

PRODUCT SPECIFICATION

1.0" IPS LCD Module with SPI Interface
DT010ATFT



Revision 1.1
20 November 2023

Displaytech, a SEACOMP company

Phone: 1.760.918.6722

sales@seacomp.com

www.seacomp.com

Contents of this document are subject to change without notice. No part of this document may be reproduced or transmitted in any form or by any means, electronic or physical, for any purpose, without the express written permission of Displaytech.

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 | 1 |
| 1.1 Applications | 1 |
| 1.2 LCD Features | 1 |
| 1.3 Acronyms | 1 |
| 2 Pin Descriptions | 2 |
| 3 Specifications | 2 |
| 3.1 Absolute Maximum Ratings | 2 |
| 3.2 Electrical Characteristics | 3 |
| 3.2.1 LED Backlight Circuit | 3 |
| 4 Timing Characteristics | 3 |
| 4.1 4-Wire Serial Interface | 4 |
| 4.2 Reset | 5 |
| 5 Optical Characteristics | 5 |
| 5.1 Figures | 6 |
| 6 Environmental/Reliability Testing | 8 |
| 6.1 Inspection Criteria | 8 |
| 7 Precautions for Use of LCD Modules | 9 |
| 7.1 Safety | 9 |
| 7.2 Handling | 9 |
| 7.3 Static electricity | 9 |
| 7.4 Storage | 9 |
| 7.5 Cleaning | 9 |
| 7.6 Cautions for installation and assembly | 9 |
| 8 Mechanical Drawing | 10 |

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 Ratings²

| 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

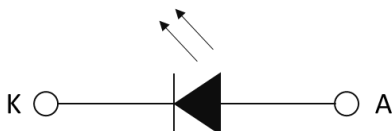
| POWER | | | | | |
|-----------------------|------------|------|-----|-----|------|
| PARAMETER | | MIN | TYP | MAX | UNIT |
| Supply Voltage | V_{DD} | 2.5 | 2.8 | 3.3 | V |
| Supply Voltage, Logic | V_{DDIO} | 1.65 | 1.8 | 3.3 | V |
| Supply Current | I_{DD} | – | 2 | 3 | mA |

| 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

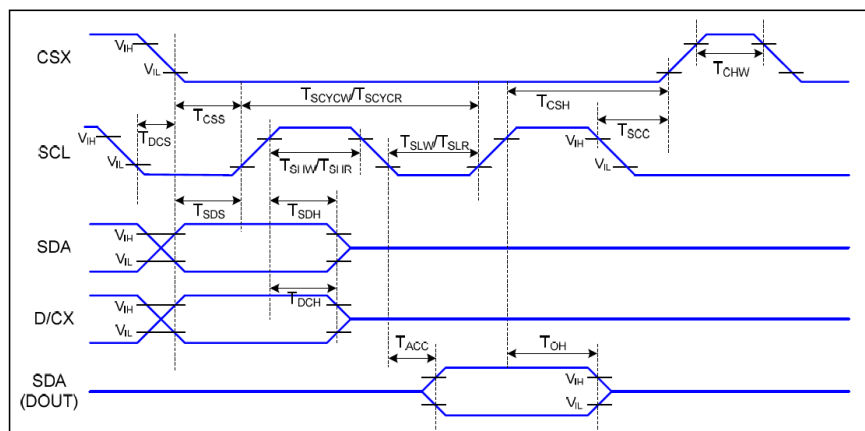


³ Backlight Power Consumption: 70mW Max.

4 Timing Characteristics

4.1 4-Wire Serial Interface

Figure 2: 4-line Serial Interface Timing Diagram



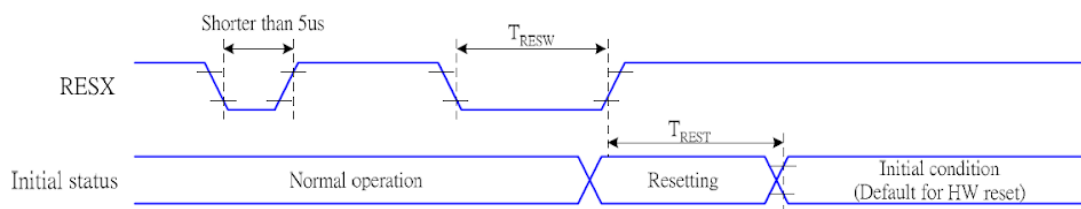
| SPI INTERFACE ⁴ | | | | | |
|----------------------------|-------------|--------------------------------|------|------|------|
| PARAMETER | | | MIN. | MAX. | UNIT |
| CS | T_{CSS} | Chip select setup time (write) | 15 | – | ns |
| | T_{CSH} | Chip select hold time (write) | 15 | – | ns |
| | T_{CSS} | 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 | – | $^{\circ}C$ |
| | 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

