PRODUCT SPECIFICATION

5.0” TFT LCD Module with RGB Interface

DT050BTFT, DT050BTFT-TS, DT050BTFT-PTS

Displaytech
a seacomp company

Revision 1.3
16 Nov 2023

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Revision History

REV	CHANGE DESCRIPTION	DATE	APPR
1.3	Initial Release	16 NOV 2023	PRW

Table of Contents

1 Overview

The Displaytech **DT050BTFT** is a 5.0” color display, composed of an active-matrix TFT LCD panel, LCD drivers, FPC cable with RGB interface, and LED backlight. The display area has a RGB pixel resolution of 800 x 480 pixels. In addition, this series includes the **DT050BTFT-PTS** with capacitive touch panel and driver, as well as the **DT050BTFT-TS** with resistive touch panel.

1.1 Applications

- Video systems
- Mobile devices
- Navigation systems

1.2 Features

- Size — 5.0 Inches
- Resolution — 800(RGB) x 480 Pixels
- Type — a-Si TFT, Transmissive, Normally white
- Interface
  - LCD — 24-bit RGB
  - Capacitive Touch[1] — I^2C
  - Resistive Touch[2] — 4-Wire Analog
- Module Dimensions
  - DT050BTFT — 120.70mm (W) x 75.80mm (L) x 2.85mm (H)
  - DT050BTFT-PTS — 121.10mm (W) x 76.20mm (L) x 4.75mm (H)
  - DT050BTFT-TS — 120.70mm (W) x 75.80mm (L) x 4.05mm (H)
- Active Area — 108.00mm (W) x 64.80mm (L)
- Pixel Pitch — 0.135mm (W) x 0.135mm (L)
- Viewing Direction — All
- Backlight Type — LED, White
- Drivers
  - TFT — ILI6137 / ILI5960
  - Capacitive Touch — FT5426

1.3 Acronyms

- FPC — Flexible Printed Circuit
- I^2C — Inter-Integrated Circuit
- LCD — Liquid Crystal Display
- LED — Light Emitting Diode
- PCAP — Capacitive Touch
- RGB — Red-Green-Blue
- TFT — Thin-Film Transistor

[1] DT050BFT-PTS only
[2] DT050BTFT-TS only

2 Pin Descriptions

LCD INTERFACE[3]			
PIN	**NAME**	**TYPE**	**DESCRIPTION**
1	LED-K	PWR	LED Backlight, Cathode
2	LED-A	PWR	LED Backlight, Anode
3	NC	–	No connection
4	VDD	PWR	Supply voltage
5 ~ 12	R0 ~ R7	I	Red data bus
13 ~ 20	G0 ~ G7	I	Green data bus
21 ~ 28	B0 ~ B7	I	Blue data bus
29	GND	PWR	Ground
30	CLK	I	Pixel Clock
31	DISP	I	Display on
32	HSYNC	I	Horizontal sync
33	VSYNC	I	Vertical sync
34	DE	I	Data input enable
35	NC	–	No connection
36	GND	PWR	Ground
37	NC (XR[4])	O	Resistive touch panel, X+
38	NC (YD[4])	O	Resistive touch panel, Y-
39	NC (XL[4])	O	Resistive touch panel, X-
40	NC (YU[4])	O	Resistive touch panel, Y+

CAPACITIVE TOUCH INTERFACE[5]			
PIN	**NAME**	**TYPE**	**DESCRIPTION**
1	VDD-3V3	PWR	3.3V Supply voltage
2	SCL	I	I^2C clock
3	SDA	I	I^2C data
4	$\overline{\text{INT}}$	O	Interrupt
5	$\overline{\text{RST}}$	I	Reset
6	GND	PWR	Ground

[3] Recommended mating connector: FH12A-40S-0.5SH(55) or equivalent
[4] DT050BTFT-TS only
[5] DT050BTFT-PTS only. Recommended mating connector: FH12-6S-0.5SH(55) or equivalent.

3 Specifications

3.1 Absolute Maximum Ratings[6]

ELECTRICAL				
PARAMETER		**MIN**	**MAX**	**UNIT**
Supply Voltage, Analog	V_{DD}	-0.5	5.0	V
Supply Voltage, PCAP	V_{DD-3V3}	-0.3	3.6	V
Backlight Current	I_F	–	75	mA

ENVIRONMENTAL				
PARAMETER		**MIN**	**MAX**	**UNIT**
Operating Temperature	T_{OP}	-20	70	°C
Storage Temperature	T_{ST}	-30	80	°C

3.2 Electrical Characteristics

POWER					
PARAMETER		**MIN**	**TYP**	**MAX**	**UNIT**
Supply Voltage, LCD	V_{DD}	3.0	3.3	3.6	V
Supply Voltage, Capacitive Touch	V_{DD-3V3}	2.7	3.3	3.6	V
Supply Current, Total	I_{DD}	–	22.0	–	mA

