



San Technology, Inc.

**SPECIFICATION
FOR
LCD Module**

Customer P/N:

Santek P/N: ST0350A2W-RSLW-F

DOC. Revision: RS01

Customer Approval:

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	SIGNATURE	DATE
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1. GENERAL SPECIFICATION

1.1 Description

The ST0350A2W-RSLW-F is a color active matrix Thin Film Transistor (TFT) Liquid Crystal Display (LCD) that uses amorphous silicon(a-Si) TFT as a switching device. This model is composed of a single 3.5 inches transmissive type main TFT-LCD panel. The resolution of the panel is 320 x 240 pixels and can display up to 262K color.

1.2 Feature

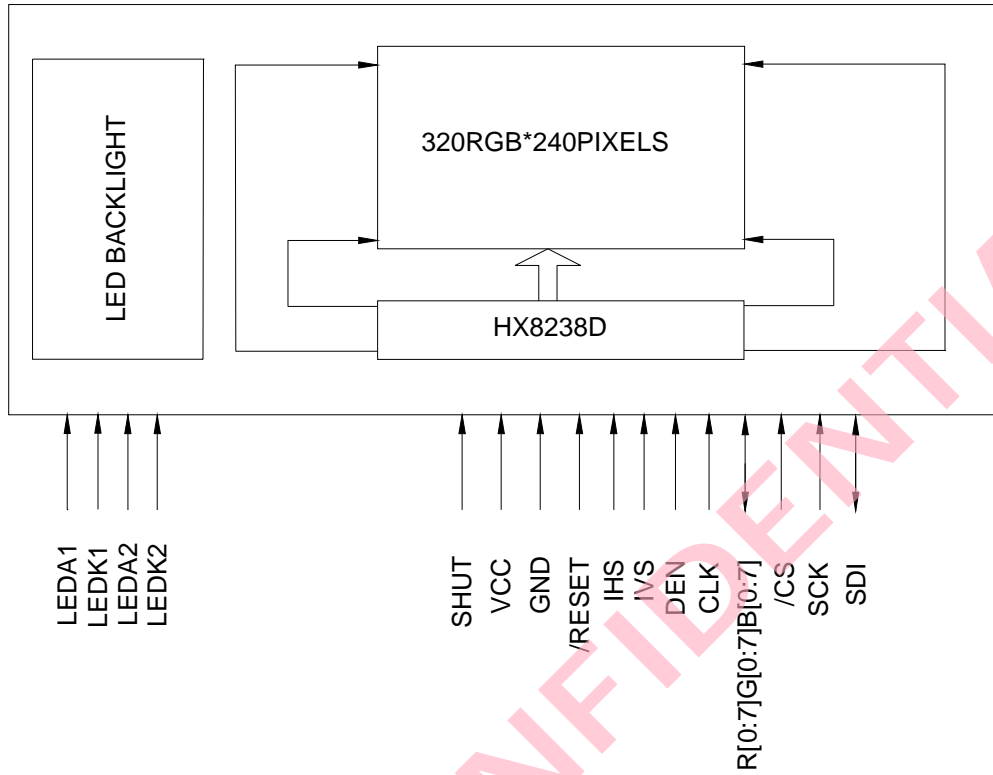
- TN type for main TFT-LCD panel
- Structure COG+FPC+BL
- Full, Normal (Still), Partial, Sleep, Standby mode are available

