

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
MODEL	SCT030001-V01
CUSTOMER APPROVED	

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RECORDS OF REVISIONS

Revision No	Revision Date	Description
Ver: A0	2015-12-01	First release
Ver:A1	2015-12-07	Change characteristics

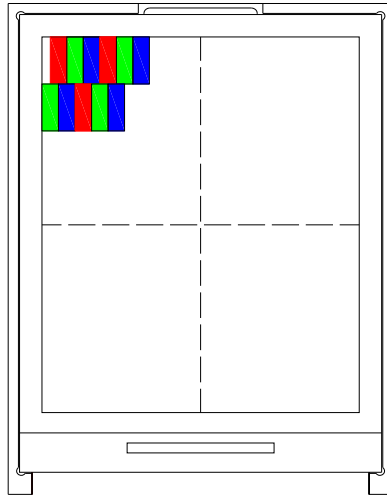
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- General Description
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1. General Description

This LCM **SCT030001-V01** is a TFT LCD module, comprising a **960**-channel source driver, a **240**-channel gate driver, **960 x 240** dots graphic, and power supply circuit. The 262k color can be display.

This TFT-LCD has **3.0** inch diagonally measured active display area with **960x240** resolution.



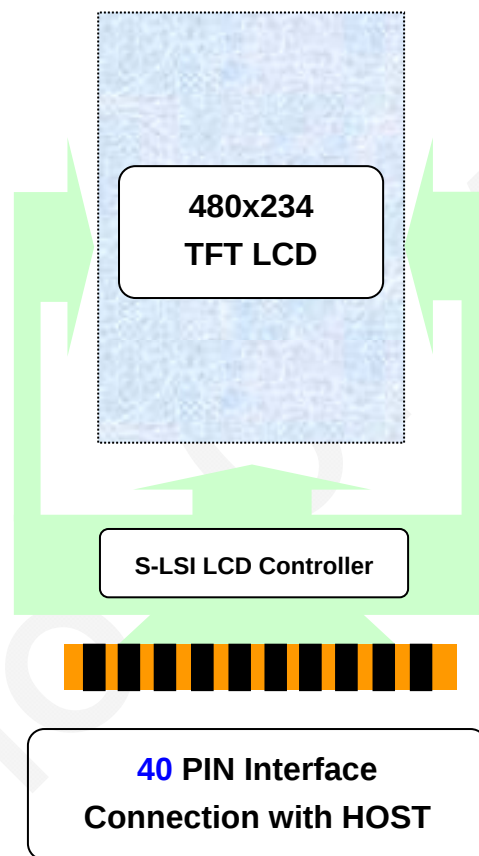
1.1 Mechanical Specifications

Item	Nominal Dimension	Unit
Dot Matrix	960 x 240	Dots
Module Size (W×H×T)	43.44 x 74.79 x 2.6	mm.
Active Area (W×H)	36.84 x 65.52	mm.
Pixel arrangement	Delta RGB	mm.
Color depth	262K (MAX)	colors
Interface	8-bit RGB / CCIR / YUV	-
Driving IC Package	COG	-

1.2 Display Specifications

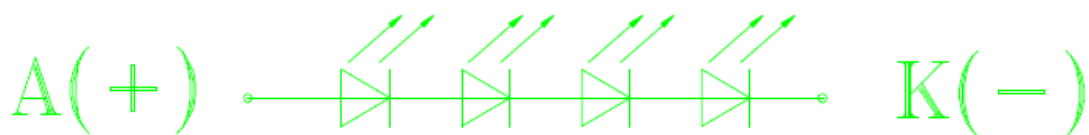
Item	Nominal Dimension	Unit
Operating temperature	-20 ~70	°C
Storage temperature	-30~80	°C
LCD Type	a-Si TFT	-
LCD Mode	TN/Normal White	-
Backlight Type	LED x 4	PCS

