


SPECIFICATIONS

FOR

LCD MODULE

CUSTOMER	
MODEL	SCT021004-V01
CUSTOMER APPROVED	

APPROVED BY	CHECKED BY	ORGANIZED BY
	Lr.Yin	HCZ

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1. General Description

This Module SCT021004-V01 is TFT Liquid Crystal Display Module. This specification covers the delivery requirements for the liquid crystal display module delivered by quality to Customer.

1.1. Mechanical & Display Specifications

Item	Standard value	Unit
LCD Size	2.13	inch
Dot Matrix	122 × 250	pixel
Module Size	27.068 × 56.2 × 0.72	mm
Active Area	23.668 × 48.5	mm
Dot Pitch	0.194 × 0.194	mm
Color depth	Mono, black and white	-
Display Mode	Normally White	-
Viewing Direction	All	-
Gray Scale Inversion Direction	All	-
Driver IC	ST7306	-
Interface	4line-SPI	-
Weight	TBD	g

Note: Requirements on Environmental Protection: RoHS

1.2. Interface Pin

Pin No.	Symbol	Type	Description
1	GND	P	Ground
2	GND	P	Ground
3	VPP	I	The programming power supply. Left this pin open.
4	SDA	I/O	Serial data Input and output
5	SCL	I	Serial clock input
6	RST	I	reset signal
7	A0	I	Display data/command selection pin in 4-line serial interface
8	CS	I	Chip Select signal
9	VDDI	P	Power supply for Digital
10	VDDA	P	Power supply for Analog
11	GND	P	Ground
12	GND	P	Ground

Note1: TYPE definition: I-----Input O---Output P----Power/Ground

2. Electrical Characteristics

2.1. Absolute Maximum Rating

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDDA	-0.3	4.0	V	
Input Signal Voltage	VDDI	-0.3	4.0	V	
Operating Temperature	T _{OPR}	-20	+70	°C	Ambient
Storage Temperature	T _{STG}	-30	+80	°C	Ambient

