深圳市拓普微科技开发有限公司
SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT050DNCFWU-NMN

LCD Module User Manual

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Linli		
Date: 2018-12-29	Date:	Date:

Rev.	Descriptions	Release Date
0.1	Preliminary	2018-12-29

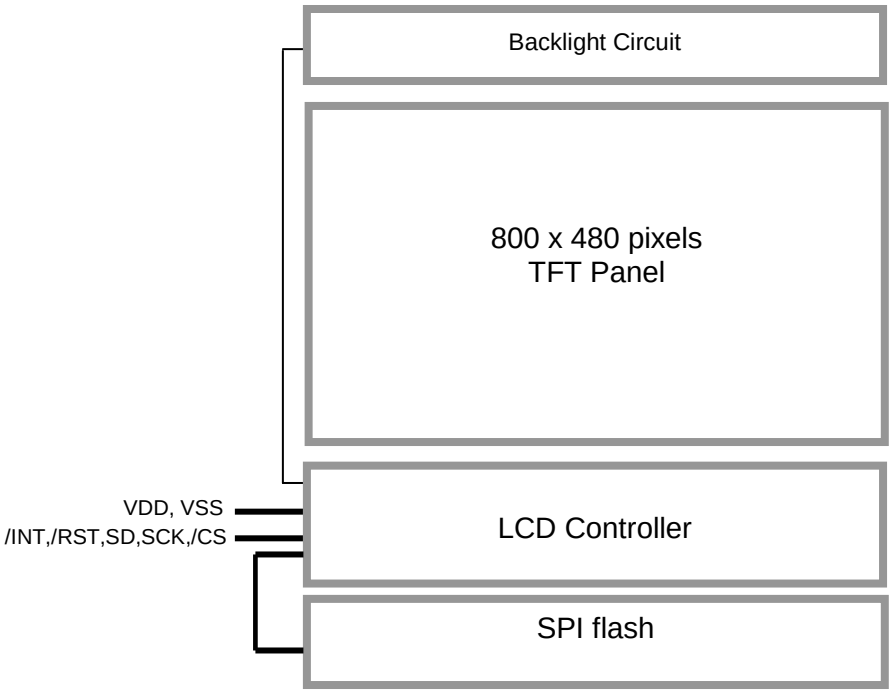
Table of Content

1. General Specification

Screen Size(Diagonal) :	5.0”
Outline Dimension :	143.5 x 80.9x 12.1max (mm) (see attached drawing for details)
Active Area :	108.0 x 64.8 (mm)
Color Depth:	65k
Number of dots :	800 x 480
Pixel Pitch :	0.135 x 0.135 (mm)
Pixel Configuration :	RGB Stripe
Backlight :	LED
Surface Treatment :	Anti-Glare Treatment
Viewing Direction :	6H (gray scale inverse)(*2) 12H(*3)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C

Note:
*1 Color tune may slightly changed by temperature and driving voltage.
*2. For saturated color display content (eg. pure-red, pure-green, pure-blue, or pure-colors-combinations)
*3. For "color scales" display content

2. Block Diagram



3. Terminal Functions

3.1 Interface

Pin No.	Pin Name	I/O	Descriptions	Note
1	VCC(5.0V)	P	Positive Power Supply	
2	VCC(5.0V)			
3	/CS	I	Chip Select /CS=L, enable access to the LCD interface /CS=H, disable access to the LCD interface	
4	NC	-	-	
5	SD	I/O	Serial Data Input / Output	
6	SCK	I	Serial Clock Input	
7	/RST	I	Reset signal /RST = L, Initialization is executed /RST = H, Normal running.	
8	/INT	O	Interrupt Signal Output The interrupt output for host to indicate the status.	
9,10	GND(0V)	P	Power Ground	

4. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V_{CC}	-0.3	+6.0	V	GND = 0V
Operating Temperature	T_{OP}	-20	+70	°C	No Condensation
Storage Temperature	T_{ST}	-30	+80	°C	No Condensation

