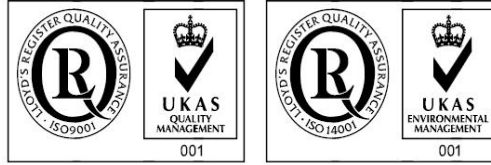**深圳市勋瑞光电科技有限公司**

Xunrui photoelectric technology（shenzhen）CO,.LTD.

CERT. No. QAC0946535
(ISO9001)

CERT. No. HKG002005
(ISO14001)

Product Specification

Customer: _____   _____

Model Name: _____H028VQ40E3512_____

Date: _____

Version: _____

■ **Preliminary Specification**

☐ **Final Specification**

For Customer's Acceptance

Approved by	Comment

Approved by	Reviewed by	Prepared by

Table of Contents

深圳市勋瑞光电科技有限公司
Xunrui photoelectric technology（shenzhen）CO,.LTD.

1. Record of Revision

Rev	Issued Date	Description	Editor
1.0	2018/03/08	First Release	Rich Liang

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Xunrui photoelectric technology（shenzhen）CO,.LTD.

2. General Specifications

Feature		Spec
Characteristics	Size	2.8inch
	Resolution	240(horizontal)*320(Vertical)
	Interface	RGB
	Connect type	Connector
	Display Colors	65K
	Technology type	a-Si
	Pixel pitch (mm)	0.18x 0.18
	Pixel Configuration	R.G.B.Stripe
	Display Mode	Normally White
	Driver IC	ST7789V
	Viewing Direction	6 O'clock
	Gray Scale Inversion Direction	12 O'clock
Mechanical	LCM (W x H x D) (mm)	50*69.2*2.0
	Active Area(mm)	43.2*57.6
	With /Without TSP	Without
	Weight (g)	13 g
	LED Numbers	4LEDs

Note 1: Viewing direction for best image quality is different from TFT definition; there is a 180 degree shift.

Note 2: Requirements on Environmental Protection: RoHS

Note 3: LCM weight tolerance: +/- 5%

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3. Input/output Terminals

Pin No.	Symbol	I/O	Function
1	GND	P	Ground
2	LED-A	P	LED anode
3	LED-K	P	LED cathode
4	GND	P	Ground
5	VCC	P	Power Supply for logic
6	IOVCC	p	Digital IO Pad power supply
7	RESET	I	Reset signal
8	VSYNC	I	Frame signal for interface operation
9	HSYNC	I	Line signal for interface operation
10	DOTCLK	I	Dot clock signal
11	ENABLE	I	Data enable signal
12-29	DB17-DB0	I	RGB Data input
30	SDO	O	Serial output signal
31	SDI	I	Serial input signal
32	SCL	I	The serial interface clock
33	/CS	I	Chip select input pin
34	FAMRK/TE	O	Effect output pin to frame writing
35	GND	P	Ground
36	X+(XR)	O	Touch PIN
37	Y+(YD)	O	
38	X-(XL))	O	
39	Y-(YU)	O	
40	GND	P	Ground

4. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Supply Voltage	V_{CC}	2.5	4.8	V	
Input Voltage	IOVCC	1.65	3.3	V	
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

5. Electrical Characteristics

Driving TFT LCD Panel

Ta = 25 ℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Analog Supply Voltage		V_{CC}	2.5	2.8	3.3	V	
Logic Signal Input /Output Voltage		IOVCC	1.65	1.8	3.3	V	
Input Signal Voltage	Low Level	V_{IL}	VSS	-	0.3x IOVCC	V	
	High Level	V_{IH}	0.7x IOVCC	-	IOVCC	V	
TFT Common Electrode		V_{COMH}	2.5	-	5	V	
TFT Gate ON Voltage		V_{GH}	10	-	16	V	
TFT Gate ON Voltage		V_{GL}	-10	-	-5	V	

Driving Backlight

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	20		mA	
Forward Voltage	V_F	-	12.8		V	
Backlight Power consumption	W_{BL}	-			W	
LED Lifetime		25000	-	-	Hrs	

Note 1: Each LED: IF =20 mA, VF =3.2V.

