

MDT0154C3IH-SPI	240 x 240	SPI Interface	TFT Module
Specification			
Version: 1		Date: 24/08/2023	
Revision			
1	22/08/2023	First issue	

Display Features		 RoHS compliant	
Display Size	1.54"		
Resolution	240 x 240		
Orientation	Square		
Appearance	RGB		
Logic Voltage	2.8V		
Interface	SPI		
Brightness	850 cd/m ²		
Touchscreen	---		
Module Size	31.52 x 33.72 x 1.94 mm		
Operating Temperature	-10°C ~ +60°C	Created By	Checked By
Pinout	15 way FFC	TSB	WE
Pitch	0.30mm	Box Quantity	Weight / Display
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* - For full design functionality, please use this specification in conjunction with the ST7789T3-G4-1 display driver specification.(Provided Separately)

Display Accessories	
Part Number	Description
MDIB-CC1	Interconnect board for standard pitch pinouts to fine pitch wires. Providing pinouts for 2.54 pinout. 1.27, 1, 0.845, 0.8, 0.7, 0.65, 0.62, 0.6, 0.5 & 0.3 pads.

Optional Variants	
Appearances	Voltage



General Specifications

- Size: 1.54" inch
- Dot Matrix: 240 x RGB x 240 dots
- Module dimension: 31.52 x 33.72 x 1.94 mm
- Active area: 27.72 x 27.72 mm
- Pixel pitch: 0.1155 x 0.1155 mm
- LCD type: TFT, Normally Black, Transmissive
- Viewing Angle: 80/80/80/80
- Backlight Type: LED, Normally White
- Drive IC: ST7789T3-G4-1 or Equivalent
- TFT Interface: SPI
- With /Without TP: Without TP
- Surface: Anti-Glare

*Color tone slight changed by temperature and driving voltage.

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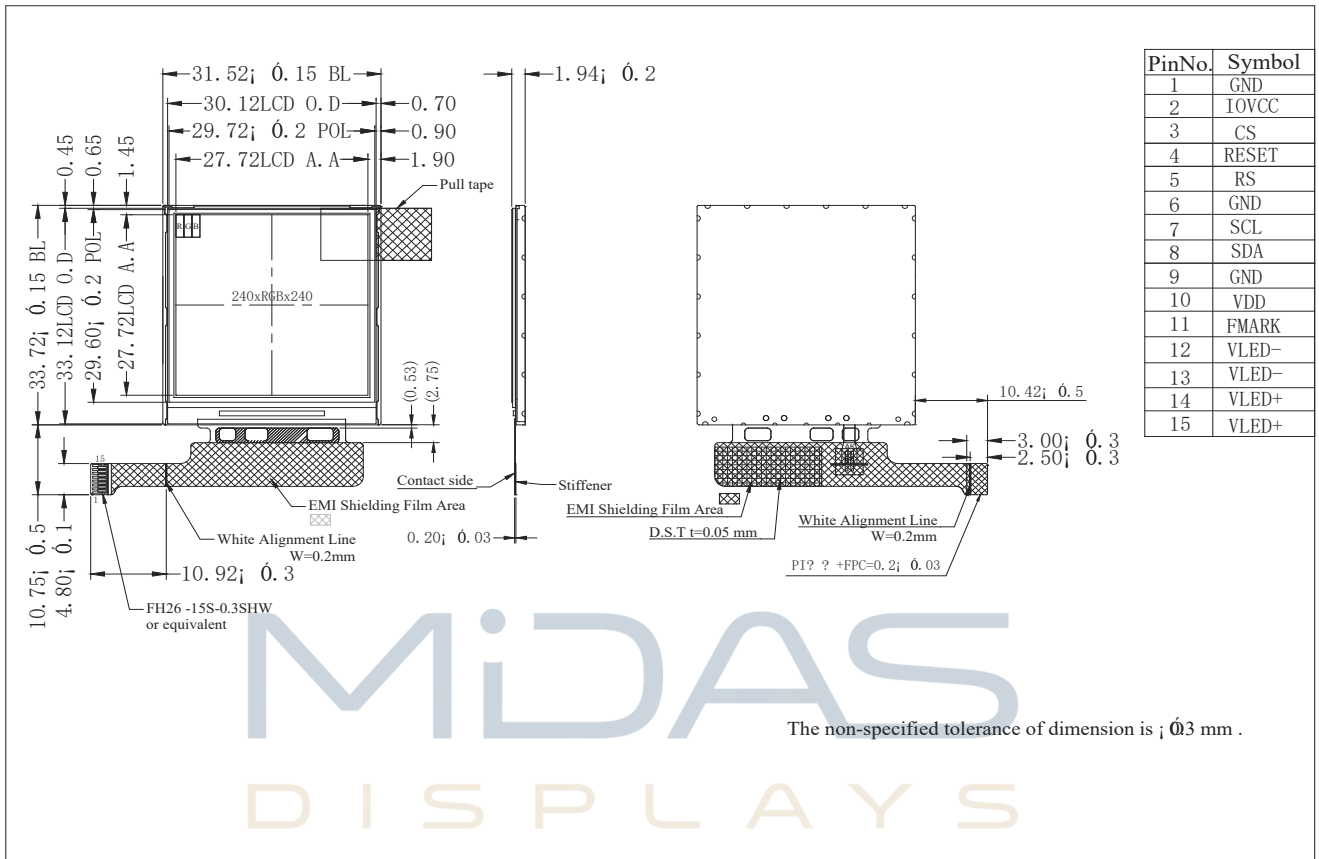
Interface