1.3 Block Diagram



1.4 Back-light Unit

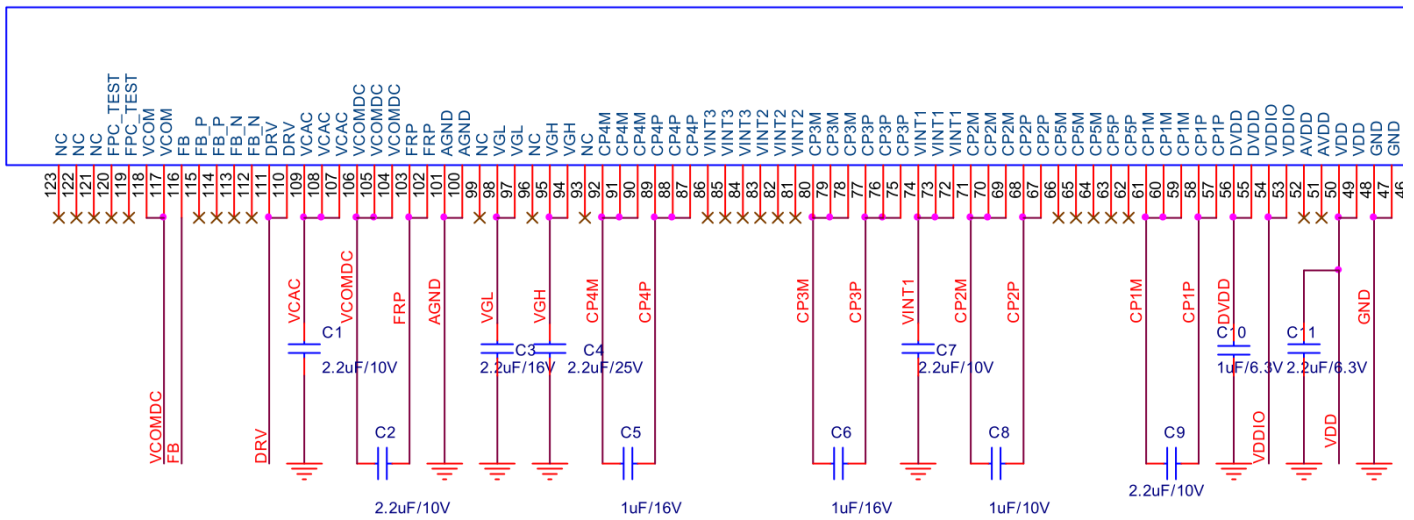
If = 20mA



1.5 Interface Pin

Pin No	Pin Symbol	Level	Description
1	VCOM	-	VCOM
2	K	-	LED backlight Cathode
3	A	-	LED backlight Anode
4	DRV	-	Gate signal for the power transistor of the boost converter
5	VCAC	-	Intermediate voltage for charge pump
6	VCOM	-	VCOM DC output
7	FRP	-	Frame polarity output
8	AGND	-	Power ground
9	VGL	-	Negative low power supply for gate driver output
10	VGH	-	Positive power supply for gate driver output
11	C4M	-	Pins to connect capacitors for power circuitry
12	C4P	-	Pins to connect capacitors for power circuitry
13	VINT3	-	Floating this pin.
14	VINT2	-	Floating this pin.
15	C3M	-	Pins to connect capacitors for power circuitry
16	C3P	-	Pins to connect capacitors for power circuitry
17	VINT1	-	Power setting capacitor connect pin
18	C2N	-	Pins to connect capacitors for power circuitry
19	C2P	-	Pins to connect capacitors for power circuitry
20	C1N	-	Pins to connect capacitors for power circuitry
21	C1P	-	Pins to connect capacitors for power circuitry
22	DVDD	-	Power setting capacitor connecting pins.
23	VDDIO	1.65-3.6V	Power supply for charge pump circuit
24	VDD	2.7-3.6V	Power supply for digital interface
25	AGND	-	Power ground
26-33	D0-D7	H/L	Data input
34	DCLK	H/L	Data clock
35	HSYNC	H/L	Line synchronizing
36	VSYNC	H/L	Frame synchronizing
37	SCL	H/L	Serial clock input
38	SDA	H/L	Serial data input
39	CSB	H/L	Serial chip select, Low enable
40	VCOM	-	VCOM

Note: The external capacitor is required on the those pin as following



2. Interface Timing

Output Timing Tables

8-bit RGB

AC Electrical Characteristics (VDD =2.7~3.6V, VDDIO=AVDD=VDD, AGND=GND=0V, TA=25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	Fclk	-	27	30	MHz	
CLKIN cycle time	Tcph	-	52	-	ns	
CLK pulse duty	Tcw	40	50	60	%	Tcph
Time that the HSD to Source output	Thso	-	3.5	-	CLKIN	
Time that the HSD to Gate output	Thgo	-	64.5	-	CLKIN	
Time that the HSD to Gate output off	Thgz	-	22.5	-	CLKIN	