Note 2: Optical performance should be evaluated at Ta=25℃ only.

Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness.

Typical operating life time is estimated data.

6. Interface Timing

ST7789V supports two kinds of RGB interface, DE mode and HV mode. Each mode also can select with ram and without ram. The table shown below uses command B1h to select RGB interface mode.

RCM[1:0]	WO	RGB Mode	Data Path
10	0	DE mode	Ram
	1		Shift register (without Ram)
11	0	HV mode	Ram
	1		Shift register (without Ram)

8.9.5 RGB Interface Timing

The timing chart of RGB interface DE mode is shown as follows.
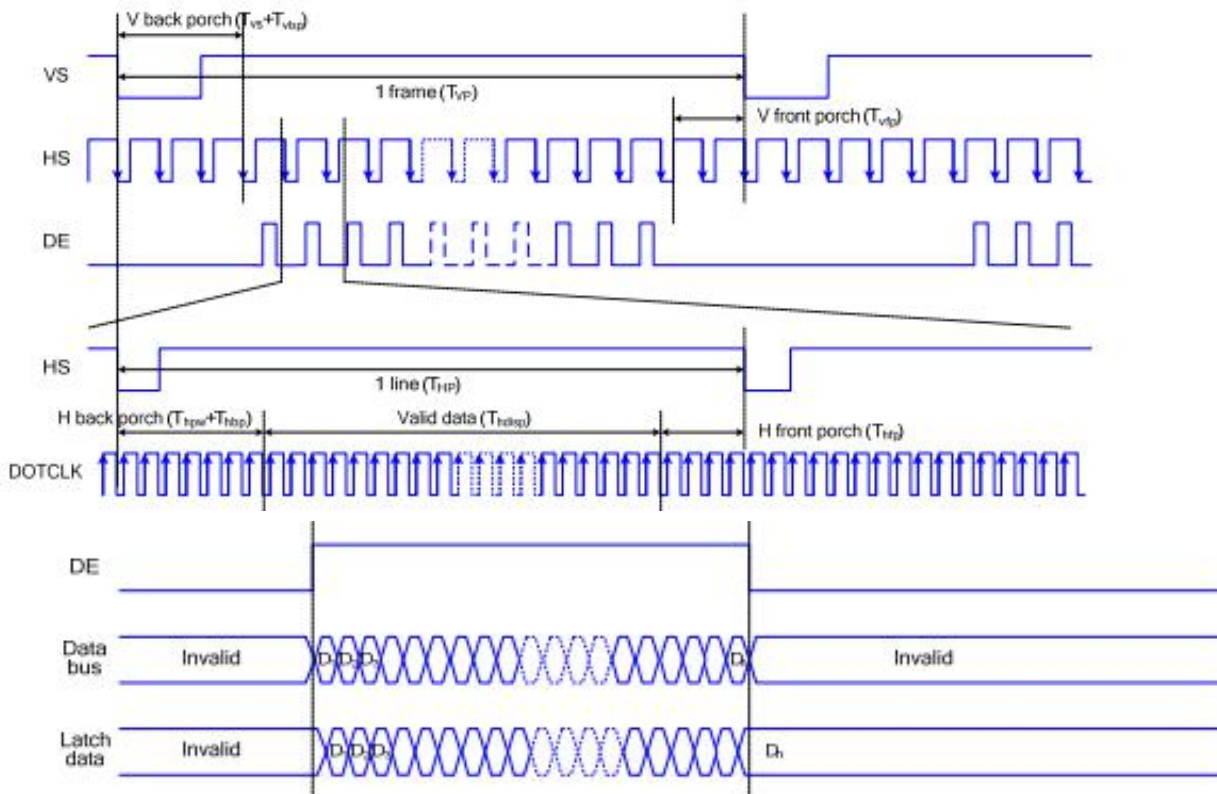
Note: The setting of front porch and back porch in host must match that in IC as this mode.

