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

ALP ELECTRONIX

- 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^2.
- FPC connector.

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^2
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**	-20ºC - +70ºC	-
17	**Storage temperature**	-30ºC - +80ºC	-
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	V	-
Storage Temperature	T_{STG}	-30	80	V	-

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}	$0.7*V_{DD}$	-	V_{DD}	V
Gate Driver Low Voltage	V_{IL}	GND	-	$0.3*V_{DD}$	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[1]		-	180	144	mW
Brightness		-	350	-	cd/m^2
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: Ta=25±3 °C, typical IL 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 Ta=25°Cand IL=80mA. The LED lifetime could be decreased if operating IL is larger than 100mA. The constant current driving method is suggested.

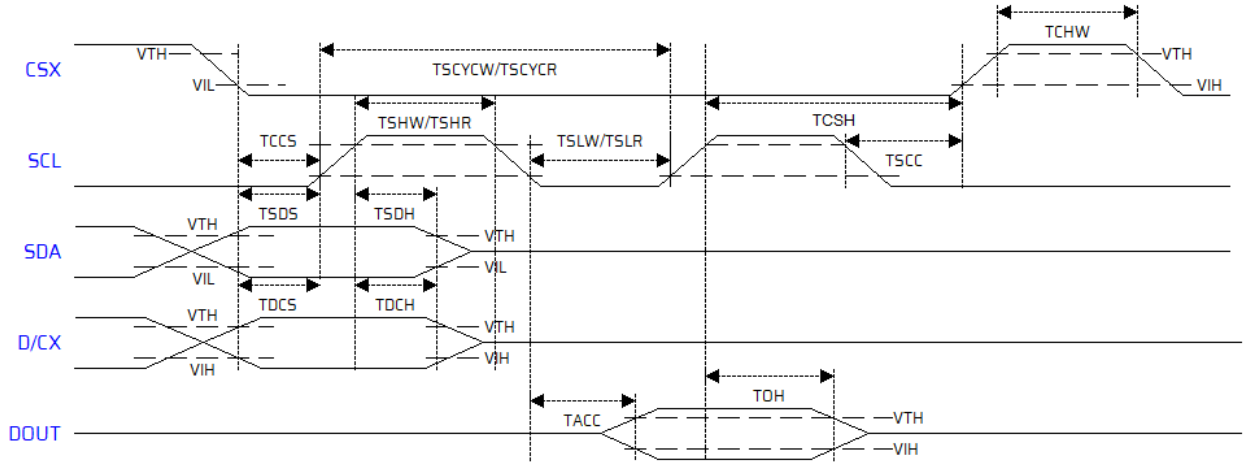
Notes:

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

3 Interface Characteristics

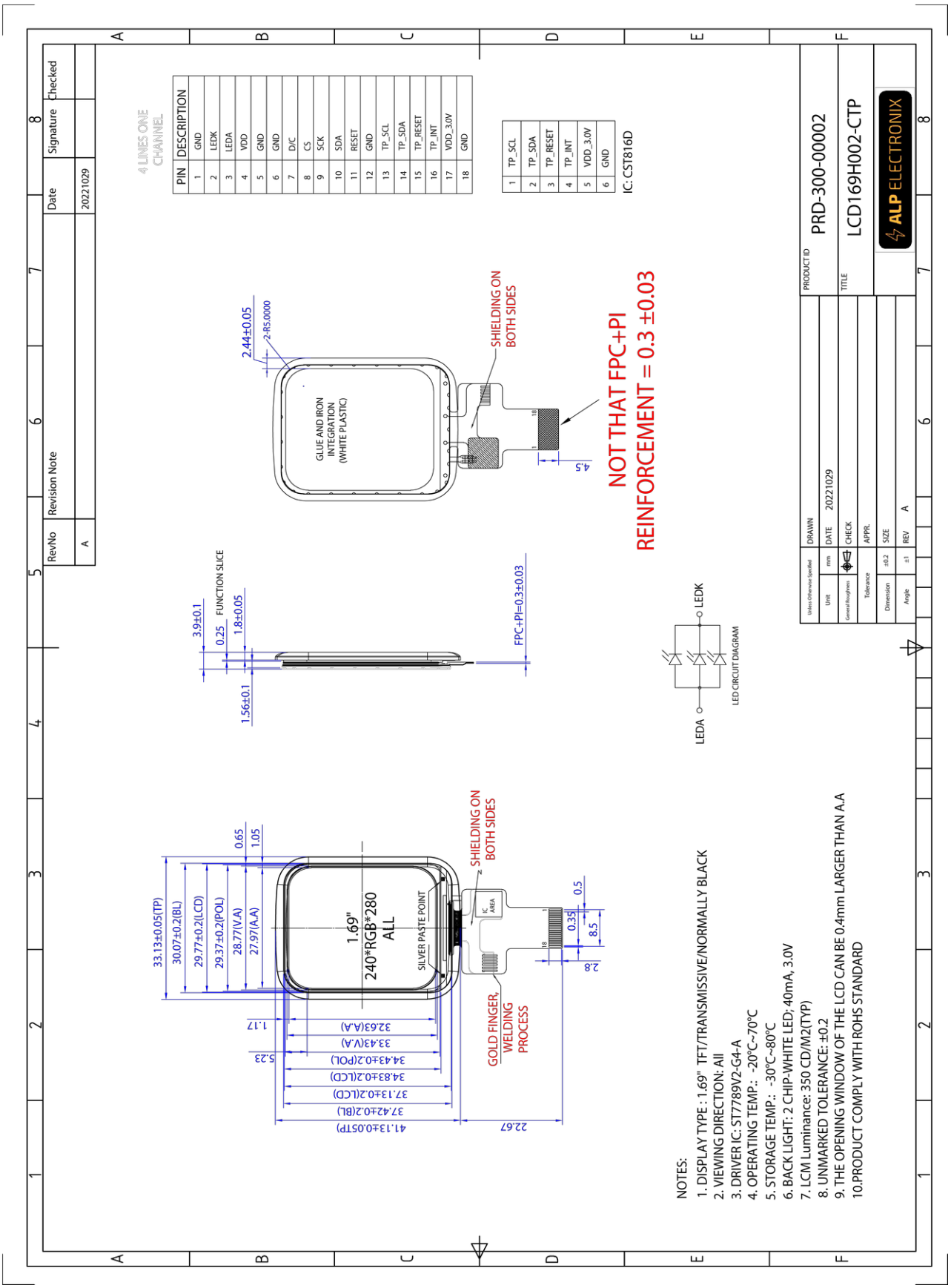
8080 Series Serial interface Characteristics: 4-line

