

TFT-LCD Module SPECIFICATIONS

For Customer: _____

☐ : APPROVAL FOR SPECIFICATION

Customer Model No. _____

☐ : APPROVAL FOR SAMPLE

Module No.: SDT050BMS-02

Date : 2020-03-13

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For Customer's Acceptance:

Approved By	Comment

PREPARED	CHECKED	VERIFIED BY QA DEPT	VERIFIED BY R&D DEPT





3. General Specifications

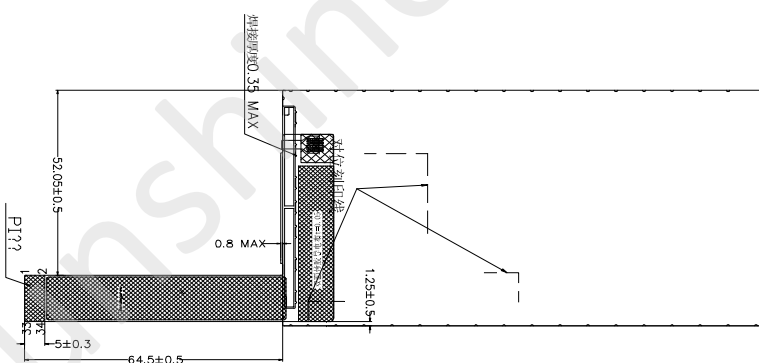
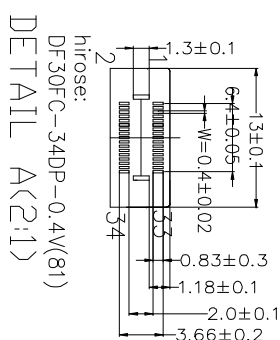
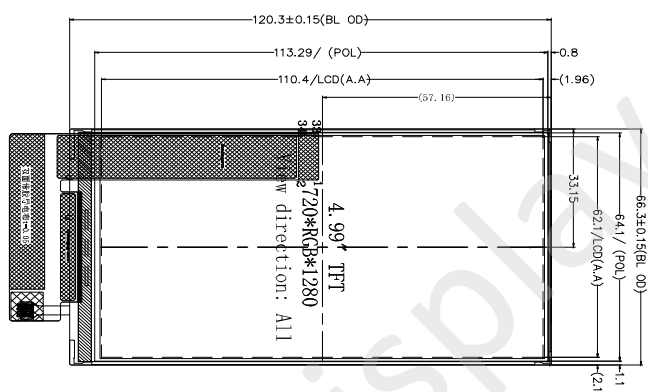
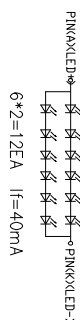
SDT050BMS-02 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC,. The 4.99" display area contains 720 x (RGB)x 1280 pixels and can display up to 16.7M colors. This product accords with ROHS environmental Criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M		1
Viewing Direction	ALL	O'Clock	
Operating temperature	-10~+60	°C	
Storage temperature	-20~+70	°C	
Module size	66.3X120.3X2.15	mm	2
Active Area(W×H)	62.1X110.4	mm	
Number of Dots	720×1280	dots	
LCM Controller	ST7703	-	
Power Supply Voltage	2.8	V	
Backlight	6S2P-LEDs (white)	pcs	
Weight	---	g	
Interface	MIPI	-	
-	-		

Note 1: Color tune is slightly changed by temperature and driving voltage.

4.Outline Drawing

- NOTES:
1. DISPLAY MODE : TFT AHVA Mode, 16.7M Color LCD, Transmissive, Normal Black
 2. VIEWING DIRECTION : U/L/D/R 80/80/80/80
 3. Driver IC : ST7701S
 4. OPERATING TEMPERATURE: -10°C TO 60°C
 5. STORAGE TEMPERATURE: -20°C TO 70°C
 6. GENERAL TOLERANCE: ± 0.2
- S5LM Lumiance: LED/350cd/m (Typical)



背视图
FPC 弯折出货

REVISE	Revision note	DATE	NAME
V0	First	2020.2.25	CJ

pin	Assignment
1	gnd
2	gnd
3	VDD
4	D3-
5	gnd
6	D3+
7	MTP
8	gnd
9	gnd
10	D0-
11	LED-
12	D0+
13	gnd
14	gnd
15	LED+
16	CK-
17	gnd
18	CK+
19	LED-
20	gnd
21	gnd
22	D1-
23	VDDIO
24	D1+
25	gnd
26	gnd
27	TE
28	D2-
29	gnd
30	D2+
31	LED_PWM
32	gnd
33	gnd
34	RESET

		深圳市阳光显示科技有限公司 Sunshine Display Technology Limited	
Sunshine Display		www.sunshinedisplay.com	
Approved By		SIZE:	TFT_LCD 5.0"
Checked By		DWARKING_NO.:	SJT050UBMS-02
Drawn By	LYY	CUSTOMER_NO.	
UNIT:mm			

5. Absolute Maximum Ratings($T_a=25^{\circ}\text{C}$)

5.1 Electrical Absolute Maximum Ratings.($V_{SS}=0\text{V}$, $T_a=25^{\circ}\text{C}$)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	-0.3	6.6	V	1, 2
	VDDIO	-0.3	5.5		

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.

