


# SPECIFICATIONS

## FOR

### LCD MODULE

<b>CUSTOMER</b>	
<b>MODEL</b>	<b>SCT022004-V01</b>
<b>CUSTOMER APPROVED</b>	

<b>APPROVED BY</b>	<b>CHECKED BY</b>	<b>ORGANIZED BY</b>
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# RECORDS OF REVISIONS

Version	Content	Date
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# CONTENTS

- **General Description**
- **Electrical Characteristics**
- **Optical characteristics**
- **Reliability**
- **Precaution**
- **Outline Dimension**
- **Packing Information**

## 1. General Description

This Module SCT022004-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	2.2	inch
Dot Matrix	176(RGB) × 220	pixel
Module Size	41.90 × 55.26 × 2.35	mm
Active Area	34.85 × 43.56	mm
Dot Pitch	0.198 × 0.198	mm
Pixel Configuration	R.G.B. Stripe	-
Color depth	262K	-
Display Mode	Normally white, Transmissive	-
Technology Type	a-Si	-
Viewing Direction	6 o'clock	-
Gray Scale Inversion Direction	12 o'clock	-
Driver IC	ILI9225G	-
Interface	16-bit MCU	-
LED Numbers	3 LEDs	-
Weight	TBD	g

## 1.2. Interface Pin

Pin No.	Symbol	Type	Description
1	D0	I/O	Data bus
2	D1	I/O	Data bus
3	D2	I/O	Data bus
4	D3	I/O	Data bus
5	GND	P	Ground
6	IOVCC	P	Power supply for I/O
7	CS	I	Chip Select signal
8	RS	I	Display data/command selection pin in MCU interface. DCX='1': display data or parameter. DCX='0': register index / command.
9	WR	I	Write signal
10	RD	I	Read signal
11	LEDA	P	LED driving anode
12	LEDK1	P	LED driving cathode
13	LEDK2	P	LED driving cathode
14	LEDK3	P	LED driving cathode
15	D4	I/O	Data bus
16	D8	I/O	Data bus
17	D9	I/O	Data bus
18	D10	I/O	Data bus
19	D11	I/O	Data bus
20	D12	I/O	Data bus
21	D13	I/O	Data bus
22	D14	I/O	Data bus
23	D15	I/O	Data bus
24	RESET	I	Chip reset signal
25	VCI	P	Power supply for system
26	VCI	P	Power supply for system
27	GND	P	Ground
28	D5	I/O	Data bus
29	D6	I/O	Data bus
30	D7	I/O	Data bus

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 (Analog)	V <sub>CI</sub>	-0.3	4.6	V	
Power Supply Voltage (IO)	IOVCC	-0.3	4.6	V	
Input Signal Voltage	V <sub>IN</sub>	-0.3	IOVCC+0.3	V	Note 1
Operating Temperature	T <sub>OPR</sub>	-20	+70	°C	Ambient
Storage Temperature	T <sub>STG</sub>	-30	+80	°C	Ambient

Note1: V<sub>IN</sub> represent IO

### 2.2. DC Electrical Characteristics

#### 2.2.1. Driving TFT LCD Panel

GND=0V, T<sub>a</sub>=25°C

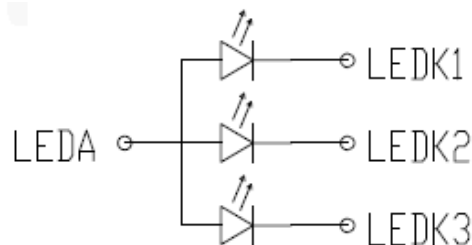
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog Operating Voltage	V <sub>CI</sub>	2.5	2.8	3.3	V	
Logic Operating Voltage	IOVCC	1.65	1.8	3.3	V	
Logic High level input voltage	V <sub>IH</sub>	0.7IOVCC	-	IOVCC	V	
Logic Low level input voltage	V <sub>IL</sub>	0	-	0.3IOVCC	V	
Logic High level output voltage	V <sub>OH</sub>	0.8IOVCC	-	IOVCC	V	I <sub>OH</sub> =-1.0mA
Logic Low level output voltage	V <sub>OL</sub>	0	-	0.2IOVCC	V	I <sub>OL</sub> =1.0mA
Power Consumption	I <sub>CC</sub>	-	TBD	-	mA	

#### 2.2.2. Driving Backlight

T<sub>a</sub>=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Current	I <sub>F</sub>	-	60	60	mA	Note1
Forward Current Voltage	V <sub>F</sub>	2.75	-	3.5	V	
Operating Life Time	-	10000			hrs	

Note 1: The figure below shows the connection of backlight LED.