Note1: VIN represent IO

2.2. DC Electrical Characteristics

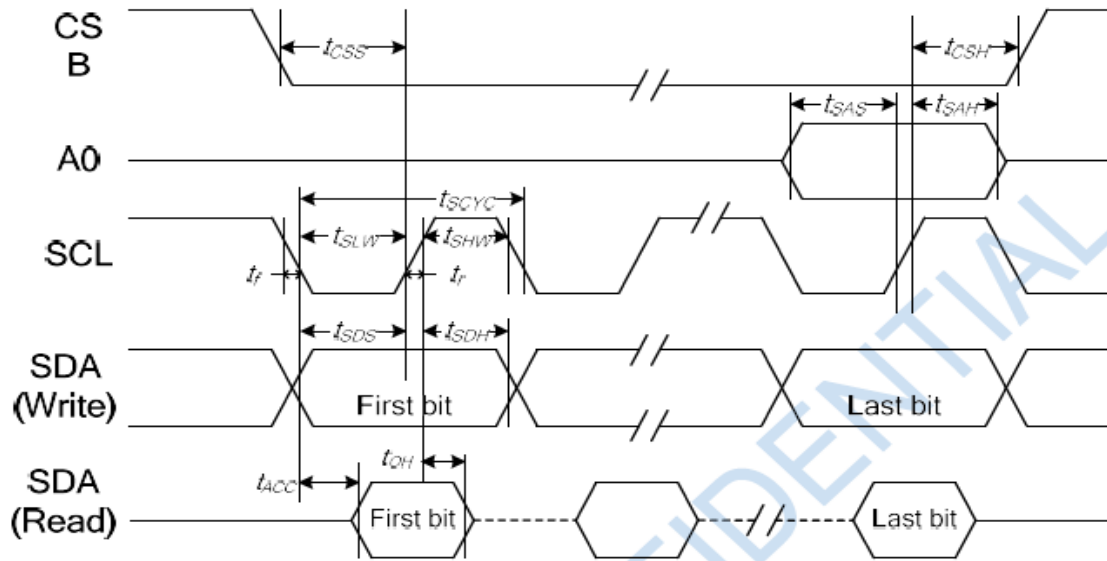
2.2.1. Driving TFT LCD Panel

GND=0V, Ta=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply Voltage	VDDA	2.55	3.3	3.6	V	
Input Signal Voltage	VDDI	1.65	3.3	3.6	V	
Logic High level input voltage	V _{IH}	0.7VDDI	-	VDDI	V	
Logic Low level input voltage	V _{IL}	VSS	-	0.3VDDI	V	
Logic High level output voltage	V _{OH}	0.8VDDI	-	VDDI	V	I _{OH} =-1.0mA
Logic Low level output voltage	V _{OL}	VSS	-	0.2VDDI	V	I _{OL} =1.0mA
Power Consumption	I _{CC}	-	40	60	uA	All Pixel ON
(VDDA=VDDI=3.3V, Low Power Mode)		-	120	200	uA	Updating Display

2.3. AC Electrical Characteristics

2.3.1. 4Line SPI Serial Data Transfer Interface Characteristics



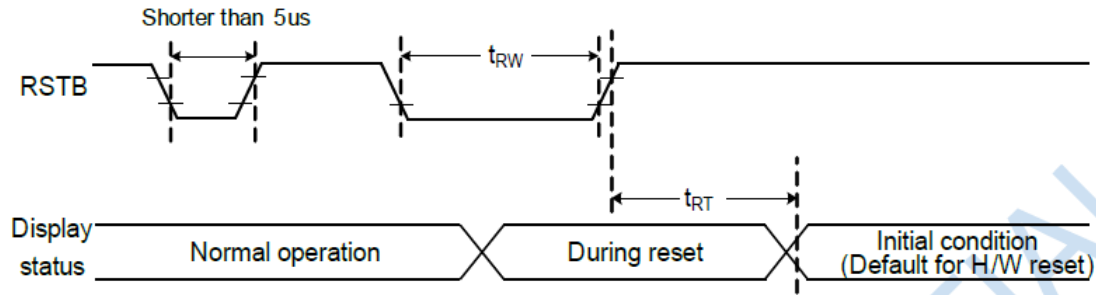
VDDI = 1.8~3.3V, Ta = 25°C

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period (Write)	SCL	tSCYC		30	—	ns
Serial clock period (Read)				150		
SCLK "H" pulse width (Write)		tSHW		15	—	
SCLK "H" pulse width (Read)				60		
SCLK "L" pulse width (Write)		tSLW		15	—	
SCLK "L" pulse width (Read)				60		
Address setup time	A0	tSAS	10	—		
Address hold time		tSAH	10	—		
Data setup time	SDA	tSDS	10	—		
Data hold time	(Write)	tSDH	10	—		
Read data access time	SDA	tACC	For maximum CL=30p	10	50	
Read data output disable time	(Read)	tOH	For minimum CL=8p	15	50	
CSB-SCLK time	CSB	tCSS	10	—		
CSB-SCLK time		tCSH	10	—		

Note:

1. The input signal rise and fall time (tr, tf) are specified at 15 ns or less.
2. All timing is specified using 20% and 80% of VDDI as the standard.

2.3.2. Reset Timing



VDDI = 1.8~3.3V, Ta = 25°C

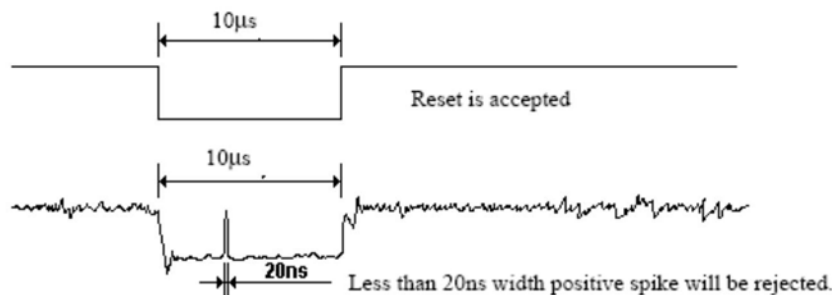
Item	Symbol	Condition	Min.	Max.	Unit
Reset "L" pulse width	tRW		1	—	ms
Reset cancel	tRT	Note1, 5 (sleep-in mode)	—	5	ms
		Note1, 6, 7 (sleep-out mode)	—	120	ms

Notes:

- The reset cancel includes also required time for loading ID bytes, VSource setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RSTB.
- Spike due to an electrostatic discharge on RSTB line does not cause irregular system reset according to the table below:

RSTB Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

- 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.
- Spike Rejection also applies during a valid reset pulse as shown below:



- When Reset applied during Sleep In Mode.
- When Reset applied during Sleep Out Mode.
- It is necessary to wait 5msec after releasing RSTB before sending commands. Also Sleep Out command cannot be sent for 120msec.

3. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle	θ_L	$CR \geq 2$	-	60	-	degree	Note5
	θ_R		-	60	-		
	θ_U		-	60	-		
	θ_D		-	60	-		
Contrast Ratio	CR	$\theta=0^\circ$ optimal	-	18	-	-	Note3
Response Time	$T_R + T_F$	$T_a=25^\circ C$	-	5	7	ms	Note2
Color Chromaticity	White	$\theta=0^\circ$	-	0.300	-	-	Note6
				0.330			

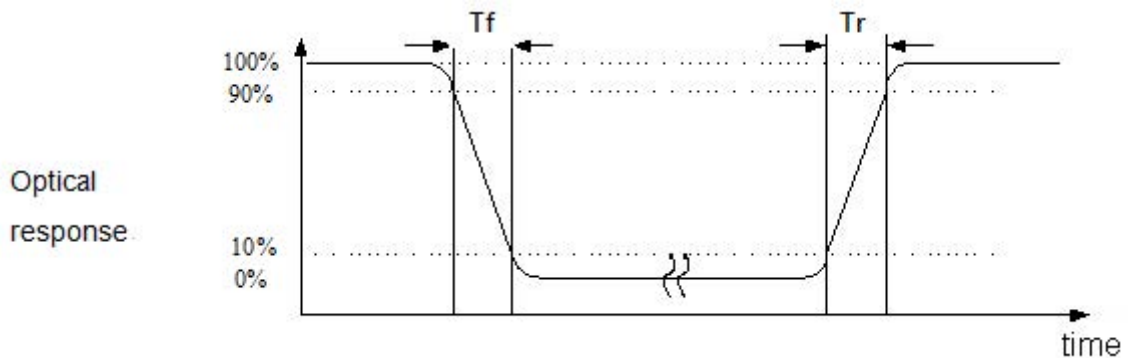
Note:

1. Test equipment setup

After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. CA-210 of KONICA MINOLTA, which utilized for Chromaticity and BM-7 for other optical characteristics.

2. Definition of response time: T_R and T_F

The figure below is the output signal of the photo detector.

