# LN32240T024SA3098

## 2.4 inch, 240*320 pixels resolution, RGB interface, TN-TFT-LCD

Disclaimer：The product design is subject to alternation and improvement without prior notice.

# Table of Contents

# 1 General Feature

| Feature | | Description | Unit |
|---|---|---|---|
| Display Spec. | Size | 2.4 | inch |
| | Resolution | 240(H)*320(V) | pixels |
| | Pixel Configuration | RGB stripe | - |
| | Pixel Pitch | 0.153(H)*RGB*0.153(V) | mm |
| | Viewing Direction | 6 o'clock | - |
| Mechanical Characteristics | Outside Dimension | 42.72(W)*59.40(H)*2.30(D) | mm |
| | Active Area | 36.72(W)*48.96(H) | mm |
| | Luminance | 300 | cd/m² |
| | LED Numbers | 4 LEDS | - |
| | Pin Order | From left to right 40PIN_0.5mm | - |
| | Weight | 9 | g |
| Electrical Characteristics | Interface | RGB_18bit | - |
| | Color Depth | 262K | colors |
| | Driver Condition | 2.8(Type) | V |
| | Driver IC | ILI9341 | - |
| Temperature Range | Operating Temp. | -20~70 | ℃ |
| | Storage Temp. | -30~80 | ℃ |

**Note: Requirements on Environmental Protection: RoHS.**

# 2 Mechanical Drawing

It is recommended that the window opening of the cabinet be about 0.4MM larger than the AA single side of LCD to avoid light leakage.

**NOTES:**
1. DISPLAY TYPE : 262K COLOR TFT-LCD, TRANSMISSIVE, NORMALLY WHITE;
2. OPERATING TEMP:-20℃~70℃;
3. STORAGE TEMP:-30~80℃;
4. LCD DRIVER:ILI9341;
5. Bocklight:4 Chip-White LEDs, Module BRIGHTNESS:300cd/m2(typ);
6. GENERAL TOLERANCE:±0.2mm;
7. Mark "*" as the key size , in line with "ROHS" standard.

Drawing dimensions: 26.6±0.5 · 59.4±0.2 BL · 55.96±0.1 TFT · 1.13 · 48.96 LCD .AA · 2.83 · (19.81±0.50) · *19.5 · 48 · 0.5 · 3.6±0.3 · 38.72 LCD AA · 40.02±0.1 TFT · 42.72±0.2 BL · 1.5 · 3 · 0.3±0.03 · *2.3±0.2 · 5±0.30 · 20.5±0.10

2.4"  240RGB*320  Viewing Direction  PULL TAPE  Single Area  Stiffener

LEDA — LEDK
LED CIRCUIT DIAGRAM

| No | PIN NAME | No | PIN NAME |
|----|----------|----|----------|
| 1 | LEDK | 21 | GND |
| 2 | LEDA | 22 | GND |
| 3 | GND | 23 | B0 |
| 4 | VCC | 24 | B1 |
| 5 | B2 | 25 | B2 |
| 6 | GND | 26 | B3 |
| 7 | R0 | 27 | B4 |
| 8 | R1 | 28 | B5 |
| 9 | R2 | 29 | GND |
| 10 | R3 | 30 | PCLK |
| 11 | R4 | 31 | NC |
| 12 | R5 | 32 | HSYNC |
| 13 | GND | 33 | GND |
| 14 | DEN | 34 | VSYNC |
| 15 | G0 | 35 | NC |
| 16 | G1 | 36 | GND |
| 17 | G2 | 37 | CS |
| 18 | G3 | 38 | SCL |
| 19 | G5 | 39 | SDA |
| 20 | G6 | 40 | RESET |

**DWIN Technologies**

| TITL | LCM OUTLINE DIMENSION | | | | |
|------|------|------|------|------|------|
| D/N | | PAGE | PREPARED | CHECK | APPROVED |
| VER | A | REV | 0 | | |
| MODULE NO:LN32240T024SA3098 | | | DATE | DATE | DATE |
| SCALE | NTS | UNIT | MM | | |

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# 3 Input/Output Terminals

| Pin NO. | Symbol | Function | Remark |
|---------|--------|----------|--------|
| 1 | LEDK | Back light cathode | |
| 2 | LEDA | Back light anode | |
| 3 | GND | Ground | |
| 4 | VCC | Power supply | |
| 5-6 | GND | Ground | |
| 7-12 | R0-R5 | Data bus | |
| 13-14 | GND | Ground | |
| 15-20 | G0-G5 | Data bus | |
| 21-22 | GND | Ground | |
| 23-28 | B0-B5 | Data bus | |
| 29 | GND | Ground | |
| 30 | PCLK | Clock signal | |
| 31 | NC | Not connect | |
| 32 | HSYNC | Line synchronizing signal | |
| 33 | VSYNC | Frame synchronizing signal | |
| 34 | DEN | Data ENABLE signal | |
| 35 | NC | Not connect | |
| 36 | GND | Ground | |
| 37 | CS | A Chip Select signal | |
| 38 | SCL | Serial clock input for SPI interface | |
| 39 | SDA | Serial data input/output bidirectional pin for SPI interface | |
| 40 | RESET | Reset Signal pin | |

# 4 Electrical Characteristics

## 4.1 Driving TFT LCD Panel

| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Analog Voltage | VCC | 2.6 | 2.8 | 3.3 | V | |
| Input Logic High Voltage | VIH | 0.7VCC | - | VCC | V | |
| Input Logic Low Voltage | VIL | GND | - | 0.3VCC | V | |
| Output Logic High Voltage | VOH | 0.8VCC | - | VCC | V | |
| Output Logic Low Voltage | VOL | GND | - | 0.2VCC | V | |

