V)
37	RESET	Reset signal
38	GND	Ground
39	AGND1	GND
40	AVDD1	+12V
41	VCOM	+3.9V



42	DIMO	Brightness control signal. Normally pull high
43	DIMI	Backlight dimmer signal for external controller. DIMO = "0", Turn off external backlight controller DIMO = "1", Logical control signal to turn on external backlight controller NOTE : If CABC OFF , DIMO = DIMI . Else DIMO is controlled by CABC
44	NC	No connection
45	NC	
46	NC	
47	NC	
48	NC	
49	NC	
50	NC	TP interface
51	XL	
52	YD	
53	XR	
54	YU	No connection
55	NC	
56	VGH	+16V
57	NC	No connection
58	VGL	-7V
59	GGND	GND
60	NC	No connection

## Current Consumption

(PCLK=50MHZ)

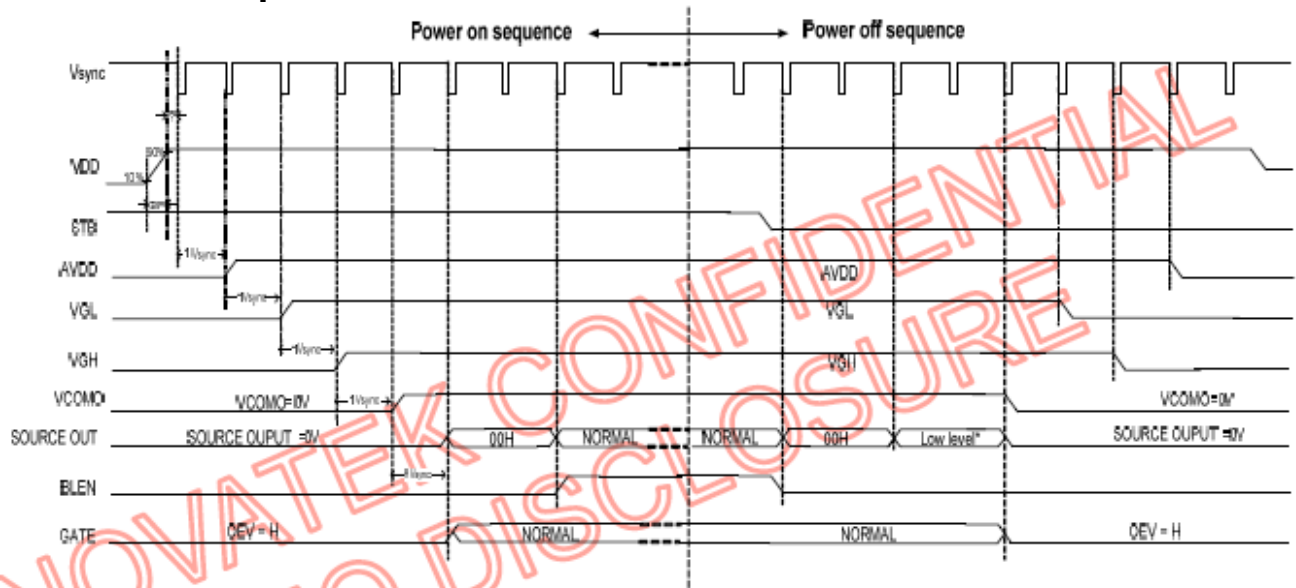
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	IGH		0.2	0.5	mA	V <sub>GH</sub> =16V
	IGL		0.2	1.0	mA	V <sub>GL</sub> = -7.5V
	ICC		80	120	mA	V <sub>CC</sub> =3.3V
	IAV <sub>DD</sub>		39	50	mA	AV <sub>DD</sub> =12V

## Backlight Driving Conditions

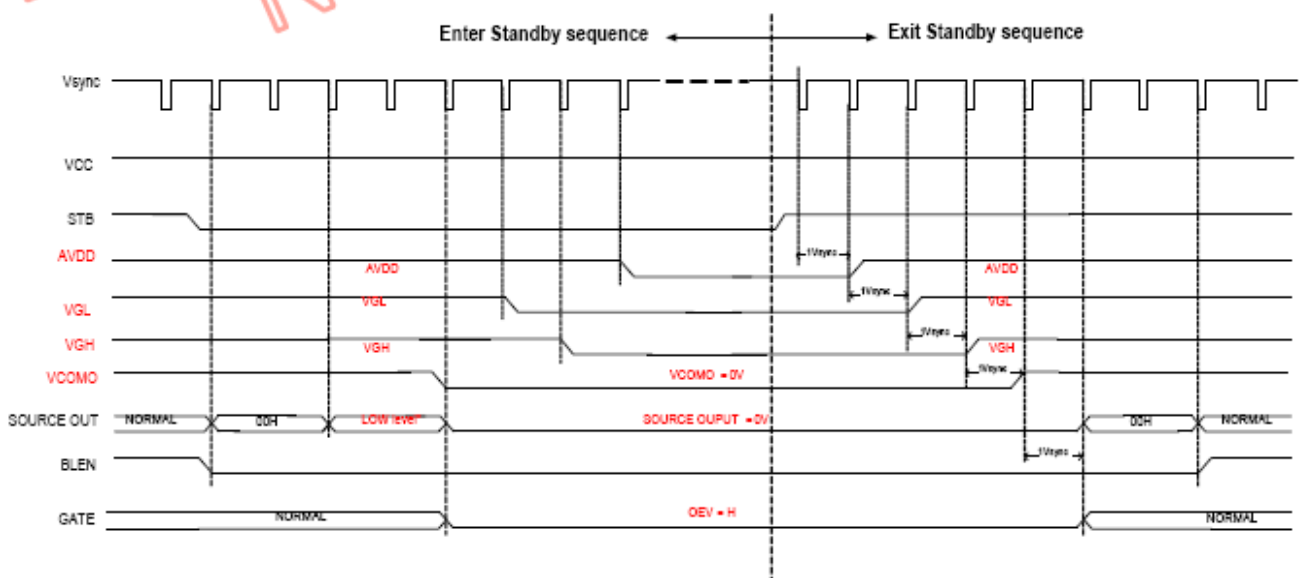
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LED forward voltage	V <sub>L</sub>	9.3	9.9	10.5	V	Note 1
LED forward current	I <sub>L</sub>	144	160	176	mA	

