

DM-TFT28-479

2.76" 480 x 480 Round TFT - SPI, RGB

Table of Contents

Record of Revision	3
1 General Specifications	4
2 Pin Assignment	5
3 Absolute Maximum Ratings	6
4. Electrical Characteristics	6
5 Timing Chart	7
6 Optical Characteristics	11
7 Environmental / Reliability Test	14
8 Mechanical Drawing	15
9 Precautions for Use of LCD Modules	16

Record of Revision

Rev.	Date	Description	Editor
1.0	2022-9-26	First release	

1 General Specifications

No.	Item	Specification	Remark
1	LCD Size	2.8 inch (Diagonal)	
2	Driver Element	a-Si TFT active matrix	
3	Resolution	480 (RGB) ×480	
4	Display Mode	Normally Black, Transmissive	
5	Pixel Pitch	0.0487 (H) × 0.1461 (V)	
6	Display Colors	16.7M	
7	Surface Treatment	--	
8	Color Arrangement	RGB-Stripe	
9	Interface	MIPI 2 Lane	
10	Viewing Direction	All	
11	Gray Scale Inversion Direction	/	Note 1
12	Outline Dimension (mm)	73.03(W) × 76.48 (H) × 2.34(T)	
13	Active Area (mm)	70.13(W) ×70.13 (H)	
14	Touch Screen	Without CTP	
15	Display Driver IC	ST7701	
16	Touch Driver IC	/	

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180° shift.

Note 2: RoHS compliant.

2 Pin Assignment

2.1 LCD Pin assignment

Match connector: XF2M-3015-1A (OMRON) or equivalent.

N	Symbol	I/O	Description	Remark
1	LEDA	p	LED Anode	
2	LEDK1	p	LED Cathode1	
3	LEDK2	p	LED Cathode2	
4	VCI	P	Power Supply 2.8V	
5	IOVCC	P	LCD I/O power supply(1.8V)	
6	RESET	I	Reset pin	
7	TE	O	Tearing effect(1.8V)	
8	NC	-	No connection.	
9	GND	P	Ground	
10	D0P	I/O	MIPI DSI differential data pair (Data lane 0)	
11	D0N	I/O	MIPI DSI differential data pair (Data lane 0)	
12	GND	P	Ground	
13	D1P	I	MIPI DSI differential data pair (Data lane 1)	
14	D1N	I	MIPI DSI differential data pair (Data lane 1)	
15	GND	P	Ground	
16	CLKP	I	MIPI DSI differential clock pair	
17	CLKN	I	MIPI DSI differential clock pair	
18	GND	P	Ground	
19	NC	-	No connection.	
20	NC	-	No connection.	
21	GND	P	Ground	
22	NC	-	No connection.	
23	NC	-	No connection.	
24	GND	P	Ground	
25	TP_INT(NC)	-	Touch Interrupt,No connection	
26	TP_SDA(NC)	-	Touch IIC Data signal,No connection	
27	TP_SCL(NC)	-	Touch IIC Clock signal,No connection	
28	TP_RESET(NC)	-	Touch Reset Signal,No connection	
29	TP_VCI(NC)	-	Touch Power supply,No connection	
30	TP_IOVCC(NC)	-	Touch I/O Power supply,No connection	

I---Input, O---Output, P--- Power/Ground

3 Absolute Maximum Ratings

Ta = 25°C

Item	Symbol	Min.	Max.	Unit	Remark
Power Voltage	V _{CI}	-0.30	+5.5	V	
	IOVCC	-0.30	+3.5		
Operating Temperature	Top	-20.0	70.0	°C	
Storage Temperature	T _{st}	-30.0	80.0	°C	
Operating and Storage Humidity	H _{stg}	10%	90%	%(RH)	

4. Electrical Characteristics

4.1 Recommended Operating Condition

V_{CI}=3.3V, GND=0V, Ta = 25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply Voltage	V _{CI}	2.8	3.0	3.3	V	
	IOVCC	1.65	1.8	3.3		
Input Signal Voltage	Low Level V _{IL}	0	-	0.3 x IOVCC	V	
	High Level V _{IH}	0.7 x IOVCC	-	IOVCC	V	
Current of digital supply voltage	I _{IOVCC}	-	-	20	mA	V _{CI} =3.3V, color bar pattern
Current of analog supply voltage	I _{VCI}	-	-	55	mA	

