

# 1.9" 170\*320 IPS ST7789V2 16.7M 16 Bit 39 Pin



- ST7789V2 is driven with 24 bit color depth.
- LCD can display 16.7M Colors (8R:8G:8B).
- 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).
- 16 Bits Parallel Interface.
- Normally black.
- IPS, all view direction.
- Power Supply
  - VDD: 2.4V - 3.6V.
- Brightness: 400 cd/m<sup>2</sup>.
- FPC Connector.



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# 1 General Specifications

Feature		Specifications
Display Spec.	LCD type	1.9 inch
	Resolution (H*V)	170(RGB) x 320
	Luminance	400 cd/m <sup>2</sup>
	Technology Type	a-Si TFT
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	Normally Black
	Viewing Direction	ALL
	Gray Scale Inversion Direction	-
Mechanical Characteristics	Outline Dimensions (W x H x T) (mm)	25.8 x 49.72 x 1.8
	Active Area(mm)	22.695 x 42.72
	CTP View Area(mm)	/
	With /Without Touch screen	Without TSP
	Connector Type	-
	Backlight Type	LED
	Weight (g)	TBD
Electrical Characteristics	Display Interface	MCU 16BIT/8BIT
	Touch Interface	I2C
	Number of color	16.7M
	Display Driver IC	ST7789V2
	Touch Driver IC	-
	LED Numbers	4 LED

Note 1: Viewing direction is following the data which measured by optics equipment.

Note 2: Requirements on Environmental Protection: RoHS

Note 3: LCM weight tolerance: +/- 5%

## 2 Electrical Characteristics

### 2.1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	$V_{DD}$	-0.3	4.6	V
Operation Temperature	$T_{OP}$	-20	70	°C
Storage Temperature	$T_{ST}$	-30	80	°C

### 2.2 Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (IO)	$V_{CC}$	2.4	3.3	3.6	V
Digital Operation Current	$I_{CC}$	-	8	10	mA

### 2.3 Backlight Unit

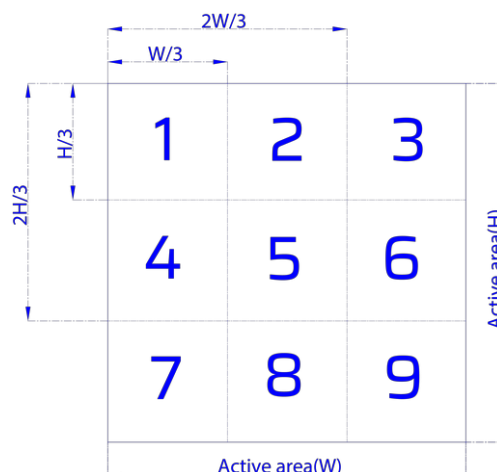
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Voltage for LED backlight	$V_{LED}$	2.8	3.0	3.2	V	
Current for LED backlight	$I_{LED}$	-	80	-	mA	3 LED
Power Consumption <sup>1</sup>	$P_{bl}$	-	240	-	mW	1
LED Life Time <sup>3</sup>		25000	-	-	hr	3

Notes:

- Where  $I_{LED} = 80\text{mA}$ ,  $V_{LED} = 3.0\text{V}$ ,  $P_{CONSUMPTION} = I_{LED} * V_{LED}$ .
- Uniform measure condition:
  - Measure 9 point, measure location is shown on the right side.
  - Uniform = (Min. brightness / Max brightness) \* 100%
  - Best contrast.
- The environmental test has been conducted under ambient air flow at  $T_A = 25 \pm 2^\circ\text{C}$ , 60%RH $\pm 5\%$ .

