DisplayModule

DM-TFT24-405

2.4" 240 × 320 TFT LCD DISPLAY PANEL WITH RESISTIVE TOUCH - MCU

Contents

1 Revision History

Date	Changes
2019-10-09	First release

2 Main Features

Item	Specification	Unit
Diagonal Size	2.4	inch
Display Element	TFT active matrix	-
Display mode	Transmissive/ Normally White	-
Pixel arrangement	RGB vertical stripe	-
Display Colors	65K	Colors
Resolution	240(RGB) x 320	pixel
Controller IC	ST7789V	-
Interface	8/16 Bit MCU	-
Active Area	36.72 x 48.96	mm
Panel Dimension	42.72 x 60.26 x 3.8	mm
Pixel Pitch	0.153 x 0.153	mm
Viewing angle	12:00	o'clock
Weight	TBD	g

3 Pin Description

3.1 Panel Pin Description

Pin No.	Symbol	Function Description
1	DB0	DATA BUS. If not used pins must be fixed to GND level.
2	DB1	
3	DB2	
4	DB3	
5	GND	GND
6	IOVCC	POWER SUPPLY
7	/CS	Chip select input pin
8	RS	A register select signal
9	/WR	Write enable clock input pin
10	/RD	Read enable clock input pin
11	IM0	Interface select.
12	XL	Touch panel LIFT Glass Terminal
13	YU	Touch panel Top Film Terminal
14	XR	Touch panel Right Glass Terminal
15	YD	Touch panel Bottom Film Terminal
16	LED-A	Backlight+
17	LED-K1	Backlight-
18	LED-K2	Backlight-
19	LED-K3	Backlight-
20	LED-K4	Backlight-
21	NC	NC
22	DB4	DATA BUS If not used pins must be fixed to GND level.
23	DB10	
24	DB11	
25	DB12	
26	DB13	
27	DB14	
28	DB15	
29	DB16	
30	DB17	
31	/RESET	HARDWARE RESET PIN
32	VCI	POWER SUPPLY
33	IOVCC	POWER SUPPLY
34	GND	GND
35	DB5	DATA BUS DB5 If not used pins must be fixed to GND level.
36	DB6	
37	DB7	

4 Mechanical Drawing

4.1 Panel Mechanical Drawing

NOTES:
1. DISPLAY TYPE: 2.4", TFT-LCD, 262K COLORS
2. DISPLAY MODE: T/N NORMALLY WHITE
3. VIEWING DIRECTION: SUPER WIDE VIEWING ANGL
4. DRIVER IC: ST7789V (COG)
5. VCI: 2.8V, IOVCC: 1.8V/2.8V
6. OPERATING TEMP: -20°C TO 70°C
   STORAGE TEMP: -30°C TO 80°C
7. BACK LIGHT: LED WHITE, 4 LED, 60mA, 3.2±0.3V
8. RoHS COMPLIANT.

FRONT / BACK

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K1(-) K2(-) K3(-) K4(-)   A(+)

NOTE: If not use PIN,fix to the GND.

IM0	Interface type	DB Pin in use
0	80-system 16-bit interface	D17-D10, D8-D1
1	80-system 8-bit interface	D17-D10

PIN	DESCRIPTION
1	DB0
2	DB1
3	DB2
4	DB3
5	IOVCC
6	GND1
7	/CS
8	RS
9	/WR
10	/RD
11	IM0
12	YU
13	XL
14	XR
15	YD
16	LED-A
17	LED-K1
18	LED-K2
19	LED-K3
20	LED-K4
21	NC
22	DB4
23	DB10
24	DB11
25	DB12
26	DB13
27	DB14
28	DB15
29	DB16
30	DB17
31	/RESET
32	VCI
33	IOVCC
34	GND
35	DB5
36	DB6
37	DB7