## 4.2 LED Backlight Specification

| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Forward Voltage | VF | 11.2 | 12.8 | 13.2 | V | |
| Forward Current | IF | - | 20 | - | mA | |
| Luminance | Lv | - | 300 | - | cd/m$^2$ | If=20mA |
| Power Consumption | PLED | - | 256 | - | mW | |
| Uniformity(with L/G) | Avg | 75 | 80 | - | % | |
| LED Life Time | Hr | - | 30000 | - | Hour | |

Note: The LED Supply Voltage is defined by the number of LED at Ta=25℃, and IL=20mA/LED.
Note: The "LED life time" is defined as the module luminance decrease to 50% original brightness at Ta=25℃ and IL=20mA/LED. The LED lifetime could be decreased if operating IL is large than 20mA/LED.

# 5 Timing Characteristics

## 5.1 3-line Serial Interface Characteristics
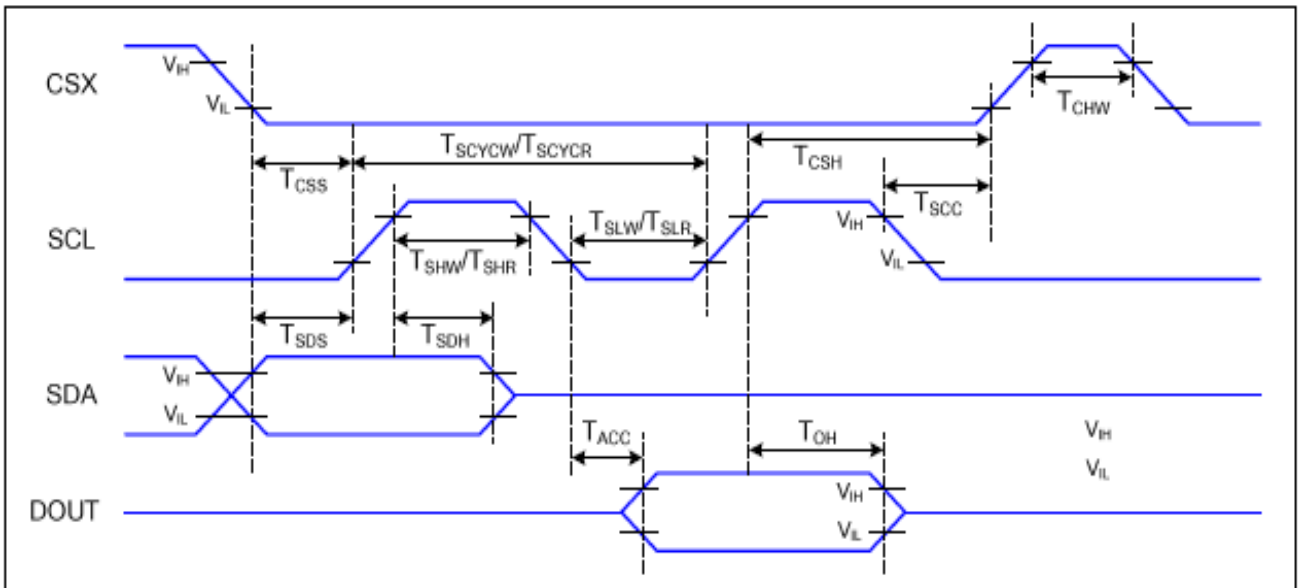


| Signal | Symbol | Parameter | min | max | Unit |
|---|---|---|---|---|---|
| SCL | tscycw | Serial Clock Cycle (Write) | 100 | - | ns |
| | tshw | SCL "H" Pulse Width (Write) | 40 | - | ns |
| | tslw | SCL "L" Pulse Width (Write) | 40 | - | ns |
| | tscycr | Serial Clock Cycle (Read) | 150 | - | ns |
| | tshr | SCL "H" Pulse Width (Read) | 60 | - | ns |
| | tslr | SCL "L" Pulse Width (Read) | 60 | - | ns |
| SDA / SDI (Input) | tsds | Data setup time (Write) | 30 | - | ns |
| | tsdh | Data hold time (Write) | 30 | - | ns |
| SDA / SDO (Output) | tacc | Access time (Read) | 10 | - | ns |
| | toh | Output disable time (Read) | 10 | 50 | ns |
| CSX | tscc | SCL-CSX | 20 | - | ns |
| | tchw | CSX "H" Pulse Width | 40 | - | ns |
| | tcss | CSX-SCL Time | 60 | - | ns |
| | tcsh | | 65 | - | ns |

