

AMOLED

Product Specification

Model Name: E141F320360M0

Description: 1.41" (320x360) AMOLED

Doc. Version: 01

Customer: Common Customers

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- Approved for Preliminary Specification
- Approved for Final Specification
- Approved for Final Specification & Sample

| | | |
|------------|---------|------------|
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| |
|---------------------|
| Customer's Approval |
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| Reversion History | | | |
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| Reversion. No | Date | Contents | Remark |
| 01 | 2017-07-19 | First Draft | |
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1 Scope

This Specification defines AMOLED manufactured by EverDisplay Optonics(Shanghai) Limited, from here on refer as EDO. In the case of any unspecified item, it may require both EDO 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 | 2.01 | 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 | 1.65 | 1.8 | 1.95 | V | Ref |
| Analog Power supply | VCI | 2.7 | 2.8 | 2.9 | V | Ref |

1) Normal Mode

Power Supply: IOVCC=1.8V VCI=2.8V

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

Power Supply: IOVCC=1.8V VCI=2.8V

Frame Frequency: $F_{frame}=15\text{HZ}$ @ 25degC, Brightness 30 nits,

| Display Condition | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-------------------------|------------------|------|------|------|------|--------------------------|
| 10% Pixel On 30 nits | IELVDD /ELVSS | - | - | - | mA | Supplied by Driver IC |
| | IVCI | - | 5 | 6.5 | mA | Ref |
| | IVDDIO | - | 0.5 | 1 | mA | Ref |

3) 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 _{IN} (I2C) | Input voltage range | 0 | - | 3.6 | V |
| V _{OUT} (I2C) | Output voltage range | 0 | - | VBUS | V |
| V _{IN} (INT) | Input voltage range | 0 | - | 3.6 | V |
| V _{OUT} (INT) | Output voltage range | 0 | - | VBUS | V |
| V _{OUT} (TX) | Output voltage range | 0 | - | 3.3 | V |
| V _{OUT} (RX) | Input voltage range | 0 | - | 3.3 | V |



25 Ball WLCSP (TOP VIEW) assignments

| 项目 | 规格 | 备注 |
|-------------------|-----------------|---------------------------------|
| Operating voltage | 2.7-3.6V | |
| Operating current | 2.5mA | |
| Linearity | Center part≤1mm | Test tool: φ6mm copper cylinder |

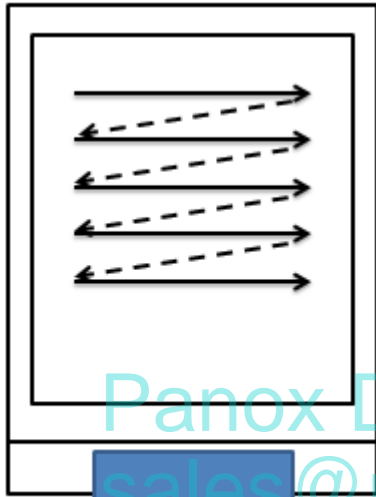
| | | |
|---------------|---|---|
| | The peripheral position $\leq 2\text{mm}$ | |
| Sensitivity | No broken line | Lineation with 5mm/s&20mm/s respectively by $\Phi 6\text{mm}$ copper cylinder |
| Response time | $\leq 10\text{ms}$ | |

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 | GF1 | - | For customer's requirement |
| 14 | GF3 | - | For customer's requirement |
| 15 | GND_3 | Power | GND |
| 16 | GND_4 | Power | GND |
| 17 | GND_5 | Power | GND |
| 18 | GF2 | - | For customer's requirement |
| 19 | NC | - | No connector |
| 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_6 | Power | GND |
| 25 | DSI_D0P | I/O | MIPI DSI data0+ |

| | | | |
|----|---------|-------|-------------------------------|
| 26 | DSI_D0N | I/O | MIPI DSI data0- |
| 27 | GND_7 | 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. |