4.2 Backlight Unit Driving Condition

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Current	I _F	-	80	100	mA	4 LEDs (1 LED Serial, 4 LED Parallel)
Forward Current Voltage	V _F	-	6.4	6.8	V	
Backlight Power Consumption	W _{BL}	-	512	680	mW	
Operating Life Time	--	30000	--	--	hrs	Note 2, Note 3

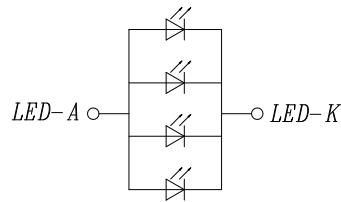
Note1: The LED driving condition is defined for each module (1 LED Serial, 4 LED Parallel).

Note2: When LCM is operated, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: Optical performance should be evaluated at Ta=25°C When LED is driven at high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

Note4: The LED driving condition is defined for each LED module.

LED CIRCUIT DIAGRAM:

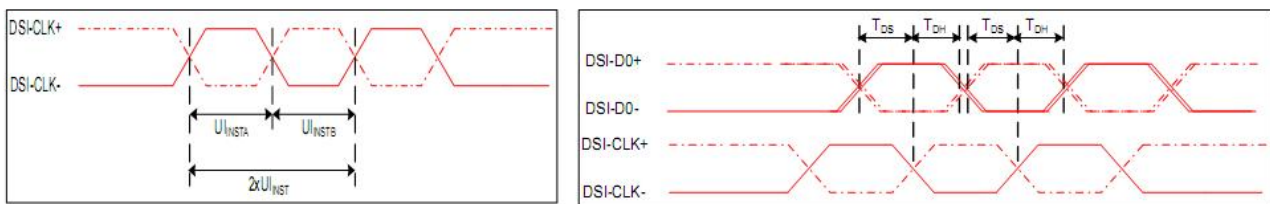


IF=80mA Vf=6.4V

5 Timing Chart

5.1 DSI Interface Timing Characteristics: high speed mode-clock channel timing

High Speed Mode



DSI clock channel timing

Rising and falling time on clock and data channel

VDDI=1.8, VDD=2.8, AGND=DGND=0V, Ta=25 °C

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	2xUI_INSTA	Double UI instantaneous	2.5	25	ns	
DSI-CLK+/-	UI_INSTA UI_INSTB	UI instantaneous halves	1.25	12.5	ns	UI = UI_INSTA = UI_INSTB
DSI-Dn+/-	t_DS	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	t_DH	Data to clock hold time	0.15	-	UI	