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## 5.2 RGB Interface Characteristics
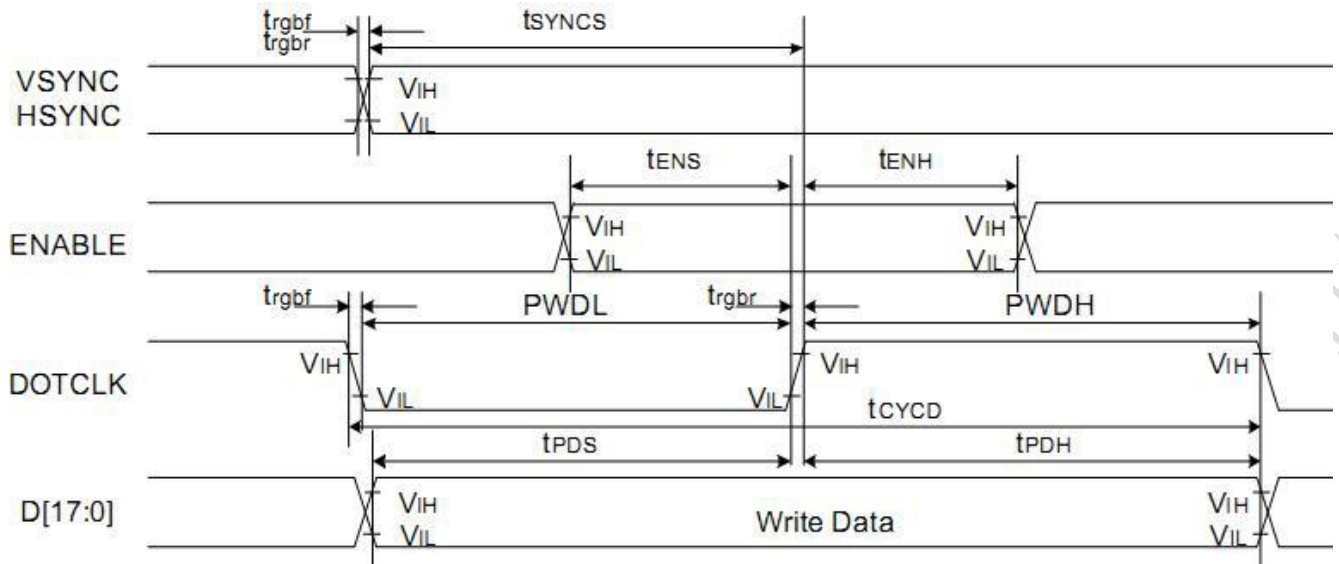


| Signal | Symbol | Parameter | min | max | Unit |
|--------|--------|-----------|-----|-----|------|
| VSYNC / HSYNC | $t_{SYNCS}$ | VSYNC/HSYNC setup time | 15 | - | ns |
| | $t_{SYNCH}$ | VSYNC/HSYNC hold time | 15 | - | ns |
| DE | $t_{ENS}$ | DE setup time | 15 | - | ns |
| | $t_{ENH}$ | DE hold time | 15 | - | ns |
| D[17:0] | $t_{POS}$ | Data setup time | 15 | - | ns |
| | $t_{PDH}$ | Data hold time | 15 | - | ns |
| DOTCLK | PWDH | DOTCLK high-level period | 15 | - | ns |
| | PWDL | DOTCLK low-level period | 15 | - | ns |
| | $t_{CYCD}$ | DOTCLK cycle time | 100 | - | ns |
| | $t_{rgbr}$ , $t_{rgbf}$ | DOTCLK,HSYNC,VSYNC rise/fall time | - | 15 | ns |

## 5.3 RGB Interface Definition

| Parameters | Symbols | Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Horizontal Synchronization | Hsync | | 2 | 10 | 16 | DOTCLK |
| Horizontal Back Porch | HBP | | 2 | 20 | 24 | DOTCLK |
| Horizontal Address | HAdr | | - | 240 | - | DOTCLK |
| Horizontal Front Porch | HFP | | 2 | 10 | 16 | DOTCLK |
| Vertical Synchronization | Vsync | | 1 | 2 | 4 | Line |
| Vertical Back Porch | VBP | | 1 | 2 | - | Line |
| Vertical Address | VAdr | | - | 320 | - | Line |
| Vertical Front Porch | VFP | | 3 | 4 | - | Line |
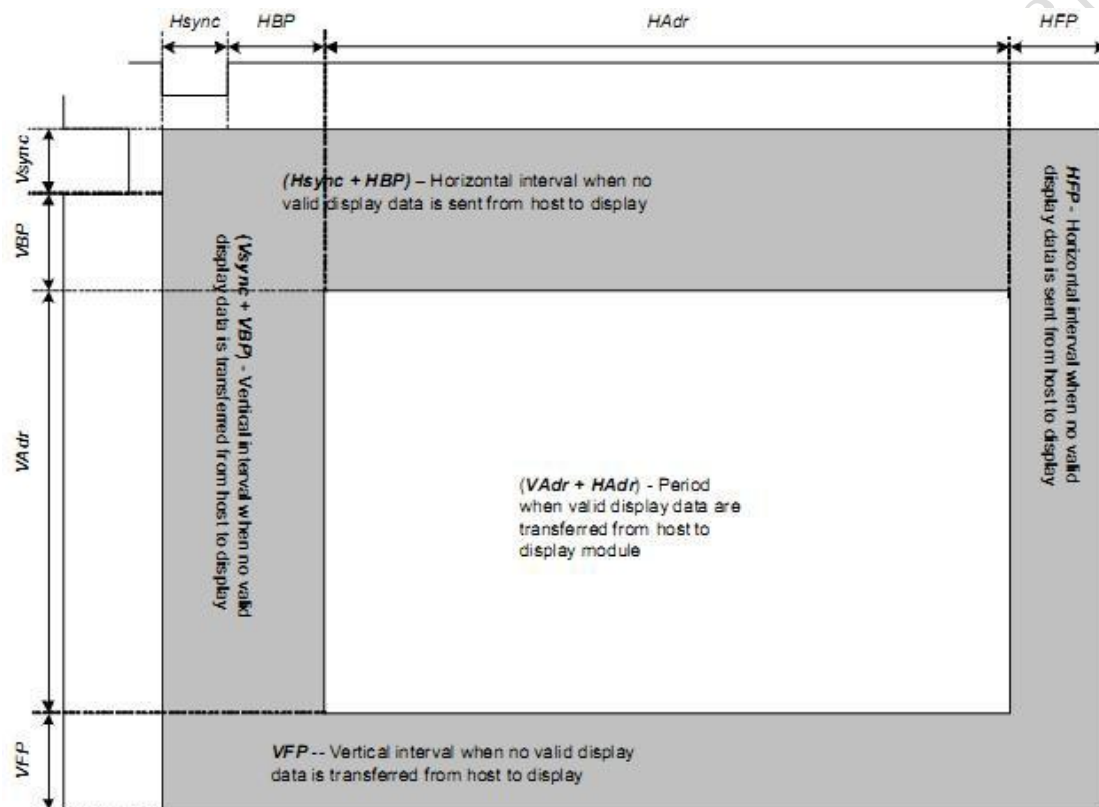


