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TFT | CHARACTER | UWVD | FSC | SEGMENT | CUSTOM | REPLACEMENT

TFT Display Module

Part Number

E70RD-FS400-C

Overview:

- 7.0-inch TFT: 119.72x176.78mm
- 1200x1920 IPS
- 4-Lane MIPI DSI
- Special Temperature Range
- All View
- Transmissive
- Capacitive Touch Panel
- 400 NITS
- Controllers: R69429, FT5436
- RoHS Compliant

Description

This is a color active matrix TFT (Thin Film Transistor) LCD (Liquid Crystal Display) that uses amorphous silicon TFT as a switching device. This model is composed of a transmissive type TFT-LCD Panel, driver circuit, capacitive touch panel and a backlight unit. The resolution of the 7.0" TFT-LCD contains 1200(RGB)x1920 pixels and can display up to 16.7M colors.

TFT Features

Display Colors: 16.7M

Interface: MIPI

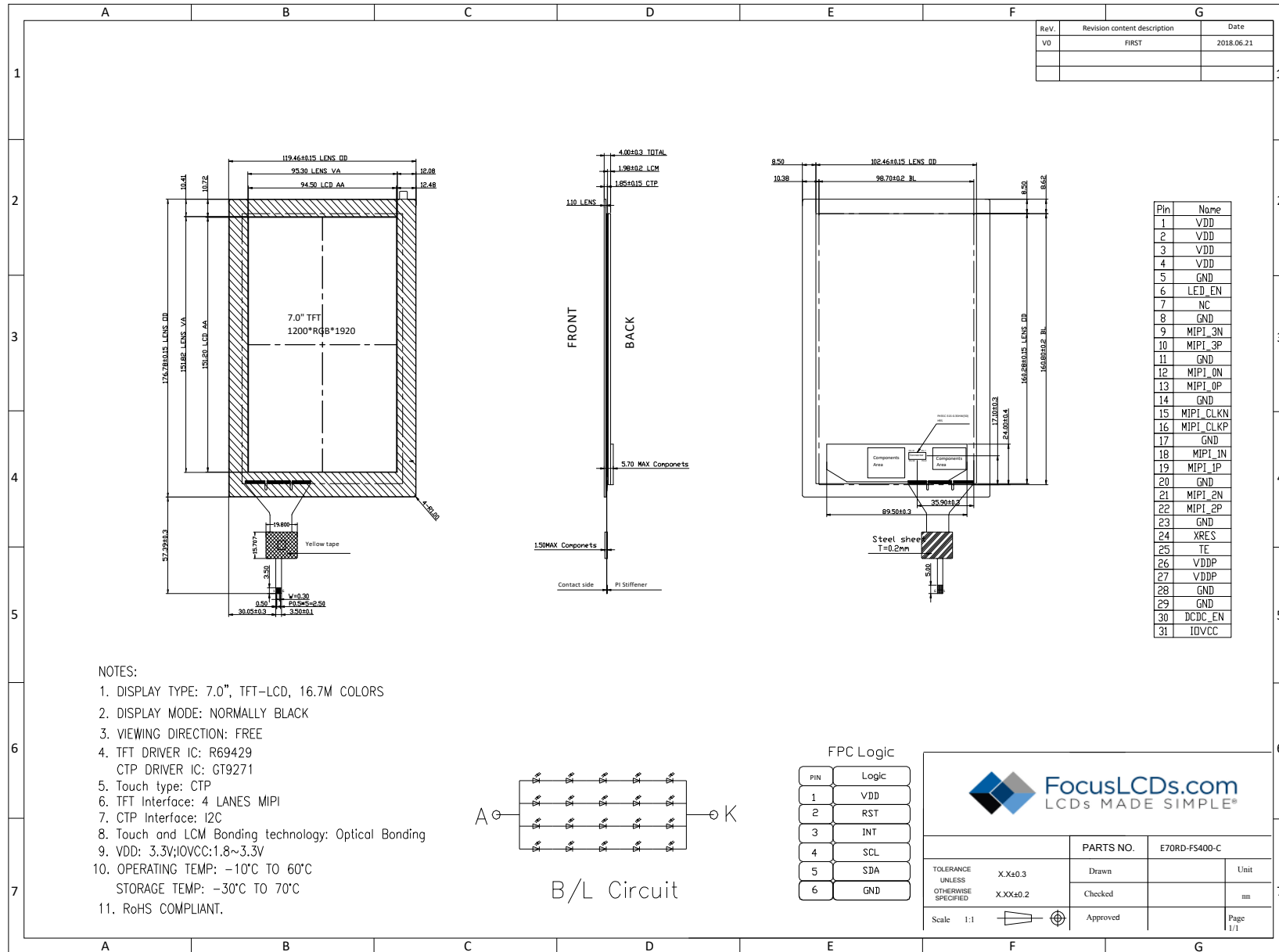
Touch Panel: Capacitive

| General Information Items | Specification | Unit | Note |
|---------------------------|-------------------------------|---------|---------|
| | Main Panel | | |
| TFT Display area (AA) | 94.5(H) x 151.2(V) (7.0 inch) | mm | - |
| Driver Element | TFT active matrix | - | - |
| Display Colors | 16.7M | colors | - |
| Number of pixels | 1200(RGB)x1920 | dots | - |
| TFT Pixel arrangement | RGB vertical stripe | - | - |
| Pixel Pitch | 0.07875(H)x0.07875(V) | mm | - |
| Viewing angle | ALL | o'clock | - |
| TFT Controller IC | R69429 | - | - |
| CTP Driver IC | GT9271 | - | - |
| TFT Interface | 4-Lane MIPI | - | - |
| CTP Interface | I2C | - | - |
| CTP Structure | G+G | - | - |
| CTP Slave Address | 0x5D(7bit) or 0x14(7bit) | - | - |
| CTP Bonding | Tape | - | - |
| Touch Mode | Five Points and Gestures | - | - |
| Display mode | Transmissive/ Normally Black | - | - |
| Operating temperature | -10~+60 | °C | - |
| Storage temperature | -30~+70 | °C | - |
| Recommended Resolution | 1080(RGB)x1920 | pixels | 55-60Hz |

