

# PRODUCT SPECIFICATION

3.5" IPS LCD Module with RGB and SPI Interface  
DT035CTFT-IPS-SHB, DT035CTFT-IPS-SHB-PTS

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Revision 1.0  
10 April 2025

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## Revision History

REV	CHANGE DESCRIPTION	DATE	APPR
1.0	Initial Release	10 APR 2025	BHI

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## 1 Overview

The **DT035CTFT-IPS-SHB** and **DT035CTFT-IPS-SHB-PTS** are 3.5" color IPS LCD modules with wide formfactor. Each composed of an LCD panel, display drivers, FPC display cable with RGB and SPI interface, and adjustable LED backlight unit. The display's active area has a resolution of 320 x 480 pixels. The DT035CTFT-IPS-SHB-PTS, is equipped with an additional capacitive touch panel.

### 1.1 Applications

- Industrial devices
- Consumer devices
- Medical devices

### 1.2 LCD Features

Model No.		DT035CTFT-IPS-SHB	DT035CTFT-IPS-SHB-PTS
<b>LCD Panel</b>	Display Size	3.5"	3.5"
	Resolution	320 (RGB) x 480	320 (RGB) x 480
	Viewing Angle (U/D/L/R)	80° / 80° / 80° / 80°	80° / 80° / 80° / 80°
	Brightness	1,000 cd/m <sup>2</sup>	850 cd/m <sup>2</sup>
	Backlight Life	30,000 hrs	30,000 hrs
	Contrast Ratio	700:1	700:1
	Response Time	30 ms	30 ms
	Voltage	3.3 V Power	3.3 V Power
	Signal Interface	4-Line SPI & 16-bit RGB	4-Line SPI & 16-bit RGB
	Dimension (W x H x D)	54.40 x 86.24 x 3.50 mm	54.40 x 86.24 x 5.50 mm
<b>Touch Screen</b>	Touch Screen	N/A	Capacitive Touch Screen
	Signal Interface		I <sup>2</sup> C
	Surface Hardness		≥ 6H
<b>Environment</b>	Operating Temperature	-20°C to +70°C	-20°C to +70°C
	Storage Temperature	-30°C to +80°C	-30°C to +80°C

## 2 Pin Descriptions

LCD INTERFACE			
PIN	NAME	TYPE	DESCRIPTION
1	<u>RST</u>	I	Display reset (active low)
2	<u>CSX</u>	I	Chip select (active low)
3	DCX	I	Display data/command selection (RS) pin in MCU interface: DCX='1': display data or parameter. DCX='0': register index / command.
4	SCK (WRX/SCL)	I	Write enable in MCU parallel interface. In SPI mode, this pin is used as SCL.
5	MOSI	I	4 SPI interface input pin
6	MISO	O	4 SPI interface output pin
7	VSYNC	I	Vertical (Frame) synchronizing input signal for RGB interface operation.
8	HSYNC	I	Horizontal (Line) synchronizing input signal for RGB interface operation.
9	DE(ENABLE)	I	Data enable signal for RGB interface operation.
10	DOTCLK	I	Dot clock signal for RGB interface operation.
11~26	DB15~DB0	I	16-bit RGB I/F: DB[15:0] are used. DB[4:0](B0-B4): 5 bit data bus display blue data. DB[5:10](G0-G5): 6 bit data bus display green data. DB[11:15](R0-R4): 5 bit data bus display red data.
27	VDD	PWR	Power supply
28	VDD	PWR	Power supply
29	GND	PWR	Ground
30	TP_GND <sup>1</sup>	PWR	CTP Power ground
31	TP_RST <sup>1</sup>	I	CTP Reset pin
32	TP_INT <sup>1</sup>	O	CTP Interrupt signal
33	TP_SDA <sup>1</sup>	IO	CTP Data signal
34	TP_SCL <sup>1</sup>	I	CTP Clock signal.
35	TP_IOVCC <sup>1</sup>	PWR	CTP I/O power supply
36	TP_VDD <sup>1</sup>	PWR	CTP Power supply
37	NC		Not Connected
38	LED-A	PWR	LED backlight, anode
39	LED-K	PWR	LED backlight, cathode

<sup>1</sup> Only DT035CTFT-IPS-SHB-PTS. For DT035CTFT-IPS-SHB, these pins are Not Connected (NC).

### 3 Specifications

#### 3.1 Absolute Maximum Ratings

Operation outside of the maximum ratings listed below may result in permanent damage to the LCD.

ELECTRICAL				
PARAMETER		MIN	MAX	UNIT
Supply Voltage	V <sub>DD</sub>	-0.3	4.6	V
Logic Input Voltage	V <sub>IN</sub>	-0.3	V <sub>DDIO</sub> + 0.3	V
Logic Output Voltage	V <sub>OUT</sub>	-0.3	V <sub>DDIO</sub> + 0.3	V

ENVIRONMENTAL				
PARAMETER		MIN	MAX	UNIT
Operating Temperature	T <sub>OP</sub>	-20	+70	°C
Storage Temperature	T <sub>ST</sub>	-30	+80	°C