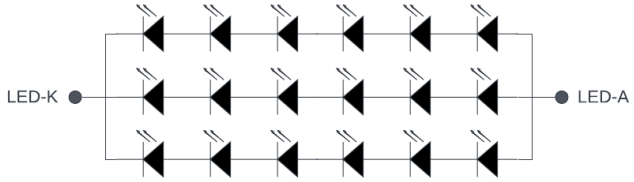
LOGIC					
PARAMETER		**MIN**	**TYP**	**MAX**	**UNIT**
Input Voltage, High	V_{IH}	0.7 x V_{DD}	–	V_{DD}	V
Input Voltage, Low	V_{IL}	0	–	0.3 x V_{DD}	V
Output Voltage, High	V_{OH}	V_{DD} - 0.1	–	V_{DD}	V
Output Voltage, Low	V_{OL}	–	–	GND + 0.4	V

LED BACKLIGHT					
PARAMETER		**MIN**	**TYP**	**MAX**	**UNIT**
Forward Current[7]	I_F	–	60	–	mA
Forward Voltage	V_F	–	19.2	21.0	V
LED Lifetime[8]	–	–	50,000	–	Hr

[6] Operation outside of the maximum ratings listed here may result in permanent damage to the LCD.
[7] Backlight Power Consumption: 1.15W (typ)
[8] LED lifetime is defined as the amount of time it takes for brightness to decrease to 50% of its original value at T_A = 25 °C and I_F = 60 mA. LED lifetime may decrease if operating current, I_F, is higher than 60 mA.

3.2.1 LED Backlight Circuit Diagram

Figure 1: DT050BTFT LED Backlight

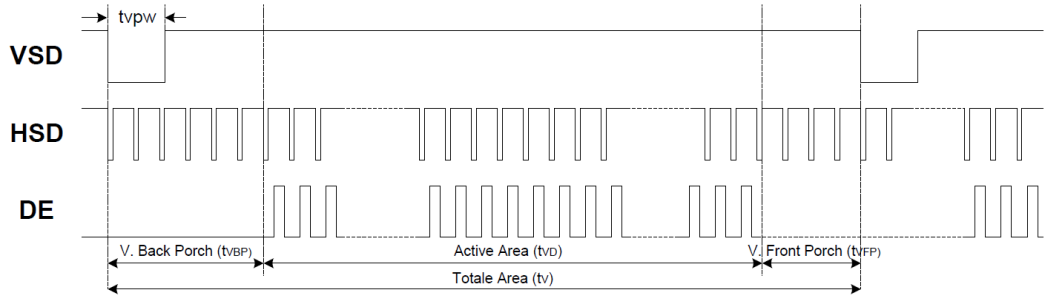


6 x 3 = 18 LEDs, I_F = 60mA (Typ.)

4 Display Data Input Timing

4.1 Vertical Input Timing

Figure 2: Timing Diagram, Vertical Input

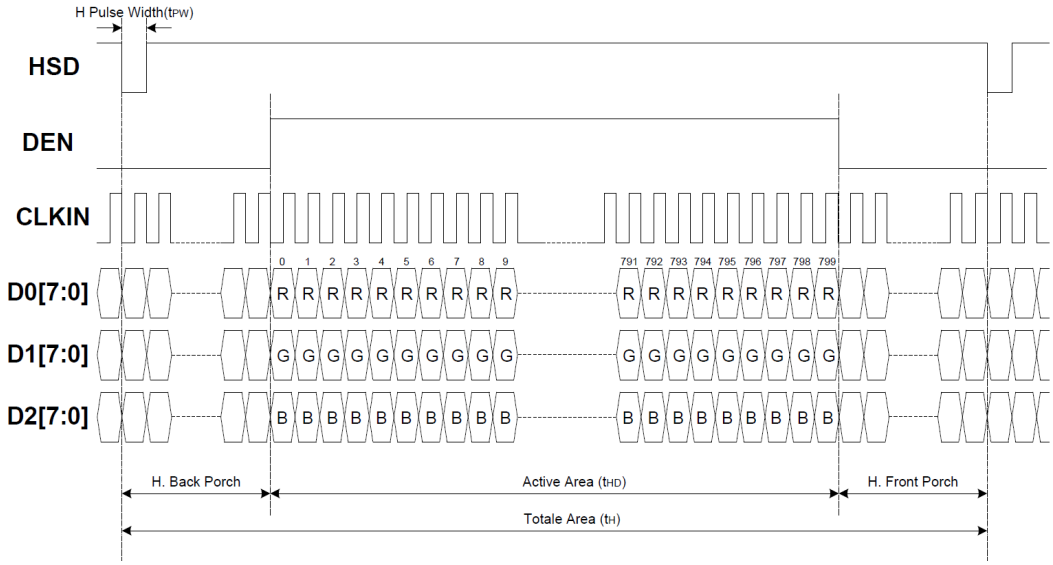


VERTICAL INPUT TIMING					
PARAMETER		**MIN**	**TYP**	**MAX**	**UNIT**
Vertical Display Area	t_{VD}	–	480	–	HSD
VSD Period	t_V	510	525	650	HSD
VSD Pulse Width	t_{VPW}	1	–	20	HSD
VSD Back Porch	t_{VBP}	23	23	23	HSD
VSD Front Porch	t_{VFP}	7	22	147	HSD

4.2 Horizontal Input Timing

Data on the 24-bit RGB bus will be treated as active display data when DE = High.