Cautions:
Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

5. Electrical Characteristics

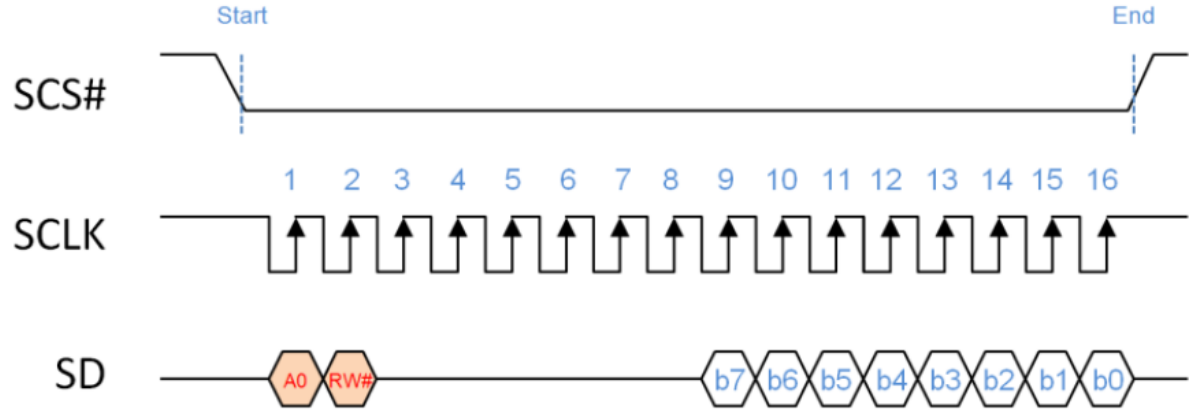
5.1 DC Characteristics (MCU terminal)

VDD=5.0V, VSS=0V, T_{OP} =25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Operating Voltage	VCC	4.7	5.0	5.3	V	VCC
Input High Voltage	V_{IH}	2.3	-	3.3	V	SD,SCK /CS, /RST
Input Low Voltage	V_{IL}	VSS	-	0.7	V	
Output Signal High Voltage	V_{OH}	2.4	-	3.3	V	SD,/INT
Output Signal Low Voltage	V_{OL}	VSS	-	0.4	V	
Operating Current	I_{CC}	-	(250)	-	mA	All black, Backlight ON
		-	(70)	-	mA	All black, Backlight OFF

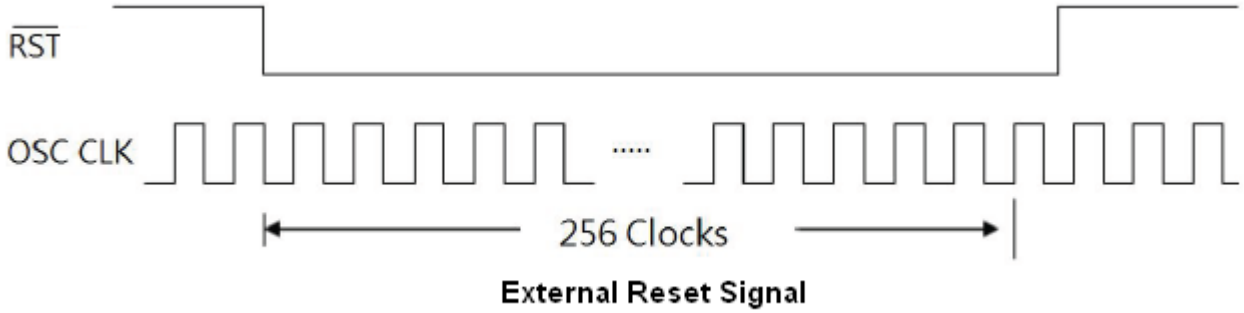
6. AC Characteristics

6.1 3-Wire SPI Timing



Item	A0	WR#
Status Register Read	Low	High
Write Register's Address	Low	Low
Write Data to Register or Memory	High	Low
Read Register's Data	High	High

