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

# TFT Display Module

## Part Number

E35GH-CW320-R

Overview:

- 3.5-Inch TFT (56.54x84.96mm)
- 320x480 Pixels
- 16/18/24-Bit RGB Interface
- Operating Temp -20C to 70C
- 6:00 Viewing Angle
- Transmissive
- Resistive Touch Panel
- 320 Nits
- Controller: ILI9488
- 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 and a backlight unit. The resolution of the 3.5" TFT-LCD contains 320(RGB)x480 pixels and can display up to 16.7M colors.

**TFT Features:**

Input Voltage: 3V

TFT Interfaces: 16/18/24-Bit RGB

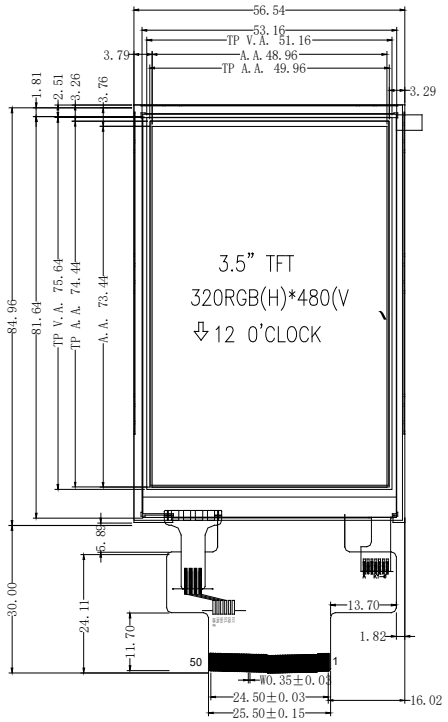
| General Information Items | Specification<br>Main Panel | Unit | Note |
|---|---|---|---|
| TFT Display Area (AA) | 48.96 (H) x 73.44 (V) (3.5 inch) | mm | - |
| Driver Element | TFT active matrix | - | - |
| Display Colors | 16.7M | colors | - |
| Number of Pixels | 320(RGB)x480 | dots | - |
| TFT Pixel Arrangement | RGB vertical stripe | - | - |
| Pixel Pitch | 51 (H) x 153 (V) | mm | - |
| Viewing Angle | 6:00 | - | - |
| TFT Controller IC | ILI9488 | - | - |
| LCM Interface | 16/18/24-Bit RGB | - | - |
| Display Mode | Transmissive/ Normally White | - | - |
| Operating Temperature | -20～+70 | ℃ | - |
| Storage Temperature | -30～+80 | ℃ | - |

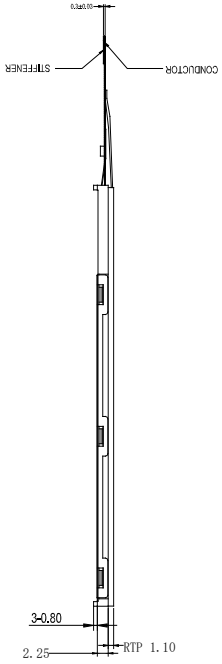
**Mechanical Information**

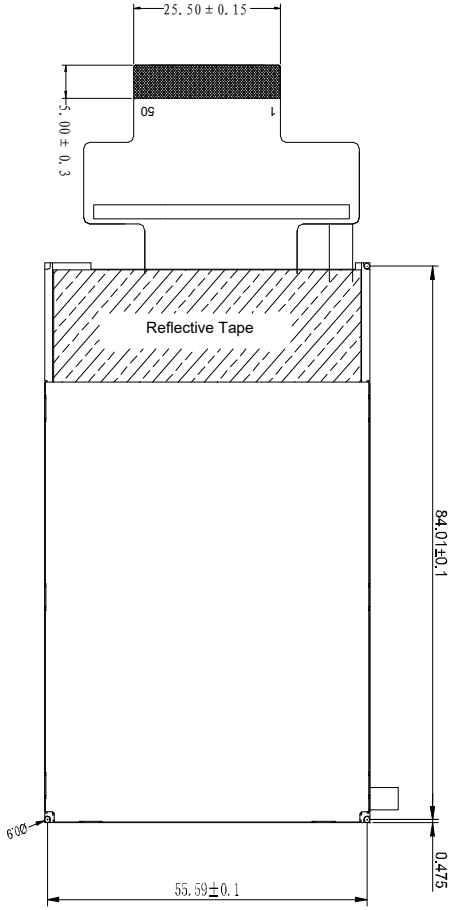
| Item | | Min | Typ. | Max | Unit | Note |
|---|---|---|---|---|---|---|
| Module size | Height (H) | | 56.54 | | mm | - |
| | Vertical (V) | | 84.96 | | mm | - |
| | Depth (D) | | 3.35 | | mm | - |