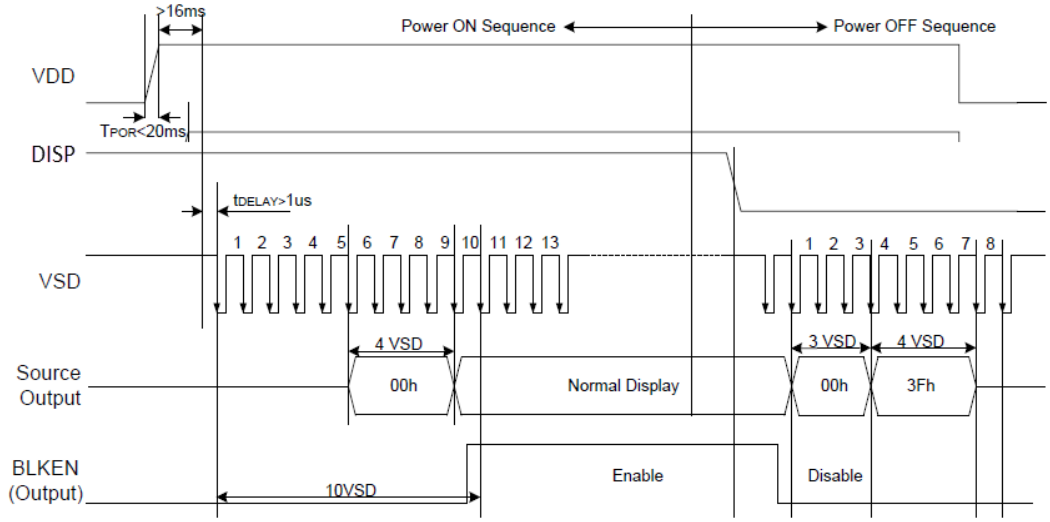
Figure 3: Timing Diagram, Horizontal Input



HORIZONTAL INPUT TIMING					
PARAMETER		**MIN**	**TYP**	**MAX**	**UNIT**
Horizontal Display Area	t_{HD}	–	800	–	CLK
CLK Frequency	f_{CLK}	–	33.3	50	MHz
1 Horizontal Line Period	t_H	862	1056	1200	CLK
HSD Pulse Width	t_{HPW}	1	–	40	CLK
HSD Back Porch	t_{HBP}	46	46	46	CLK
HSD Front Porch	t_{HFP}	16	210	354	CLK

4.3 Power On/Off

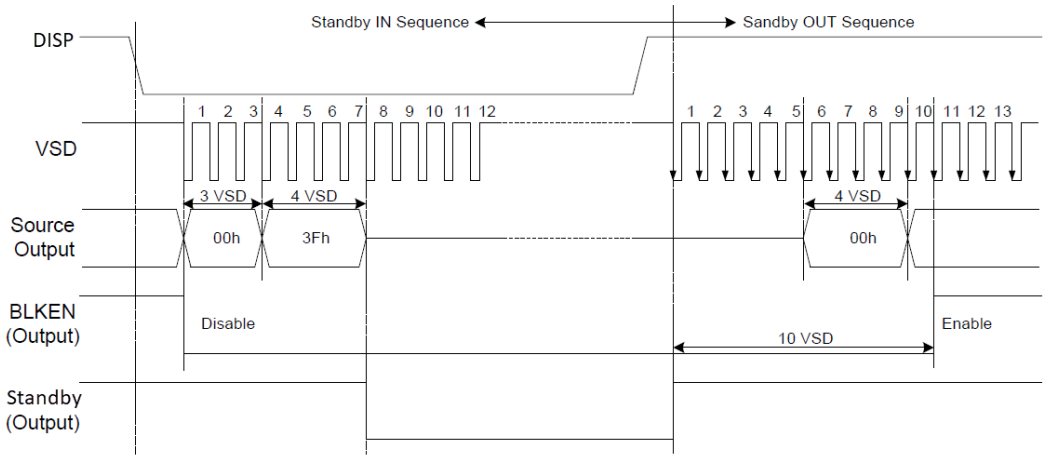
Figure 4: Power On/Off Sequence



4.4 Display Standby

To save power, put the display in standby mode by setting DISP = Low.