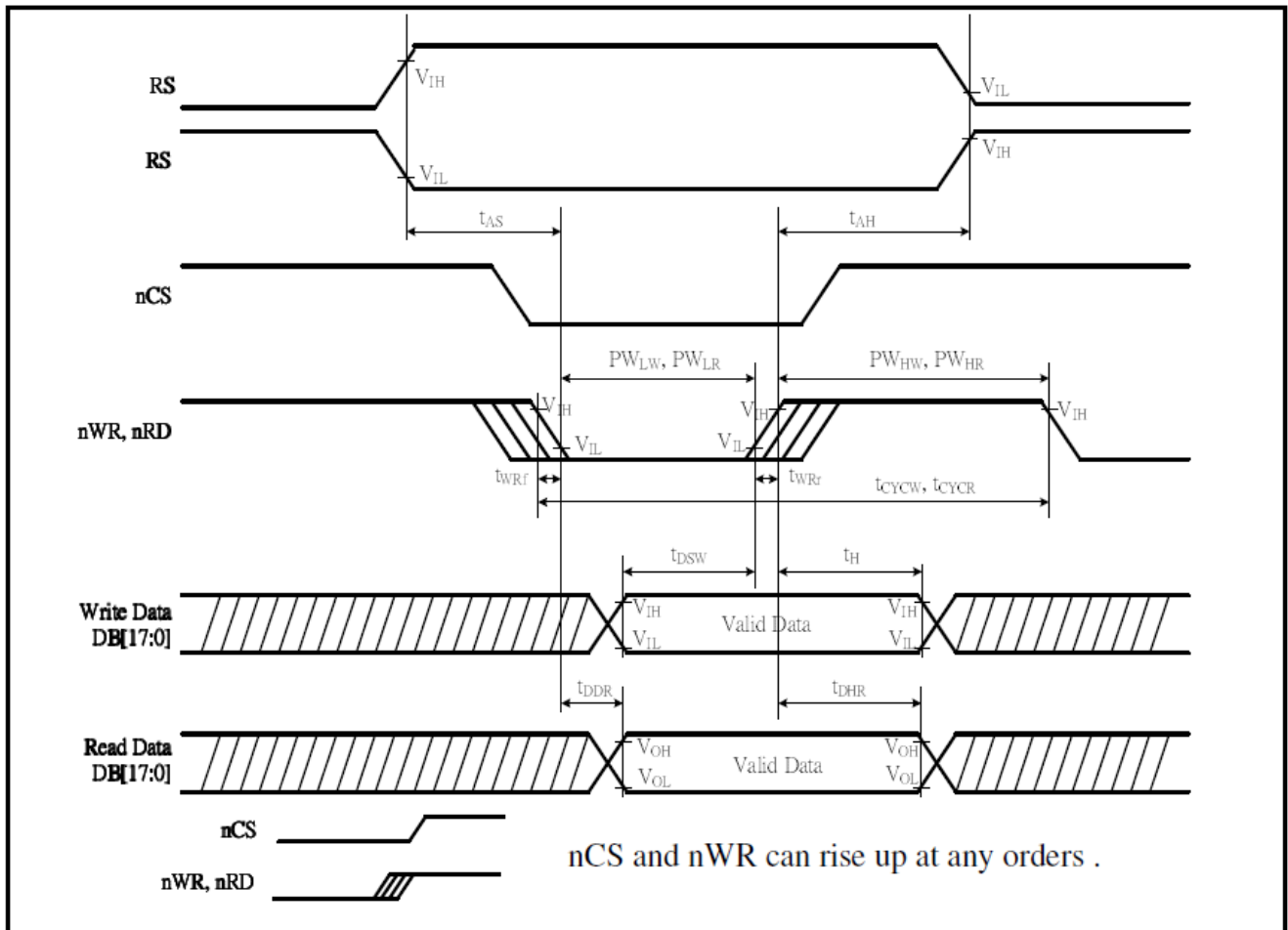
Note 2: One LED: I<sub>F</sub> =20mA.