Figure 25 Timing Chart of Signals in RGB Interface DE Mode

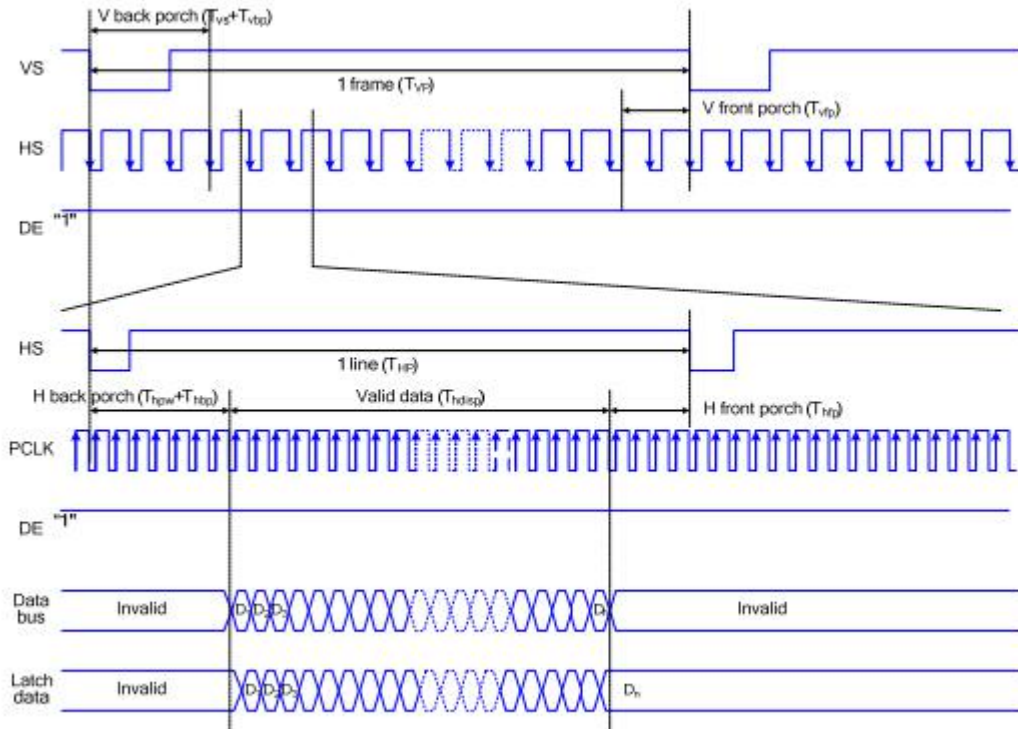The timing chart of RGB interface HV mode is shown as follows.

Figure 26 Timing chart of RGB interface HV mod

Please refer to the following table for the setting limitation of RGB interface signals.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	2	10	hpw+hbp=31	Clock
Horizontal Sync. Back Porch	hbp	4	10		Clock
Horizontal Sync. Front Porch	hfp	2	38	-	Clock
Vertical Sync. Width	vs	1	4	vs+vbp=127	Line
Vertical Sync. Back Porch	vbp	1	4		Line
Vertical Sync. Front Porch	vfp	1	8	-	Line

Note:

1. Typical value are related to the setting of dot clock is 7MHz and frame rate is 70Hz..

2. If the setting of hpw is 10 dot clocks and hbp is 10 dot clocks, the setting of HBP in command B1h is 20 dot clocks
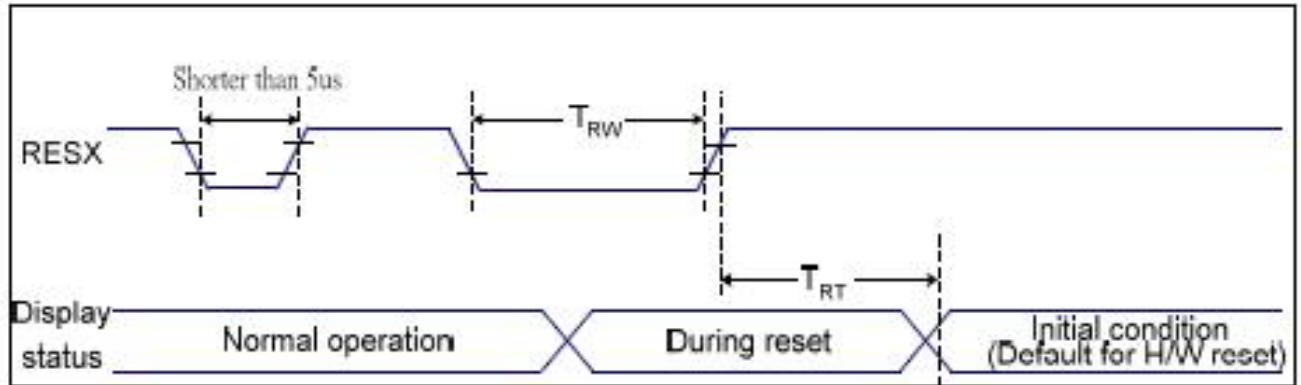
3. In with ram mode, hpw+hbp+hfp≥22

6.2 Reset Timing:

Figure 7 Reset Timing

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 – 70 ℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

Table 8 Reset Timing

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7. Optical Characteristics

Items		Symbol	Condition	Min	Typ	Max	Unit		Remark
Viewing angles		θ_T	Center CR≥10	-	55	-	Degree		Note2
		θ_B		-	65	-			
		θ_L		-	65	-			
		θ_R		-	65	-			
Contrast Ratio		CR	Θ =0	300	350	-	-		Note1, Note3
Response Time		T_{ON}	25°C	-	20	30	ms		Note1, Note4
		T_{OFF}		-	25	35			
Chromaticity	White	X_W	Backlight is on	0.26	0.31	0.36	-		Note1, Note5
		Y_W		0.28	0.33	0.38	-		
Uniformity		U		80	-	-	%		Note1, Note6
NTSC				-	50	-	%		Note5
Luminance		L		300	350	-	nits		Note1, Note7

Test Conditions:

1. IF= 20mA (one channel), the ambient temperature is 25.

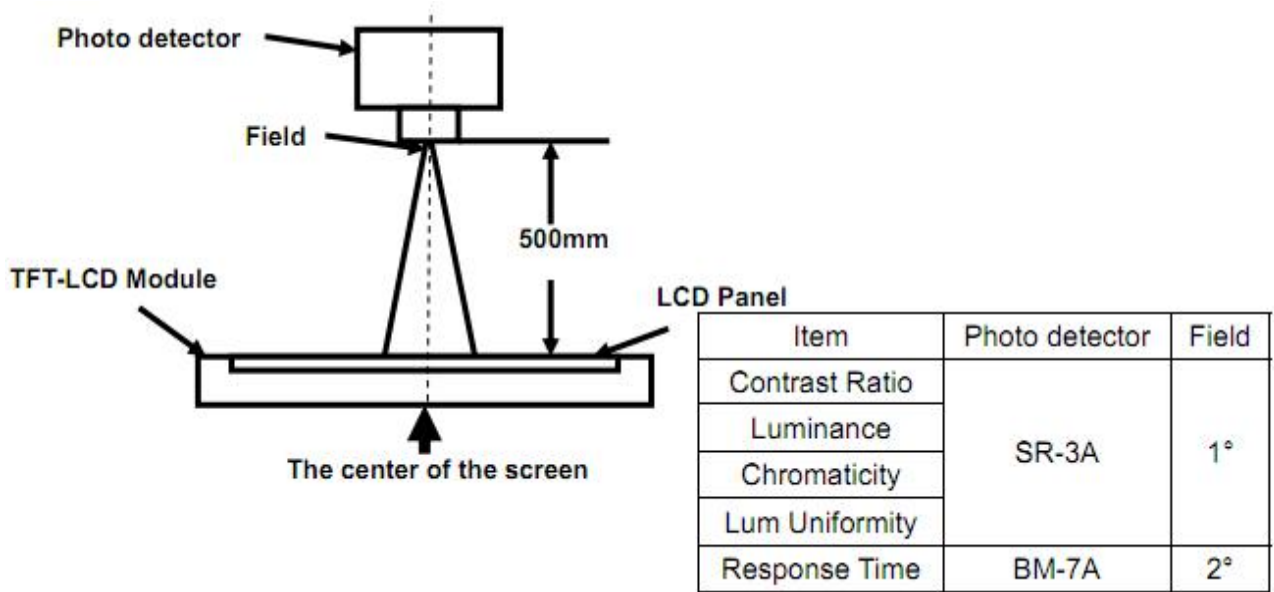2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