Figure 4: Standby Sequence



5 AC Timing Characteristics

Figure 5: AC Timing Characteristics

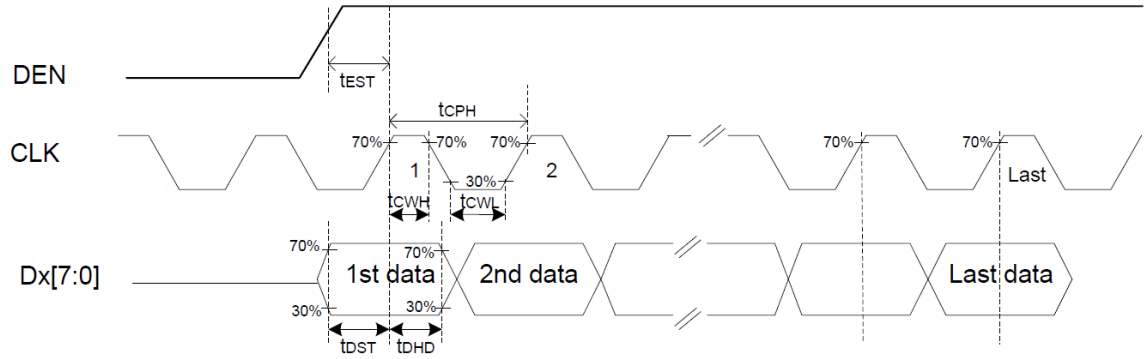


Figure 6: Source Output Timing Diagram

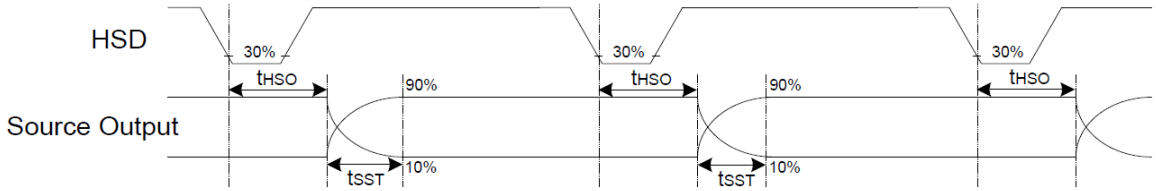


Figure 7: Vertical Timing Diagram

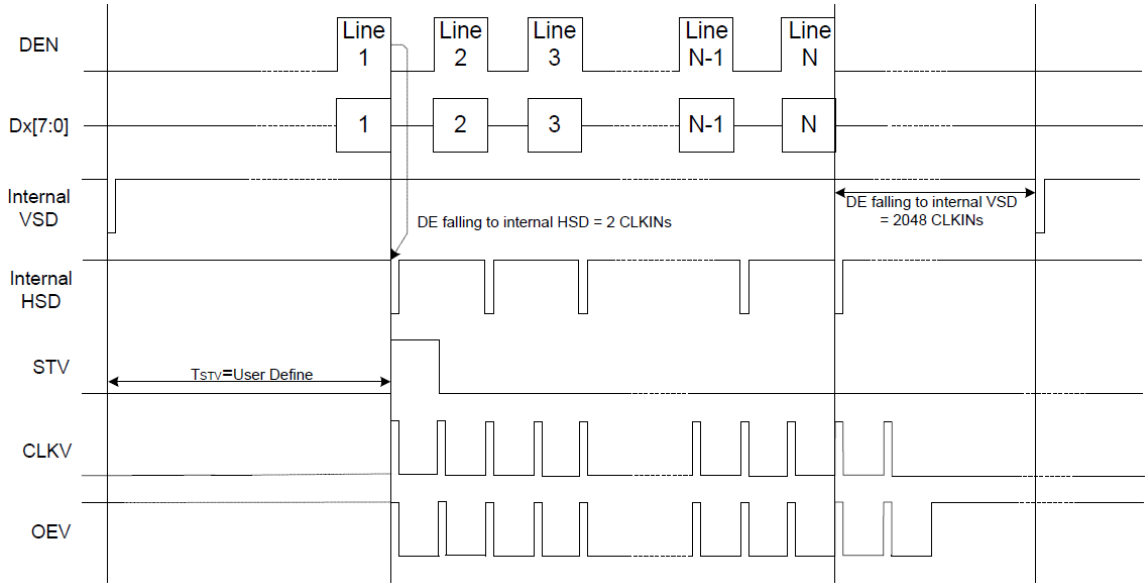
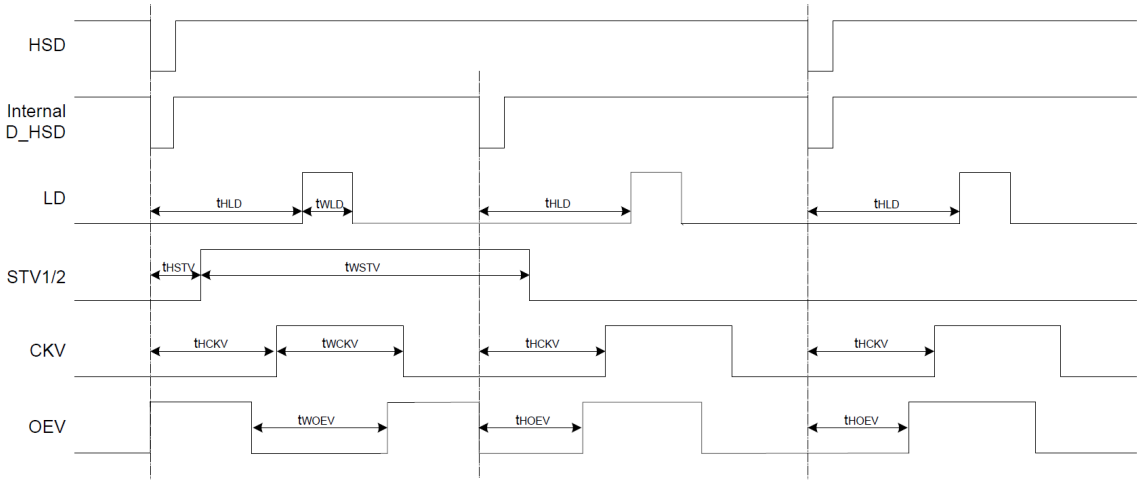