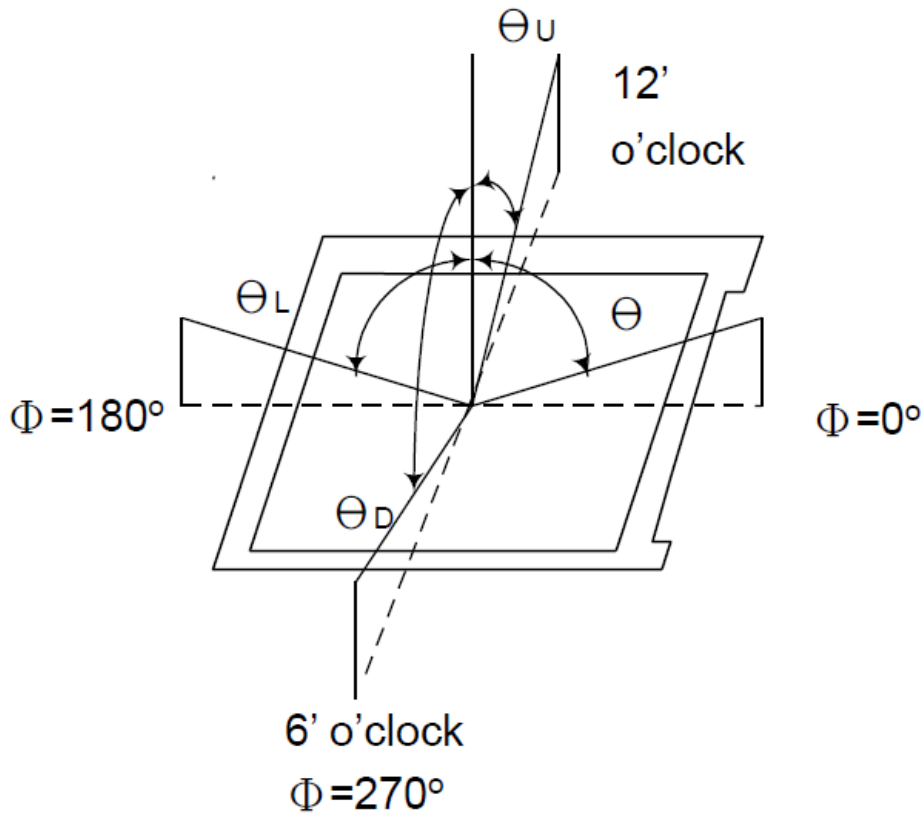


3. Definition of contrast ratio

$$CR = \frac{\text{Luminance with all pixel white}}{\text{Luminance with all pixel black}}$$

4. The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

5. Definition of viewing angle:



6. Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

4. Reliability

4.1. Reliability Condition

No.	Item	Condition	Remark
1	High temperature Operating	70°C, 240hrs	Finish product (With polarizer)
2	Low temperature Operating	-20°C, 240hrs	Finish product (With polarizer)
3	High temperature Storage	80°C, 240hrs	Finish product (With polarizer)
4	Low temperature Storage	-30°C, 240hrs	Finish product (With polarizer)
5	High temperature & Humidity Storage	80°C, 90%RH, 240hrs	Finish product (With polarizer)
6	Thermal Shock Storage (No operation)	-30°C, 30min. <=> 80°C, 30min. 100 Cycles	Finish product (With polarizer)
7	ESD Test	Voltage: +8KV R:330Ω, C:150pF Air discharge, 10 times	Finish product (With polarizer)
8	Vibration Test	0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	Finish product (With polarizer)
9	Drop Test	Packed, 60cm free fall 1 corner, 3 edges, 6 surfaces	Finish product (With polarizer)

*One single product test for only one item.

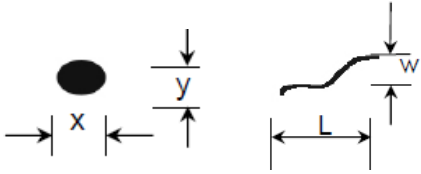
* Judgment after test: keep in room temperature for more than 2 hours.

- Current consumption < 2 times of initial value
- Contrast > 1/2 initial value
- Function: work normally

4.2. Inspection plan

Class	Item	Judgment	Class
Packing & Indicate	1.Outside and inside package	"Model no.", "lot no." and " quantity" should indicate on the package.	Minor
	2.Model mixed and quantity	Other model mixed rejected. Quantity short or over rejected.	Critical
	3.Product indication	"Model no." should indicate on the product	Major
Assembly	4.Dimension,LCD glass scratch and scribe defect	According to specification or drawing	Major
Appearance	5.Viewing area	Polarizer edge or LCD's sealing line is visible in the viewing area rejected	Minor
	6.Blemish,black spot, white spot in the LCD and LCD glass cracks	According to standard of visual inspection (inside viewing area)	Minor
	7.Blemish,black spot White spot and scratch on the polarizer	According to standard of visual inspection (inside viewing area)	Minor
	8.Bubble in polarizer	According to standard of visual inspection (inside viewing area)	Minor
	9.LCD's rainbow color	Strong deviation color (or Newton ring) of LCD rejected. Or according to limited sample (if needed, and inside viewing area)	Minor
	10.FPC	Burned area or wrong part number is on FPC. The symbol, character, and mark of FPC are unidentifiable. The stripped solder mask, $A > 1.0\text{mm}$. $0.3\text{mm} < \text{stripped solder mask or visible circuit}$, $A < 1.0\text{mm}$,and the number is ≥ 4 pieces. Particle between circuits in solder mask. Circuit is peeled off or cracked. Any circuit risen or exposed. $0.2\text{mm} < \text{Area of solder ball}$, A is $\leq 0.4\text{mm}$,the number of solder ball is ≥ 3 pieces. The magnitude of solder ball, A is $> 0.4\text{mm}$.	Minor
Electrical	11.Electrical and optical characteristics (contrast, VOP, chromaticity etc.)	According to standard of visual inspection (inside viewing area)	Critical
	12.Missing pattern	Missing dot, line, character rejected	Critical
	13.Short circuit, wrong pattern display	Non display, wrong pattern display, current consumption out of specification rejected	Critical
	14.Pin hole, pattern deformity	According to standard of visual inspection	Minor
	15.Black spot, white spot, black line, white line, slant line, background uneven, color uneven	Strong deviation color rejected Or according to limited sample full off screen (all black) disregards	Minor
	16.Stick image (retention image)	Fixed test picture within two hours rejected	Minor