5 Optics & Electrical Characteristics

5.1 Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
C.I.E. (White)	(x)	C-light	0.253	0.303	0.353	-	C.I.E.1931
	(y)		0.309	0.359	0.409		
C.I.E(Red)	(x)		0.581	0.631	0.681	-	
	(y)		0.265	0.315	0.365		
C.I.E(Green)	(x)		0.261	0.311	0.361	-	
	(y)		0.478	0.528	0.578		
C.I.E(Blue)	(x)		0.081	0.131	0.181	-	
	(y)		0.119	0.169	0.219		
Transmittance (with Polarizer)	$T(\%)$	-	5.5	6.0	-	%	
Contrast Ratio	CR	$\theta=0°$	400	500	-	%	Note
Response time	T_{ON}	25℃	-	20	30	ms	
	T_{OFF}						
NTSC	$S(\%)$		-	55	-	%	
View Angles	θ_L	CR>10	40	60	-	°	
	θ_R		40	60	-		
	θ_T		45	50	-		
	θ_B		15	70	-		
Option View Direction	6 O'clock						

Measuring Condition

1. Measuring surrounding：dark room

2. Ambient temperature：25±2℃

3. 15min. warm-up time.

Note: Definition of contrast ratio

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

"White state ":The state is that the LCD should driven by Vwhite.

"Black state":The state is that the LCD should driven by Vblack.

Vwhite:To be determined   Vblack:To be determined.

5.2 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Digital Supply Voltage	V_{DD}	-0.3	4.6	V
Digital interface Supply Voltage	V_{DDIO}	-0.3	4.6	V
Operating Temperature	T_{OP}	-20	70	°C
Storage Temperature	T_{STG}	-30	80	°C

Note : Ta=25°C VSS=0V

5.3 DC Characteristics

Item	Symbol	Min	Typ.	Max	Unit
Digital Supply Voltage	V_{DD}	2.4	3.3	4.2	V
Digital interface Supply Voltage	V_{DDIO}	1.65	3.3	4.2	V
Normal mode Current consumption	I_{DD}	-	8	-	mA
Low Level Input Voltage	V_{IL}	GND	-	0.3 x V_{DDIO}	V
High Level Input Voltage	V_{IH}	0.7 x V_{DDIO}	-	V_{DDIO}	V
Low Level Output Voltage	V_{OL}	GND	-	0.2 x V_{DDIO}	V
High Level Output Voltage	V_{OH}	0.8 x V_{DDIO}	-	V_{DDIO}	V

5.4 LED Backlight Characteristics

The back-light system is edge-lighting type with 4chips White LED

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Forward voltage	V_F	-	3.2	-	V	
Forward current	I_F	60	80	-	mA	
LCM Luminance	L_V	500	-	-	cd/m^2	
LED life time	Hr	50000	--	--	Hour	Note1,2
Uniformity	AVg	80	--	--	%	