#### 3.2 Electrical Characteristics

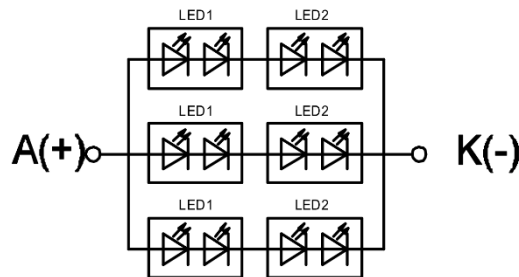
POWER					
PARAMETER		MIN	TYP	MAX	UNIT
Supply Voltage	V <sub>DD</sub>	3.15	3.3	3.45	V
Supply Current	I <sub>DD</sub>	–	–	TBD	mA

LOGIC					
PARAMETER		MIN	TYP	MAX	UNIT
Input Voltage, High	V <sub>IH</sub>	0.7 x V <sub>DDIO</sub>	–	V <sub>DDIO</sub>	V
Input Voltage, Low	V <sub>IL</sub>	0	–	0.3 x V <sub>DDIO</sub>	V
Output Voltage, High	V <sub>OH</sub>	0.8 x V <sub>DDIO</sub>	–	V <sub>DDIO</sub>	V
Output Voltage, Low	V <sub>OL</sub>	0	–	0.2 x V <sub>DDIO</sub>	V

### 3.3 Backlight Characteristics

LED BACKLIGHT						
PARAMETER		MIN	TYP	MAX	UNIT	Remark
Forward Current	$I_F$	–	60	–	mA	6 LEDs
Forward Voltage	$V_F$	11.4		13.4	V	6 LEDs
Reverse Current	$I_r$			25	uA	$V_r=5.0V$ , 1LED
Luminous Tolerance	$I_v-m$	80			%	$(\min/\max)*100\%$
Power dissipation	$P_d$				mW	6 LEDs
Reverse voltage	$V_R$			5	V	1 LED
LED Lifetime <sup>2</sup>	–	–	30,000	–	Hr	

#### 3.3.1 LED Backlight Circuit Diagram

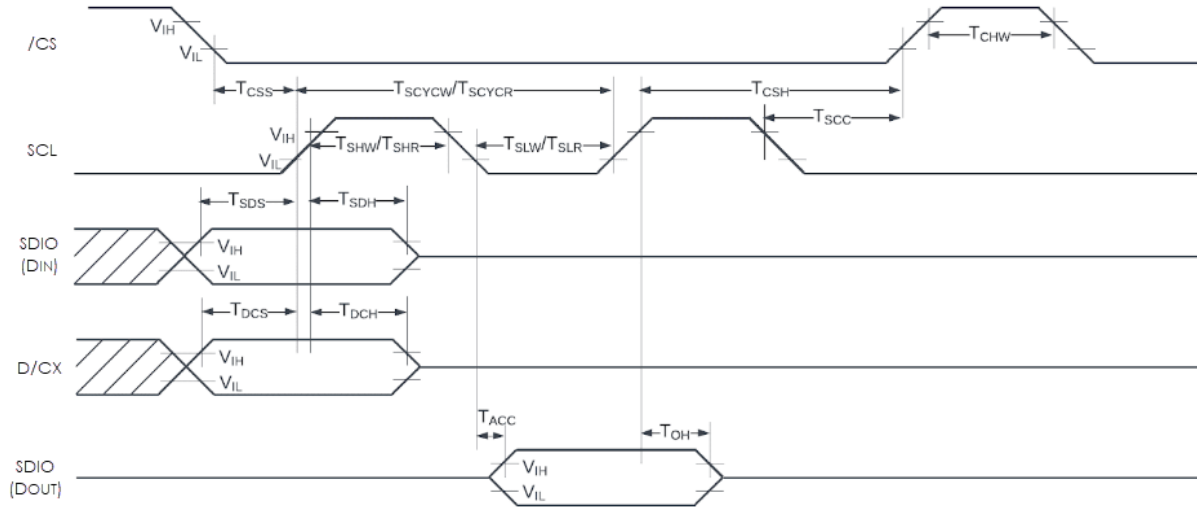


**Figure 1 Backlight**  
 2 x 3 = 6 LEDs,  $I_F = 60 \text{ mA}$

<sup>2</sup> LED lifetime is defined as the amount of time it takes for brightness to decrease to 50% of its original value at  $T_A=25^\circ\text{C}$  and  $I_F=60\text{mA}$ . LED lifetime may decrease if operating current,  $I_F$ , is higher than 60mA.

## 4 Timing Characteristics<sup>3</sup>

### 4.1 4-Wire Serial Interface



**Figure 2:** Timing Diagram, 4-Wire Serial Interface

TIMING CHARACTERISTICS: 4-WIRE SERIAL INTERFACE <sup>4</sup>					
SIGNAL	PARAMETER		MIN	MAX	UNIT
<u>CS</u>	$T_{CSS}$	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
	$T_{SHW}$	S L H pulse width, Write	15	–	nS
	$T_{SLW}$	S L L pulse width, Write	15	–	nS
	$T_{SCYCR}$	Serial clock cycle, Read	150	–	nS
	$T_{SHR}$	S L H pulse width, Read	60	–	nS
	$T_{SLR}$	S L 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	$T_{SDS}$	Data setup time	10	–	nS