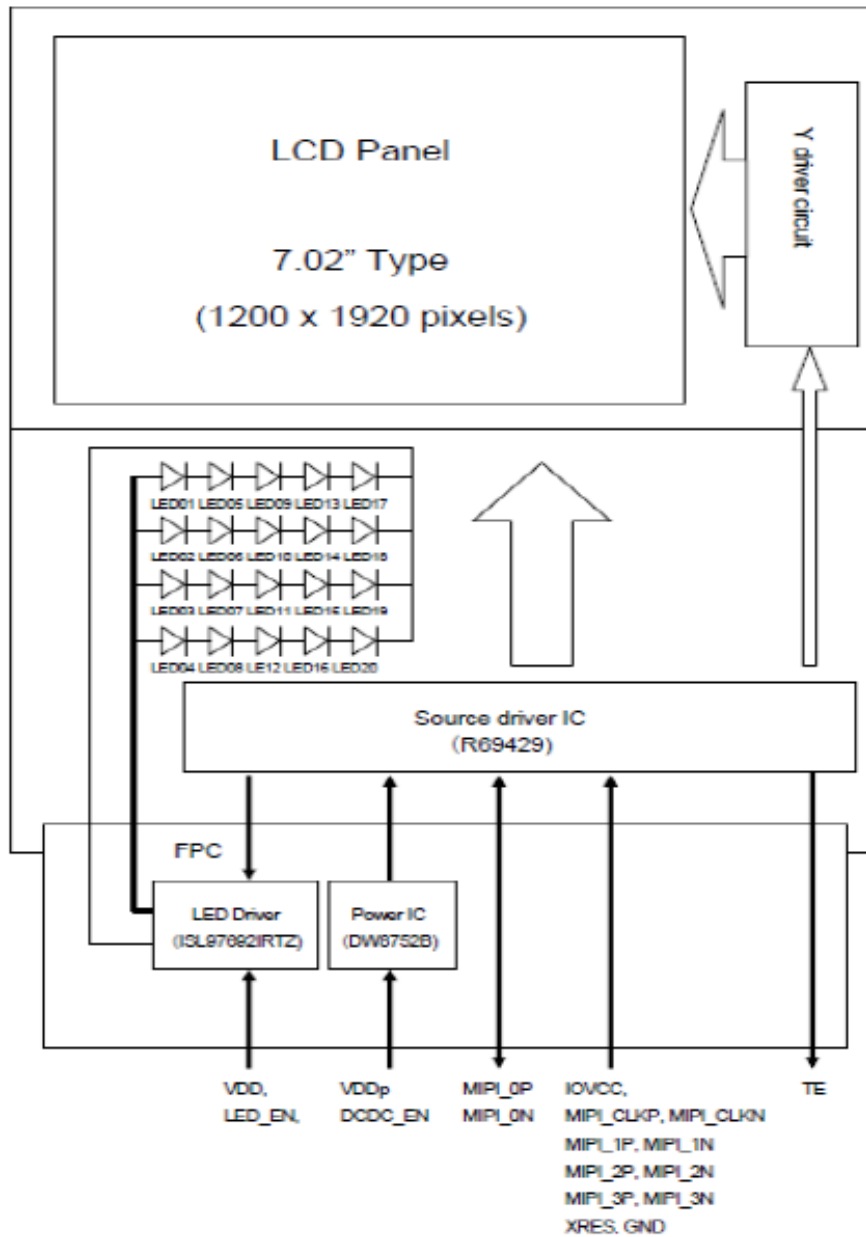
Mechanical Information

| Item | | Min | Typ. | Max | Unit | Note |
|-------------|----------------|-----|--------|-----|------|------|
| Module Size | Horizontal (H) | | 119.46 | | mm | - |
| | Vertical (V) | | 176.78 | | mm | - |
| | Depth (D) | | 4.0 | | mm | - |
| | Weight | | -- | | g | |

1. Outline Dimensions



2. Block Diagram



3. Input TFT Terminal Pin Assignment

Recommended TFT Connector: FH41-31S-0.5SH(05)

Recommended CTP Connector: FH12-8S-0.5SH(55)

| NO. | Symbol | Description | I/O |
|-----|---------|---|-----|
| 1 | VDD | LED power supply (3-5V) | P |
| 2 | VDD | | P |
| 3 | VDD | | P |
| 4 | VDD | | P |
| 5 | GND | Ground | P |
| 6 | LED_EN | Backlight enable. Active High. | P |
| 7 | NC | | |
| 8 | GND | Ground | P |
| 9 | D3N | MIPI DSI differential data pair (Data lane 3) | I/O |
| 10 | D3P | | I/O |
| 11 | GND | Ground | P |
| 12 | D0N | MIPI DSI differential data pair (Data lane 0) | I/O |
| 13 | D0P | | I/O |
| 14 | GND | Ground | P |
| 15 | CLKN | MIPI DSI differential clock pair | I/O |
| 16 | CLKP | | |
| 17 | GND | Ground | P |
| 18 | D1N | MIPI DSI differential data pair (Data lane 1) | I/O |
| 19 | D1P | | |
| 20 | GND | Ground | P |
| 21 | D2N | MIPI DSI differential data pair (Data lane 2) | I/O |
| 22 | D2P | | |
| 23 | GND | Ground | P |
| 24 | RESET | Reset signal of the device, active low. | O |
| 25 | TE | Tearing effect signal | O |
| 26 | VDDp | Power Supply (3-5V) | P |
| 27 | VDDp | Power Supply (3-5V) | P |
| 28 | GND | Ground | P |
| 29 | GND | Ground | P |
| 30 | DCDC_EN | Power supply IC enable, active high | P |
| 31 | IOVCC | Power supply for LCM (1.8V) | P |

I: Input, O: Output, P: Power

3.1 CTP

| NO. | Symbol | Description | I/O |
|-----|--------|--------------------------------|-----|
| 1 | VDD | Supply Voltage | P |
| 2 | RST | External reset pin, active low | I |
| 3 | INT | External interrupt pin | I |
| 4 | SCL | I2C clock input | I |
| 5 | SDA | I2C data input and output | I/O |
| 6 | GND | Ground | P |

