

# AMOLED

## Product Specification

Model Name:    AHEM0141-01

Description:    1.41" (320x360) AMOLED

Doc. Version:    02

Customer: \_\_\_\_\_

Approved for Preliminary Specification

Approved for Final Specification

Approved for Final Specification & Sample

Prepared	Checked	Approved

Customer's Approval

Reversion History			
Reversion. No	Date	Contents	Remark
01	2017-05-03	First Draft	
02	2017-07-12	1) 变更 MDL 图纸 2) OD 光学变更: 6.7 Viewing Angle: CR ratio ≥10= » 1000 Min: 88= » 80 6.9 Color Temp 规格删除; 6.10 Color shift 规格删除; 6.11 影像残留: 增加非高亮模式条件	

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## 1 Scope

This Specification defines AMOLED manufactured by HuaErSheng Limited, from here on refer as HES. In the case of any unspecified item, it may require both HES and the party designs this module into its product to work out a solution.

## 2 Features

### 2.1 Product Applications

Smart Watch

### 2.2 Product Features

- 1) Display color: 16.7M (RGB x 8bits)
- 2) Display format: 1.41 "(320RGBx360)
- 3) Pixel arrangement: Real RGB arrangement
- 4) Interface: MIPI

## 3 Mechanical Specifications

Item	Specification	unit
LTPS Glass outline	26.04x31.78	mm
Encapsulation Glass outline	26.04 x30.18	mm
Number of dots	320(W) x RGB x 360(H)	dots
Active area	23.84x26.82	mm
Diagonal size	1.413	inch
Pixel pitch	74.49 x 74.49	μm
Glass thickness (LTPS/Encap. glass)	0.2 / 0.3	mm
Weight	TBD	g

## 4 Maximum Rating

Parameter	Symbol	Spec			Unit	Note
		Min.	Typ.	Max.		
Analog/boost power voltage	VCI	-0.3	-	5.5	V	-
I/O voltage	VDDIO	-0.3	-	5.5	V	-
Operating temperature	Top	-20	-	70	°C	-
Storage temperature	Tstg	-40	-	80	°C	-

## 5 Electrical Specifications

### 5.1 Electrical Characteristics

#### 5.1.1 Power Characteristic:

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
AMOLED Power positive	ELVDD	4.55	4.6	4.65	V	-
AMOLED power Negative	ELVSS	-2.45	-2.4	-2.35	V	Ref
Digital Power supply	VDDIO	2.4	3.0	3.3	V	Ref
Analog Power supply	VCI	2.85	3.0	3.15	V	Ref

#### 1) Normal Mode

**Power Supply:** IOVCC=1.8V VCI=2.8V

**Frame Frequency:**  $F_{\text{frame}}=60\text{HZ @ }25\text{degC}$ , Brightness 350 nits, Command Mode,

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On 350nits	IELVDD /ELVSS	-	16	19	mA	Ref
	IVCI	-	6.0	7.2	mA	Ref
	IVDDIO	-	5.8	6.0	mA	Ref
50% Pixel On 175nits	IELVDD /ELVSS	-	8	9.5	mA	Ref
	IVCI	-	6.6	8	mA	Ref
	IVDDIO	-	5.8	6.0	mA	Ref

#### 2) Deep Standby Mode

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
Deep Standby	IVCI	-	-	3	uA	-
	IVDDIO	-	-	3	uA	-