Note1: 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%.
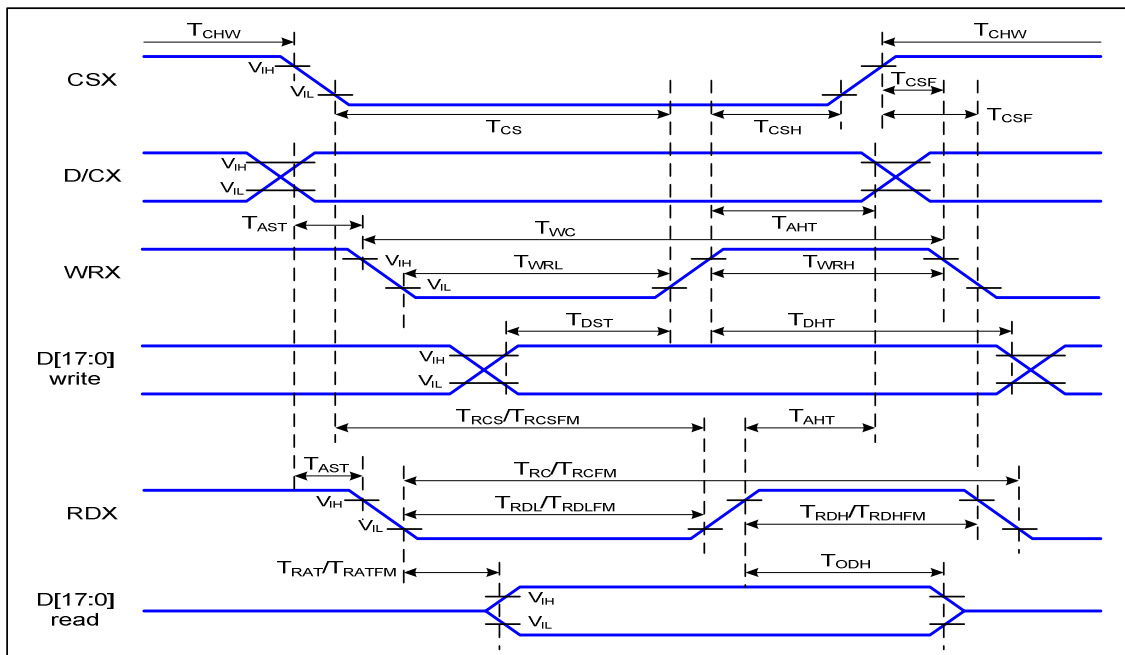
Note2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25°C and IL=80mA. The LED lifetime could be decreased if operating IL is larger than 80mA. The constant current driving method is suggested.
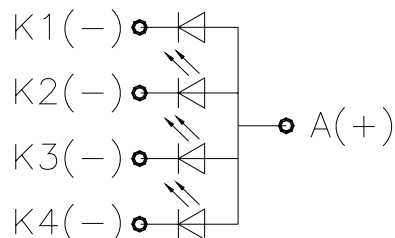

BLU CIRCUIT DIAGRAM

5.5 AC Characteristics

### 5.5.1 8080-Series MPU Parallel Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 °C

| Signal	Symbol	Description	Min	Max	Unit	Note
D/CX	T_{AST}	Address setup time	0	-	ns	
	T_{AHT}	Address hold time(Write/Read)	10	-	ns	
CSX	T_{CHW}	CSH "H" Pulse Width	0	-	ns	
	T_{CS}	Chip select setup time(Write)	10	-	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 pules L duration(FM)	355	-	ns	
D[17…0]	T_{DST}	Data setup time	10	-	ns	ForCL=30pF
	T_{DHT}	Data hold time	10	-	ns	
	T_{RAT}	Read access time(ID)	-	40	ns	
	T_{RATFM}	Read access time(FM)	-	340	ns	
	T_{ODH}	Output disable time	20	80	ns	
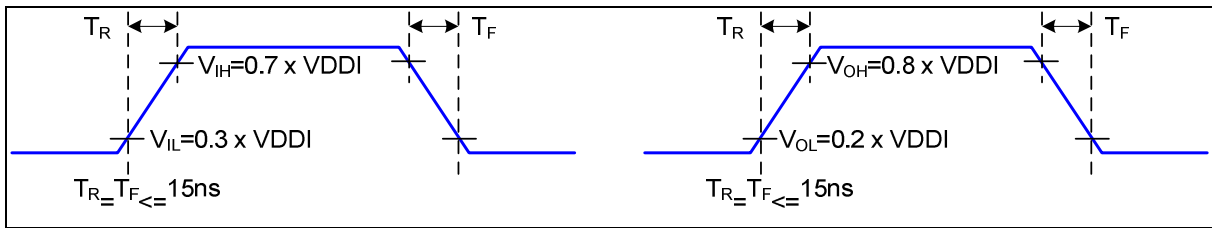
Rising and Falling Timing for I/O Signal
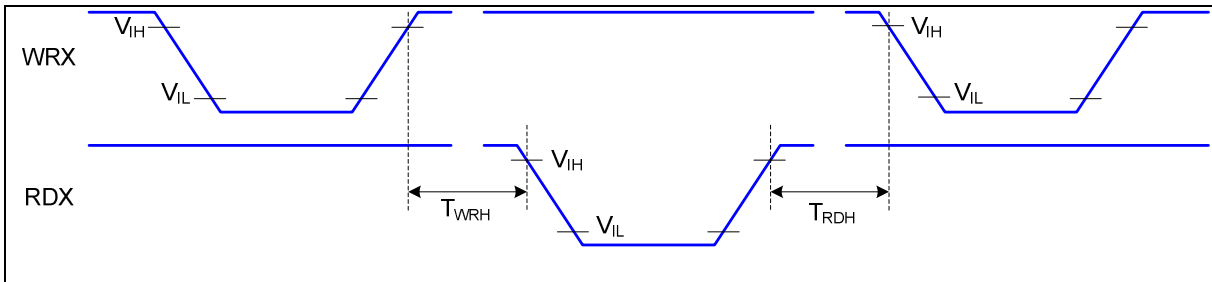
Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (Tr, Tf) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