Mipi Interface- High Speed Mode Timing Characteristics

5.2 Low speed mode-Data Clock Channel Timing

Low Power Mode

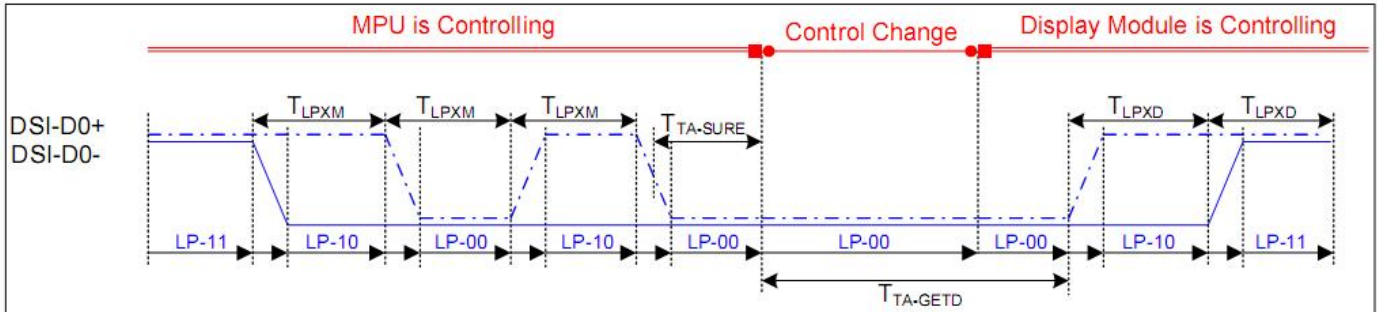


Figure Bus Turnaround (BTA) from display module to MPU Timing

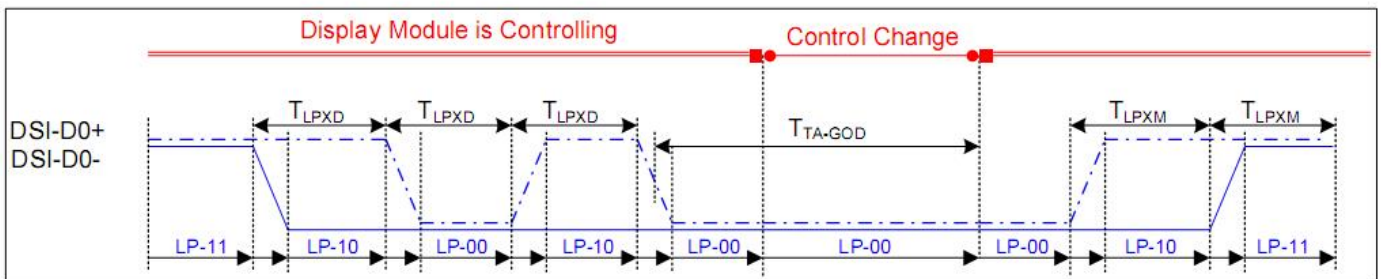


Figure Bus Turnaround (BTA) from MPU to display module Timing

VCI=2.8, AGND=DGND=0V, Ta=25 °C

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-D0+/-	TLPXM	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Input
DSI-D0+/-	TLPXD	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Output
DSI-D0+/-	TTA-SURED	Time-out before the MPU start driving	T_{LPXD}	$2 \times T_{LPXD}$	ns	Output
DSI-D0+/-	TTA-GETD	Time to drive LP-00 by display module		$5 \times T_{LPXD}$	ns	Input
DSI-D0+/-	TTA-GOD	Time to drive LP-00 after turnaround request-MPU		$4 \times T_{LPXD}$	ns	Output

Table Mipi Interface Low Power Mode Timing Characteristics

5.3 Recommended Timing Setting of TCON

TCON (Embedded in Source IC) Input Timing (DCLK, HS, VS, DE)

VCI=2.8V, GND=0V, Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK	Fclk	-	15	-	MHz	
	tclk	-	66.67	-	ns	
HSD	hdisp	-	480	-	tclk	
	hpw	-	2	-	tclk	
	hbp	-	10	-	tclk	
	hfp	-	10	-	tclk	
VSD	vdisp	-	480	-	th	
	vs	-	6	-	th	
	vbp	-	10	-	th	
	vfp	-	10	-	th	

Note: For reference only, it needs to be adjusted according to the actual display effect

