深圳市勋瑞光电科技有限公司
Xunrui Shenzhen Optoelectronics Technology Co., Ltd.

Product Specification

Customer: ______________________

Model Name: H028SQ40E3547-T

Date: 2022-07-27

Version: A1

■ **Preliminary Specification**

□ **Final Specification**

For Customer's Acceptance

Approved by	Comment

Approved by	Reviewed by	Prepared by

Table of Contents

1. Record of Revision

Rev	Issued Date	Description	Editor
A0	2022/07/07	First Release	gl.Liu
A1	2022/07/27	Change the FPC structure	gl.Liu

2. General Specifications

Feature		Spec
Characteristics	Size	2.8inch
	Resolution	240(horizontal)*320(Vertical)
	Interface	MCU 16bit
	Connect type	Soldering
	Display Colors	262K
	Technology type	a-Si
	Pixel pitch (mm)	0.18x 0.18
	Pixel Configuration	R.G.B.Stripe
	Display Mode	Normally White
	Driver IC	ST7789V
	Viewing Direction	12 O'clock
	Gray Scale Inversion Direction	12 O'clock
Mechanical	LCM (W x H x D) (mm)	50*69.2*3.55
	Active Area(mm)	43.2*57.6
	With /Without TSP	With+TSP
	Weight (g)	TBD
	LED Numbers	4LEDs

Note 1: Viewing direction for best image quality is different from TFT definition; there is a 180 degree shift.

Note 2: Requirements on Environmental Protection: RoHS

Note 3: LCM weight tolerance: +/- 5%

3. Input/output Terminals

PIN NO	PIN NAME	DESCRIPTION
1	GND	Power supply Ground.
2	DB0	data bus.
3	DB1	data bus.
4	DB2	data bus.
5	DB3	data bus.
6	GND	Power supply Ground.
7	VCC	Analog power supply.
8	CS	Chip enable, Low-active.
9	RS	Data/Command register address.
10	WR	Write signal, rising-edge-trigger.
11	RD	Read signal, rising-edge-active.
12	NC	NC
13	YU	Resistive touch YU PIN
14	XL	Resistive touch XL PIN
15	YD	Resistive touch YD PIN
16	XR	Resistive touch XR PIN
17	LEDA	Backlight anode.
18~21	LEDK	Backlight cathode.
22	NC	NC
23	DB4	data bus.
24~31	DB8~DB15	data bus.
32	RESET	Reset signal, keep Low for more than 10ms after power
33~34	VCC	Analog power supply
35	GND	Power supply Ground.
36~38	DB5-DB7	data bus.
39~40	GND	Power supply Ground.

4. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Supply Voltage	V_{CC}	-0.3	4.6	V	
Input Voltage	IOVCC	-0.3	4.6	V	
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

5. Electrical Characteristics

5.1 Driving TFT LCD Panel

Ta = 25 □C

<table>
<tr><th colspan="2">Item</th><th>Symbol</th><th>MIN</th><th>TYP</th><th>MAX</th><th>Unit</th><th>Remark</th></tr>
<tr><td colspan="2">Analog Supply Voltage</td><td>V_{CC}</td><td>2.5</td><td>2.8</td><td>3.3</td><td>V</td><td></td></tr>
<tr><td colspan="2">Logic Signal Input /Output Voltage</td><td>IOVCC</td><td>1.65</td><td>2.8</td><td>3.3</td><td>V</td><td></td></tr>
<tr><td rowspan="2">Input Signal Voltage</td><td>Low Level</td><td>V_{IL}</td><td>VSS</td><td>-</td><td>0.3x IOVCC</td><td>V</td><td></td></tr>
<tr><td>High Level</td><td>V_{IH}</td><td>0.7x IOVCC</td><td>-</td><td>IOVCC</td><td>V</td><td></td></tr>
<tr><td colspan="2">TFT Common Electrode</td><td>V_{COM}</td><td>-</td><td>VSS</td><td>-</td><td>V</td><td></td></tr>
<tr><td colspan="2">TFT Gate ON Voltage</td><td>V_{GH}</td><td>13</td><td>15</td><td>15</td><td>V</td><td></td></tr>
<tr><td colspan="2">TFT Gate ON Voltage</td><td>V_{GL}</td><td>-12</td><td>-10</td><td>-7</td><td>V</td><td></td></tr>
</table>

Note 1:
VCOM value should be adjusted by different condition to optimize Flicker Value.
Note 2:
VGH and VGL are the operating voltages of TFT gate.
Note 3:
TFT Operation Frame rate 45MIN~60type~70MAX

5.2 Driving Backlight

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	60	80	mA	
Forward Voltage	V_F	2.8	3.0	3.2	V	
Backlight Power consumption	W_{BL}	-	0.18	0.26	W	
LED Lifetime		25000	-	-	Hrs	

Note 1: Each LED: IF =20 mA, VF =3.1V.