1.3 General Specification

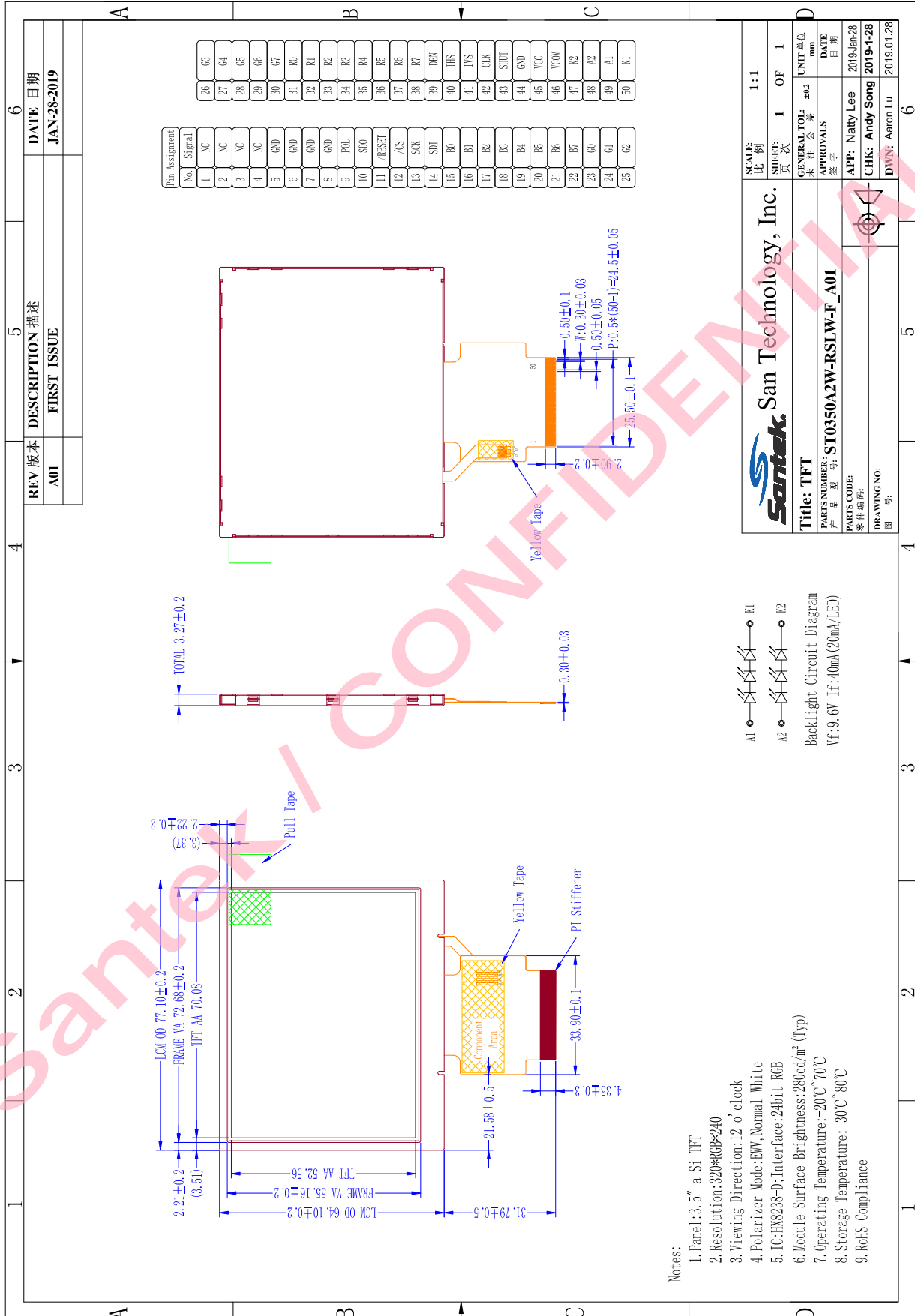
No.	Item	Specification	Unit	Remark
1	LCD Size	3.5	inch	-
2	Panel Type	a-Si TFT TRANSMISSIVE	-	-
3	Resolution	320 x (RGB) x 240	pixel	-
4	Display Mode	Normally White, Transmissive	-	-
5	Display Number of Colors	262K	-	-
6	Viewing Direction	12 o'clock	-	Note
7	Contrast Ratio	500(Typ)	-	-
8	Luminance	280(Typ)	cd/m2	-
9	Module Size	64.10(W) x 77.10(L) x3.27(T)	mm	Note
10	Active Area	52.56(W) x 70.08(L)	mm	Note
11	Pixel Pitch	0.219(W) x 0.219(L)	mm	-
12	Weight	-	g	-
13	Driver IC	HX8238-D	-	-
14	Driver IC RAM Size	320x18x240	bit	-
15	Light Source	6 LEDs White	-	-
16	Interface	RGB	-	-
17	Operating Temperature	-20~70	°C	-
18	Storage Temperature	-30~80	°C	-

Note: Please refer to the mechanical drawing.