5.5.2　Display RESET Timing Characteristics
Reset input timing
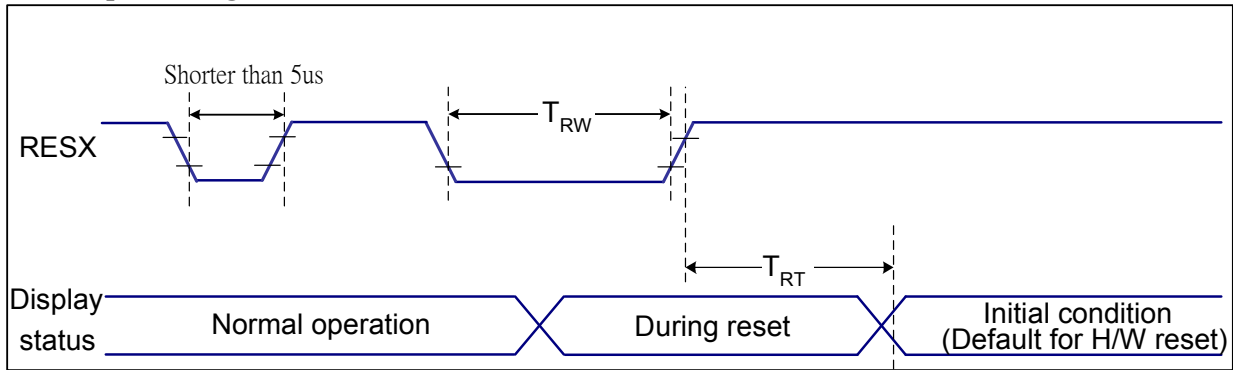
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70°C

| Related Pins	Symbol	Parameter	Min	Max	Unit
RESX	TRW	Reset pulse duration	10	-	μs
	TRT	Reset cancel	-	5(Note 1,5)	ms
			-	120(Note 1,6,7)	ms

Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5μs	Reset Rejected
Longer than 9μs	Reset
Between 5μs and 9μs	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:
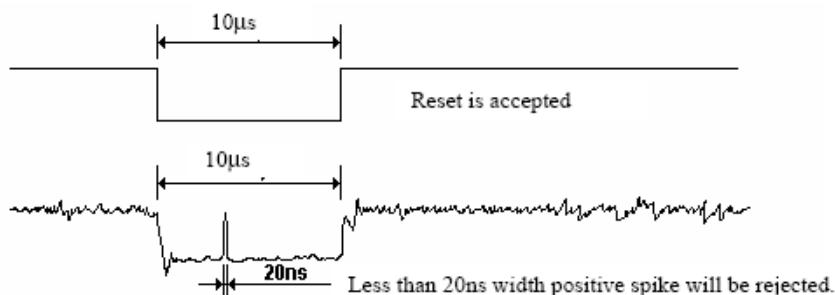
Note 5: When Reset applied during Sleep In Mode