Note 2: Optical performance should be evaluated at Ta=25℃ only.

Note 3: If LED is driven by 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.

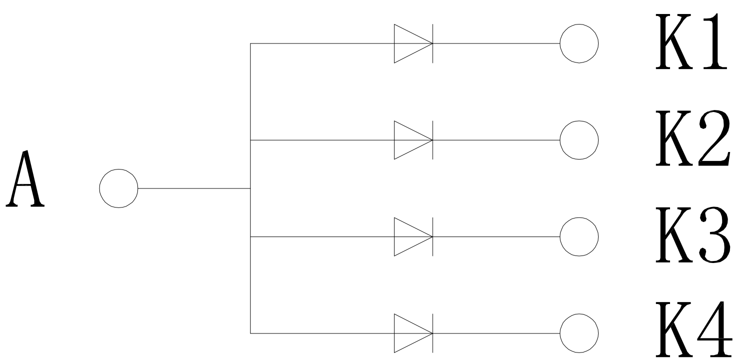


Figure: LED connection of backlight

6. Interface Timing

6.1 Display Parallel 18/16/9/8-bit Interface Timing Characteristics(8080 II system)

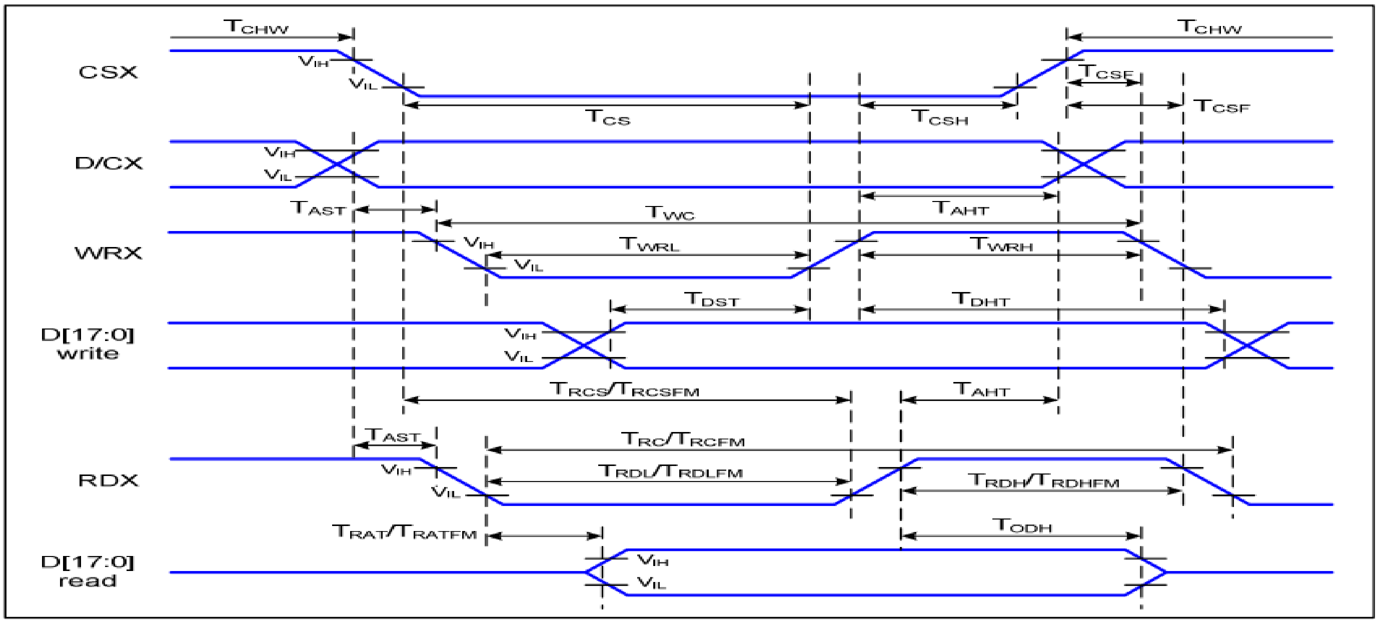


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 ℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF

	T_{DHT}	Data hold time	10		ns	
	T_{RAT}	Read access time (ID)		40	ns	
	T_{RATFM}	Read access time (FM)		340	ns	
	T_{ODH}	Output disable time	20	80	ns	

Table 4 8080 Parallel Interface Characteristics

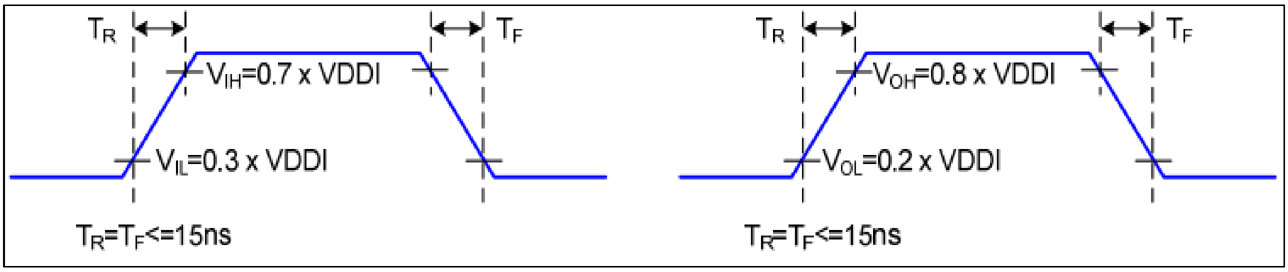


Figure 2 Rising and Falling Timing for I/O Signal

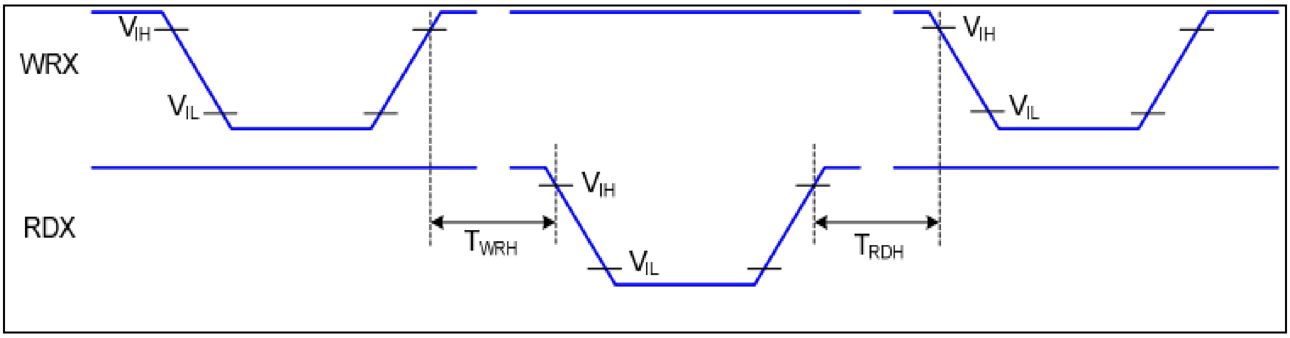
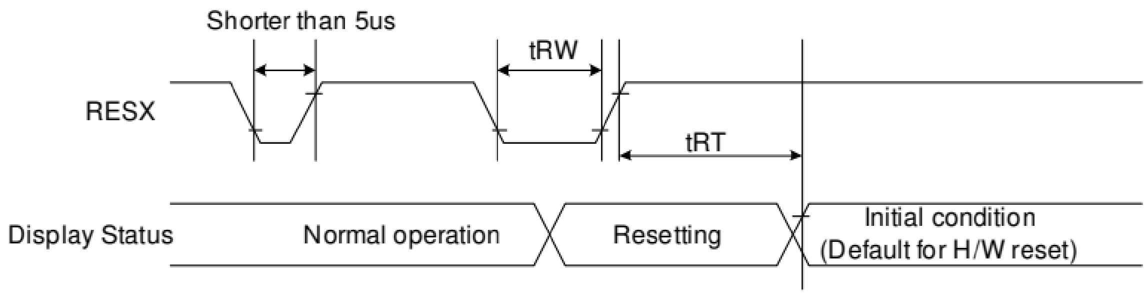


