



珠海三泰克科技有限公司
San Technology (Zhuhai) Co., Ltd.

SPECIFICATION FOR LCD Module

Customer P/N:

Santek P/N: ST0276A1W-RSMLW-F

DOC. Revision: RS01

Customer Approval:

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	SIGNATURE	DATE
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Document Revision History

Version	Revise Date	Description	Changed by
RS01	2024-07-24	First issue	Caihua

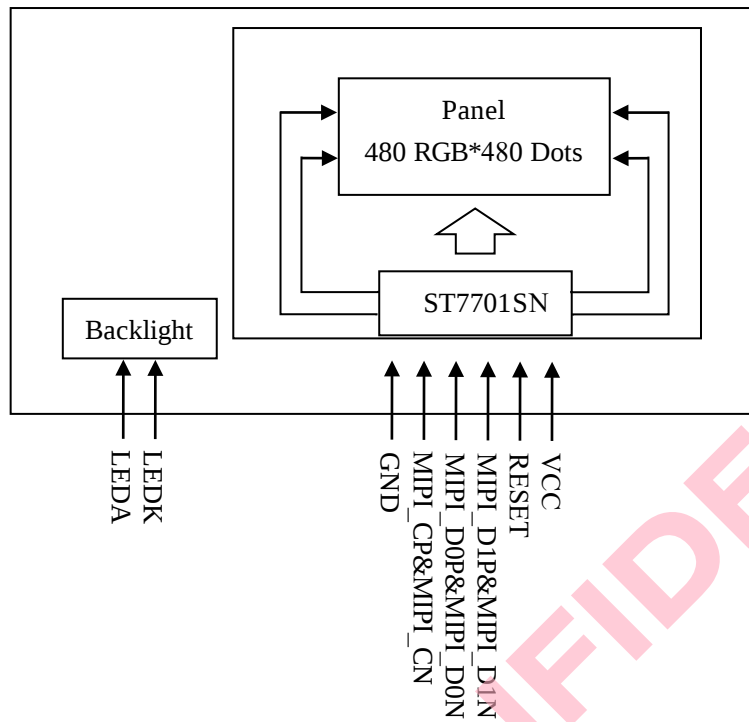
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1. General Specification

Item	Specification	Unit
LCD size	2.76 (Circle)	inch
Display Mode	Normally Black	--
Resolution	480(RGB)x480	Pixel
Polarizer Type	Transmissive	--
Pixel Arrangement	RGB Vertical Stripe	--
Viewing direction	All Direction(85/85/85/85)	--
Module outline dimension	73.03(H)*76.48(W)*2.23(D)(w/o FPC)	mm
LCD AA	70.128(H)* 70.128(V)	mm
Colors	16.7M	--
Driver IC	ST7701SN	--
Interface	MIPI(2 Lane)	--
Backlight	White LED 6PCS	--
Brightness	550 cd/m ² (Typ.)	--
Operating Temperature	-20°C~ +70°C	--
Storage Temperature	-30°C~ +80°C	--

2. Block Diagram



4. Pin Description

Pin No.	Symbol	Description
1	LEDA	Power supply for backlight (Anode)
2	LEDA	Power supply for backlight (Anode)
3	LEDA	Power supply for backlight (Anode)
4	LEDK	Power supply for backlight (Cathode)
5	VCC	Power supply
6	NC	No connect
7	NC	No connect
8	NC	No connect
9	NC	No connect
10	NC	No connect
11	NC	No connect
12	NC	No connect
13	RESET	Reset signal for LCM(low active)
14	NC	No connect
15	GND	Ground
16	MIPI_D0P	MIPI DSI differential data pair(Positive)
17	MIPI_D0N	MIPI DSI differential data pair(Negative)
18	GND	Ground
19	MIPI_D1P	MIPI DSI differential data pair(Positive)
20	MIPI_D1N	MIPI DSI differential data pair(Negative)
21	GND	Ground
22	MIPI_CP	MIPI DSI differential clock pair(Positive)
23	MIPI_CN	MIPI DSI differential clock pair(Negative)
24	GND	Ground
25	NC	No connect
26	NC	No connect
27	GND	Ground
28	NC	No connect
29	NC	No connect
30	GND	Ground

5. Electrical Characteristics

5.1 Absolute maximum ratings

Item	Symbol	Rating	Unit
Supply Voltage	VCC	- 0.3 ~ +4.6	V
Operating Temperature Range	TOPR	-20 ~ +70	°C
Storage Temperature Range	TSTG	-30 ~ +80	°C

Table 1 Absolute Operation Range

Note: If one of the above items is exceeded its maximum limitation momentarily, the quality of the product may be degraded. Absolute maximum limitation, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the recommend range.