## 5.4 Reset Timing
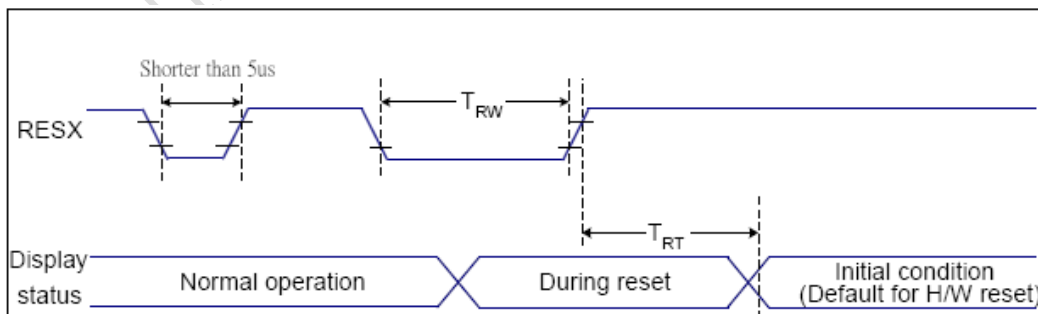


| Related Pins | Symbol | Parameter | MIN | MAX | Unit |
|---|---|---|---|---|---|
| RESX | TRW | Reset pulse duration | 10 | - | us |
| | TRT | Reset cancel | - | 5 | ms |
| | | | | 120 | ms |