8-bit Dummy RGB

AC Electrical Characteristics (VDD =2.7~3.6V, VDDIO=AVDD=VDD, AGND=GND=0V, TA=25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	Fclk	-	24.5/27	30	MHz	
CLKIN cycle time	Tcph	-	40/37	-	ns	
CLK pulse duty	Tcw	40	50	60	%	Tcph
Time that the HSD to Source output	Thso	-	3.5	-	CLKIN	
Time that the HSD to Gate output	Thgo	-	64.5	-	CLKIN	
Time that the HSD to Gate output off	Thgz	-	22.5	-	CLKIN	

YUV640 / YUV720

AC Electrical Characteristics (VDD =2.7~3.6V, VDDIO=AVDD=VDD, AGND=GND=0V, TA=25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	Fclk	-	24.5/27	30	MHz	
CLKIN cycle time	Tcph	-	40/37	-	Ns	
CLK pulse duty	Tcw	40	50	60	%	Tcph
Time that the HSD to Source output	Thso	-	3.5	-	CLKIN	
Time that the HSD to Gate output	Thgo	-	64.5	-	CLKIN	
Time that the HSD to Gate output off	Thgz	-	22.5	-	CLKIN	

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AC Electrical Characteristics (VDD =2.7~3.6V , VDDIO=AVDD=VDD, AGND=GND=0V, TA=25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	Fclk	-	27	30	MHz	
CLKIN cycle time	Tcph	33	37	-	Ns	
CLK pulse duty	Tcw	40	50	60	%	Tcph
Time that the HSD to Source output	Thso	-	3.5	-	CLKIN	
Time that the HSD to Gate output	Thgo	-	64.5	-	CLKIN	
Time that the HSD to Gate output off	Thgz	-	22.5	-	CLKIN	

Parallel RGB

AC Electrical Characteristics (VDD =2.7~3.6V, VDDIO=AVDD=VDD, AGND=GND=0V, TA=25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	Fclk	-	6.2	7.5	MHz	
CLKIN cycle time	Tcph	-	161	-	ns	
CLK pulse duty	Tcw	40	50	60	%	Tcph
Time that the HSD to Source output	Thso	-	3.5	-	CLKIN	
Time that the HSD to Gate output	Thgo	-	16.5	-	CLKIN	
Time that the HSD to Gate output off	Thgz	-	4.5	-	CLKIN	

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8-bit Dummy RGB (320 mode/NTSC/24.535Mhz) Input Timing

Parameter	Symbol	Interface			Unit
		Min.	Typ.	Max.	
CLKIN frequency	fCLKIN	20.45	24.535	30	MHz
HSD period	tH	1320	1560	1907	CLKIN
HSD display period	tHD	1280			CLKIN
HSD back porch	tHBP	40	241	255	CLKIN
HSD front porch	tHFP	0	39	372	CLKIN
HSD pulse width	tHSW	1	1	200	CLKIN
VSD period time	tV	242.5	262.5	450.5	H
Vertical display area	tVD	240			H
VSD back porch	tVBP	1	21	31	H
Odd field		1.5	21.5	31.5	
VSD front porch	tVFP	1.5	1.5	179.5	H
Even field		1	1	179	
VSD pulse width	tVSW	1	1	200	CLKIN
1 Frame		485	525	901	H

8-bit Dummy RGB (320 mode/PAL/24.375Mhz) Input Timing

Parameter	Symbol	Interface			Unit
		Min.	Typ.	Max.	
CLKIN frequency	fCLKIN	20.45	24.375	30	MHz
HSD period	tH	1308	1560	1920	CLKIN
HSD display period	tHD	1280			CLKIN
HSD back porch	tHBP	3	241	255	CLKIN
HSD front porch	tHFP	25	39	385	CLKIN
HSD pulse width	tHSW	1	1	200	CLKIN
VSD period time	tV	292.5	312.5	450.5	H
Vertical display area	tVD	288			H
VSD back porch	tVBP	3	23	34	H
Odd field		3.5	23.5	34.5	
VSD front porch	tVFP	1.5	1.5	128.5	H
Even field		1	1	128	
VSD pulse width	tVSW	1	1	200	CLKIN
1 Frame		585	625	901	H