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and I<sub>L</sub>=160mA.

## Power On/Off Sequence



## Enter and Exit Standby Mode Sequence:



\*Note : Low level = 3FH , when NBW = L (Normally white)  
 Low level = 00H , when NBW = H (Normally black)



## Parallel RGB input timing table

For 1024x600 panel

## DE mode

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency @ Frame rate = 60Hz	fclk	40.8	51.2	67.2	MHz
Horizontal display area	thd	1024			DCLK
HSYNC period time	th	1114	1344	1400	DCLK
HSYNC blanking	thb+thfp	90	320	376	DCLK
Vertical display area	tvd	600			H
VSYNC period time	tv	610	635	800	H
VSYNC blanking	tvb+tvfp	10	35	200	H

## HV mode

## Horizontal input timing

Parameter		Symbol	Value			Unit
Horizontal display area		thd	1024			DCLK
DCLK frequency @ Frame rate = 60Hz		fclk	Min.	Typ.	Max.	
			44.9	51.2	63	MHz
1 Horizontal Line		th	1200	1344	1400	DCLK
HSYNC pulse width	Min.	thpw	1			
	Typ.		-			
	Max.		140			
HSYNC blanking		thb	160	160	160	
HSYNC front porch		thfp	16	160	216	

## Vertical input timing

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	tvd	600			H
VSYNC period time	tv	624	635	750	H
VSYNC pulse width	tvpw	1	-	20	H
VSYNC Blanking (tvb)	tvb	23	23	23	H
VSYNC Front porch (tvfp)	tvfp	1	12	127	H



## DC Electrical Characteristics

(VDD= 2.3 to 3.6V, AVDD= 6.5 to 13.5V, GND=AGND= 0V, TA= -20 to +85°C)

TTL mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Low level input voltage	Vil	0	-	0.3xVDD	V	For the digital circuit
High level input voltage	Vih	0.7xVDD	-	VDD	V	For the digital circuit
Input leakage current	Ii	-	-	±1	μA	For the digital circuit
High level output voltage	Voh	VDD-0.4	-	-	V	Ioh= -400μA
Low level output voltage	Vol	-	-	GND+0.4	V	Iol= +400μA
Pull low/high resistor	Ri	200K	250K	300K	ohm	For the digital input pin @ VDD=3.3V
Digital Operating Current	Idd	-	8 (TBD)	10 (TBD)	mA	Fclk=65 MHz, FLD=50KHz, VDD=3.3V
Digital Stand-by Current	Ist1	-	10 (TBD)	50 (TBD)	μA	Clock & all functions are stopped
Analog Operating Current	Idda	-	10 (TBD)	12 (TBD)	mA	No load, Fclk=65MHz, FLD=50KHz @ AVDD=10V, V1=8V, V14=0.4V
Analog Stand-by Current	Ist2	-	10 (TBD)	50 (TBD)	μA	No load, Clock & all functions are stopped
Input level of V1 ~ V7	Vref1	0.4* AVDD	-	AVDD-0.1	V	Gamma correction voltage input
Input level of V8 ~ V14	Vref2	0.1	-	0.6* AVDD	V	Gamma correction voltage input
Output Voltage deviation	Vod1	-	±20	±35	mV	Vo = AGND+0.1V ~ AGND+0.5V & Vo = AVDD-0.5V ~ AVDD-0.1V
Output Voltage deviation	Vod2	-	±15	±20	mV	Vo = AGND+0.5V ~ AVDD-0.5V
Output Voltage Offset between Chips	Voc	-	-	±20	mV	Vo = AGND+0.5V ~ AVDD-0.5V
Dynamic Range of Output	Vdr	0.1	-	AVDD-0.1	V	SO1 ~ SO1536
Sinking Current of Outputs	IOLy	80	-	-	μA	SO1 ~ SO1536; Vo=0.1V v.s 1.0V , AVDD=13.5V
Driving Current of Outputs	IOHy	80	-	-	μA	SO1 ~ SO1536; Vo=13.4V v.s 12.5V , AVDD=13.5V
Resistance of Gamma Table	Rg	0.7*Rn	1.0*Rn	1.3*Rn	ohm	Rn: Internal gamma resistor