Figure 3 Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (Tr, Tf) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

6.2 Reset Timing:



Signal	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

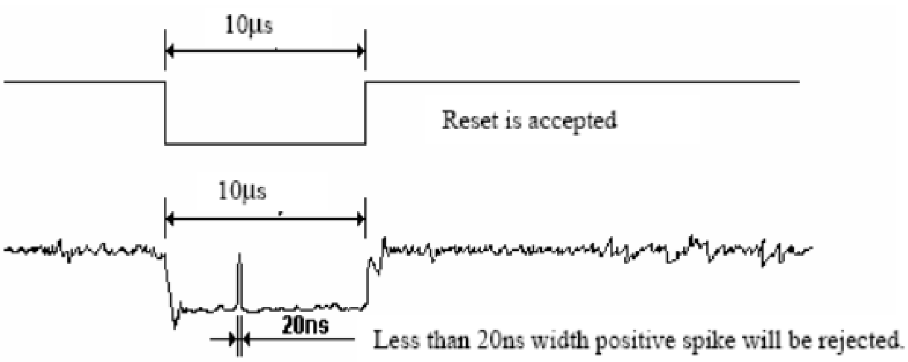
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In -mode.) And then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

7. Optical Characteristics

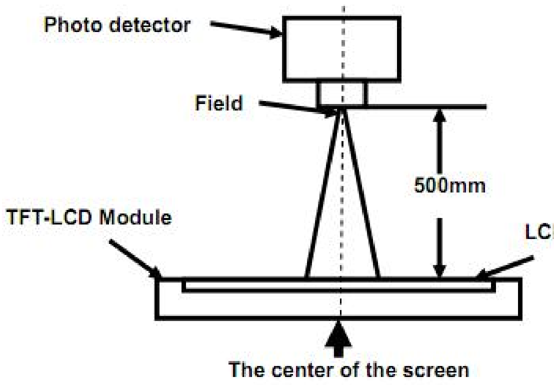
Items	Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing angles	θ_T	Center CR≥10	-	50	-	Degree	Note2
	θ_B		-	20	-		
	θ_L		-	45	-		
	θ_R		-	45	-		
Contrast Ratio	CR	Θ =0	-	500	-	-	Note1 Note3
Response Time	T_{ON}	25°C	-	16	-	ms	Note1 Note4
	T_{OFF}		-	16	-		
Chromaticity White	X_W	Backlight is on	0.28	0.31	0.34	-	Note1 Note5
	Y_W		0.29	0.32	0.35	-	
Uniformity	U		80	-	-	%	Note1 Note6
NTSC			-	55	-	%	Note5
Luminance	L		230	250	-	Cd/m2	Note1 Note7

Test Conditions:

1. IF= 60mA (one channel), the ambient temperature is 25.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical 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).