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

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

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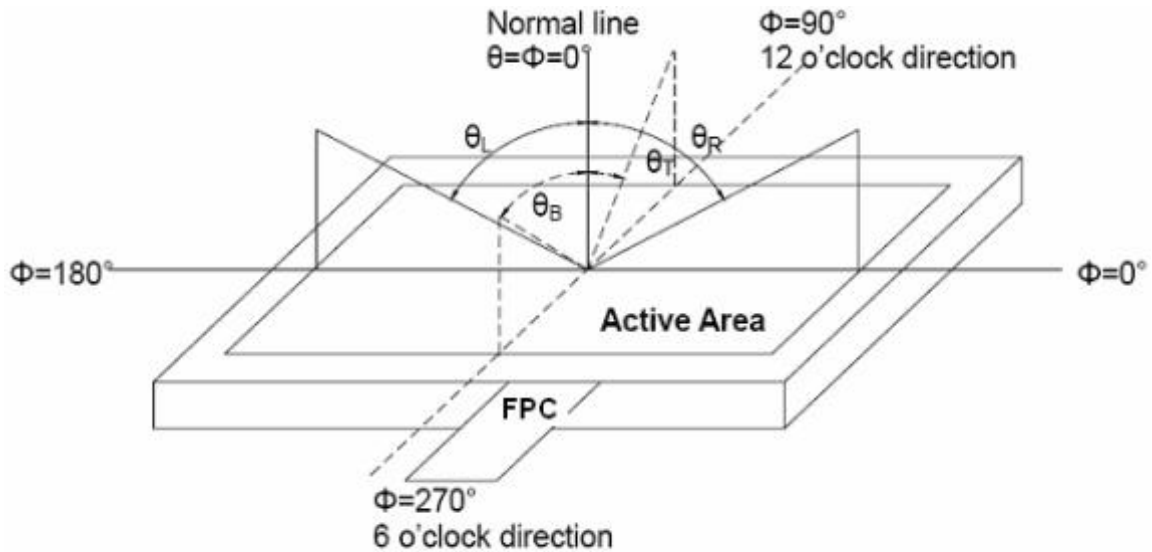Viewing angle is measured at the center point of the LCD by CONOSCOPE (ergo-80).

Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

"White state ": The state is that the LCD should drive by Vwhite.
"Black state": The state is that the LCD should drive by Vblack.

Vwhite: To be determined Vblack: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.
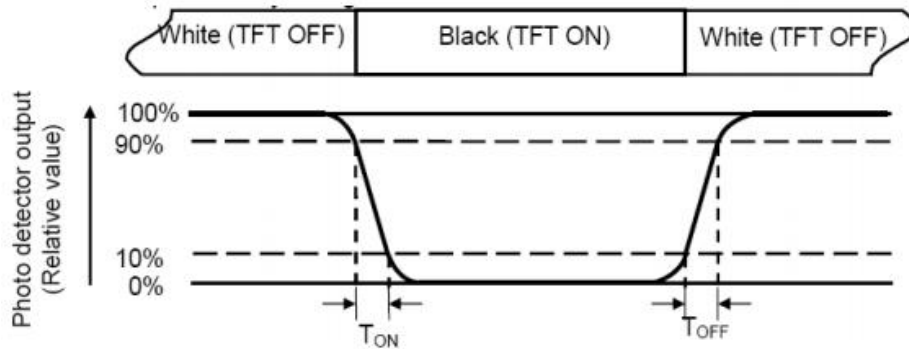
Note 5: Definition of color chromaticity (CIE1931).