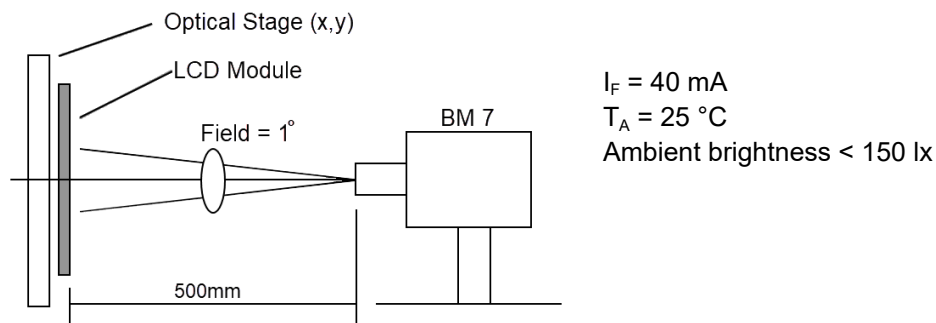
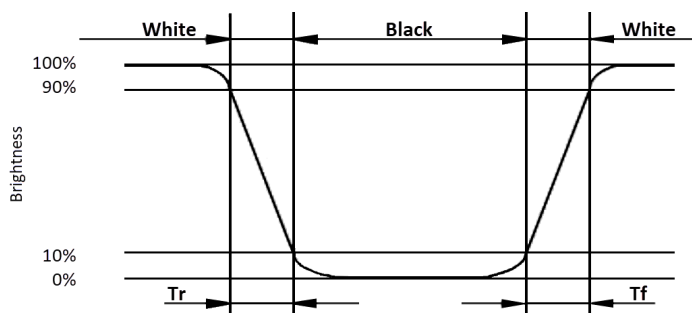


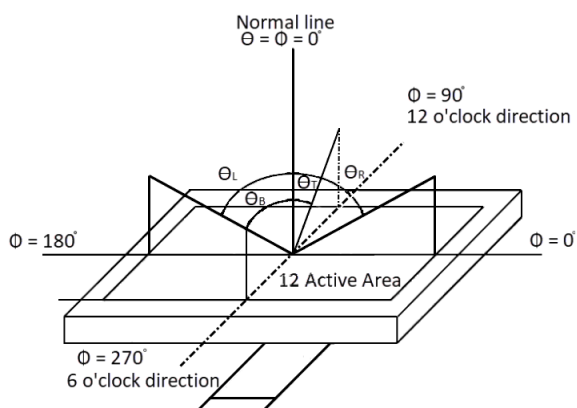
Figure 5: Response Times



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

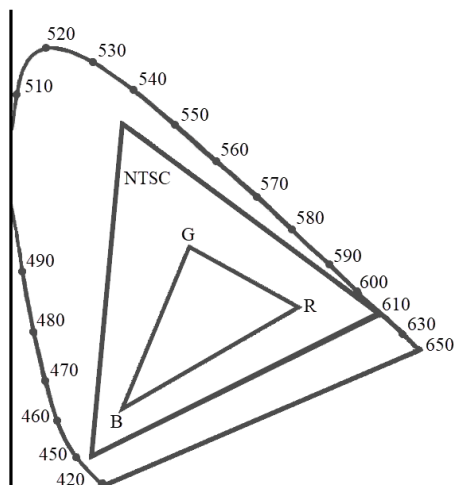
Rise Time (TR) = Time required for display to transition from black to white

Figure 6: Viewing Angles



Viewing angle is measured from center point of LCD

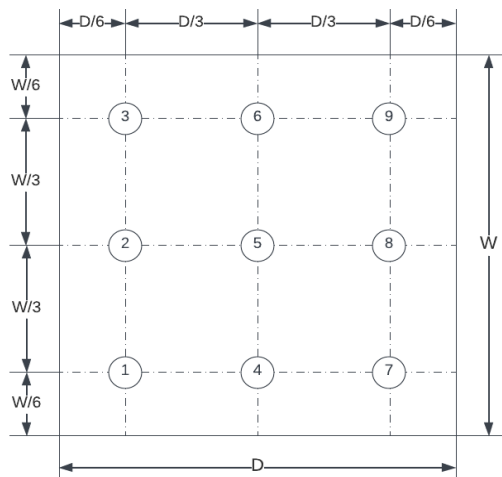
Figure 7: Chromaticity (CIE 1931)



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

* 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 $\text{Luminance}_{\text{MIN}} / \text{Luminance}_{\text{MAX}}$

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance}_{\text{WhitePixels}}}{\text{Surface Luminance}_{\text{BlackPixels}}}$$

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 $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ 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.

