PRODUCT SPECIFICATION

1.0” IPS LCD Module with SPI Interface

DT010ATFT

Displaytech

a seacomp company

Revision 1.1

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Revision History

REV	CHANGE DESCRIPTION	DATE	APPR
1.0	Initial release	30 JUN 2020	KK
1.1	Format update	20 NOV 2023	PRW

Table of Contents

1 Overview

The Displaytech **DT010ATFT** is a 1.0” color display, composed of an IPS LCD panel, LCD driver, FPC cable with serial interface, and LED backlight. The 0.96” display area has a RGB pixel resolution of 80 x 160 pixels.

1.1 Applications

- Video systems
- Mobile systems
- Wearable devices

1.2 LCD Features

Size	0.96 inches
Resolution	80 (RGB) x 160 Pixels
Type	IPS, Transmissive, Normally black
Interface	4-Line SPI
Pixel Configuration	RGB Vertical Stripe
Module Dimensions	13.50 mm (W) x 27.95 mm (L) x 1.40 mm (H)
Active Area	10.80 mm (W) x 21.70 mm (L)
Pixel pitch	0.135 mm (W) x 0.135 mm (H)
Viewing Direction	All
Backlight Type	LED, White
LCD Driver	ST7735

1.3 Acronyms

FPC	Flexible Printed Circuit
IPS	In-Plane Switching
LCD	Liquid Crystal Display
LED	Light Emitting Diode
RGB	Red-Green-Blue
SPI	Serial-Peripheral Interface

2 Pin Descriptions

LCD INTERFACE[1]			
PIN	NAME	TYPE	DESCRIPTION
1	NC	–	No connection
2	NC	–	No connection
3	SDA	I/O	Serial interface data
4	SCL	I	Serial interface clock
5	D/C	I	Display data (1) / Command (0) select
6	$\overline{\text{RESET}}$	I	Display reset
7	$\overline{\text{CS}}$	I	Chip select
8	GND	PWR	Ground
9	NC	–	No connection
10	VDD	PWR	Supply voltage
11	LED-K	PWR	LED backlight Cathode
12	LED-A	PWR	LED backlight Anode
13	GND	PWR	Ground

3 Specifications

3.1 Absolute Maximum Ratings[2]

ELECTRICAL				
PARAMETER		MIN	MAX	UNIT
Supply Voltage, Analog	V_{DD}	-0.3	4.6	V
Supply Voltage, Digital	V_{DDIO}	-0.3	4.6	V
Logic Input Voltage	V_{IN}	-0.3	V_{DDIO} + 0.3	V
Logic Output Voltage	V_{OUT}	-0.3	V_{DDIO} + 0.3	V

ENVIRONMENTAL				
PARAMETER		MIN	MAX	UNIT
Operating Temperature	T_{OPR}	-20	+70	°C
Storage Temperature	T_{STG}	-30	+80	°C

[1] Recommended mating connector: XF3M-1315-1B
[2] Operation outside of the maximum ratings listed here may result in permanent damage to the LCD.

3.2 Electrical Characteristics

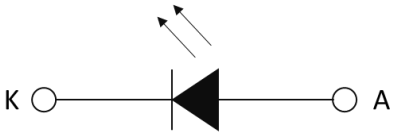
POWER					
PARAMETER		MIN	TYP	MAX	UNIT
Supply Voltage	V_{DD}	2.5	2.8	3.3	V
Supply Voltage, Logic	V_{DDIO}	1.65	1.8	3.3	V
Supply Current	I_{DD}	–	2	3	mA

LOGIC					
PARAMETER		MIN	TYP	MAX	UNIT
Logic Input Voltage, High	V_{IH}	0.7 * V_{DDIO}	–	V_{DDIO}	V
Logic Input Voltage, Low	V_{IL}	GND	–	0.3 * V_{DDIO}	V
Logic Output Voltage, High	V_{OH}	0.8 * V_{DDIO}	–	V_{DDIO}	V
Logic Output Voltage, Low	V_{OL}	GND	–	0.2 * V_{DDIO}	V

LED BACKLIGHT[3]					
PARAMETER		MIN	TYP	MAX	UNIT
Forward Current	I_F	–	20	25	mA
Forward Voltage	V_F	–	2.8	–	V