1. LCM PIN Definition

Pin No.	Symbol	Function
1	GND	Ground.
2	IOVCC	Power Supply for I/O System
3	CS	Chip selection pin
4	RESET	This signal will reset the device
5	RS	Display data/command selection pin in 4-line serial interface
6	GND	Ground.
7	SCL	This pin is used to be serial interface clock
8	SDA	SPI interface input/output pin
9	GND	Ground.
10	VDD	Power Supply for Analog
11	FMARK	Tearing effect signal is used to synchronize MCU to frame memory writing.
12	VLED-	Power Supply For LED Backlight Cathode Input
13	VLED-	Power Supply For LED Backlight Cathode Input.
14	VLED+	Power Supply For LED Backlight Anode Input.
15	VLED+	Power Supply For LED Backlight Anode Input.



Contour Drawing



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Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-10	—	+60	°C
Storage Temperature	TST	-20	—	+70	°C

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

- Temp. $\leq 60^{\circ}\text{C}$, 90% RH MAX. Temp. $> 60^{\circ}\text{C}$, Absolute humidity shall be less than 90% RH at 60°C

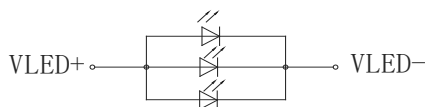
Electrical Characteristics

1. TFT LCD MODULE

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Analog Supply Voltage	VDD	2.4	2.8	3.3	V	-
Power Supply for I/O System	IOVCC	1.65	1.8	3.3	V	$\text{IOVCC} \leq \text{VDD}$
Input High Voltage	VIH	0.7 IOVCC	-	IOVCC	V	Digital input pins
Input Low Voltage	VIL	GND	-	0.3 IOVCC	mV	Digital input pins
Output High Voltage	VoH	0.8 IOVCC	-	IOVCC	mV	Digital input pins
Output Low Voltage	VoL	GND	-	0.2 IOVCC	W	Digital input pins
(Panel+LSI) Power Consumption	Black Mode	-	6.0	-	mA	VDD = 2.8V
	Sleeping Mode	-	0.015	-	mA	

2. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	Vf	If=60mA	2.8	3.0	3.2	V
Backlight Power Consumption	WBL	If=60mA	-	192	-	mW
LED Life Time	-		-	30,000	-	Hr