## 2.3. AC Electrical Characteristics

### 2.3.1. i80-System Interface Timing Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V, VCI=2.5~3.3V)

Item	Symbol	Unit	Min.	Max.	Test Condition
Bus cycle time	Write	$t_{CYCW}$	ns	66	-
	Read	$t_{CYCR}$	ns	300	-
Write low-level pulse width	$PW_{LW}$	ns	35	500	-
Write high-level pulse width	$PW_{HW}$	ns	35	-	-
Read low-level pulse width	$PW_{LR}$	ns	150	-	-
Read high-level pulse width	$PW_{HR}$	ns	150	-	-
Write / Read rise / fall time	$t_{WRr}/t_{WRf}$	ns	-	15	-
Setup time	Write ( RS to nCS, E/nWR )	$t_{AS}$	ns	10	-
	Read ( RS to nCS, RW/nRD )			5	-
Address hold time	$t_{AH}$	ns	5	-	-
Write data set up time	$t_{DSW}$	ns	10	-	-
Write data hold time	$t_H$	ns	15	-	-
Read data delay time	$t_{DDR}$	ns	-	100	-
Read data hold time	$t_{DHR}$	ns	5	-	-

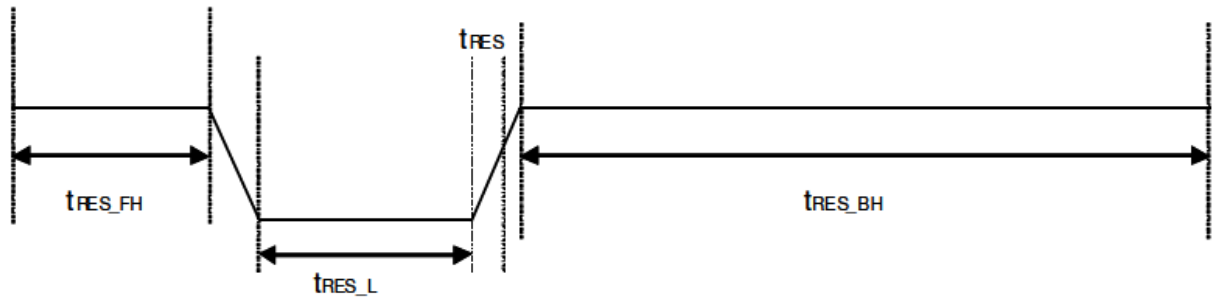


### 2.3.2. Reset Timing

Reset Timing Characteristics (IOVCC = 1.65 ~ 3.3V)

Item	Symbol	Unit	Min.	Typ.	Max
Reset front high-level with	$t_{RES\_FH}$	ms	1		
Reset low-level width	$t_{RES\_L}$	us	10		
Reset back high-level width	$t_{RES\_BH}$	ms	50		
Reset rise time	$t_{rRES}$	us			10

nRESET





### 3. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark		
Viewing angle	$\theta T$	$CR \geq 10$		45	-	degree	Note5		
	$\theta B$			20	-				
	$\theta L$			45	-				
	$\theta R$			45	-				
Contrast Ratio	CR	$\theta=0^\circ$ optimal	-	700	-	-	Note3		
Response Time	$T_R$	$T_a=25^\circ C$	-	8	16	ms	Note2		
	$T_F$		-	12	24				
Color Chromaticity	White	$\theta=0^\circ$	-0.05	+0.05	-	-	26Note6		
								x	0.303
	y							0.325	
	Red							x	0.626
								y	0.334
	Green							x	0.277
								y	0.549
	Blue							x	0.142
y		0.122							
Uniformity	U	$\theta=0^\circ$	70	80	-	%	Note7		
Luminance	L	$I_F=Typ.$		TBD	-	cd/m <sup>2</sup>	Note8		