## 5.5 Power Sequence
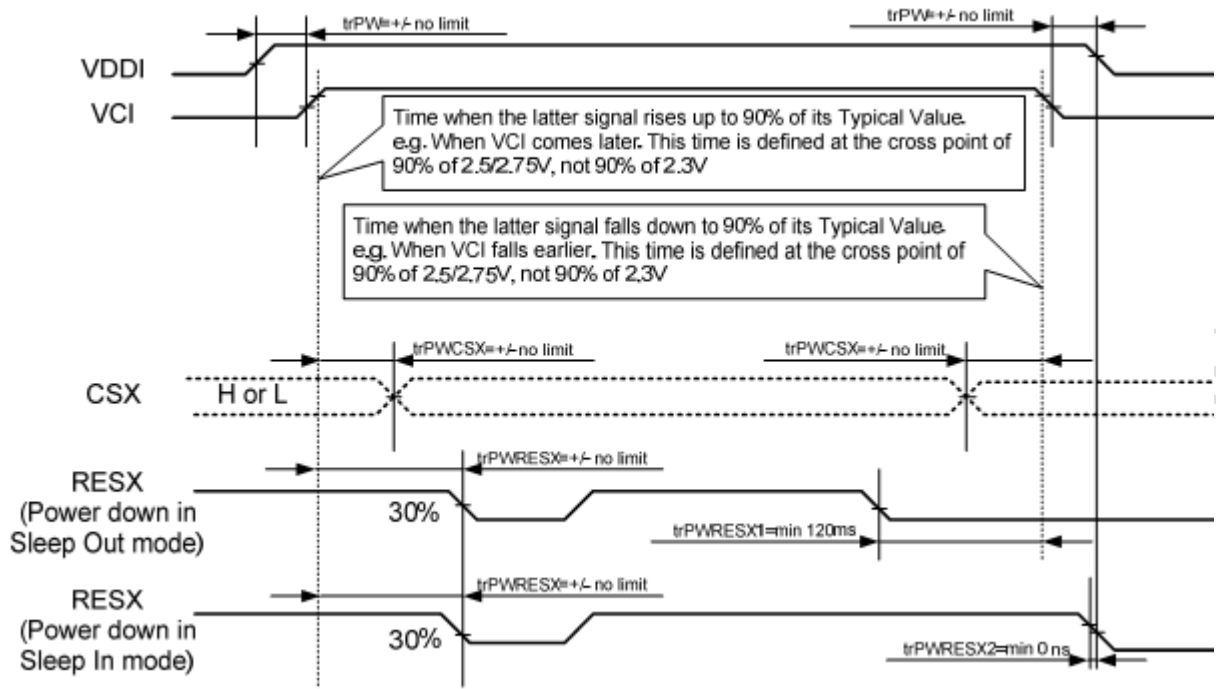


Case 1 – RESX line is held High or Unstable by Host at Power ON
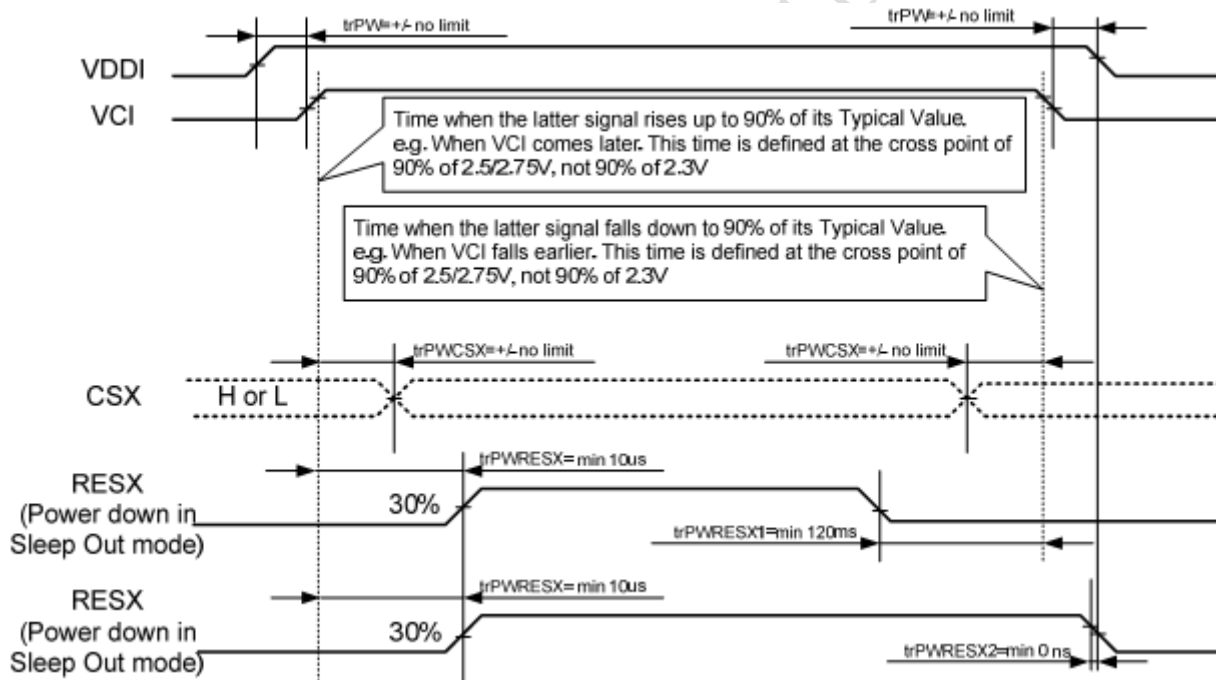


Case 2 – RESX line is held Low by Host at Power ON

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# 6 Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Viewing Angle | Top | CR≧10 | - | 45 | - | Deg. | Note 2,3 |
| | Bottom | | - | 20 | - | | |
| | Left | | - | 45 | - | | |
| | Right | | - | 45 | - | | |
| Contrast Ratio | CR | θ=0° | - | 250 | - | | Note 3 |
| Response Time | Tr+Tf | θ=0° | - | 30 | | ms | |
| Color Chromaticity (CIE1931) | Wx | θ=0° | 0.288 | 0.308 | 0.328 | | Note 1,5 |
| | Wy | | 0.305 | 0.325 | 0.345 | | |
| | Rx | | 0.592 | 0.612 | 0.632 | | |
| | Ry | | 0.309 | 0.329 | 0.349 | | |
| | Gx | | 0.279 | 0.299 | 0.319 | | |
| | Gy | | 0.547 | 0.567 | 0.587 | | |
| | Bx | | 0.124 | 0.144 | 0.164 | | |
| | By | | 0.090 | 0.110 | 0.130 | | |
| Transmittance | Trans | θ=0° | 4.5 | 5.0 | - | % | |

Test conditions:

IF= 20 mA, and the ambient temperature is 25℃.

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 LCD.
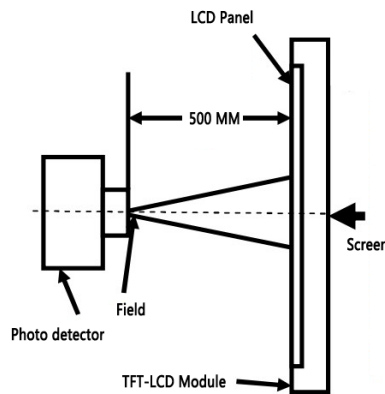


Note 2: Definition of viewing angle range and measurement system.

The viewing angle is measured at the center point of the LCD by BM-7A.
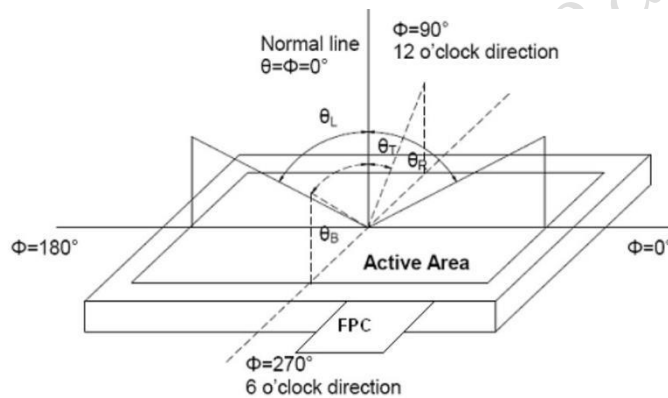


Note 3: Definition of contrast ratio.

