



## **4DLCD-21-480-480 Series**

- 2.1" Round TFT-LCD
- Colour active matrix TFT-LCD module

Available in:

4DLCD-21-480-480-NT-NM-300-D/R/S

4DLCD-21-480-480-CT-NM-250-D/R/S

# Datasheet

## Revision History

REVISION	DATE	COMMENT	REMARKS
1.0	03/12/2022	Initial Draft	Initial Draft Version

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## 1. General Specification

**4DLCD-21-480-480 Series** is a colour active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a colour round TFT-LCD panel, driver IC, FPC and a back light unit, and with or without a capacitive touch panel. The module display area contains 480 x 480 pixels. This product accords with RoHS environmental criterion.

ITEM		CONTENTS	UNIT
LCD Type		TFT / Transmissive / Normally Black	
Size		2.1	Inch
Viewing Direction		ALL	O'Clock
Display Mode		Nomally Black	
LCD (W × H)		56.18 x 59.71 x 2.3	mm <sup>3</sup>
Active Area (W × H x D)		53.28 x 53.28	mm <sup>2</sup>
Dot Pitch (W × H)		-	mm <sup>2</sup>
Number of Dots (Pixels)		480 (RGB) × 480	
Driver IC		ST7701S	
Backlight Type		4 LEDs	
Surface Luminance	4DLCD-21-480-480	300(typical)	cd/m <sup>2</sup>
Interface Type		RGB	
Color Depth		262K	
Pixel Arrangement		RGB Vertical Stripe	
Input Voltage		2.8 (typical)	V
With/Without TP		Optional	
Weight	4DLCD-21-480-480	TBD	g