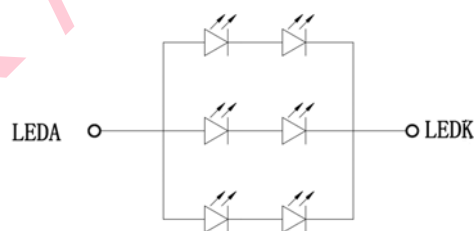
5.2 Backlight Specification

Item	Symbol	Min.	Typ.	Max.	Unit
Forward Current	I _F	-	60	-	mA
Forward Voltage	V _F	5.4	6	6.6	V
Backlight Power Consumption	W _{BL}	-	0.36	-	W

Note1: If LED is driven by high current, high ambient temperature & humidity condition.

The life time of LED will be reduced.

Note2: Constant current drive is recommended.



V_F: 5.4~6.6V

I_F: 40mA

Backlight Circuit Diagram

5.3 DC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
System Voltage	VCC	2.5	2.8	3.6	V	

Table 2 Basic DC Characteristics

Notes:

1. Typical: IOVCC=1.8V, VCI=2.8V; Ta=25 °C

6. Timing Characteristics

6.1 High Speed Mode

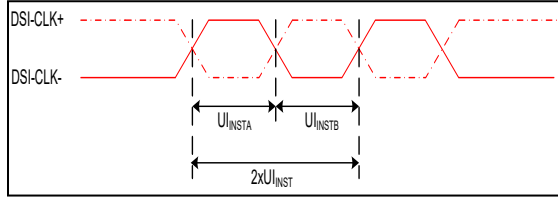


Figure 4 DSI clock channel timing

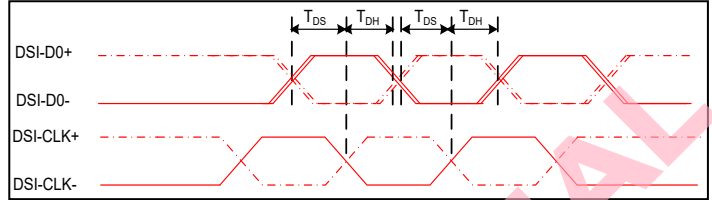


Figure 5 Rising and falling time on clock and data channel

$IOVCC=1.8, VCI=2.8, AGND=DGND=0V, Ta=25^{\circ}C$

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	$2xUI_{INSTA}$	Double UI instantaneous	2.5	25	ns	
DSI-CLK+/-	UI_{INSTA} UI_{INSTB}	UI instantaneous halves	1.25	12.5	ns	$UI = UI_{INSTA} = UI_{INSTB}$
DSI-Dn+/-	t_{DS}	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	t_{DH}	Data to clock hold time	0.15	-	UI	