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

"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. Time ON (TON) is the time between photo detector output intensity changed from 90% to 10%. And time off (TOFF) is the time between photo detector output intensity changed from 10% to 90%.
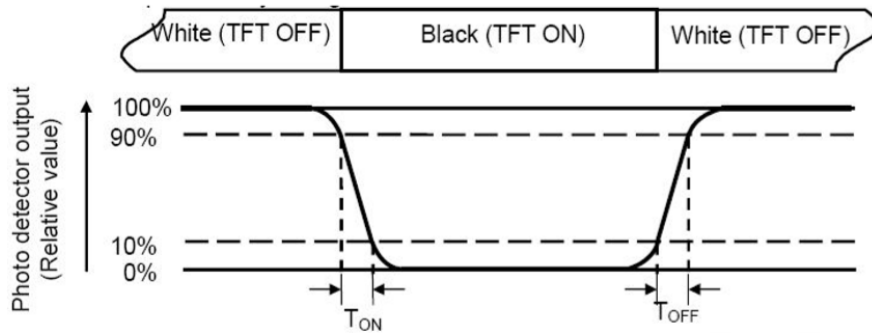


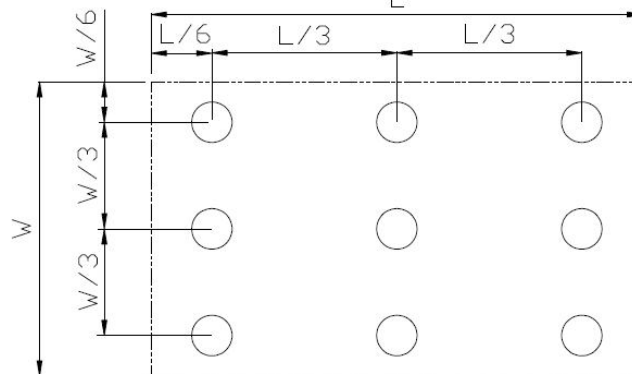Note 5: Definition of color chromaticity (CIE1931).
Color coordinates measured at center point of LCD.

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



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.

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# 7 Environmental Reliability Test

| NO | Test Item | Condition | Remarks |
|---|---|---|---|
| 1 | High Temperature Operation | Ta=+70℃,48hours | IEC60068-2-1:2007 GB2423.2-2008 |
| 2 | Low Temperature Operation | Ta=-20℃,48hours | IEC60068-2-1:2007 GB2423.1-2008 |
| 3 | High Temperature Storage | Ta=+80℃,48hours | IEC60068-2-1:2007 GB2423.2-2008 |
| 4 | Low Temperature Storage | Ta=-30℃,48hours | IEC60068-2-1:2007 GB2423.1-2008 |
| 5 | Storage at High Temperature and Humidity | Ta=+40℃,90% RH max,48hours | IEC60068-2-78 :2001 GB/T2423.3-2006 |
| 6 | Thermal Shock (non-operation) | -20℃ /30min +70℃/30min, Change time:5min,10cycles | Start with cold temperature, End with high temperature, IEC60068-2-14:1984, GB 2423.22-2002 |

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# 8 Packing Capacity & Dimension

| Dimension | |
|---|---|
| Dimension(mm) | 42.72(W)*59.40(H)*2.30(D) |
| Net Weight | 9g |
| Packing Capacity | |

| Size | LCD Size and Resolution | Layer | Quantity(Pcs) |
|---|---|---|---|
| 220mm(L)x160mm(W)x47mm(H) | 2.4 inch 240*320 | 1 | 1 |
| 600mm(L)x450mm(W)x300mm(H) | 2.4 inch 240*320 | 2 | 240 |

Packing instruction：

The LCD is placed in the grid, covered with a PE static bag and compactly assembled, the upper and the lower layers of the grid are protected by buffer spaces.

The LCD covered with a PE static bag and compactly assembled

placed in the grid

The upper and the lower layers of the grid are protected by buffer spaces

Packed

# 9 Appearance Inspection

9.1 General rules for inspection

　9.1.1 Anti-static wearables (anti-static wristbands, gloves) must be worn during the inspection.

　9.1.2 Do not use bare hands to touch the position of the device, golden fingers, and the surface of the screen to prevent the sweat from human hands from causing oxidation and affecting the appearance.

　9.1.3 It is forbidden to stack products out of specification and handle them with care to avoid damage to components.

　9.1.4 The repaired products need to be inspected to prevent rosin and tin slag from exceeding the specifications.

　9.1.5 When technical documents and process documents have specific requirements for products, the technical documents and process documents shall be the main requirements.

9.2 Inspection conditions

　9.2.1 The conditions of display function check

　Angle: ±5°;

　Inspection method: visual inspection. The inspection object is 30-40cm away from the light source, and the eye is 30-40cm away from the inspection object;

　Illumination: 300-500Lux;
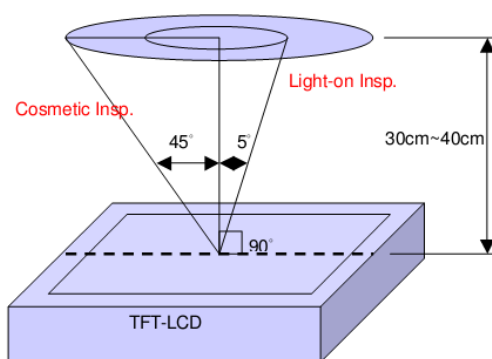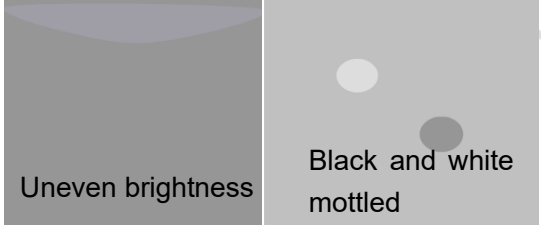
　Inspection time: 5-10S.

