

PRODUCT SPECIFICATION **FOR LCD MODULE**

Revision: 1.0

Model No: LS028I06-MP-V1

Module Type: COG+FPC+B/L

APPROVED SIGNATURE

- Approved Product Specification only
- Approved Product Specification and Samples

<u>Prepared By</u>	<u>Checked By</u>	<u>Approved By</u>

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1. General Description

LS028I06-MP-V1 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit and a backlight unit. The panel size is 2.83 inch and the resolution is 480(RGB)*640, the panel can display up to 16.7 M colors.

2. Physical Features

Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 480(RGB)×640 Dot-matrix
Input Data	MIPI
Viewing Direction (Grayscale Inversion)	Free (IPS)
Drive	ST7701SN

3. Mechanical Specification

Item	Specification	Unit
Module size (H×V×D)	50 ×69.21 ×2.3	mm
Number of dots	480(RGB) ×640	pixel
Active area (H×V)	43.2×57.6	mm



5. Absolute Maximum Ratings

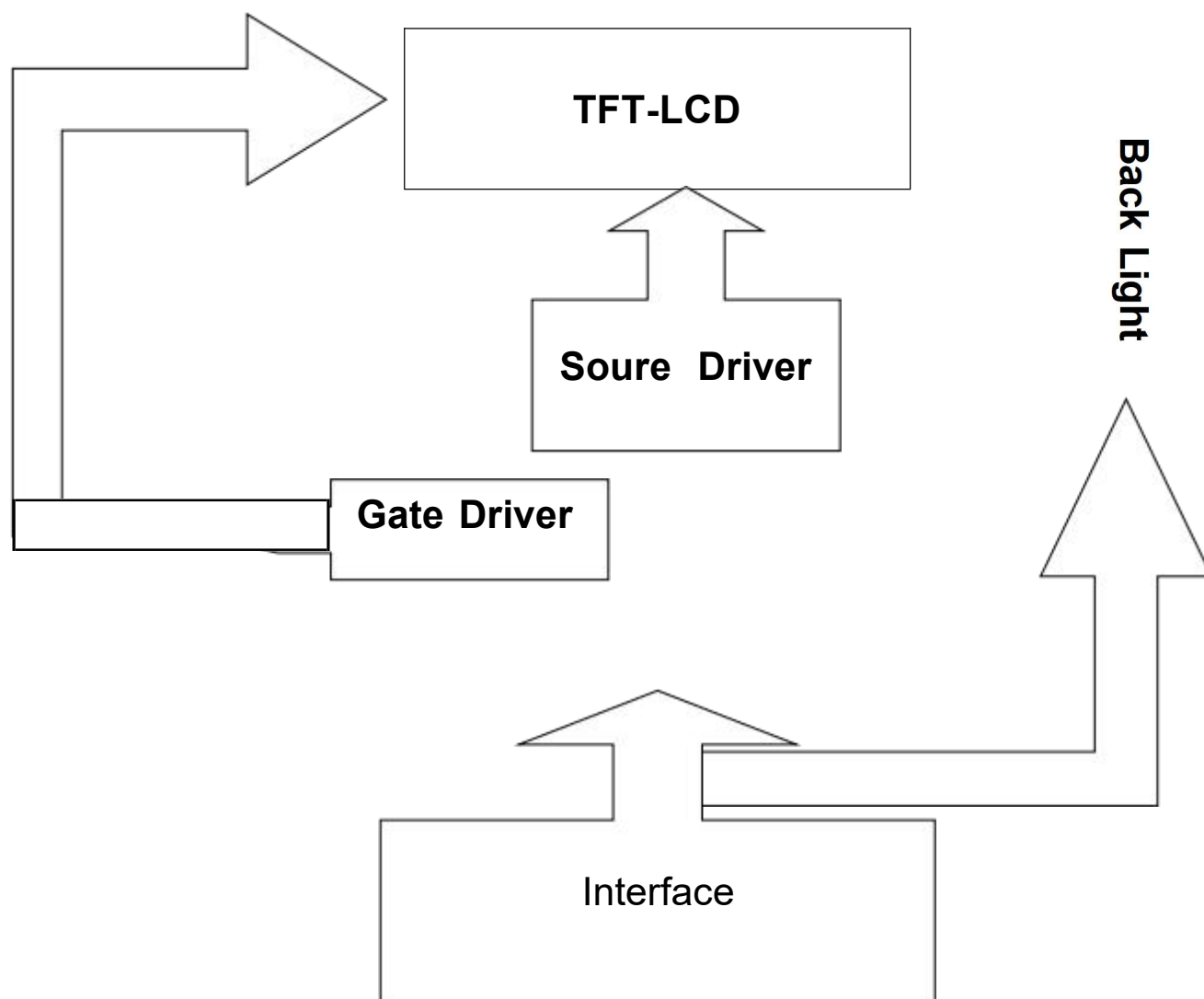
Item	Symbol	Min	Max	Unit	Remark
Supply voltage	VCC	-0.3	3.6	V	Note1 Note2
Supply voltage	IOVCC	-0.3	3.6	V	
Operating temperature	TOPR	-20	70	°C	
Storage temperature	TSTR	-30	80	°C	