Figure 8: Gate Output Timing Diagram



AC TIMING CHARACTERISTICS[9]					
PARAMETER		**MIN**	**TYP**	**MAX**	**UNIT**
VDD Power on slew rate	t_{POR}	–	–	20	ms
RSTB Pulse Width	t_{RST}	10	–	–	µs
CLK Cycle Time	t_{CPH}	20	–	–	ns
CLK Pulse Duty	t_{CWH}	40	50	60	%
VSD Setup time	t_{VST}	8	–	–	ns
VSD Hold time	t_{VHD}	8	–	–	ns
HSD Setup time	t_{HST}	8	–	–	ns
HSD hold time	t_{HHD}	8	–	–	ns
Data setup time	t_{DST}	8	–	–	ns
Data hold time[7]	t_{DHD}	8	–	–	ns
DE setup time	t_{EST}	8	–	–	ns
DE hold time	t_{EHD}	8	–	–	ns
Output Stable time	t_{SST}	–	–	6	µs
CLK Frequency	f_{CLK}	–	40	50	MHz
CLK Cycle Time	t_{CLK}	20	25	–	ns
CLK Pulse Duty	t_{CWH}	40	50	60	%
Time from HSD to Source Output	t_{HSO}	–	20	–	CLK
Time from HSD to LD	t_{HLD}	–	20	–	CLK
Time from HSD to STV	t_{HSTV}	–	2	–	CLK
Time from HSD to CKV	t_{HCKV}	–	20	–	CLK
LD Pulse Width	t_{WLD}	–	10	–	CLK
CKV Pulse Width	t_{WCKY}	–	66	–	CLK
OEV Pulse Width	t_{WOEV}	–	74	–	CLK

[9] V_{DD} = 3.0V ~ 3.6V, GND = 0V, T_A = -20°C ~ +85°C, CLK = 50 MHz. See ILI6137 datasheet for details.

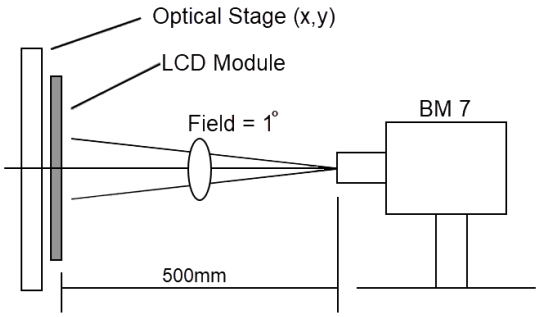
6 Optical Characteristics

OPTICAL CHARACTERISTICS[10]					
PARAMETER		**MIN**	**TYP**	**MAX**	**UNIT**
Contrast Ratio[11,12]	CR	400	500	–	–
Response Time[13]	T_{ON} / T_{OFF}	–	20	30	mS
Viewing Angles[14,15]	ΘT	–	80	–	°C
	ΘB	–	80	–	
	ΘL	–	80	–	
	ΘR	–	80	–	
Chromaticity[16]	X_{RED}	TYP - 0.05	0.618	TYP + 0.05	–
	Y_{RED}		0.326		
	X_{GRN}		0.317		
	Y_{GRN}		0.568		
	X_{BLU}		0.127		
	Y_{BLU}		0.165		
	X_{WHT}		0.330		
	Y_{WHT}		0.357		
NTSC[16]	S	–	50	–	%
Luminance[12]					
DT050BTFT	L	–	500	–	cd/m^2
DT050BTFT-PTS		–	430	–	
DT050BTFT-TS		–	400	–	
Uniformity[12]	U	75	80	–	%

[10] See Section 7.1, Figure 3
[11] Viewing Angle (Θ) = 0°
[12] See Section 7.1, Figure 7
[13] See Section 7.1, Figure 4
[14] Contrast Ratio (CR) ≥ 10
[15] See Section 7.1, Figure 5
[16] See Section 7.1, Figure 6

7 Figures

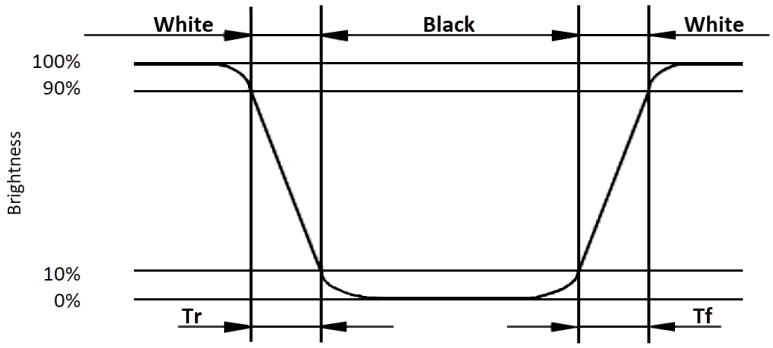
Figure 3: Optical Measurement System



Conditions:

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

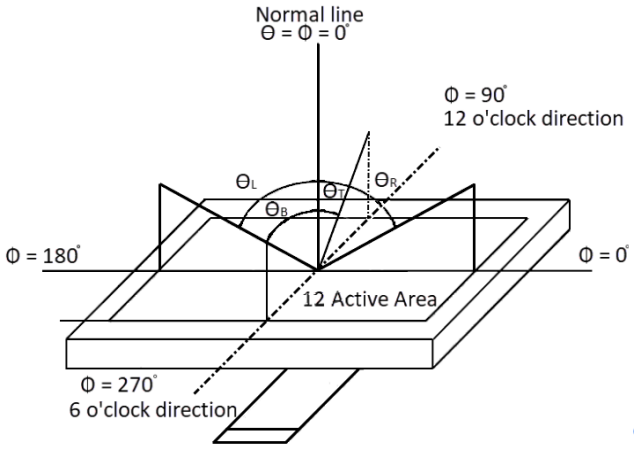
Figure 4: Response Times



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

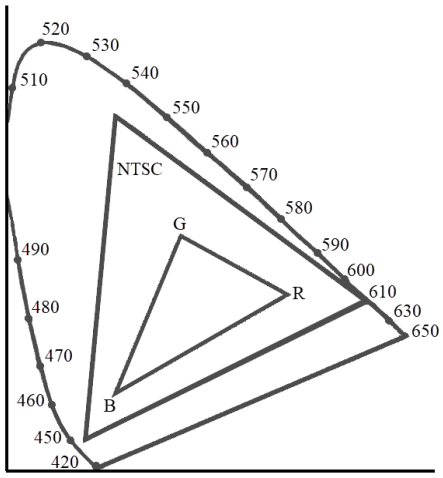
Rise Time (T_R) = Time required for display to transition from black to white

Figure 5: Viewing Angles



Viewing angle is measured from center point of LCD

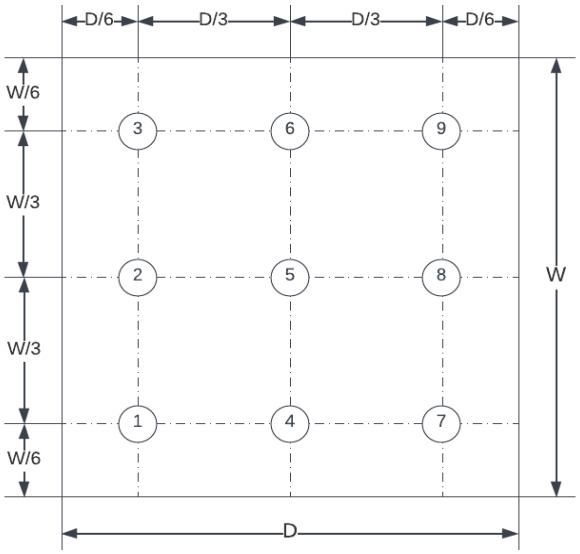
Figure 6: Chromaticity (CIE 1931)



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

* Color coordinates measured at center point of LCD

Figure 7: 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 $Luminance_{MIN}$ / $Luminance_{MAX}$

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

8 Environmental/Reliability Testing

Judgment is based on inspection performed after testing, per criteria described in the Inspection Criteria table.[17]

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

8.1 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

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

9 Precautions for Use of LCD Modules

9.1 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.

9.2 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.

9.3 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.

9.4 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.