## 1. Outline Dimensions

| Rev. | Description | Date |
|---|---|---|
| 1.0 | First | 8/31/22 |
| | | |



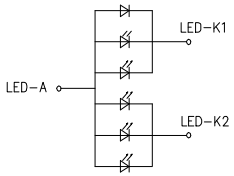




| Pin | Name |
|---|---|
| 1 | LEDA |
| 2 | LEDK1 |
| 3 | LEDK2 |
| 4 | NC |
| 5 | NC |
| 6 | NC |
| 7 | IMO |
| 8 | IM1 |
| 9 | IM2 |
| 10 | RESET |
| 11 | VSYNC |
| 12 | HSYNC |
| 13 | DOTCLK |
| 14 | DE |
| 15 | DB17 |
| 16 | DB16 |
| 17 | DB15 |
| 18 | DB14 |
| 19 | DB13 |
| 20 | DB12 |
| 21 | DB11 |
| 22 | DB10 |
| 23 | DB9 |
| 24 | DB8 |
| 25 | DB7 |
| 26 | DB6 |
| 27 | DB5 |
| 28 | DB4 |
| 29 | DB3 |
| 30 | DB2 |
| 31 | DB1 |
| 32 | DB0 |
| 33 | SDO |
| 34 | SDI |
| 35 | RD |
| 36 | WR(D/C) |
| 37 | D/C(SCL) |
| 38 | CS |
| 39 | TE |
| 40 | VDDI |
| 41 | VDDI |
| 42 | VCI |
| 43 | GND |
| 44 | XR |
| 45 | YD |
| 46 | XL |
| 47 | YU |
| 48 | GND |
| 49 | GND |
| 50 | GND |

NOTES:
1. DISPLAY TYPE: 3.5-INCH TFT-LCD, 16.7M COLORS
2. DISPLAY MODE: TRANSMISSIVE, NORMALLY WHITE
3. VIEWING ANGLE: 6:00
4. OPERATING TEMP: -20°C TO +70°C
   STORAGE TEMP: -30°C TO +80°C
5. LCD VOLTAGE: 3.3V
6. TFT IC: ILI9488
7. TFT INTERFACE: 16/18/24-Bit RGB INTERFACE
8. TOUCH PANEL: RESISTIVE
9. BACKLIGHT: 6 White LED CHIPS, 120mA, 3.2V
10. RoHS COMPLIANT

LED Circuit




LED: Vf=3.2V , If=120mA



| | | | |
|---|---|---|---|
| Model Name: E35GH-CW320-R | | | |
| General Tol: ± 0.2 | | | |
| Approvals | Date | Drawing No.: | Scale: |
| DWN: | | | |
| CHK: | | Size: | Unit: mm |
| APP: | | | Page: 1/1 |