## AC Electrical Characteristics

(VDD= 2.3 to 3.6V, AVDD= 6.5 to 13.5V, GND=AGND= 0V, TA= -20 to +85°C)

TTL mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
VDD Power On Slew rate	T <sub>POR</sub>	-	-	20	ms	From 0V to 90% VDD
RSTB pulse width	T <sub>Rst</sub>	50	-	-	us	DCLK = 65MHz
DCLK cycle time	T <sub>cph</sub>	14			ns	
DCLK pulse duty	T <sub>cwh</sub>	40	50	60	%	
VSD setup time	T <sub>vst</sub>	5	-	-	ns	
VSD hold time	T <sub>vhd</sub>	5	-	-	ns	
HSD setup time	T <sub>hst</sub>	5	-	-	ns	
HSD hold time	T <sub>hhd</sub>	5	-	-	ns	
Data set-up time	T <sub>dsu</sub>	5	-	-	ns	D0[7:0], D1[7:0], D2[7:0] to DCLK
Data hold time	T <sub>dhd</sub>	5	-	-	ns	D0[7:0], D1[7:0], D2[7:0] to DCLK
DE setup time	T <sub>esu</sub>	5	-	-	ns	
DE hold time	T <sub>ehd</sub>	5	-	-	ns	
Output stable time	T <sub>sst</sub>	-	-	6	us	10% to 90% target voltage. CL=90pF, R=10K ohm (Cascade)
				3		Dual gate



## ◆ ELECTRO-OPTICAL CHARACTERISTICS

Driving condition: VDD= 3.3V, I<sub>BL</sub>= 20mA/LED, Temperature =23℃±5℃ Humidity=60%±20%RH

Item			Light angle (°)	Temp (°C)	Symbol	Specifications			Unit	Conditions	Note
						Min.	Typ.	Max.			
Transmittance			0	25	-	-	5.1	-	%	(Equipment :BM-7/CS200)	(1)
Contrast ratio			0	25	Cr	-	TBD	-	-		(2)
Brightness			0	25	-	300	-	-	-		-
Luminance uniformity (surface within panel)			0	25	Lu	70	80	-	%		(3)
Cross talk			0	25	CTV	-	-	20	%		(4)
Chromaticity	R x		0	25	Rx	-	TBD	-	-		-
	R y				Ry	-	TBD				
	G x				Gx	-	TBD	-			
	G y				Gy	-	TBD	-			
	B x				Bx	-	TBD	-			
	B y				By	-	TBD	-			
	W x				Wx	-	TBD	-			
	W y				Wy	-	TBD	-			
Color Reproduction Area(NTSC)			0	25	-	-	TBD	-	%	CIE1931(x,y)	(5)
Response time	Tr		0	25	-	-	5	-	ms	Viewing normal angle $\theta_x = \theta_y = 0^0$	-
	Tf					-	15	-			
Viewing angle	Hor.	$\theta_{x+}$	0	25	-	50	60	-	deg	Center CR≥10	-
		$\theta_{x-}$			-	50	60	-			
	Ver.	$\theta_{y+}$			-	50	60	-			
		$\theta_{y-}$			-	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

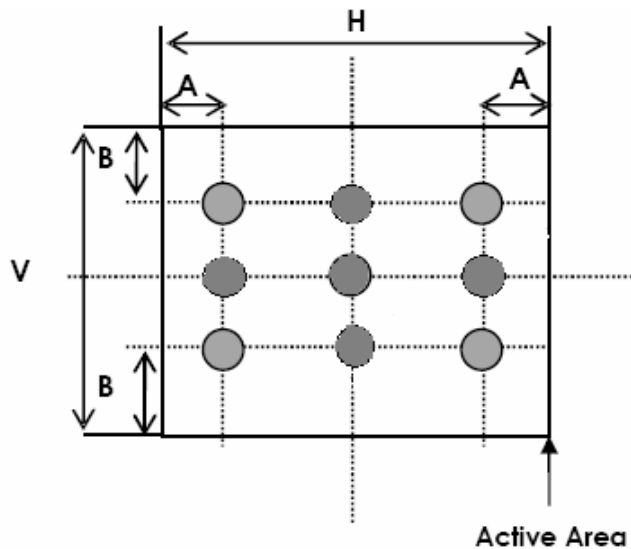
- (3). Surface luminance uniformity within panel

