

# 1.69" 240\*280 IPS ST7789V 262K SPI FPC Connector 18 Pin - CTP CST816D



- ST7789V3 is driven with 18 bit color depth.
- Single chip TFT-LCD Controller/Driver with On-chip Frame Memory (FM).
- Display Features
  - Programmable Partial Display Duty
  - CABC for saving current consumption
- Driving Algorithm
  - Dot Inversion.
  - Column Inversion.
  - Color enhancement.
- Display Colors (Color Mode)
  - Full Color: 262K, RGB=(666), Idle Mode Off
  - Color Reduce: 8-color, RGB=(111), Idle Mode On
- Programmable Pixel Color Format (Color Depth) for Various Display Data input Format
  - 12-bit/pixel: RGB=(444)
  - 16-bit/pixel: RGB=(565)
  - 18-bit/pixel: RGB=(666)
- Capacitive Touch Screen
  - 100Hz (min) Refresh Rate.
  - Single point gesture and real two-point operation;
  - I2C master/slave communication interface, configurable rate range 10KHz~1MHz;
- SPI interface
  - 4 Line SPI Interface.
- Normally black.
- IPS, all view direction.
- Power Supply
  - VDD: 2.4V - 3.3V.
  - VDDIO: 1.65V - 3.3V.
- Brightness: 350 cd/m<sup>2</sup>.
- FPC connector.



Ordering &  
Details



Support &  
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Technical  
Documentation

# 1 General Description

No.	Item	Contents	Unit
1	Screen Size	1.69"	inch
2	Display mode	Normally black	-
3	Resolution	240RGB(H) x 280(V)	pixels
4	Display area	27.97(H) x 32.63(V)	mm
5	Pixel pitch	0.11655(H) x 0.11655(V)	mm
6	Outline Dimension	33.13 x 41.13 x 3.61	mm
7	Pixel arrangement	RGB vertical stripe	-
8	Viewing Direction(eye)	ALL	-
9	Display colors	262K	colors
10	Luminance	350	cd/m <sup>2</sup>
11	Contrast Ratio	800:1	-
12	Interface	QSPI	-
13	Back-light	LED Side-light type	-
14	Drive IC	ST7789V	-
15	Touch Panel Driver IC	CST816D	-
16	Operating temperature	-20°C - +70°C	-
17	Storage temperature	-30°C - +80°C	-
18	Weight	-	gram

## 2 Electrical Characteristics

### 2.1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Note
Supply Voltage	$V_{DD}$	-0.3	+4.6	V	GND=0V
Touch Panel Supply Voltage	$V_{DDTP}$	-0.3	+4.6	V	GND=0V
Operation Temperature	$T_{OPR}$	-20	70	°C	-
Storage Temperature	$T_{STG}$	-30	80	°C	-

### 2.2 Operating Conditions

#### 2.2.1 TFT LCD Module

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	$V_{DD}$	2.4	3.3	3.3	V
Touch Panel Supply Voltage	$V_{DDTP}$	2.8	3.3	3.3	V
Gate Driver High Voltage	$V_{IH}$	$0.7 \cdot V_{DD}$	-	$V_{DD}$	V
Gate Driver Low Voltage	$V_{IL}$	GND	-	$0.3 \cdot V_{DD}$	V

### 2.3 Backlight Unit

Parameter	Symbol	Min.	Typ.	Max.	Unit
Voltage for LED backlight	$V_{LED}$	2.8	3.2	3.2	V
Current for LED backlight	$I_{LED}$	-	45	60	mA
Power Consumption <sup>1</sup>		-	180	144	mW
Brightness		-	350	-	cd/m <sup>2</sup>
Operating LED life time	$H_R$		4500		Hour

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition:  $T_a=25\pm3\text{ }^{\circ}\text{C}$ , typical  $I_L$  value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at  $T_a=25^{\circ}\text{C}$  and  $I_L=80\text{mA}$ . The LED lifetime could be decreased if operating  $I_L$  is larger than 100mA. The constant current driving method is suggested.