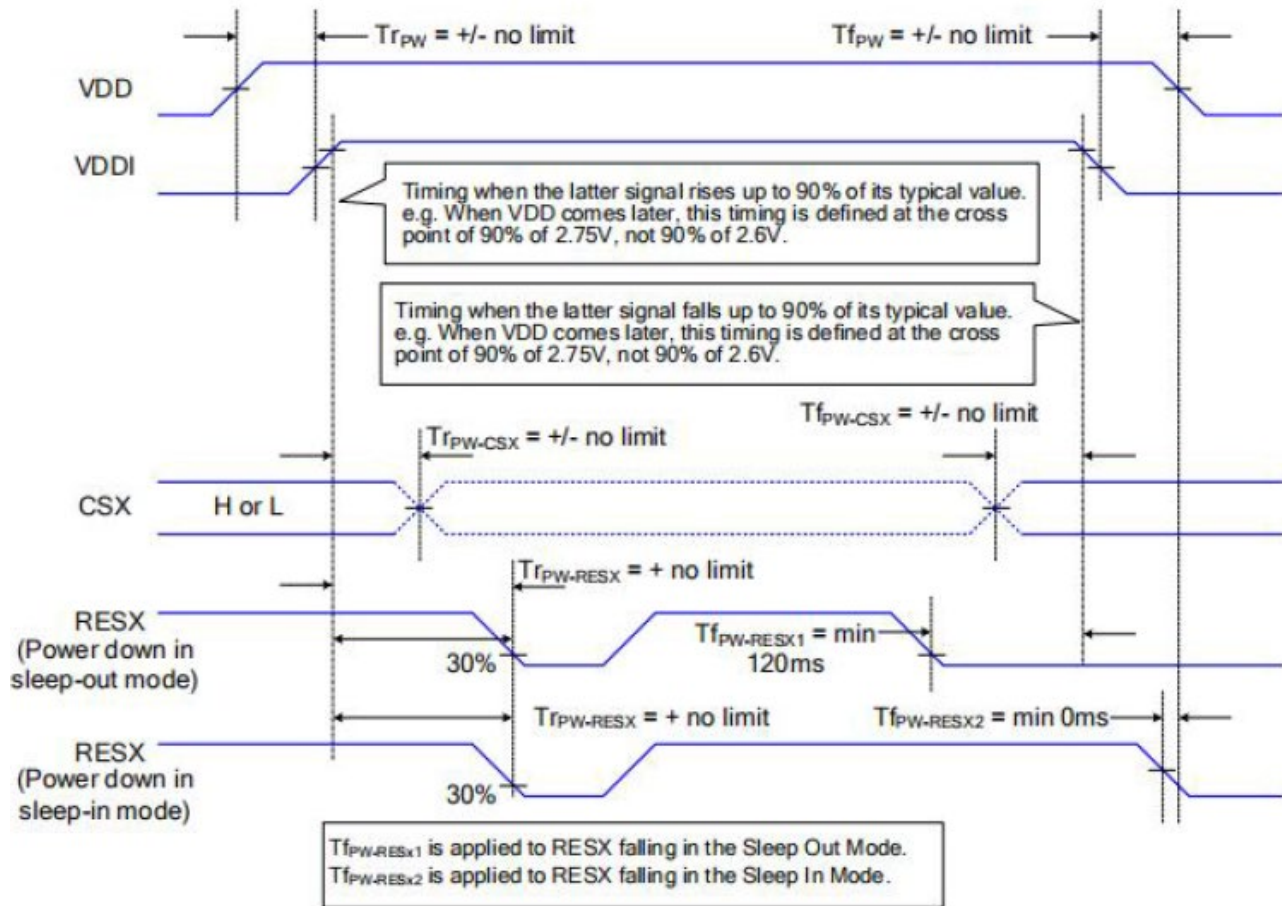
Backlight LED Circuit



AC Characteristics

1. Power Sequence

The power on/off sequence is illustrated below



2. Timing Characteristics (4-line serial)

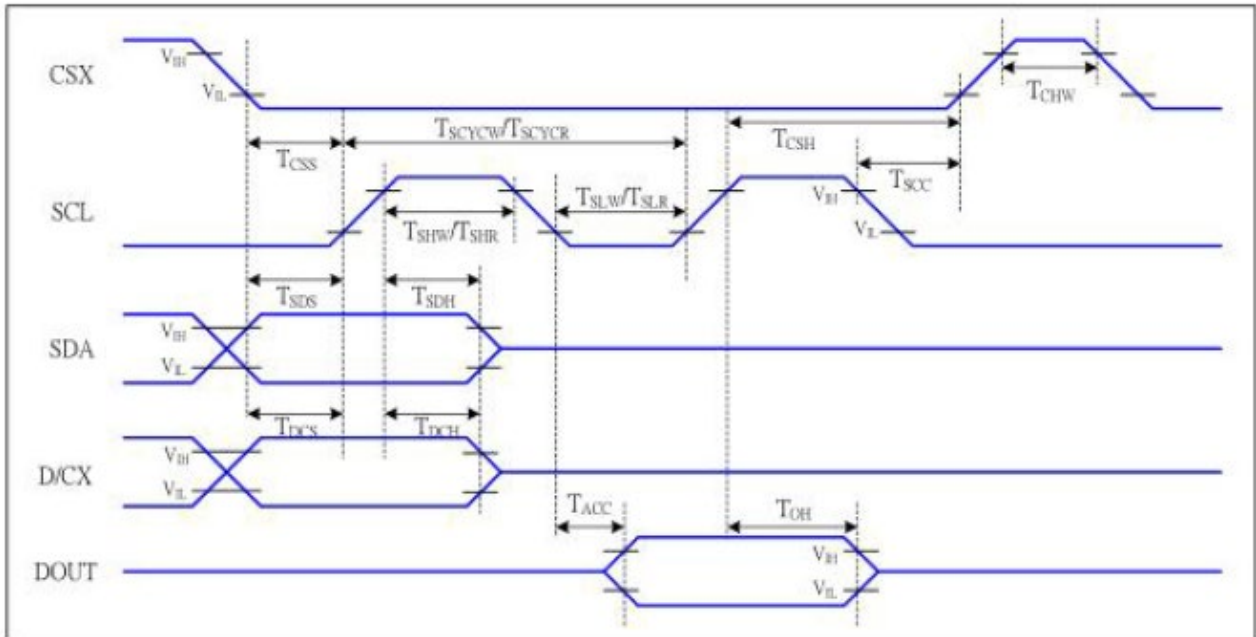


Figure 1 4-line serial interface timing Characteristics

VDDI=1.65 to 3.6V, VDD=2.4 to 3.6V, AGND=DGND=0V, Ta=25°C

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	
SCL	T_{SCYCW}	Serial clock cycle (Write)	16		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "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_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

Note :This section is only for reference,Details please refer to the IC specification.

Optical Characteristics

Item	Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time	Tr+ Tf	$\theta=0^\circ$ 、 $\Phi=0^\circ$	-	30	40	.ms	Note 3
Contrast ratio	CR	At optimized viewing angle	700	900	-	-	Note 4
Color Chromaticity	White	$\theta=0^\circ$ 、 $\Phi=0^\circ$	0.238	0.288	0.338		Note 2,6,7
			0.259	0.309	0.359		
Viewing angle	Hor.	Θ_R	75	80	-	Deg.	Note 1
		Θ_L	75	80	-		
	Ver.	Φ_T	75	80	-		
		Φ_B	75	80	-		
Brightness	-	-	800	850	-	cd/m ²	Center of display
Uniformity	(U)	-	75	-	-	%	Note 5