**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:**

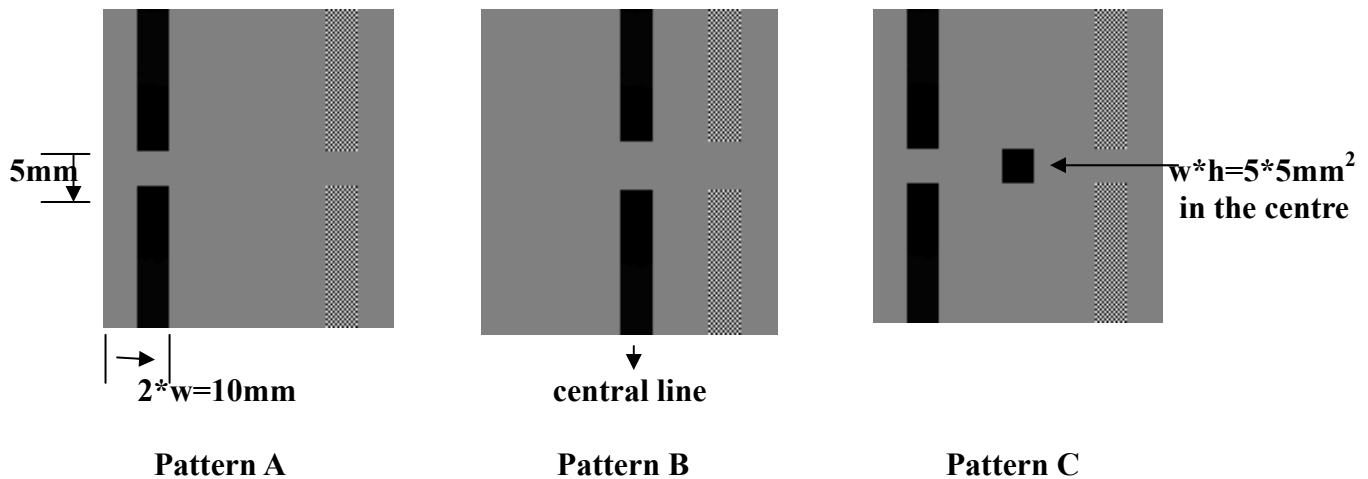
Crosstalk is an effect where the contrast of a display pixel is influenced by the state of the related pixels. A measure for this effect is the Cross Talk Value (CTV)

##### **Measurement conditions:**

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

##### **•Test Pattern (valid for all greyscales):**

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



● **Definitions:**

**Cross Talk Value:**

$$CTV = |L_vA - L_vB| / L_vA * 100\%$$

**Where:**

**L<sub>v</sub>A:** Luminance measured with the centre test point of pattern A

**L<sub>v</sub>B:** Luminance measured with the centre test point of pattern B.

● **Measuring procedure:**

Adaptation of the display to the highest contrast ratio ( $CR = L_vA/L_vC$ ) 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:

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



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

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

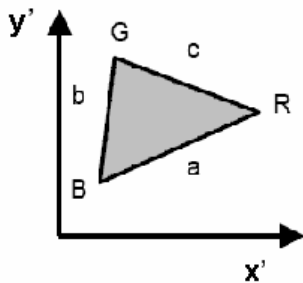
**Colour distance definition (maximum allowed colour distance to specified typical colour coordinate):**

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

**Where:**

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

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



**Color Gamut definition:**

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

**Where**

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

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

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

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

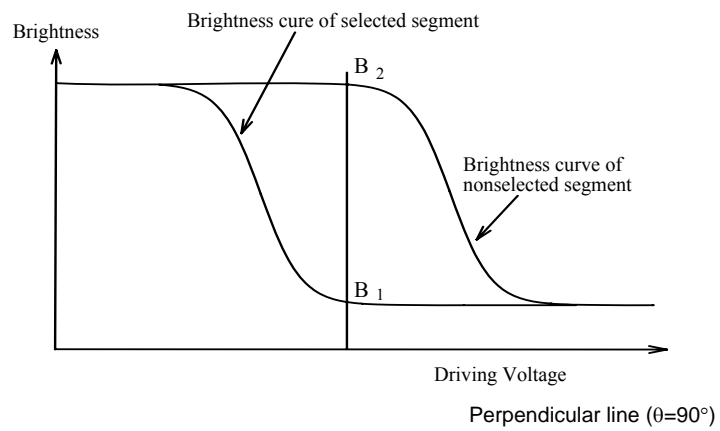
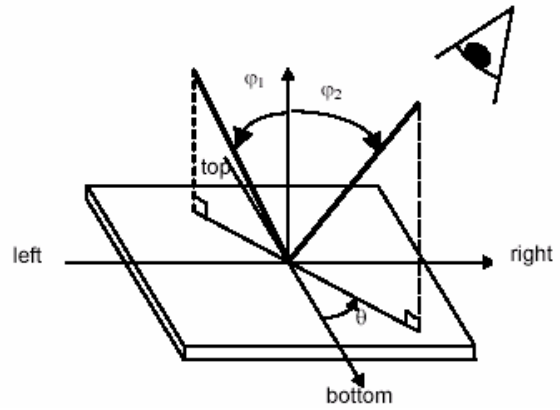
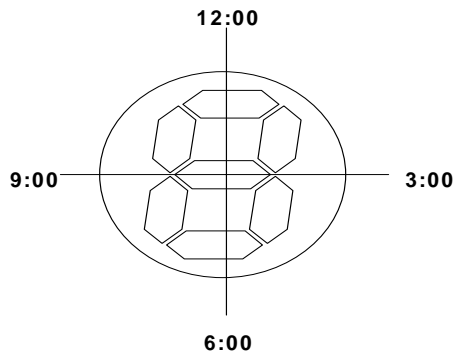
**Color Gamut Ratio (NTSC) related to NTSC':**