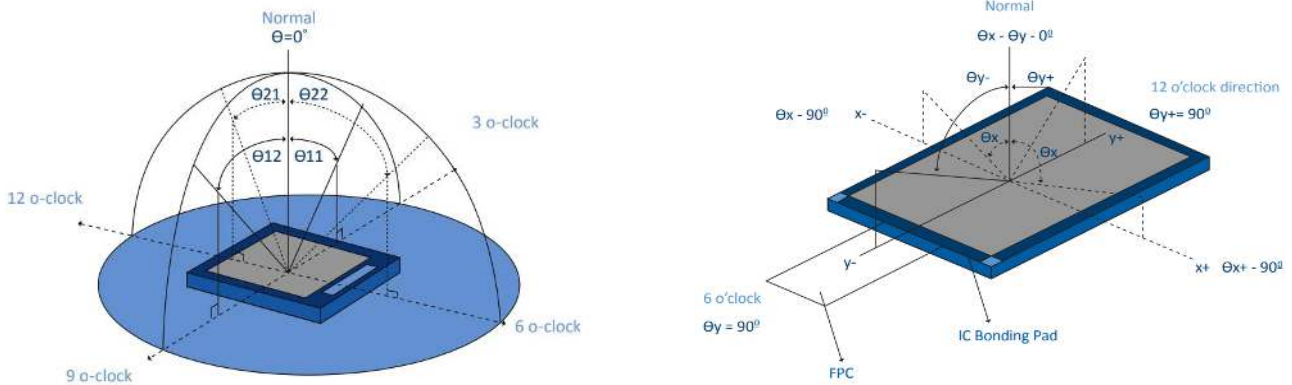
4. LCD Optical Characteristics

4.1 Optical Specifications

| Item | Symbol | Condition | Min | Typ. | Max | Unit | Note | |
|---------------------------|--------|---------------------------------------|-------|------|------|--------|--------|--------|
| Color Gamut | S% | $\theta=0$ Normal viewing angle | -- | 71.5 | -- | % | (3) | |
| Contrast Ratio | CR | | 700 | 1000 | -- | % | (2) | |
| Color Filter Chromaticity | White | | W_x | 0.27 | 0.31 | 0.35 | degree | (5)(6) |
| | | | W_y | 0.29 | 0.33 | 0.37 | | |
| | Red | | R_x | 0.60 | 0.64 | 0.68 | | |
| | | | R_y | 0.29 | 0.33 | 0.37 | | |
| | Green | | G_x | 0.27 | 0.31 | 0.35 | | |
| | | | G_y | 0.57 | 0.61 | 0.65 | | |
| | Blue | | B_x | 0.11 | 0.15 | 0.19 | | |
| | | | B_y | 0.01 | 0.05 | 0.09 | | |
| Viewing Angle | Hor. | Θ_L | 80 | -- | -- | degree | (1)(6) | |
| | | Θ_R | 80 | -- | -- | | | |
| | Ver. | Θ_T | 80 | -- | -- | | | |
| | | Θ_B | 80 | -- | -- | | | |
| Option View Direction | ALL | | | | | | (1) | |

Optical Specification Reference Notes:

(1) Definition of Viewing Angle: The viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3,9 o'clock direction and the vertical or 6,12 o'clock direction with respect to the optical axis which is normal to the LCD surface.

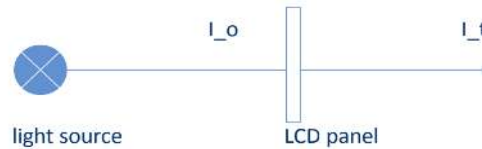


(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

$$Cr = \frac{Lw}{Ld}$$

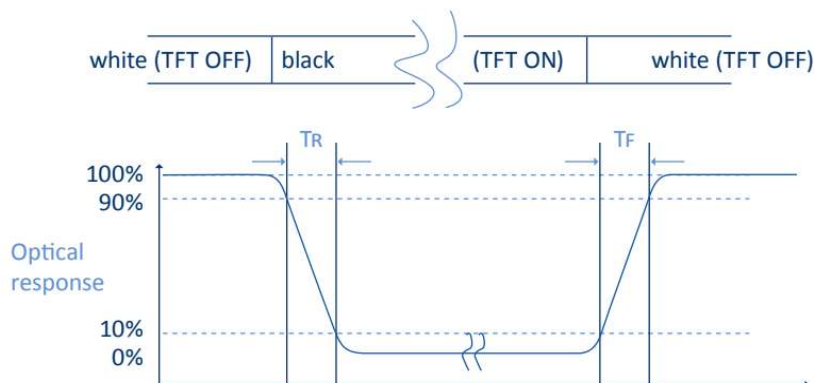
(3) Definition of transmittance (T%): The transmittance of the panel including the polarizers is measured with electrical driving. The equation for transmittance Tr is:

$$Tr = \frac{I_t}{I_o} \times 100\%$$



I_o = the brightness of the light source.
 I_t = the brightness after panel transmission

(4) Definition of Response Time (T_r , T_f): The rise time ' T_r ' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time ' T_f ' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.