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/ Lmax
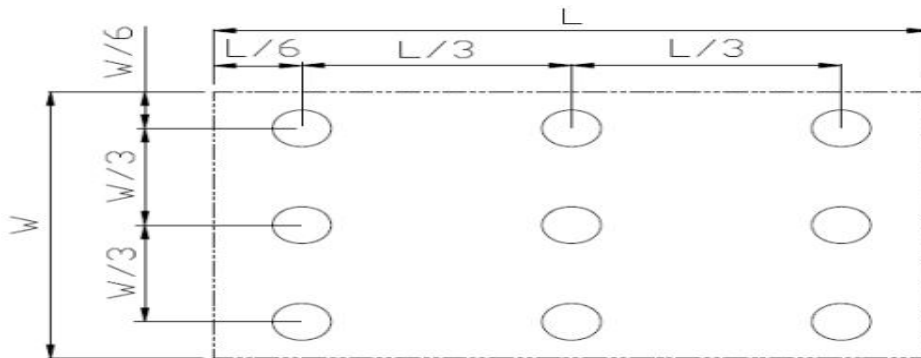
L-------Active area length W----- Active area width

Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

8. Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts= +70℃, 240hrs	Note 1 IEC60068-2-2, GB2423. 2-89
2	Low Temperature Operation	Ta= -20℃, 240hrs	Note 2 IEC60068-2-1 GB2423.1-89
3	High Temperature Storage	Ta= +80℃, 240hrs	IEC60068-2-2 GB2423. 2-89
4	Low Temperature Storage	Ta= -30℃, 240hrs	IEC60068-2-1 GB/T2423.1-89
5	High Temperature & Humidity Storage	Ta= +60℃, 90% RH max, 160 hours	IEC60068-2-3 GB/T2423.3-2006
6	Thermal Shock (Non-operation)	-30℃ 30 min ~ +80℃ 30 min Change time: 5min, 30 Cycle	Start with cold temperature, end with high temperature IEC60068-2-14, GB2423.22-87
7	Electro Static Discharge (Operation)	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5times; (Environment: 15℃ ~35℃, 30% ~ 60%, 86Kpa ~ 106Kpa)	IEC61000-4-2 GB/T17626.2-1998
8	Vibration (Non-operation)	Frequency range: 10~55Hz, Stroke: 1.mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X .Y. Z. (package condition)	IEC60068-2-6 GB/T2423.5-1995
9	Shock (Non-operation)	60G 6ms, ± X, ±Y , ± Z,3 times for each direction	IEC60068-2-27 GB/T2423.5-1995
10	Package Drop Test	Height: 80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8-1995