2. BLOCK DIAGRAM



3.MECHANICAL DRAWING

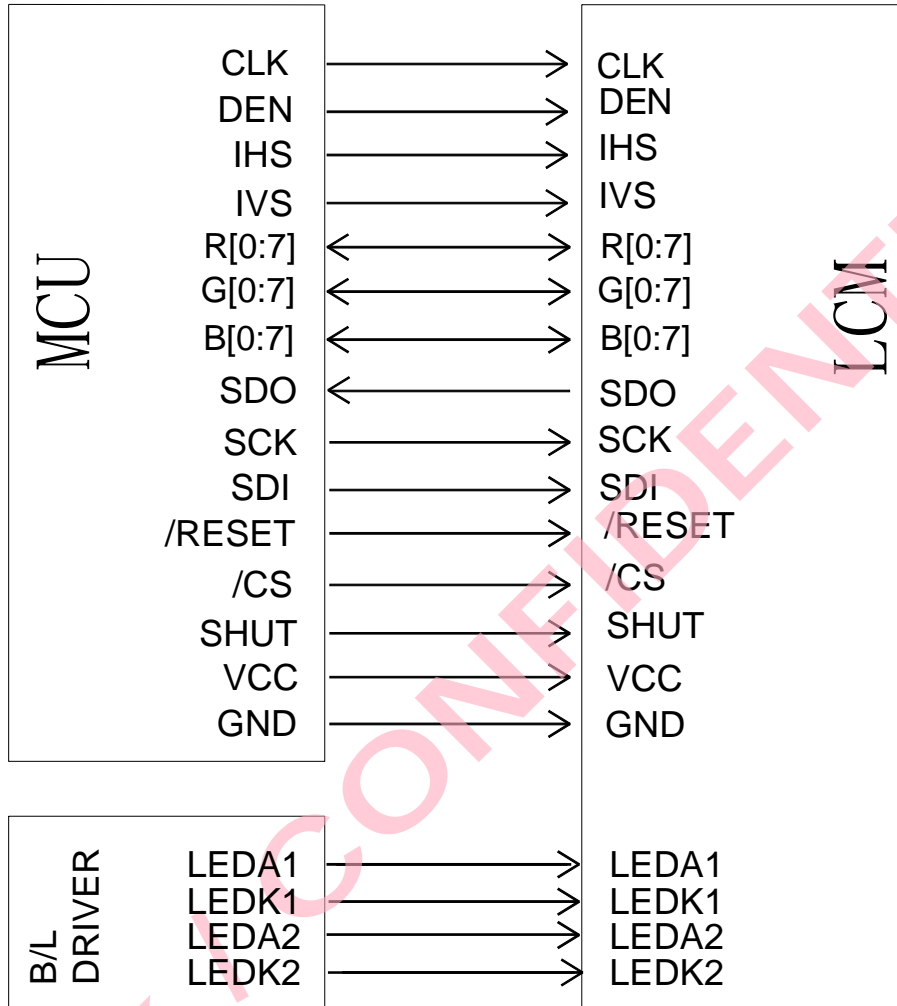


4.INTERFACE ASSIGNMENT

PIN NO.	SYMBOL	FUNCTION DESCRIPTIONS
1	NC	No connect
2	NC	No connect
3	NC	No connect
4	NC	No connect
5	GND	Ground.
6	GND	Ground.
7	GND	Ground.
8	GND	Ground.
9	POL	Polarity signal to monitor VCOM signal
10	SDO	Data output pin in serial mode.
11	/RESET	System reset pin.
12	/CS	Chip select pin of serial interface.
13	SCK	Clock pin of serial interface.
14	SDI	Data input pin in serial mode.
15~22	B0~B7	Graphic Data Input Pins. Blue Data.
23~30	G0~G7	Graphic Data Input Pins. Green Data.
31~38	R0~R7	Graphic Data Input Pins. Red Data.
39	DEN	Display enable pin from controller.
40	IHS	Line synchronization signal.
41	IVS	Frame synchronization signal.
42	CLK	Dot-clock signal and oscillator source.
43	SHUT	Display shut down pin to put the driver into sleep mode.
44	GND	Ground.
45	VCC	Power supply.
46	VCOM	A power supply for the TFT-display common electrode.
47	K2	Power supply cathode input for backlight K2.
48	A2	Power supply anode input for backlight A2.
49	A1	Power supply anode input for backlight A1.
50	K1	Power supply cathode input for backlight K1.