#### 5.1.2 Driver IC

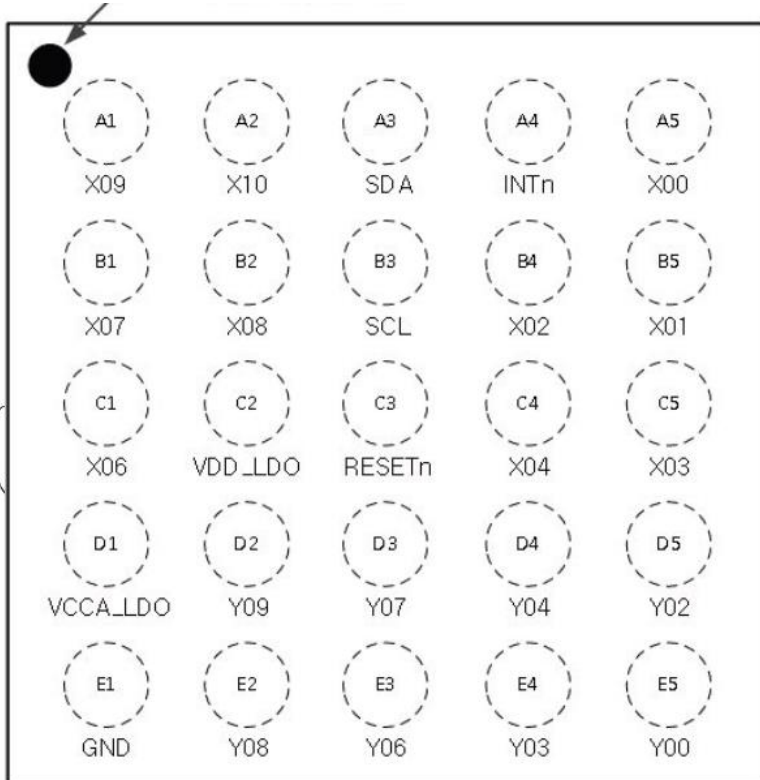
**RM67162 (refer to the datasheet).**

### 5.2 TP IC Recommended Operating Conditions

Touch IC: ZTW522 (refer to the datasheet)

Symbol	Description	Min	TYP	MAX	UNIT
VCCA	Analog power supply voltage	2.7	3.3	3.6	V

V <sub>IN</sub> (I2C)	Input voltage range	0	-	3.6	V
V <sub>OUT</sub> (I2C)	Output voltage range	0	-	VBUS	V
V <sub>IN</sub> (INT)	Input voltage range	0	-	3.6	V
V <sub>OUT</sub> (INT)	Output voltage range	0	-	VBUS	V
V <sub>OUT</sub> (TX)	Output voltage range	0	-	3.3	V
V <sub>OUT</sub> (RX)	Input voltage range	0	-	3.3	V



25 Ball WLCSP (TOP VIEW) assignments

项目	规格	备注
工作电压	2.7-3.6V	
工作电流	2.5mA	
Linearity	中间部位≤1mm (AA区四周内缩10mm以内)	测试工具: φ6mm铜柱
	边缘部位≤2mm (AA区到内缩的10mm之间)	
Sensitivity	不可有断线	Φ6mm铜柱, 分别以5mm/s, 20mm/s速度划线
响应时间	≤10ms	
抗干扰	灯箱干扰	将被测机放于灯箱测架上, 进行各种操作测试, 可正常操作
	电磁干扰	手机、WIFI讯号干扰下可正常操作

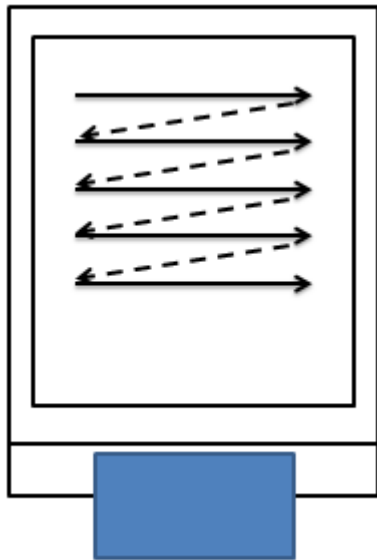
	电源适配器干扰		用电源适配器供电时可正常操作
	水膜测试		触摸屏表面有水膜时可正常操作
	汗水测试		触摸手指有汗液时可正常操作
ESD测试	接触放电	±8kv	TP处于工作模式时进行测试， 测试后TP功能应正常
	空气放电	±12kv	

