



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: _____ **H028HQ24E2510** _____

Date: _____

Version: _____

Preliminary Specification

Final Specification

For Customer's Acceptance

| Approved by | Comment |
|-------------|---------|
| | |

| Approved by | Reviewed by | Prepared by |
|-------------|-------------|-------------|
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1. Record of Revision

| Rev | Issued Date | Description | Editor |
|-----|-------------|---------------|------------|
| 1.0 | 2018/01/12 | First Release | Rich Liang |
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2. General Specifications

| | Feature | Spec |
|------------------------|--------------------------------|-------------------------------|
| Characteristics | Size | 2.8inch |
| | Resolution | 240(horizontal)*320(Vertical) |
| | Interface | 8-bit MCU |
| | 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*2.3 |
| | 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 | PIN NAME | DESCRIPTION |
|--------|----------|-------------------------------------------------|
| 1 | GND | Ground |
| 2 | GND | Ground |
| 3 | IOVCC | power supply for interface logic circuits |
| 4 | TE | Tearing effect output pin |
| 5 | CS | Chip select |
| 6 | RS | This pin is used to select "Data or Command" in |
| 7 | WR | Write signalcircuits |
| 8 | RD | Read signal |
| 9 | DB10 | DATA BUS |
| 10 | DB11 | DATA BUS |
| 11 | DB12 | DATA BUS |
| 12 | DB13 | DATA BUS |
| 13 | DB14 | DATA BUS |
| 14 | DB15 | DATA BUS |
| 15 | DB16 | DATA BUS |
| 16 | DB17 | DATA BUS |
| 17 | RESET | Reset signal input terminal, active at 'L' |
| 18 | VCI | power supply |
| 19 | LEDA | LED backlight anode |
| 20 | LEDK1 | Power for LED backlight (Cathode) |
| 21 | LEDK2 | Power for LED backlight (Cathode) |
| 22 | LEDK3 | Power for LED backlight (Cathode) |
| 23 | LEDK4 | Power for LED backlight (Cathode) |
| 24 | GND | 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 | °C | |
| Storage Temperature | T _{STG} | -30 | 80 | °C | |

5. Electrical Characteristics

Driving TFT LCD Panel

Ta = 25 °C

| 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 | - | 80 | 100 | mA | |
| Forward Voltage | V _F | - | 3.2 | 3.3 | V | |
| Backlight Power consumption | W _{BL} | - | 0.256 | 0.33 | W | |
| LED Lifetime | | 25000 | - | - | Hrs | |

Note 1: Each LED: I_F =20 mA, V_F =3.2V.

Note 2: Optical performance should be evaluated at Ta=25°C 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

6.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus

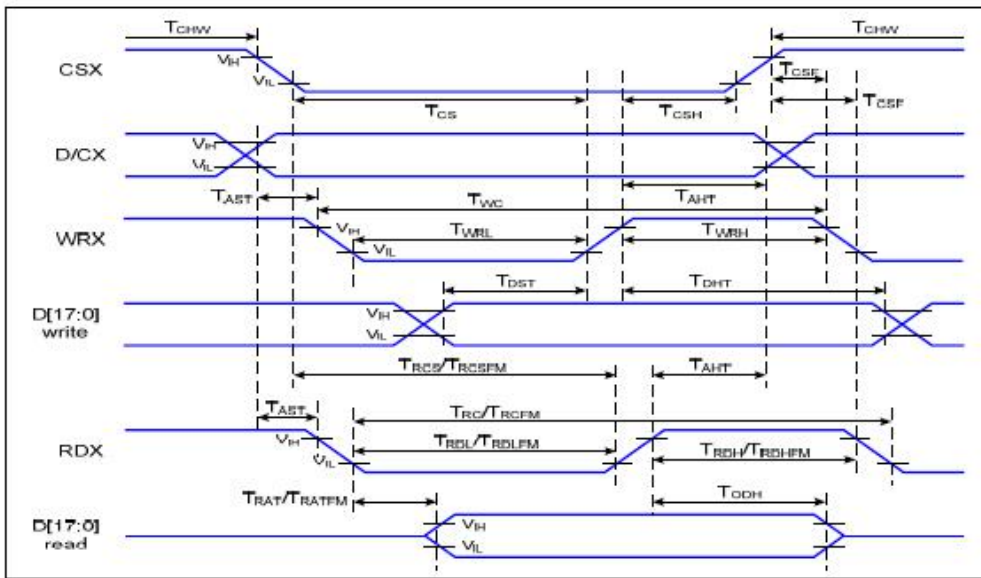


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDD1=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 °C

| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|----------|--------------------|------------------------------------|-------------|-----|------|-----------------------------|
| D/CX | T _{AST} | Address setup time | 0 | | ns | - |
| | T _{AHT} | Address hold time (Write/Read) | 10 | | ns | |
| CSX | T _{CHW} | Chip select "H" pulse width | 0 | | ns | - |
| | T _{CS} | Chip select setup time (Write) | 15 | | ns | |
| | T _{RCS} | Chip select setup time (Read ID) | 45 | | ns | |
| | T _{RCSFM} | Chip select setup time (Read FM) | 355 | | ns | |
| | T _{CSF} | Chip select wait time (Write/Read) | 10 | | ns | |
| | T _{CSH} | Chip select hold time | 10 | | ns | |
| | WRX | T _{WC} | Write cycle | 66 | | |
| WRX | T _{WRH} | Control pulse "H" duration | 15 | | ns | |
| | T _{WRL} | Control pulse "L" duration | 15 | | ns | |
| RDX (ID) | T _{RC} | Read cycle (ID) | 160 | | ns | When read ID data |
| | T _{RDH} | Control pulse "H" duration (ID) | 90 | | ns | |
| | T _{RDL} | Control pulse "L" duration (ID) | 45 | | ns | |
| RDX (FM) | T _{RCFM} | Read cycle (FM) | 450 | | ns | When read from frame memory |
| | T _{RDHFM} | Control pulse "H" duration (FM) | 90 | | ns | |
| | T _{RDLFM} | Control pulse "L" duration (FM) | 355 | | ns | |
| D[17:0] | T _{DST} | Data setup time | 10 | | ns | For CL=30pF |



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6.2 Reset Timing:

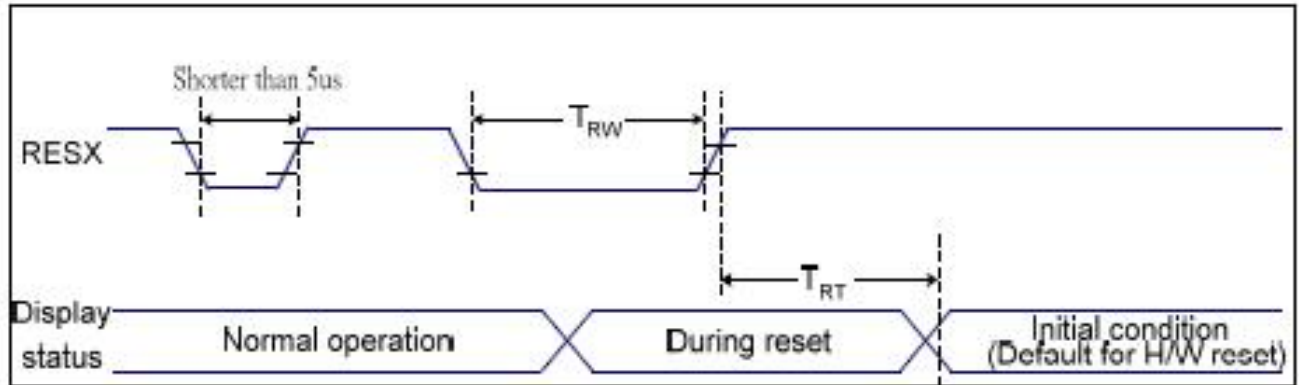


Figure 7 Reset Timing

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

| 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



7. Optical Characteristics

| Items | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|----------------|-------|------------|------------------------|------|------|------|--------|-----------------|
| Viewing angles | | θ_T | Center CR \geq 10 | - | 65 | - | Degree | Note2 |
| | | θ_B | | - | 55 | - | | |
| | | θ_L | | - | 65 | - | | |
| | | θ_R | | - | 65 | - | | |
| Contrast Ratio | | CR | $\Theta = 0$ | 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 | | 200 | 250 | - | 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.