5. ELECTRICAL SPECIFICATION

5.1. APPLICATION CIRCUIT



5.2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN	TYP	MAX	
Power Supply for Analog	VCC	Ta=25 °C	-0.3	-	5.0	V
Power Supply for Digital IO	IOVCC	Ta=25 °C	-0.3	-	4.0	V

Note: Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is applied.

5.3. TYPICAL OPERATION CONDITION

5.3.1 DC Characteristics

ITEM	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN	TYP	MAX	
Power Supply for Analog	VCC	Ta=25 °C	2.5	3.3	3.6	V
Power Supply for Digital IO	IOVCC	Ta=25 °C	1.6	3.3	3.6	V
Input Signal "H" Level	V _{IH}	-	0.8IOVCC	-	IOVCC	V
Input Signal "L" Level	V _{IL}	-	0	-	0.2IOVCC	V
Output Signal "H" Level	V _{OH}	I _{OH} =-0.1mA	0.9IOVCC	-	IOVCC	V
Output Signal "L" Level	V _{OL}	I _{OL} =0.1mA	0	-	0.1IOVCC	V
Frame Frequency	f _{FRAME}	-	55	70	85	Hz

Note: To prevent IC latch up or DC operation in LCD panel, the power on/off sequence should follow the driver IC specification.

5.3.2 Current Consumption

Item	Symbol	Values		Unit	Remark
		Typ.	Max.		
Normal(Still) Mode	I _{CI1}	28	48	mA	Note1
Sleep Mode	I _{CI2}	100	-	uA	Note2

Note1: Test Condition

IOVCC=VCC=3.3V;

Display Pattern: All Pixel white

Frame Rate=60Hz at Line Inversion

Operating Temperature: 25°C

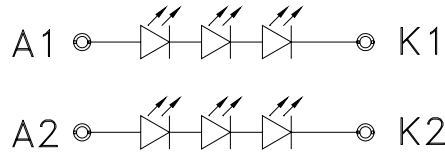
Max. current check pattern:



Note2: In the standby mode, all the internal display operations are suspended including the internal R-C oscillator.

5.4. BACKLIGHT SPECIFICATION

5.4.1 BACKLIGHT CIRCUIT

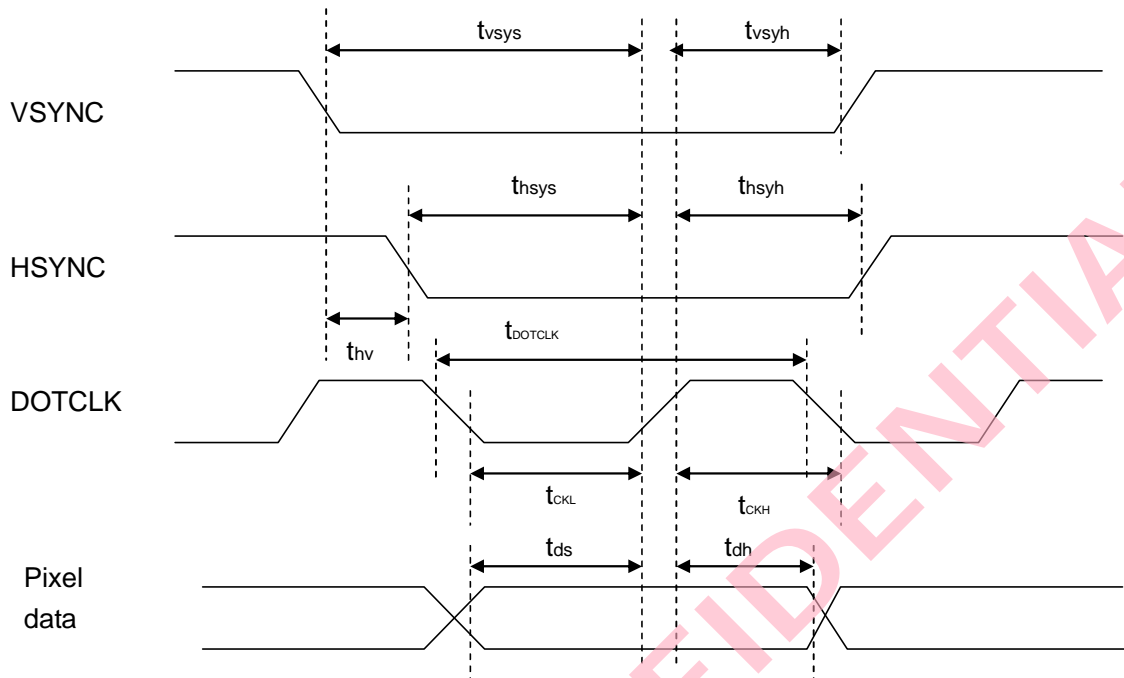


5.4.2 ELECTRICAL CHARACTERISTICS

(T=25°C)