2. $V_{DD} > V_{SS}$ must be maintained.

3. Please be sure users are grounded when handing LCD Module.

5.2 Environmental Absolute Maximum Ratings.

1. The response time will become lower when operated at low temperature.

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-20°C	70°C	-10°C	60°C	1,2
Humidity	-	-	-	-	3

2. Background color changes slightly depending on ambient temperature.

The phenomenon is reversible.

3. $T_a \leq 40^{\circ}\text{C}$: 85%RH MAX.

$T_a > 40^{\circ}\text{C}$: Absolute humidity must be lower than the humidity of 85%RH at 40°C .

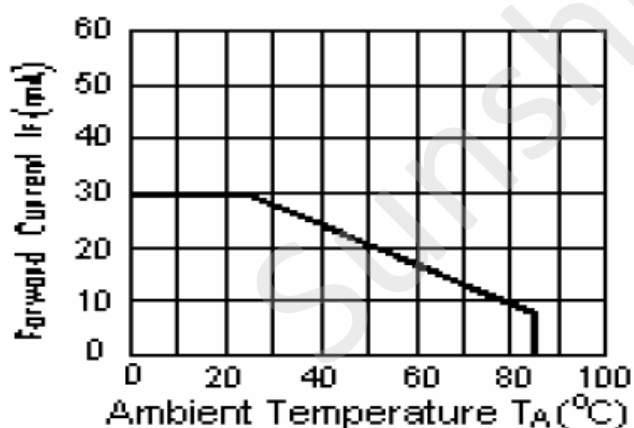
6. Electrical Specifications

6.1 Electrical characteristics($V_{SS}=0V$, $T_a=25^{\circ}C$)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply	VDD	$T_a=25^{\circ}C$	2.5	2.8	6.2	V	
	VDDIO	$T_a=25^{\circ}C$	1.65	1.8	2.0	V	
Power supply	VDD-CTP	$T_a=25^{\circ}C$	2.7	2.8	3.3	V	
Input voltage	'H'	V_{IH}	$T_a=25^{\circ}C$	$0.7 \cdot V_{DDIO}$	-	VDDIO	V
	'L'	V_{IL}	$T_a=25^{\circ}C$	0	-	$0.3 \cdot V_{DDIO}$	V

6.2 LED backlight specification($V_{SS}=0V$, $T_a=25^{\circ}C$)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	V_f	$I_f=40mA$	16.2	18.0	19.8	V	
Uniformity	ΔB_p	$I_f=40mA$	75	80	-	%	
Life Time	time	$I_f=40mA$	-	20K	-	hours	1



Note 1: Brightness to be decreased to 50% of the initial value at ambient temperature $T_a=25^{\circ}C$