3.2.1 LED Backlight Circuit

Figure 1: DT010ATFT Backlight
1 LED, I_F = 20 mA

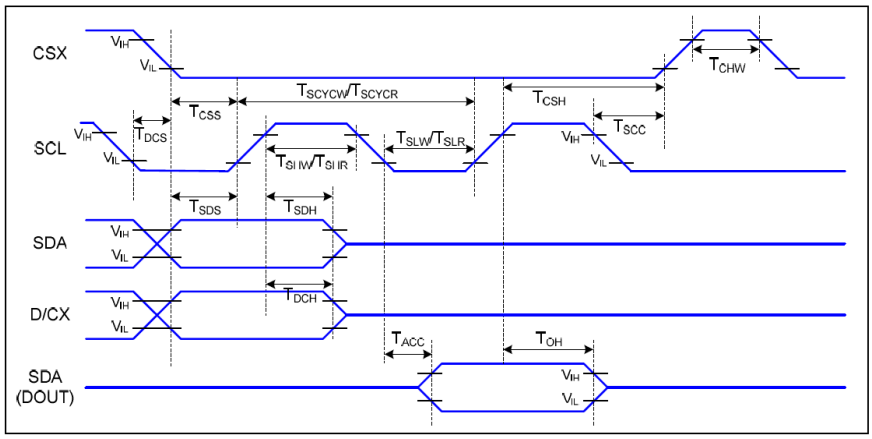


[3] Backlight Power Consumption: 70mW Max.

4 Timing Characteristics

4.1 4-Wire Serial Interface

Figure 2: 4-line Serial Interface Timing Diagram

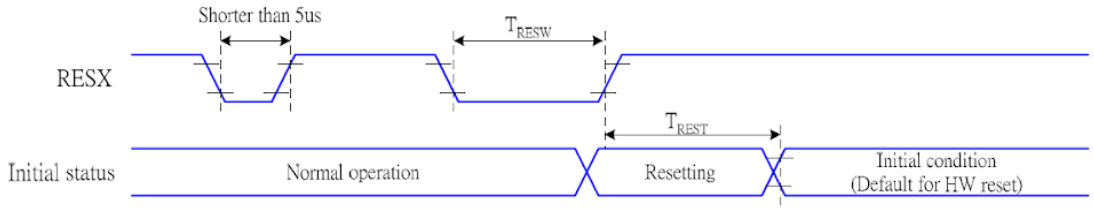


SPI INTERFACE[4]					
PARAMETER			MIN.	MAX.	UNIT
$\overline{CS}$	T_{CSS}	Chip select setup time (write)	15	–	ns
	T_{CSH}	Chip select hold time (write)	15	–	ns
	T_{CSS}	Chip select setup time (read)	60	–	ns
	T_{SCC}	Chip select hold time (read)	65	–	ns
	T_{CHW}	Chip select “H” pulse width	40	–	ns
SCL	T_{SCYCW}	Serial clock cycle (write)	66	–	ns
	T_{SHW}	SCL “H” pulse width (write)	30	–	ns
	T_{SLW}	SCL “L” pulse width (write)	30	–	ns
	T_{SCYCR}	Serial clock cycle (read)	150	–	ns
	T_{SHR}	SCL “L” pulse width (read)	60	–	ns
	T_{SLR}	SCL “L” pulse width (read)	60	–	ns
D/C	T_{DCS}	Data/Command select setup time	–	0	ns
	T_{DCH}	Data/Command select hold time	10	–	ns
SDA[5]	T_{SDS}	Serial Data setup time	10	–	ns
	T_{SDH}	Serial Data hold time	10	–	ns
	T_{ACC}	Access time	10	50	ns
	T_{OH}	Output disable time	–	50	ns

[4] VDD = 2.6 to 3.3 V, VDDIO = 1.65 to 3.3 V, GND = 0 V, T_A = 25°C
[5] For maximum CL = 30pF, for minimum CL = 8pF

4.2 Reset

Figure 3: Reset Timing



RESET TIMING				
PARAMETER		MIN	MAX	UNIT
t_{RESW}	Reset pulse duration	10	–	µS
t_{REST}	Reset cancel	–	5	mS