**NTSC' = F (display)/F (NTSC')**

**NTSC' primaries:**

	<b>x'</b>	<b>y'</b>
<b>Red</b>	<b>0.67</b>	<b>0.33</b>
<b>Green</b>	<b>0.21</b>	<b>0.71</b>
<b>Blue</b>	<b>0.14</b>	<b>0.08</b>

$$F (\text{NTSC}') = 74.42$$



**◆ SPECIFICATION OF QUALITY ASSURANCE****● Summary**

The customer should check and accept the products of BYD within one month after reception. This standard for quality assurance should affirm the quality of LCD products to supply to purchaser by BYD COMPANY LIMITED. 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=0.65

Minor defect:: AQL= 1.5

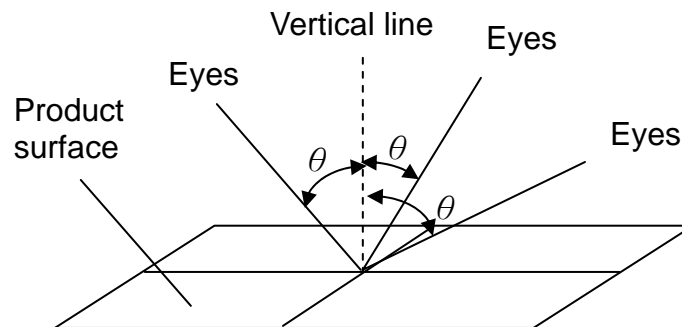
**● Nonconforming Analysis & Deal With Manners****✧ Nonconforming Analysis****1、 Purchaser should supply the detail data of nonconforming sample and the non-suitable state.****2、 After accepting the detail data from purchaser ,the analysis of nonconforming should be finished in two weeks.****3、 If supplier 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;**

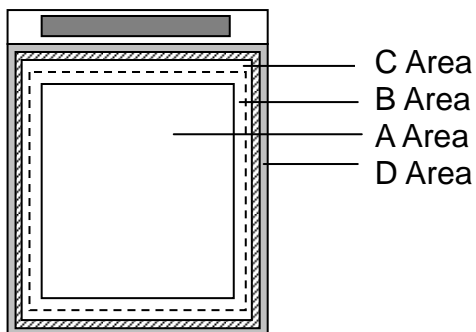


- 2、 When test the model of Transmissive product must add the reflective plate.
- 3、 The test direction is base on about around 30 degree(within  $\theta$  range)of vertical line, and the test time is below 5s.



#### 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

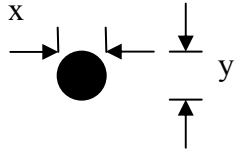
#### ■ Basic principle:

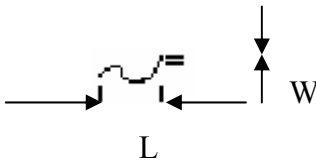
- 1、 It will accord to the AQL when the standard can not be described.
- 2、 The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.
- 3、 Must add new item on time when it is necessary.

#### ■ Inspection specification

NO	Item	Criterion	AQL
01	Electrical Testing	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	0.65																	
02	LCM black spots, white spots, bright spots , contamination (display/non-displ ay)	<div><math display="block">\Phi=(x+y)/2</math></div> <table><tr><td></td><td>Size</td><td>Acceptable QTY</td><td>Remark</td></tr><tr><td rowspan="4">Common dots defect</td><td><math>\Phi \leq 0.15</math></td><td>Ignore</td><td>/</td></tr><tr><td><math>0.15 &lt; \Phi \leq 0.25</math></td><td>3</td><td>The distance between two defective dots should be larger than 10 mm; for the neglectable dot, there should be no more than 5 dots within 1cm<sup>2</sup></td></tr><tr><td><math>0.25 &lt; \Phi \leq 0.30</math></td><td>2</td><td>/</td></tr><tr><td><math>0.30 &lt; \Phi</math></td><td>0</td><td>/</td></tr></table>		Size	Acceptable QTY	Remark	Common dots defect	$\Phi \leq 0.15$	Ignore	/	$0.15 < \Phi \leq 0.25$	3	The distance between two defective dots should be larger than 10 mm; for the neglectable dot, there should be no more than 5 dots within 1cm <sup>2</sup>	$0.25 < \Phi \leq 0.30$	2	/	$0.30 < \Phi$	0	/	1.5
	Size	Acceptable QTY	Remark																	
Common dots defect	$\Phi \leq 0.15$	Ignore	/																	
	$0.15 < \Phi \leq 0.25$	3	The distance between two defective dots should be larger than 10 mm; for the neglectable dot, there should be no more than 5 dots within 1cm <sup>2</sup>																	
	$0.25 < \Phi \leq 0.30$	2	/																	
	$0.30 < \Phi$	0	/																	