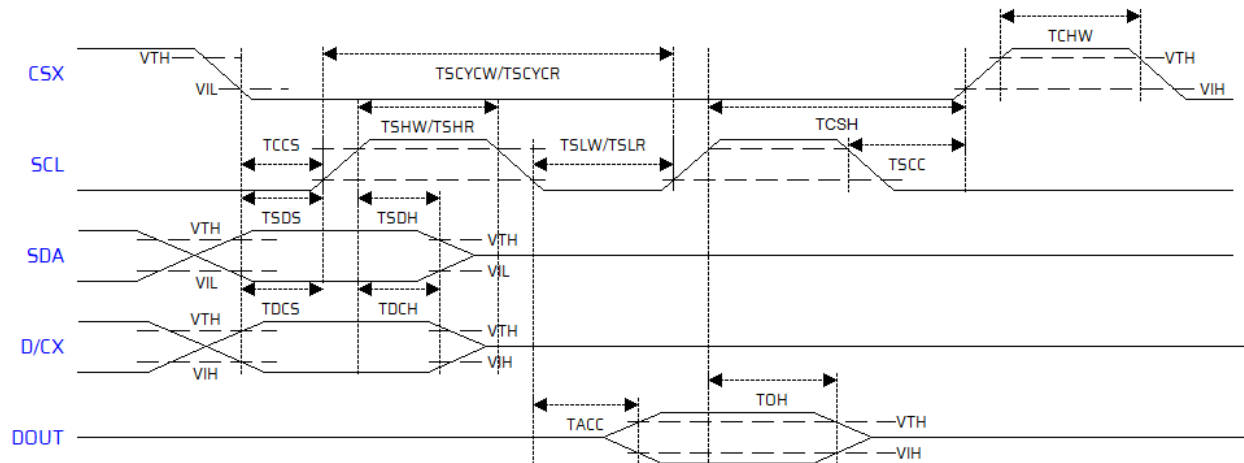
Notes:

- **Permanent damage may occur to the LCD module if beyond this specification.**
- Where  $I_{LEDmax} = 45\text{mA}$ ,  $V_{LEDmax} = 3.2\text{V}$ ,  $P_{CONSUMPTION} = I_{LED} \cdot V_{LED}$ .