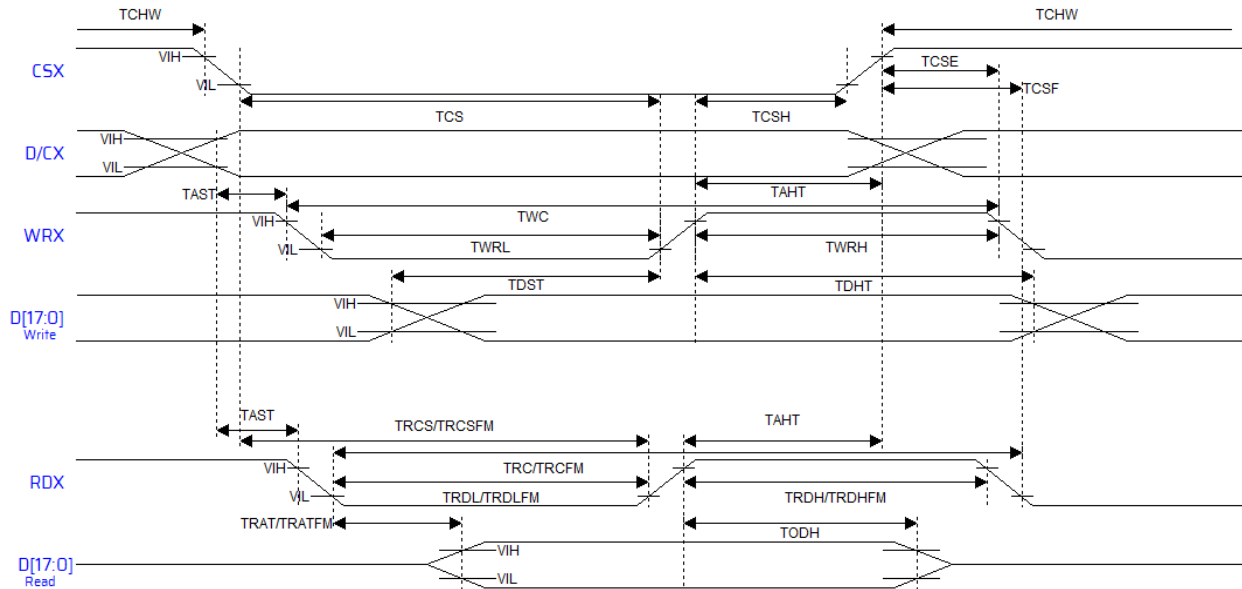
Test Conditions:

- There are 4 Groups LED
- $T_a = 25^\circ\text{C}$
- Brightness to be decreased to 50% of the initial value