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec
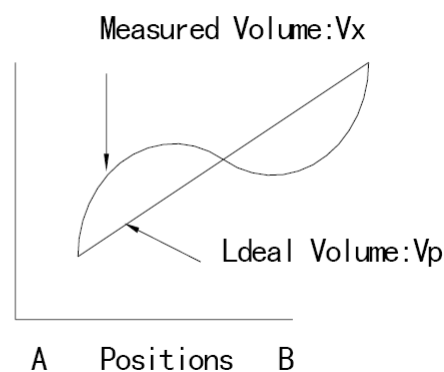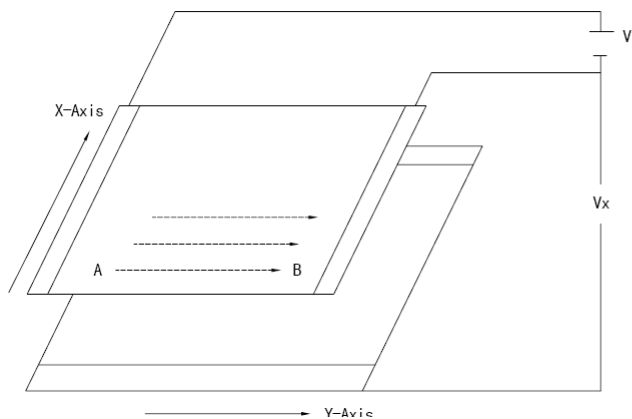
6 TP Feature

6.1 Conditions of use and storage

Item	Content of Test	Note
Temperature range upon operation	Humidity: 20%~90% non dew, condensation -20°C~70°C	In a simple substance
Temperature range upon storage	Humidity: 20%~90% non dew, condensation -30°C~80°C	In a simple substance

6.2 Electrical property

Item	Value	Note
Maximum voltage	DV5V	
Resistance between terminals	X direction[Film side]:200-600Ω	
	Y direction [Glass side]:300-900Ω	
Insulation resistance	DC 25V 20MΩor above	Connect X + ～X- and Y+ ～Y-, apply 25VDC Between X and Y for perform measurements
Chattering	10 msec or below	
Rating	Voltage is DC 5V	

6.3 Mechanical property

Item	Performance		Note
Input method	Used of an exclusive pen or finger		
Load upon operation	Exclusive pen	60-100g or below	Operation and measurement with a pen must be carried out under the following tip conditions: Stylus pen material : POM(ployacetal) . Tip : Diameter 3.0mm, SR 0.8 mm
	Finger	60-100g or below	Operations and measurement methods simulated for a finger must be carried out under the following tip conditions. Material :Silicon rubber (Hardness : 30°Hs) Tip: Diameter 12.0 mm, SR 12.5mm
Surface hardness	Pencil hardness : 3H or above		It complies with the way of test method JIS K5400.

6.4 Optical property

Item	Performance	Note
Total light transmittance	80% or above	JIS K7105
Haze	5% or below	JIS K7136
Film specification	Polished type with hard coated surface	

7 Reliability

Test Item	Content of Test	Test Condition	Note
High Temperature Storage	Endurance test applying the high storage temperature for a long time.	80℃ 96hrs	2
Low Temperature Storage	Endurance test applying the high storage temperature for a long time.	-30℃ 96hrs	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℃ 96hrs	-
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20 ℃ 96hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60℃,90%RH max, for 96hrs under no-load condition excluding the polarizer. Then taking it out and drying it at normal temperature.	60℃,90%RH 96hrs	1,2
Thermal Shock Resistance	The sample should be allowed stand the following 5 cycles of operation		-

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 rest chamber.

8 Warranty and Conditions

http://www.displaymodule.com/pages/faq HYPERLINK "http://www.displaymodule.com/pages/faq"