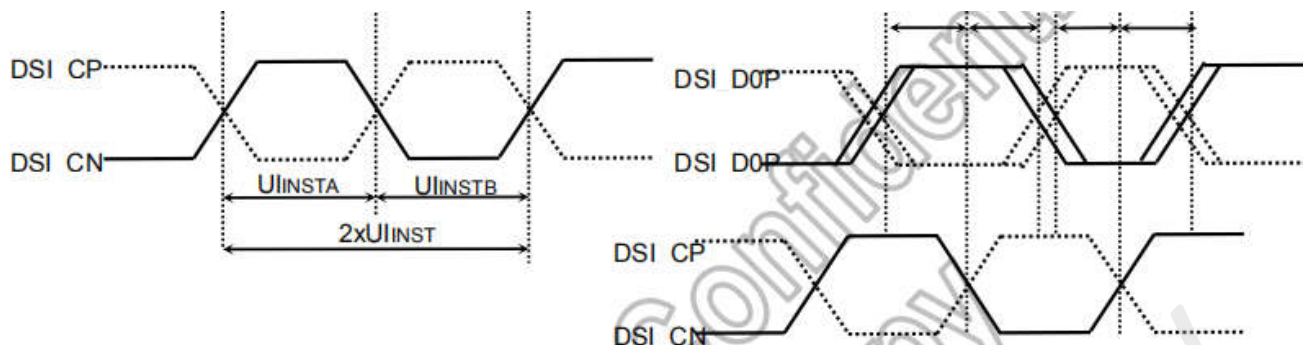
6.3 Interface signals

Pin No.	Symbol	I/O	Function	Note
1-2	GND	P	Ground.	
3	VDD	P	Power supply	
4	D3-	I	MIPI differential data3- input	
5	GND	P	Ground.	
6	D3+	I	MIPI differential data3+ input	
7	MTP	P	No use please NC	
8-9	GND	P	Ground.	
10	D0-	I	MIPI differential data0- input	
11	LED-	I	LED back light(Cathode)	
12	D0+	I	MIPI differential data0+ input	
13-14	GND	P	Ground.	
15	LED+	I	LED back light(Anode)	
16	CK-	I	MIPI CLOCK differential signal input	
17	GND	P	Ground.	
18	CK+	I	MIPI CLOCK differential signal input	
19	LED-	P	LED back light(Cathode)	
20-21	GND	P	Ground.	
22	D1-	I	MIPI differential data1- input	
23	VDDIO	P	Power supply for IO	
24	D1+	I	MIPI differential data1+ input	
25-26	GND	P	Ground.	
27	TE	O	Tearing effect output	
28	D2-	I	MIPI differential data2- input	
29	GND	P	Ground.	
30	D2+	I	MIPI differential data2+ input	
31	LED_PWM	O	This PIN is connecting with the external LED driver	
32-33	GND	P	Ground.	
34	RSEX	I	Reset pin, Active Low	