### 5.3 I/O Connection

#	Pin name	I/O	Description
1	ELVDD	Power	Power supply for OLED
2	ELVSS	Power	Power supply for OLED
3	VPP	Power	Power supply for OTP. Leave the pin to open when not in use.
4	GND_1	Power	GND
5	DSI_CLKN	I/O	MIPI DSI clock-
6	DSI_CLKP	I/O	MIPI DSI clock+
7	GND_2	Power	GND
8	XRES	I	This signal will reset the device and must be applied to properly initialize the chip. Active low.
9	VDD1	Power	Driver IC analog supply
10	TP_RESX	I	Reset
11	TP_SDA	I/O	I2C Data Line
12	TP_INT	I/O	Interrupt to Host
13	KEY_COL	-	For customer's requirement
14	KEY_PWR	-	For customer's requirement
15	GND_3	Power	GND
16	GND_4	Power	GND
17	GND_5	Power	GND
18	KEY_ROW	-	For customer's requirement
19	GND_6	Power	GND
20	TP_SCL	I/O	I2C Clock Line
21	TP_VDD	Power	TP Power Supply
22	VDD2	Power	Driver IC analog supply
23	TE	O	Tear effect output
24	GND_7	Power	GND
25	DSI_D0P	I/O	MIPI DSI data0+
26	DSI_D0N	I/O	MIPI DSI data0-

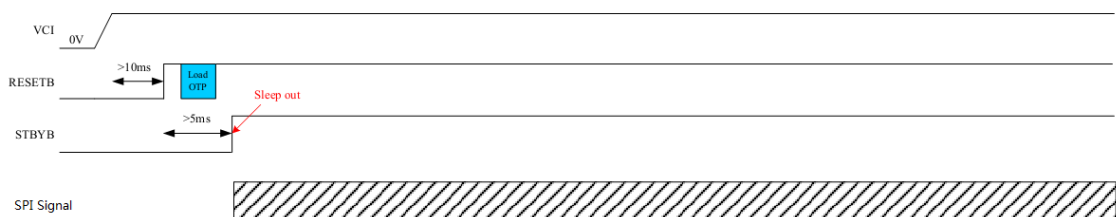
27	GND_8	Power	GND
28	VDDIO1	Power	Driver IC digital I/O supply.
29	VDDIO2	Power	Driver IC digital I/O supply.
30	SWIRE	O	Power IC control signal.

### 5.4 Graphic memory writing direction

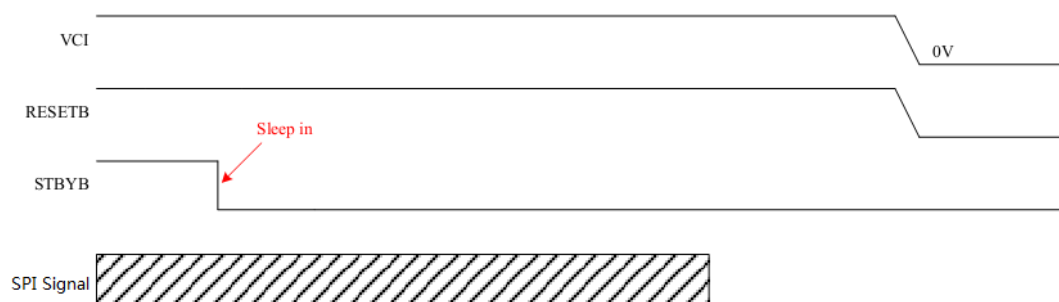


### 5.5 Recommended Operating Sequence

#### 5.5.1 Power on sequence



#### 5.5.2 Power off sequence





### 5.5.3 Timing requirements for RESETB

When RESETB of the reset pin equals to Low, it will be in the condition of reset.

When it is in the condition of reset, it will make the device recover the initial set.

However, in order to avoid the reset noise cause reset, there is a mechanism to judge about whether the reset is needed or not.

The closed interval of Low can be shown as the following.

(Test condition: VDDIO=1.65V~3.6V, VSS=0V, TA=-20°C~+70°C)

Parameter	Symbol	Conditions	Spec			Unit
			Min.	Typ.	Max.	
Reset low pulse width	Trst	-	20	-	-	μs