6.2 TFT Controller Reset Timing

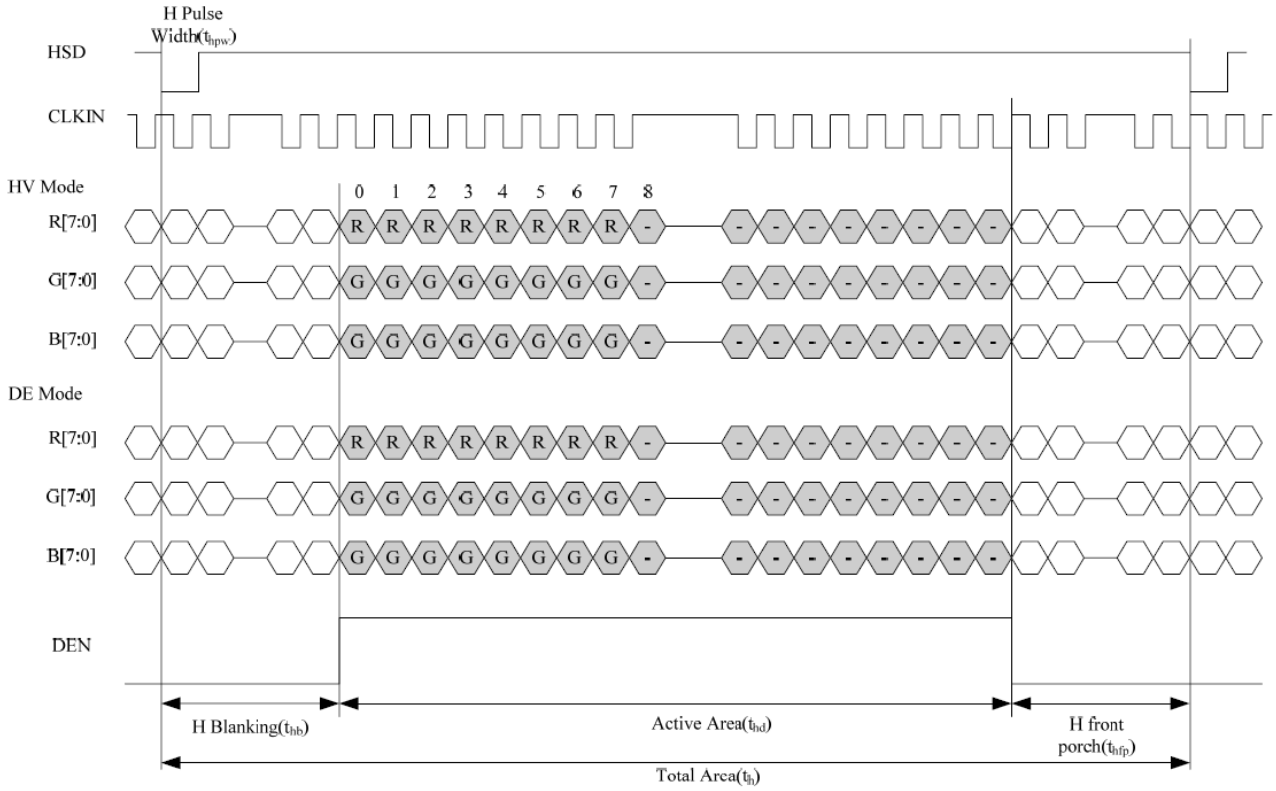


Note:
*1: The external reset event will be admitted when /RST keep low and stable at least 256 OSC clocks. (Oscillator frequency is10HMz)
*2: TFT Controller embedded a Power-On-Reset for core system. It is an active low signal and may output to external circuits by /RST pin to synchronize whole system. When system power(3.3V) on, internal reset will active until internal power stable and then de-active after 256 OSC(X'tal Oscillator) clocks.