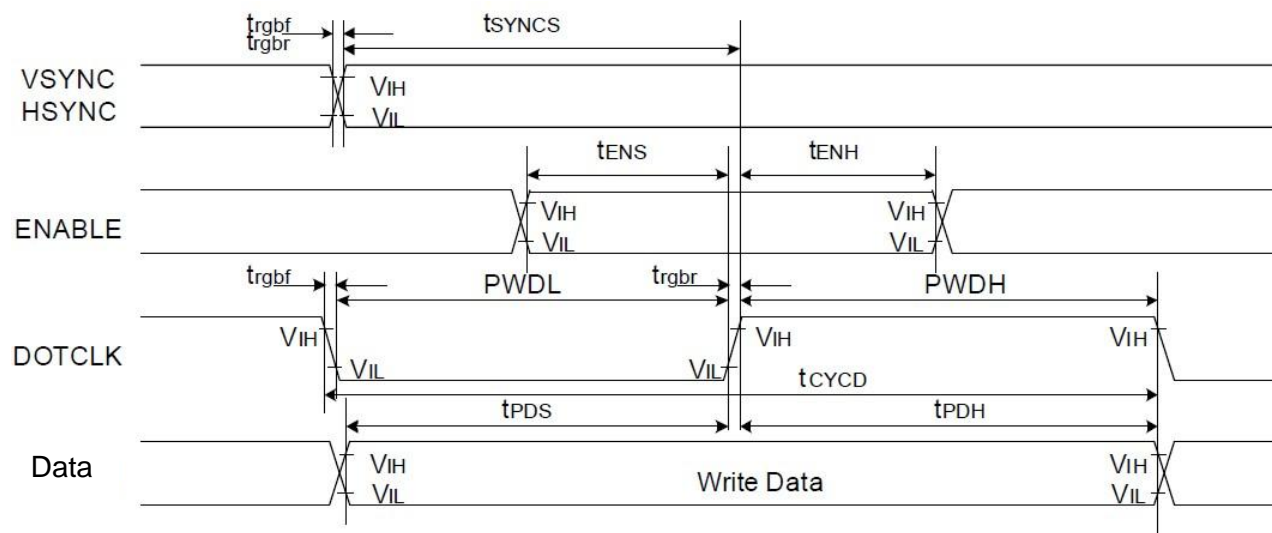
<sup>3</sup> Input signal rise & fall times are specified at 15 nS or less.

Logic high & low levels are specified as 10% - 90% of  $V_{DDIO}$  for input signals.

<sup>4</sup> GND = 0V,  $V_{DDIO}$  = 1.65V ~ 3.3V,  $V_{DD}$  = 2.6V ~ 3.3V,  $T_A$  = -30°C ~ 70°C

(DIN)	T <sub>SDH</sub>	Data hold time	10	–	nS
DOUT	T <sub>ACC</sub>	Access time <sup>5</sup>	10	50	nS
	T <sub>OH</sub>	Output disable time <sup>7</sup>	15	50	nS

## 4.2 RGB Interface

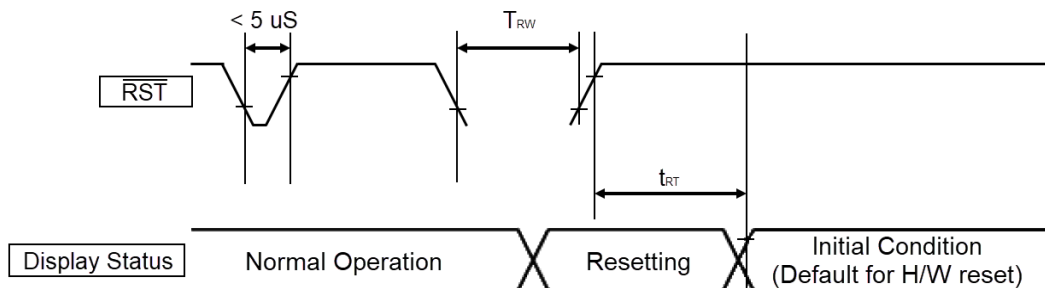


**Figure 3:** Timing Diagram, RGB Interface

TIMING CHARACTERISTICS: RGB INTERFACE, 16-BIT					
SIGNAL		PARAMETER	MIN	MAX	UNIT
HSYNC, VSYNC	T <sub>SYNCS</sub>	VSYNC, HSYNC Setup Time	30	–	nS
	ENABLE	T <sub>ENS</sub>	Enable Setup Time	25	–
ENABLE	T <sub>ENH</sub>	Enable Hold Time	25	–	nS
	DOTCLK	PWDH	D/CX Setup time	60	–
PWDL		D/CX Hold time	60	–	nS
T <sub>CYCD</sub>		DOTCLK Cycle Time	120	–	nS
Trghr, Trghf		DOTCLK Rise/Fall Time	–	20	nS
DB	T <sub>PDS</sub>	PD Data Setup Time	50	–	nS
	T <sub>PDH</sub>	PD Data Hold Time	50	–	nS

<sup>5</sup> For maximum  $C_L = 30\text{pF}$ , Minimum  $C_L = 8\text{pF}$

### 4.3 Reset Timing



**Figure 4: Reset Timing**

RESET TIMING CHARACTERISTICS <sup>6</sup>					
PARAMETER		MIN	TYP	MAX	UNIT
Pulse width, Reset low	$t_{RSTWW}$	10	–	–	μS
Pulse width, Reset complete					
Sleep In mode	$t_{RST(I)}$	–	–	5	mS
Sleep Out mode	$t_{RST(O)}$	–	–	120	mS

### 4.4 CTP Power Sequence

In power down mode, all the clocks of ST1633i are stopped. The way to exit power down mode is by a hardware reset or I2C.