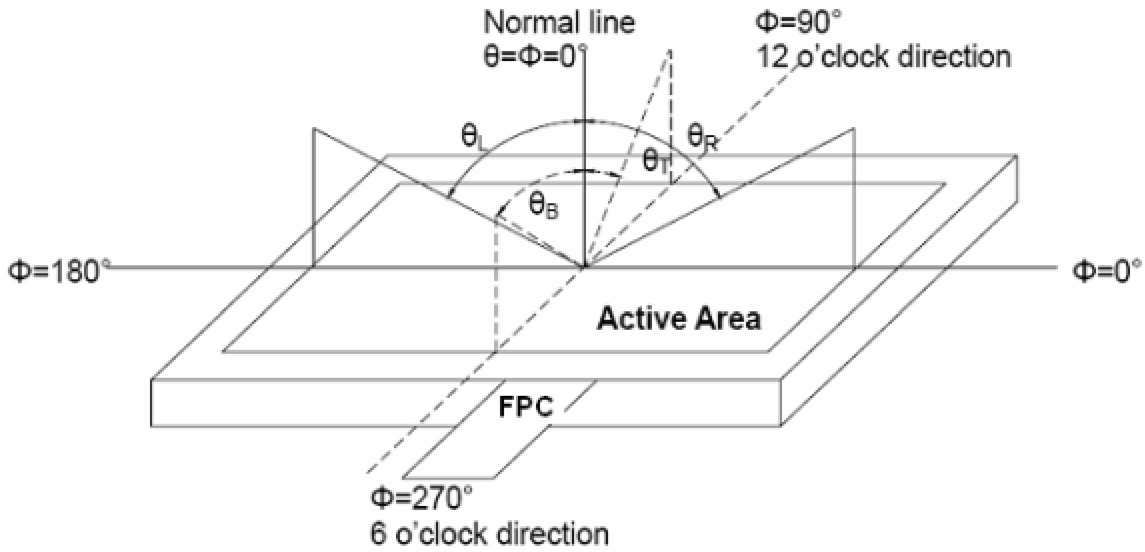


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

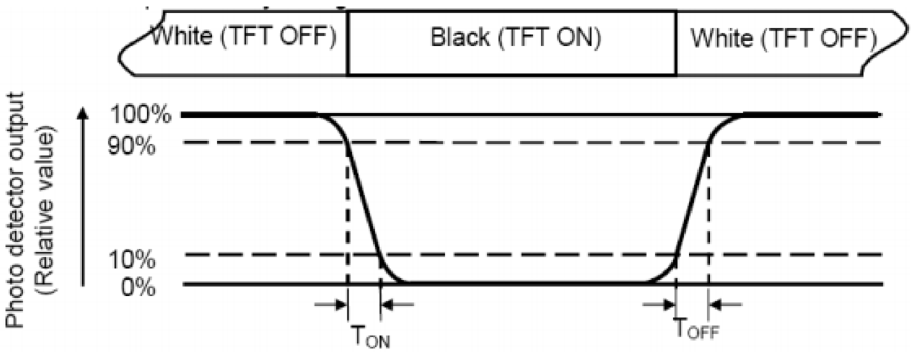
“White state “: The state is that the LCD should drive by Vwhite.

“Black state”: The state is that the LCD should drive by Vblack.

Vwhite: To be determined Vblack: 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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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.