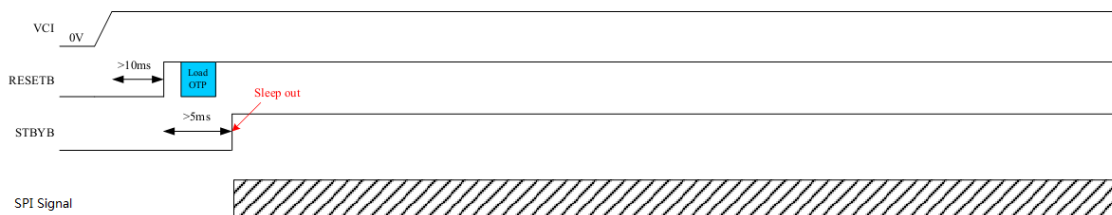
5.4 Graphic memory writing direction



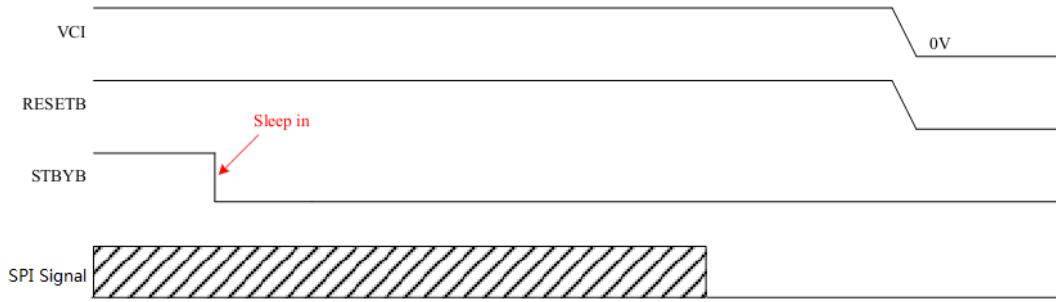
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5.5 Recommended Operating Sequence

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

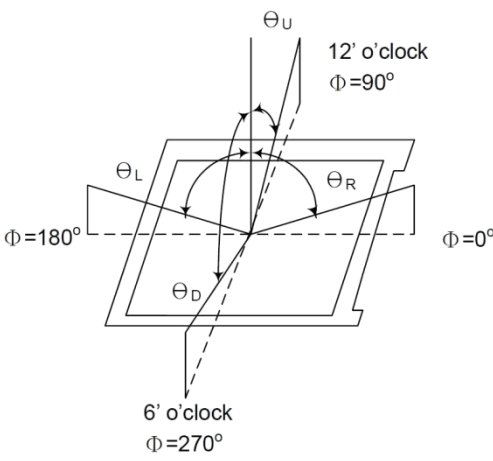
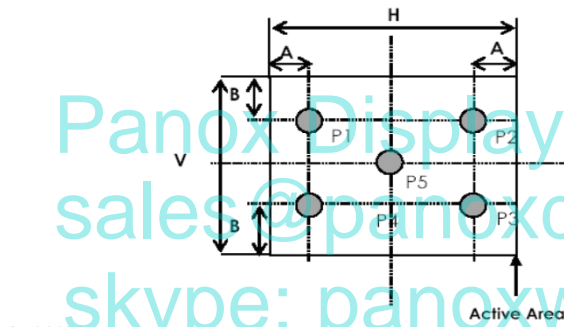
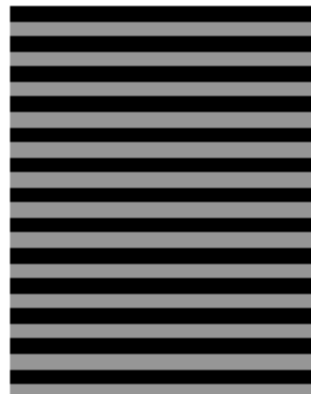
Test condition: 25°C±3°C, 65±20%RH, darkroom.