**Note 1:** RoHS compliant

**Note 2:** LCD weight tolerance: ± 5%.

### Available in:

4DLCD-21-480-480-NT-NM-300-D/R/S

4DLCD-21-480-480-CT-NM-250-D/R/S

### Part Number Details:

NT - Non Touch

RP - Resistive Touch

CP - Capacitive Touch

EAR - Metal or Plastic EARs

CLB - Glass Cover Lenz Bezel

NM - No Mounting

L - LVDS

D - MIPI/DSI

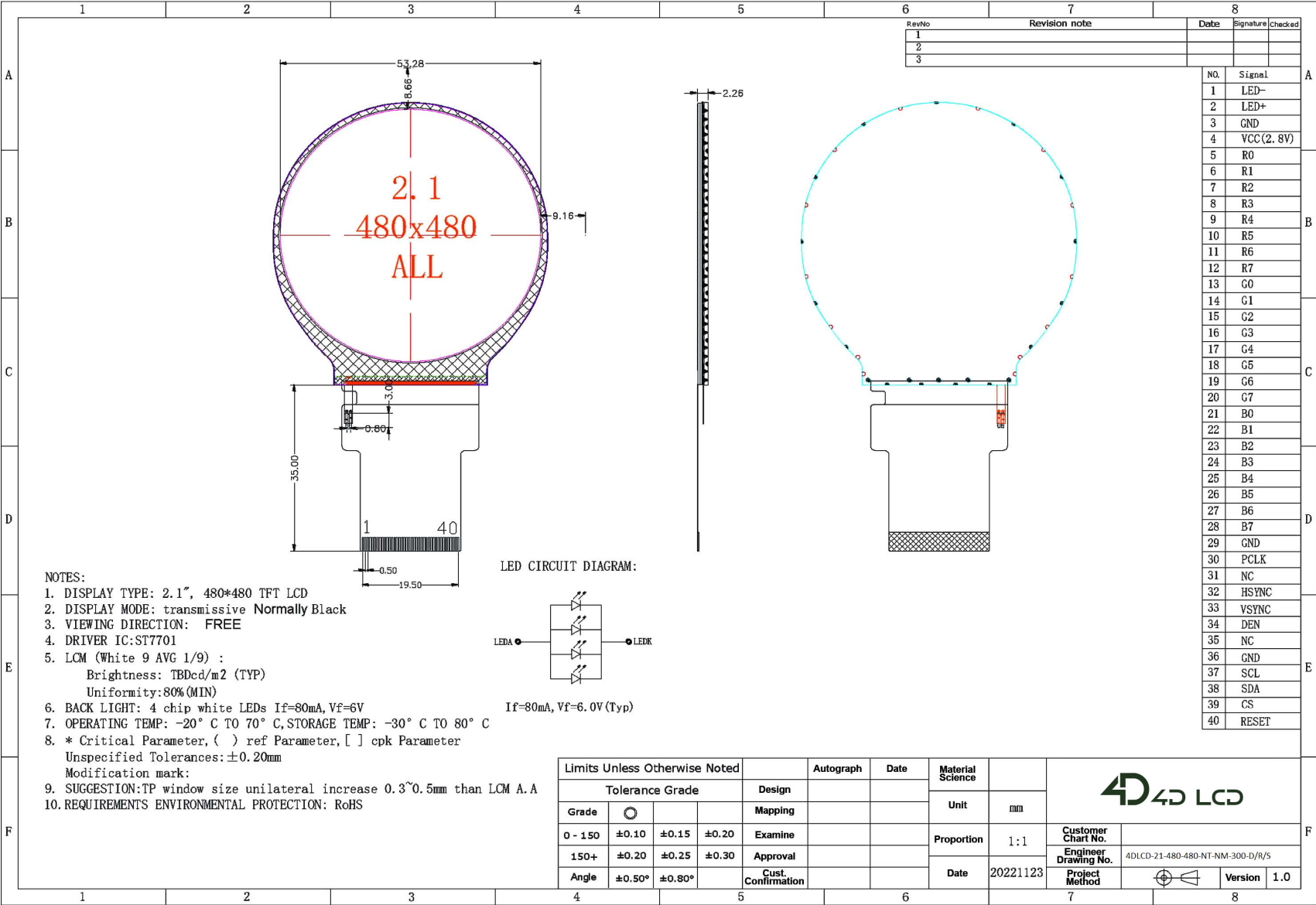
R - RGB

S - SPI

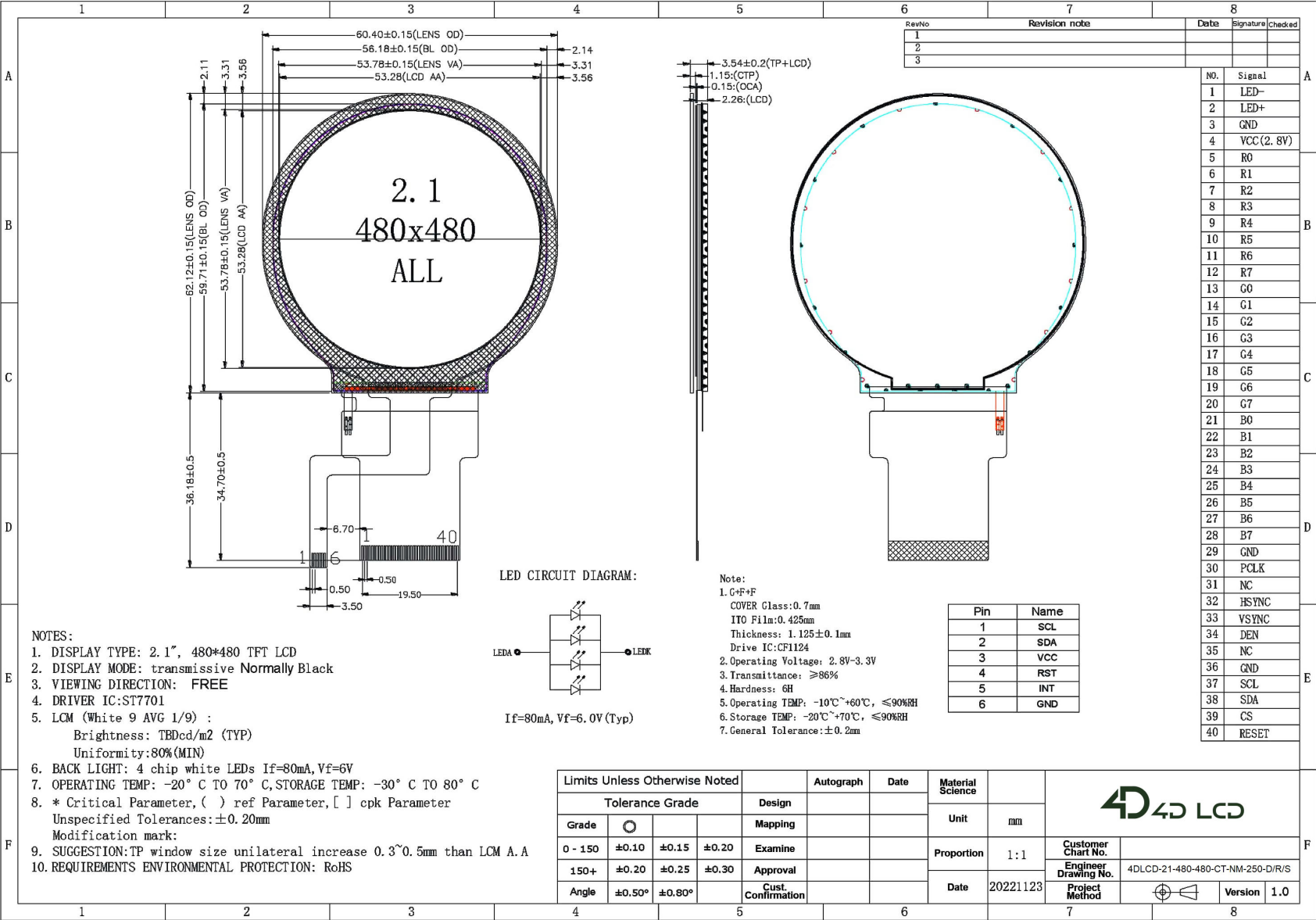
M8 - MCU 8bit

M16 - MCU 16bit

2. TFT LCD Display Drawing (Non-Touch Version)  
4DLCD-21-480-480-NT-NM-300-D/R/S (Non-Touch Version)



3. TFT LCD Display Drawing (With Capacitive Touch)  
4DLCD-21-480-480-CT-NM-250-D/R/S (With Capacitive Touch)



## 4. Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage for LCD Logic	VDD/VCC	0.3	4.8	V
Input Voltage	VIN	-	VDD+0.3	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Humidity	RH	-	90% (Max 60°C)	RH

## 5. Electrical Characteristics

### 5.1. Driving TFT LCD Panel

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
Operating Voltage	VDD/DCC	2.5	2.8	4.8	V	-
Supply Current	IDD	-	-	50	mA	VDD=2.8V, Ta=25°C
Input Voltage 'H' Level	V <sub>IH</sub>	0.8 VDD	-	VDD	V	-
Input Voltage 'L' Level	V <sub>IL</sub>	0	-	0.2 VDD	V	-
Input Leakage Current	I <sub>IL</sub>	-1.0	-	1.0	μA	VIN=VDD or VSS

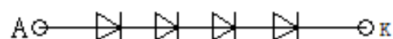
Note: Voltage greater than above may damage the module. All voltages are specified relative to VSS=0V.

### 5.2. Driving Backlight

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
Forward Current	I <sub>F</sub>	-	20	22	mA	-
Forward Voltage	V <sub>F</sub>	-	12.8	-	V	-
Connection Mode		-	4Series	-	-	-
LED Number		-	4	-	pcs	-