Luminance Uniformity (U) = Lmin/ Lmax

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

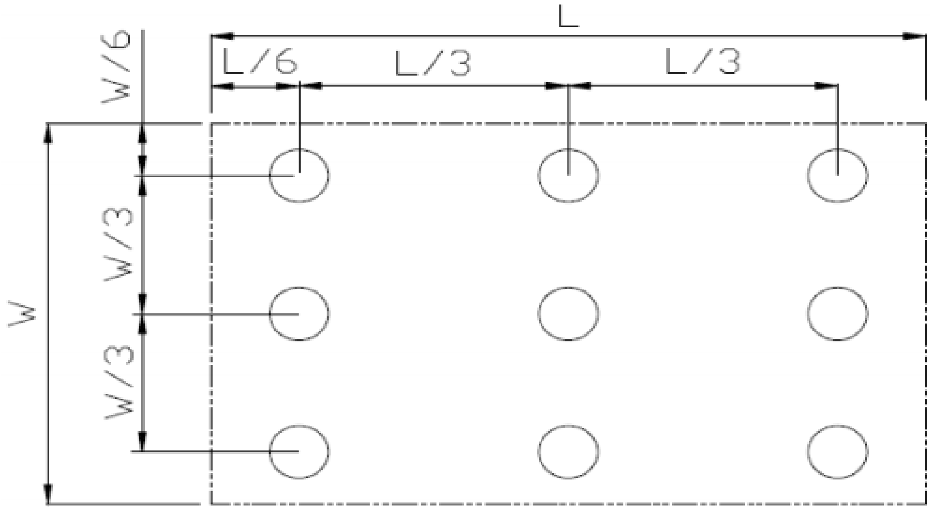


Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

8. Environmental / Reliability Tests

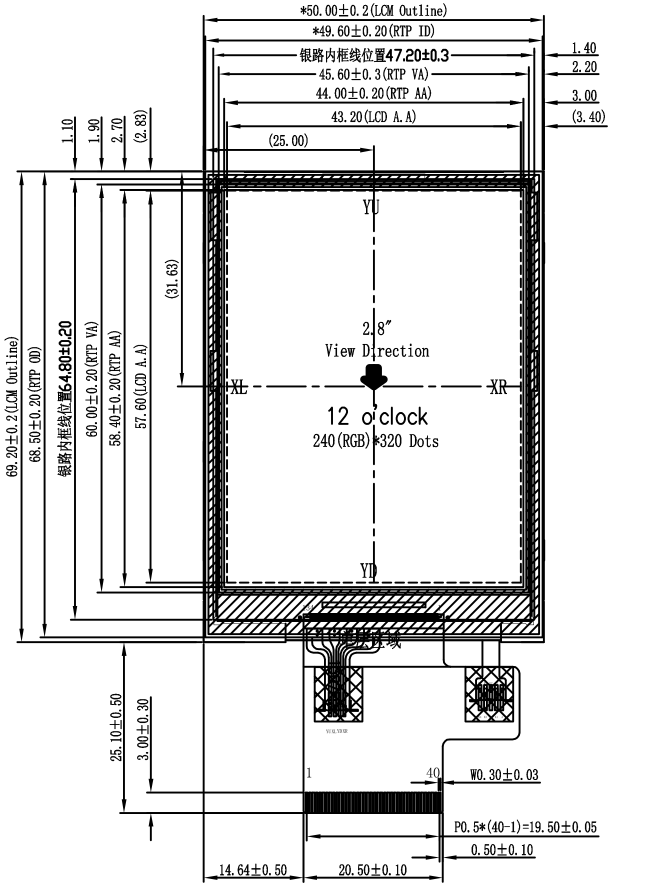
No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts= +70℃, 48hrs	Note 1 IEC60068-2-2, GB2423. 2-89
2	Low Temperature Operation	Ta= -20℃, 48hrs	Note 2 IEC60068-2-1 GB2423.1-89
3	High Temperature Storage	Ta= +80℃, 48hrs	IEC60068-2-2 GB2423. 2-89
4	Low Temperature Storage	Ta= -30℃, 48hrs	IEC60068-2-1 GB/T2423.1-89
5	High Temperature & Humidity Storage	Ta= +60℃, 90% RH max, 48 hours	IEC60068-2-3 GB/T2423.3-2006
6	Thermal Shock (Non-operation)	-20℃ /0.5h ~ +70℃/0. 5h for a toal, 24 Cycles	Start with cold temperature, end with high temperature IEC60068-2-14, GB2423.22-87
7	Electro Static Discharge (Operation)	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5times; (Environment: 15℃ ~35℃, 30% ~ 60%, 86Kpa ~ 106Kpa)	IEC61000-4-2 GB/T17626.2-1998
8	Vibration (Non-operation)	Frequency range: 10~55Hz, Stroke: 1.mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X .Y. Z. (package condition)	IEC60068-2-6 GB/T2423.5-1995
9	Shock (Non-operation)	60G 6ms, ± X, ±Y , ± Z,3 times for each direction	IEC60068-2-27 GB/T2423.5-1995
10	Package Drop Test	Height: 80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8-1995

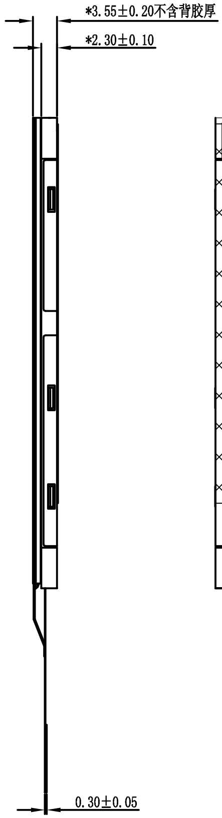
Note: 1. TS is the temperature of panel's surface.
Note: 2. Ta is the ambient temperature of sample.