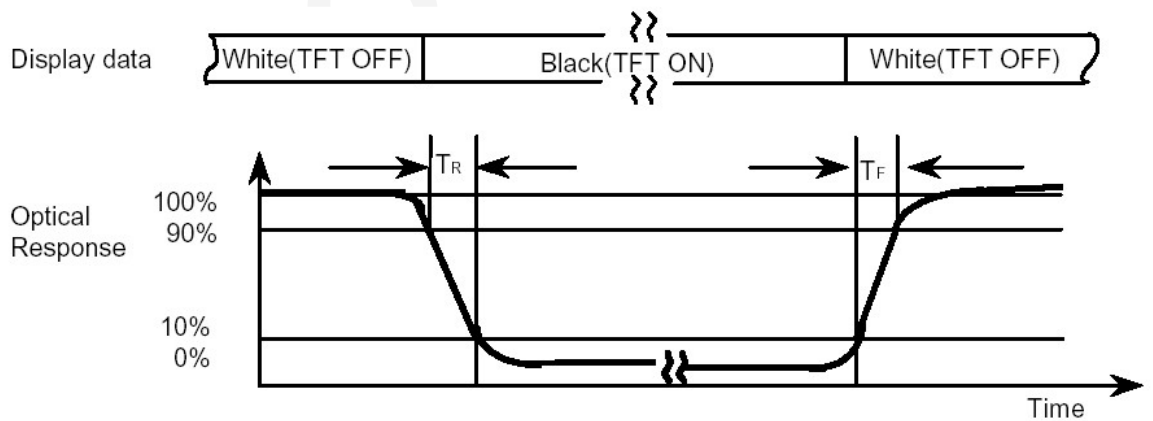
Note:

#### 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. Optical specifications are measured by Topcon BM-7 with a viewing angle of  $1^\circ$  at a distance of 50cm and normal direction.

#### 2. Definition of response time: $T_R$ and $T_F$

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

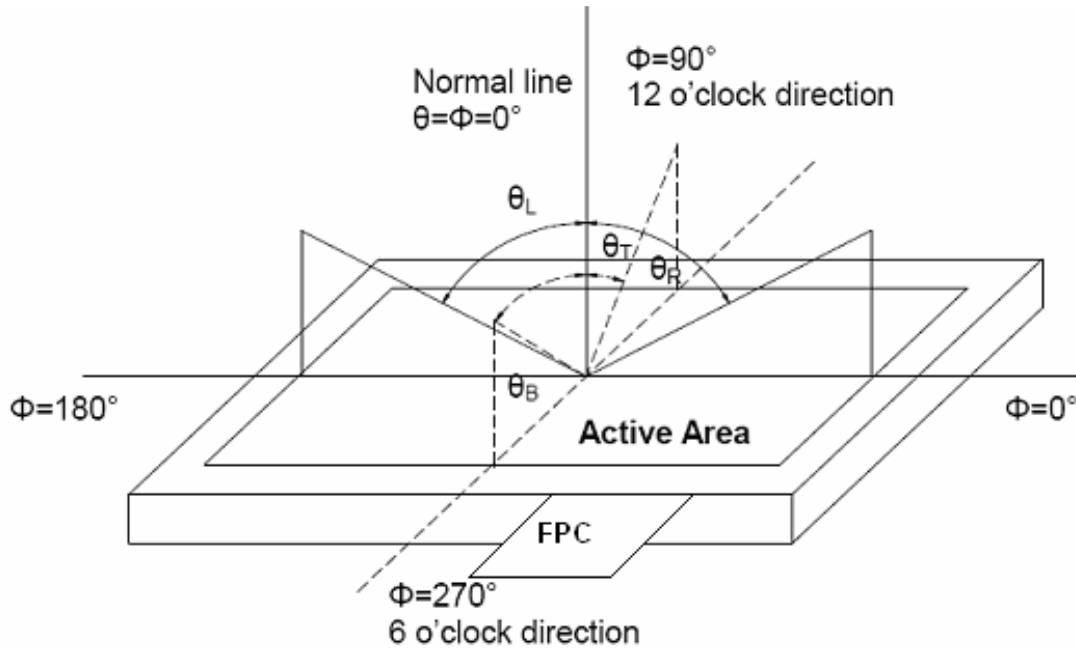


#### 3. Definition of contrast ratio

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

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.