9.5 Cleaning

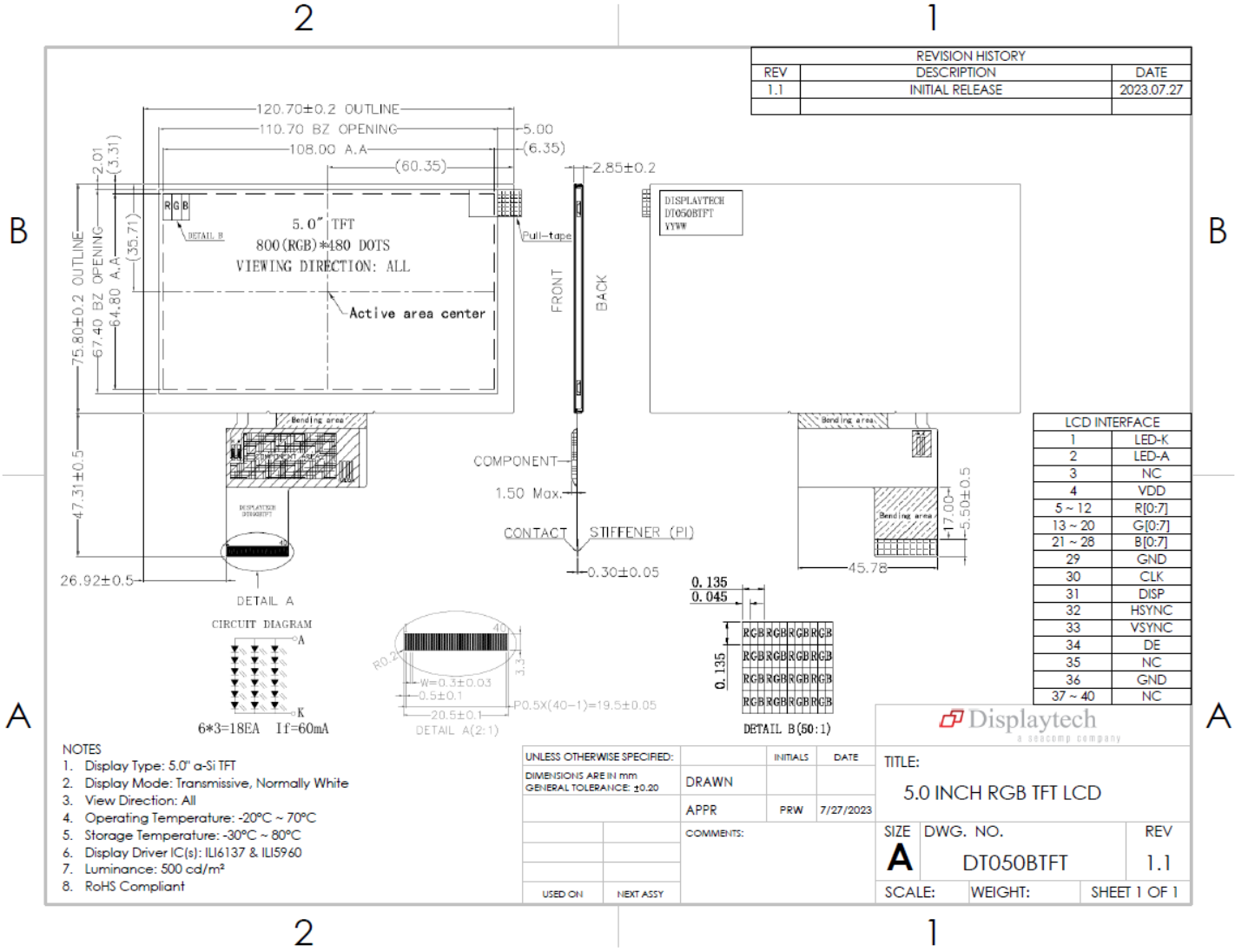
A. To clean the product, wipe with a soft cloth moistened with ethanol. Do not allow ethanol to get between upper film and bottom glass, as this may cause peeling issues and/or defective operation. Do not use any organic solvent or detergent other than ethanol.

9.6 Cautions for installation and assembly

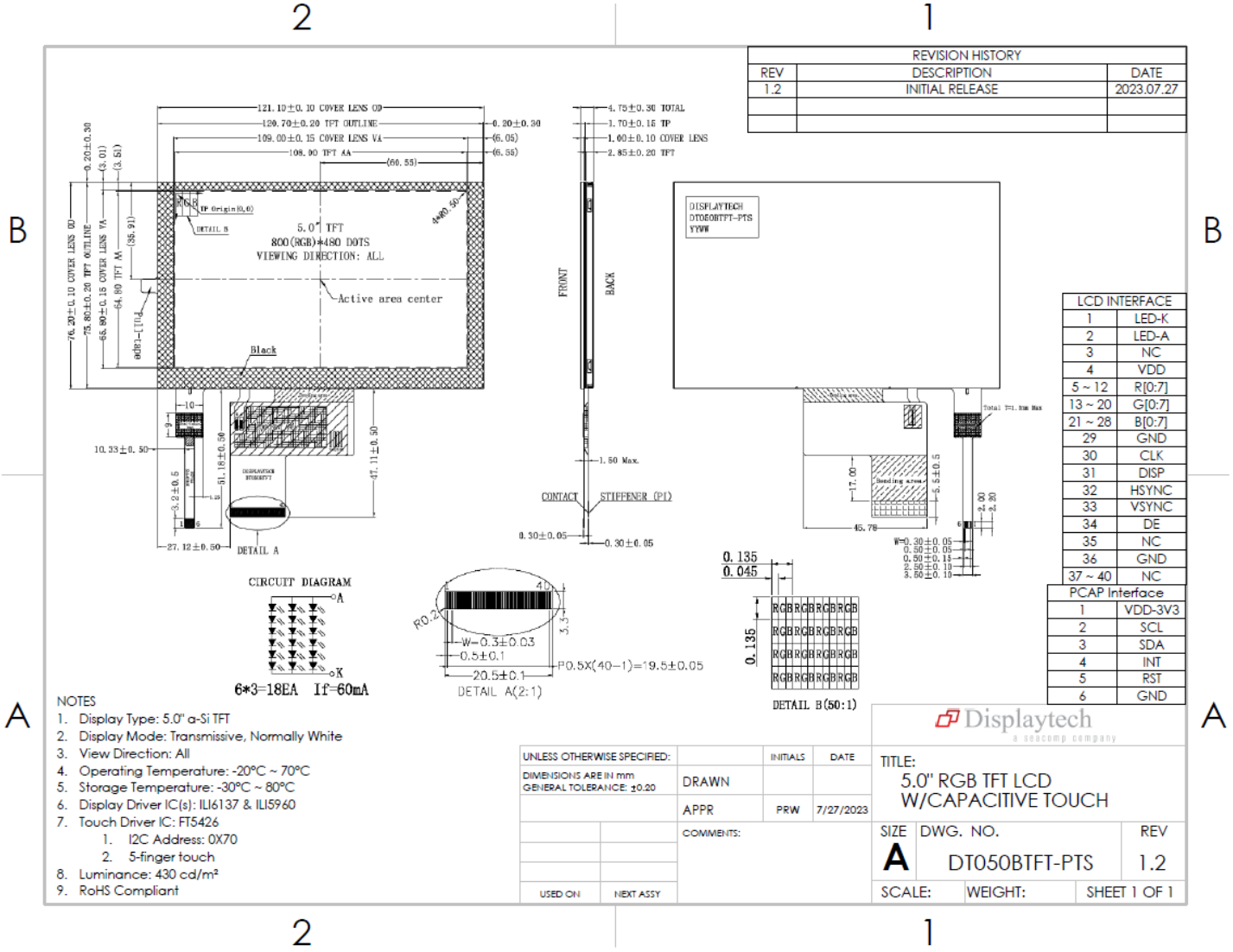
A. Bezel edge must be positioned between Active area and Viewing area.
B. For a stable display assembly, Displaytech recommends designing a support for the backside of the display.
C. Do not display any fixed pattern for long periods of time. If a fixed pattern must be displayed, use a screen saver in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