PARAMETER	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN	TYP	MAX	
FORWARD VOLTAGE (Single Chip)	VF	IF=40mA	9.0	9.6	10.2	V

5.5. INTERFACE TIMING CHARACTERISTICS



Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	f _{DOTCLK}	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	t _{DOTCLK}	100	33.3	154	51.3	-	-	ns
Vertical Sync Setup Time	t _{vsys}	20	10	-	-	-	-	ns
Vertical Sync Hold Time	t _{vsyh}	20	10	-	-	-	-	ns
Horizontal Sync Setup Time	t _{hsys}	20	10	-	-	-	-	ns
Horizontal Sync Hold Time	t _{hsyh}	20	10	-	-	-	-	ns
Phase difference of Sync Signal Falling Edge	t _{hv}	1		-		240		t _{DOTCLK}
DOTCLK Low Period	t _{CKL}	50	15	-	-	-	-	ns
DOTCLK High Period	t _{CKH}	50	15	-	-	-	-	ns
Data Setup Time	t _{ds}	12	10	-	-	-	-	ns
Data hold Time	t _{dh}	12	10	-	-	-	-	ns
Reset pulse width	t _{RES}	10		-		-		μs

Note: External clock source must be provided to DOTCLK pin of HX8238-D. The driver will not operate if absent of the clocking signal.

6.OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Values			Unit	Remark
				Min.	Typ.	Max.		
Viewing Angle Range	Left	θ_L	$CR \geq 10$	50	60	-	degree	Note 1,2
	Right	θ_R		50	60	-		
	Top	Φ_T		55	65	-		
	Botto	Φ_B		40	50	-		
Response Time		$T_{on} + T_{off}$	Normal $\theta = \Phi = 0^\circ$	-	35	-	ms	Note 2,3
Contrast Ratio		CR	Normal $\theta = \Phi = 0^\circ$	300	500	-	-	Note 2,4
Luminance		L	Normal $\theta = \Phi = 0^\circ$	240	280	-	cd/m ²	Note 2,5
Color Chromaticity (CIE1931)	White	Wx	Normal $\theta = \Phi = 0^\circ$	0.2491	0.2991	0.3491	-	Note 2,6
		Wy		0.3031	0.3531	0.4031		
	Red	Rx		0.5563	0.6063	0.6563		
		Ry		0.3133	0.3633	0.4133		
	Green	Gx		0.2819	0.3319	0.3819		
		Gy		0.5706	0.6206	0.6706		
	Blue	Bx		0.0945	0.1445	0.1945		
		By		0.0446	0.0946	0.1446		
Color Gamut		NTSC	CIE1931	-	60	-	%	-
Luminance Uniformity		U_L	Normal $\theta = \Phi = 0^\circ$	75	80	-	%	Note 2,7