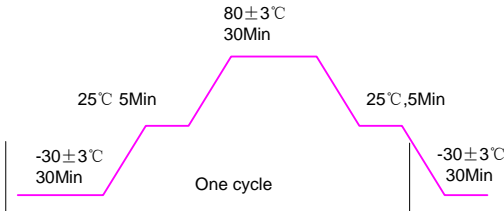
03	Scratches/line type contamination (display/non-display)	<div>As following drawing</div> <div></div> <table><tr><th>Length</th><th>Width</th><th>Acceptable QTY</th><th>Remark</th></tr><tr><td>---</td><td><math>W \leq 0.03</math></td><td>Ignore</td><td>/</td></tr><tr><td><math>L \leq 3.5</math></td><td><math>0.03 &lt; W \leq 0.05</math></td><td>3</td><td rowspan="2">More than 10mm between two defects</td></tr><tr><td><math>L \leq 2.5</math></td><td><math>0.05 &lt; W \leq 0.08</math></td><td>3</td></tr><tr><td>---</td><td><math>0.08 &lt; W</math></td><td>0</td><td>/</td></tr></table> <div>The LCD with extensive crack is not acceptable.</div>	Length	Width	Acceptable QTY	Remark	---	$W \leq 0.03$	Ignore	/	$L \leq 3.5$	$0.03 < W \leq 0.05$	3	More than 10mm between two defects	$L \leq 2.5$	$0.05 < W \leq 0.08$	3	---	$0.08 < W$	0	/	
Length	Width	Acceptable QTY	Remark																			
---	$W \leq 0.03$	Ignore	/																			
$L \leq 3.5$	$0.03 < W \leq 0.05$	3	More than 10mm between two defects																			
$L \leq 2.5$	$0.05 < W \leq 0.08$	3																				
---	$0.08 < W$	0	/																			
04	Polarizer bubbles	<div>If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.</div> <table><tr><th>Size</th><th>Acceptable QTY</th><th>Remark</th></tr><tr><td><math>\Phi \leq 0.20</math></td><td>ignore</td><td>/</td></tr><tr><td><math>0.20 &lt; \Phi \leq 0.50</math></td><td>2</td><td>More than 10mm between two defects</td></tr><tr><td><math>0.50 &lt; \Phi</math></td><td>0</td><td>/</td></tr></table>	Size	Acceptable QTY	Remark	$\Phi \leq 0.20$	ignore	/	$0.20 < \Phi \leq 0.50$	2	More than 10mm between two defects	$0.50 < \Phi$	0	/	1.5							
Size	Acceptable QTY	Remark																				
$\Phi \leq 0.20$	ignore	/																				
$0.20 < \Phi \leq 0.50$	2	More than 10mm between two defects																				
$0.50 < \Phi$	0	/																				
05	Backlight elements	<div>5.1 Illumination source flickers when lit.</div> <div>5.2 Spots or scratches that appear when lit must be judged using LCD spot, lines and contamination standards.</div> <div>5.3 Backlight doesn't light or color is wrong</div>	<div>0.65</div> <div>1.5</div> <div>0.65</div>																			
06	Soldering	<div>6.1 No unmelted solder paste may be present on the PCB.</div> <div>6.2 No cold solder joints, missing solder connections, oxidation or icicle.</div> <div>6.3 No residue or solder balls on PCB.</div> <div>6.4 No short circuits in components on PCB.</div>	<div>0.65</div> <div>0.65</div> <div>1.5</div> <div>0.65</div>																			



07	General appearance	7.1 No oxidation, contamination, curves or, bends on interface pin (OLB) of FPC	1.5
		7.2 No cracks on interface pin(OLB) of FPC	0.65
		7.3 NO contamination, solder residue or solder balls on product.	1.5
		7.4 The IC on the FPC may not be damaged, circuits.	0.65
		7.5 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.	1.5
		7.6 Sealant on top of the ITO circuit has not hardened	1.5
		7.7 Pin type must match type in specification sheet.	1.5
		7.8 LCD pin loose or missing pins.	0.65
		7.9 Product packaging must the same as specified on packaging specification sheet.	1.5
		7.10 Product dimension and structure must conform to product specification sheet.	1.5

## ◆ RELIABILITY

### 1. Environmental Test

No	Test Item	Test Condition& Criteria	Sample Size	Determinant Stand.
1-1	High Temperature Operation	Temperature: $70 \pm 3^{\circ}\text{C}$ ; Humidity: Except; Test method: Operation Duration: 96Hrs	Sample Do: $\geq 2\text{PCS}$ On Going: $\geq 3\text{PCS}/\text{LOT}$	TS-01 TS-02
1-2	Low temperature Operation	Temperature: $-20 \pm 3^{\circ}\text{C}$ ; Humidity: Except; Test method: Operation Duration: 96Hrs	Sample Do: $\geq 2\text{PCS}$ On Going: $\geq 3\text{PCS}/\text{LOT}$	TS-01 TS-02
1-3	High Temperature / High Humidity Operation	Temperature: $60 \pm 3^{\circ}\text{C}$ ; Humidity: $95\% \pm 3\%\text{RH}$ ; Test method: Operation Duration: 96Hrs	Sample Do: $\geq 2\text{PCS}$ On Going: $\geq 3\text{PCS}/\text{LOT}$	TS-01 TS-02
1-4	Temperature Shock	Shock Temperature & Time:  <p>The diagram illustrates a temperature shock cycle. It starts at <math>-30 \pm 3^{\circ}\text{C}</math> for 30 minutes, ramps up to <math>25^{\circ}\text{C}</math> for 5 minutes, then to <math>80 \pm 3^{\circ}\text{C}</math> for 30 minutes. It then ramps down to <math>25^{\circ}\text{C}</math> for 5 minutes, and finally back to <math>-30 \pm 3^{\circ}\text{C}</math> for 30 minutes. This sequence is labeled as 'One cycle'.</p>	Sample Do: $\geq 2\text{PCS}$ On Going: $\geq 3\text{PCS}/\text{LOT}$	TS-01 TS-02