Table 7 Mipi Interface- High Speed Mode Timing Characteristics

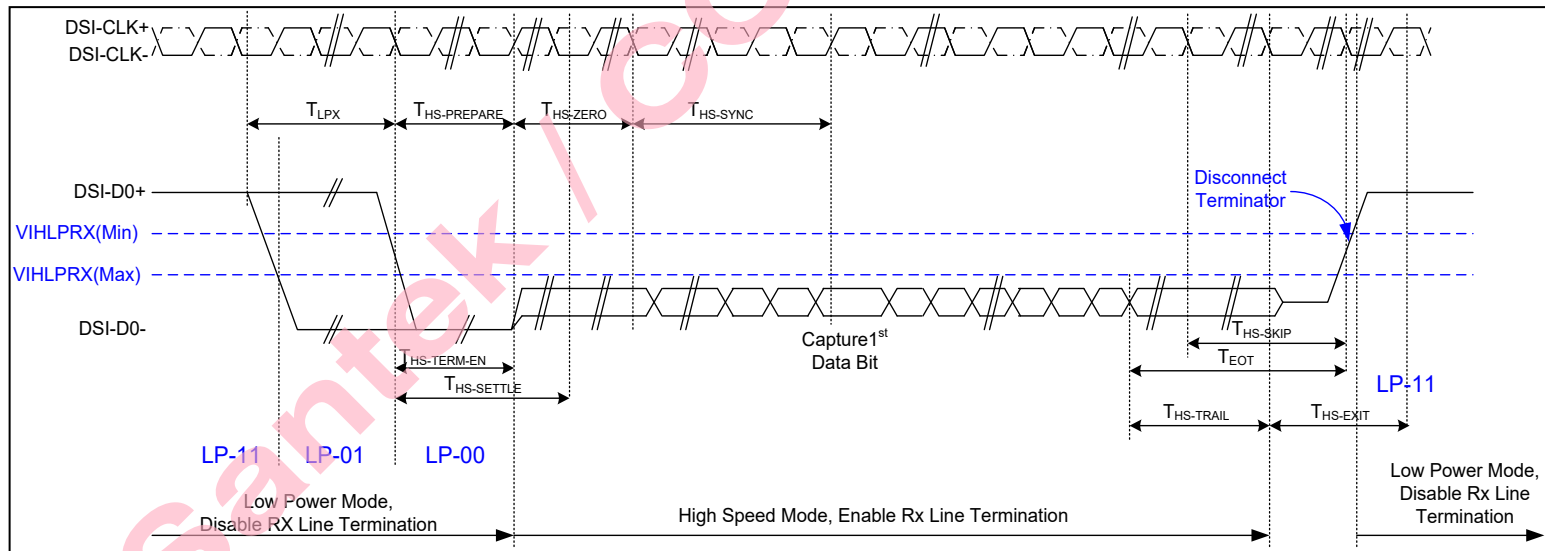


Figure 7 Data lanes-Low Power Mode to/from High Speed Mode Timing

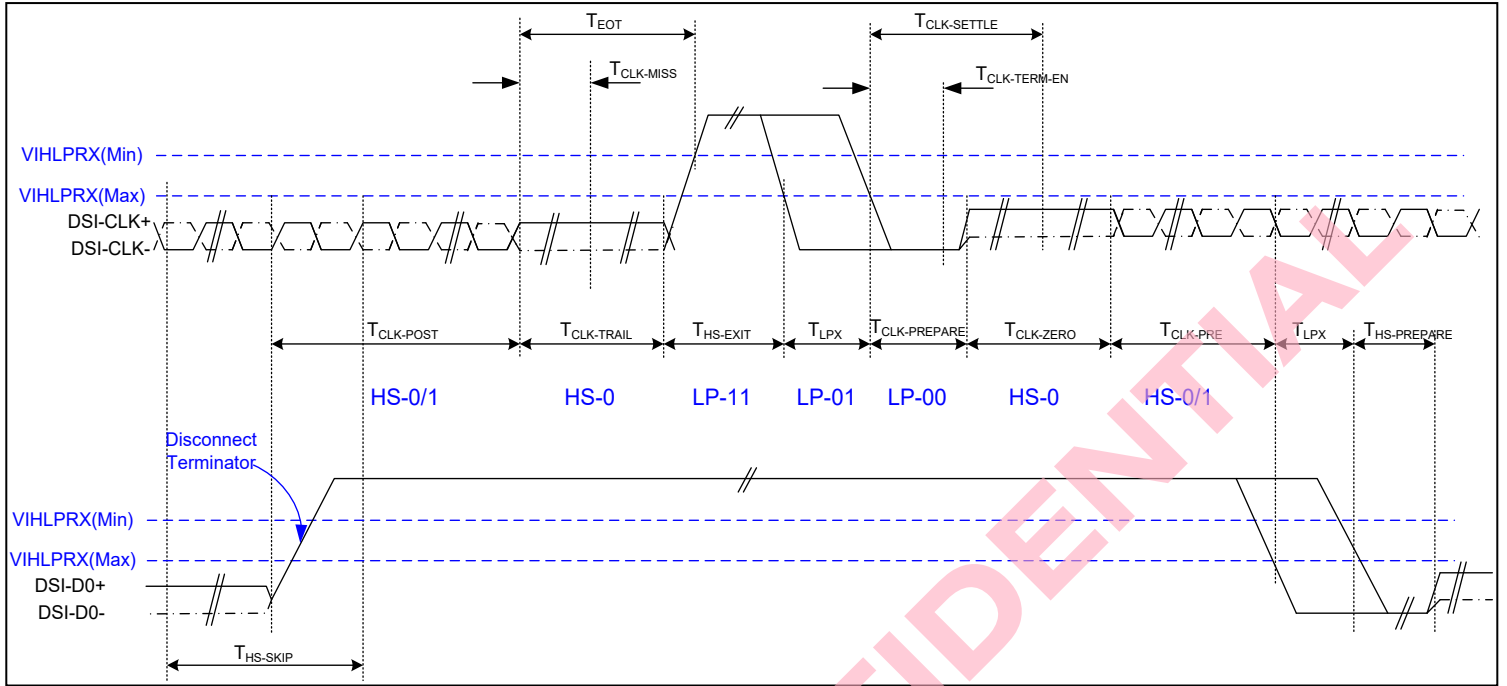


Figure 8 Clock lanes- High Speed Mode to/from Low Power Mode Timing

6.2 Low Power Mode

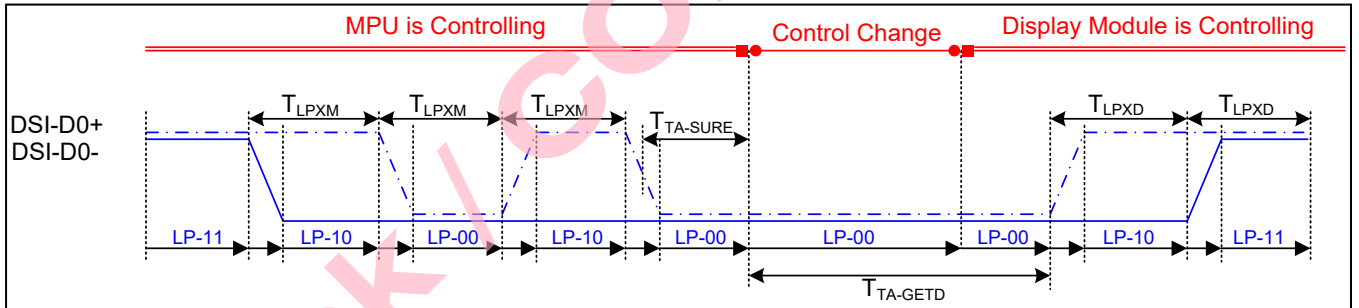