Note 1: Definition of viewing angle

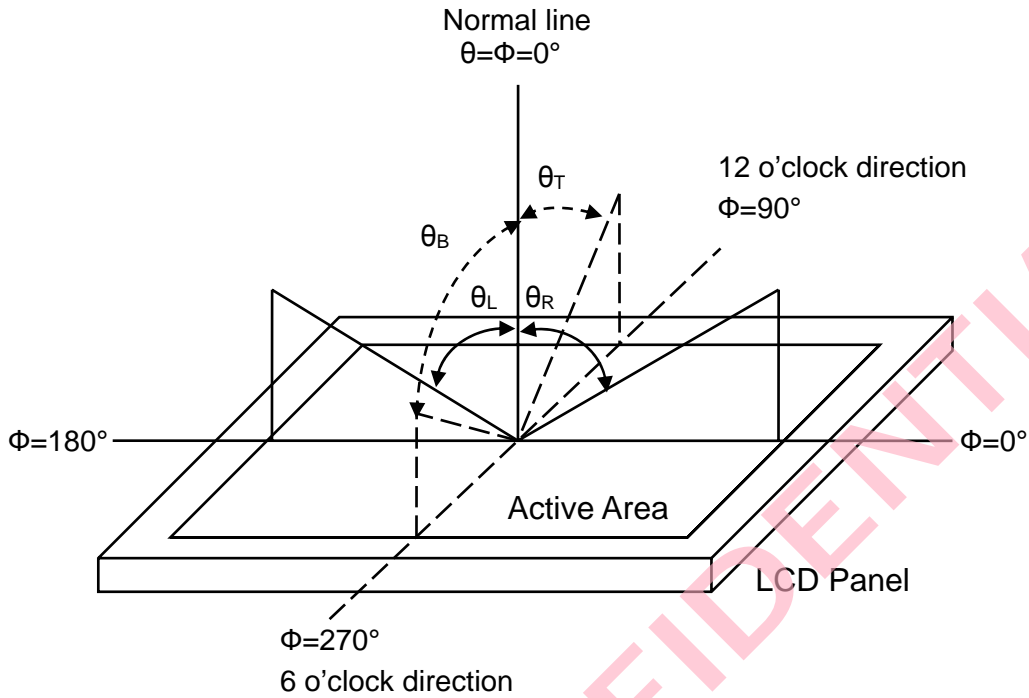


Fig. 1 Definition of viewing angle

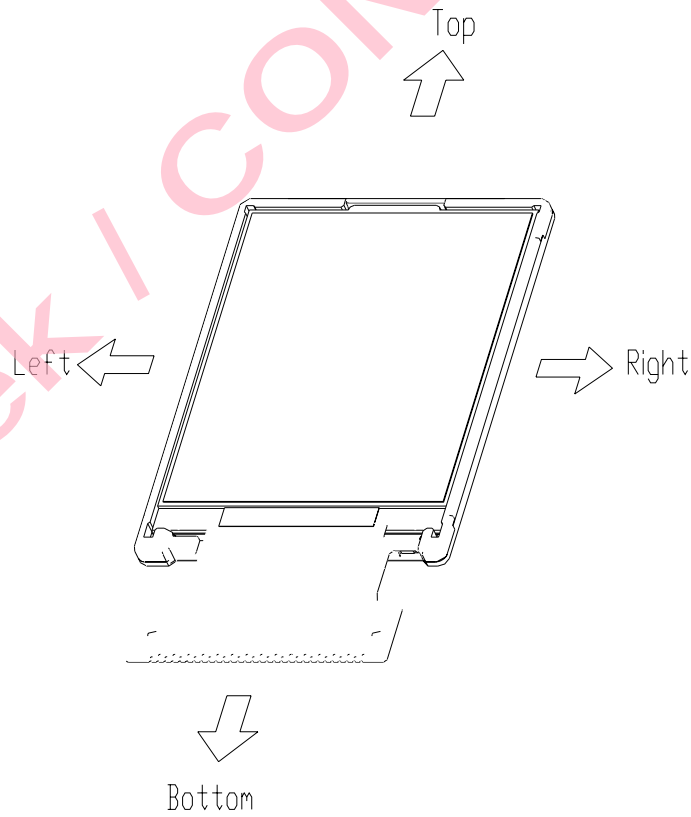


Fig. 2 Definition of viewing angle for display

Note 2: Definition of optical measurement system

The optical characteristics should be measured in a dark room with ambient temperature $T_a=+25\text{ }^\circ\text{C}$. The optical properties are measured at the center point of the LCD screen after 5 minutes operation. (Equipment: Photo detector TOPCON BM-7 Field of view: 1° /Height: 500mm.)