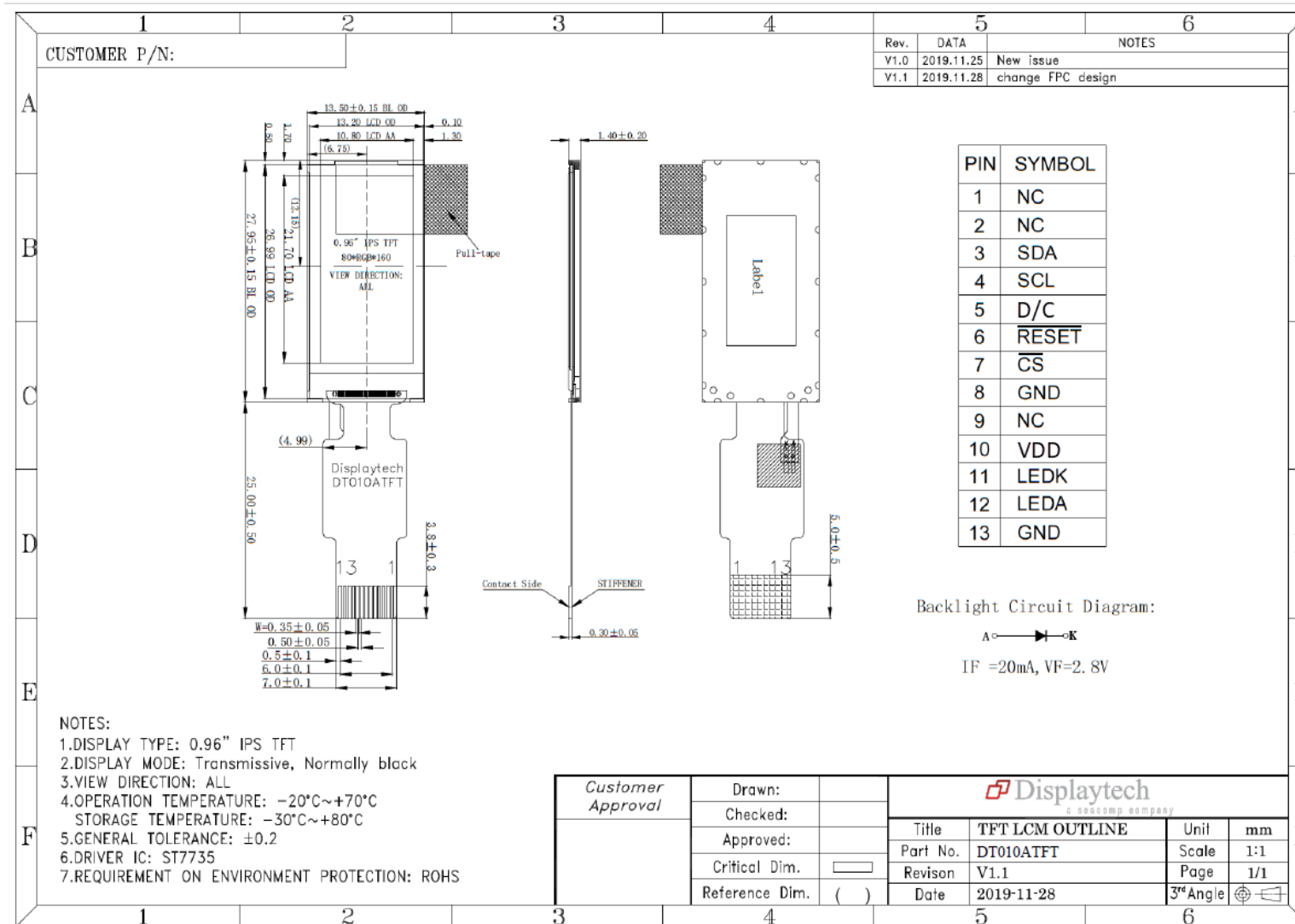
7.5 Cleaning

- 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



Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Displaytech:](#)

[DT010ATFT](#)