Figure 6 Bus Turnaround (BTA) from display module to MPU Timing

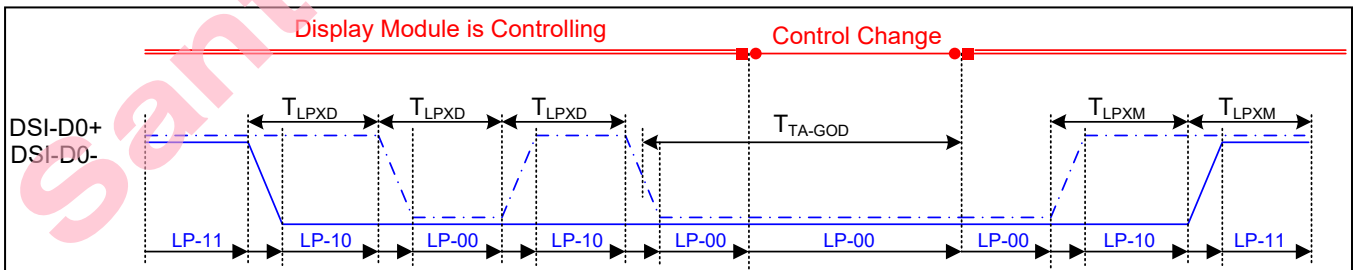
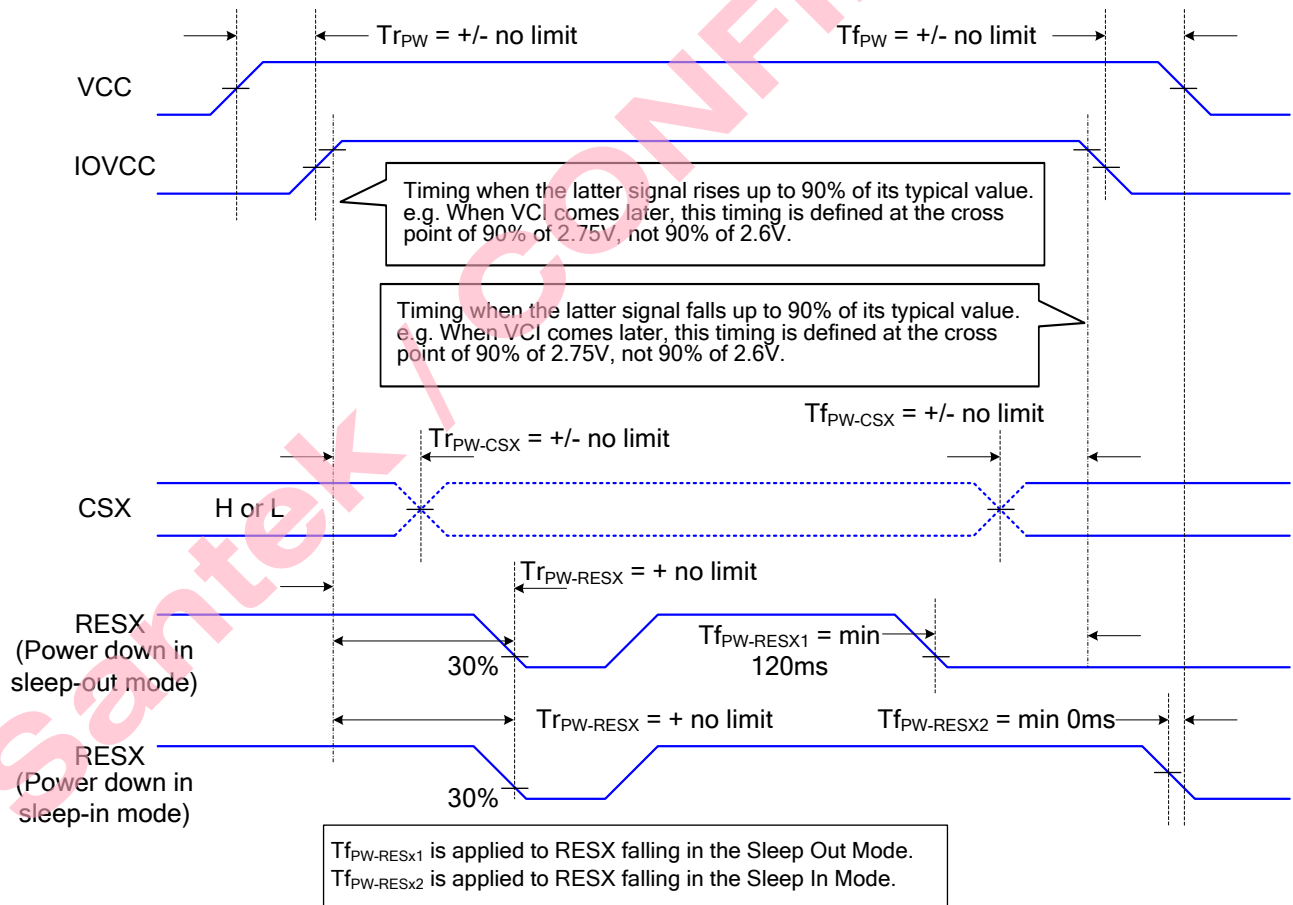


Figure 7 Bus Turnaround (BTA) from MPU to display module Timing

$IOVCC=1.8, VCI=2.8, AGND=DGND=0V, T_a=25\text{ }^{\circ}\text{C}$

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
Low Power Mode to High Speed Mode Timing						
DSI-Dn+/-	TLPX	Length of any low power state period	50	-	ns	Input
DSI-Dn+/-	THS-PREPARE	Time to drive LP-00 to prepare for HS transmission	40+4 UI	85+6 UI	ns	Input
DSI-Dn+/-	THS-TERM-EN	Time to enable data receiver line termination measured from when Dn crosses VILMAX	-	35+4 UI	ns	Input
DSI-Dn+/-	THS-PREPARE + THS-ZERO	THS-PREPARE + time to drive HS-0 before the sync sequence	140+ 10UI	-	ns	Input