		Duration: 20cycle								
1-5	Temperature Cycle	normal temperature 2H→-30±3℃,10H(3H) →60±3℃,90±3%,RH10H(3H) →80±3℃,10H(2H) →(25℃) 5 cycles	Sample Do:≥2PCS On Going:≥3PCS/ LOT	TS-01 TS-02						
<table><tr><td>Item</td><td>FAULT JUDGMENT CRITERIA</td></tr><tr><td>TS-01</td><td>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.</td></tr><tr><td>TS-02</td><td>1. No clearly visible defects or deterioration of display quality allowed. 2. No function – related abnormalities.</td></tr></table>					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.	TS-02	1. No clearly visible defects or deterioration of display quality allowed. 2. No function – related abnormalities.
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.									
TS-02	1. No clearly visible defects or deterioration of display quality allowed. 2. No function – related abnormalities.									

**NOTE:**

- When temperature moves, LCD's valve voltage will be influenced by it, which leads to LCD's contrast and chroma change.
- 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)	2PCS	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	2PCS	The inspection of appearance、the whole structure no error

**3. Soldering**

- Soldering temperature: 340+/-10℃.
- Available times for repeated soldering: 5 times
- Attentions paid when soldering:
  - FPC's golden finger and soldering pad are butt-jointed before soldered. Tolerance is within the 1/3 width of golden finger and 0.5~1mm of FPC's length is allowed to be exposed in the jointed soldering pad.



- B. Coat proper tin in the iron-head when soldering, with dragging speed of 2.5cm/sec.  
C. The soldering part is warmed up first with iron-head when there is a rework. Then heat it up from one side until tin is melted, last, take off FPC.

**4. 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

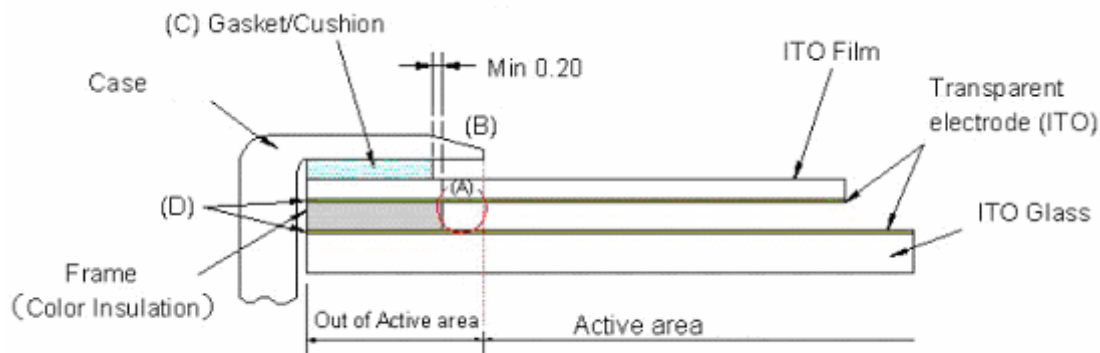
- Do not give excessive strain to the product.

- Flexible pattern cable is connected to the TP body by heat-seal(thermal pressure) method.

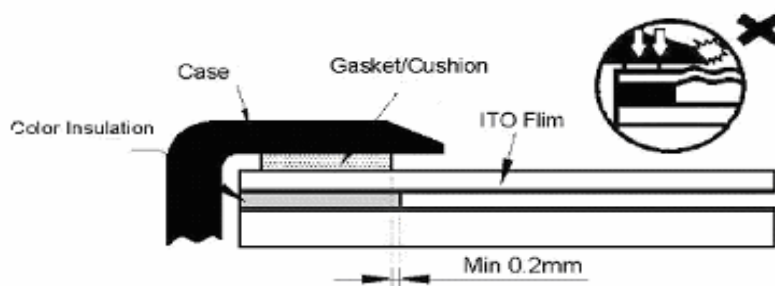
So, do not apply excessive forces to the flexible pattern.

- 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.

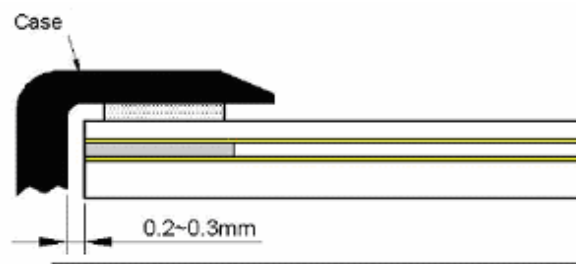
- Pressing inside of boundary of the frame( part(A) as shown in below ) may cause fault operation, so please design to avoid pressing of touch panel at part (A) such as having gasket/cushion at part (C). Particularly the area (B) shall be free from burr. The gasket/cushion material at the part (C) should not be exceeded to inside of the boundary of the frame.