10 Mechanical Drawings

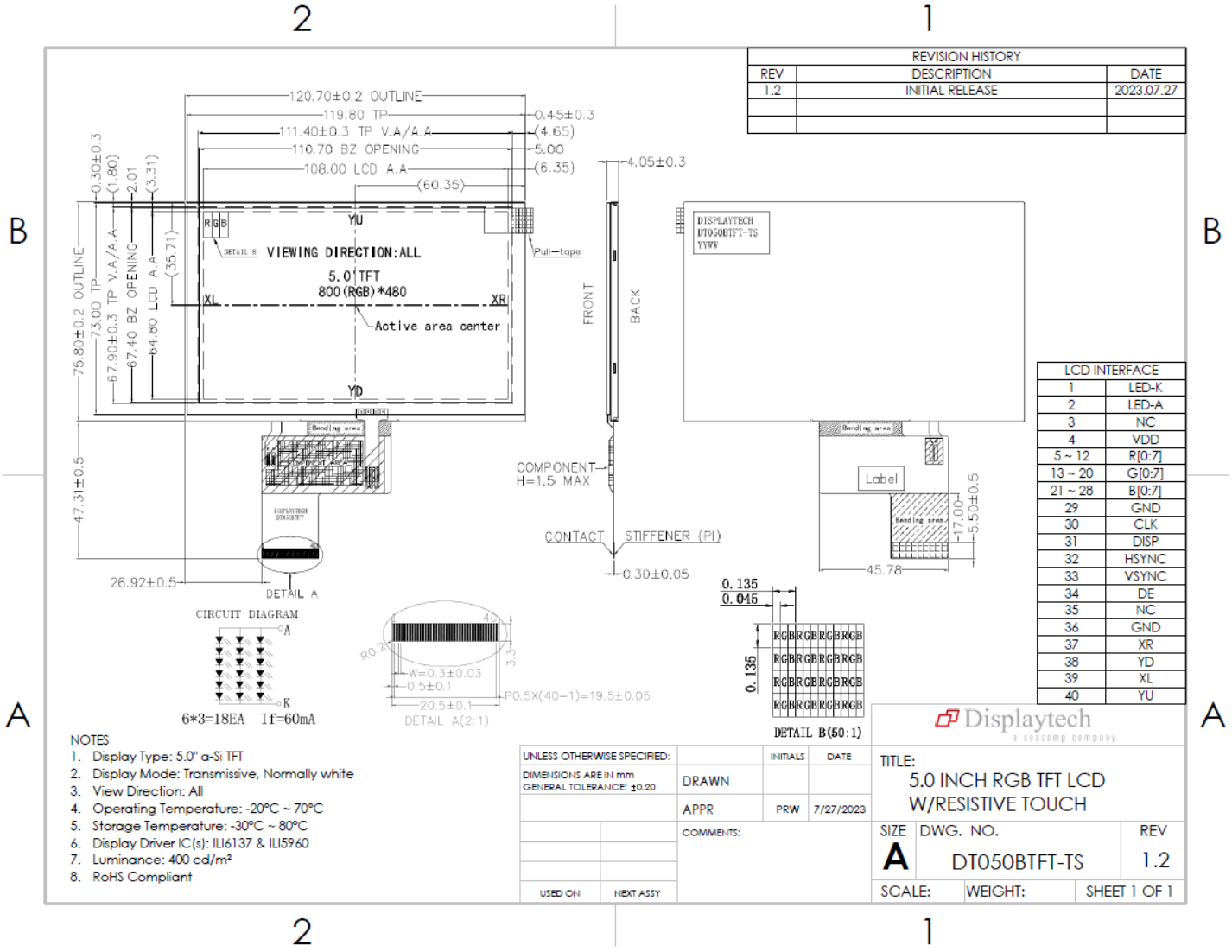
10.1 DT050BTFT



10.2 DT050BTFT-PTS



10.3 DT050BTFT-TS



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