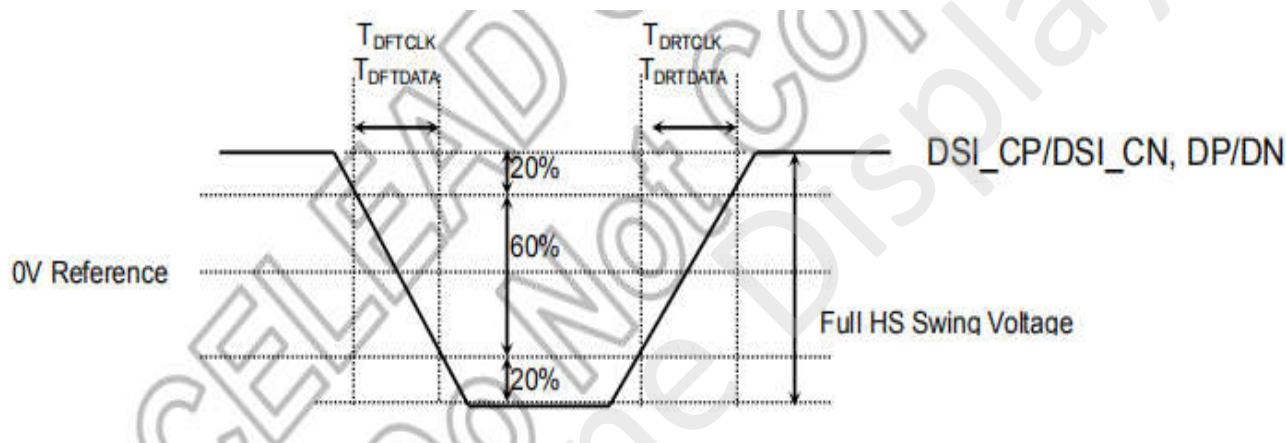
6.4 AC Characteristics

6.4.1 DSI Interface Timing Characteristics

6.4.1.1 High Speed Mode



Clock Timing Characteristics

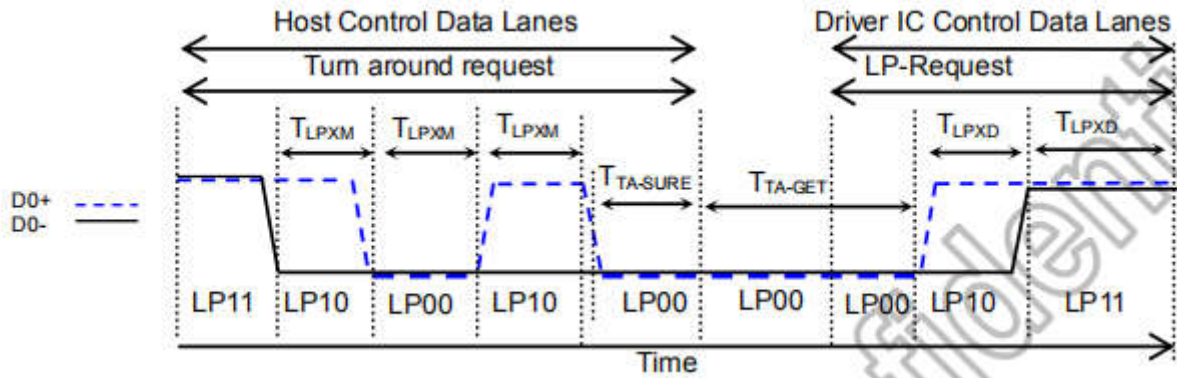


High Speed Mode Characteristics

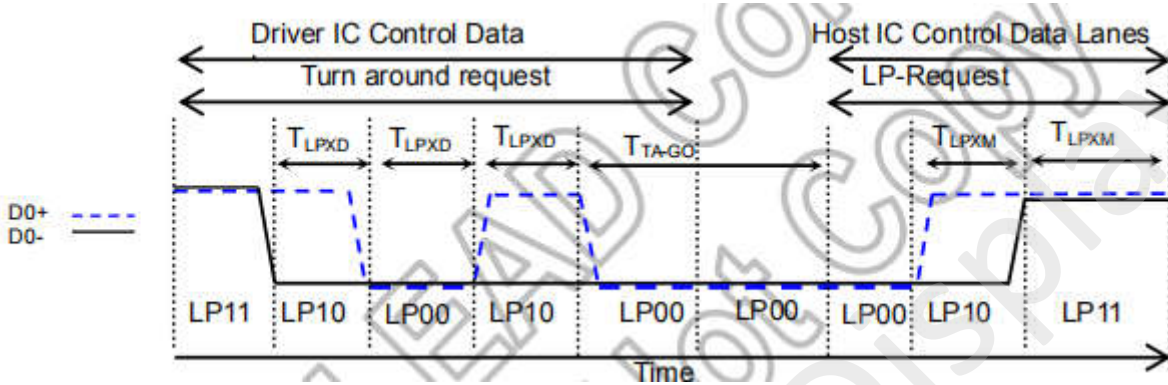
Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Double UI instantaneous	$2xU_{INST}$	TBD	-	25	ns
	UI instantaneous	U_{INSTA} U_{INSTB}	TBD	-	12.5	ns
DP/DN	Data to clock setup time	T_{DS}	$0.15xUI$	-	-	ps
	Data to clock hold time	T_{DH}	$0.15xUI$	-	-	ps
DSI_CP/ DSI_CN	Differential rise time for clock	T_{DRTCLK}	150	-	$0.3UI$	ps
	Differential fall time for clock	T_{DFTCLK}	150	-	$0.3UI$	ps
DP/DN	Differential rise time for data	$T_{DRTDATA}$	150	-	$0.3UI$	ps
	Differential fall time for data	$T_{DFTDATA}$	150	-	$0.3UI$	ps