5.4 Reset input timing

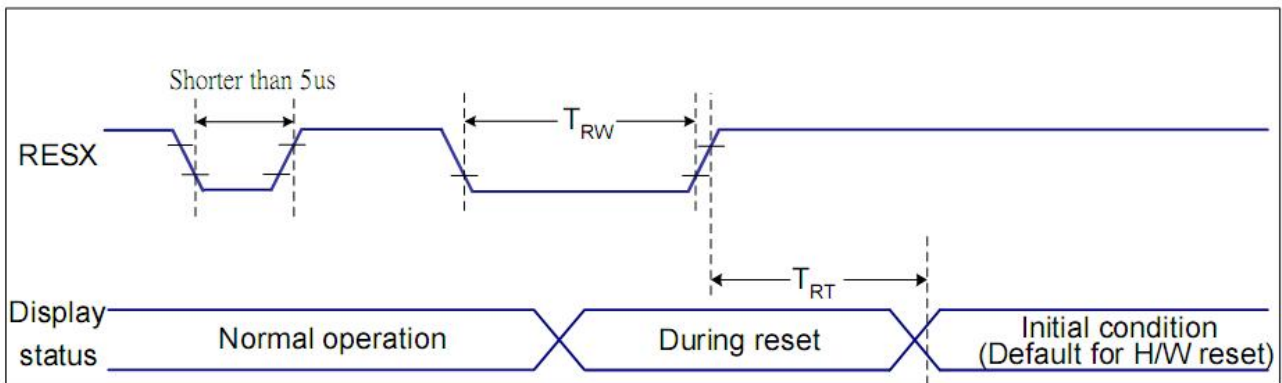


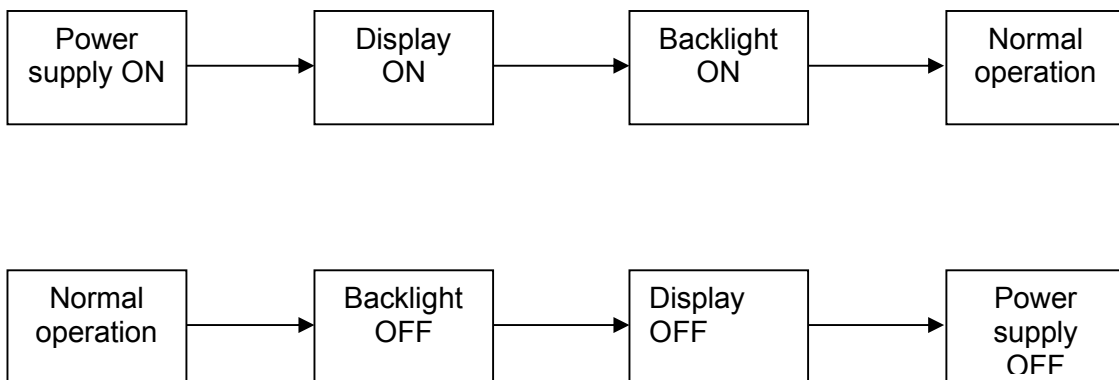
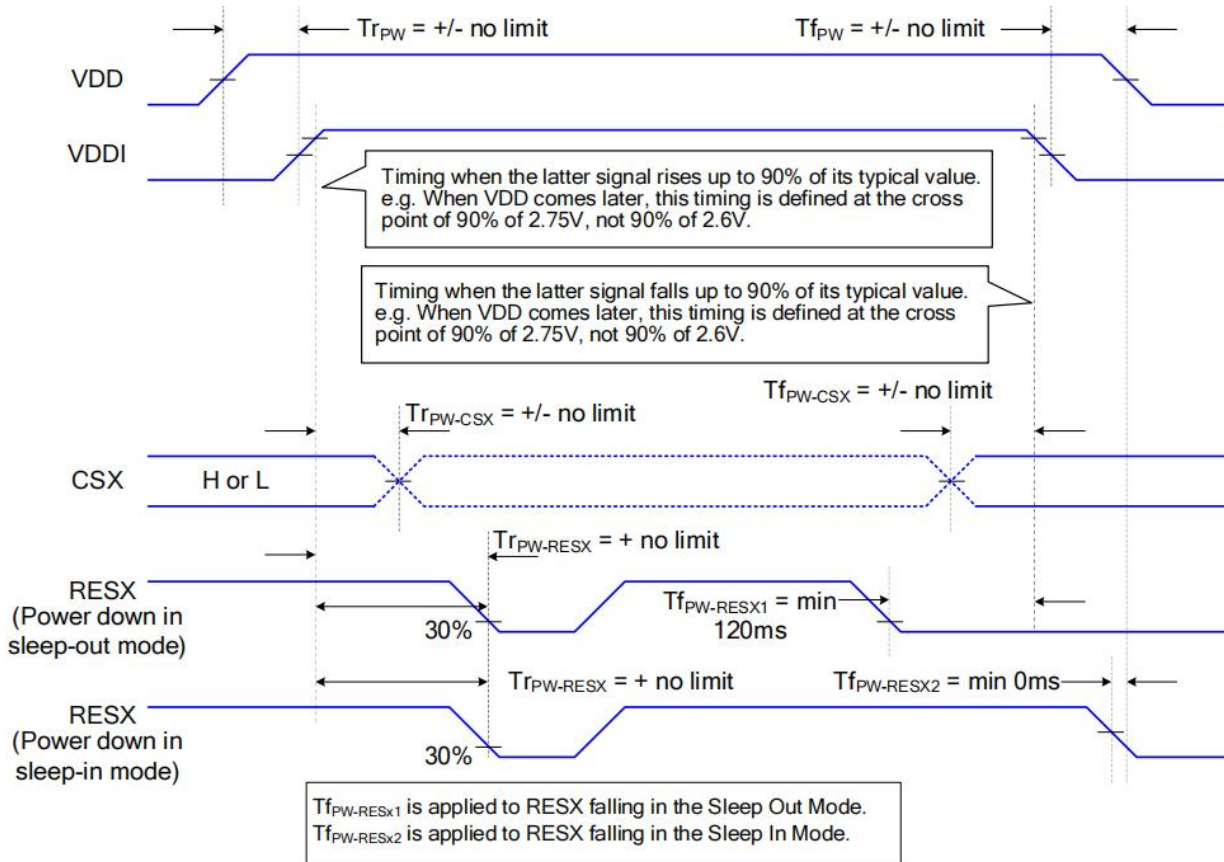
Figure Reset Timing