| No | Item | Symbol | Condition | Value | | | Unit | Remark | |
|----|-----------------------------------|----------|--------------------------|------------------|------|------|-------------------|--------|--------|
| | | | | Min. | Typ. | Max. | | | |
| 1 | Brightness | L | Full white Without CG | 300 | 350 | 385 | cd/m ² | 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 | | 0.63 | 0.66 | 0.69 | | |
| | | | Y | | 0.31 | 0.34 | 0.37 | | |
| | | 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 | | | $\text{Log}(L_v - L_b) = \log(V) + \log(a)$ $V(\text{Gray}) = 48, 72, 104, 132, 164, 192, 224, 252, 255$ $\text{Lum}(\text{gray}255) = 350\text{nit}$ | 2.0 | 2.2 | 2.4 | - | |
| 9 | Luminance decrease ratio | | | @30 degree | - | - | 45 | % | Note5. |
| 10 | Flicker | | | Normal $\Theta = \Phi = 0^\circ$ | - | -35 | -30 | dB | Note6. |
| 11 | Crosstalk | | | - | - | - | 4 | % | Note7. |
| 12 | OLED Life Time | | | $L > 92\% @ 25^\circ\text{C}$ | 100 | | | | Note8. |

See the note in the table below:

| No | Item | Details |
|--------|---------------|---------|
| Note1 | Brightness | |
| Note 2 | Response time | |

| | | |
|---------------|---------------------------------|--|
| <p>Note 3</p> | <p>Viewing Angle</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>Brightness Uniformity</p> |  <p>A: 1/4H B: 1/4V H, V: Active Area</p> |
| <p>Note 5</p> | <p>Luminance decrease ratio</p> | <p>Definition of Luminance decrease ratio Test pattern : Full White The luminance decrease ratio is calculated by using following formula:</p> $\text{Luminance decrease ratio} = 1 - \frac{\text{Luminance test at left, right, top, bottom}}{\text{Luminance test at left, right, top, bottom}}$ |
| <p>Note 6</p> | <p>Flicker</p> | <p>Suggested Instruments: Konica Minolta CA-310 or Klein Instruments K-8</p>  <p>Odd row : L0 Black Even row : L186 gray level</p> <p>Flicker Test Pattern</p> |

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

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

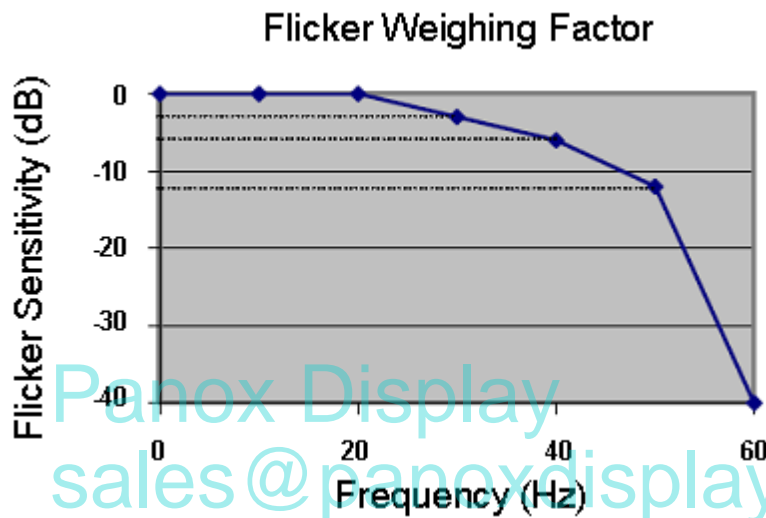
Where

$f_{FFTC}(n)$ is the n-th FFT coefficient.

$f_{FFTC}(0)$ is the 0-th FFT coefficient which is DC component.