Table: Reset timing

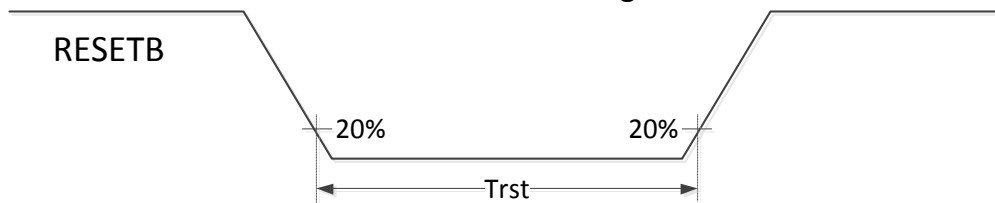


Figure: Reset timing

## 6 Electro-Optical Specification

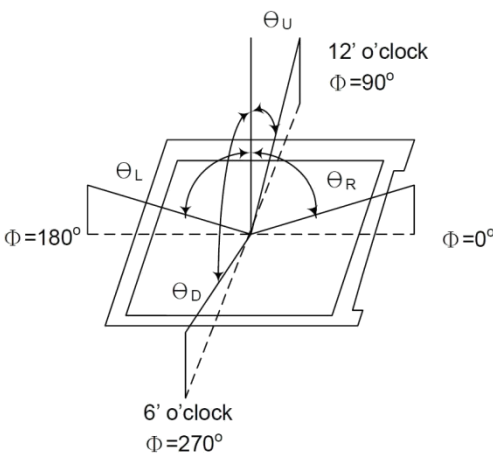
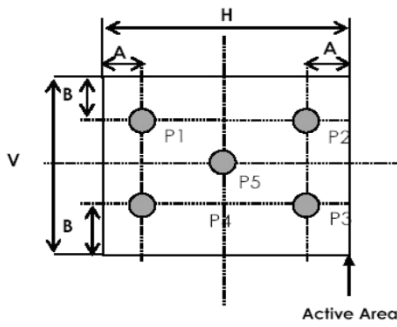
Test condition: 25°C±3°C, 65±20%RH, 暗房。

No	Item	Symbol	Condition	Value			Unit	Remark	
				Min.	Typ.	Max.			
1	Brightness	L	Full white Without CG (带POL保护膜)	300	350	385	cd/m <sup>2</sup>	Note1.	
2	Brightness Uniformity	UL	Full white	80	-	-	%	Note4	
3	Contrast Ratio	CR	Normal θ=Φ=0°	10000	-	-	-	Note3.	
4	Response time	Ton+Toff	Normal θ=Φ=0°	-	2	4	ms	Note2.	
5	Color Coordinate of CIE1931	White	X	Normal θ=Φ=0°	0.28	0.30	0.32	-	Note1.
			Y		0.29	0.31	0.33		
		Red	X		0.64	0.67	0.70		
			Y		0.30	0.33	0.36		
		Green	X		0.16	0.21	0.26		
			Y		0.68	0.73	0.78		
		Blue	X		0.09	0.13	0.17		
			Y		0.02	0.06	0.10		
6	Color Gamut	NTSC	CIE1931	90	105	-	%		
7	Viewing Angle		Top/Bottom/Right/Left CR ratio ≥ 1000	80			°	Note3.	
8	Gamma		Log(Lv-Lb)=log(V)+log(a)	2.0	2.2	2.4	-		

		V(Gray)= 48,72,104,132, 164,192,224,,25 5 Lum(gray255)=3 50nit					
9	Color Temp (与色坐标定义重复)	-	6724	7524	8324	K	
10	Color shift (抽测30/8000, 无法百 百量)	@30 degree		4	5	JNCD	Note5.
11	影像残留 (Image Retention)	ND06	-	-	2	Sec	Note6. (非高 亮模 式)
12	亮度衰减率 Luminance decrease ratio	@30 degree	-	-	45	%	Note7.
13	Flicker	Normal $\Theta = \Phi = 0^\circ$	-	-35	-30	dB	Note8.
14	Crosstalk	-	-	-	4	%	Note9.
15	OLED Life Time	L > 95% @ 25°C	100				Note10

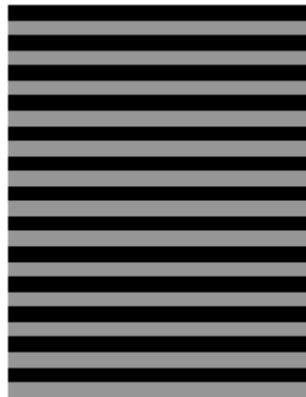
备注: (见下表)

