



一众显示科技有限公司

TEAM SOURCE DISPLAY TECH. CO, LTD.

# TFT-LCD Module Specification

**Module NO.:** ProLCD-T043C01

**Version:** V1.0

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

<b>For Customer' s Acceptance:</b>	
<b>Approved by</b>	<b>Comment</b>

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V1.0	2023-09-07	Initial Release	

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# 1 General Characteristics

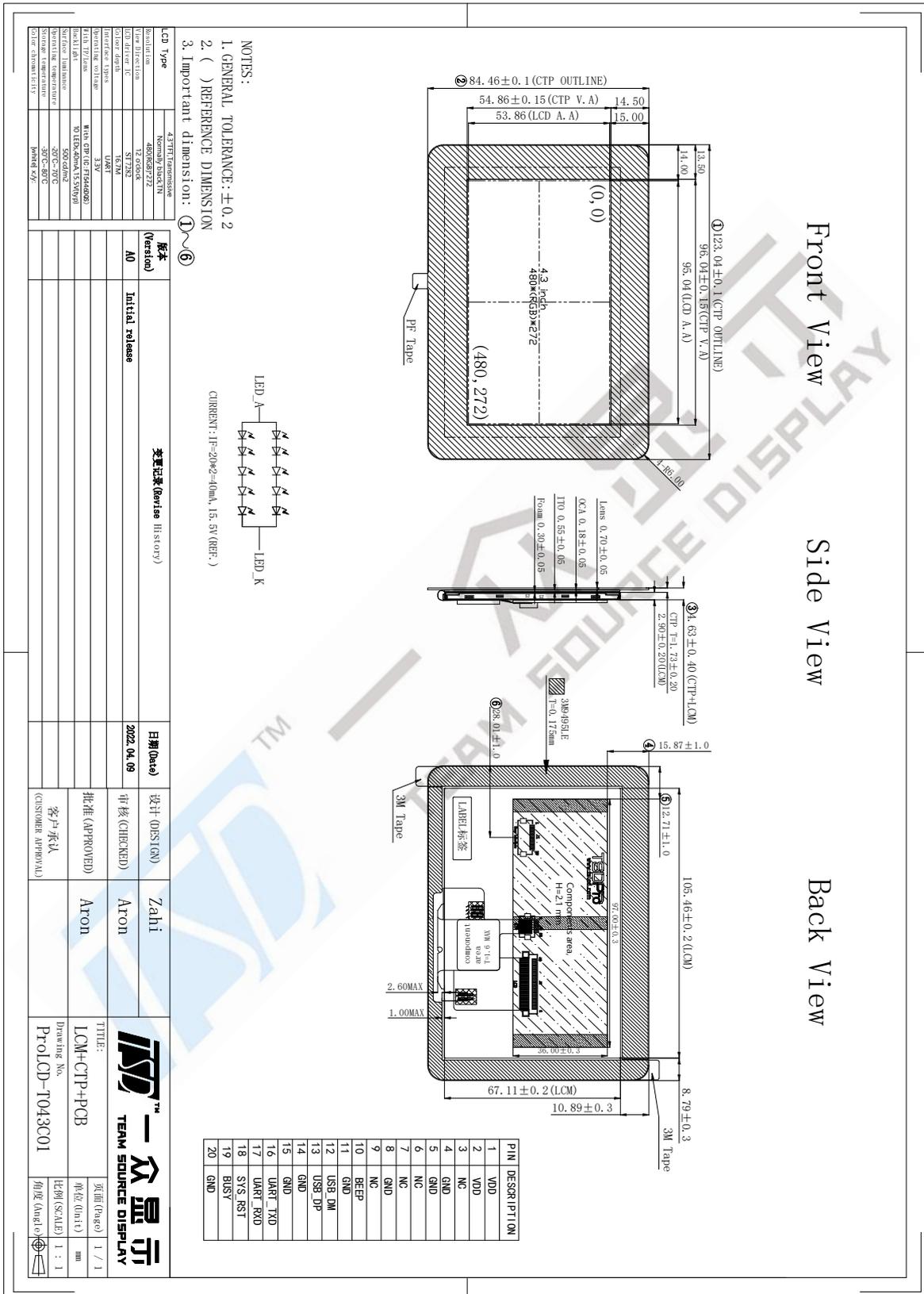
## 1.1 Introduction

ProLCD-T043C01 is a transmission type color active matrix liquid crystal display (LCD), using amorphous thin film transistor (TFT) as a switching device. This product is composed of TFT LCD panel, driver IC, FPC, PCB board, backlight and capacitive touch screen. The active display area is a 4.3-inch measurement on the diagonal, with an active resolution of 480 \* RGB \* 272. This product can be used to display pictures and text. The characteristics of this product are shown in the following table below.

## 1.2 General Information

ITEM	Specification	Unit
LCD Type	a-Si TFT, Transmissive, Normally white, TN	-
LCD Size	4.3	inch
Resolution (W x H)	480x (RGB) × 272	pixel
Outline size	123.04(H)x84.46(V)x4.63(T)	mm
Active Area	95.04 (H) x 53.86 (V)	mm
Pixel Pitch	0.1980(H) x 0.1980(V)	mm
Viewing Direction	12 o'clock	-
Color Depth	16.7M	-
Pixel Arrangement	RGB-stripe	-
Backlight Type	10LEDs/40mA/15.5V	-
Surface Luminance	500	cd/m <sup>2</sup>
Interface Type	UART	-
Input Voltage	VDD:+5V; I/O:3.3V	V
With/Without TP	With ctp (ic:FT5446DQS)	-
Weight	TBD	g

## 2 Product drawings



### 3 Interface description

#### 3.1 LCM interface description

N0.	Name	Descriptions