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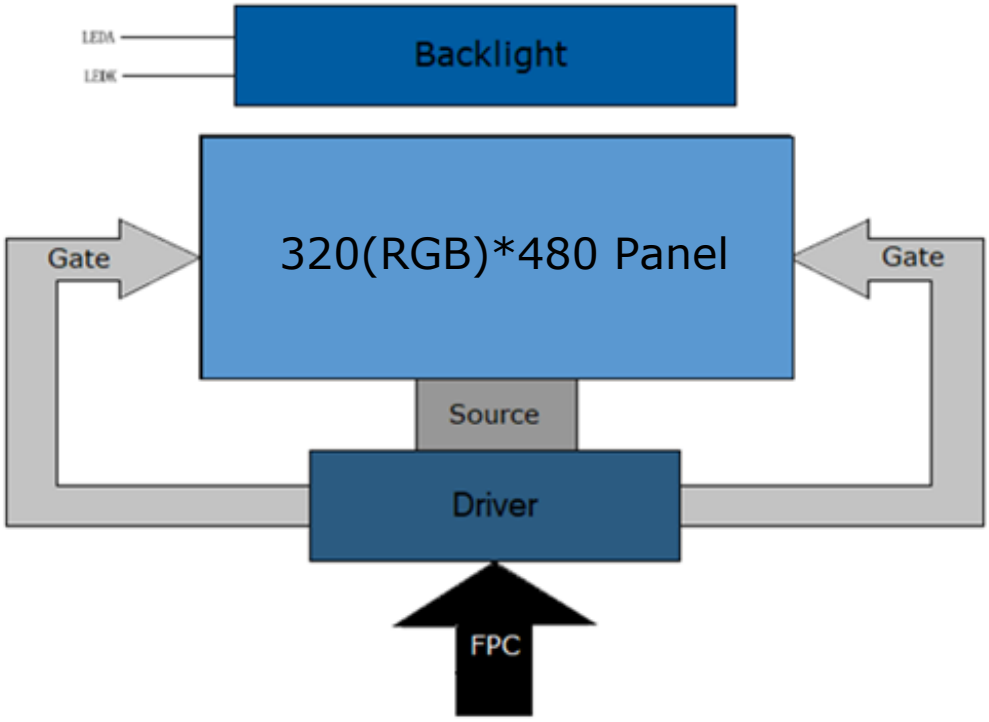
## 2. Block Diagram



## 3. Input Terminal Pin Assignment

Recommended Connector: FH12S-50S-0.5SH(55)

| No. | Symbol | Description | I/O |
|---|---|---|---|
| 1 | LEDA | Anode Pin of The Backlight | P |
| 2 | LEDK1 | Cathode Pin of The Backlight | P |
| 3 | LEDK2 | Cathode Pin of The Backlight | P |
| 4 | NC | Not Connected | - |
| 5 | NC | Not Connected | - |
| 6 | NC | Not Connected | - |
| 7 | IMO | IM2=0, IM1=0, IM0=0: MIPI-DBI Type B 24-bit bus (DB_EN=1)<br>IM2=0, IM1=0, IM0=0: MIPI-DBI Type B 18-bit bus (DB_EN=0)<br>IM2=0, IM1=0, IM0=1: MIPI-DBI Type B 9-bit bus<br>IM2=0, IM1=1, IM0=0: MIPI-DBI Type B 16-bit bus<br>IM2=0, IM1=1, IM0=1: MIPI-DBI Type B 8-bit bus<br>IM2=1, IM1=0, IM0=1: MIPI-DBI Type C Option 1 (3-line SPI)<br>IM2=1, IM1=1, IM0=0: MIPI-DSI<br>IM2=1, IM1=1, IM0=1: MIPI-DBI Type C Option 3 (4-line SPI) | I |
| 8 | IM1 | | I |
| 9 | IM2 | | I |
| 10 | RESET | Reset Input Signal | I |
| 11 | VSYNC | DPI: Frame Sync Signal - Fix to DGND level when not in use | I |
| 12 | HSYNC | DPI: Line Sync Signal - Fix to DGND level when not in use | I |
| 13 | DOTCLK | DPI: Dot Clock Signal - Fix to IOVCC level when not in use | I |
| 14 | DE | DPI: Data Enable Input Signal - Fix to DGND level when not in use | I |
| 15 | DB17 | MIPI-DBI Type B 24-bit bus (DB_EN=1): DB [23:0]<br>MIPI-DBI Type B 18-bit bus (DB_EN=0): DB [17:0]<br>MIPI-DBI Type B 16-bit bus: DB [15:0]<br>MIPI-DBI Type B 9-bit bus: DB [9:0]<br>MIPI-DBI Type B 8-bit bus: DB [7:0]<br>MIPI-DPI 24-bit: DB [23:0]<br>MIPI-DPI 18-bit: DB [17:0]<br>MIPI-DPI 16-bit: DB [15:0] | I/O |
| 16 | DB16 | | I/O |
| 17 | DB15 | | I/O |
| 18 | DB14 | | I/O |
| 19 | DB13 | | I/O |
| 20 | DB12 | | I/O |
| 21 | DB11 | | I/O |
| 22 | DB10 | | I/O |
| 23 | DB9 | | I/O |
| 24 | DB8 | | I/O |
| 25 | DB7 | | I/O |
| 26 | DB6 | | I/O |
| 27 | DB5 | | I/O |
| 28 | DB4 | | I/O |
| 29 | DB3 | | I/O |
| 30 | DB2 | | I/O |
| 31 | DB1 | | I/O |
| 32 | DB0 | | I/O |
| 33 | SDO | DBI Type C ; SDO - Serial Data Output - Leave pin open when not in use | O |
| 34 | SDI | DBI Type C ; DINA/SDA: Serial Data Input/Output bi-directional pin - Fix to IOVCC or DGND when not in use | I/O |
| 35 | RD | DBI Type B: Serves at read signal - Fix to IOVCC or DGND when not in use | I |
| 36 | WR(D/C) | DBI Type B; WRX Pin, serves as write signal ; DBI Type C: SCL Pin as serial clock when operating in serial interface. Fix to IOVCC or DGND level when not in use. | I |
| 37 | D/C(SCL) | DBI Type B: Data/Command Selection Pin; Low: Command; High: Parameter | I |
| 38 | CS | DBI Type B: Chip select input signal; Low - Chip selected and accessible; High - Chip is not selected and not accessible. Fix to IOVCC or DGND level when not in use. | I |
| 39 | TE | Tearing Effect Output Signal - Leave open when not in use. | O |
| 40 | VDDI | Supply voltage to digital circuit - connected to external power supply of 1.65~3.3V | P |
| 41 | VDDI | Supply voltage to digital circuit - connected to external power supply of 1.65~3.3V | P |
| 42 | VCI | Supply voltage to analog circuit - connected to external power supply of 2.5~3.3V; Connect to a stabilizing capacitor between VCI and GND | P |
| 43 | GND | Power Ground | P |
| 44 | XR | TP Signal | I |
| 45 | YD | TP Signal | I |
| 46 | XL | TP Signal | I |
| 47 | YU | TP Signal | I |
| 48 | GND | Power Ground | P |
| 49 | GND | Power Ground | P |
| 50 | GND | Power Ground | P |