6.3 Power on/off sequence



7. Reset Timing

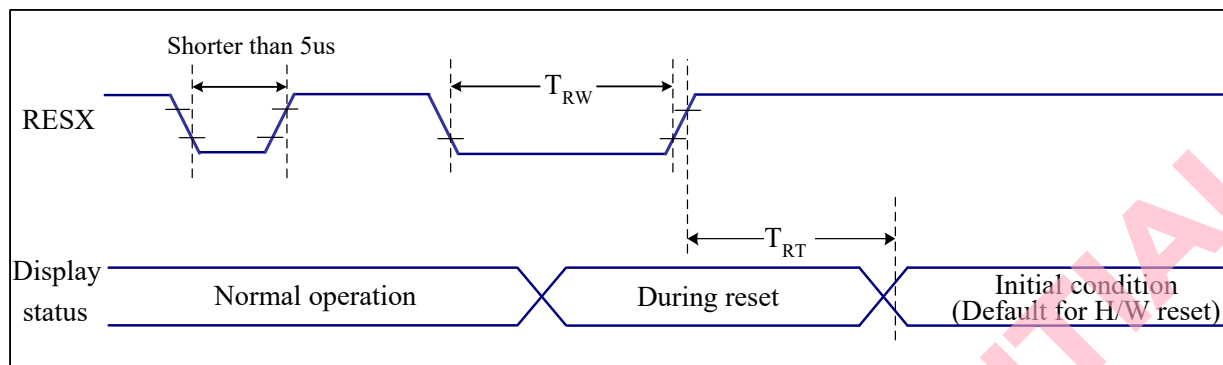


Figure 9 Reset Timing

$IOVCC=1.8V, VCI=2.8V, AGND=DGND=0V, T_a=25^\circ C$

Related Pins	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

Table 9 Reset Timing

Notes:

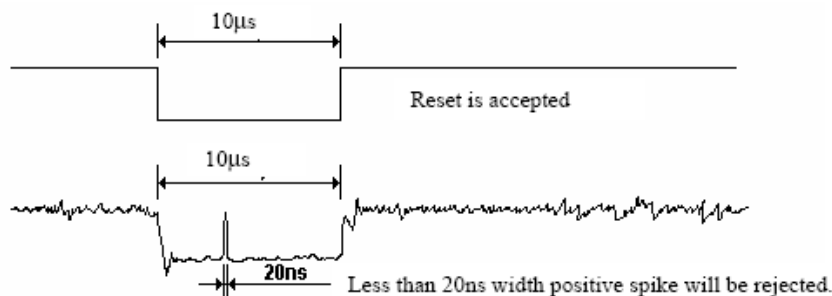
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (t_{RT}) within 5 ms after a rising edge of RESX.

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 9us	Reset
Between 5us and 9us	Reset starts

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.

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



5. When Reset applied during Sleep In Mode.

6. When Reset applied during Sleep Out Mode.

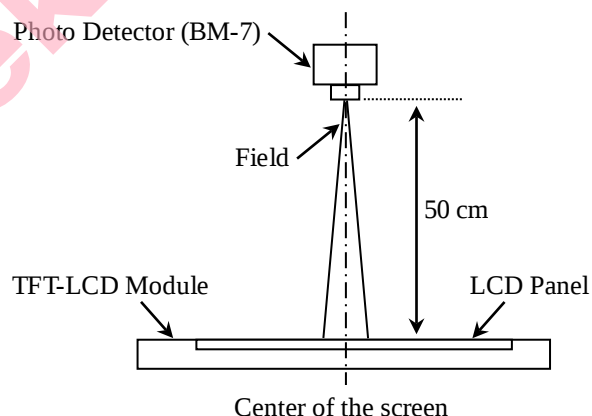
7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec

8. Optical Characteristics

Ta=25°C

Item	Symbol	Specifications			Unit	Note
		Min.	Typ.	Max.		
Contrast Ratio	Cr ($\theta=0^\circ$)	500	1000	-	-	Note 1,2
Response Time(25°C)	T _R +T _F ($\theta=0^\circ$)	-	35	40	ms	Note 3
Viewing Angle (Cr $\geq$ 10)	θ_R	$\phi=0^\circ$	80	85	-	Note 4 Reference
	θ_L	$\phi=180^\circ$	80	85	-	
	θ_T	$\phi=90^\circ$	80	85	-	
	θ_B	$\phi=270^\circ$	80	85	-	
Chromaticity ($\theta=0^\circ$)	White	x	0.2574	0.3074	0.3574	Note 1,5
		y	0.3176	0.3676	0.4176	
	Red	x	0.5904	0.6404	0.6904	
		y	0.2812	0.3312	0.3812	
	Green	x	0.2636	0.3136	0.3636	
		y	0.5536	0.6036	0.6536	
	Blue	x	0.0938	0.1438	0.1938	
		y	0.0341	0.0841	0.1341	
Luminance	$\theta=0^\circ$	440	550	-	cd/m ²	Note 1,6
Luminance Uniformity	-	70	80	-	%	Note 1,7
Color Gamut(NTSC)	-	60	65	-	%	Reference

Note 1: Definition of optical measurement system.



Note 2: Definition of contrast ratio.

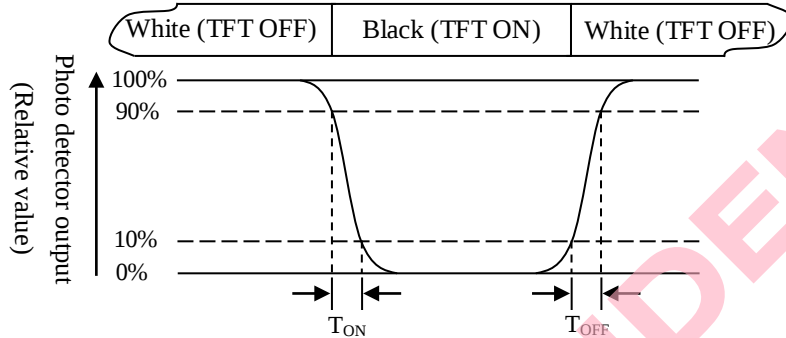
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 3: Definition of response time

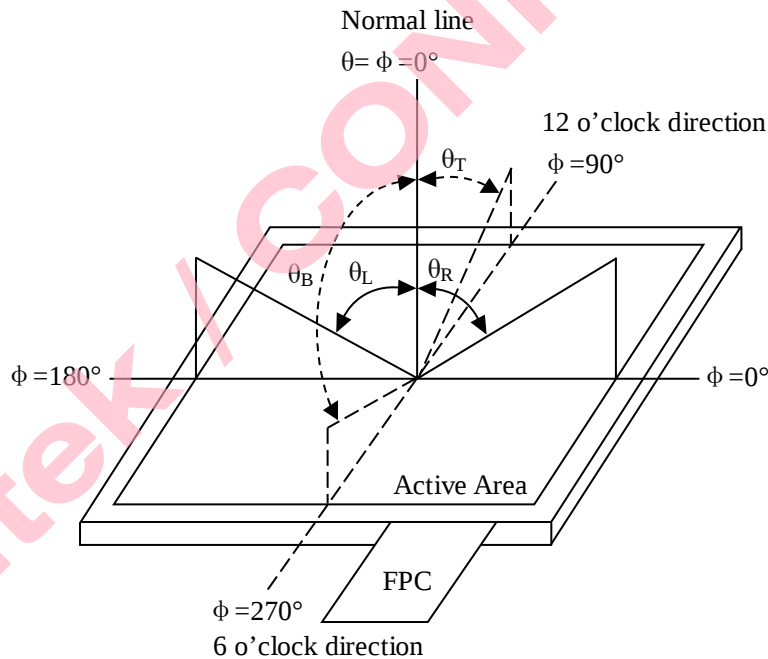
The response time is defined as the LCD optical switching time interval between "White" state and "Black" state.

Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%.

Fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 4: Definition of viewing angle range.



Note 5: 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.