1	VDD+5V	Power Supply: +5V
2	VDD+5V	Power Supply: +5V
3	NC	No Connect
4	GND	System Ground. (0V)
5	GND	System Ground. (0V)
6	NC	No Connect
7	NC	No Connect
8	GND	System Ground. (0V)
9	NC	No Connect
10	BEEP	Connect and drive the buzzer
11	GND	System Ground. (0V)
12	USB_DM	USB Data Terminal (Negative)
13	USB_DP	USB Data Terminal (Positive)
14	GND	System Ground. (0V)
15	GND	System Ground. (0V)
16	Uart_TXD	Serial Communication Sends Data Output Pin
17	Uart_RXD	Serial Communication Receives Data Input Pin
18	SYS_RST	Reset Input Signal
19	BUSY	Busy state output
20	GND	System Ground. (0V)

## 4 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage	VDD	-0.3	5.5	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Storage Humidity	RH	-	90%(Max 60°C)	RH

## 5 Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Operating voltage	VDD	4.5	5.0	5.5	V
Input Current	I <sub>DC</sub>	-	TBD	-	mA
UART Baud Rate	BR	-	115200	-	bps

## 6 Backlight Characteristics

Item	Symbol	Condition	Specification			Unit	Remark
			Min	Typ	Max		
Response time (By Quick)	Tr+Tf	$\theta = 0^\circ$	-	25	50	ms	
Contrast ratio	CR	$\theta = 0^\circ$	-	500	-		
Viewing angle	Top	$CR \geq 10$	-	50	-	Deg.	
	Bottom	$CR \geq 10$	-	60	-		
	Left	$CR \geq 10$	-	70	-		
	Right	$CR \geq 10$	-	70	-		
Color chromaticity (CIE1931)	Wx	$\theta = 0^\circ$	-0.03	TBD	+0.03		
	Wy			TBD			
	Rx			TBD			
	Ry			TBD			
	Gx			TBD			
	Gy			TBD			
	Bx			TBD			
	By			TBD			
NTSC			TBD	TBD	-		
Uniformity(white)			TBD	TBD			
Luminance	L			500	-	cd/m <sup>2</sup>	
LED Life Time			20000	30000	-	Hours	

Note 1: Ambient temperature = 25°C.