Host application can reset ST1633i through RESET pin. The RESET pin is active low and needs to be held low for 1 μs to take effect.

<sup>6</sup> GND = 0V,  $V_{DDIO}$  = 1.65V ~ 1.95V,  $V_{DD}$  = 2.6V ~ 2.9V,  $T_A$  = -30°C ~ 70°C

## 5 Optical Characteristics

OPTICAL CHARACTERISTICS <sup>7</sup>						
PARAMETER		MIN	TYP	MAX	UNIT	
Contrast Ratio <sup>8,9</sup>	CR	500	700	–	–	
Response Time <sup>10</sup>	T <sub>ON</sub> / T <sub>OFF</sub>	–	30	35	mS	
Viewing Angles <sup>11,12</sup>	Θ <sub>T</sub>	70	80	–	°	
	Θ <sub>B</sub>	70	80	–		
	Θ <sub>L</sub>	70	80	–		
	Θ <sub>R</sub>	70	80	–		
Chromaticity <sup>13</sup>	X <sub>RED</sub>	–	TBD	–	–	
	Y <sub>RED</sub>	–	TBD	–		
	X <sub>GRN</sub>	–	TBD	–		
	Y <sub>GRN</sub>	–	TBD	–		
	X <sub>BLU</sub>	–	TBD	–		
	Y <sub>BLU</sub>	–	TBD	–		
	Y <sub>WHT</sub>	–	TBD	–		
Luminance <sup>13</sup>	DT035CTFT-IPS-SHB	L	800	1000	–	cd/m <sup>2</sup>
	DT035CTFT-IPS-SHB-PTS		650	850	–	
Uniformity <sup>13</sup>	U	75	–	–	%	

