深圳市海量视界电子科技有限公司

LCD Module Specifiction

Customer:	
Module No.:	**HL021TWV9006ACT**
Customer P/N:	
Date:	
Version:	**V1.0**

Approved by	Checked by	Prepared by

Final Approval by Customer	
Approved by	**Comment**

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1.Record of Revision

Rev.	Issued Date	Description	Editor
1.0	2025-09-22	First release	Chen

2.General Specifications

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

Note 2: ROHS compliant.

Item	Specification	Unit
LCD size	2.1	inch
Display Mode	Normally Black	--
Resolution	480(RGB)x480	Pixel
Pixel pitch	0.111*RGB*0.111	mm
Pixel Arrangement	RGB Vertical Stripe	
Viewing direction	ALL	-
Module outline dimension	71.27(H)*71.27(V)*3.6(D)	mm
LCD AA	53.28x53.28	mm
Colors	16.7M	-
Driver IC	ST7701	-
Interface	MIPI 2lane	--
Backlight	White LED	--
Touch IC	CST826	
Surface hardness	6H	
Touch structure	G+F	
Cover lens	GLASS	
Color	Black	
Operating Temperature	-20℃~ +70℃	--
Storage Temperature	-30℃~ +80℃	--

3.Pin Assignment

PIN	Symbol	Description	Remark
1	LEDA	LED ANODE	
2	LEDK	LED CATHODE	
3	LEDK	LED CATHODE	
4	VCI	LCD analog power supply (3.3V)	
5	IOVCC	LCD analog power supply (1.8-3.3V)	
6	RESET	Reset Signal	
7	TE	Tearing effect output	
8	PWM	The PWM frequency output for LCD driver control.	
9	GND	Ground	
10	D0P	DSI-D0+ data signals	
11	D0N	DSI-D0- data signals	
12	GND	Ground	
13	D1P	DSI-D1+ data signals	
14	D1N	DSI-D1- data signals	
15	GND	Ground	
16	CLKP	DSI-Clock+	
17	CLKN	DSI-Clock-	
18	GND	Ground	
19-20	NC	Not connect	
21	GND	Ground	
22-23	NC	Not connect	
24	GND	Ground	
25	TP_INT	Touch Interrupt	
26	TP_SDA	Touch IIC Data signal	
27	TP_SCL	Touch IIC Clock signal	
28	TP_RESET	Touch Reset Signal	
29	TP_VCI	Touch Power supply	
30	TP_IOVCC/NC	Touch Power supply/NC	

4.Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Voltage	VCI	-0.30	+3.3	V	
	IOVCC	-0.30	+3.3	V	
	TP_VCI	/	/	V	
	TP_IOVCC	/	/	V	
Operating Temperature	Top	-20.0	70.0	℃	
Storage Temperature	T_{st}	-30.0	80.0	℃	
Operating and Storage Humidity	H_{stg}	10%	90%	%(RH)	

5.Electrical Characteristics

5.1Recommended Operating Condition

VCI=3.3V，GND=0V，Ta = 25℃

Item		Symbol	Min.	TYP.	Max.	Unit	Remark
Digital supply Voltage		IOVCC	1.65	1.8	1.95	V	
Analog supply Voltage		VCI	2.5	2.8	3.3	V	
TP Power		TP_VCI	/	/	/	V	
TP Power		TP_IOVCC	/	/	/	V	NOTES
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	35	Ma	VCI=3.3V, color bar pattern
Current of analog supply voltage		I_{VCI}	-	35	50	Ma	

5.2 Backlight Unit Driving Condition

Item	Symbol	Min.	TYP.	Max.	Unit	Remark
Forward Current	I_F	-	80	-	Ma	(4LED Parallel)
Forward Current Voltage	V_F	2.8	3.1	3.3	V	
Backlight Power Consumption	W_{BL}	224	248	264	mW	
Operating Life Time	--	20000	--	--	hrs	Note 2, Note 3

Note1: The LED driving condition is defined for each module.

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℃ 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.