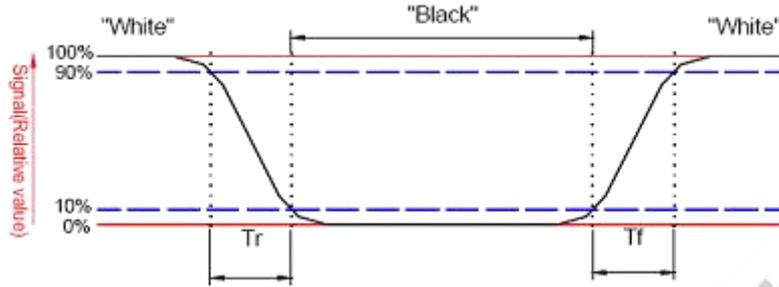
Note 2: The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60%RH ± 5 %.

Note 3: To be measured with a viewing cone of 2° by Topcon luminance meter BM-7.

Note 4: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to “White” (falling time) and from “White” to “Black” (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

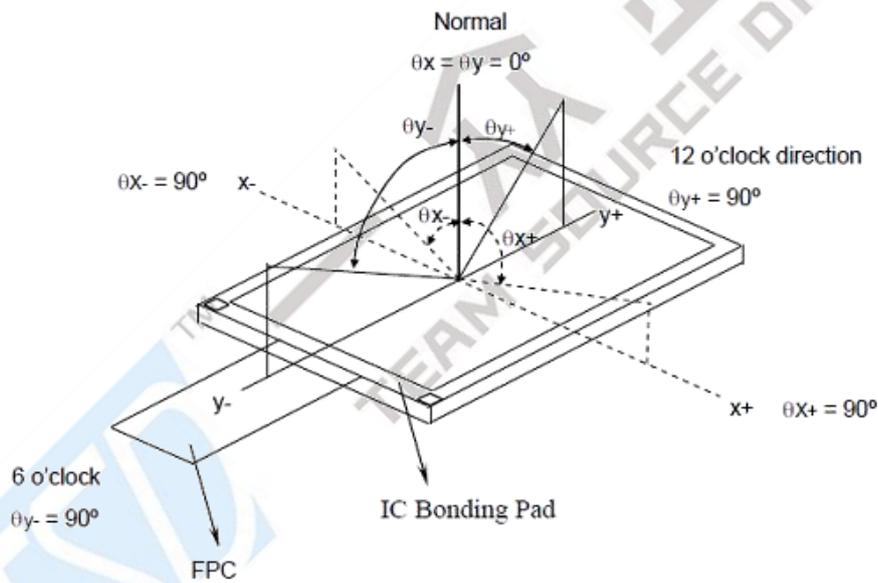


Note 6: Definition of contrast ratio:

Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.

## 7 Display function

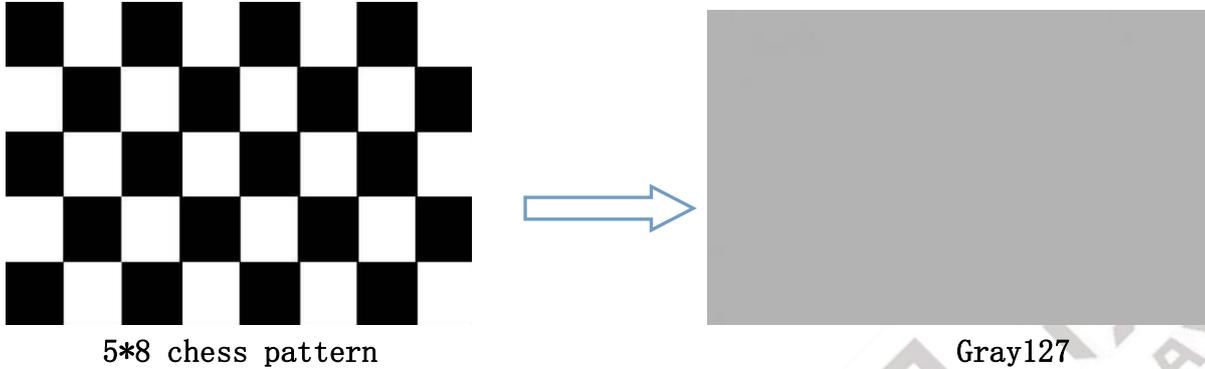
LT7688 supports TFT serial screen commands, including picture static display, picture dynamic display, text display, geometric graphics, etc., as follows Table lists the parameters.