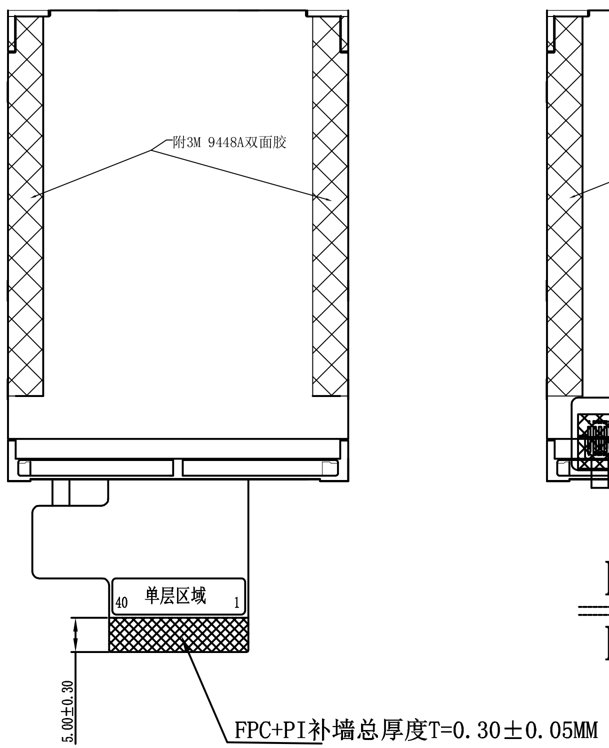
9. Mechanical Drawing

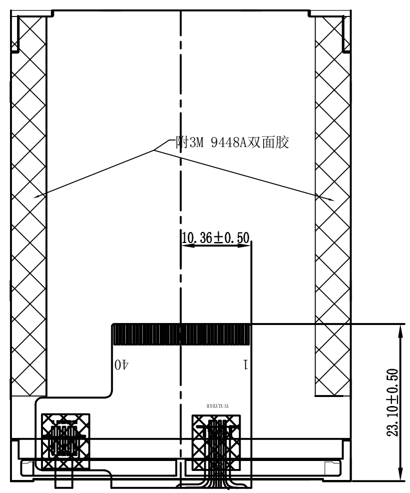
A0	2022/07/28	First issue

屏使用MCU16位









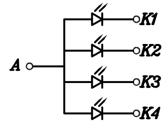
FPC弯折参考

FPC展开出货

1	GND
2	DB0
3	DB1
4	DB2
5	DB3
6	GND
7	VDD
8	CS
9	RS
10	WR
11	RD
12	NC
13	YU
14	XL
15	YD
16	XR
17	LEDA
18	LEDK
19	LEDK
20	LEDK
21	LEDK
22	NC
23	DB4
24	DB8
25	DB9
26	DB10
27	DB11
28	DB12
29	DB13
30	DB14
31	DB15
32	RESET
33	VDD
34	VDD
35	GND
36	DB5
37	DB6
38	DB7
39	GND
40	GND

RTP技术参数：

1. ITO膜+ITO玻璃+FPC引线
   ITO膜：亮面防刮0.188mm
   ITO玻璃：高阻0.7MM
   总厚度：1.15 MAX
2. 电路等级：DC 3V 5~30mA
3. 绝缘阻抗：≥20MΩ(25V DC)
4. 透光率：≥78%
5. 操作压力：30-100g
6. 端点阻抗：X：150-900Ω Y：150-900Ω
7. 响应时间：<10ms
8. 表面硬度：3H
9. 工作环境：-20℃~+70℃，≤90%RH
10. 储存环境：-30℃~+80℃，≤90%RH
11. 未注尺寸公差按±0.20mm
12. 产品符合"ROHS"要求.



CIRCUIT DIAGRAM

(If=60mA , VF= 2.8~3.2V)