3.1.1 Serial interface Characteristics(4-line serial)



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

4 Mechanical Drawing



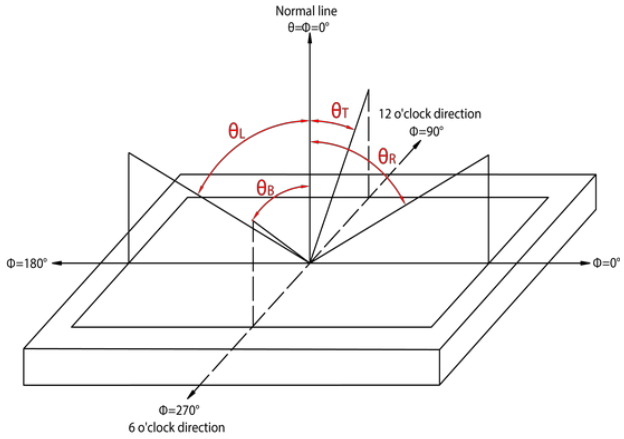
5 Pin Definition

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

6 Optical Characteristics

Item	Symbol	Condition	Measuring Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle[1]	**θ**	CR≥10	Φ = 0°	25°C	70	80	-	Degree	Note 1
			Φ = 180°	25°C	70	80	-		
	θ		Φ = 90°	25°C	70	80	-		
			Φ = 270°	25°C	70	80	-		
Brightness	L_{br}	θ=0 Normal Viewing Angle IBL=60mA	-	-	-	350	-	cd/m²	Note 4 Note 5 Note 7
Contrast Ratio	**CR**		-	25°C	800	1000	-	-	Note 2 Note 4
Response Time	T_R+T_F		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

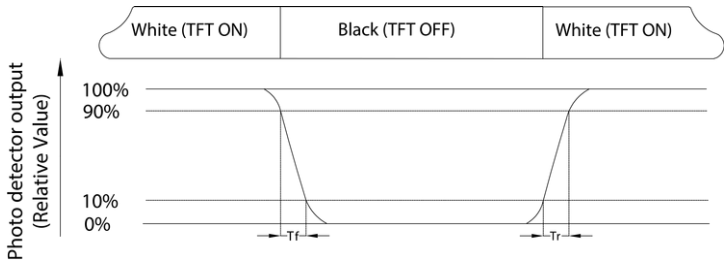


Note 2: Definition of Contrast Ratio(CR):

Measured at the center point of panel

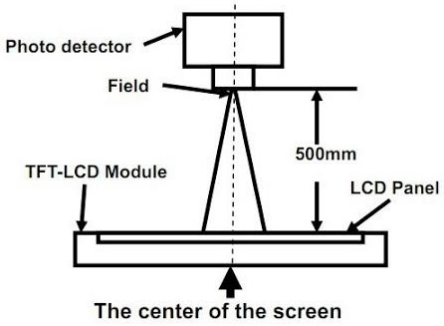
$$Contrast\ Ratio\,(CR) = \frac{Luminance\ measured\ when\ LCD\ is\ on\ the\ White\ state}{Luminance\ measured\ when\ LCD\ is\ on\ the\ Black\ state}$$

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



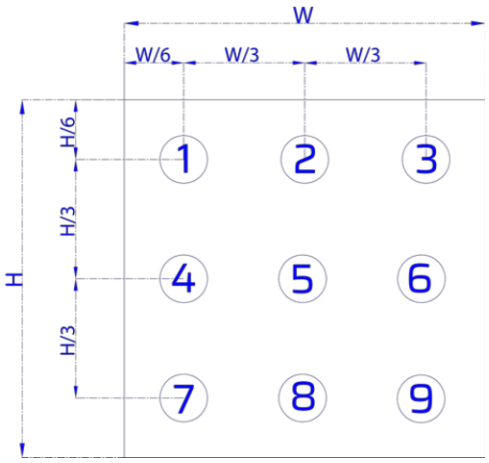
Note 5: Definition of brightness uniformity

The luminance uniformity is calculated by using following formula.

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

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

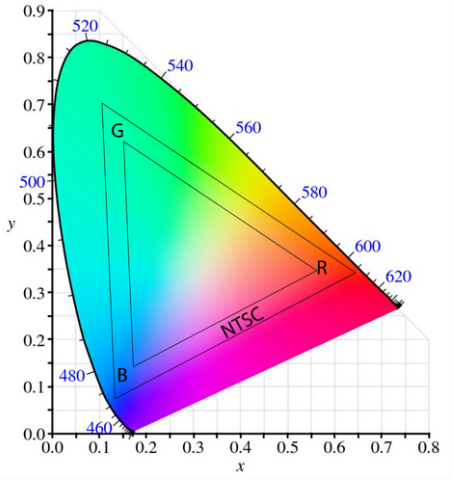
Bp (Min.) = Minimum brightness in 9 measured spots



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

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

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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