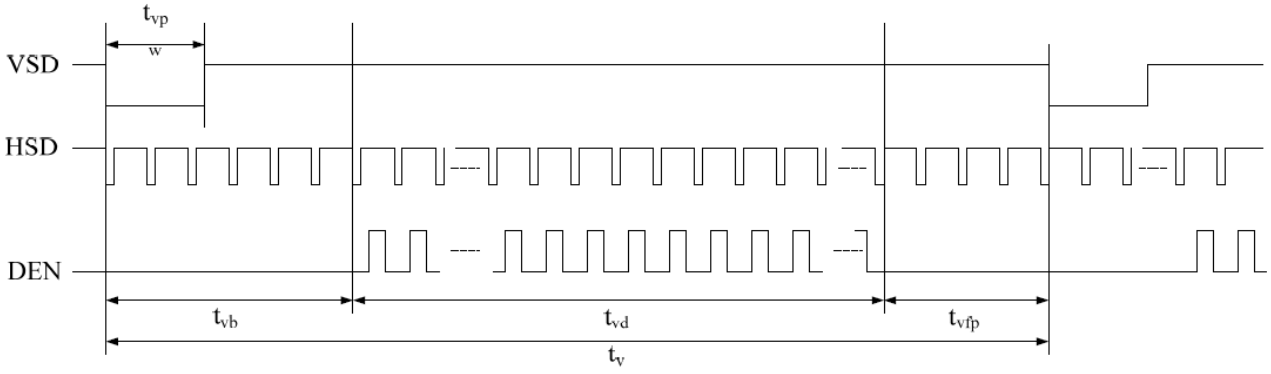
6.3 Panel Setting of Timing

Parameter	Symbol	Spec			Unit	Remark
		MIN.	TYP.	MAX.		
Horizontal Display Area	thd	-	800	-	CLKIN	
CLKIN Frequency(60HZ)	fclk	-	30	50	MHZ	
One Horizontal Line	th	889	928	1143	CLKIN	
HSD pulse width	thpw	1	48	255	CLKIN	
HSD Blanking	thb		88		CLKIN	
HSD Front Porch	thfp	1	40	255	CLKIN	
Vertical Display Area	tvd		480		TH	
VSD period time	tv	513	525	767	TH	
VSD pulse width	tvpw	3	3	255	TH	
VSD Blanking(tvb)	tvb		32		TH	
VSD Front Porch(tvfp)	tvfp	1	13	255	TH	

Horizontal Input Timing Diagram



Vertical Input Timing Diagram



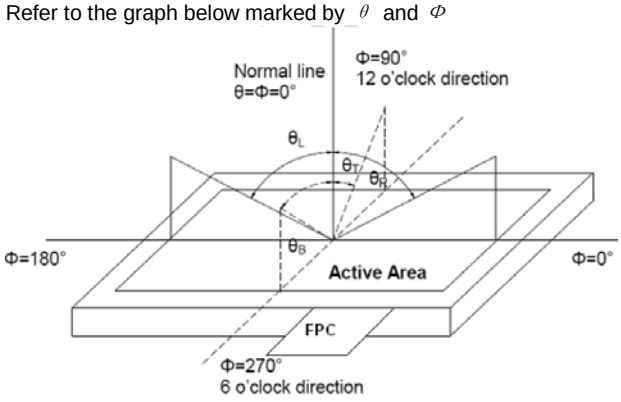
7. Optical Characteristics

Item		Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle		θ_T	(CR≥10)	40	50	-	degree	Note 2
		θ_B		60	70	-		
		θ_L		60	70	-		
		θ_R		60	70	-		
Contrast ratio		CR	θ=0°	500	600	-	-	Note 1,3
Response Time		T_{on}	25℃	-	20	30	msec	Note 1,4
		T_{off}					msec	
Chromaticlty	White	X	Backlight is on	0.260	0.310	0.360		Note 1,5
		Y		0.280	0.330	0.380		
	Red	X		0.540	0.590	0.640		
		Y		0.300	0.350	0.400		
	Green	X		0.298	0.348	0.398		
		Y		0.520	0.570	0.620		
	Blue	X		0.095	0.145	0.195		
		Y		0.060	0.110	0.160		
Luminance		L		-	(350)	-	cd/m^2	Note 1,6
NTSC				-	50		%	Note 5
Luminance uniformity		U		75	80	-	%	Note 1,7