8-bit Dummy RGB (360 mode/NTSC/27Mhz) Input Timing

Parameter	Symbol	Interface			Unit
		Min.	Typ.	Max.	
CLKIN frequency	fCLKIN	23	27	30	MHz
HSD period	tH	1468	1716	1907	CLKIN
HSD display period	tHD	1440			CLKIN
HSD back porch	tHBP	3	241	255	CLKIN
HSD front porch	tHFP	25	35	212	CLKIN
HSD pulse width	tHSW	1	1	200	CLKIN
VSD period time	tV	242.5	262.5	450.5	H
Vertical display area	tVD	240			H
VSD back porch	tVBP	1	21	31	H
Odd field		1.5	21.5	31.5	
VSD front porch	tVFP	1.5	1.5	179.5	H
Even field		1	1	179	
VSD pulse width	tVSW	1	1	200	CLKIN
1 Frame		485	525	901	H

8-bit Dummy RGB (360 mode/PAL/27Mhz) Input Timing

Parameter	Symbol	Interface			Unit
		Min.	Typ.	Max.	
CLKIN frequency	fCLKIN	23	27	30	MHz
HSD period	tH	1468	1728	1920	CLKIN
HSD display period	tHD	1440			CLKIN
HSD back porch	tHBP	3	241	255	CLKIN
HSD front porch	tHFP	25	47	225	CLKIN
HSD pulse width	tHSW	1	1	200	CLKIN
VSD period time	tV	292.5	312.5	450.5	H
Vertical display area	tVD	288			H
VSD back porch	Odd field	tVBP	3	23	H
	Even field		3.5	23.5	
VSD front porch	Odd field	tVFP	1.5	1.5	H
	Even field		1	1	
VSD pulse width	tVSW	1	1	200	CLKIN
1 Frame		585	625	901	H

YUV 720 mode/NTSC Input Timing

Parameter	Symbol	Interface			Unit
		Min.	Typ.	Max.	
CLKIN frequency	fCLKIN	-	27	-	MHz
HSD period	tH	-	1716	-	CLKIN
HSD display period	tHD	1440			CLKIN
HSD back porch	tHBP	-	240	-	CLKIN
HSD front porch	tHFP	-	36	-	CLKIN
HSD pulse width	tHSW	-	1	-	CLKIN
VSD period time	tV	-	262.5	-	H
Vertical display area	tVD	240			H
VSD back porch	Odd field	tVBP	-	21	H
	Even field		-	21.5	
VSD front porch	Odd field	tVFP	-	1.5	H
	Even field		-	1	
VSD pulse width	tVSW	-	1	-	CLKIN
1 Frame		-	525	-	H

YUV 720 mode/PAL Input Timing

Parameter	Symbol	Interface			Unit
		Min.	Typ.	Max.	
CLKIN frequency	fCLKIN	-	27	-	MHz
HSD period	tH	-	1728	-	CLKIN
HSD display period	tHD	1440			CLKIN
HSD back porch	tHBP	-	240	-	CLKIN
HSD front porch	tHFP	-	48	-	CLKIN
HSD pulse width	tHSW	-	1	-	CLKIN
VSD period time	tV	-	312.5	-	H
Vertical display area	tVD	288			H
VSD back porch	Odd field	tVBP	-	24	H
	Even field		-	24.5	
VSD front porch	Odd field	tVFP	-	0.5	H
	Even field		-	0	
VSD pulse width	tVSW	-	1	-	CLKIN
1 Frame		-	625	-	H

YUV 640 mode/NTSC Input Timing

Parameter	Symbol	Interface			Unit
		Min.	Typ.	Max.	
CLKIN frequency	fCLKIN	-	24.535	-	MHz
HSD period	tH	-	1560	-	CLKIN
HSD display period	tHD	1280			CLKIN
HSD back porch	tHBP	-	240	-	CLKIN
HSD front porch	tHFP	-	40	-	CLKIN
HSD pulse width	tHSW	-	1	-	CLKIN
VSD period time	tV	-	262.5	-	H
Vertical display area	tVD	240			H
VSD back porch	Odd field	tVBP	21	-	H
	Even field		21.5	-	
VSD front porch	Odd field	tVFP	1.5	-	H
	Even field		1	-	
VSD pulse width	tVSW	-	1	-	CLKIN
1 Frame		-	525	-	H