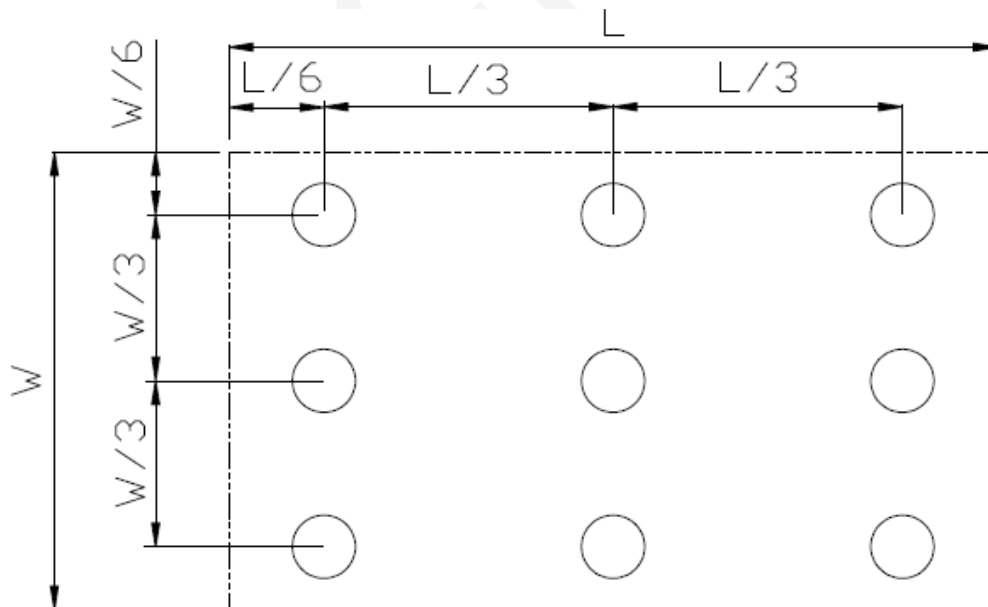
7. Definition of Luminance Uniformity

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

$$\text{Luminance Uniformity}(U) = L_{\text{MIN}} / L_{\text{MAX}}$$

L-----Active area length

W----- Active area width



$L_{\text{MAX}}$ : The measured maximum luminance of all measurement position.

$L_{\text{MIN}}$ : The measured minimum luminance of all measurement position.

8. Definition of Luminance:

Measure the luminance of white state at center point.

## 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 $\geq 4$ 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 $\geq 3$ 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 <table border="1"> <thead> <tr> <th>Diameter (mm)</th> <th>Acceptable Quantity</th> </tr> </thead> <tbody> <tr> <td><math>0.25 &lt; A</math></td> <td>0</td> </tr> </tbody> </table>	Diameter (mm)	Acceptable Quantity	$0.25 < A$	0										
	Diameter (mm)	Acceptable Quantity														
$0.25 < A$	0															
Blemish, black spot, white spot and scratch on the polarizer.	Note: $A = (x + y)/2$ (mm)  (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><math>W \leq 0.03</math></td> <td>Acceptable</td> </tr> <tr> <td><math>L &lt; 5</math></td> <td><math>0.03 &lt; W \leq 0.07</math></td> <td>3</td> </tr> <tr> <td><math>L &lt; 5</math></td> <td><math>0.03 &lt; W \leq 0.07</math></td> <td>1</td> </tr> <tr> <td>-</td> <td><math>0.07 &lt; W</math></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><math>A &lt; 0.3</math></td> <td>Acceptable</td> </tr> <tr> <td><math>0.3 &lt; A &lt; 0.5</math></td> <td>1</td> </tr> <tr> <td><math>0.5 &lt; A</math></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						
Diameter (mm)	Acceptable Quantity															
$A < 0.3$	Acceptable															
$0.3 < A < 0.5$	1															
$0.5 < A$	0															
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><math>0.4 &lt; A</math></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.