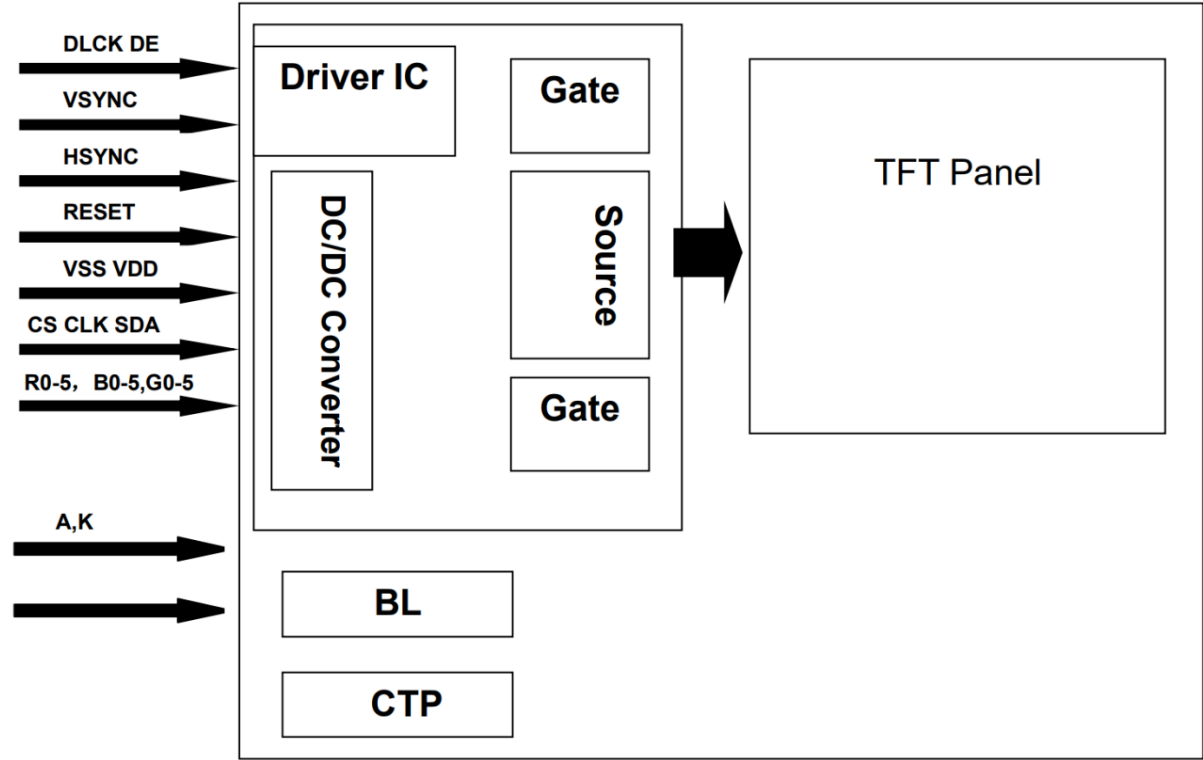
Note1: Optical performance should be evaluated at Ta=25°C only .If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

LED CIRCUIT DIAGRAM:



**IDD=20mA, VDD=12.8V TYP**

5.3. Block Diagram





## 6. Electro-Optical Characteristics

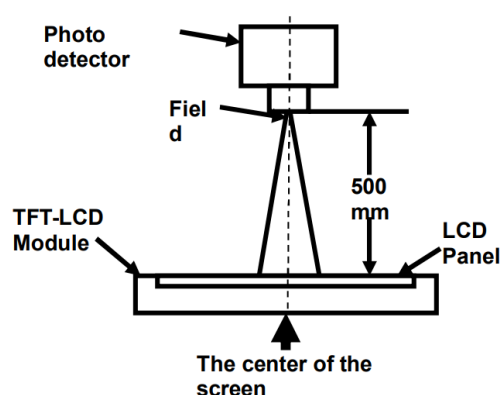
ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	REMARK
View Angles	$\Theta T$	$CR \geq 10$	-	80	-	Deg	Note 2
	$\Theta B$		-	80	-		
	$\Theta L$		-	80	-		
	$\Theta R$		-	80	-		
Contrast Ratio	CR	$\theta = 0^\circ$	700	900	-	-	Note 1, Note 3
Response Time	TON	$25^\circ C$	-	30	40	ms	Note 1, Note 4
	TOFF						
Uniformity	U	-	70	80	-	%	Note 1, Note 6
NTSC	-	-	-	70	-	%	Note 5
Luminance	L	-	280	300	-	$cd/m^2$	Note 1, Note 7

Test Conditions:

1. VF=12.8V, IF=20mA, the ambient temperature is  $25^\circ C$ .
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.



Item	Photo detector	Field
Contrast Ratio	SR-3A	$1^\circ$
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	$2^\circ$

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).