6. Electrical Characteristics

Item		Symbol	Rating			Unit	Remark
			Min	Typ	Max		
Supply voltage		VCC	2.5	2.8	3.6	V	Note1
Supply voltage		IOVCC	1.65	1.8	3.3	V	
Input Voltage	L level	VIL	0	---	0.3*IOVCC	V	
	H level	VIH	0.7*IOVCC	---	IOVCC	V	

7. Module Function Description

7- 1. Block Diagram Of LCM



7-2. Pin Description

Pin No.	Symbol	Description
1	LEDA	Back-light Anode
2	LEDK	Back-light Cathode
3	VCC	Power supply for interface logic circuits(2.8V-3.2V)
4	GND	Power Ground
5	D0N	MIPI-DSI DATE signal input
6	D0P	MIPI-DSI DATE signal input
7	GND	Power Ground
8	CN	MIPI-DSI DATE signal input
9	CP	MIPI-DSI DATE signal input
10	GND	Power Ground
11	DN1	MIPI-DSI DATE signal input
12	DP1	MIPI-DSI DATE signal input
13-33	GND	Power Ground
34	RESET	Reset input pin
35-37	GND	Power Ground
38	VCC	Power supply for interface logic circuits(2.8V-3.2V)
39	GND	Power Ground
40	VCC	Power supply for interface logic circuits(2.8V-3.2V)
31	VCC	Power supply for interface logic circuits(2.8V-3.2V)
32	VCC	Power supply for interface logic circuits(2.8V-3.2V)

7-3 Timing Characteristics

7.5.4 MIPI Interface Characteristics:

7.5.4.1 High Speed Mode

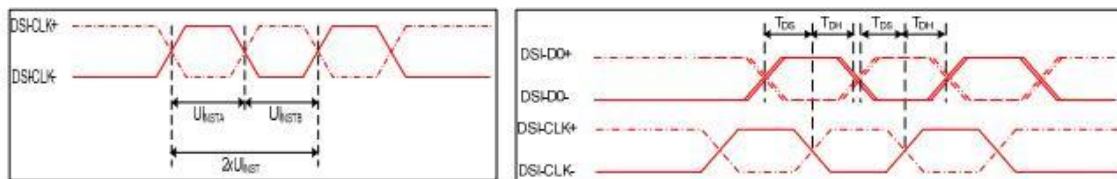


Figure 4 DSI clock channel timing

Figure 5 Rising and falling time on clock and data channel

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

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	$2xUI_{INSTA}$	Double UI instantaneous	4	25	ns	
DSI-CLK+/-	UI_{INSTA} UI_{INSTB}	UI instantaneous halves	2	12.5	ns	$UI = UI_{INSTA} = UI_{INSTB}$
DSI-Dn+/-	tDS	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	tDH	Data to clock hold time	0.15	-	UI	

Table 7 Mipi Interface- High Speed Mode Timing Characteristics

7-4 Reset Timing

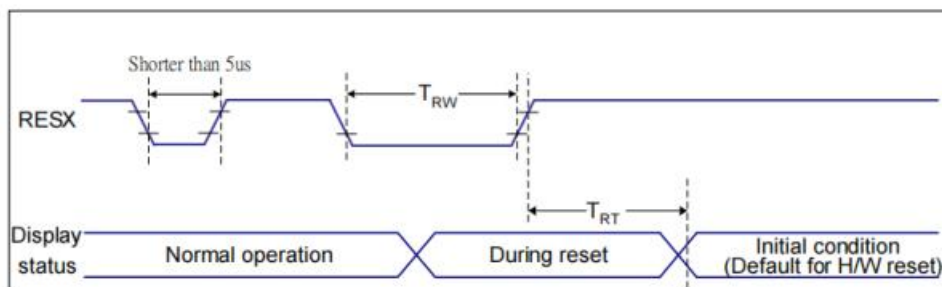


Figure 9 Reset Timing

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

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:

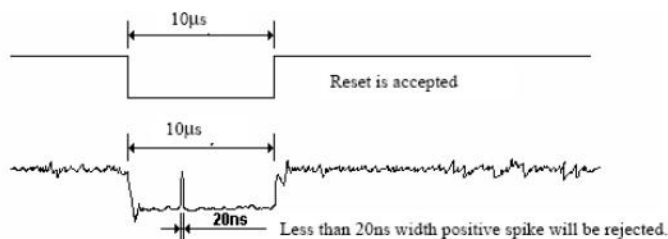
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

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.

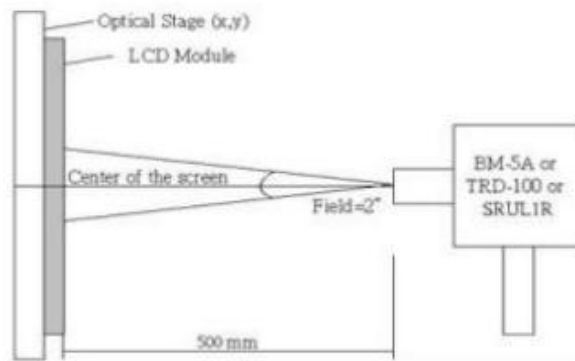
8. Electro-Optical Characteristics

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center point)		C/R	-	1000	1500	-	-	BM-7 Note(2)
Luminance of white (Center point)		L _w	B/L on	15%	TBD	15%	cd/m ²	CA-210
Luminance uniformity		U _w	θ = 0. Normal viewing angle B/L On Note(1)	80	-	-	%	BM-7 Note(3)
Response Time		Tr + Tf		-	30	35	ms	BM-5AS Note(4)
Color Chromaticity (CIE 1931)	White	W _x		0.279	0.294	0.309	-	CA-210 Note(5)
		W _y		0.298	0.313	0.328		
	Red	R _x		0.643	0.658	0.673		
		R _y		0.303	0.318	0.333		
	Green	G _x		0.235	0.250	0.265		
		G _y		0.555	0.570	0.585		
	Blue	B _x		0.124	0.139	0.154		
		B _y		0.072	0.087	0.102		
Viewing Angle	Hor.	θ _T	C/R≥10	75	80	-	Deg	EZ Contrast Note(6)
		θ _B		75	80	-		
	Ver.	θ _L		75	80	-		
		θ _R		75	80	-		
Optima View Direction			ALL					Note(7)

* This condition will be changed by the evaluation circumstance. If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.

Notes:

- (1) Test Equipment Setup: After stabilizing and leaving the panel alone at a given temperature for 30min, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room 30min after lighting the back-light. This should be measured in the center of screen.

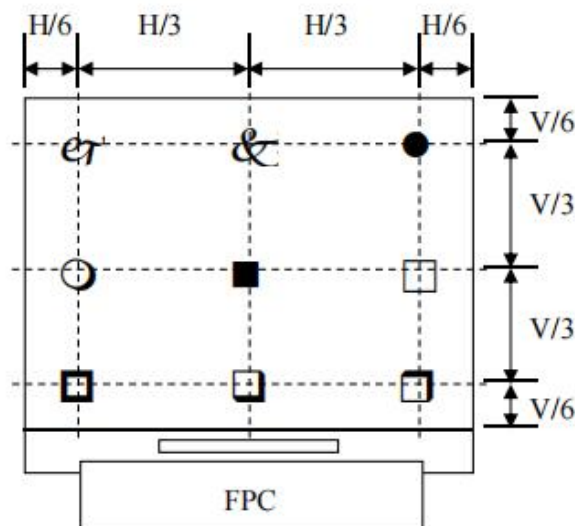


(2) Definition of Contrast Ratio (CR):

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance measured when LCD on the "white" state}}{\text{Luminance measured when LCD on the "black" state}}$$