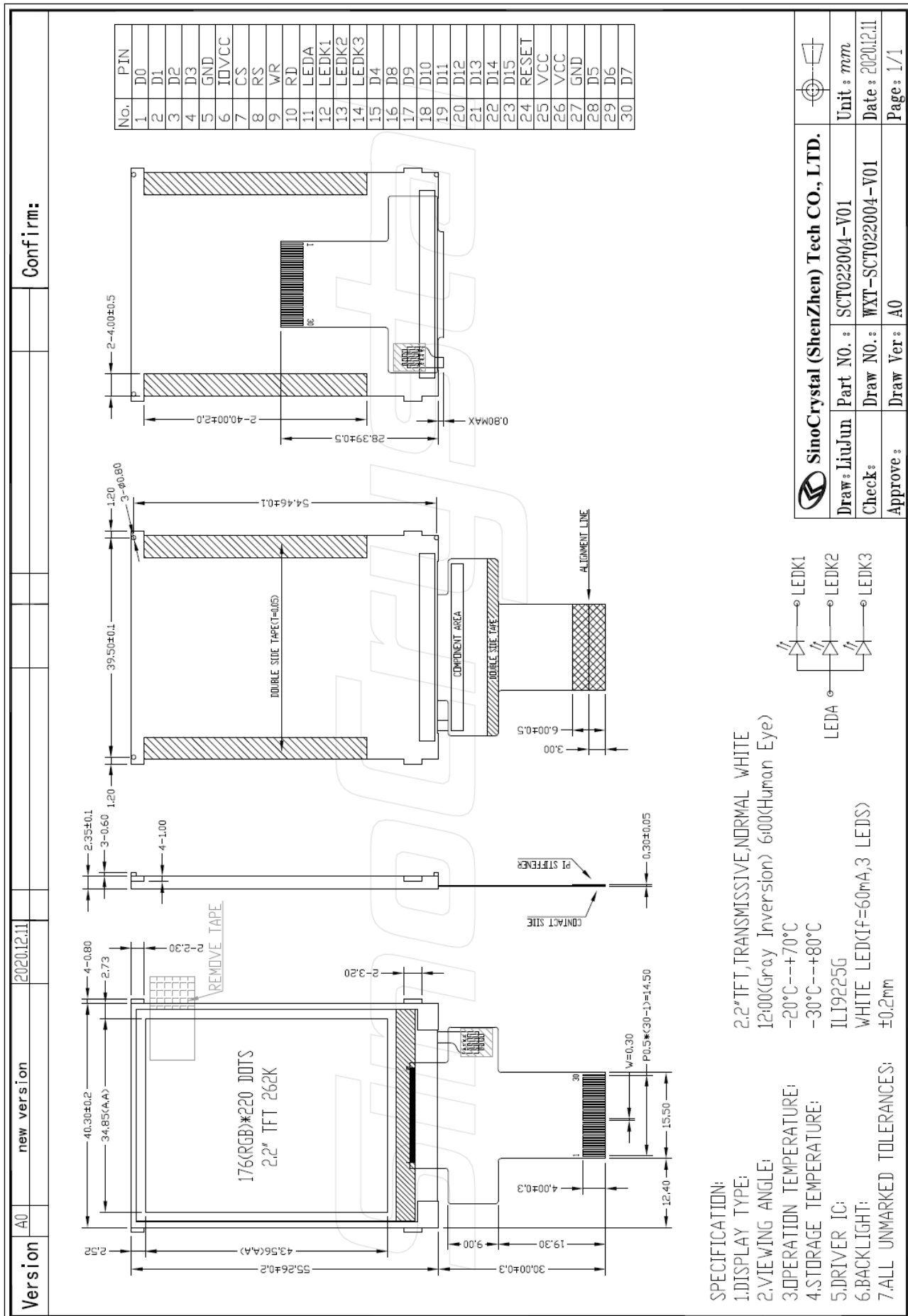
### 5.2. Storage Precautions

- (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