6.4.3.2 Low Power Mode

BET from HOST to Display Mouldle Timing



BET from Display Module to Host Timing

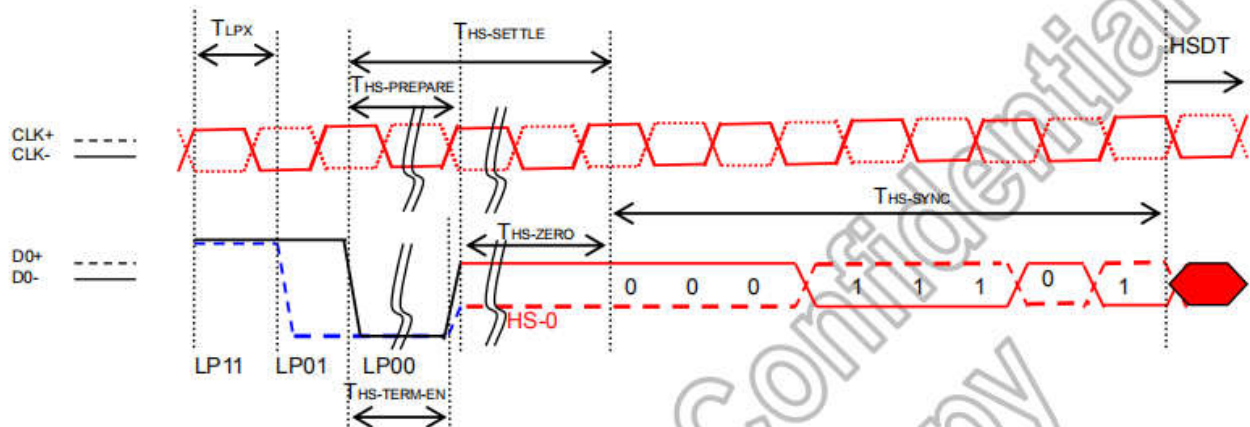


Low Speed Mode Characteristics

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11 Host → Display module	T_{LPXM}	50	-	-	ns
	Length of LP-00/LP01/LP10/LP11 Display module → Host	T_{LPXD}	50	-	-	ns
	Time-out before the MPU start driver	$T_{TA-SURE}$	T_{LPXD}	-	$2 \times T_{LPXD}$	ns
	Time to drive LP-00 by display module	T_{TA-GET}	$5 \times T_{LPXD}$	-	-	ns
	Time to drive LP-00 after turnaround request Host	T_{TAGO}	$4 \times T_{LPXD}$	-	-	ns

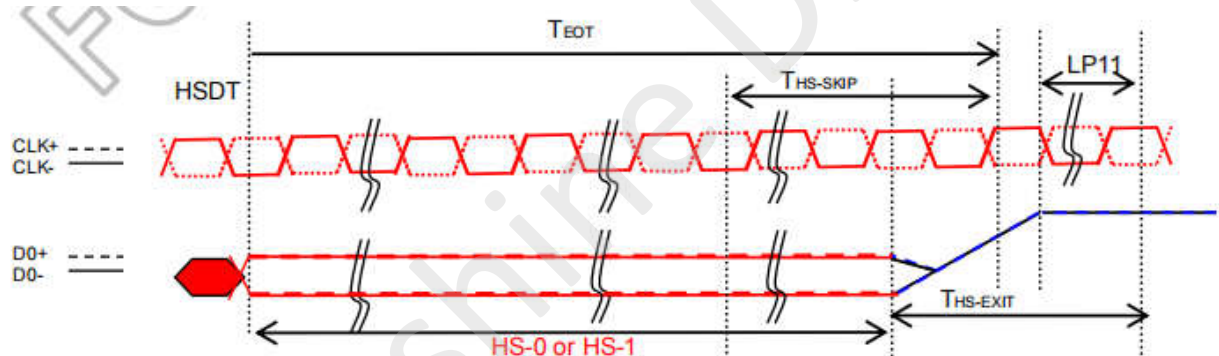
6.4.3.3 DSI BURSTS

DSI Low Power Mode to High Speed Mode Timing



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11	T _{LPX}	50	-	-	ns
	Time to Driver LP-00 to prepare for HS transmission	T _{HS-PREPARE}	40+4UI	-	85+6UI	ns
	Time to enable data receiver line termination	T _{HS-TERM-EN}	-	-	35+4xUI	ns
	Time to drive LP-00 by display module	T _{TA-GET}	5xT _{LPXD}	-	-	ns
	Time to drive LP-00 after turnaround request Host	T _{TAGO}	4xT _{LPXD}	-	-	ns

DSI High Speed Mode to/from Low Power Mode Timing



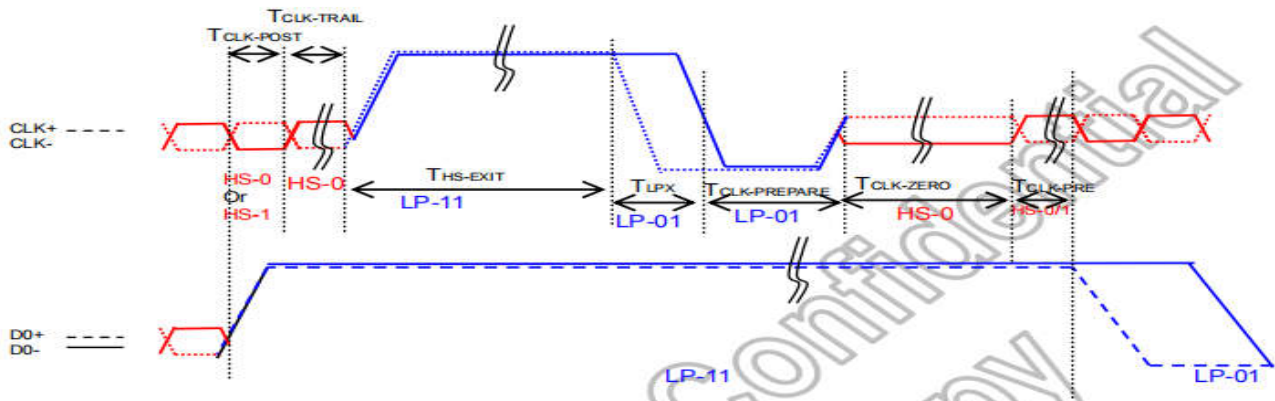
NOTE:

If the last bit is HS-0, the transmitter changes from HS-0 to HS-1

If the last bit is HS-0, the transmitter changes from HS-1 to HS-0

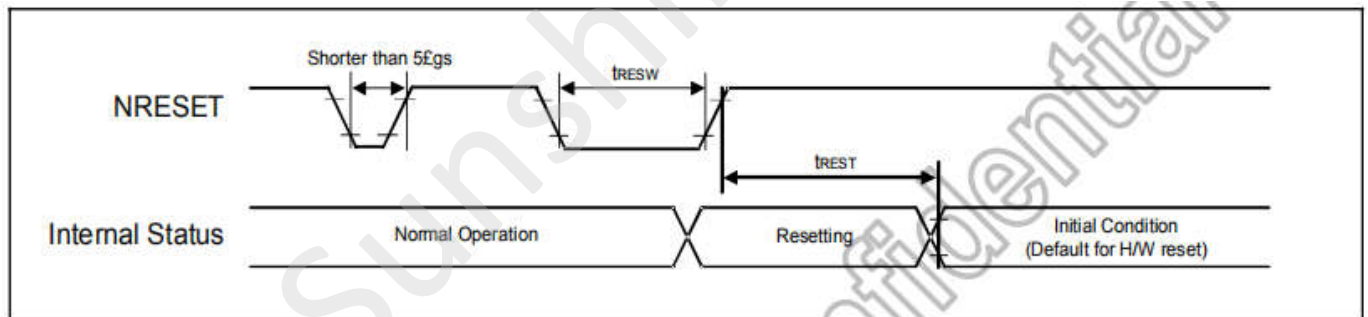
Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Time-Out at Display Module to Ignore Transition Period of EoT	T _{HS-SKIP}	40	-	55+4xUI	ns
	Time to Driver LP-11 after HS Burst	T _{HS-EXIT}	100	-	-	ns

6.4.3.4 Clock Lane High Speed Mode to/from Low Power Mode Timing



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Time that the MCU shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	T _{CLK-POST}	60+52xUI	-	-	ns
	Time to drive HS differential state after last payload clock bit of a HS transmission burst	T _{CLK-TRAIL}	60	-	-	ns
	Time to drive LP-11 after HS burst	T _{HS-EXIT}	100	-	-	ns
	Time to drive LP-00 to prepare for HS transmission	T _{CLK-PREPARE}	38	-	95	ns
	Time-out at Clock Lane Display Module to enable HS Termination	T _{CLK-TERM-EN}	-	-	38	ns
	Minimum lead HS-0 drive period before starting Clock	T _{CLK-PREPARE} + T _{CLK-ZERO}	300	-	-	ns
	Time that the HS clock shall be driven prior to any associated data Lane beginning the transition from LP to HS mode	T _{CLK-PRE}	8xUI			

6.5 Reset Input Timing



Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
t _{RESW}	Reset low pulse width ⁽¹⁾	NRESET	10	-	-	-	μs
t _{REST}	Reset complete time ⁽²⁾	-	15	-	-	When reset applied during SLPIN mode	ms
		-	120	-	-	When reset applied during SLPOUT mode	ms

**7. Optical Characteristics**

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		$\theta=0^{\circ}$ $\Phi=0^{\circ}$	-	350	-	Cd/m ²	1
Uniformity	△Bp			75	80	-	%	1,2
Viewing Angle	3:00		Cr≥10	70	80	-	Deg	3
	6:00			70	80	-		
	9:00			70	80	-		
	12:00			70	80	-		
Contrast Ratio	Cr		$\theta=0^{\circ}$ $\Phi=0^{\circ}$	600	900	-	-	4
Response Time	T _r +T _f			-	30	35	ms	5
Color of CIE Coordinate	W	x	$\theta=0^{\circ}$ $\Phi=0^{\circ}$	Typ -0.05	0.315	Typ +0.05	-	1,6
		y			0.355		-	
	R	x			0.661		-	
		y			0.323		-	
	G	x			0.274		-	
		y			0.583		-	
	B	x			0.134		-	
		y			0.124		-	
NTSC Ratio	S			64	68	-	%	

Note: The parameter is slightly changed by temperature, driving voltage and materiel

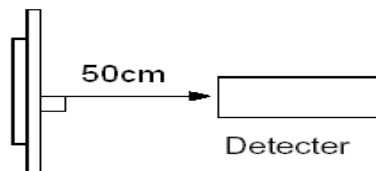
Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white.