序号	项目	内容
Note1	光学特 性测试	
Note 2	响应时 间测试	

<p>Note 3</p>	<p>视角及对比度说明</p>	 <p>Contrast Ratio Dark Room C.R=LW/LB LW: full white brightness of display center P0; LB: full black brightness of display center P0.</p>
<p>Note 4</p>	<p>亮度均匀性测试</p>	 <p>A: 1/4H B: 1/4V H.V: Active Area</p>
<p>Note 5</p>	<p>色偏测试</p>	<p>For JNCD measure: Fix on one pattern like white pattern, On the condition <math>\theta=0 \phi=0^\circ</math>, we can get the color coordinate <math>(u_1', v_1')</math> and on <math>30^\circ</math> we can get another color coordinate <math>(u_2', v_2')</math> <math>\Delta = \text{Square Root}((u_2' - u_1')^2 + (v_2' - v_1')^2)</math> JNCD stands for "Just Noticeable Color Difference" For the <math>(u', v')</math> color space JNCD=0.0040. 2JNCD means <math>\Delta u''v'' &lt; 0.0080</math> For color shift we need to measure white/red/green/blue pattern</p>
<p>Note 6</p>	<p>影像残留</p>	<p><b>Image Retention (IR)</b> To check image retention, a <b>8x8 Chess Pattern</b> shall be displayed for <b>30sec</b> and do the judgment after switching the pattern to <b>L186</b> Gray Level.</p>
<p>Note 7</p>	<p>亮度衰减率</p>	<p>Definition of Luminance decrease ratio Test pattern : Full White The luminance decrease ratio is calculated by using following formula:</p>

$$\text{Luminance decrease ration} = 1 - \frac{\text{Luminance test at left, right, top, bottom}}{\text{Luminance test at left, right, top, bottom}}$$

Suggested Instruments: **Konica Minolta CA-310** or **Klein Instruments K-8**



**Odd row : L0 Black**  
**Even row : L186 gray level**

**Flicker Test Pattern**

The flicker level is defined by **Fast Fourier Transformation (FFT)** as follows:

$$\text{Flicker} = 20 \log_{10} \left( 2 \frac{f_{FFTC}(n)}{f_{FFTC}(0)} \right) + FS(Hz) \quad (\text{dB})$$

闪烁  
**Flicker**

Note 8

Where

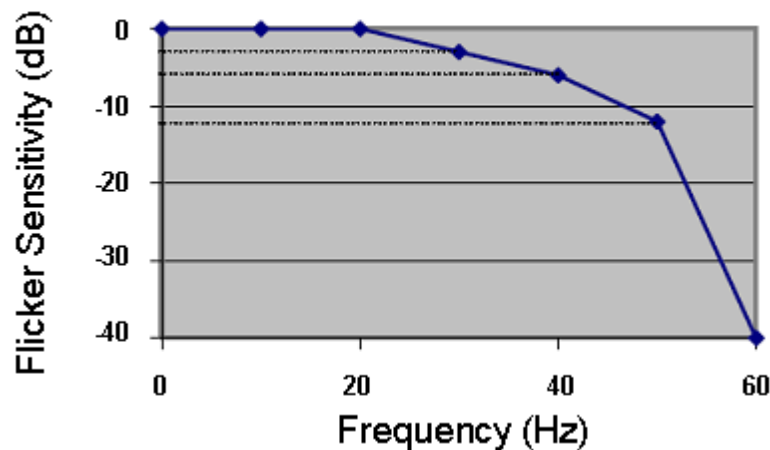
**fFFTC(n)** is the n-th FFT coefficient.

**fFFTC(0)** is the 0-th FFT coefficient which is DC component.

**FS(Hz)** is the flicker sensitivity as a function of frequency.

The peak flicker level shall be reported based on the calculation using above formula in which FS(Hz) is determined by the flicker weighing factor shown below.