(5) Definition of Color Gamut:

Measuring machine CFT-01. NTSC's Primaries: $R(x,y,Y), G(x,y,Y), B(x,y,Y)$. FPM520 of Westar Display Technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics. The color chromaticity shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

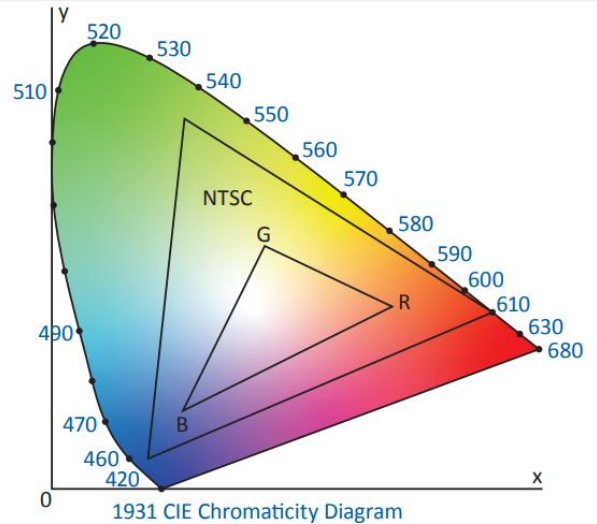
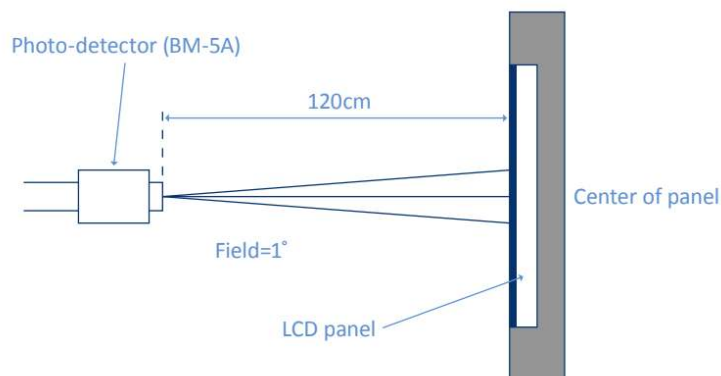
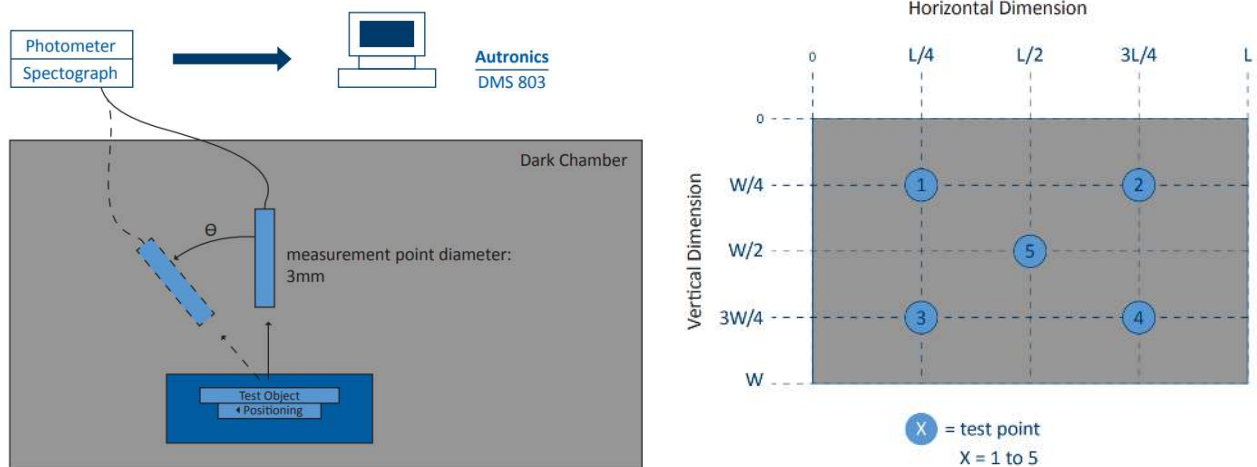


Fig. 1931 CIE chromacity diagram

$$\text{Color gamut: } S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$

(6) Definition of Optical Measurement Setup:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 20 minutes.