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

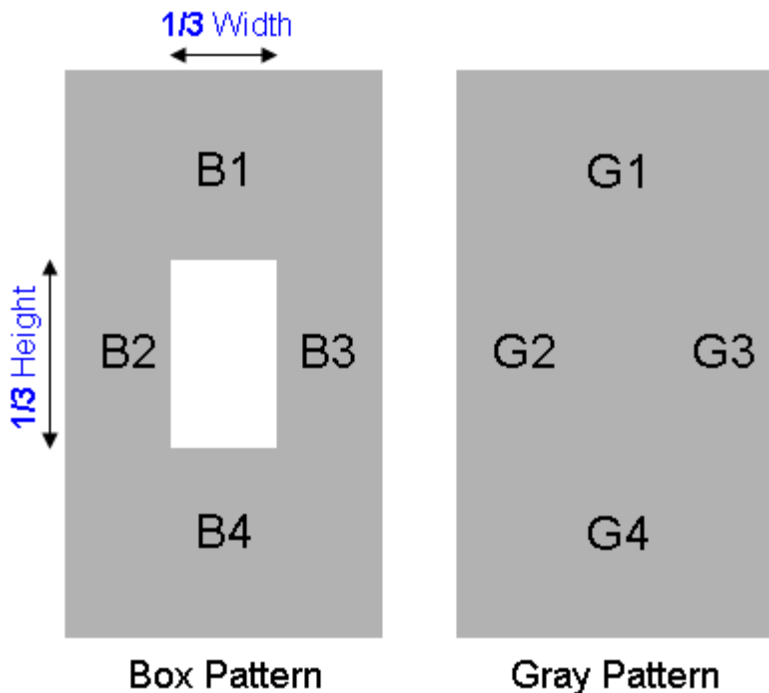
The peak flicker level shall be reported based on the calculation using above formula in which $FS(Hz)$ is determined by the flicker weighing factor shown below.



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.



Note 7 Crosstalk

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

| | | |
|--------|------------------|--|
| Note 8 | Life Time | <p>OLED life time is defined by the Minimum Duration Time that the luminance is decayed to a specific ratio (ex. 95%) of initial state.</p> <p>Test Pattern under duration period: L255 White</p> |
|--------|------------------|--|

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 |

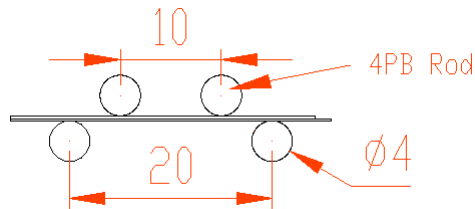
7.2 Electrical Test

| Item | Main spec | Note |
|-------------------|--|---|
| Air Discharge | ±2 kV , 150pF/330Ω (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 | ±2kV, 150pF/330Ω (Module level; without CG) | |

7.3 Mechanical Test

| Test item | Test condition | Note |
|------------------------------|---|---------|
| 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 |