The brightness is the average value of 9 measured spots. Measurement equipment BM-7 (Φ5mm)

Measuring condition:

- *Measuring surroundings: Dark room.*
- *Measuring temperature: $T_a = 25^\circ\text{C}$.*
- *Adjust operating voltage to get optimum contrast at the center of the display.*

Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

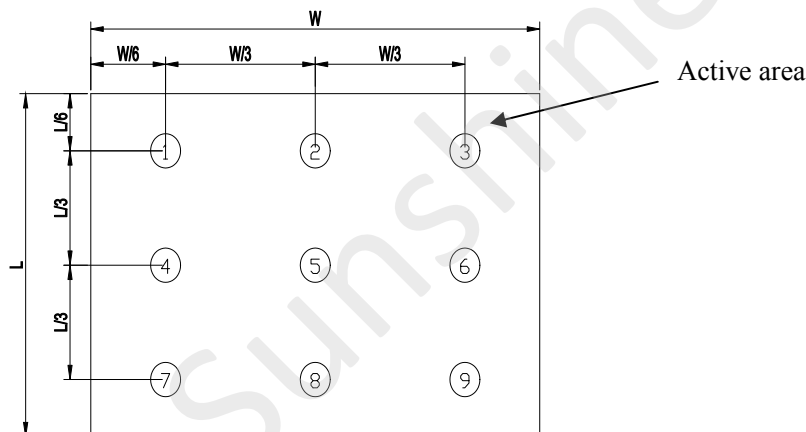


Note 2: The luminance uniformity is calculated by using following formula.

$$\Delta B_p = B_p (\text{Min.}) / B_p (\text{Max.}) \times 100 (\%)$$

$B_p (\text{Max.})$ = Maximum brightness in 9 measured spots

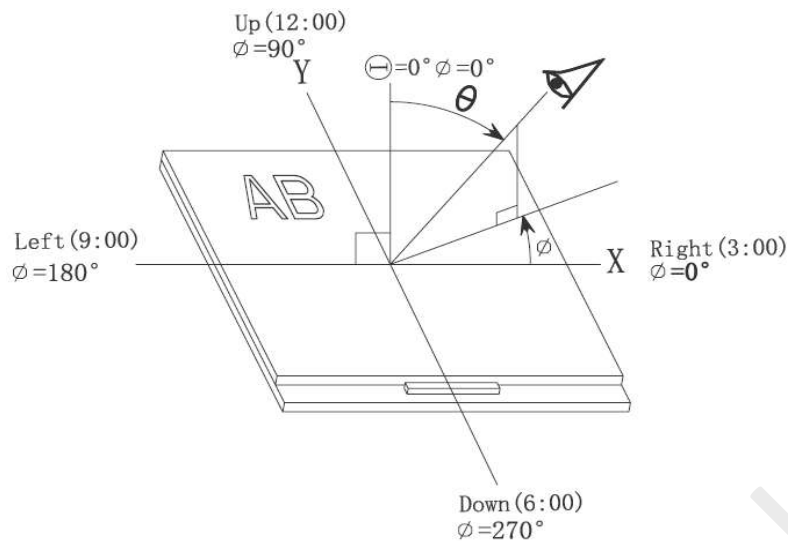
$B_p (\text{Min.})$ = Minimum brightness in 9 measured spots.