# 4. LCD Optical Characteristics

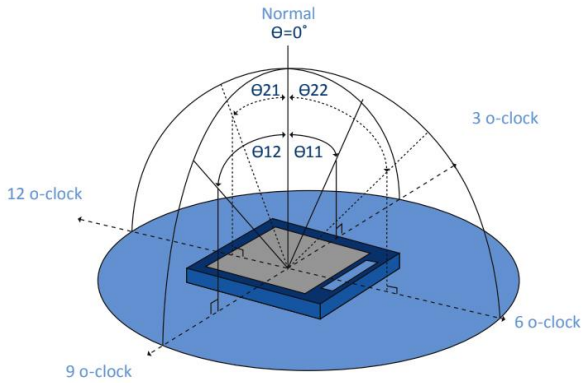
## 4.1 Optical Specifications

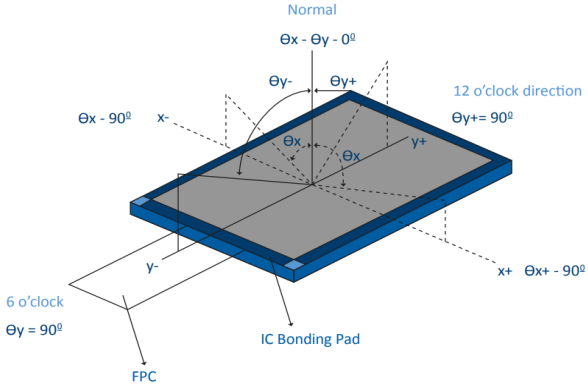
| Item | | Symbol | Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Transmittance | | T(%) | | -- | (14.74) | -- | % |
| Contrast Ratio | | CR | | 400 | 500 | -- | % |
| Color Gamut | | S(%) | | | (60) | | % |
| Response Time | Rising | $T_R$ | θ=0 Normal viewing angle | - | 4 | 8 | ms |
| | Falling | $T_F$ | | - | 12 | 24 | |
| Color Filter Chromaticity | White | $W_X$ | | 0.283 | 0.303 | 0.323 | |
| | | $W_Y$ | | 0.305 | 0.325 | 0.345 | |
| | Red | $R_X$ | | 0.606 | 0.626 | 0.646 | |
| | | $R_Y$ | | 0.314 | 0.334 | 0.354 | |
| | Green | $G_X$ | | 0.257 | 0.277 | 0.297 | |
| | | $G_Y$ | | 0.529 | 0.549 | 0.569 | |
| | Blue | $B_X$ | | 0.122 | 0.142 | 0.162 | |
| | | $B_Y$ | | 0.102 | 0.122 | 0.142 | |
| Viewing Angle | Hor. | ΘL | CR≥10 | 60 | 70 | -- | degree |
| | | ΘR | | 60 | 70 | -- | |
| | Ver. | ΘT | | 60 | 70 | -- | |
| | | ΘB | | 40 | 60 | -- | |
| Option View Direction | | 6:00 | | | | | |