Principal function	Fine item function	instruction code( 1 Byte)
Show the picture	Single sheet / multiple pictures	80h, 8Ah,8Fh
	Cycle dial-up	81h, 84h
	GIF cartoon	88h, 89h
	Pop-up pictures	D8h
	Circulating scroll	D9h, DBh
	Digital picture	90h, 91h
	Transparent picture	82h
	Set display buffer	8Eh
Display control picture	Control slider	94h,95h
	Single control picture	A0h, A1h
	Virtual control	A2h,A3h
	Swipe the picture in full	B4h
	Displays the base image and	9Bh,9Ch
Indicators and mapping	Progress bar index diagram	B0h
	Circular index diagram	DCh
	Two-dimensional code	98h
	Pointer chart	B1h
	Set graphics cursor	86h
	Display graphics cursor	87h
Displays the word library	The Word Bank-1~4	C0h~C3h
Displays the word library	Big Word Library -1	D0h
	Big Word Library -2	D1h
	Big Word Library -3	D2h
	Big Word Library -4	D3h
Back brightness	Set the brightness	BAh
	On/Off	BCh
Wav file	Play	8Ch
	Pause	8Dh
Power-on instruction	Power-on instruction	9Ah/00
Merge instruction	Merge execution of multiple	9Ah
Reset LT7688	Reset LT7688	BDh
Serial screen detection	On-line check	BEh
	Version check	BFh

geometric drawing	Draw a point	DFh
	straight line	E0h
	Hollow round	E1h
	Solid circle	E2h
	Solid round with frame	E3h
	Hollow elliptic	E4h
	Solid oval	E5h
	Framed solid ellipse	E6h
	Hollow rectangle	E7h
	filled rectangle	E8h
	Frame rectangle	E9h
	Hollow rounded rectangle	EAh
	Solid rounded rectangle	EBh
	Framed rounded rectangle	ECh
	Hollow triangle	EDh
	Solid triangle	EEh
	Framed triangle	EFh
	Hollow quadrangle	F0h
	Solid quadrilateral	F1h
	Hollow pentagon	F2h
	A solid pentagon	F3h
	Square cylinder	F4h
	cylinder	F5h
Form window	F6h	

## 8 RELIABILITY TEST

**Remark (1):** Switch the image to Grey 127 after displaying the 5\*8 chess pattern for 60 minutes, the afterimage disappears within 5 minutes.



### 8.1 About Image Sticking

#### 8.1.1 What is Image Sticking?

If you remain a fixed image on LCD Display for a long period of time, you may experience a phenomenon called Image Sticking. Image Sticking - sometimes also called “image retention” or “ghosting” - is a phenomenon where a faint outline of a previously displayed image remains visible on the screen when the image is changed. It can occur at variable levels of intensity depending on the specific image makeup, as well as the amount of time the core image elements are allowed to remain unchanged on the screen. In POS applications, for example, a button menu which remains fixed, or in which the “frame” elements (core image) remain fixed and the buttons may change, may be susceptible to image sticking. It is important to note that if the screen is used exclusively for this application, the user may never notice this phenomenon since the screen never displays other content. It is only when an image other than the “retained” image is shown on the screen that this issue becomes evident. Image sticking is different that the “burn-in” effect commonly associated with phosphor based devices.