6.Timing Characteristics

6.1 MIPI Interface Characteristics :

6.1.1 High speed mode

Figure 4 DSI clock channel timing

Figure 5 Rising and falling time on clock and data channel

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

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	2xUIINSTA	Double UI instantaneous	2.5	25	ns	
DSI-CLK+/-	UIINSTA UIINSTB	UI instantaneous halfs	1.25	12.5	ns	UI = UIINSTA= UIINSTB
DSI-Dn+/-	tDS	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	tDH	Data to clock hold time	0.15	-	UI	

Table 7 Mipi Interface- High Speed Mode Timing Characteristics

6.1.2 Lowe Power Mode

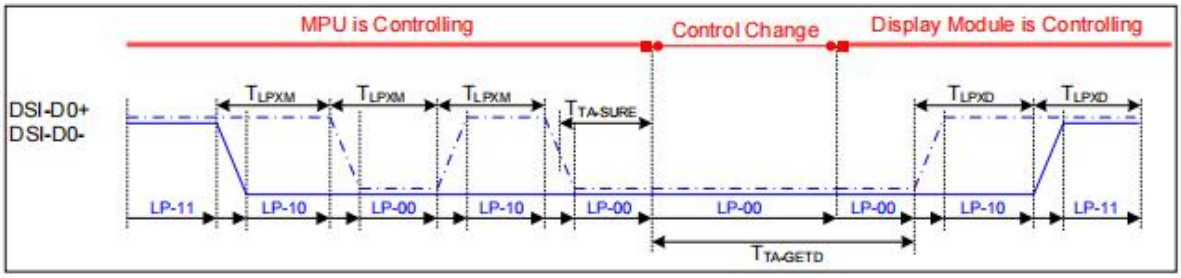


Figure 6 Bus Turnaround (BTA) from display module to MPU Timing

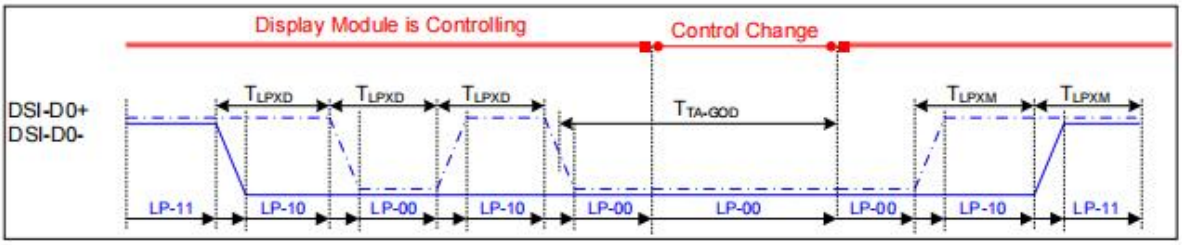


Figure 7 Bus Turnaround (BTA) from MPU to display module Timing

VDDI=1.8, VDD=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}	$2xT_{LPXD}$	ns	Output
DSI-D0+/-	TTA-GETD	Time to drive LP-00 by display module	$5xT_{LPXD}$		ns	Input
DSI-D0+/-	TTA-GOD	Time to drive LP-00 after turnaround request-MPU	$4xT_{LPXD}$		ns	Output