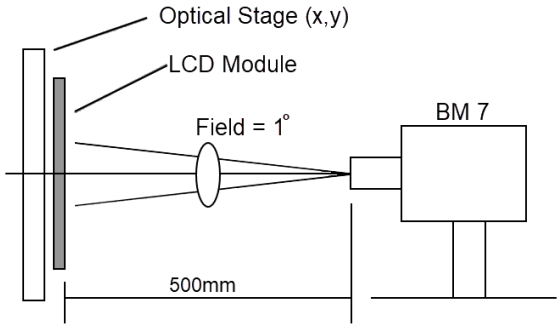
5 Optical Characteristics

OPTICAL CHARACTERISTICS[6]					
PARAMETER		MIN	TYP	MAX	UNIT
Contrast Ratio[7, 8]	CR	–	800	–	–
Response Time[9]	T_{ON} / T_{OFF}	–	30	40	mS
Viewing Angles[10, 11]	ΘT	–	80	–	°C
	ΘB	–	80	–	
	ΘL	–	80	–	
	ΘR	–	80	–	
Chromaticity[12]	X_{RED}	Typ. - 0.002	0.610	Typ. + 0.002	–
	Y_{RED}		0.333		
	X_{GRN}		0.281		
	Y_{GRN}		0.533		
	X_{BLU}		0.146		
	Y_{BLU}		0.138		
	X_{WHT}		0.306		
	Y_{WHT}		0.327		
Luminance[8]	L	–	300	–	Cd/m^2
Uniformity[8]	U	80	–	–	%

[6] See Section 5.1, Figure 4
[7] Viewing Angle (Θ) = 0°
[8] See Section 5.1, Figure 8
[9] See Section 5.1, Figure 5
[10] Contrast Ratio (CR) ≥ 10
[11] See Section 5.1, Figure 6
[12] See Section 5.1, Figure 7

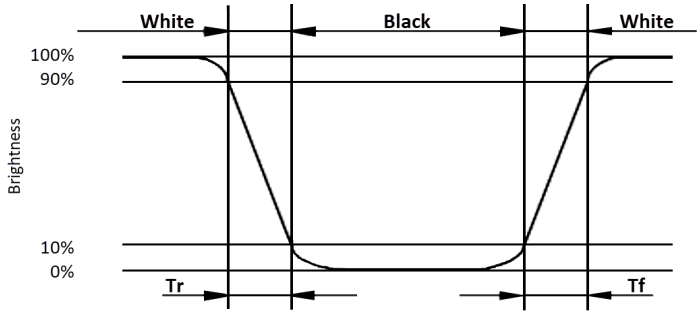
5.1 Figures

Figure 4: Optical Measurement System



I_F = 40 mA
T_A = 25 °C
Ambient brightness < 150 lx

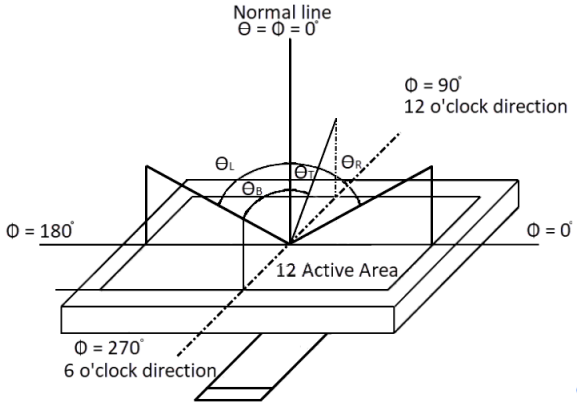
Figure 5: Response Times



Decay Time (TF) = Time required for display to transition from white to black

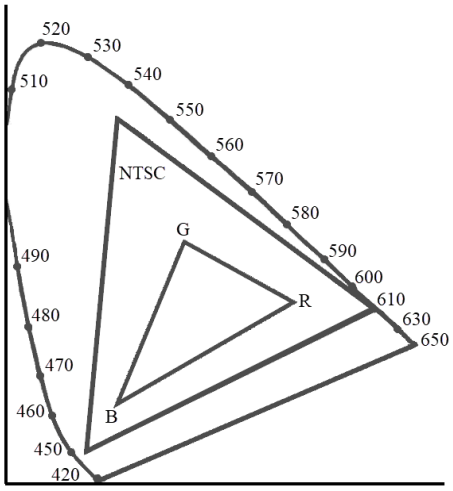
Rise Time (TR) = Time required for display to transition from black to white