## 3 Interface Characteristics

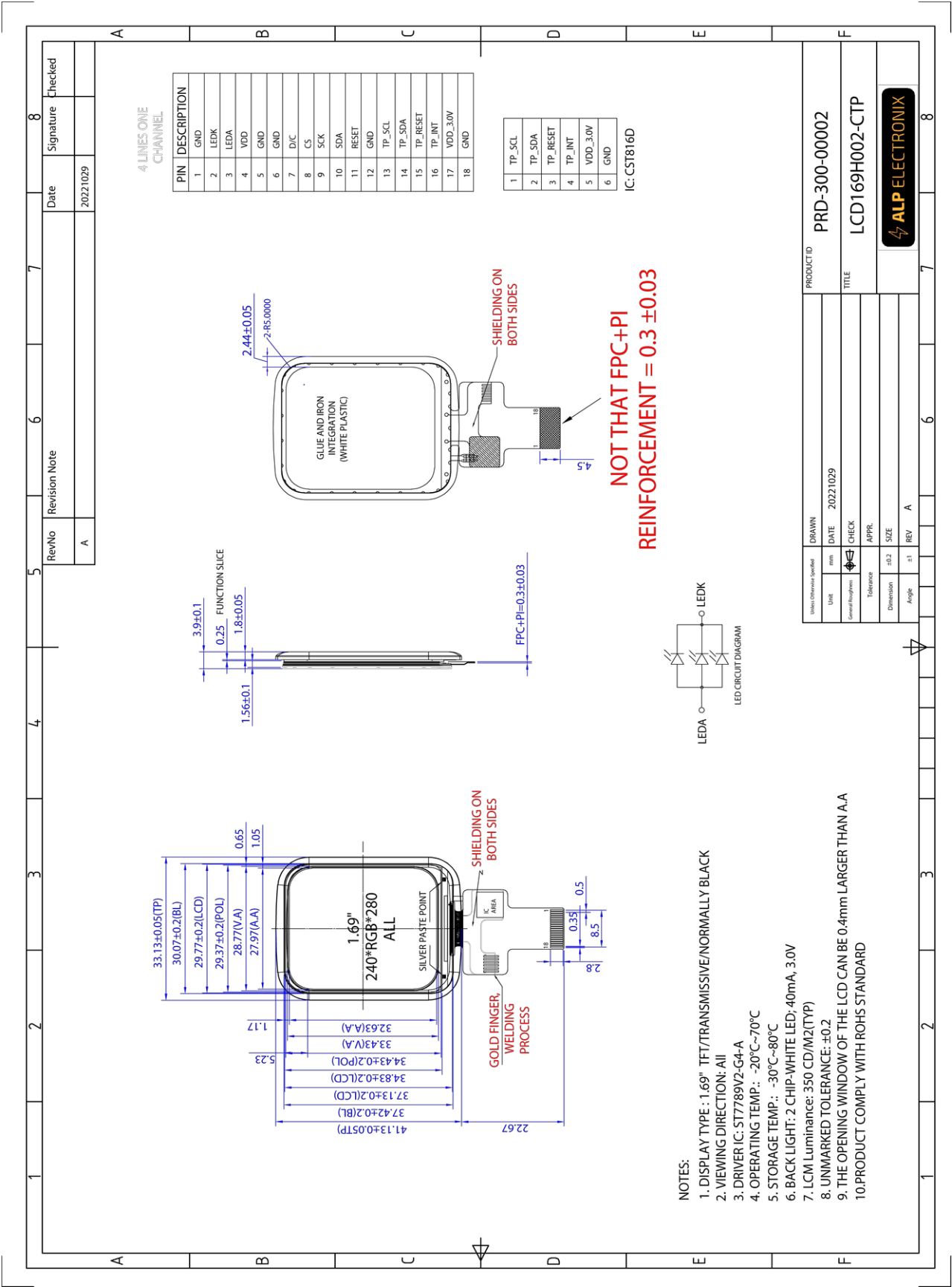
8080 Series Serial interface Characteristics: 4-line

### 3.1.1 Serial interface Characteristics(4-line serial)



Signal	Symbol	Parameter	Min	Max.	Unit	Description
CSX	T <sub>CSS</sub>	Chip select setup time (write)	15		ns	
	T <sub>CSH</sub>	Chip select hold time (write)	15		ns	
	T <sub>CSS</sub>	Chip select setup time (read)	60		ns	
	T <sub>SCC</sub>	Chip select hold time (read)	65		ns	
	T <sub>CHW</sub>	Chip select "H" pulse width	40		ns	
SCK	T <sub>SCYCW</sub>	Serial clock cycle (write)	16		ns	-write command & data ram
	T <sub>SHW</sub>	SCK "H" pulse width (write)	7		ns	
	T <sub>SLW</sub>	SCK "L" pulse width (write)	7		ns	
	T <sub>SCYCR</sub>	Serial clock cycle (read)	150		ns	-read command & data ram
	T <sub>SHR</sub>	SCK "H" pulse width (read)	60		ns	
	T <sub>SLR</sub>	SCK "L" pulse width (read)	60		ns	
D/CX	T <sub>DCS</sub>	D/CX setup time	10		ns	
	T <sub>DCH</sub>	D/CX hold time	10		ns	
SDA (DIN)	T <sub>SDS</sub>	Data setup time	7		ns	
	T <sub>SHD</sub>	Data hold time	7		ns	
DOUT	T <sub>ACC</sub>	Access time	10	50	ns	For maximum CL =30pF For minimum CL=8pF
	T <sub>OH</sub>	Output disable time	15	50	ns	