Table 8 Mipi Interface Low Power Mode Timing Characteristics

6.1.3 DSI Bursts Mode

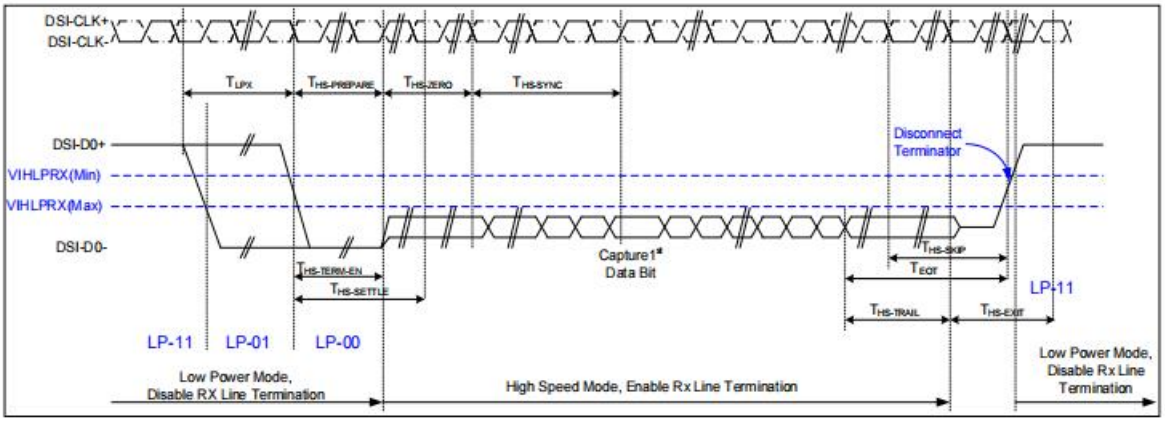


Figure 7 Data lanes-Low Power Mode to/from High Speed Mode Timing

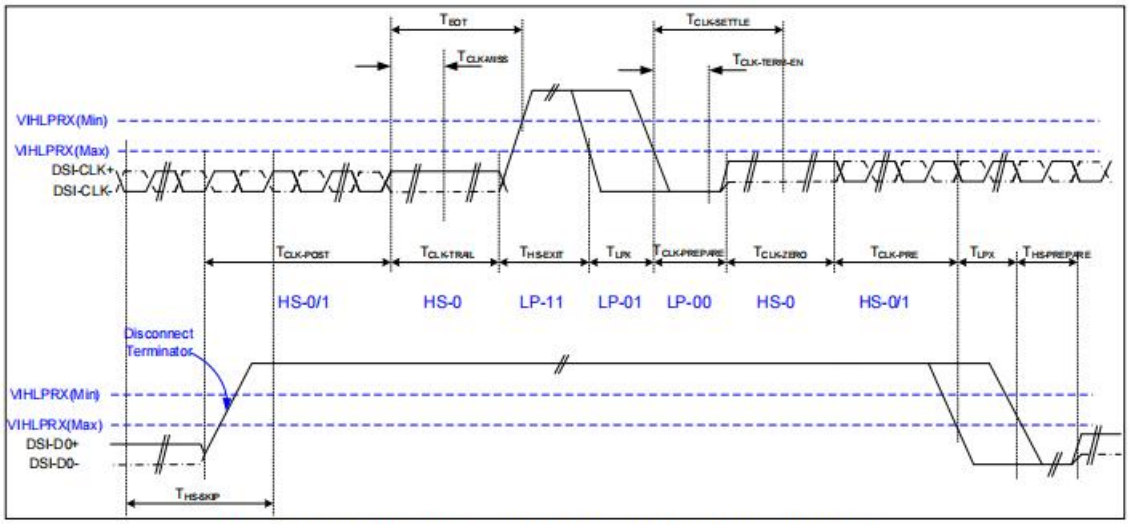


Figure 8 Clock lanes- High Speed Mode to/from Low Power Mode Timing

6.2 MIPI Input Timing Table

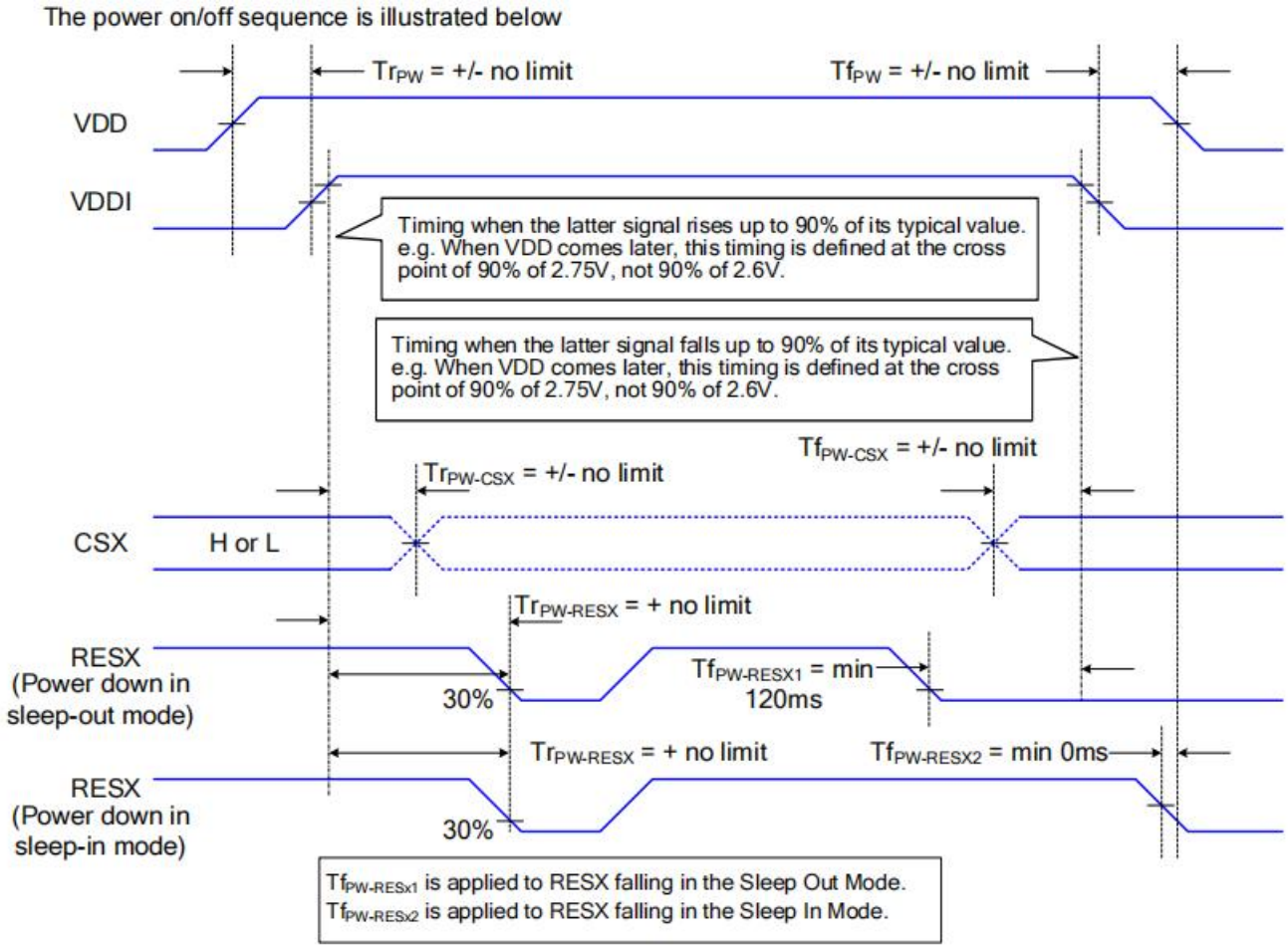
(TA=25℃)

480RGB X 480 Resolution Timing Table							
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency		Fclk	17	20	27	MHz	
HSYNC	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp	4	60	255	DCLK	
	Front Porch	Thfp	4	60	255	DCLK	
	Pulse Width	Thw	2	20	8	DCLK	
VSYNC	Display Period	Tvdisp		480		HSYNC	
	Back Porch	Tvbp	8	20	254	HSYNC	
	Front Porch	Tvfp	8	20	254	HSYNC	
	Pulse Width	Tvw	2	4	8	HSYNC	

Note: 1. The minimum blanking time depends on the GIP timing of the panel specification