VCI=2.8, AGND=DGND=0V, Ta=25 °C

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5	ms
			120	ms	

Table Reset Timing

5.5 Power On Timing:(VCI=VDD; IOVCC=VDDI)



6 Optical Characteristics

Ta=25°C

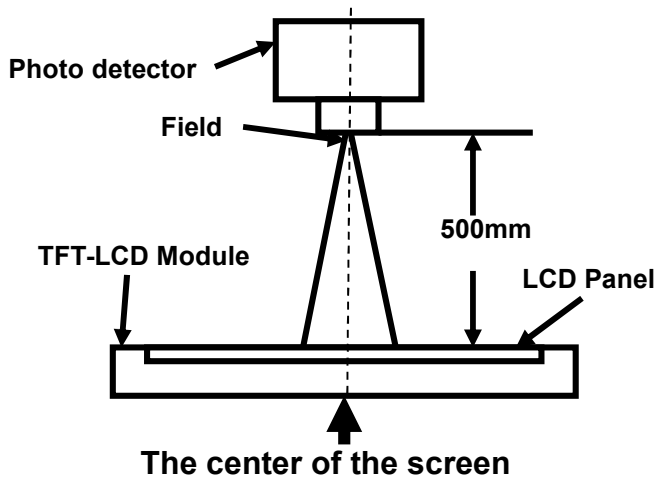
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
View Angles	θT	$CR \geq 10$	80	85	-	Degree	Note 2
	θB		80	85	-		
	θL		80	85	-		
	θR		80	85	-		
Contrast Ratio	CR	$\theta=0^\circ$	1000	1200	-		Note1 Note3
Response Time	T_{ON}	25°C	-	35	40	ms	Note1 Note4
	T_{OFF}						
Chromaticity	White	x	Backlight is on	0.268	0.298	0.328	Note1 Note5
		y		0.297	0.327	0.357	
	Red	x		0.617	0.647	0.677	
		y		0.283	0.313	0.343	
	Green	x		0.233	0.263	0.293	
		y		0.530	0.560	0.590	
	Blue	x		0.107	0.137	0.167	
		y		0.076	0.106	0.1361	
Uniformity	U		75	80	-	%	Note1 Note6
NTSC			60	65	-	%	Note 5
Luminance	L		-	380	-	cd/m ²	Note1 Note7

Test Conditions:

1. $I_F=80$ mA, $V_F=6.4$ V and the ambient temperature is $25\pm 2^\circ\text{C}$. humidity is $65\pm 7\%$
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

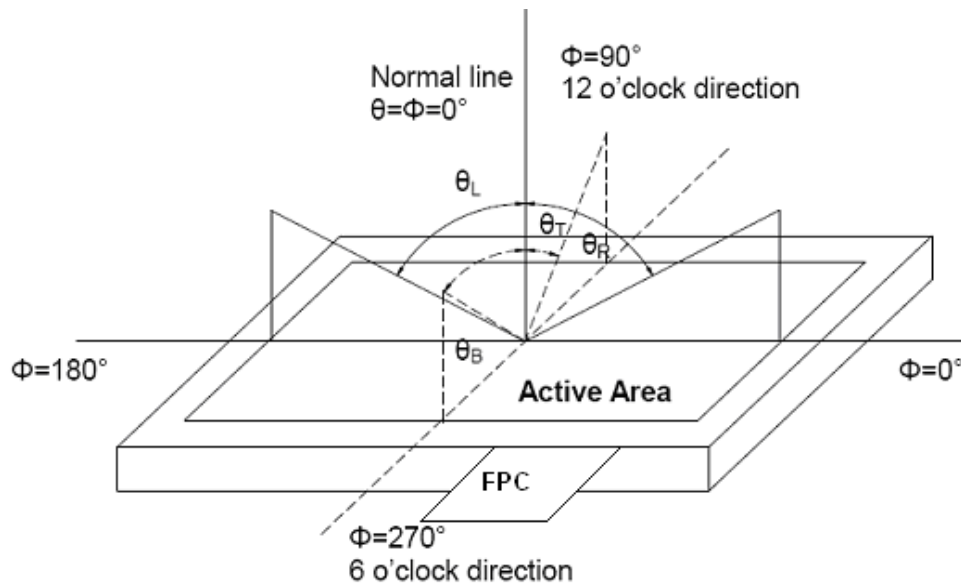
Properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

Viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。



Note 3: Definition of contrast ratio

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

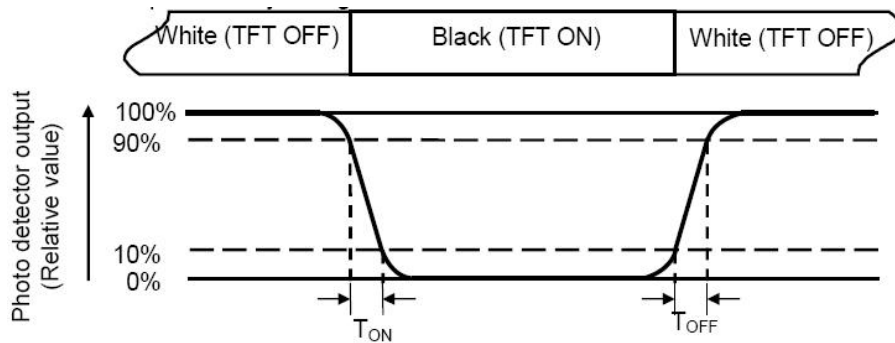
“White state “: The state is that the LCD should drive by V_{white}.

“Black state”: The state is that the LCD should drive by V_{black}.

V_{white}: To be determined V_{black}: To be determined.

Note 4: Definition of response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

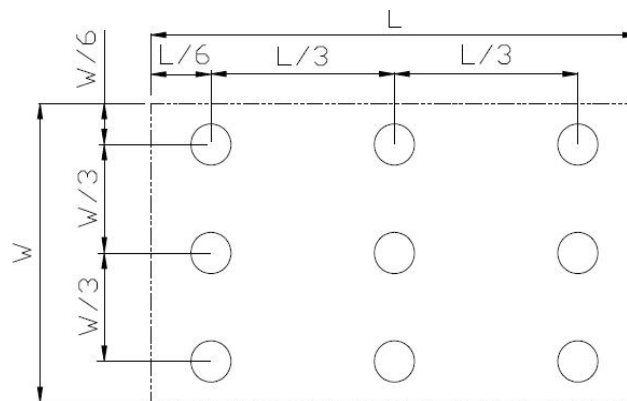
Color coordinates measured at center point of LCD.

Note 6: Definition of luminance uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\min} / L_{\max}$$

L-----Active area length W----- Active area width



L_{\max} : The measured Maximum luminance of all measurement position.

L_{\min} : The measured Minimum luminance of all measurement position.

Note 7: Definition of luminance:

Measure the luminance of white state at center point.