YUV 640 mode/PAL Input Timing

Parameter	Symbol	Interface			Unit
		Min.	Typ.	Max.	
CLKIN frequency	fCLKIN	-	24.375	-	MHz
HSD period	tH	-	1560	-	CLKIN
HSD display period	tHD	1280			CLKIN
HSD back porch	tHBP	-	240	-	CLKIN
HSD front porch	tHFP	-	40	-	CLKIN
HSD pulse width	tHSW	-	1	-	CLKIN
VSD period time	tV	-	312.5	-	H
Vertical display area	tVD	288			H
VSD back porch	Odd field	tVBP	24	-	H
	Even field		24.5	-	
VSD front porch	Odd field	tVFP	0.5	-	H
	Even field		0	-	
VSD pulse width	tVSW	-	1	-	CLKIN
1 Frame		-	625	-	H

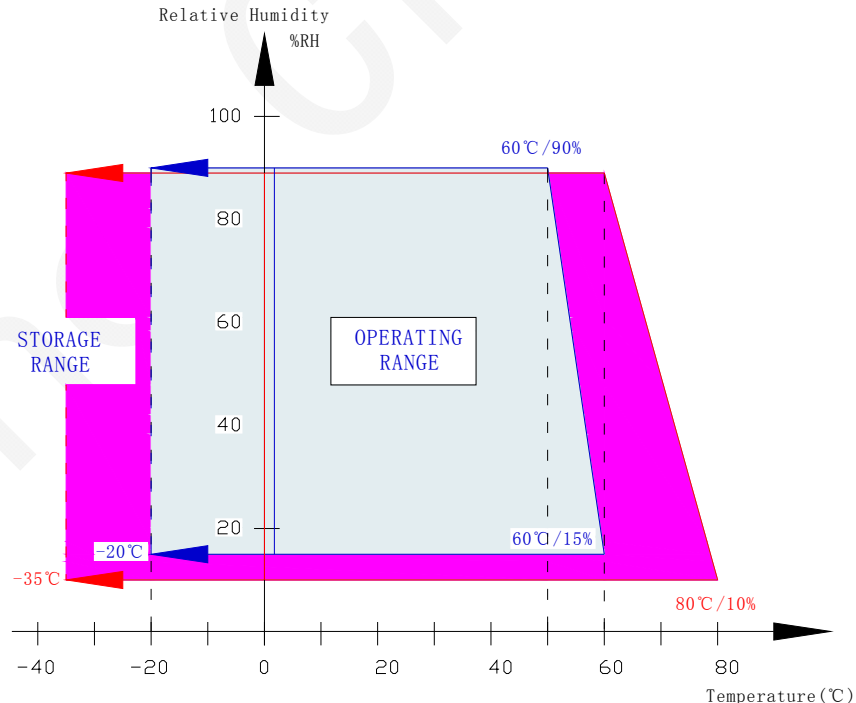
3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Supply voltage for logic	VDDIO	0	+5V	V
Supply voltage	VDD	0	+5V	V
Operate temperature range	TOP	-20	70	°C
Storage temperature range	TST	-30	80	°C

Note:

- (1) 90%RH maximum humidity, 60°C maximum wet-bulb temperature When operated at a temperature lower than 0°C, the LCD worked slowly and the screen appeared low-contrast images due to the characteristics of LC(Liquid Crystal).
- (2) If any fixed pattern is displayed on LCD for minutes, image-sticking phenomenon may occur.
- (3) Degradation could occur to pixels' TFT when DC BIOS is input into its gate-signal under POWER OFF WAITING STAND-BY & SLEEP MODE. Therefore, LCD should be turn off then.
- (4) Please operate a LCD module on the basis of the recommended S/W(Register)



Temperature & Humidity Graph at Absolute Environment

DATA). If you want to change any part of the S/W, you must take driver's confirmation.