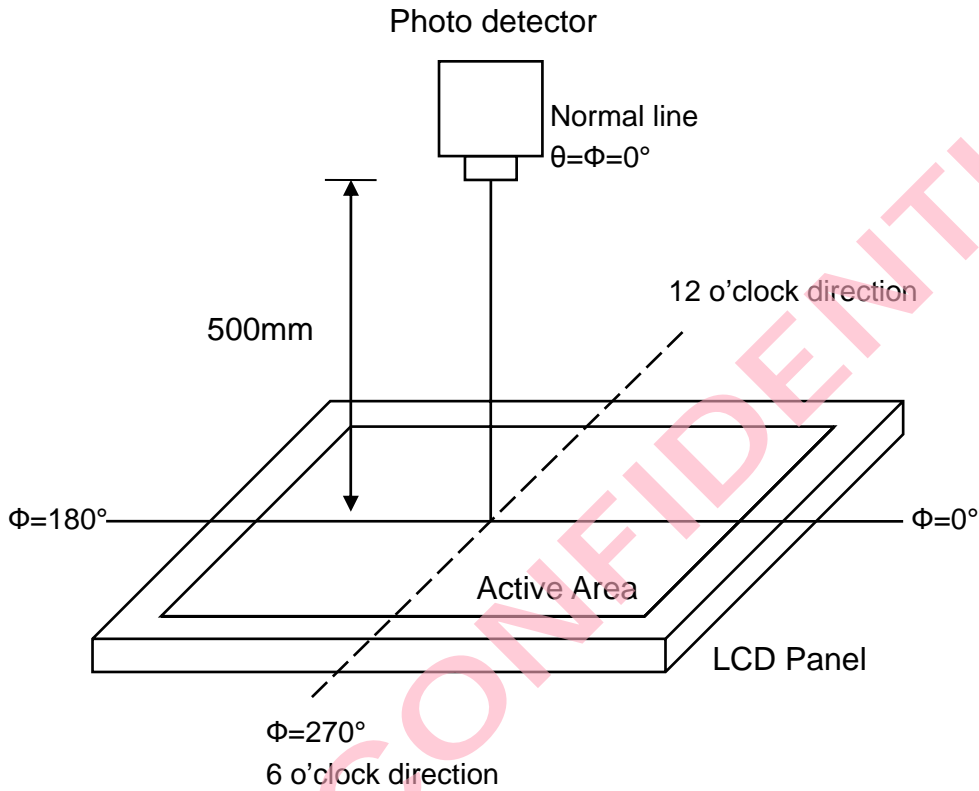


Fig. 3 Optical measurement system setup

Note 3: 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%.

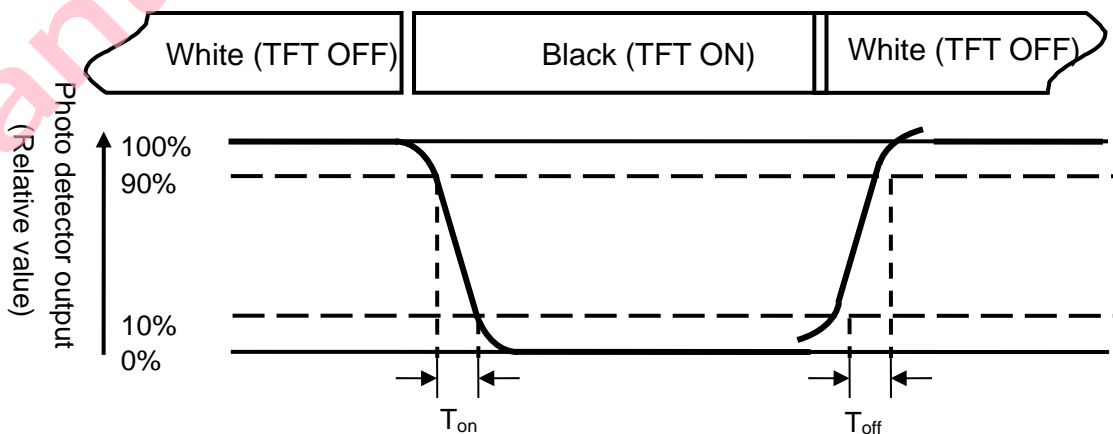


Fig. 4 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of luminance

Measured at the center area of the panel when LCD panel is driven at “white” state.

Note 6: Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD when panel is driven at “White”, “Red”, “Green” and “Blue” state respectively.