2. To ensure the compatibility of different panels, it is recommended to use the typical setting.

6.4 Power On /OFF Timing



6.5 Reset Timing

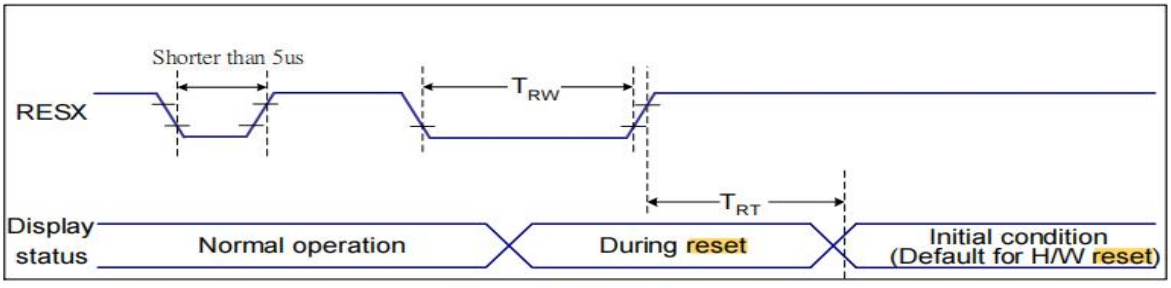
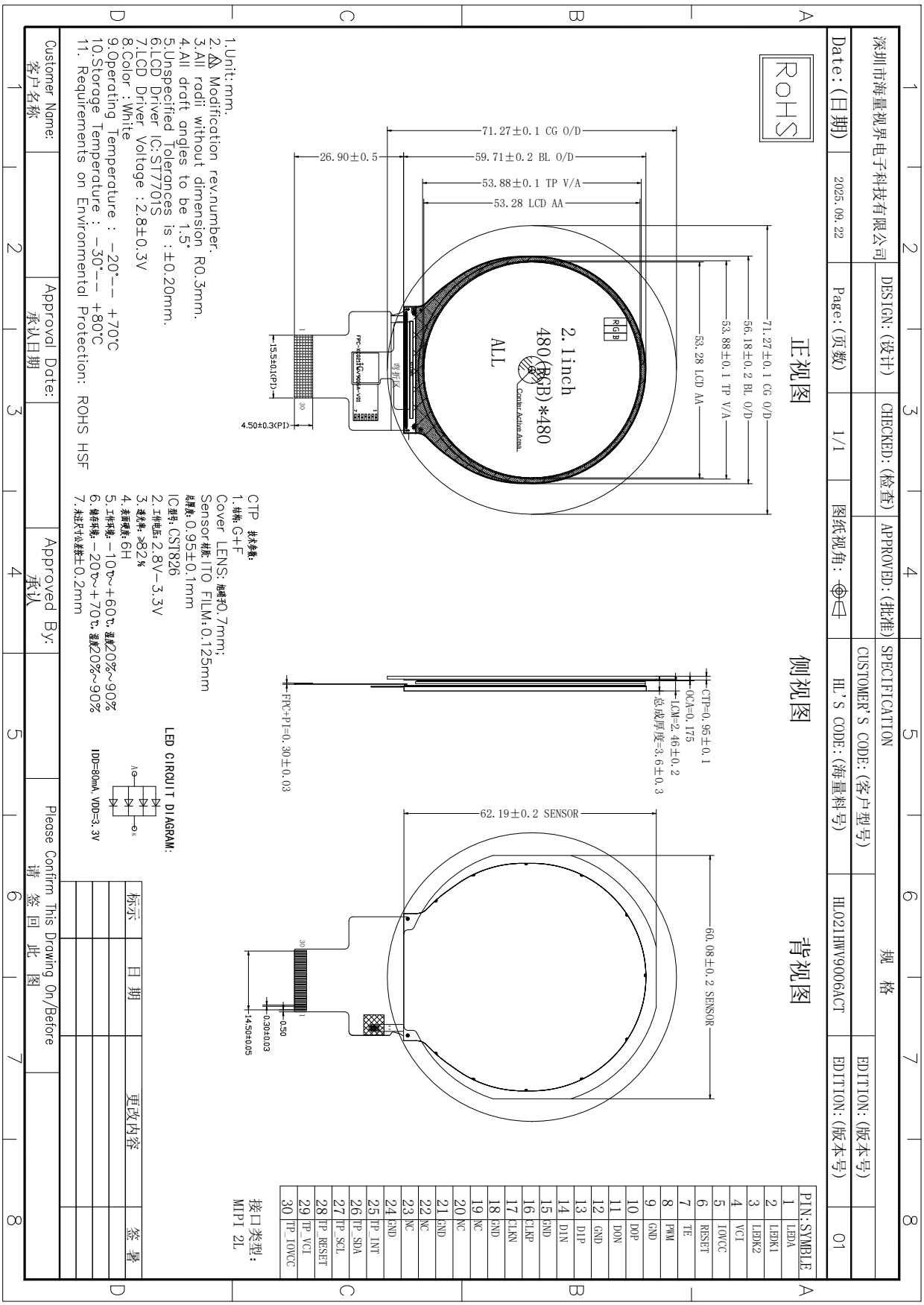