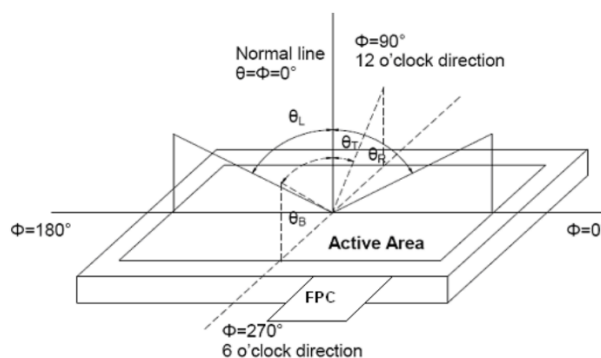


Fig. 1 Definition of viewing angle



## Note 3: Definition of contrast ratio

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

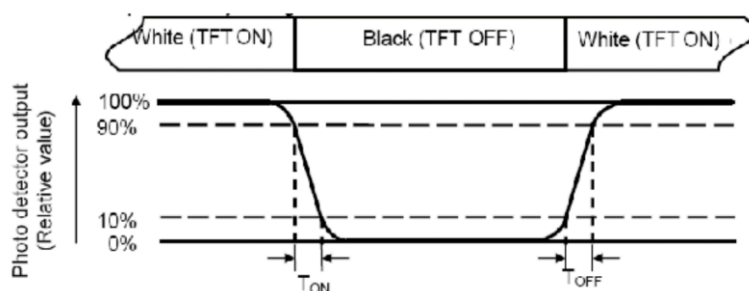
"White state": The state is that the LCD should be driven by  $V_{\text{white}}$ .

"Black state": The state is that the LCD should be driven by  $V_{\text{black}}$ .

$V_{\text{white}}$ : To be determined  $V_{\text{black}}$ : 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 ( $T_{\text{ON}}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{\text{OFF}}$ ) 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.

$$\text{Luminance Uniformity (U)} = L_{\text{min}} / L_{\text{max}}$$

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

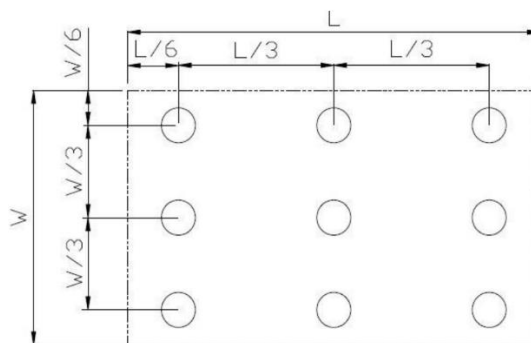


Fig. 2 Definition of uniformity

$L_{\text{max}}$ : The measured maximum luminance of all measurement position.  $L_{\text{min}}$ : The measured minimum luminance of all measurement position.