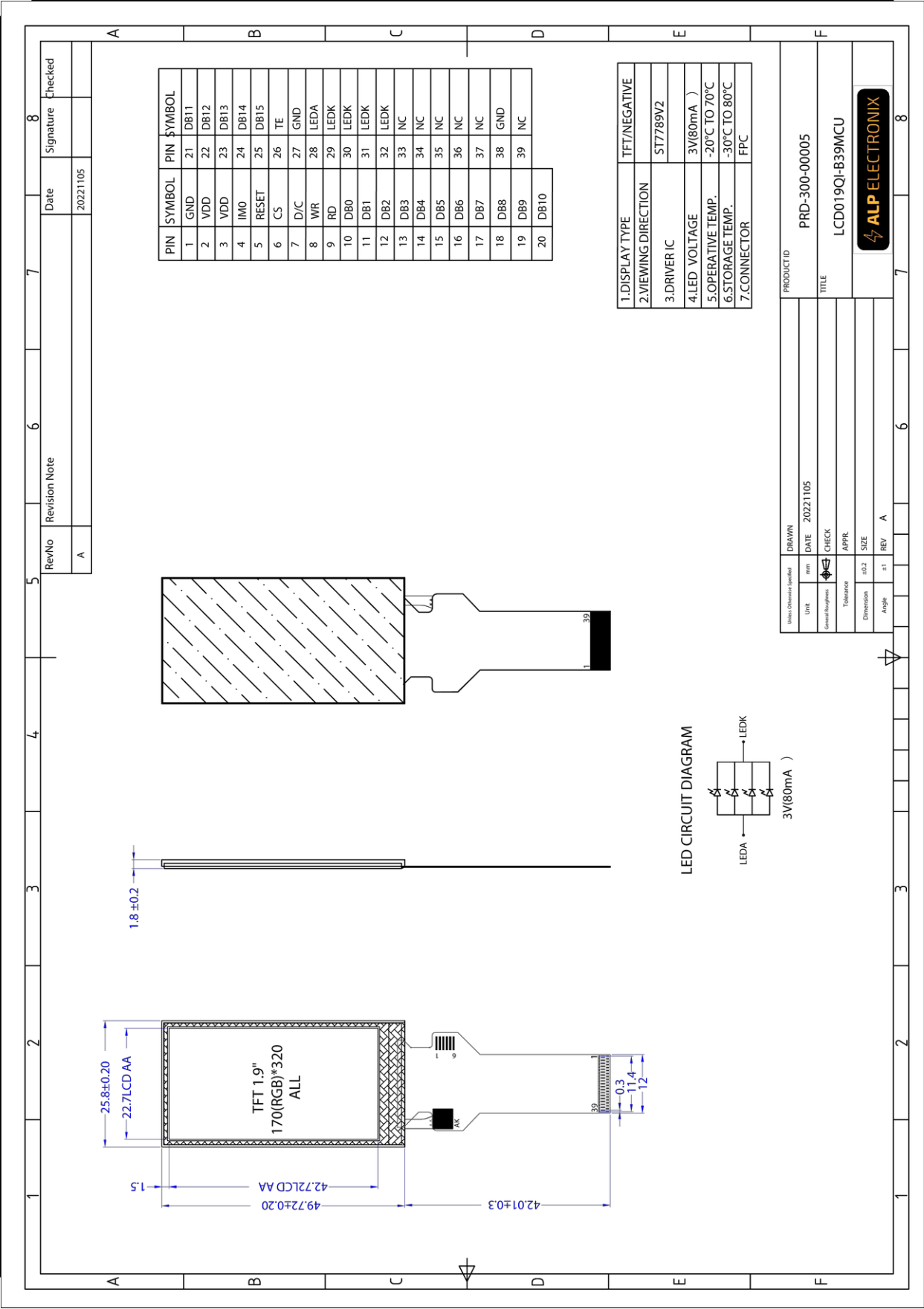
## 2.4 Timing Characteristic of The LCD

### 2.4.1 8080 Series MCU Parallel interface Characteristics:



Signal	Symbol	Parameter	Min	Max.	Unit	Description
D/CX	$T_{AST}$	Adress setup time	0	-	ns	-
	$T_{AHT}$	Adress hold time (Write/Read)	10	-	ns	
CSX	$T_{CHW}$	Chip select "H" pulse width	0	-	ns	-
	$T_{CS}$	Chip select setup time (Write)	15	-	ns	
	$T_{RCS}$	Chip select setup time (Read ID)	45	-	ns	
	$T_{RCSFM}$	Chip select setup time (Read FM)	355	-	ns	
	$T_{CSF}$	Chip select wait time (Write/Read)	10	-	ns	
	$T_{CSH}$	Chip select hold time	10	-	ns	
WRX	$T_{WC}$	Write cycle	66	-	ns	-
	$T_{WRH}$	Control pulse "H" duration	15	-	ns	
	$T_{WRL}$	Control pulse "L" duration	15	-	ns	
RDX (ID)	$T_{RC}$	Read cycle (ID)	160	-	ns	When read ID data
	$T_{RDH}$	Control pulse "H" duration (ID)	90	-	ns	
	$T_{RDL}$	Control pulse "L" duration (ID)	45	-	ns	
RDX (FM)	$T_{RCFM}$	Read cycle (FM)	450	-	ns	When read from frame memory
	$T_{RDHFM}$	Control pulse "H" duration (FM)	90	-	ns	
	$T_{RDLFM}$	Control pulse "L" duration (FM)	355	-	ns	
D[17:0]	$T_{DST}$	Data setup time	10	-		For CL=30pF