**Flicker Weighing Factor**



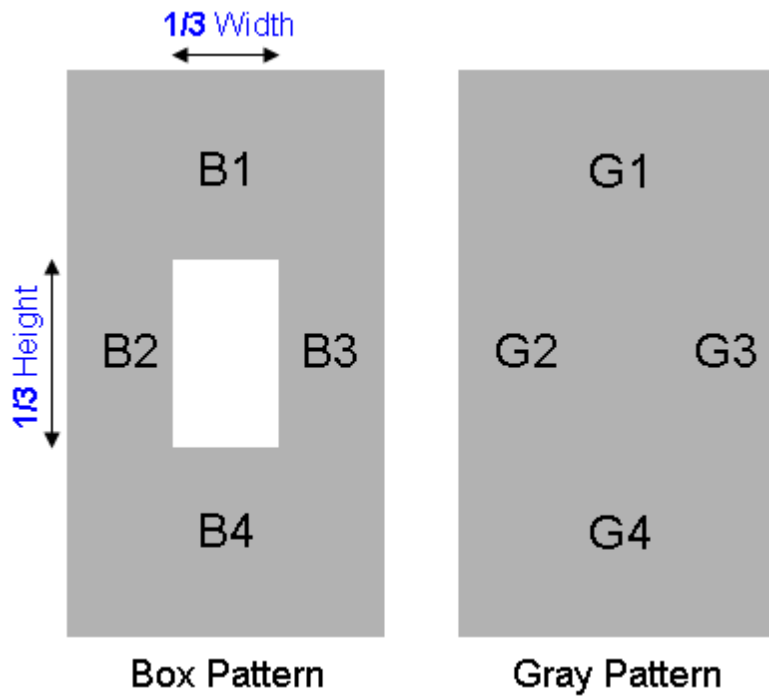
串扰  
**Crosstalk**

Note 9

Crosstalk shall be calculated by the luminance of **B1~B4** and **G1~G4** in the patterns shown below.

Box Pattern: **L128** gray level background with a **L255** White window in the central area.

Gray Pattern: **L128** gray level background only.



*Crosstalk*

$$\equiv \text{Maximum} : \left\{ \frac{|B1 - G1|}{G1}, \frac{|B2 - G2|}{G2}, \frac{|B3 - G3|}{G3}, \frac{|B4 - G4|}{G4} \right\} \times 100\%$$

Note  
10

寿命测试  
**Life Time**

OLED life time is defined by the **Minimum Duration Time** that the luminance is decayed to a specific ratio (ex. **95%**) of initial state.  
Test Pattern under duration period: **L255 White**

## 7 Reliability

### 7.1 Environmental Test

Item	Main spec	No. of failures / No. of examinations
High Temperature Operation	70°C / 128hrs	0/5
Low Temperature Operation	-20°C / 128hrs	0/5
High Temperature Storage	80°C / 128hrs	0/5
Low Temperature Storage	-40°C / 128hrs	0/5
High Temperature Humidity Operation	60°C/93%RH/ 128hrs	0/10
Thermal Shock	-40°C~85°C dwell time=0.5hr, 50 cycles.	0/16

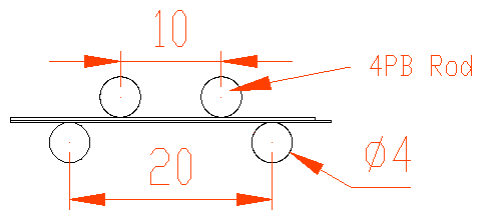
## 7.2 Electrical Test

Item	Main spec	Note
Air Discharge	$\pm 2$ kV , 150pF/330 $\Omega$ (Module level; without CG)	5Points, Each 10times. After one time discharge, panel and gun touch the ground, through the whole test, turn on ion fan. No degradation of OLED performance after this test.
Contact Discharge	$\pm 2$ kV, 150pF/330 $\Omega$ (Module level; without CG)	