4 Mechanical Drawing



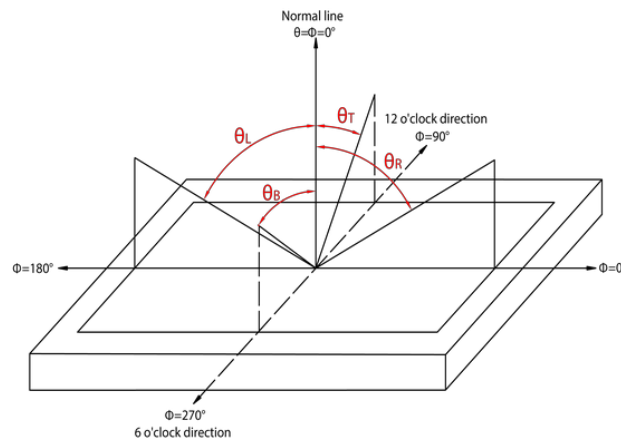
## 5 Pin Definition

Pin no.	Symbol	Description
1	<b>GND</b>	Ground pin.
2	<b>LEDK</b>	Backlight LED cathode pin.
3	<b>LEDA</b>	Backlight LED anode pin.
4	<b>VDD</b>	Power supply pin. 2.8V.
5	<b>GND</b>	Ground pin.
6	<b>GND</b>	Ground pin.
7	<b>D/C</b>	Display data/command selection pin in parallel.
8	<b><math>\overline{\text{CS}}</math></b>	SPI chip select input pin. Active low.
9	<b>SCK</b>	SPI interface clock.
10	<b>SDA</b>	SPI interface input/output pin.
11	<b><math>\overline{\text{RESET}}</math></b>	Reset signal. Active low.
12	<b>GND</b>	Ground pin.
13	<b>TP_SCL</b>	Touch panel I <sup>2</sup> C clock signal.
14	<b>TP_SDA</b>	Touch panel I <sup>2</sup> C data input/output bidirectional pins.
15	<b><math>\overline{\text{TP\_RESET}}</math></b>	Touch panel reset signal. Active low.
16	<b>TP_INT</b>	Touch panel interrupt signal.
17	<b>VDD_3.0V</b>	Touch panel power supply.
18	<b>GND</b>	Ground pin.

## 6 Optical Characteristics

Item	Symbol	Condition	Measuring Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle <sup>1</sup>	θ	CR≥10	Φ = 0°	25°C	70	80	-	Degree	Note 1
	θ		Φ = 180°	25°C	70	80	-		
			Φ = 90°	25°C	70	80	-		
			Φ = 270°	25°C	70	80	-		
Brightness	L <sub>br</sub>	θ=0 Normal Viewing Angle IBL=60mA	-	-	-	350	-	cd/m <sup>2</sup>	Note 4 Note 5 Note 7
Contrast Ratio	CR		-	25°C	800	1000	-	-	Note 2 Note 4
Response Time	T <sub>R</sub> +T <sub>F</sub>		θ = 0° Φ = 0°	25°C	-	35	40	mS	Note 3
Color Chromaticity (CIE1931)	White		Wx	25°C	-	0.323	-	-	Note 6
			Wy	25°C		0.323			
Luminance Uniformity	ΔL		-		-	80	90		%
Color Gamut	NTSC		θ=0°		-	70		%	Note 6
Optimal View Direction	Free								Note 1

Note 1: Definition of Viewing Angle

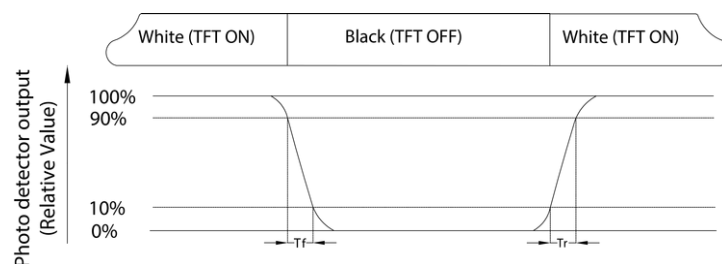


Note 2: Definition of Contrast Ratio(CR):