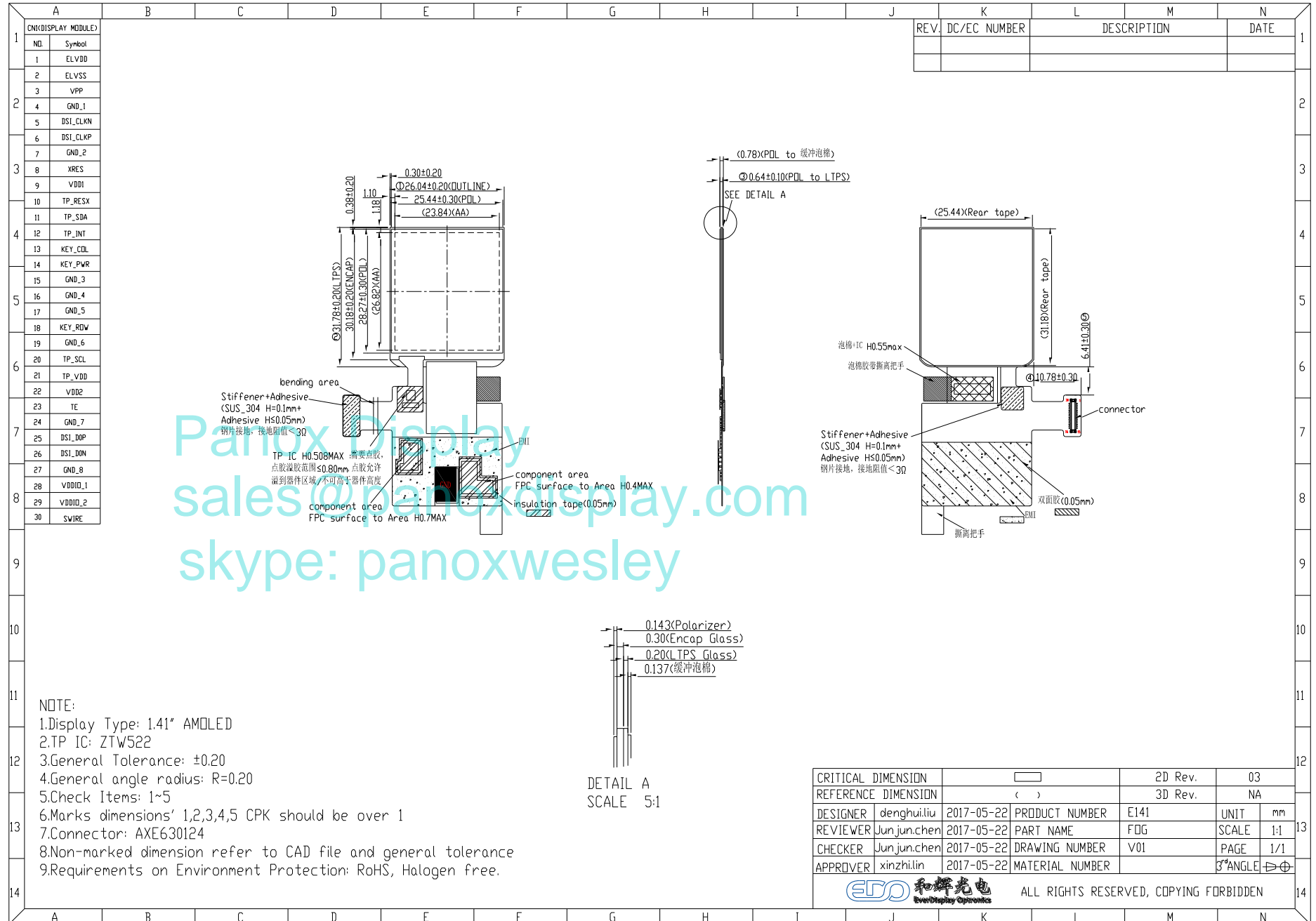
Note 11 Glass Strength Test- 4PB



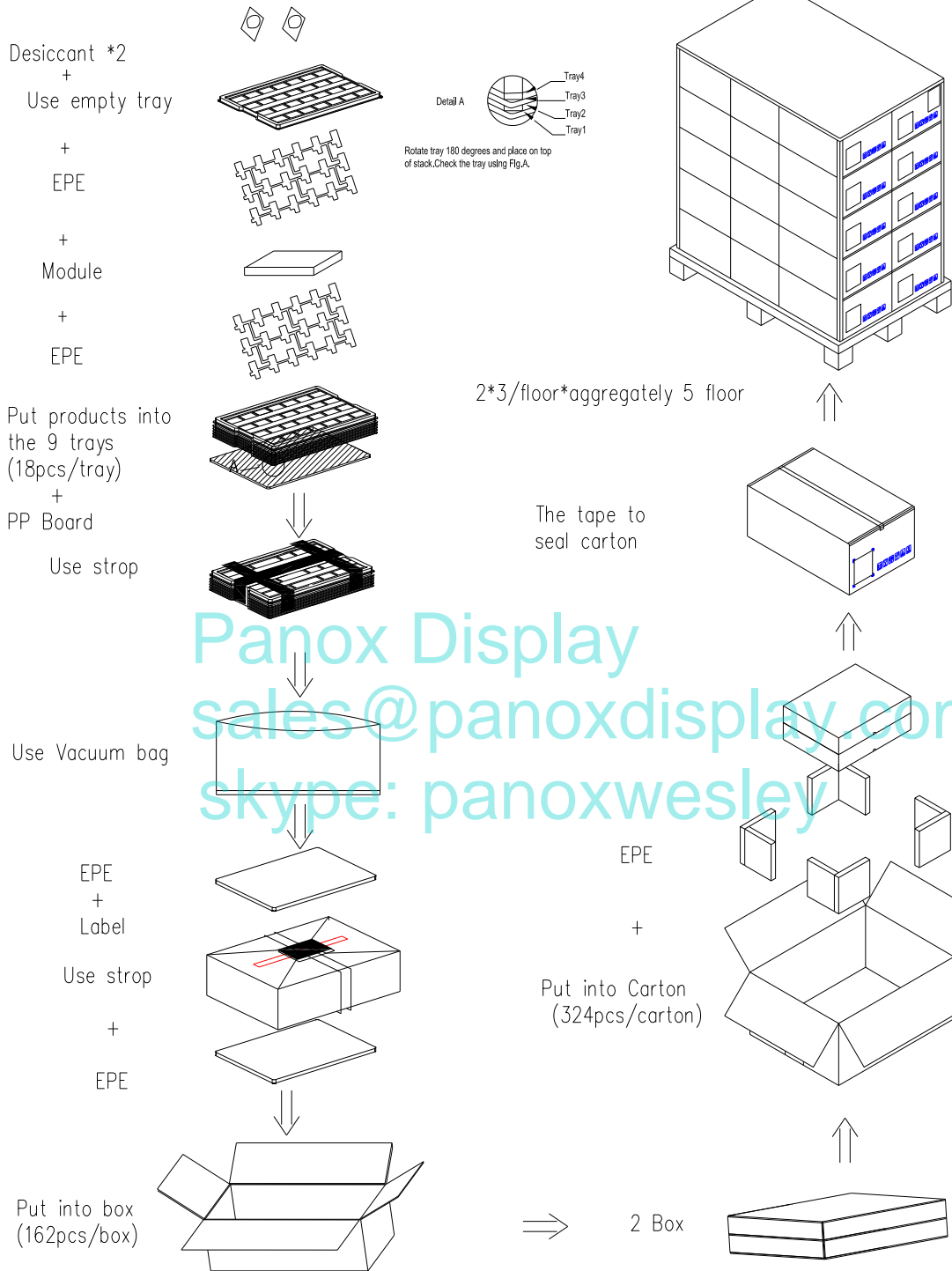
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8 Outline Dimension Drawing

Refer to the 2D drawing.



9 Packing Specification



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(2) Inner packing (material/identifying/package quantity)

| NO | Item | Material | Size | Quantity | Module Quantity | Note |
|----|------|----------|------|----------|-----------------|------|
|----|------|----------|------|----------|-----------------|------|



| | | | | | | |
|---|--------------------|-------|-------------------|----|---|----------------|
| 1 | Box | paper | 459*294*115mm | 2 | 162PCS /carton | |
| 2 | Tray | PET | 455*290 | 20 | 9 layers under first empty tray, 18PCS/Tray | 10 Tray/carton |
| 4 | Vocuum bag | Al | 660*440*0.28mm | 2 | / | |
| 5 | EPE | EPE | 394.3*228.23*0.1m | 36 | 2/Tray | |
| 6 | Lable of inner box | PET | 52*100*0.075mm | 2 | / | |

(3) Outer packing (material/identifying/package quantity)

| NO | Item | Material | Size | Quantity | Module Quantity | Note |
|----|-----------------------|----------|---------------|----------|-------------------|------|
| 1 | Carton | paper | 516*338*248mm | 1 | 324PCS MDL/Carton | |
| 2 | Lable of outer carton | paster | 52*100*0.1m | 1 | /carton | |

(4) Others

Environment-friendly products need to be attached "ROHS" mark on outer packing.

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