## 7.3 Mechanical Test

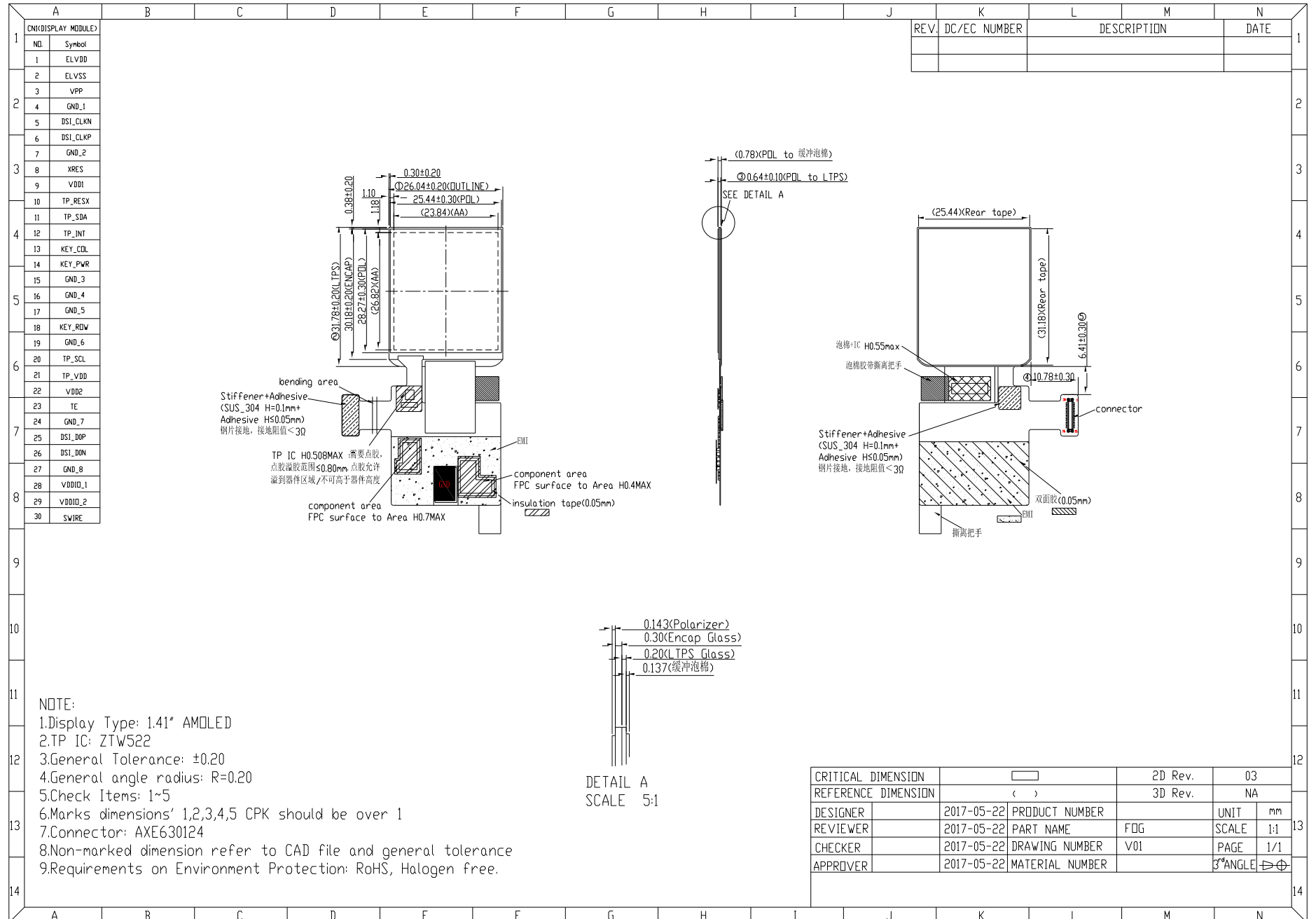
Test item	Test condition	Note
Glass Strength Test- 4PB	B10 $\geq$ 100MPa	Panel (80 pcs) Note 11
Packing vibration-proof test	2g, f=10->55->10Hz apply in each of X, Y, and Z direction for 30 min	Package
Packing Drop test	Drop the packing from 60cm height, 6-faces, 3-edges and 1-corner(one time for each)	Package
Pol Hardness Testing	1、 loading :500g 2、 Test point of view: 45° 3、 Way of marking : At a rate of 10 mm/s, marking off 5 line segments of 50mm in length 4、 Instrument and tools: Special fixture for hardness testing, 2H pencil of Mitsubishi	Deep scratches $\leq$ 1mm