<sup>7</sup> See Section 5.1, Figure 5

<sup>8</sup> Viewing Angle (Θ) = 0°

<sup>9</sup> See Section 5.1, Figure 7

<sup>10</sup> See Section 5.1, Figure 6

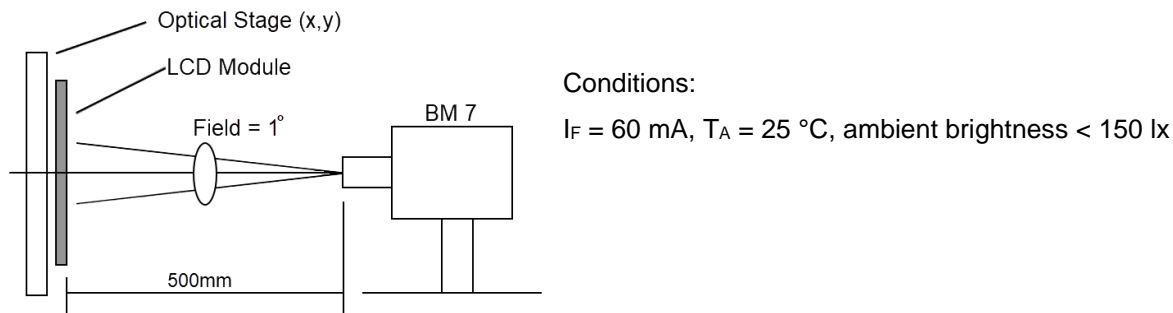
<sup>11</sup> Contrast Ratio (CR) ≥ 10

<sup>12</sup> See Section 5.1, Figure 7

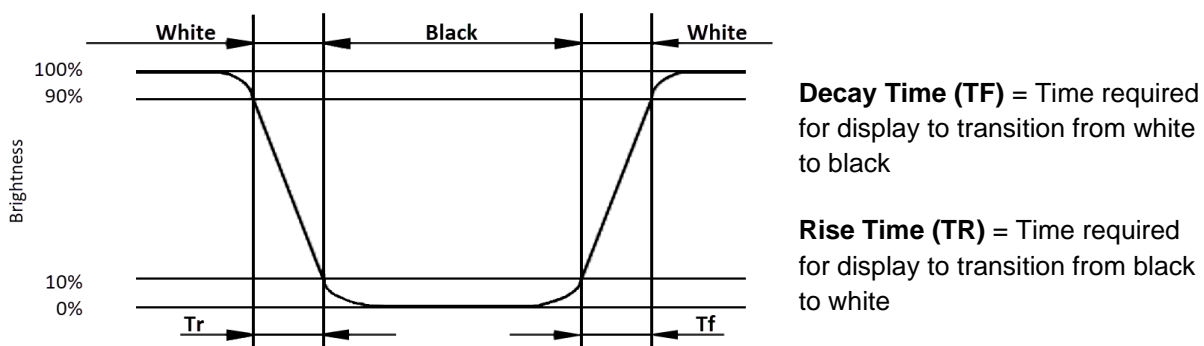
<sup>13</sup> See Section 5.1, Figure 9

## 5.1 Figures

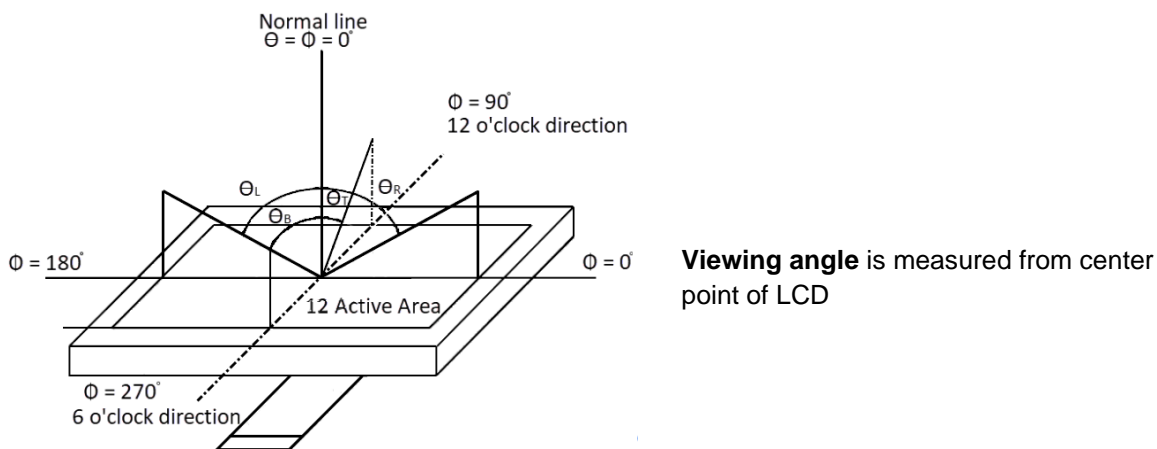
**Figure 5: Optical Measurement System**



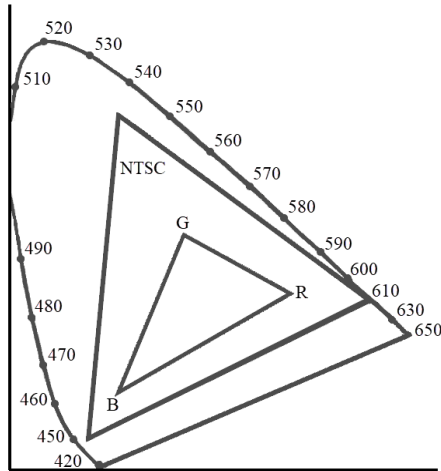
**Figure 6: Response Times**



**Figure 7: Viewing Angles**



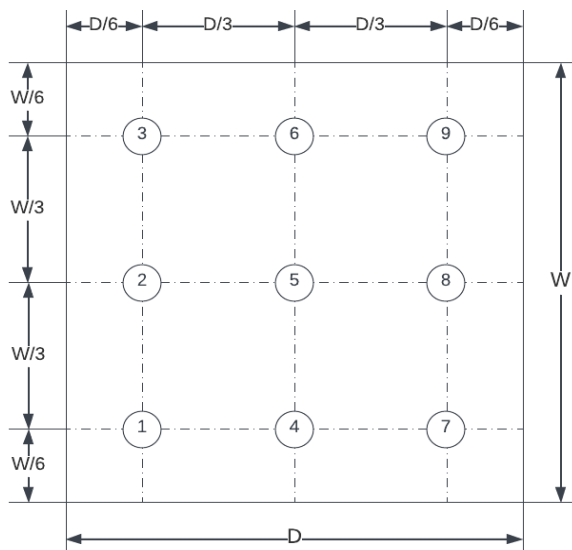
**Figure 8: Chromaticity (CIE 1931)**



**Chromaticity** = Area of  $\Delta_{RGB}$  / Area of  $\Delta_{NTSC}$

\* Color coordinates measured at center point of LCD

**Figure 9: 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** =  $\frac{\text{Surface Luminance}_{WhitePixels}}{\text{Surface Luminance}_{BlackPixels}}$

## 6 Environmental/Reliability Testing

Judgment is based on inspection performed after test, per the Inspection Criteria table.<sup>14</sup>

ITEM UNDER TEST	TEST CONDITION
High Temperature Operation	T <sub>A</sub> = 70°C, 120 Hrs
Low Temperature Operation	T <sub>A</sub> = -20°C, 120 Hrs
High Temperature Storage	T <sub>S</sub> = 80°C, 120 Hrs
Low Temperature Storage	T <sub>S</sub> = -30°C, 120 Hrs
High Temperature & Humidity Storage	T <sub>S</sub> = 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 = 150pF, R = 330Ω, 5 points/panel Air: 8KV (5x), Contact: 4KV (5x)
Vibration (Non-Operation)	Frequency Range: 10Hz ~ 55Hz Stroke: 1.5mm Sweep: 10Hz ~ 55Hz ~ 10Hz 2 Hrs each in X, Y, Z directions
Package Drop Test	Height: 80cm 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

<sup>14</sup> 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 off immediately using soap and water.

### 7.2 Handling

- A. LCD panel is made of plate glass. Do not subject 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. Transparent electrodes may be disconnected if panel is used in an environment where dew condensation is present.
- E. Properties of semiconductor devices may be affected when exposed to light, possibly resulting in integrated circuit (IC) malfunctions. To prevent such malfunctions, design and mounting layout should be done in such a way that IC is not exposed to light during use.