**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.



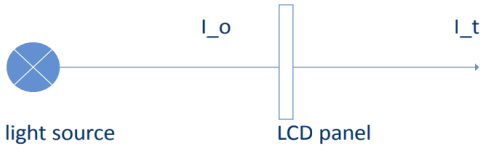




(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

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

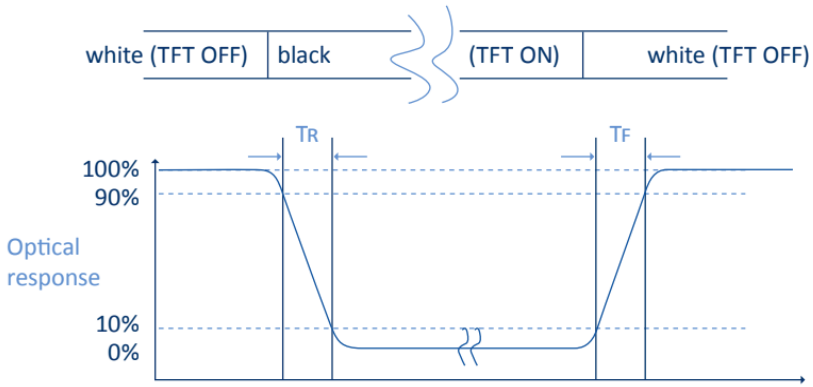
(3) Definition of transmittance (T%): The transmittance of the panel including the polarizers is measured with electrical driving. The equation for transmittance Tr is:

$$Tr = \frac{It}{Io} \; x \; 100\%$$

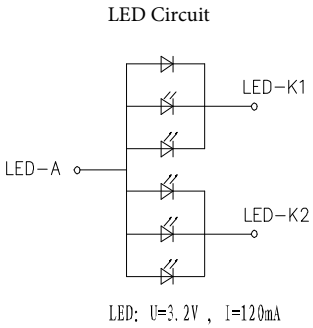



Io = the brightness of the light source.
It = the brightness after panel transmission

(4) Definition of Response Time (Tr, Tf): The rise time 'Tr' 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 'Tf' 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.



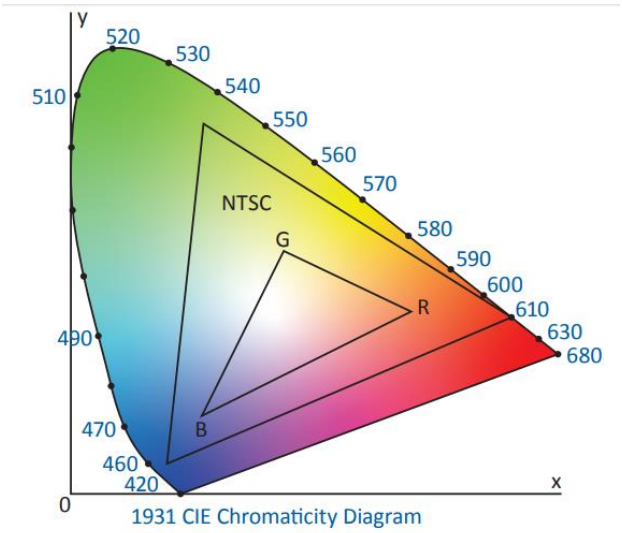
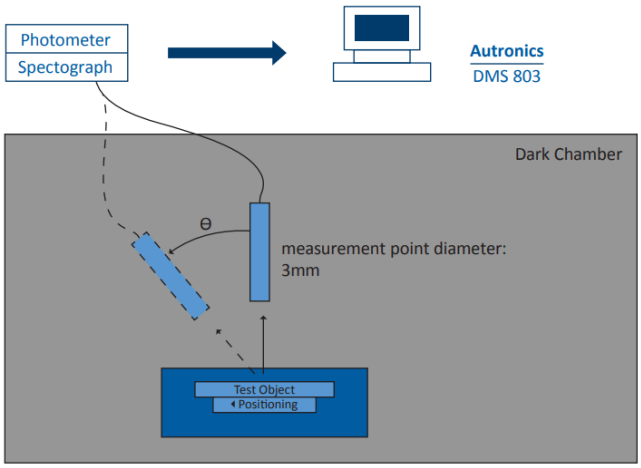