3.2 DC Characteristics

(VDD=2.7~3.6V, VDDIO=AVDD=VDD, AGND=GND=0V, TA=25°C)

• (For the digital circuit :)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
I/O Supply Voltage	VDDIO	1.65	-	VDD	V	
Low Level Input Voltage	Vil	GND	-	0.3xVDDIO	V	VDDIO = 2.7V~3.6V
		GND	-	0.2xVDDIO		VDDIO = 1.65V~2.7V
High Level Input Voltage	Vih	0.7xVDDIO	-	VDDIO	V	VDDIO = 2.7V~3.6V
		0.8xVDDIO	-	VDDIO		VDDIO = 1.65V~2.7V
Input Leakage Current	Ii	-	-	±1	uA	Digital input pins.
Pull-high/low Impedance	Rin	180k	350k	650k	Ω	VDDIO = 3.3V

• (For the analog circuit :)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gamma supply voltage	GMA_H	-	3.0	-	V	VDD=AVDD(For Low voltage LC)
		-	4.6	-		AVDD=VINT1(For Normal LC1&LC2)
Voltage Deviation of Outputs	Vdev	-	±20	±35	m	Vo=0.1V ~ 0.5V & GMA_H-0.5 ~ GMA_H-0.1V
			±15	±20	m	Vo=0.5V ~ GMA_H-0.5V
Dynamic Range of Output	Vdr	0.1	-	GMA_H-0.1	V	S1 ~ S480
Driving current of Source outputs	IOHS	-	-25	-	uA	Vos = GMA_H-0.2V, Vys = GMA_H-1.1V
Sinking current of Source outputs	IOLS	-	25	-	uA	Vos = 0.2V, Vys = 1.1V
Driving current of Gate outputs	IOHG	-	-200	-	uA	VGH = 15V, VGL = -10V, Vog = 15V, Vyg = 14.5V
Sinking current of Gate outputs	IOLG	-	200	-	uA	VGH = 15V, VGL = -10V, Vog = -10V, Vyg = -9.5V
Base drive current for PWM	IDRV	-	0.25	-	mA	VDD=3.3V, DRV=0.7 V
DRV output voltage for PWM	VDRV	0	-	VDD	V	
GMA_H voltage tolerance	VGMAHT	-75		+75	mV	AVDD=VDD(for Low Voltage LC)
		-150		+150	mV	AVDD=VINT1(for Normal LC1&2)
FRP DC Tolerance	VCAC	-100	-	+100	mV	VCAC value by VCOM_DC setting
FRP Low level output current	IOLF	-	5	-	mA	For VCAC = 5V, Vofrp = 0V Vyfrp = 0.9V
FRP High level output current	IOHF	-	-5	-	mA	For VCAC = 5V, Vofrp = 5V

4. Optical characteristics

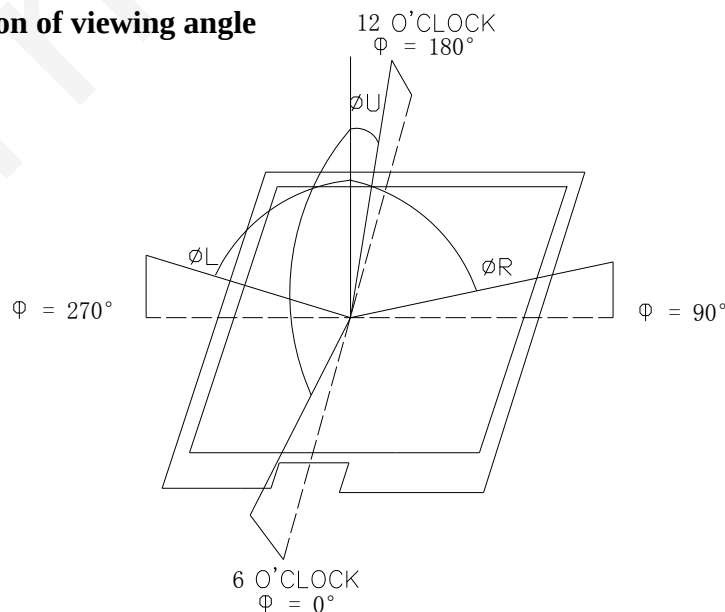
Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing angle		Left	CR≥10 Horizontal use		45		Degree	(2)
		Right			45		Degree	
		Up			55		Degree	
		Down			35		Degree	
Color Chromaticity	Red	Rx	$\theta=0$ Normal viewing angle	0.553	0.603	0.653	-	Color Chromaticity
		Ry		0.272	0.322	0.372	-	
	Green	Gx		0.235	0.285	0.335	-	
		Gy		0.495	0.545	0.595	-	
	Blue	Bx		0.097	0.147	0.197	-	
		By		0.113	0.163	0.213	-	
	White	Wx		0.246	0.296	0.346	-	
		Wy		0.272	0.322	0.372	-	
Contrast ratio		CR	optimal	-	300		-	(1)
Response time		Tr+Tf			25		ms	(3)
Luminance on surface If=20mA		Lv	Normally $\theta_x = \theta_y = 0$	180	220		cd/m ²	