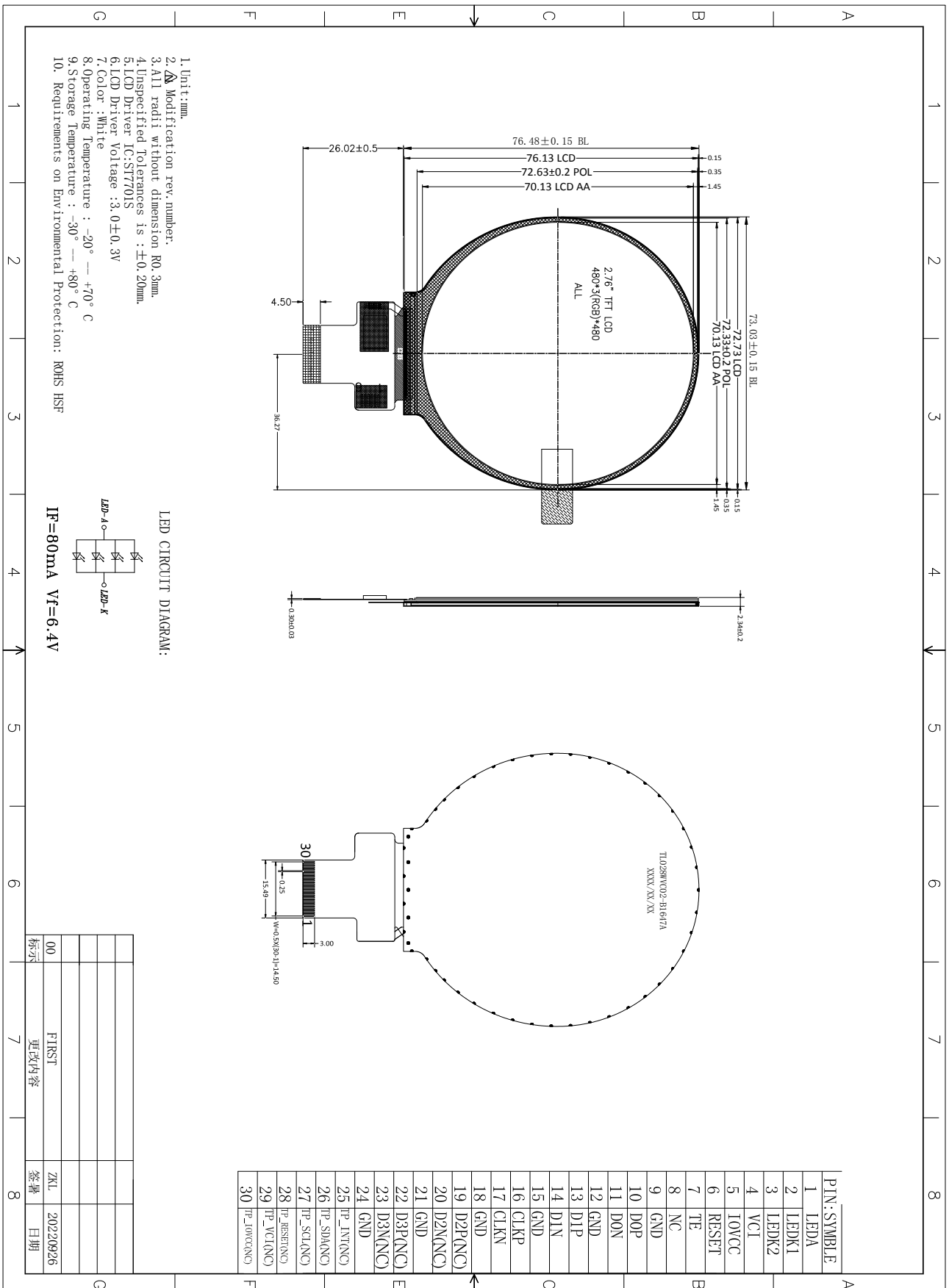
7 Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts = +70°C, 240 hours	No abnormalities in functions
2	Low Temperature Operation	Ta = -20°C, 240 hours	No abnormalities in functions
3	High Temperature Storage	Ta = +80°C, 240 hours	No abnormalities in functions
4	Low Temperature Storage	Ta = -30°C, 240 hours	No abnormalities in functions
5	Storage at High Temperature and Humidity	Ta = +60°C, 90% RH max, 240 hours	No abnormalities in functions
6	Thermal Shock (non-operating)	-30°C 30 min ~ +70°C 30 min, Change time: 0.5 hour ® 5 min ® 0.5 hour. 10 Cycle	Start with cold temperature, End with high temperature,
7	ESD	C=150pF, R=330Ω, 5point/panel Air: ±8Kv, 5times; Contact: ±4Kv, 5times (Environment: 15°C ~ 35°C, 30% ~ 60%. 86Kpa ~ 106Kpa)	No abnormalities in functions

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of samples.

8 Mechanical Drawing



9 Precautions for Use of LCD Modules

Handling Precautions

9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

9.1.6 Do not attempt to disassemble the LCD Module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

9.1.8.1 Be sure to ground the body when handling the LCD Modules.

9.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

9.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

9.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

Storage Precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is: Temperature : 0°C ~ 40°C Relatively humidity: ≤80%

9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

Transportation Precautions

9.3.1 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.