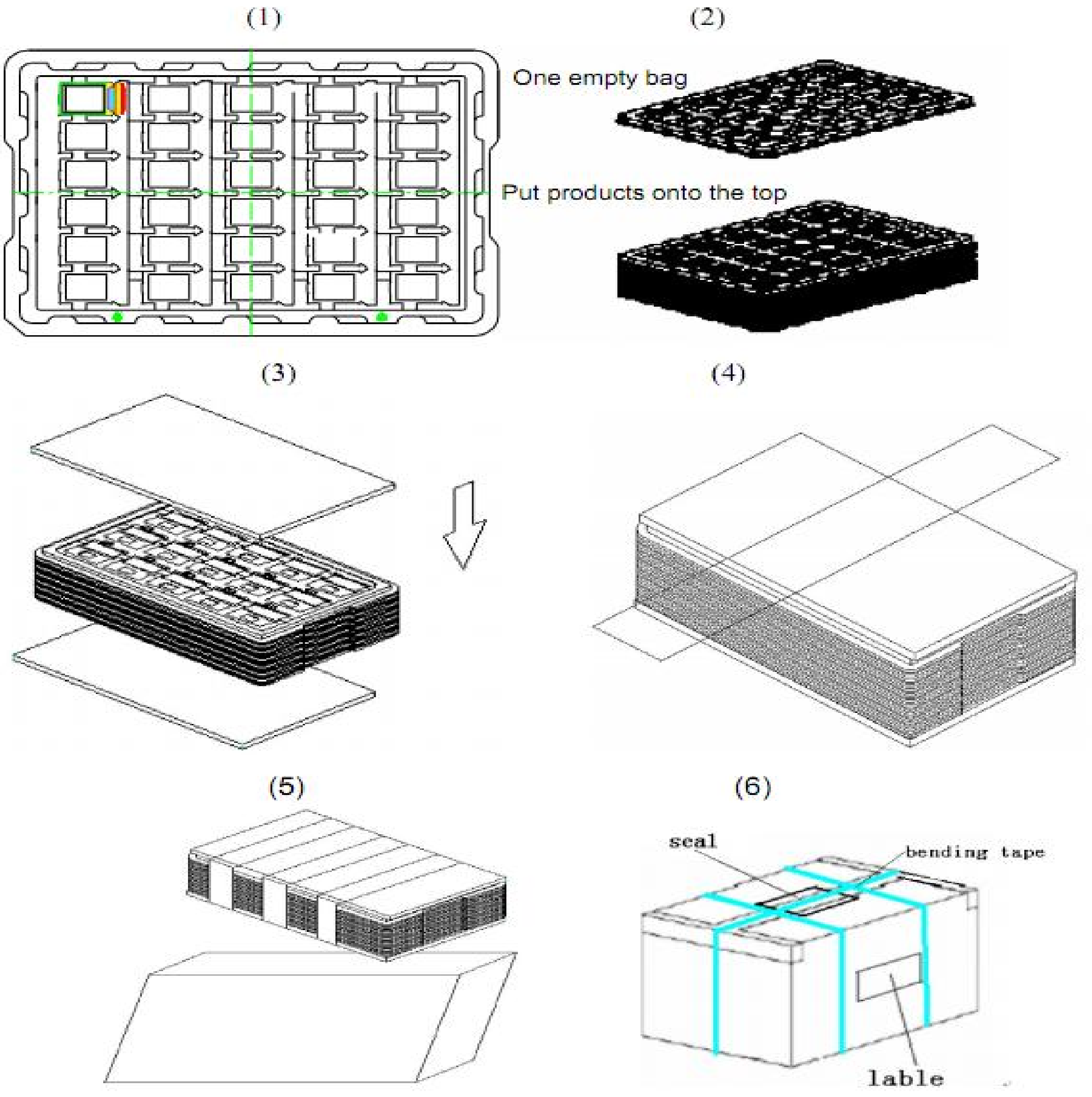
NOTES:

1. DISPLAY TYPE: 2.8 INCH TFT /Normally White Transmissive
2. BACKLIGHT: 4 CHIP WHITE LED
3. OPERATING TEMP: -20° C~+70° C
4. STORAGE TEMP: -30° c~+80° c
5. RESOLUTION: 240RGBx320
6. Luminous instensity(9 AVG):Module: 230cd/m(MIN.), 250cd/m(TYP.)
7. LCD IC:ST7789V
8. Uniformity:80%(Min)
9. "( )"reference dimension. " * "critical dimension
10. RoHS Compliant

INTERFACE	MCU Interface	深圳市勋瑞光电科技有限公司 Xunrui photoelectric technology (shenzhen) CO.,LTD.		
	FPC Connector	MODEL NAME TFT Display Module	PART NO. H028SQ40E3547-T	
VIEWING DIRECTION	12 o'clock	DWN	REV. A0	SHEET OF 1/1
		CHKD	TOLERANCE UNLESS SPECIFIED ±0.3	
Gray Scale DIRECTION	12 o'clock	PROJECTION 3RD ANGLE	UNIT mm	SCALE 1:1

10. Packing

Packing Method



1. Put module into tray cavity:
2. Tray stacking
3. Put 1 cardboard under the tray stack and 1 cardboard above:
4. Fix the cardboard to the tray stack with adhesive tape:
5. Put the tray stack into carton.
6. Carton sealing with adhesive tape.

11. Precautions for Use of LCD modules

11.1 Handling Precautions

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

11.1.2 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.

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

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

11.1.5 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

11.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

11.1.8.4 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.

11.2 Storage Precautions

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

11.2.2 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℃ ～ 40℃ Relatively humidity: ≤80%

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

11.3 Transportation Precautions

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