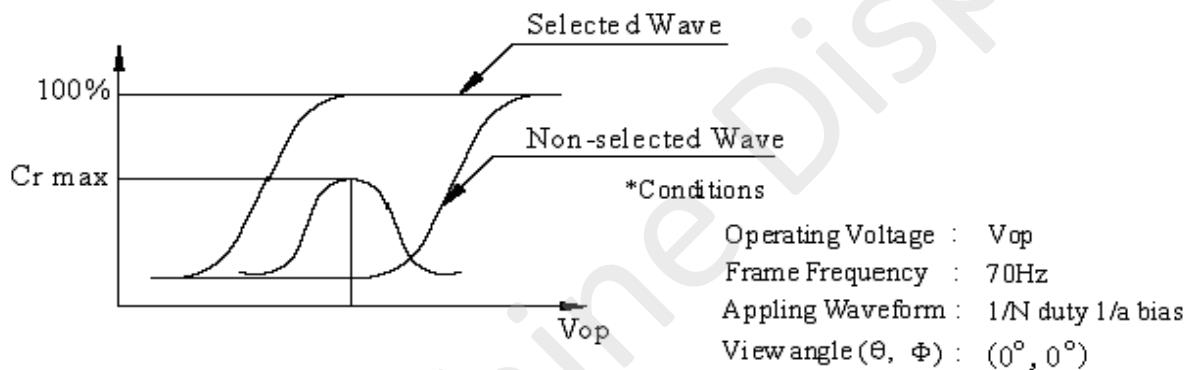


Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and Φ



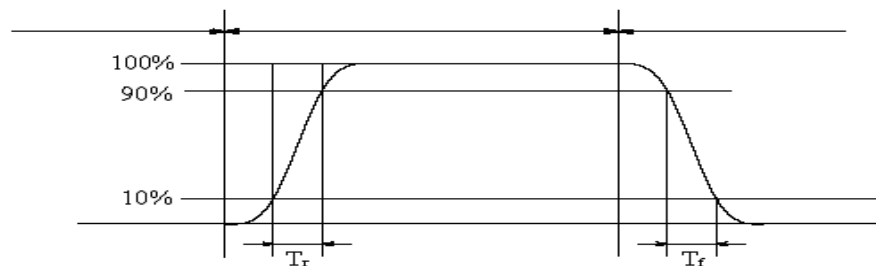
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



$$\text{Contrast ratio}(Cr) = \frac{\text{Brightness of selected dots}}{\text{Brightness of non-selected dots}}$$

Note 5: Definition of Response time. (Test LCD using DMS501):

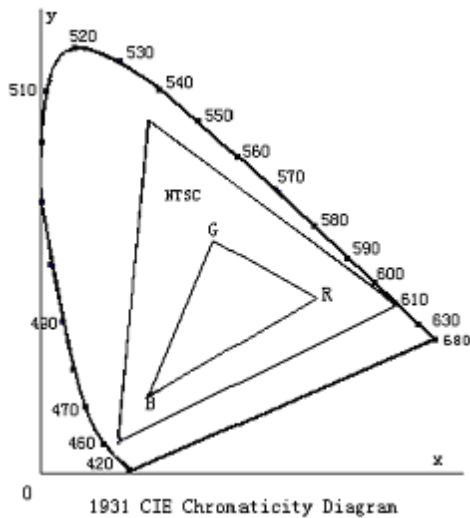
The output signals of photo detector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



The definition of response time



Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.

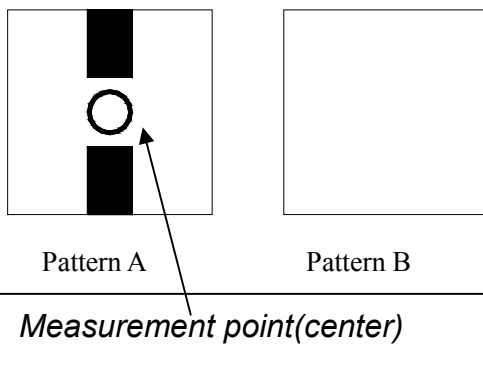


Color gamut:

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 7: Definition of cross talk.

Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100



Electric volume value=3F+/-3Hex

**8. Reliability Test Items and Criteria**

Test Item	Test condition	Remark
High Temperature Storage	Ta = 70℃ 96hrs	Note1,Note3,4
Low Temperature Storage	Ta = -20℃ 96hrs	Note1,Note3,4
High Temperature Operation	Ts = 60℃ 96hrs	Note2,Note3,4
Low Temperature Operation	Ta = -10℃ 96hrs	Note1,Note3,4
Operation at High Temperature/Humidity	+50℃, 90%RH 96hrs	Note3,Note4
Thermal Shock	-20℃/30 min ~ +70℃/30 min for a total 10 cycles, Start with cold temperature and end with high temperature.	Note3,Note4
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total)	
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	
Package Vibration Test	Random Vibration : 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)	
Package Drop Test	Height:60cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	±2KV, Human Body Mode, 100pF/1500Ω	

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature

9. Precautions for Use of LCD Modules

9.1 Handling Precautions

9.1.1 *The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.*

9.1.2 *If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.*

9.1.3 *Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.*

9.1.4 *The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.*

9.1.5 *If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:*

— Isopropyl alcohol — Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water — Ketone — Aromatic solvents

9.1.6 *Do not attempt to disassemble the LCD Module.*

9.1.7 *If the logic circuit power is off, do not apply the input signals.*

9.1.8 *To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.*

- a. *Be sure to ground the body when handling the LCD Modules.*
- b. *Tools required for assembly, such as soldering irons, must be properly ground.*
- c. *To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.*
- d. *The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.*



9.2 Storage precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

Relatively humidity: $\leq 80\%$

9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

9.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

END