Figure 6: Viewing Angles



Viewing angle is measured from center point of LCD

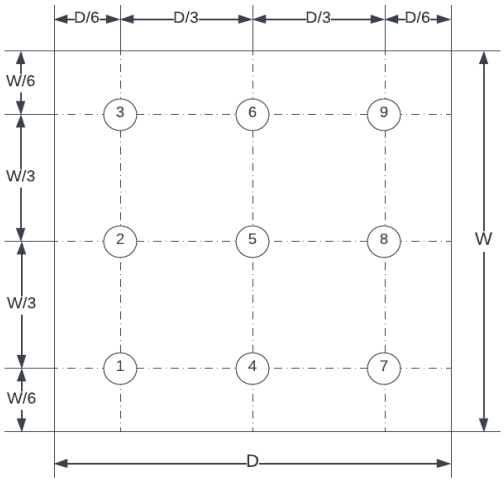
Figure 7: Chromaticity (CIE 1931)



Chromaticity = Area of $\triangle_{RGB}$ / Area of $\triangle_{NTSC}$

* Color coordinates measured at center point of LCD

Figure 8: Luminance Uniformity



Luminance is defined as the brightness of all white pixels at the center of the display area at optimum contrast.

Uniformity is determined by measuring Luminance at 9 points and calculating $Luminance_{MIN}$ / $Luminance_{MAX}$

Contrast Ratio = $\frac{Surface\ Luminance_{WhitePixels}}{Surface\ Luminance_{BlackPixels}}$

6 Environmental/Reliability Testing

Judgment is based on inspection performed after testing, per criteria described in the Inspection Criteria table.[13]

ITEM UNDER TEST	TEST CONDITION
High Temperature Operation	T_A = 70 °C, 96 Hrs
Low Temperature Operation	T_A = -20 °C, 96 Hrs
High Temperature Storage	T_S = 80 °C, 96 Hrs
Low Temperature Storage	T_S = -30 °C, 96 Hrs
High Temperature & Humidity Storage	T_S = 60 °C, 120 Hrs, 90% RH
Thermal Shock (Non-Operation)	-30 °C (30 min) ~ 80 °C (30 min) Change time: 5 min, 10 cycles
ESD (Operation)	C = 150 pF, R = 330 Ω, 5 points/panel Air: 8 KV (5x), Contact: 4 KV (5x)
Vibration (Non-Operation)	Frequency Range: 10 Hz ~ 55 Hz Stroke: 1.5 mm Sweep: 10 Hz ~ 55 Hz ~ 10 Hz 2 Hrs each in X, Y, Z directions
Package Drop Test	Height: 80 cm 1 corner, 3 edges, 6 surfaces

6.1 Inspection Criteria

INSPECTION ITEM	CRITERIA
Appearance	No cracks present on FPC No cracks present on LCD panel
LCD Panel Alignment	No bubbles present on/in LCD panel No alignment defects in active area
Electrical Current	Within device specifications
Function/Display	No broken circuits nor short circuits present No black lines present on LCD panel No other display defects

[13] Functional test shall be conducted after 4 hours of storage at normal temperature and humidity, after LCD is removed from test chamber.

7 Precautions for Use of LCD Modules

7.1 Safety

Liquid crystal in LCD is poisonous. Do not put in mouth. If liquid crystal comes in contact with skin or clothes, wash it off immediately using soap and water.

7.2 Handling

A. The LCD panel is made of plate glass. Do not subject the panel to mechanical shock or excessive force on its surface.
B. In order to ensure reliability, do not hold product by flexible printed circuit (FPC) cable.
C. Provide space so that panel does not come into contact with other components.
D. To protect the product from external force, apply a covering lens (acrylic board or similar) and keep an appropriate gap between them.
E. Transparent electrodes may be disconnected if the panel is used in an environment where dew condensation is present.
F. Properties of semiconductor devices may be affected when exposed to light, possibly resulting in IC malfunctions. To prevent such malfunctions, design and mounting layout should be done in such a way that IC is not exposed to light in actual use.