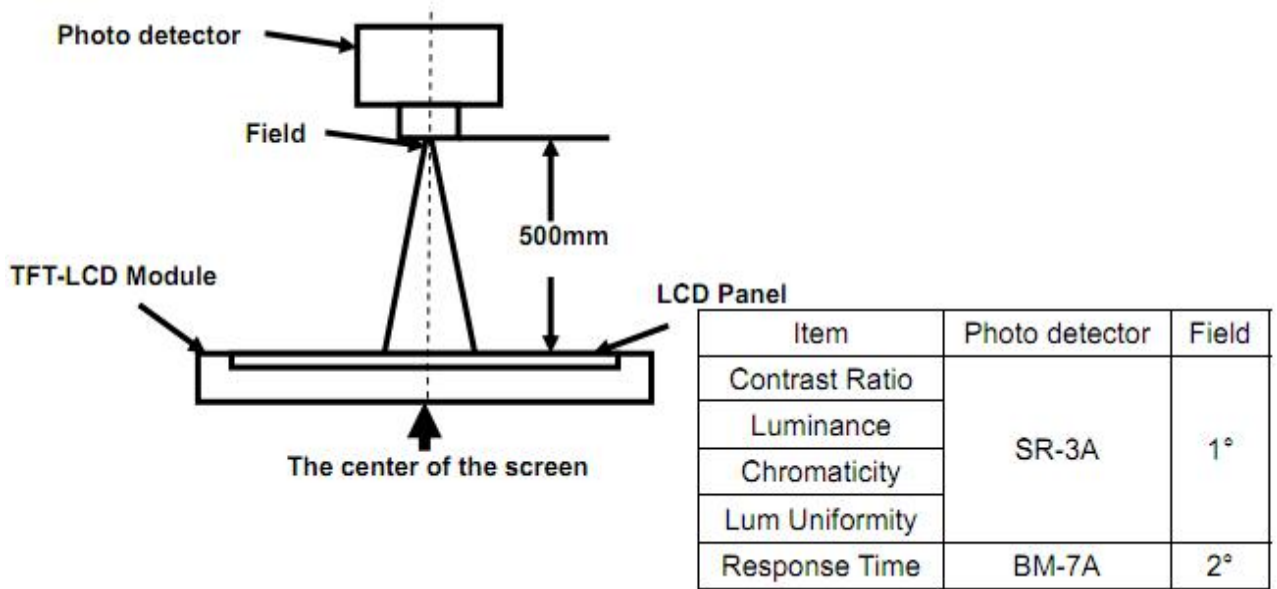
Note 1: Definition of optical measurement system.

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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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).