5. TFT Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 °C, VSS=0V)

| Characteristics | Symbol | Min | Max | Unit |
|-----------------------------|----------|------|-----------|------|
| Analog Power Supply Voltage | VDD-GND | -0.3 | 6.0 | V |
| | VDDp-GND | -0.3 | 6.0 | V |
| Power Supply Voltage Logic | IOVCC | -0.3 | 4.6 | V |
| RES Input Signal Voltage | Vi | -0.3 | IOVCC+0.3 | V |
| DSI Input Signal Voltage | ViDSI | -0.3 | 1.8 | V |
| PWR Input Signal Voltage | ViPWR | -0.3 | 5.5 | V |
| Operating Temperature | TOP | -20 | +70 | °C |
| Storage Temperature | TST | -30 | +80 | °C |

NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

| Characteristics | Symbol | Min | Typ. | Max | Unit | Note |
|-----------------------|--------|----------|------|----------|------|------|
| Analog Supply Voltage | VDD | 3.0 | -- | 5.0 | V | |
| | VDDp | 3.0 | -- | 5.0 | | |
| Logic Supply Voltage | IOVCC | 1.70 | 1.8 | 1.90 | V | |
| Level Input Voltage | VIH | 0.7IOVCC | -- | IOVCC | V | |
| | VIL | GND | -- | 0.3IOVCC | V | |
| Level Output Voltage | VOH | 0.8IOVCC | -- | IOVCC | V | |
| | VOL | GND | -- | 0.2IOVCC | V | |

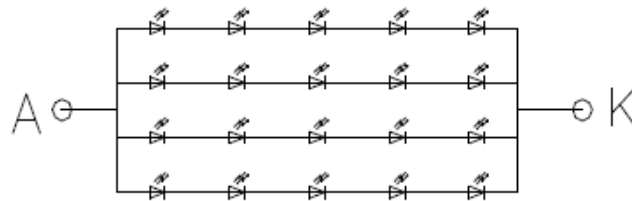
5.3 LED Backlight Characteristics

The backlight system is edge lighting type with 20 chips LED.

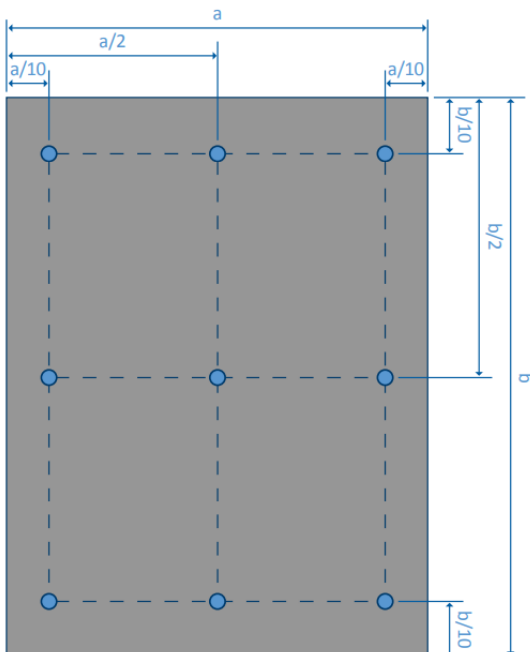
| Item | Symbol | Min | Typ. | Max | Unit | Note |
|-----------------|----------------|-------|------|-----|-------------------|-----------|
| Forward Current | I _F | 160 | 180 | -- | mA | |
| Forward Voltage | V _F | -- | 6 | -- | V | |
| LCM Luminance | LV | 440 | 400 | -- | cd/m ² | Note 3 |
| LED lifetime | Hr | 50000 | -- | -- | hour | Note1 & 2 |
| Uniformity | AVg | 80 | -- | -- | % | Note 3 |

Note 1: LED lifetime (Hr) can be defined as the time in which it continues to operate under the condition: T_a=25±3 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The "LED lifetime" is defined as the module brightness decrease to 50% original brightness at T_a=25°C and IL= 180mA



Note 3: Luminance Uniformity of these 9 points is defined as below:

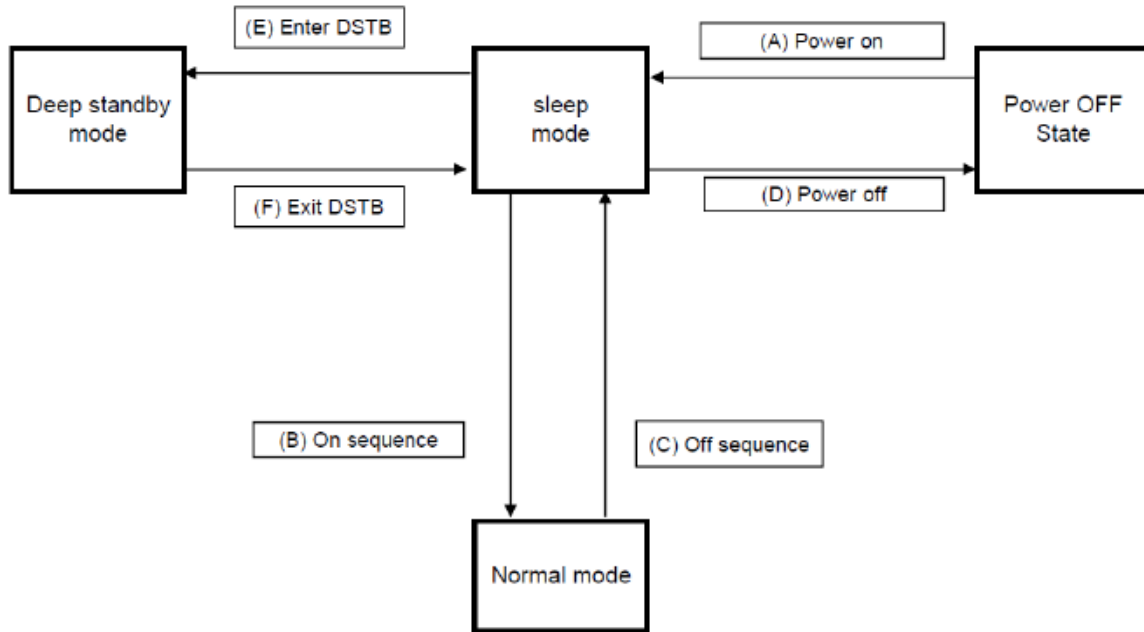


$$\text{Luminance} = \frac{\text{(Total Luminance of 9 points)}}{9}$$

$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points(1-9)}}{\text{maximum luminance in 9 points(1-9)}}$$

6. Command Sequence

(1200RGBx1920, R69429, MIPI 4lane)



7. CTP Specification

7.1 Electrical Characteristics

7.1.1 Absolute Maximum Rating

| Item | Symbol | Min | Max | Unit | Note |
|-----------------------|-----------------|------|------|------|------|
| Power Supply Voltage | VDD | 2.66 | 3.47 | V | 1 |
| I/O Digital Voltage | VDDIO | 1.8 | 3.6 | V | 1 |
| Operating Temperature | T | -10 | +60 | °C | - |
| Storage Temperature | T _{ST} | -30 | +70 | °C | - |

Note: If used beyond the absolute maximum ratings, GT9271 may permanently damage. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.