4.3. Standard of visual inspection

Class	Item	Judgment															
Minor	Blemish, black spot, white spot in the LCD.	(A) Round type Unit: mm															
	Blemish, black spot, white spot and scratch on the polarizer.	<table border="1"> <thead> <tr> <th>Diameter (mm)</th> <th>Acceptable Quantity</th> </tr> </thead> <tbody> <tr> <td>$0.25 < A$</td> <td>0</td> </tr> </tbody> </table> <p>Note: $A = (x + y)/2$ (mm)</p>	Diameter (mm)	Acceptable Quantity	$0.25 < A$	0											
Diameter (mm)	Acceptable Quantity																
$0.25 < A$	0																
	 <p>Round type Line type</p>	(B) Line type Unit: mm															
		<table border="1"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acceptable Quantity</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>$W \leq 0.03$</td> <td>Acceptable</td> </tr> <tr> <td>$L < 5$</td> <td>$0.03 < W \leq 0.07$</td> <td>3</td> </tr> <tr> <td>$L < 5$</td> <td>$0.03 < W \leq 0.07$</td> <td>1</td> </tr> <tr> <td>-</td> <td>$0.07 < W$</td> <td>Follow round type</td> </tr> </tbody> </table>	Length	Width	Acceptable Quantity	-	$W \leq 0.03$	Acceptable	$L < 5$	$0.03 < W \leq 0.07$	3	$L < 5$	$0.03 < W \leq 0.07$	1	-	$0.07 < W$	Follow round type
Length	Width	Acceptable Quantity															
-	$W \leq 0.03$	Acceptable															
$L < 5$	$0.03 < W \leq 0.07$	3															
$L < 5$	$0.03 < W \leq 0.07$	1															
-	$0.07 < W$	Follow round type															
Minor	Bubble in polarizer	Unit: mm															
		<table border="1"> <thead> <tr> <th>Diameter (mm)</th> <th>Acceptable Quantity</th> </tr> </thead> <tbody> <tr> <td>$A < 0.3$</td> <td>Acceptable</td> </tr> <tr> <td>$0.3 < A < 0.5$</td> <td>1</td> </tr> <tr> <td>$0.5 < A$</td> <td>0</td> </tr> </tbody> </table>	Diameter (mm)	Acceptable Quantity	$A < 0.3$	Acceptable	$0.3 < A < 0.5$	1	$0.5 < A$	0							
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Minor	Pin hole, Pattern deformity	Unit: mm															
		<table border="1"> <thead> <tr> <th>Diameter (mm)</th> <th>Acceptable Quantity</th> </tr> </thead> <tbody> <tr> <td>$0.4 < A$</td> <td>0</td> </tr> </tbody> </table>	Diameter (mm)	Acceptable Quantity	$0.4 < A$	0											
Diameter (mm)	Acceptable Quantity																
$0.4 < A$	0																

5. Precautions

5.1. Handling Precautions

- (1) Protect the panel from static, it may cause damage to the CMOS Gate Array IC.
- (2) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (3) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (4) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Don't use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (5) Pins of I/F connector shall not be touched directly with bare hands.
- (6) Refrain from strong mechanical shock and / or any force to the panel. In addition to damage, this may cause improper operation or damage to the panel.
- (7) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a B pencil lead.
- (8) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
- (9) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