　9.2.2 Visual inspection conditions

　Angle: ±45°;

　Inspection method: visual inspection. The inspection object is 30-40cm away from the light source, and the eye is 30-40cm away from the inspection object;
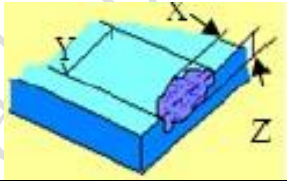
　Illumination: 800-1500Lux;

　Inspection time: 5-10S.

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## 9.3 Inspection standards

| Type | Test Items | Judgement Standard | Defect Category |
|---|---|---|---|
| Display state | Dead pixels | No dead pixels | |
| | mura | From different angles, the brightness is required to be uniform. Under the 64-level grayscale or pure black interface, there should be no uneven display brightness within the viewing angle range of 45° through 6% ND FILTER. Y series (TV film) LCD screen does not have specific requirements, and the picture inspection does not affect the display as qualified. Uneven brightness Black and white mottled | Slight defect |
| | Light leakage | Under the 64-level grayscale or pure black interface, there should be no obvious light leakage within the viewing angle range of 45° by visual inspection or through 6% ND FILTER. Y series (TV LCD screen) series can be without obvious visual defects. | Slight defect |
| | Linear foreign bodies | 1. W≤0.05, L≤2mm, negligible; 2. 0.05mm＜W≤0.1mm, L≤2mm, N≤3; 3. W＞0.1mm, L＞2mm, not allowed. | Slight defect |
| Screen surface | Within the effective area | Spotted: 1. D≤0.2mm and it is not a piece, it is not counted; 2. 0.2mm＜D≤0.5mm, N≤3; 3. D>0.5mm, L>0.5mm, W>0.5mm are not allowed; (The spotted foreign objects shall not exceed the point-line gauge D=0.5, and the black dot coverage shall be checked, and the spotted foreign objects shall be judged within the range of D=0.5) | Slight defect |

| | Foreign objects Scratch Air bubbles | Linear:<br>1. W≤0.05, L≤2mm, ignored;<br>2. 0.05＜W≤0.1mm, L≤2mm, N≤3;<br>3. W>0.1mm, L>2mm, not allowed. | |
|---|---|---|---|
| | Outside the effective area Foreign objects Scratches Air bubbles | Foreign objects are not checked, and bubbles are not allowed to D>1mm;<br>Non-inductive scratches of no more than 0.1×8mm are allowed. | Slight defect |
| | Crack | Not allowed. | Slight defect |
| | Notch | 1. Does not affect the appearance from the front;<br>2. Does not affect the relevant alignment;<br>3. X≤1mm, Y≤1mm, N≤2. | Slight defect |
| | Glass side Foreign objects Dirty | 1. The foreign body on the side is not controlled;<br>2. The paint pen marks on the side are not controlled;<br>3. Side oily note printing is not allowed. | Slight defect |
| FPC | Cracks Goldfinger crease | Not allowed. | Heavy deficit |
| | Crease | Slight creases are not controlled;<br>The crease is whitish and has lines, which is not allowed. | Heavy deficit |
| | Top wound, stab wound | No damage to the line, D≤0.2mm;<br>Damage to the line is not allowed. | Heavy deficit |
| | Scratch | Slight scratches on the surface are not controlled;<br>Damage to the line is not allowed. | Heavy deficit |
| | Goldfinger scratch | W≤0.05mm, no control;<br>W＞0.05mm, not allowed;<br>Test probe tip marks are not controlled. | Heavy deficit |
| | Component | Under-soldering, over-soldering and false soldering are not allowed. | Heavy deficit |

# 10 Precautions for Use of LCD Modules

10.1 Handling Precautions

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

10.1.2 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.

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

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

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, Can only use LCD dedicated cleaner, the following organic solvent can not be used:

－ Isopropyl alcohol
－ Ethyl alcohol
－ Ketone
－ Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

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

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an

10.1.9 optimum work environment.

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

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

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

10.1.9.4 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.

10.2 Storage precautions

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

10.2.2 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%.

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

10.3 Transportation Precautions

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

# 11 LCD Introduction

## 11.1 Process capacity

DWIN adopts original class A glass and the entire production is in the park from cleaning, cutting, bonding, and laminating of large glass to backlight assembly, quality inspection, and aging.
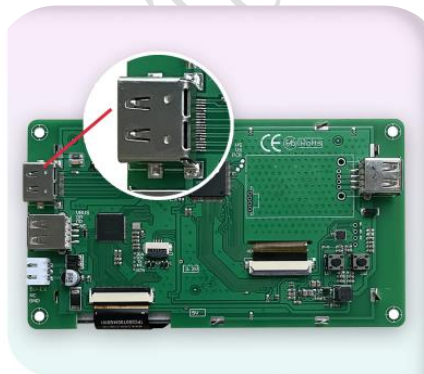
There are 12,000 square meters of clean workshop, with a monthly production capacity of about 2.5 million pieces. Each piece of LCD produced in the factory is for 30 days of aging.
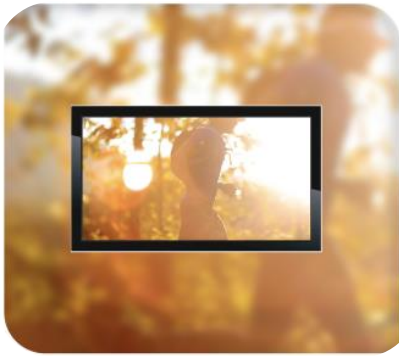


## 11.2 ODM service

Based on LCD products of 1.5~21.5 inches, DWIN provides the following customization services.