### 7.3 Static electricity

- A. Ground soldering iron tips, tools, and testers while in use.
- B. Ground your body when handling LCD products.
- C. Power on the LCD module before applying the voltage to the input terminals.
- D. Do not apply any voltage that exceeds absolute maximum rating.
- E. Store 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 display to sunlight or fluorescent light.
- B. Storage in a clean environment, free from dust, active gas, and solvents.

### 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 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.

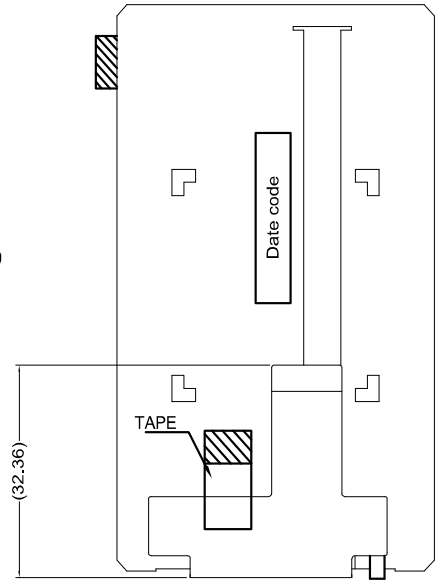
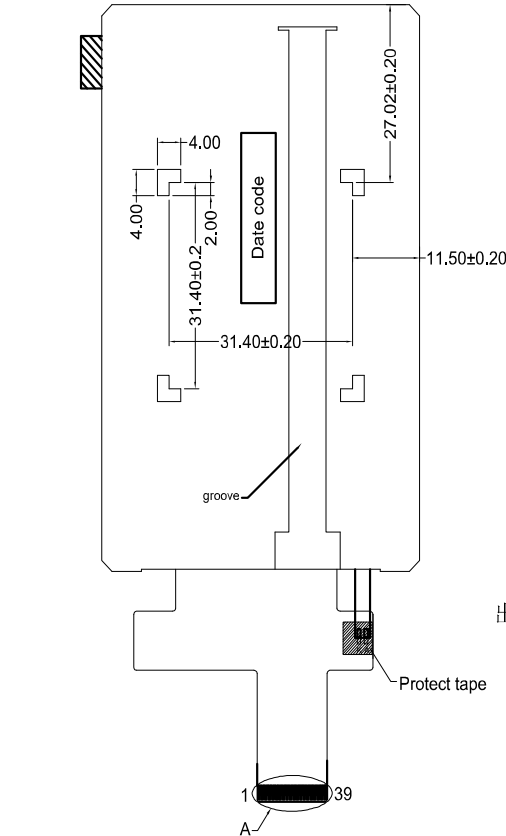
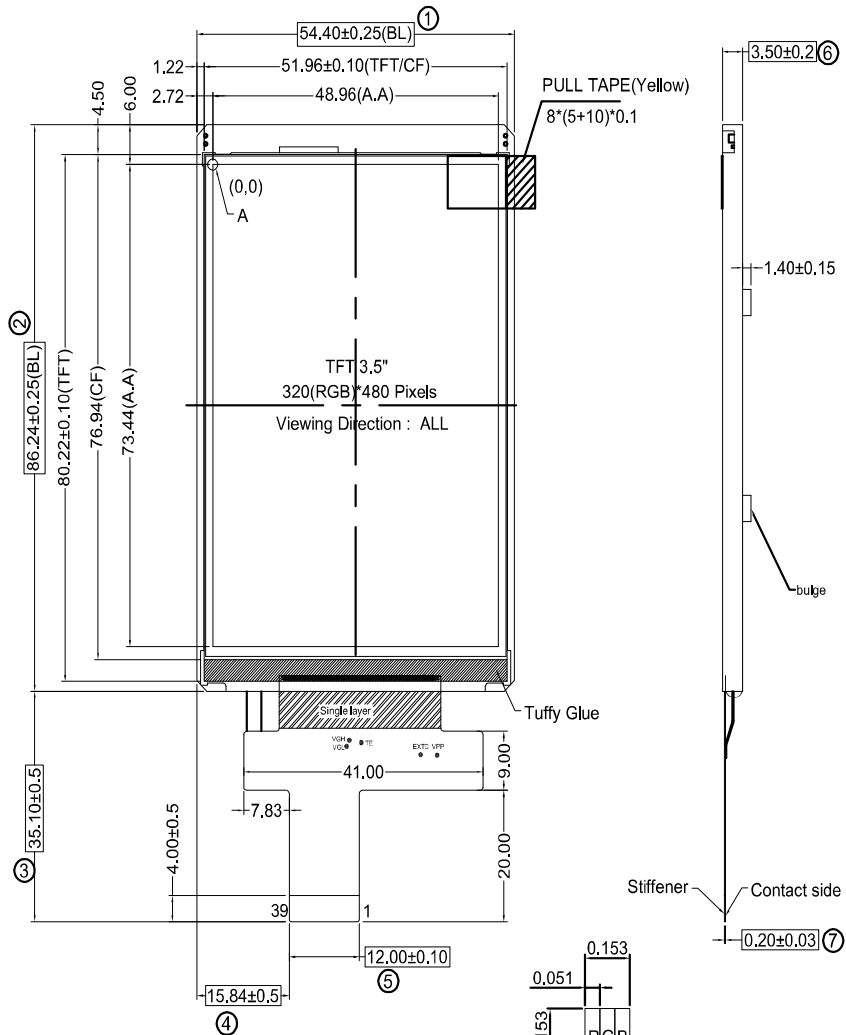
CUSTOMER