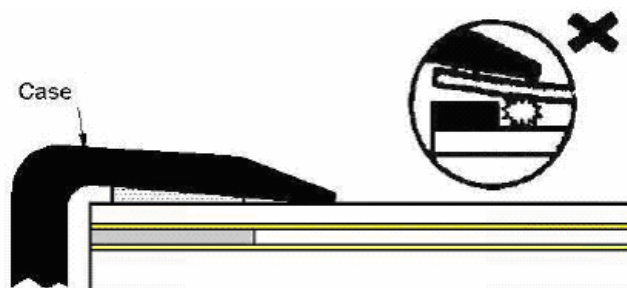
Do not make the following mistakes:



- 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

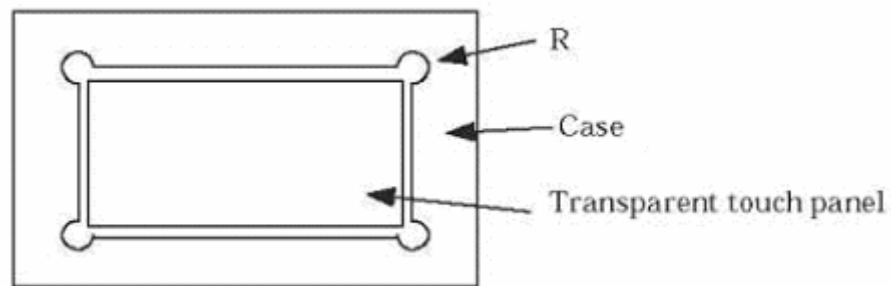


- Please keep your case flat in order not to touch with touch panel directly which causes serious damage of a transparent electrode.



- 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 not 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.

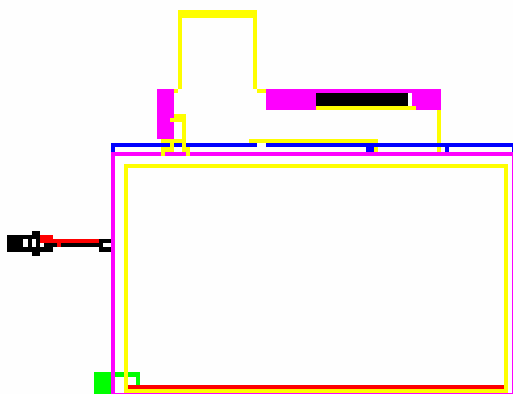
## ◆ PACKING

### ● Packing Materials

NO.	ITEM	Dimension(LXWXH) (mm)	Quantity
1	Middle box	386X335X118mm	40
2	Big box	409X360X265mm	80

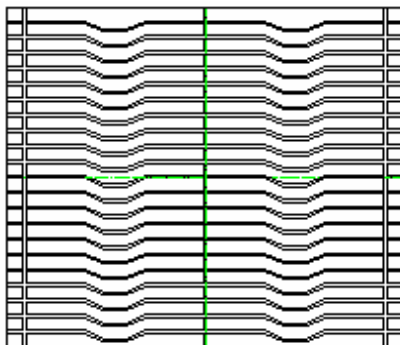
### ● Packing Method

(1)



LCM sketch-map

(3)



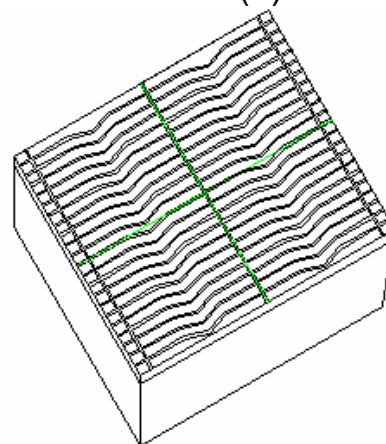
(Groove aggregate sketch-map )

(2)



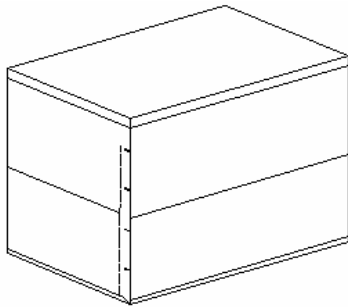
Put the LCM into gas bubbles bag

(4)



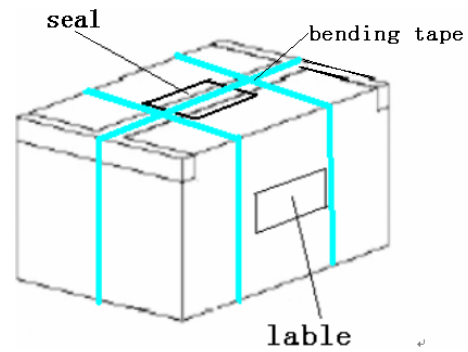
(Put the bag with LCM into the groove )

(5)



One box with two layers Groove aggregate

(6)



End

## ◆ ENVIRONMENT-RELATED SUBSTANCES

- Meet with BYD Environment-Related Substances Controlled Standard BHS-001