Note (1) Definition of contrast ratio

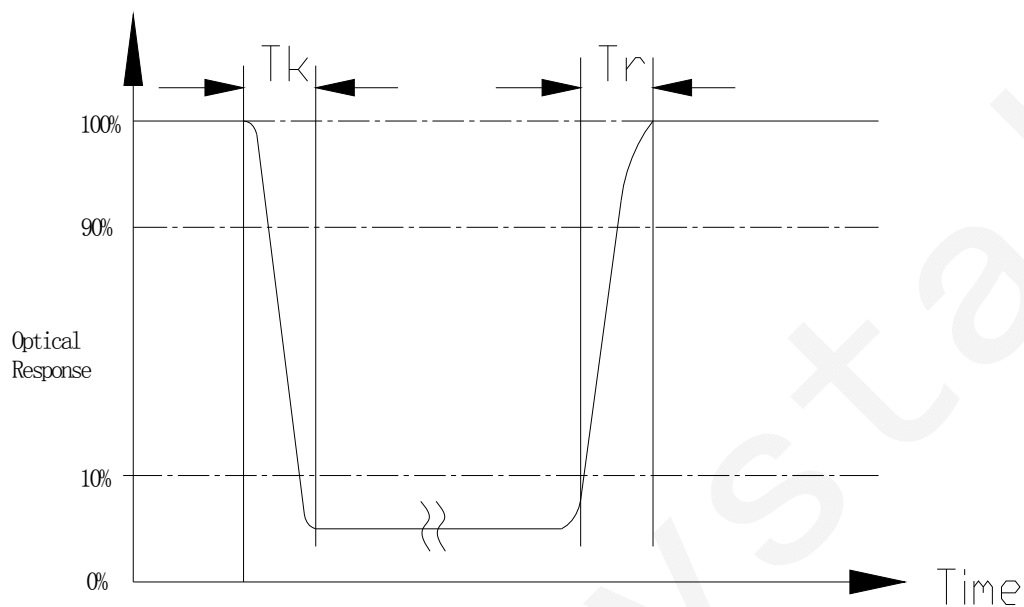
Measured at the center point of panel

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

Note (2) Definition of viewing angle



Note (3) Definition of response time: $T_r + T_f$



5. Reliability

5.1 Reliability Condition

*One single product test for only one item.

Item No	Item	Condition	Remark
1	High temperature Operating	60℃, 120Hours	Finish product (With polarizer)
2	Low temperature Operating	-10℃, 120 Hours	Finish product (With polarizer)
3	High temperature Storage	70℃, 200 Hours	Finish product (With polarizer)
4	Low temperature Storage	-20℃, 200 Hours	Finish product (With polarizer)
5	High temperature & humidity Storage	50℃, 90%RH, 120 Hours	Finish product (With polarizer)
6	Thermal Shock Storage (No operation)	-10℃ , 30min.<=> 60℃ , 30min. 10 Cycles	Finish product (With polarizer)
7	ESD test	Voltage:±8KV R:330 ohm,C:150pF Air discharge,10 times	Finish product (With polarizer)
8	Vibration test	10 => 55 =>10 => 55 => 10 Hz, within 1 minute;Amplitude:1.5mm. 15 minutes for each Direction (X,Y,Z)	Finish product (With polarizer)
9	Drop test	Packed, 100CM free fall 6 sides, 1 corner, 3edges	Finish product (With polarizer)

* 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

5.2 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 arearejected	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 LCDrejected. 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

5.3 Standard of visual inspection

Class	Item	Judgment	Class
Electrical	11.Electrical and optical characteristics (contrast 、 VOP 、 chromaticity...etc)	According to specification or drawing. (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

Class	Item	Judgment
Minor	• Blemish 、 black spot 、 white spot in the LCD.	(A) Round type:

6. Precaution

6.1 Handling

- (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.