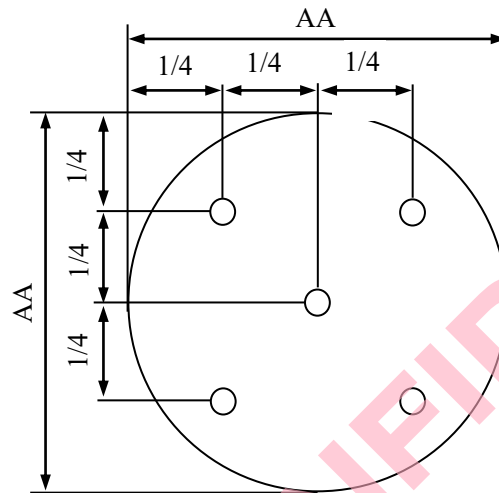
Note 6: Definition of luminance.

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

Note 7: Definition of luminance uniformity.

To test for uniformity, the tested area is divided into 5 spot. The measurement spot is placed at the center of each circle as below.

$$\text{Luminance Uniformity} = \frac{\text{Minimum luminance in measurement spot}}{\text{Maximum luminance in measurement spot}}$$



9. Reliability Tests

No.	Item	Condition	Criterion
1	High Temperature Storage	80°C,120 Hours	No defects in display and operational functions
2	Low Temperature Storage	-30°C,120 Hours	
3	High Temperature Operating	70°C,120 Hours	
4	Low Temperature Operating	-20°C,120 Hours	
5	High Temperature and Humidity Test(Storage)	60°C,90%RH,120 Hours	
6	Thermal Shock	-30°C (30mins)→80°C (30mins),10Cycle	
7	Electro-Static Discharge (Operating)	C=150pF, R=330Ω, 5 Point/Panel Contact Discharge: ±4KV, 5 times Air Discharge: ±8KV, 5 times	
8	Package Vibration Test	Frequency Range:10~55Hz Stroke: 5mm Sweep:1 hours for each direction of X.Y.Z (3 hours for total)	
9	Package Drop Test	Height: According to GB/T 2423.8-1995 1 Corner, 3 Edges, 6 Surfaces	

Remark:

1. The Test samples should be applied to only one test item.
2. Sample for each test item is 2 pcs.
3. The samples must be free from defect before test, must be restored at room condition at least for 2 hours storage at room temperature after reliability test before any inspection.
4. After a long period of high temperature, the surrounding edge of the LCM all-black image maybe appear MURA phenomenon, which is a normal phenomenon.
5. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

10. Package Drawing

TBD

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11. Incoming Inspection Specification

According to Santek Inspection Standard.

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12. Cautions

- a. Recommended Storage condition: Temperature: 25°C/+/-5°C, Humidity: ≤75%RH. Clear and free with dust and flowing particles space.
- b. Don't disassemble and reassemble the module by yourself.
- c. Acid, alkali, alcohol or touched directly by hand will damage the display.
- d. Static electricity will damage the module. Please configure grounding device. And enough anti-statics protection when touching products.
- e. The strong vibration, shock, twist or bend will cause material damage, even module broken.
- f. It is easy to cause image sticking while displaying the same pattern for very long time.
- g. The response time, brightness and performance will vary from different temperature.
- h. LCD Devices are made of fragile material such as Glass and may be broken or cracked if dropped it, so please handle them with care. Please be careful not to cut your hand if you break the glass.
- i. Do not stack the LCDs to avoid the LCDs damage and contamination.
- j. Before using the LCDs, please check the specification.
- k. LCDs contain a small amount of Liquid Crystal. Please follow local ordinances or regulations for disposal.
- l. LCD shall be stored in same packing material during import, and under the condition of room temperature (20-30 degree C).
- m. Please do not leave LCD modules under the direct sunlight or strong infra-red radiation for a long period time to prevent liquid crystal deteriorating.
- n. Please turn off the power supply before plugging or unplugging LCD module.
- o. Please do not rub, push, or hit LCD surface with hard tool etc. Film on surface is easily scratched, when droplets of water or dirt are on the surface, please gently remove them with soft fabric.
- p. Handling of main and LED FPC (Flexible Printed Circuit), please be careful, do not strongly pull or scratch FPC, to avoid failure of the components and bonding part.

13. 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 replacement on the terms set forth above. Santek shall not be responsible for any subsequent or consequential events.

13.1 Returning LCM Under Warranty –Terms and Conditions

- a. 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.
- b. 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.