## Note 7: Definition of Luminance:

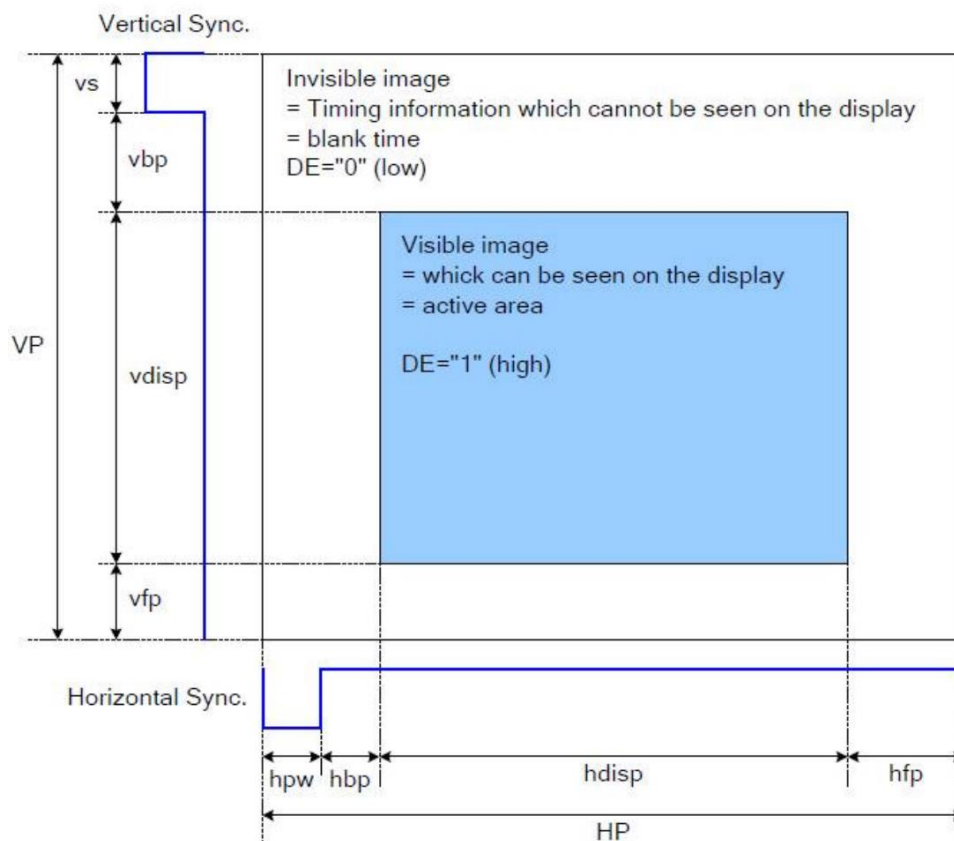
Measure the luminance of white state at center point.

## 7. Interface Descriptions

PIN NO.	SYMBOL	DESCRIPTION	REMARK
1	LED-	LED Cathod	
2	LED+	LED Anode	
3	GND	Ground	
4	VCC (2.8V)	Power Supply	
5~12	R0~R7	Red Data Input R0~R7	
13~20	G0~G7	Green Data Input G0~G7	
21~28	B0~B7	Blue Data Input B0~B7	
29	GND	Ground	
30	PCLK	RGB Dot Clock signal	
31	NC	Not Connected	
32	HSYNC	RGB Line Synchronizing Signal	
33	YSYNC	RGB Frame Synchronizing Signal	
34	DEN	Input data enable control. When DE mode, active High to enable data input (Normally pull low)	
35	NC	Not Connected	
36	GND	Ground	
37	SCL	Touch IIC Clock Signal	
38	SDA	Touch IIC Data Signal	
39	CS	Chip Selection	
40	RESET	Reset	

## 8. Interface Timing

### 8.1. System Bus Read/Write Characteristics



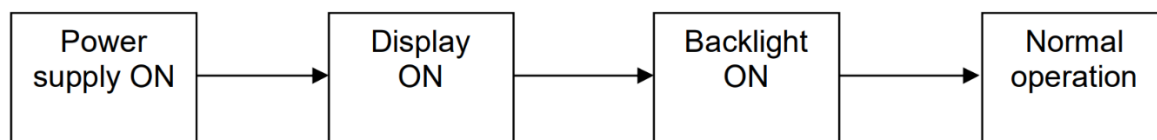
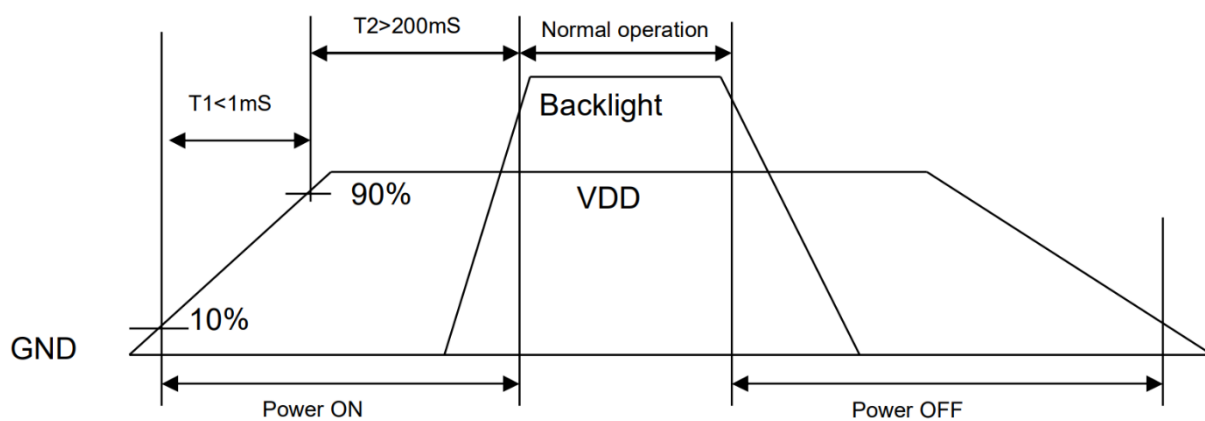
Please refer to the following table for the setting limitation of RGB interface signals.