6.2 Storage

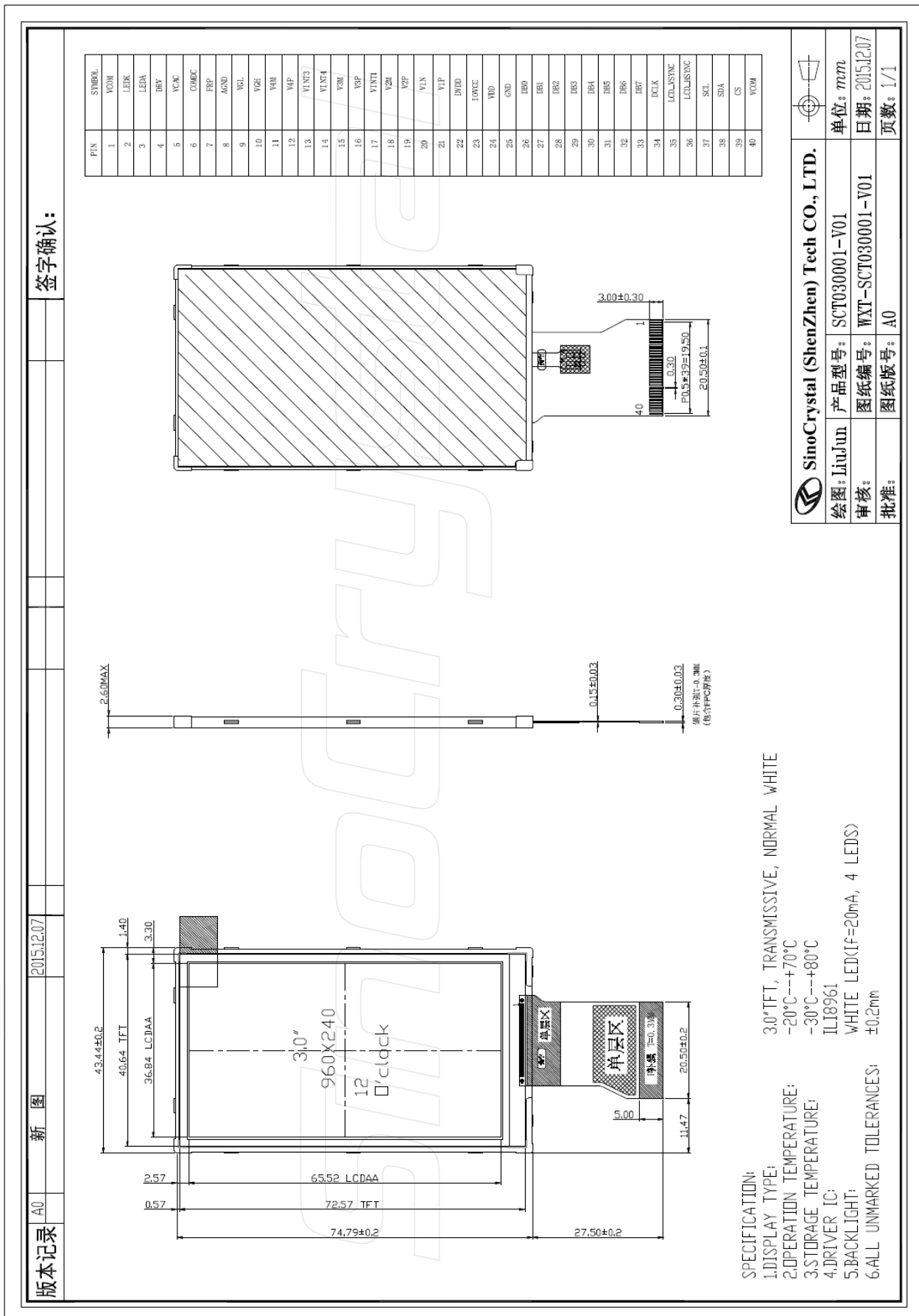
- (1) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the panel with temperature from 0 to 35°C and relative humidity of less than 70%.
- (2) The panel shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light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

6.3 Operation

- (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.

7. Outline Dimension

Refer to SCT030001-V01 drawing.



8. Packing method

8.1 Packing Quantity (TBD)

8.2 Flowing chart (TBD)