Note 7: Definition of luminance uniformity

To test for uniformity, the tested area is divided into 3 rows and 3 columns. The measurement spot is placed at the center of each circle as below.

$$\text{Luminance Uniformity (U}_L\text{)} = \frac{L_{\min}}{L_{\max}}$$

L-----Active area length

W----- Active area width

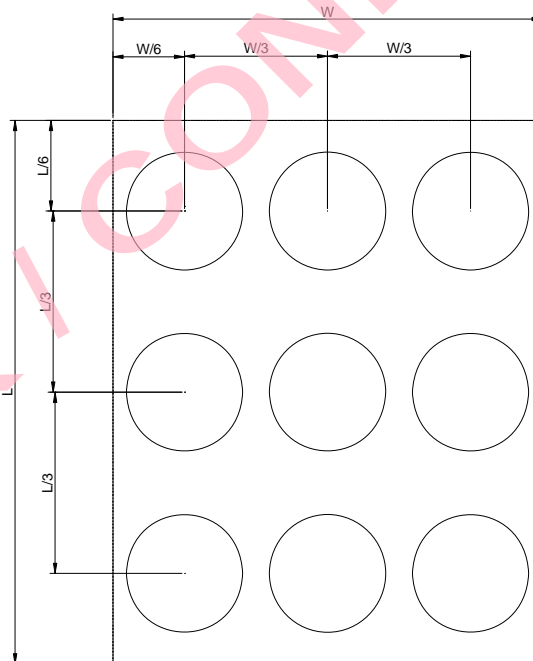


Fig. 5 Definition of luminance uniformity

L_{\min} : The measured minimum luminance of all measurement position.

L_{\max} : The measured maximum luminance of all measurement position.

7.RELIABILITY TESTS

ITEM	CONDITION	CRITERION
Operating Temperature Test	High Temperature: +70 °C, 120 hrs	No defects in display and operational functions
	Low Temperature: -20 °C, 120 hrs	
Storage Temperature Test	High Temperature: +80 °C, 120 hrs	No defects in display and operational functions
	Low Temperature: -30 °C, 120 hrs	
Humidity Endurance Test	60 °C±3°C, 90%±3%RH, 120 hrs	No defects in display and operational functions
Thermal Shock Test	-30 °C (30mins)~ +80 °C (30mins) 10 cycles	No defects in display and operational functions
Package Vibration Test	Random Vibration : Frequency:10~55Hz 1 hour for each direction of X. Y. Z. (3 hours for total)	No defects in display and operational functions
Package Drop Test	Height :72cm(Weight ≤ 10kg); 60cm(Weight ≥ 10kg) 1 corner, 3 edges, 6 surfaces	No defects in display and operational functions
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω	No defects in display and operational functions

NOTE:

- 1) The samples must be free from defect before test, must be restored at room condition at least for 2 hours after reliability test before any inspection.
- 2)After a long period of high temperature,the surrounding edge of the LCM all-black image will appear MURA phenomenon,which is a normal phenomenon.

8. PACKAGE DRAWING

TBD

9. PRECAUTIONS

9.1. HANDLING

9.1.1. Polarizer Cleaning, Petroleum ether (or N-hexane) is recommended for cleaning the front/rear polarizers and reflectors, acetone, toluene and ethanol are not allowed to avoid damaging the surface.

9.1.2. Body grounding, must wear Anti-ESD wrist strap while pick up LCDs.

9.1.3. FPC Soldering, less than 300°C/3S, solder must be grounding on grounding bench.

9.1.4. If use electric Screwdriver to do assembly, screwdriver must be grounding.

9.2. STORAGE

9.2.1. Keep in a sealed polyethylene bag.

9.2.2. Keep in a dark place.

9.2.3. Keep in temperature between 0°C and 35°C.

NOT allowed at 70°C for more than 160 Hours, or at -20°C for more than 48 Hrs.

9.3. SAFETY

If liquid crystal leak out of a damaged glass cell, **DO NOT** put it in your mouth or touch eyes, if the liquid crystal touch your skin or clothes, please wash it off immediately using soap and water.

10. LIMITED WARRANTY

Unless otherwise agreed between SANTEK and customer, SANTEK will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with SANTEK LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects over specs must be returned to SANTEK within 30 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of SANTEK limited to repair and/or replacement on the terms set forth above. SANTEK shall not be responsible for any subsequent or consequential events.

10.1. RETURNING LCM UNDER WARRANTY – TERMS AND CONDITIONS

10.1.1. No warranty can be granted if the precautions stated above have been disregarded.

The typical examples of violations are :

- Broken LCD glass.
- Circuit modified in any way, including addition of components.

10.1.2. Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB's eyelet, conductors and terminals.