1、LCD HDMI interface customization.



HDMI interface

2、Special screen customization such as high brightness, ultra-wide temperature and strong electromagnetic protection.

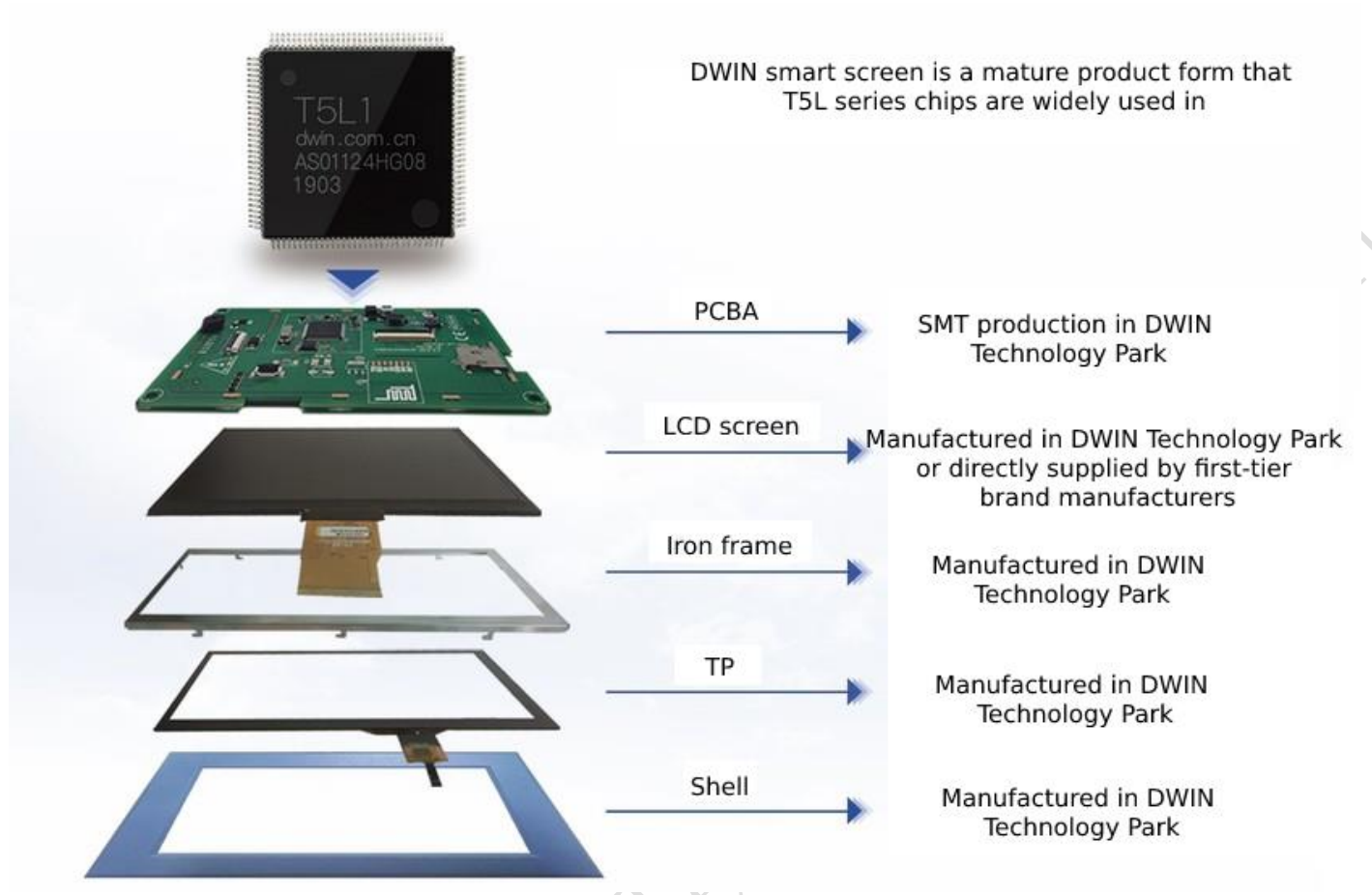| High luminance (up to 1200nit) | Ultra-wide temperature (-40~85℃) | Strong electromagnetic protection |
|---|---|---|

3、Lamination customization service of LCD + TP.

| LCM+RTP | LCM+CTP |
|---|---|

4、Customization service of DWIN self-developed T5L ASIC+ LCD + TP.

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5、Smart screen finished product customization.



DWIN smart screen is a mature product form that T5L series chips are widely used in

| | |
|---|---|
| PCBA | SMT production in DWIN Technology Park |
| LCD screen | Manufactured in DWIN Technology Park or directly supplied by first-tier brand manufacturers |
| Iron frame | Manufactured in DWIN Technology Park |
| TP | Manufactured in DWIN Technology Park |
| Shell | Manufactured in DWIN Technology Park |

Please contact our sales staff for other customization needs.

## Record of Revision

| Rev | Date | Description | Editor |
|---|---|---|---|
| 00 | 2020-11-16 | First Release | Zhou Biao |
| 01 | 2021-08-19 | Update the PIN Terminals | Ouyang Kaixing |
| 02 | 2023-01-04 | Add Product Picture, Update Operating Temp and Storage Temp | Chen |
| 03 | 2023-02-22 | Update Packing Capacity | Chen |
| 04 | 2023-05-15 | Update Terminals | Chen |

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DWIN developer forum: https://forums.dwin-global.com/index.php/forums/

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