#### 8.1.2 What causes Image Sticking?

Image sticking is an intrinsic behavior of LCD displays due to the susceptibility to polarization of the interior materials (liquid crystals) when used under static, charged conditions (continuously displaying the same image). The individual liquid crystals in an LCD panel have unique electrical properties. Displaying a fixed pattern - such as the POS menu described above - over prolonged periods can cause a parasitic charge build-up (polarization) within the liquid crystals which affects the crystals’ optical properties and ultimately prevents the liquid crystal from returning to its normal, relaxed state when the pattern is finally changed. This effect takes place at a cellular level within the LCD, and the effect can cause charged crystal alignment at the bottom or top of a crystal cell in the “z” axis, or even crystal migration to the edges of a cell, again based on their polarity. These conditions can cause image sticking over an entire area, or at boundaries of distinct color change respectively. In either case, when the liquid crystals in the pixels and sub-pixels utilized to display the static image are polarized such that they can not return fully to their “relaxed” state upon deactivation, the result is a faint, visible, retained image on the panel upon presentation of a new, different image. The actual rate of image retention depends on variation factors such as the specific image, how long it is displayed unchanged, the temperature within the panel and even the specific panel brand due to manufacturing differences amongst panel manufacturers.

### 8.1.3 How to Avoid Image Sticking?

- Try not to operate the LCD with a “fixed” image on the screen for more than 1 hours.
- If you are operating the monitor in an elevated temperature environment and with a displayed image which is contrary to the recommendations in “For Software Developers” below, image stick can occur in as little as 30 minutes. Adjust your screen saver settings accordingly.
- Power down the unit during prolonged periods of inactivity such as the hours a store is closed or a shift during which the piece of equipment isn’t used.
- Use a screensaver with a black or medium gray background that is automatically set to come on if the device is inactive for more than 5-10 minutes.
- Avoid placing the monitor in poorly ventilated areas or in areas that will create excess heat around the monitor for software developers.
- In defining the icons, buttons, or windows in the screen, try to utilize block patterns instead of distinct lines as borders for dividing the display into distinct areas.
- If it is necessary to display a static image, try to use colors that are symmetric to the middle grey level at the boundary of two different colors, and slightly shift the borders line once in a while.
- Try to utilize medium gray hues for those areas that will have prolonged display times or remain static as other menu elements change.

### 8.1.4 How to Fix the Image Sticking?

Unlike the usually irreversible “burn-in” effects commonly associated with direct view phosphor display devices such as CRTs, an image retained on an LCD display can be reversed – often to a point of total invisibility. However, the severity of the underlying causes (as described above) of the image retained on a specific display, as well as the variation factors (see “For Software Developers” above) under which the retained image was created, will dictate the final level of retention reversal. One way to erase a retained image on a panel is to run the screen (monitor “on”) in an “all black” pattern for 4-6 hours. It is also helpful to do this in an elevated temperature environment of approximately 35° to 50° C. Again, utilizing a dynamic screen saver with an all black background during prolonged idle display periods is a good way to avoid image retention issues.

### 8.1.5 Is Image Sticking Covered by TSD RMA Warranty?

Image sticking is a phenomenon inherent to LCD Display technology itself, and as such, the occurrence of this “ghosting” effect is considered normal operation by the manufacturers of the LCD display modules which are integrated into today’s monitor solutions. TSD does not warrant any display against the occurrence of image sticking. We strongly advise that you follow the operating recommendations listed above to avoid the occurrence of this phenomenon.

## 8.2 Others

1. Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)

## 9 Suggestions for using LCD modules

### 9.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated, clean it with soft cloth. If the LCM is severely contaminated, use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer. The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. 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.
7. Don't disassemble the LCM.
8. 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 modules.
  - 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.
9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

### 9.2 Storage

1. Store in an ambient temperature of 5 to 25 °C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.

## 10 Limited Warranty

- 1.Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.
- 2.If possible, we suggest customer to use up all LCD modules as soon as possible. If the LCD module storage time over twelve months, we suggest to recheck it before being used.
- 3.Any product issues must be feedback to TSD within 12 months since delivery, otherwise, we will not be responsible for the subsequent or consequential events.