Ta=25±2°C

Note 1: Definition of viewing angle range

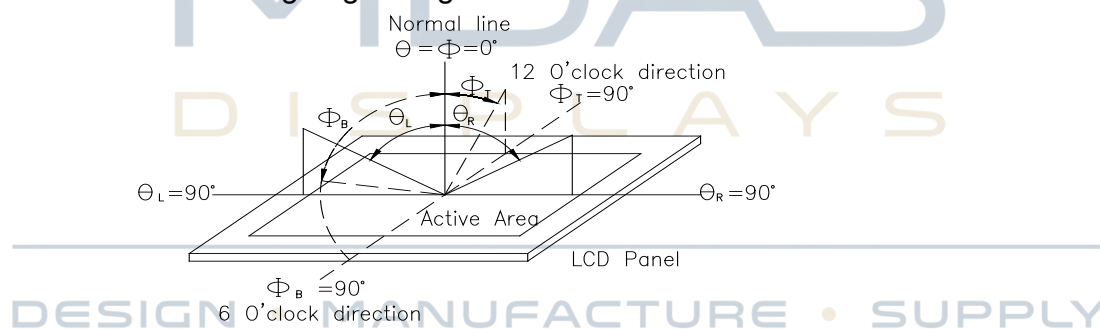


Fig 8.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 or BM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

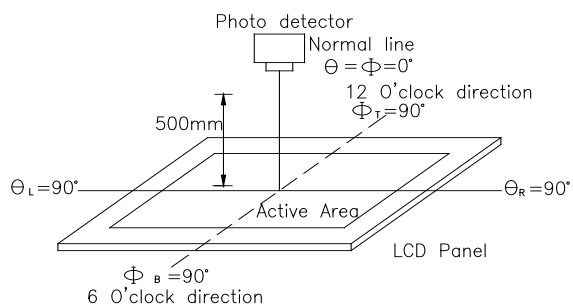
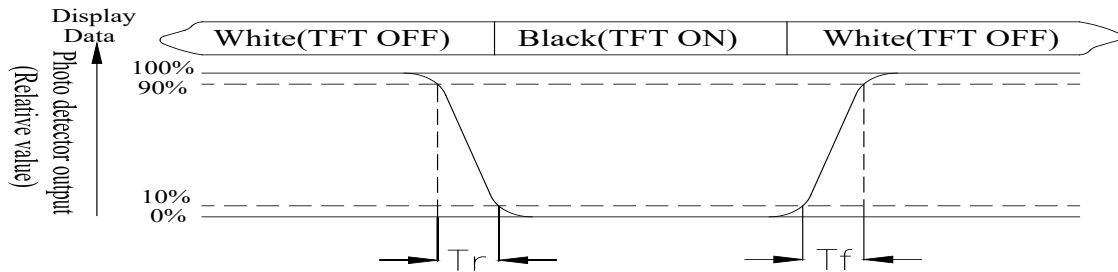


Fig 8.2. Optical measurement system setup

Note 3: 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_r , is the time between photo detector output intensity changed from 90% to 10%. And fall time, T_f , is the time between photo detector output intensity changed from 10% to 90%



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

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

Note 5: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (reference the picture in below). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = \text{Lmin/Lmax} \times 100\%$$

L = Active area length

W = Active area width

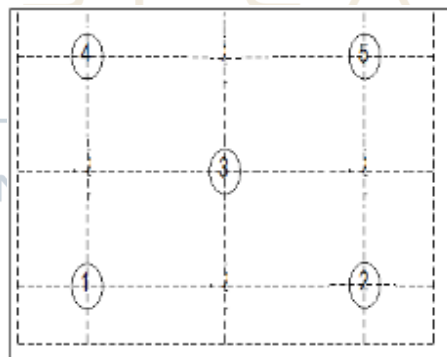


Fig 8.3. Definition of uniformity

Note 6: Definition of color chromaticity (CIE 1931)

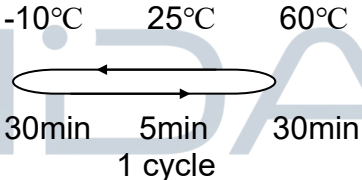
Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.



Reliability

Content of Reliability Test (Wide temperature, -10°C~60°C)

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	70°C 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-20°C 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	60°C 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-10°C 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60°C,90%RH max	60°C,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation 	-10°C/60°C 10 cycles	—
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±4KV(contact), ±8KV(air), RS=330Ω CS=150pF 10 times	—

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.