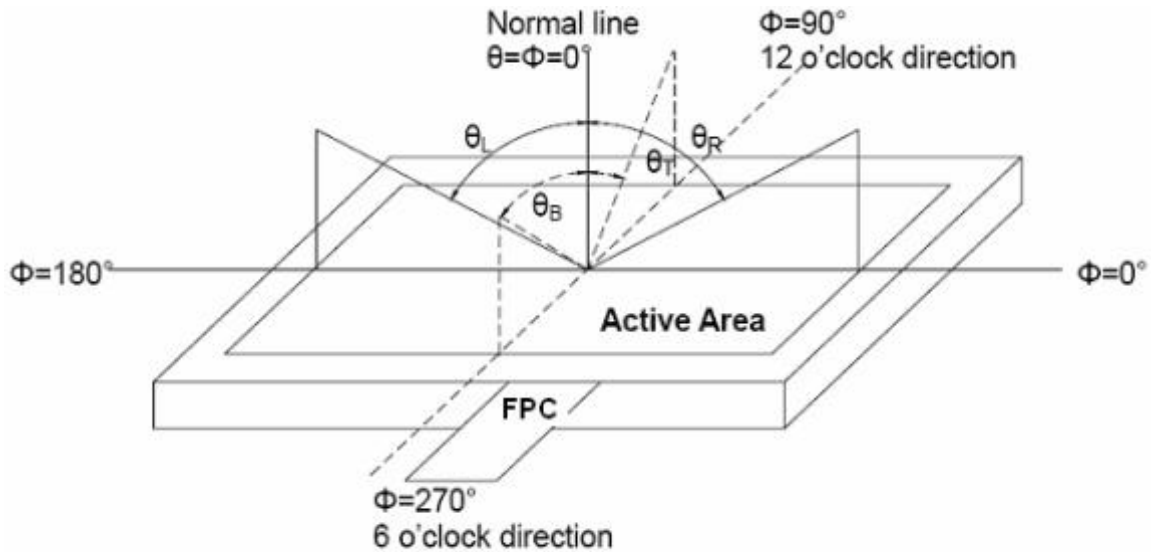


Fig. 1 Definition of viewing angle

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 V_{white}.

“Black state”: The state is that the LCD should drive by V_{black}.



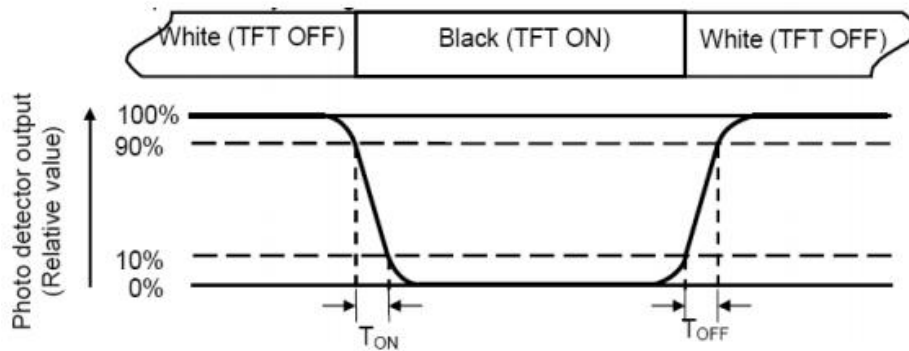
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V_{white}: To be determined V_{black}: To be determined.

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 (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) 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) = L_{min} / L_{max}

L-----Active area length W----- Active area width

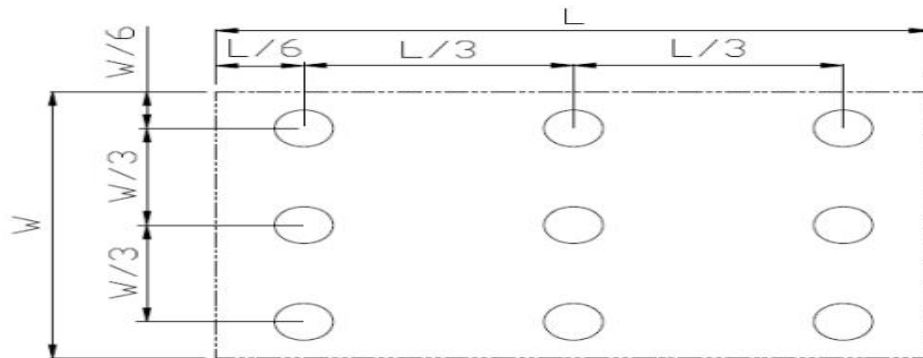


Fig. 2 Definition of uniformity

L_{max}: The measured maximum luminance of all measurement position.