(3) Definition of Luminance Uniformity: Active area is divided into 9 measuring areas (Shown in below), every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity} = \frac{\text{Min Luminance of white among 9-points}}{\text{Max Luminance of white among 9-points}} \times 100\%$$

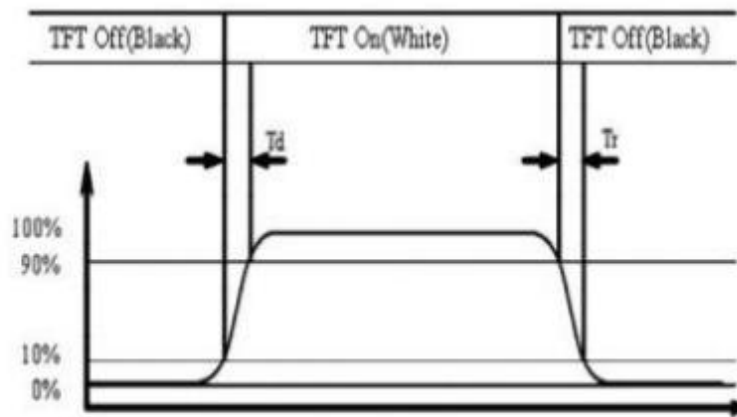


The spot locations for luminance measurement

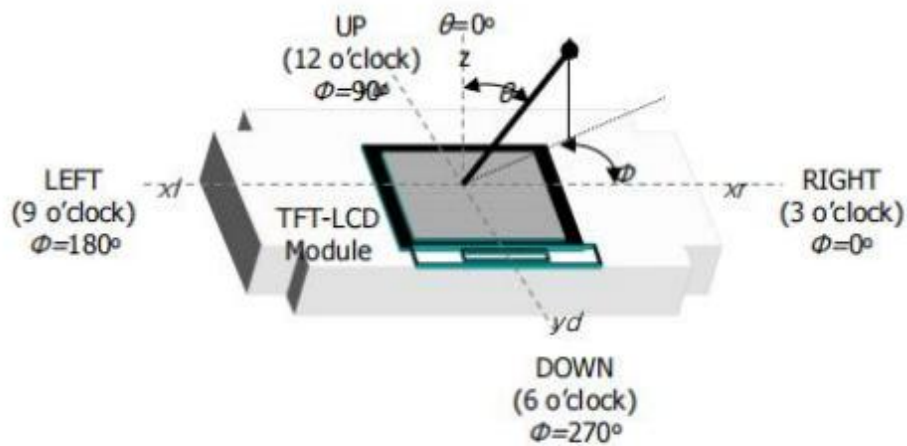
(4) Definition of Response time:

The output signals of photo detector are measured when the input signals are Changed from "black" to "white" (rising time) and from time "white" to "black" (falling time), Respectively.

The response time is defined as the time interval between the 10% and 90% of Amplitudes. Refer to figure as below.

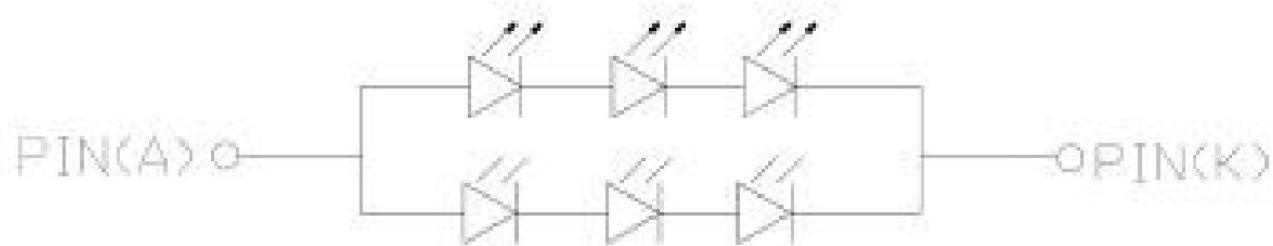


- (5) Definition of viewing angle, θ . Refer to figure as below



- (6) Definition of Color Chromaticity (CIE 1931)
Color coordinate of white & red, green, blue at center point.
- (7) The different Rubbing Direction will cause the different optima view direction.

Note(4) Backlight circuit



$V_F=9.0V$ $I_F=40mA$

背光电路图 (CIRCUIT DIAGRAM)

9.Records Of Version

Version	Revise Date	Page	Content
00		ALL	New released