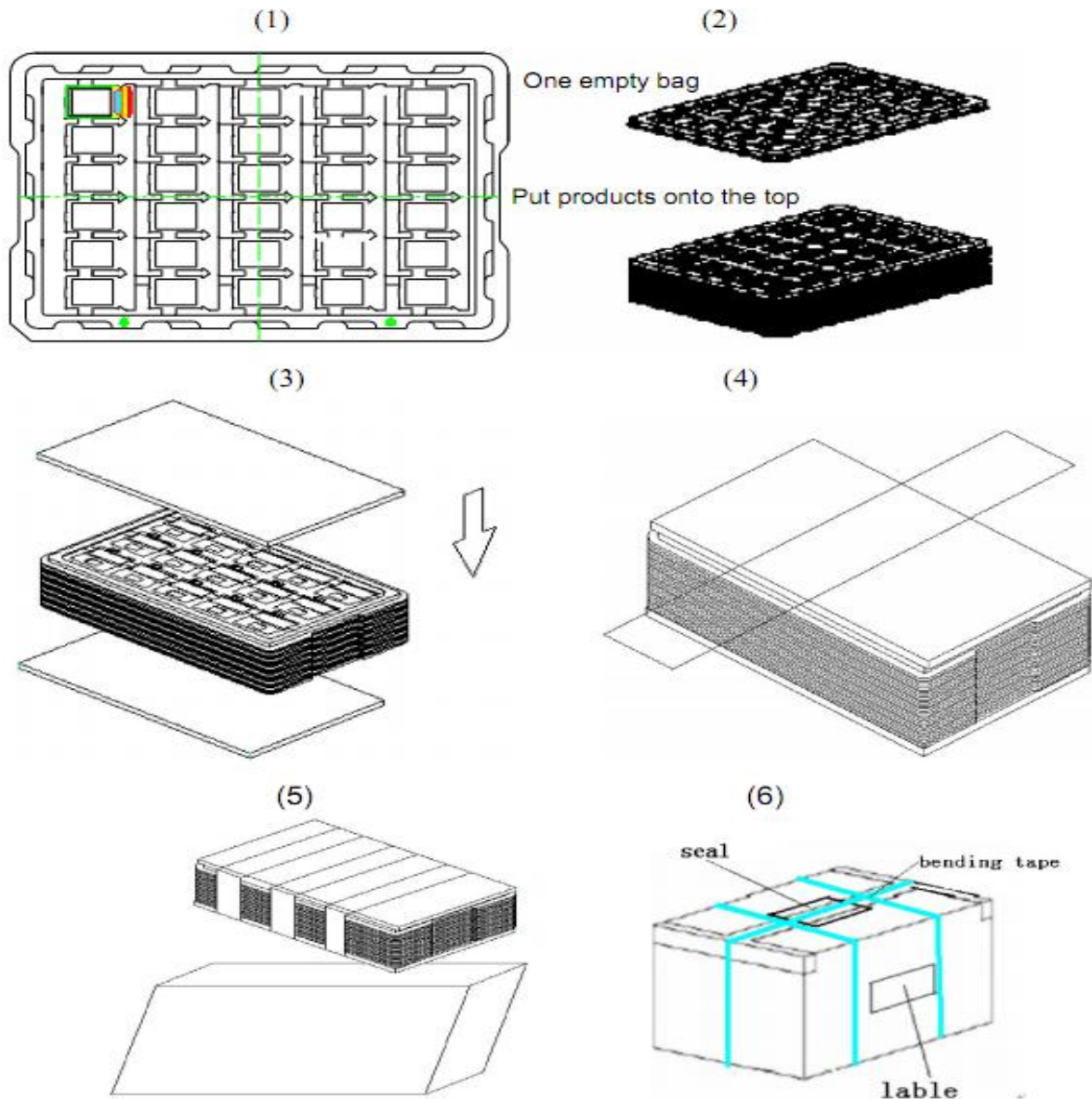Note: 1. TS is the temperature of panel's surface.
Note: 2. Ta is the ambient temperature of sample.

9. Mechanical Drawing

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10. Packing

Packing Method

(1)

One empty bag

Put products onto the top

(2)

(3)

(4)

(5)

(6)

seal

bending tape

lable

1. Put module into tray cavity:
2. Tray stacking
3. Put 1 cardboard under the tray stack and 1 cardboard above:
4. Fix the cardboard to the tray stack with adhesive tape:
5. Put the tray stack into carton.
6. Carton sealing with adhesive tape.

11. Precautions for Use of LCD modules

11.1 Handling Precautions

11.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

11.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

11.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

11.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

11.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

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

- Water
- Ketone
-Aromatic solvents

11.1.6 Do not attempt to disassemble the LCD Module.

11.1.7 If the logic circuit power is off, do not apply the input signals.

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

11.1.8.1 Be sure to ground the body when handling the LCD Modules.

11.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

11.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

11.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

11.2 Storage Precautions

11.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.2.2 The LCD modules should be stored under the storage temperature range if the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃ Relatively humidity: ≤80%

11.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

11.3 Transportation Precautions

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