5.2. Storage Precautions

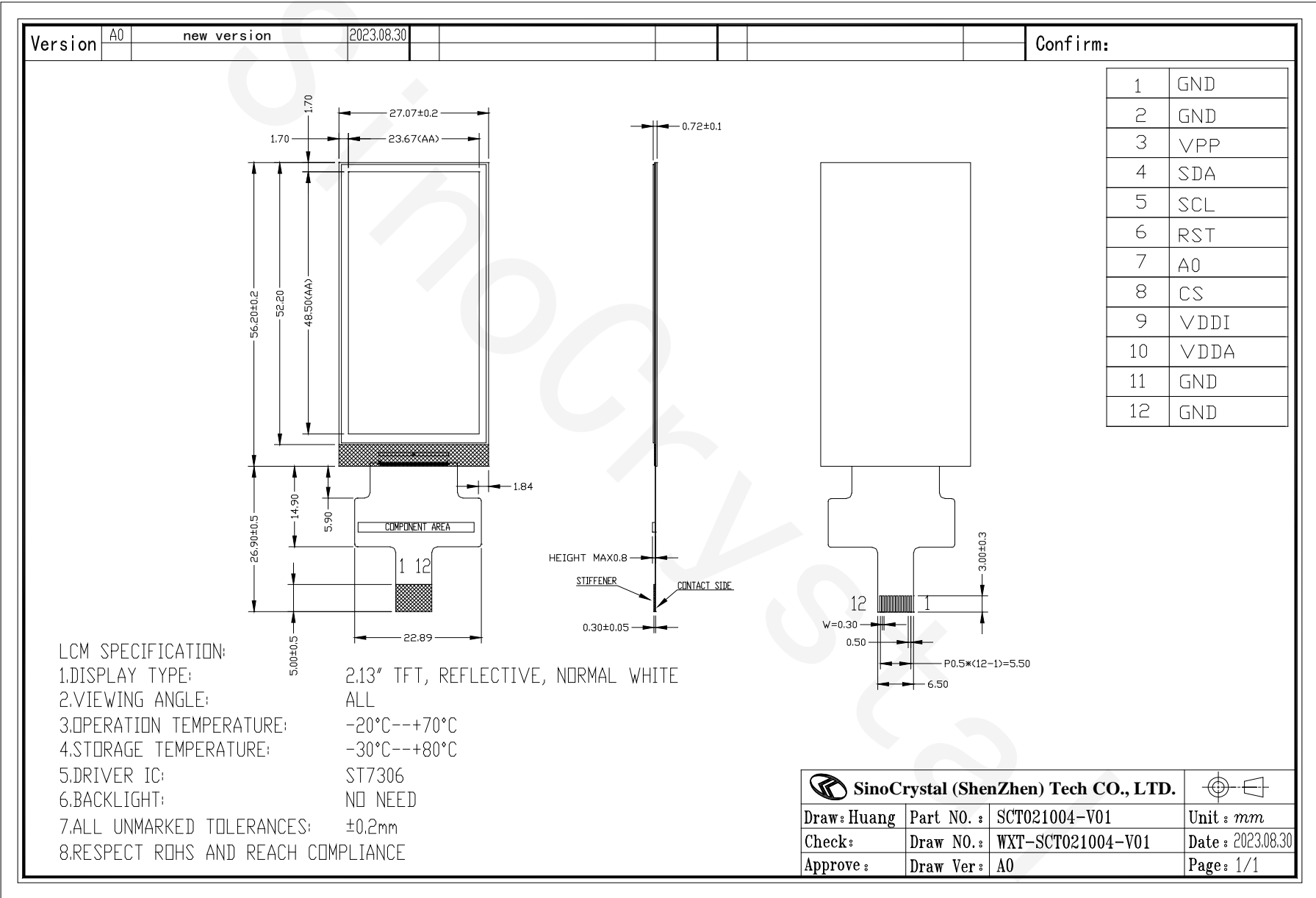
- (1) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the panel with temperature from 0 to 35°C and relative humidity of less than 70%.
- (2) The panel shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

5.3. Operation Precautions

- (1) The LCD shall be operated within the limits specified. Operation at values outside of these limits may shorten life, and/or harm display images.
- (2) Do not exceed the absolute maximum rating value. (the supply voltage variation, Input voltage variation in part contents and environmental temperature and so on). Otherwise the panel may be damaged.
- (3) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.



6. Outline Dimension



7. Packing Information

7.1. Packing Quantity

TBD.

7.2. Flowing chart

TBD.

SinoCrystal