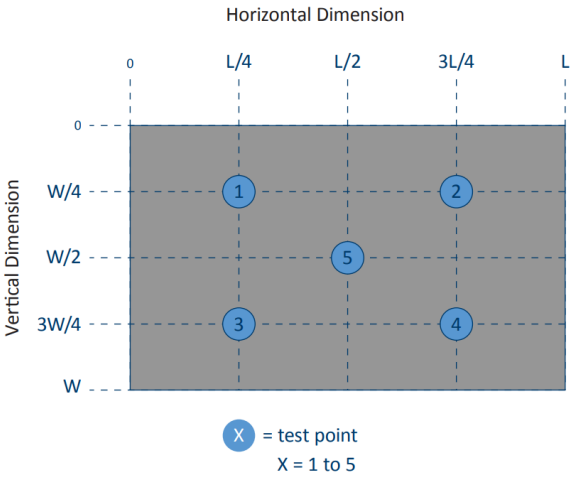

Fig. 1931 CIE chromacity diagram

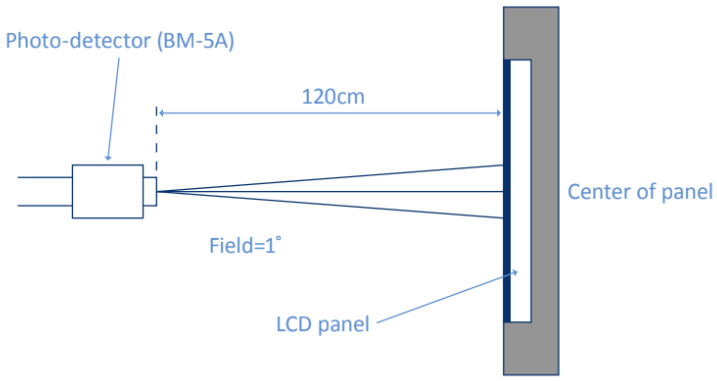
Color gamut: $S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$

(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 |
|---|---|---|---|---|
| Digital Power Supply Voltage | VDD | VSS-0.3 | 5.0 | V |

*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.*

#### 5.1.1 LCD Electrical Characteristics

(Ta=25±2°C)

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| current | $I_f$ | -- | 30 | mA | (1) |
| voltage | $V_R$ | -- | 5.0 | V | (1) |

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.

## 5.2 Electrical Characteristics

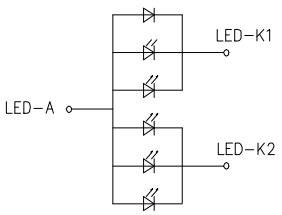
### 5.2.1 Backlight Unit

The back-light system is an edge-lighting type with six white LEDs (Light Emitting Diode). (Ta=25±2°C)

| Characteristics | Symbol | Min | Typ. | Max | Unit | Note |
|---|---|---|---|---|---|---|
| LED Current | IF | -- | 120 | -- | mA | |
| LED Voltage | VF | 2.8 | 3.2 | 3.4 | V | |
| Power Consumption | $P_{BL}$ | -- | -- | -- | mW | |
| LCM Luminance | cd/m$^2$ | -- | 320 | -- | cd/m$^2$ | |