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Horizontal Sync. Width	hbw	1	-	255	Clock
Horizontal Sync. Back Porch	hbp	1	-	255	Clock
Horizontal Sync. Front Porch	hfp	1	-	-	Clock
Vertical Sync. Width	vs	1	-	254	Line
Vertical Sync. Back Porch	vbp	1	-	254	Line
Vertical Sync. Front Porch	vfp	2	-	-	Line

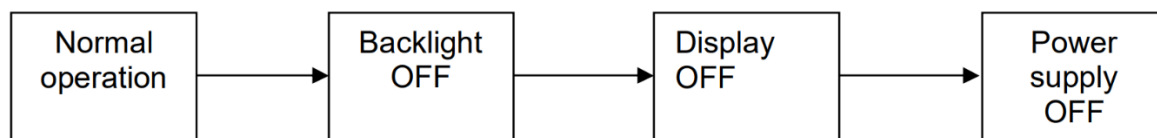
Note:

1. Typical value are related to the setting frame rate is 60Hz.

## 8.2. Power ON/OFF Timing



Power ON sequence



Power OFF sequence

## 9. Reliability Test

No.	SYMBOL	TEST CONDITION	REMARK
1	High Temperature Storage	80°C±2°C 96H Restore 2H at 25°C Power off	After test cosmetic and electrical defects should not happen.
2	Low Temperature Storage	-30°C±2°C 96H Restore 2H at 25°C Power off	
3	High Temperature Operation	70°C±2°C 96H Power on	
4	Low Temperature Operation	-20°C±2°C 96H Power	
5	High Temperature & Humidity Operation	60°C±2°C 90%RH 96H Power on	
6	Temperature Cycle	-20°C←→25°C←→70°C 30min 5min 30min After 10 cycles, restore 2H at 25°C Power off	
7	Vibration Test	10Hz~150Hz, 100m/s <sup>2</sup> , 120min	
8	Shock Test	Half-sinewave, 300m/s <sup>2</sup> , 11ms	

## 10. Precautions for Using LCD Module

### 10.1. Handling Precautions

- (1) The display panel is made of glass. Do not subject it to a mechanical shock or impact by dropping it.
- (2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
  - (3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
  - (4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
  - (5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten a cloth with one of the following solvents:
    - Isopropyl alcohol
    - Ethyl alcohol
- (6) Solvents other than those above mentioned may damage the polarizer. Especially, do not use the following:
  - Water
  - Ketone
  - Aromatic solvents
- (7) Extra care to minimize corrosion of the electrode. Water droplets, moisture condensation or a current flow in a high-humidity environment accelerates corrosion of the electrode.
- (8) Install the LCD Module by using the mounting holes. When mounting the LCD Module, make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
- (9) Do not attempt to disassemble or process the LCD Module.
- (10) NC terminal should be open. Do not connect anything.
- (11) If the logic circuit power is off, do not apply the input signals.
- (12) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD Module.
  - Tools required for assembling, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
  - The LCD Module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

### 10.2. Storage Precautions

When storing the LCD Module, avoid exposure to direct sunlight or fluorescent lamps. Keep the modules in bags (avoid high temperature/ high humidity and low temperatures below 0°C). Whenever possible, the LCD Module should be stored in the same conditions in which they were shipped from our company.

### 10.3. Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD Module have been operating for a long time showing the same display patterns the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be recovered by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD Module resulting from destruction caused by static electricity etc. exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.
- Terminal electrode sections.



## 11. Legal Information

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