7.1.2 DC Electrical Characteristics (Ta=25°C)

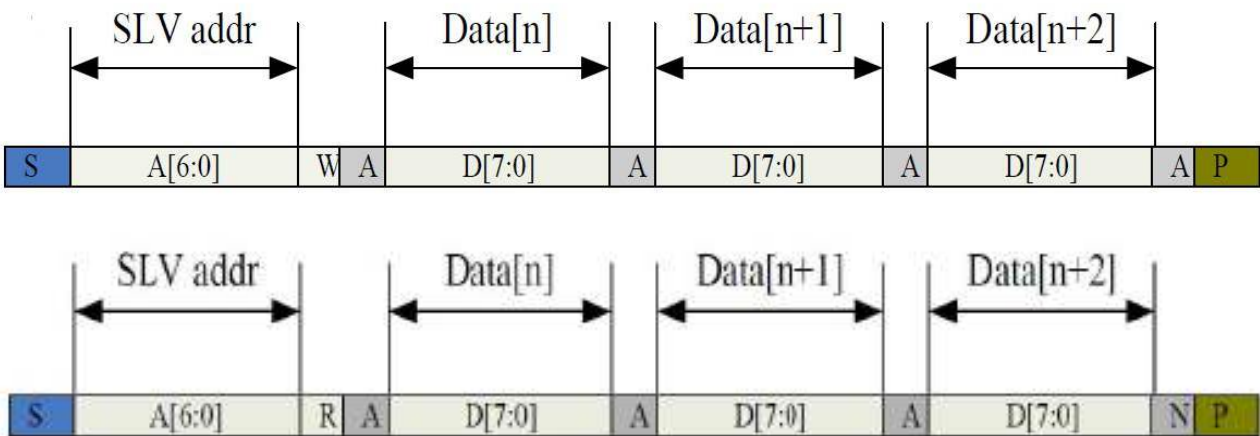
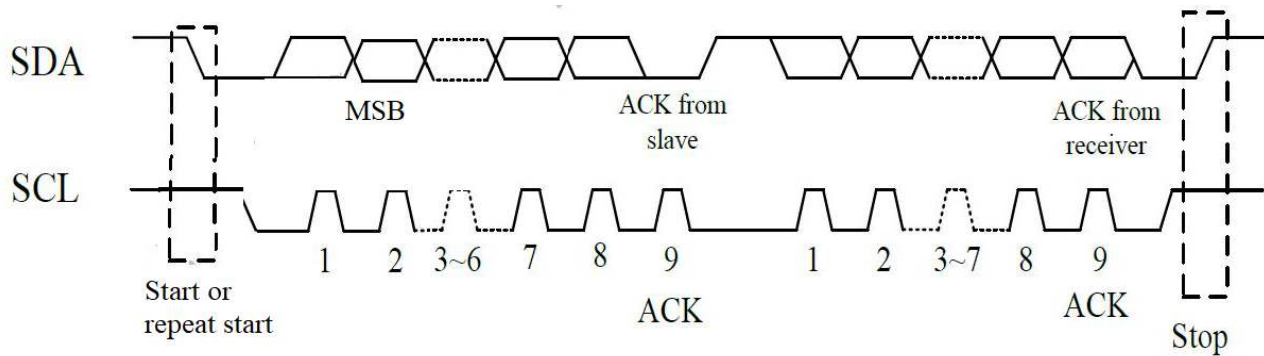
| Item | Symbol | Condition | Min | Typ. | Max | Unit | Note |
|---|------------------|--------------------------------------|----------|------|----------|------|------|
| Digital supply voltage | VDD | | 2.7 | -- | 3.6 | V | |
| I/O Leakage Current | ILI | | -1 | -- | 1 | uA | |
| Normal operation mode current consumption | I _{OPr} | VDD=2.8V Ta=25°C MCLK=17.5M Hz | -- | 11 | -- | mA | |
| Monitor mode current consumption | I _{mon} | | -- | 0.43 | -- | mA | |
| Sleep mode current consumption | I _{sip} | | 70 | -- | 120 | uA | |
| Level input voltage | V _{IH} | | 0.7IOVCC | | IOVCC | V | |
| | V _{IL} | | -0.3 | | 0.3IOVCC | V | |
| Level output voltage | V _{OH} | I _{OH} =-0.1mA | 0.7IOVCC | | | V | |
| | V _{OL} | I _{OL} =0.1mA | | | 0.3IOVCC | V | |

7.1.3 AC Characteristics

| Item | Symbol | Test Condition | Min | Typ. | Max | Unit | Note |
|----------------------|-----------------|--------------------|-----|------|-----|------|------|
| OSC clock 1 | fosc1 | VDDA=2.7V; Ta=25°C | 59 | 60 | 61 | MHz | |
| I/O output rise time | T _{tr} | VDDA=2.7V; Ta=25°C | - | 14 | - | ns | |
| I/O output fall time | T _{tf} | VDDA=2.7V; Ta=25°C | - | 14 | - | ns | |

7.1.4 I2C Interface

The I2C is always configured in the slave mode. The data transfer format is shown below.



The following table lists the meanings of the mnemonics used in the above figures.

| Mnemonics | Description |
|-----------|--|
| S | I2C start or I2C restart |
| A [6:0] | Slave address |
| R/W | Read/Write bit, '1' for read, '0' for write |
| A(N) | ACK(NACK) |
| P | Stop: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet) |

I2C Interface Timing Characteristics

| Parameter | Min | Max | Unit |
|--|-----|-----|------|
| SCL frequency | 0 | 400 | kbps |
| Bus free time between a stop and start condition | 1.3 | - | us |
| Hold time (repeated) start condition | 0.6 | - | us |
| Data setup time | 0.1 | - | ns |
| Setup time for a repeated start condition | 0.6 | - | us |
| Setup time for stop condition | 0.6 | - | us |

8. Cautions and Handling Precautions

8.1 Handling and Operating the Module

1. When the module is assembled, it should be attached to the system firmly. Do not warp or twist the module during assembly work.
2. Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
3. Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
4. Do not allow drops of water or chemicals to remain on the display surface. If you have the droplets for a long time, staining and discoloration may occur.
5. If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
6. The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
7. If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
8. Protect the module from static; it may cause damage to the CMOS ICs.
9. Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
10. Do not disassemble the module.
11. Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
12. Pins of I/F connector shall not be touched directly with bare hands.
13. Do not connect, disconnect the module in the "Power ON" condition.
14. Power supply should always be turned on/off by the item Power On Sequence & Power Off Sequence.

8.2 Storage and Transportation

1. Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%
2. Do not store the TFT-LCD module in direct sunlight.
3. The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
4. It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
5. This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.