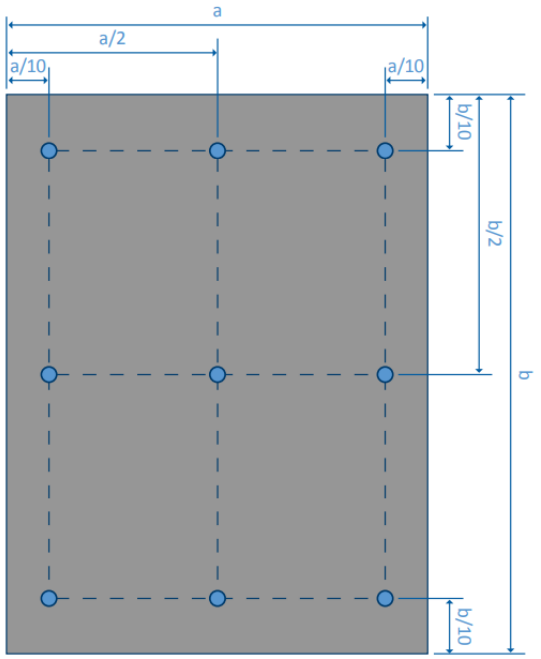
NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. Be sure to use the product within the range of the absolute maximum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

LED Circuit




LED: U=3.2V , I=120mA

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



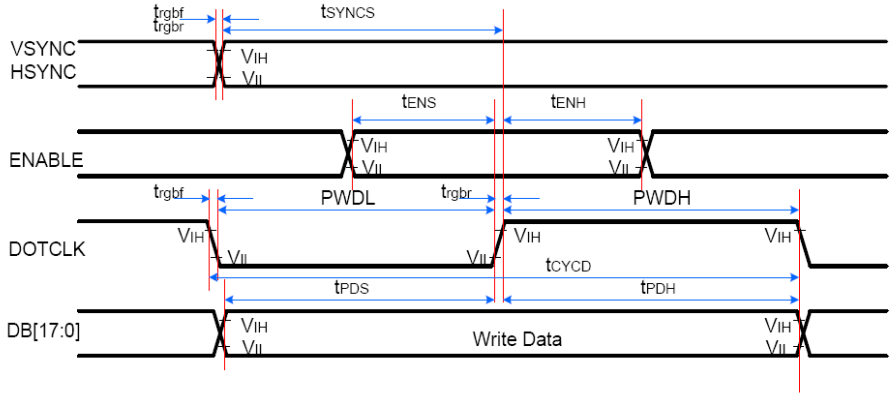

$$\text{Luminance} = \frac{\text{(Total Luminance of 9 points)}}{9}$$

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

# 6. Interface Timing

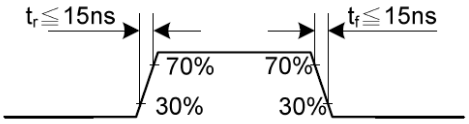
## 6.1 DPI 16/18/24-bit Interface Timing Characteristics

### 17.4.4. DPI (Display Parallel 16-/18-/24-bit interface) Timing Characteristics




| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| VSYNC/ HSYNC | $t_{SYNCS}$ | VSYNC/HSYNC setup time | 15 | - | ns | 16-/18-/24-bit bus RGB interface mode |
| | $t_{SYNCH}$ | VSYNC/HSYNC hold time | 15 | - | ns | |
| ENABLE | $t_{ENS}$ | ENABLE setup time | 15 | - | ns | |
| | $t_{ENH}$ | ENABLE hold time | 15 | - | ns | |
| DB [23:0] | $t_{POS}$ | Data setup time | 15 | - | ns | |
| | $t_{PDH}$ | Data hold time | 15 | - | ns | |
| DOTCLK | PWDH | DOTCLK high-level period | 20 | - | ns | |
| | PWDL | DOTCLK low-level period | 20 | - | ns | |
| | $t_{CYCD}$ | DOTCLK cycle time | 50 | - | ns | |
| | $t_{rgbr}$, $t_{rgbf}$ | DOTCLK,HSYNC,VSYNC rise/fall time | - | 15 | ns | |

**Note:** Ta = -30 to 70 ºC, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V



## 7.0 Controller Information

For more information on the controller, please see ILI9488 Controller Specification

## 8.0 Quality Inspection information

For more information on our the quality inspection information for this module, please visit https://focuslcds.com/content/LCD%20Quality%20Inspection%20Standards.pdf

## 9. Cautions and Handling Precautions

### 9.1 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

### 9.2. 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 ℃ 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.