CUSTOMER'S CODE

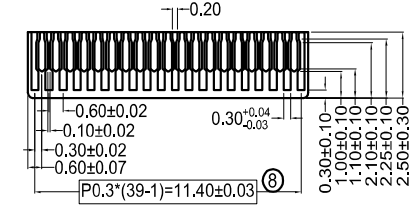
CUSTOMER'S APPROVAL

FPC PIN DEFINE

NO.	PIN TYPE
1	RESET
2	CSX
3	DCX
4	SCK(WRX/SCL)
5	MOSI(SDA)
6	MISO(SDO)
7	VSYNC
8	HSYNC
9	DE(ENABLE)
10	DOTCLK
11	R4(DB15)
12	R3(DB14)
13	R2(DB13)
14	R1(DB12)
15	R0(DB11)
16	G5(DB10)
17	G4(DB9)
18	G3(DB8)
19	G2(DB7)
20	G1(DB6)
21	G0(DB5)
22	B4(DB4)
23	B3(DB3)
24	B2(DB2)
25	B1(DB1)
26	B0(DB0)
27	VDD
28	VDD
29	GND
30	NC
31	NC
32	NC
33	NC
34	NC
35	NC
36	NC
37	NC
38	LED-A
39	LED-K



出貨示意圖 TFT FPC不粘在背光上,用膠帶固定



Detail A

TFT connector: FH26-39S-0.3SHW(0.5)OR Equv

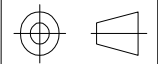
CIRCUIT DIAGRAM (LED) 2\*3=6PCS  
 BL CIRCUIT DIAGRAM

Specification

- 1.Display mode:3.5" -TFT / Transmissive / Normally Black / IPS
- 2.Driving condition: 320 RGB(H) x 480(V), VDD=3.3V
- 3.Back light:6PCS WHITE LED , Vf=11.4~13.4V(Typ) ; If=60mA
- 4.Operating temp: -20°C to 70°C , Storage temp: -30°C to 80°C
- 5.LCM Luminace(cd/m²) : 1000(Typ.)
- 6.Viewing angle: All,80 / 80 / 80 / 80
- 7.Display Driver IC : ST7796UI-G5 8.Connector: FPC
- 9.Interface : 4-Line SPI&16bit RGB 10.Unspecified tolerance: ±0.3mm
- 11.(.):REFERENCE DIMENSION 12. □IMPORTANT DIMENSION
- 13.YYMMDD: Date code (year month day) 14.Remark: RoHS

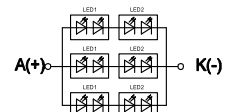
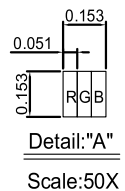
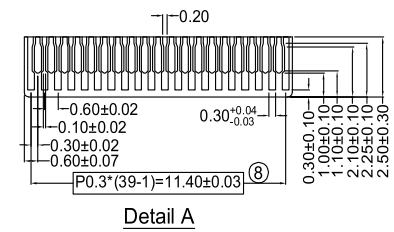
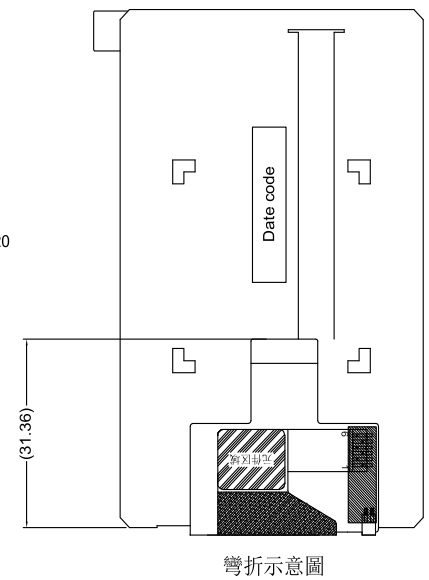
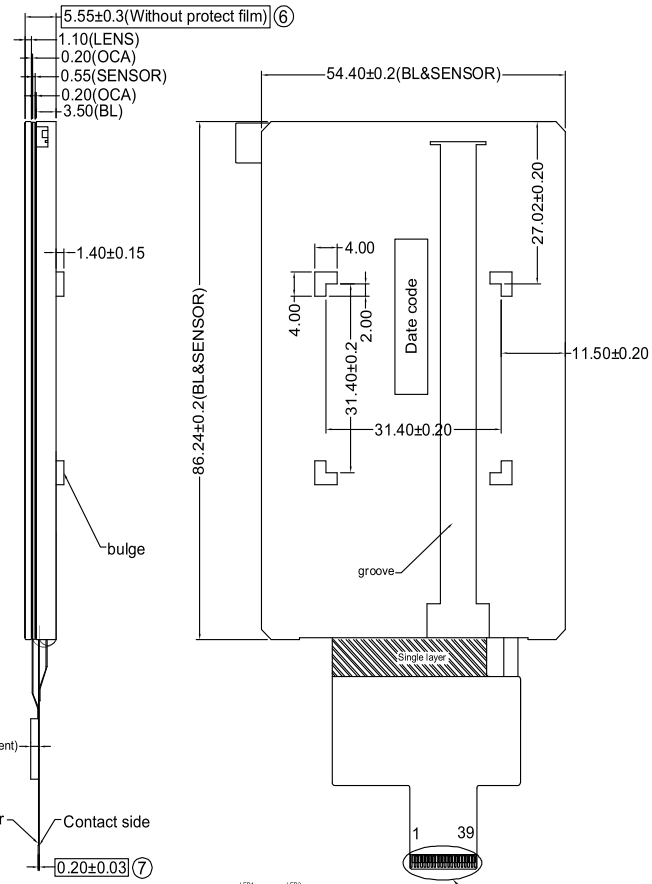
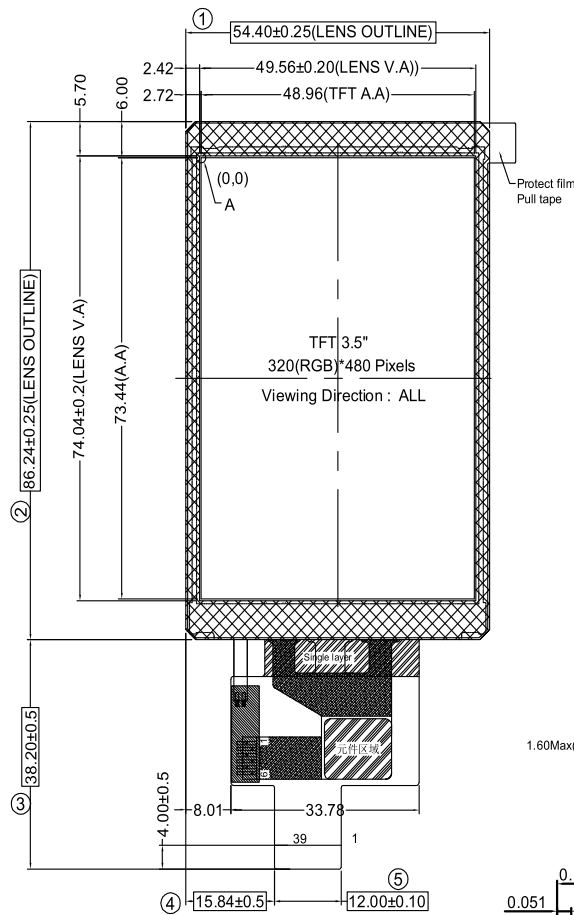
Count drawing & Spec.revision record during discussion with customer