Figure 9 Reset Timing

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

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120(Note 1, 6, 7)	ms

7. Mechanical Drawing



8.Optical Characteristics

Item		Symbol	Condition	Min.	TYP.	Max.	Unit	Remark
View Angles		θT	CR≧10	80	85	-	Degree	Note 2
		θB		80	85	-		
		θL		80	85	-		
		θR		80	85	-		
Contrast Ratio		CR	θ=0°	600	800	-		Note1 Note3
Response Time		T_{ON}	25℃		35	45	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	-	-	-		Note1 Note5
		y		-	-	-		
Uniformity		U		-	85	-	%	Note1 Note6
NTSC				-	70	-	%	Note 5
Luminance		L		-	260	-	CD/m^2	Note1 Note7

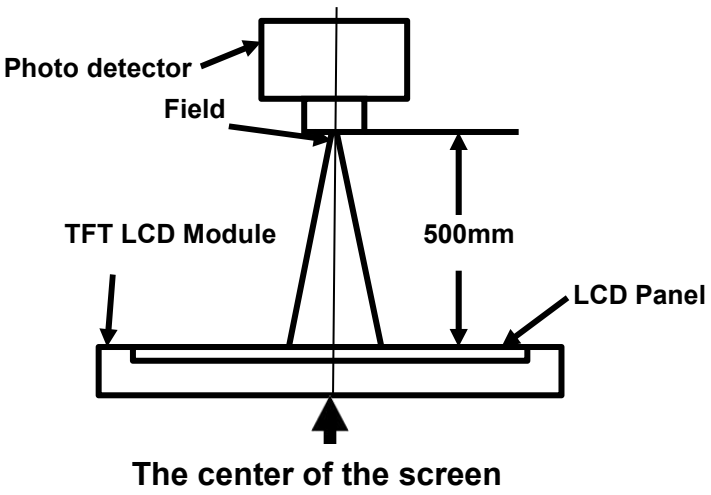
Test Conditions:

1.IF= 80 Ma, VF=3.2 V and the ambient temperature is 25±2℃.humidity is 65±7%

2.The test systems refer to Note 1 and Note 2.

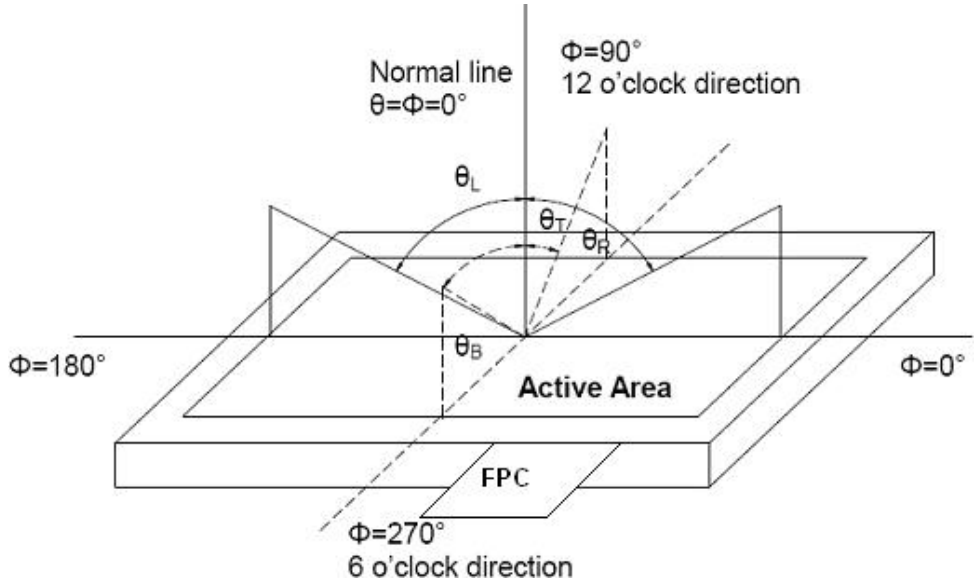
Note 1: Definition of optical measurement system.