L_{min}: 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

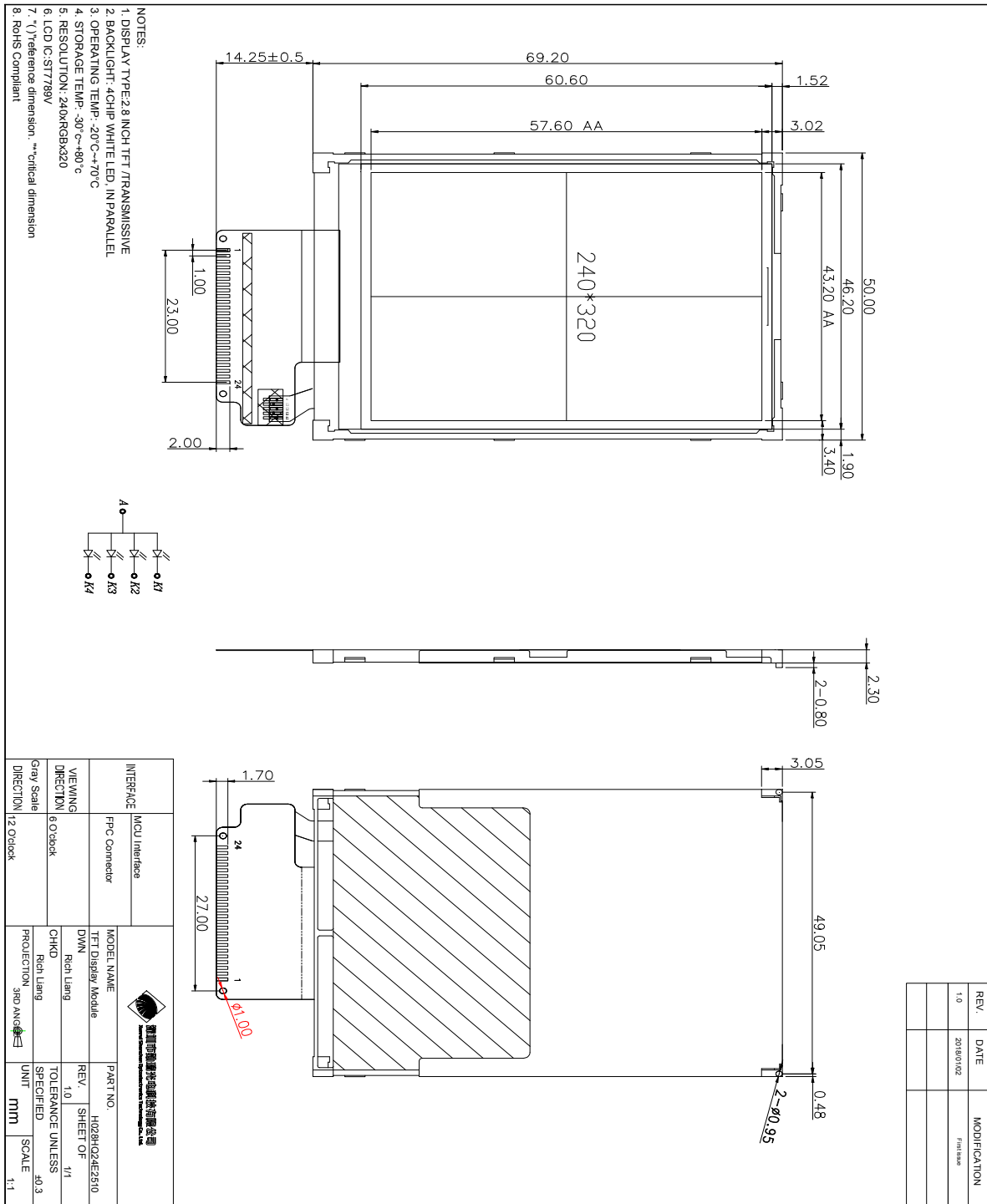
| No | Test Item | Condition | Remarks |
|----|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 1 | High Temperature Operation | Ts= +70°C, 240hrs | Note 1 IEC60068-2-2, GB2423. 2-89 |
| 2 | Low Temperature Operation | Ta= -20°C, 240hrs | Note 2 IEC60068-2-1 GB2423.1-89 |
| 3 | High Temperature Storage | Ta= +80°C, 240hrs | IEC60068-2-2 GB2423. 2-89 |
| 4 | Low Temperature Storage | Ta= -30°C, 240hrs | IEC60068-2-1 GB/T2423.1-89 |
| 5 | High Temperature & Humidity Storage | Ta= +60°C, 90% RH max, 160 hours | IEC60068-2-3 GB/T2423.3-2006 |
| 6 | Thermal Shock (Non-operation) | -30°C 30 min ~ +80°C 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°C ~35°C, 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.