Note 11 Glass Strength Test- 4PB



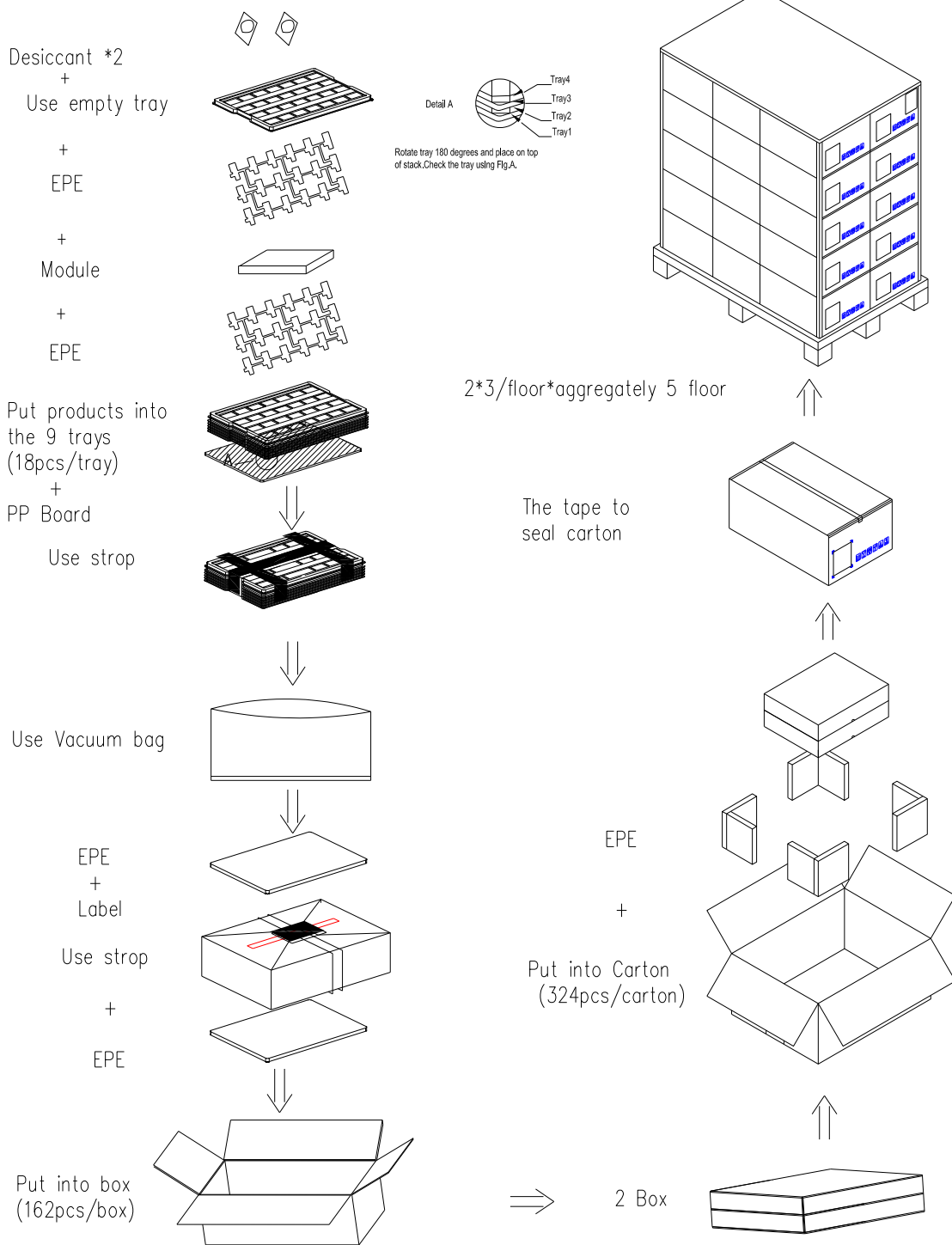
# 8 Outline Dimension Drawing

Refer to the 2D drawing.





## 9 Packing Specification



(2) 内包装（材质、标识、包装数量规格等）

NO	Item	材质	尺寸	数量	模组数量	备注
1	纸盒	纸	459*294*115mm	2	162PCS /纸盒	
2	吸塑盒	PET	455*290	20	下面9层，18PCS/吸塑，	10吸塑/盒

					最上面的吸塑为空	
4	防尘袋	Al	660*440*0.28mm	2	/	
5	珍珠棉	EPE	394.3*228.23*0.1m m	36	2/吸塑盘	
6	内盒标签	PET	52*100*0.075mm	2	/	

## (3) 外包装（材质、标识、包装数量规格等）

NO	Item	材质	尺寸	数量	模组数量	备注
1	外箱	纸	516*338*248mm	1	324PCS MDL/箱	
2	外箱标签	贴纸	52*100*0.1mm	1	/	

## (4) 其它

环保产品在外包装箱上贴“ROHS”标签