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.



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)。

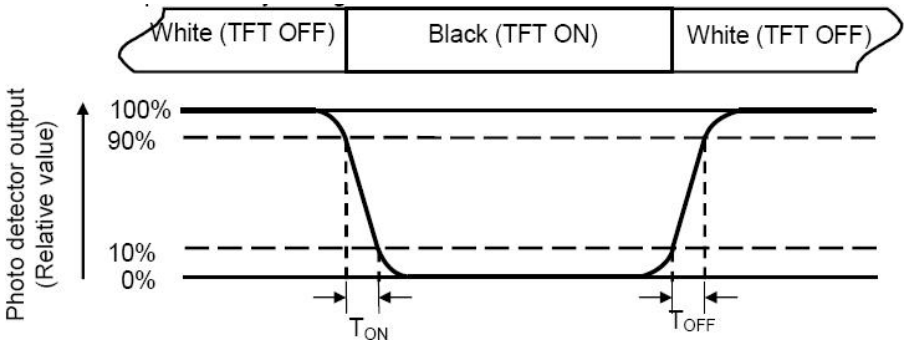


Note 3: Definition of contrast ratio

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

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)

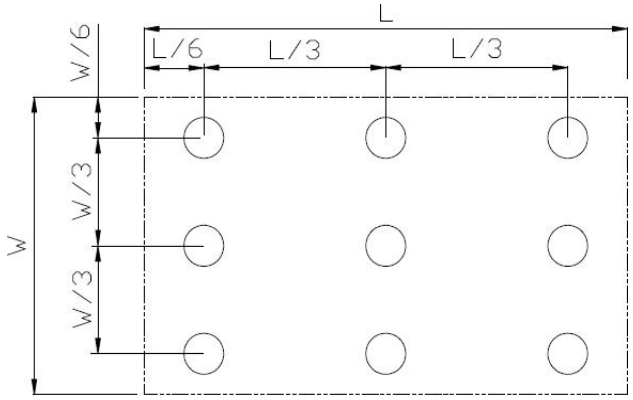
Color coordinates measured at center point ofLCD.

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.

Luminance Uniformity (U) = Luminance min / Luminance max

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



Luminance max: The measured Maximum luminance of all measurement position. Luminance min: The measured Minimum luminance of all measurement position.

Note 7: Definition of luminance:

Measure the luminance of white state at center point

9.Environmental / Reliability Test

No.	Items	Condition	Inspection after test
1	High Temperature Storage	T = 80℃±2℃ for 96 hr	Inspection after 4 hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD 2.Seal leak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current IDD is twice higher than initial value.
2	Low Temperature Storage	T = -30℃±2℃ for 96 hr	
3	High Temperature Operating	T = 70℃±2℃ for 96 hr	
4	Low Temperature Operating	T = -20℃±2℃ for 96 hr (But no condensation of dew)	
5	High Temp. and High Humidity Operating	T = 60℃±5℃ /90% for 96 hr (But no condensation dew)	
6	Thermal Shock	-20±2℃~25~70±2℃×10cycles (30min.) (5min.) (30min.)	
7	ESD	Voltage:±2KV R: 330Ω C: 150pF Air discharge, 10time	

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

Note2: Ta is the ambient temperature of samples

10.Precautions for Use of LCD Modules Handling Precautions

10.1Handling Precautions

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

10.1.2 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.

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

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

10.1.5 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

10.1.6 Do not attempt to disassemble the LCD Module.

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

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

10.1.8.1 Be sure to ground the body when handling the LCD Modules.
Tools required for assembly, such as soldering irons, must be properly ground.

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

10.1.8.3 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.

10.2 Storage Precautions

10.2.1When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2The 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℃ ～ 40℃ Relatively humidity: ≤80%

10.2.3The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3Transportation Precautions

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