Measured at the center point of panel

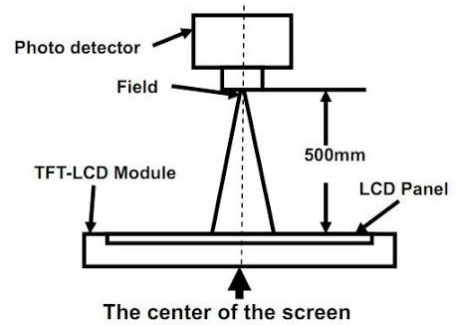
$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance measured when LCD is on the White state}}{\text{Luminance measured when LCD is on the Black state}}$$

Note 3: Definition of Response Time: Sum of TR and TF



Note 4: Definition of optical measurement setup

- Photo Meter (BM-7)
- Light Shield Room
- Ambient Luminance <2 lux
- Ambient temperature 25°C ± 3°C



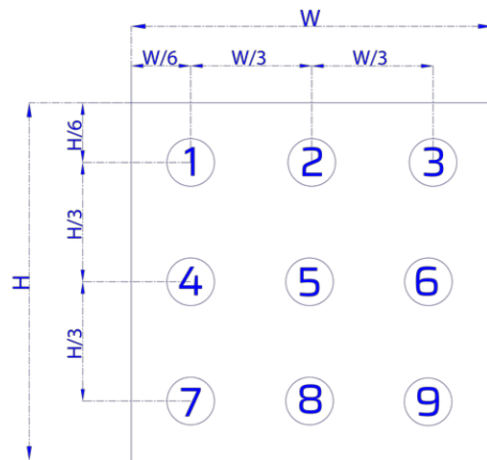
Note 5: Definition of brightness uniformity

The luminance uniformity is calculated by using following formula.

$$\Delta Bp(\%) = \frac{Bp(\text{Min.})}{Bp(\text{Max.})} * 100$$

Bp (Max.) = Maximum brightness in 9 measured spots

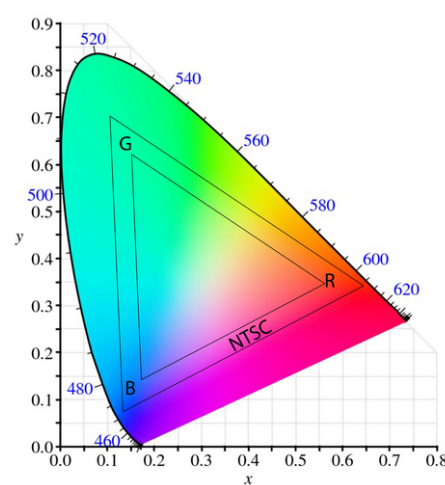
Bp (Min.) = Minimum brightness in 9 measured spots



Note 6: Definition of Color of CIE1931 Coordinate and NTSC Ratio.

$$S(\%) = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} * 100$$

Note 7: Measured the luminance of white state at center point.





## 7 Reliability

### 7.1 Contents of Reliability Tests

No.	Item	Conditions
1	High Temperature Storage	Ta= 80°C ±2°C, 72 hrs
2	Low Temperature Storage	Ta= -30°C ±2°C, 72 hrs
3	High Temperature Operation	Ta= 70°C ±2°C, 72 hrs (Operation state)
4	Low Temperature Operation	Ta= -20°C ±2°C, 72 hrs (Operation state)
5	High Temperature /Humidity Operation (Storage)	Ta= +60°C ±2°C, 90% RH, 72 hrs
6	Thermal Cycling Test (non operation)	-20°C(30min) → +70°C (30min), 10cycles
7	Vibration Test	Total fixed amplitude:15mm Vibration Frequency: 10~55Hz One cycle 60 seconds to 3 directions of X, Y, Z for Each 15 minutes
8	ESD Test	Human Body Mode 100pF±10%/1500Ω±1% Air±8kV / contact±6kV Consecutive 10times/ Each discharge
9	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces

## 8 Revision History

Revision	Details
1.0	Initial Release - 01.01.2023

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