7.3 Static electricity

A. Ground soldering iron tips, tools and testers when they are in operation.
B. Ground your body when handling the products.
C. Power on the LCD module before applying the voltage to the input terminals.
D. Do not apply voltage which exceeds the absolute maximum rating.
E. Store the products in an anti-electrostatic bag or container.

7.4 Storage

A. Store product in a dark place at +25°C ±10°C with low humidity (40% RH ~ 60% RH). Do not expose the display to sunlight or fluorescent light.
B. Storage in a clean environment, free from dust, active gas, and solvent.

7.5 Cleaning

A. To clean the product, wipe with a soft cloth moistened with ethanol. Do not allow ethanol to get between upper film and bottom glass, as this may cause peeling issues and/or defective operation. Do not use any organic solvent or detergent other than ethanol.

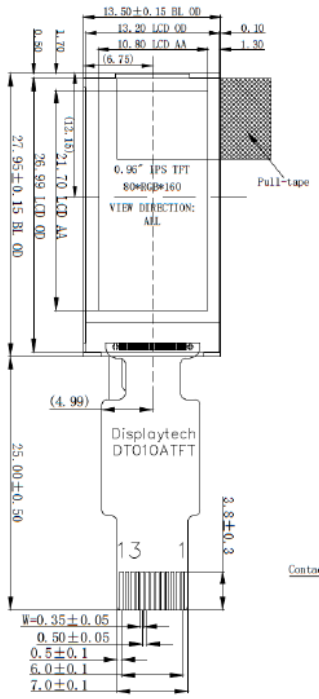
7.6 Cautions for installation and assembly

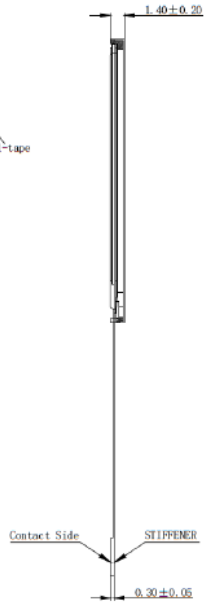
A. Bezel edge must be positioned between Active area and Viewing area.
B. For a stable display assembly, Displaytech recommends designing a support for the backside of the display.
C. Do not display any fixed pattern for long periods of time. If a fixed pattern must be displayed, use a screen saver in order to avoid image persistence.

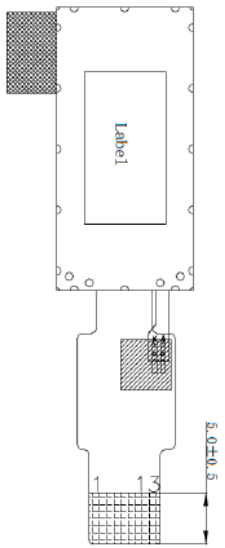
8 Mechanical Drawing

CUSTOMER P/N:

Rev.	DATA	NOTES
V1.0	2019.11.25	New issue
V1.1	2019.11.28	change FPC design

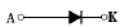






PIN	SYMBOL
1	NC
2	NC
3	SDA
4	SCL
5	D/C
6	$\overline{\text{RESET}}$
7	$\overline{\text{CS}}$
8	GND
9	NC
10	VDD
11	LEDK
12	LEDA
13	GND

Backlight Circuit Diagram:



IF =20mA, VF=2.8V

NOTES:
1.DISPLAY TYPE: 0.96" IPS TFT
2.DISPLAY MODE: Transmissive, Normally black
3.VIEW DIRECTION: ALL
4.OPERATION TEMPERATURE: −20°C~+70°C
STORAGE TEMPERATURE: −30°C~+80°C
5.GENERAL TOLERANCE: ±0.2
6.DRIVER IC: ST7735
7.REQUIREMENT ON ENVIRONMENT PROTECTION: ROHS

Customer Approval			
	Drawn:		
	Checked:		
	Approved:		
	Critical Dim.		
	Reference Dim.	( )	

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Title	TFT LCM OUTLINE	Unit	mm
Part No.	DT010ATFT	Scale	1:1
Revison	V1.1	Page	1/1
Date	2019-11-28	3rd Angle	

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