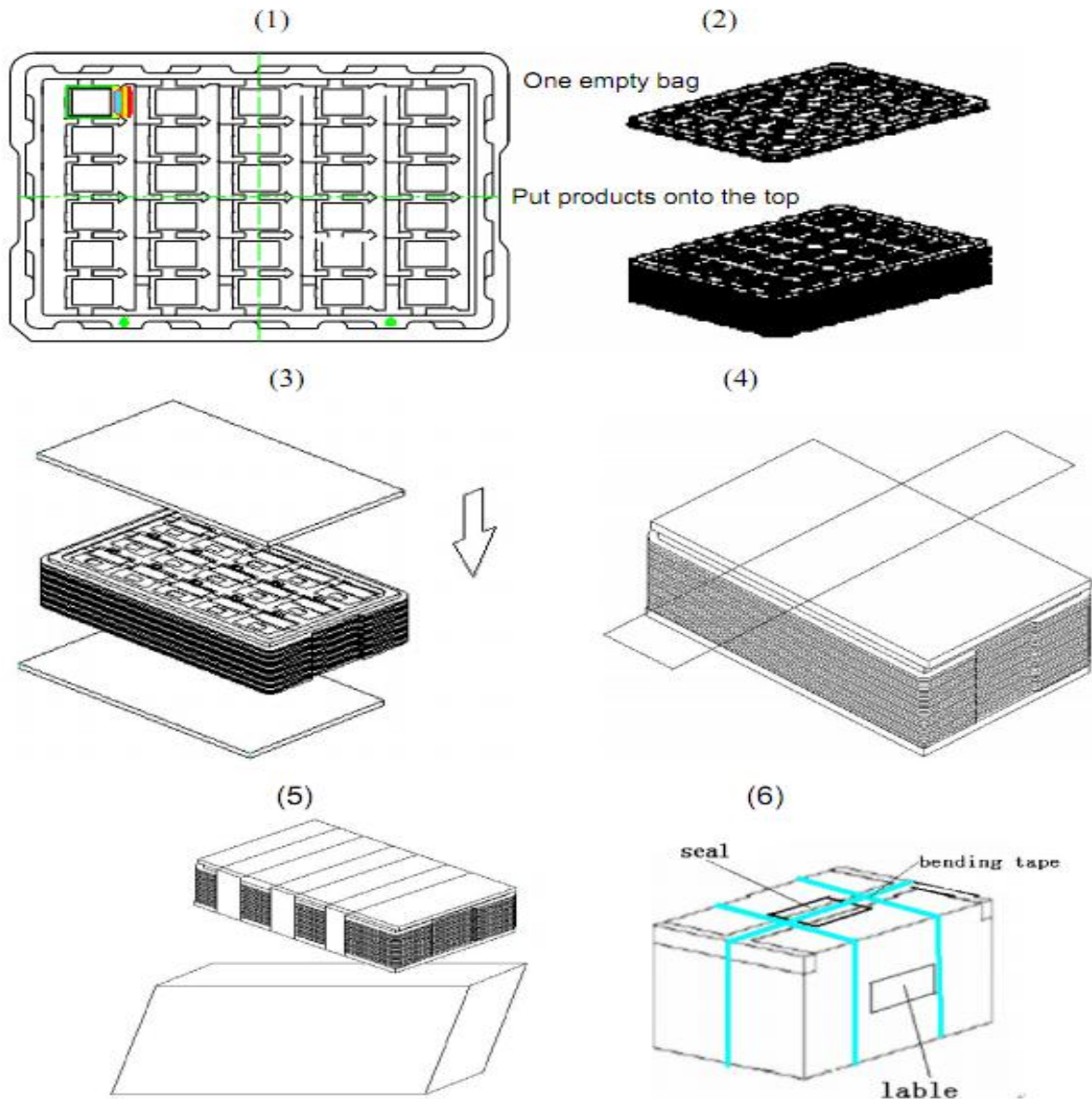
9. Mechanical Drawing





10. Packing

Packing Method



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.