Rec.#	Revision content description	Date
#00	FIRST ISSUE	2024.10.09



Mod.Name		DT035CTFT-IPS-SHB		
UNIT	SIZE	DESIGNER	CHECK	APPROVER
mm	A4	LI Li	Amy Tu	Jony Chen

SCALE	SHEET
NTS	1/1
FILE NAME	
Count Dwg.	



CIRCUIT DIAGRAM (LED) 2\*3=6PCS  
BL CIRCUIT DIAGRAM

TFT connector: FH26-39S-0.3SHW(0.5)OR Eqiv

FPC PIN DEFINE

NO.	PIN TYPE
1	RESET
2	CSX
3	DCX
4	SCK(WRX/SCL)
5	MOSI(SDA)
6	MISO(SDO)
7	VSYNC
8	HSYNC
9	DE(ENABLE)
10	DOTCLK
11	R4(DB15)
12	R3(DB14)
13	R2(DB13)
14	R1(DB12)
15	R0(DB11)
16	G5(DB10)
17	G4(DB9)
18	G3(DB8)
19	G2(DB7)
20	G1(DB6)
21	G0(DB5)
22	B4(DB4)
23	B3(DB3)
24	B2(DB2)
25	B1(DB1)
26	B0(DB0)
27	VDD
28	VDD
29	GND
30	TP_GND
31	TP_RST
32	TP_INT
33	TP_SDA
34	TP_SCL
35	TP_IQVCC
36	TP_VDD
37	NC
38	LED-A
39	LED-K

Specification

- 1.Display mode:3.5" -TFT / Transmissive / Normally Black / IPS
- 2.Driving condition: 320 RGB(H) x 480(V), VDD=3.3V
- 3.Back light:6PCS WHITE LED , Vf=11.4~13.4V(Typ) ; If=60mA
- 4.Operating temp: -20°C to 70°C , Storage temp: -30°C to 80°C
- 5.LCM with CTP Luminace(cd/m<sup>2</sup>) : 850(Typ.)
- 6.Viewing angle:All,80 / 80 / 80 / 80 7.Connector: FPC
- 8.Display Driver IC :ST7796UI-G5 CTP IC: ST1633I
- 9.Interface : 4-Line SPI&16bit RGB 10.Unspecified tolerance: ±0.3mm
- 11.(.):REFERENCE DIMENSION 12.□IMPORTANT DIMENSION
- 13.YYMMDD: Date code (year month day) 14.Remark: RoHS

Count drawing & Spec.revision record during discussion with customer

Rec.#	Revision content description	Date
#00	FIRST ISSUE	2024.10.18



Mod.Name		DT035CTFT-IPS-SHB-PTS			SCALE	SHEET
					NTS	1/1
UNIT	SIZE	DESIGNER	CHECK	APPROVER	FILE NAME	
mm	A4	LI Li	Amy Tu	Jony Chen	Count Dwg.	