3 Mechanical Drawing



## 4 Pin Definition

Pin no.	Symbol	Description
1	GND	Ground pin.
2	VDD	Power supply pin, 3.3V.
3	VDD	Power supply pin, 3.3V.
4	IMO	MCU interface mode select.
5	RESET	Reset pin. Active low.
6	CS	Chip select signal. Active low.
7	D/C	Data or command select signal.
8	WR	Write data.
9	RD	Read data.
10-25	DB0-DB15	MCU parallel interface data.
26	TE	Tearing effect.
27	GND	Ground pin.
28	LEDA	Backlight LED anode.
29-32	LEDK	Backlight LED cathode.
33	NC	No connection.
34	NC	No connection.
35	NC	No connection.
36	NC	No connection.
37	NC	No connection.
38	GND	Ground pin.
39	NC	No connection.

## 5 Optical Characteristics

Item	Symbol	Measuring Conditions		Min.	Typ.	Max.	Unit	Remark
Viewing Angle <sup>1</sup>	$\theta$	$\Phi = 0^\circ$	25°C	-	80	-	Degree	Note 2
		$\Phi = 180^\circ$	25°C	-	80	-		
	$\theta$	$\Phi = 90^\circ$	25°C	-	80	-		
		$\Phi = 270^\circ$	25°C	-	80	-		
Brightness	L <sub>br</sub>	--	-	450	500	-	cd/m <sup>2</sup>	
Uniformity	U	--	-	80	-	-	%	Note 1, Note 6
Contrast Ratio <sup>2</sup>	CR	-	25°C	700	900	-		Note 1, Note 3
Response Time	T <sub>R</sub>	$\theta = 0^\circ$	25°C	-	19	24	mS	Note 1, Note 4
	T <sub>F</sub>	$\Phi = 0^\circ$		-	-	-		
Color of CIE Coordinate	White	X	25°C	-	TBD	-	-	Note 1, Note 5
		Y	25°C		TBD			
	Red	X	25°C		TBD			
		Y	25°C		TBD			
	Green	X	25°C		TBD			
		Y	25°C		TBD			
	Blue	X	25°C		TBD			
		Y	25°C		TBD			

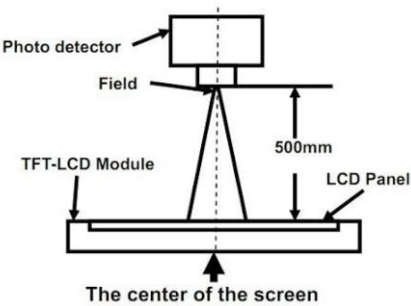
NTSC	-	-	-		65	-	%	Note 5
Luminance	L			350	400			Note 1, Note 7

Test Conditions:

- 1. IF= 20mA (one channel),the ambient temperature is 25°C.
- 2. The test systems refer to Note 1 and Note 2.

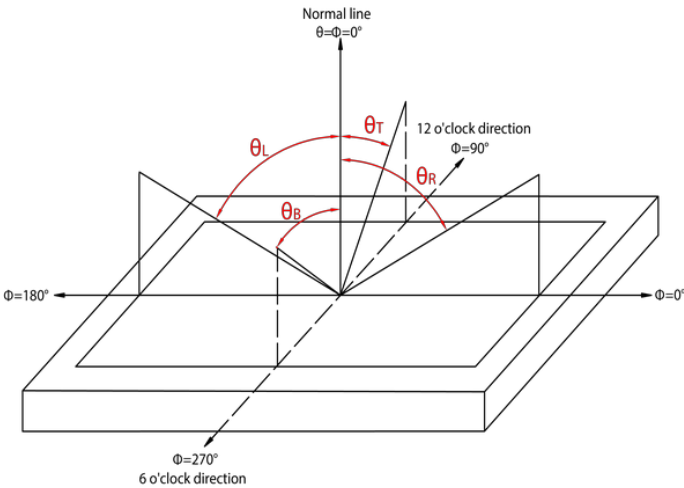
Notes:

- 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°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

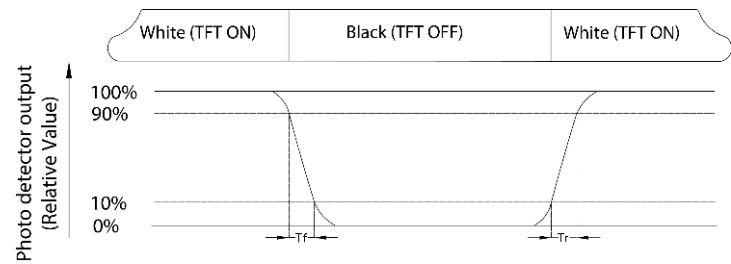
- 2. Definition of Viewing Angle:



- 3. Definition of Contrast Ratio (CR): measured at the center point of panel

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

4. Definition of Response Time: Sum of  $T_R$  and  $T_F$



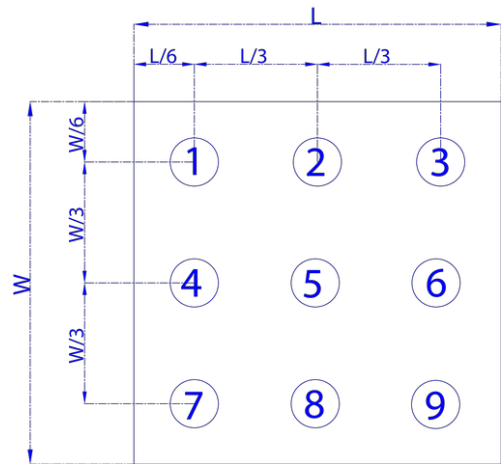
5. Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

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

$$Luminance\ Uniformity\ (U) = \frac{L_{min}}{L_{max}} * 100$$



L: Active area length W: Active area width

$L_{max}$ : The measured maximum luminance of all measurement position.

$L_{min}$ : The measured minimum luminance of all measurement position.

7. Definition of Luminance:

Measure the luminance of white state at center point.



## 6 Reliability

### 6.1 Contents of Reliability Tests

No.	Item	Conditions	Remarks
1	High Temperature Operation	70°C ±2°C, 240 hrs	Note 1 IEC60068-2-2, GB2423.2-89
2	Low Temperature Operation	-20°C ±2°C, 240 hrs	Note 2 IEC60068-2-1 GB2423.1-89
3	High Temperature Storage	80°C ±2°C, 240 hrs	IEC60068-2-2 GB2423.2-89
4	Low Temperature Storage	-30°C ±2°C, 240 hrs	IEC60068-2-1 GB/T2423.1-89
5	High Temperature /Humidity Operation	60°C ±2°C, 90% RH, 160 hrs	IEC60068-2-3 GB/T2423.3-2006
6	Thermal Shock (Non-operation)	-30°C 30 min ~ +80°C 30 min Change time: 5min, 30 Cycle	Start with cold temperature, end with high temperature IEC60068-2-14, GB2423.22-87
7	Vibration (Non-operation)	Frequency range: 10~55Hz, Stroke: 1mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X, Y, Z. (package condition)	IEC61000-4-2 GB/T17626.2-1998
8	Electro Static Discharge (Operation)	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5 times; (Environment: 15°C ~ 35°C, 30% ~ 60%, 86Kpa ~ 106Kpa)	IEC60068-2-6 GB/T2423.5-1995
9	Shock (Non-operation)	60G 6ms, ± X, ±Y, ± Z 3 times for each direction	IEC60068-2-27 GB/T2423.5-1995
10	Package Drop Test	Height: 80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8-1995

Note:

1. TS is the temperature of panel's surface.

2. Ta is the ambient temperature of sample.

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# 7 Revision History

Revision	Details
1.0	Initial Release - 01.01.2023

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