Test Conditions:
1. IF= 40 mA, VF=23.1V, and the ambient temperature is 25. ℃
2. The test systems refer to Note 1 and Note 2.

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 SR-3A (1°)
Measuring condition:
- Measuring surroundings: Dark room
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

Note 2:
The definition of viewing angle:
Refer to the graph below marked by θ and Φ

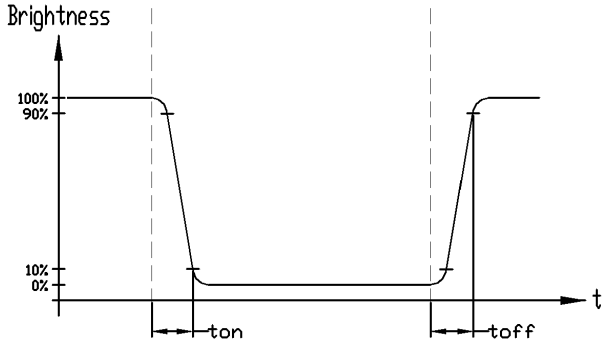


Note 3:
The definition of contrast ratio (Test LCM using SR-3A (1°)):

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

(Contrast Ratio is measured in optimum common electrode voltage)

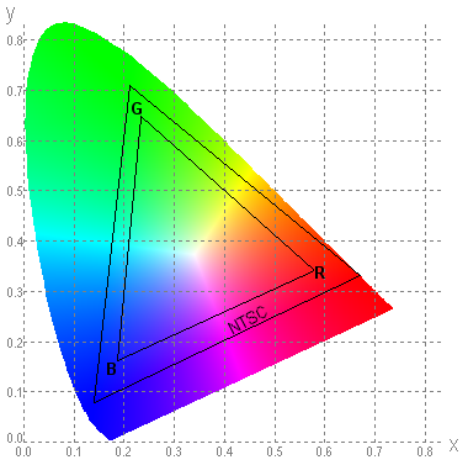
Note 4:
Definition of Response time. (Test LCD using BM-7A(2°)):
The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as below.



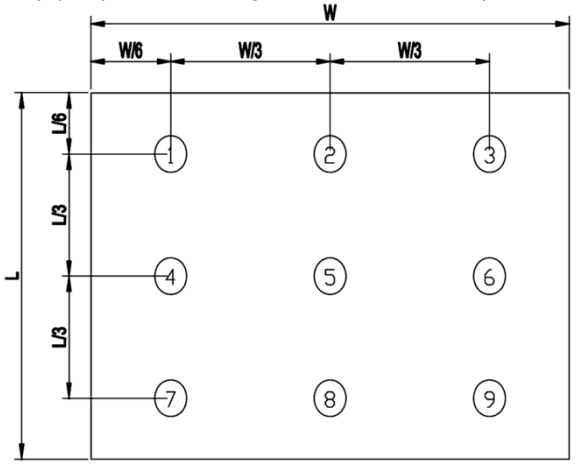
Note 5:
Definition of Color of CIE1931 Coordinate and NTSC Ratio.

Color gamut:

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



Note 6:
The luminance uniformity is calculated by using following formula.
△Bp = Bp (Min.) / Bp (Max.)×100 (%)
Bp (Max.) = Maximum brightness in 9 measured spots
Bp (Min.) = Minimum brightness in 9 measured spots.



Note 7:
Measured the luminance of white state at center point

8. Precautions of using LCD Modules

Mounting

- Mounting must use holes arranged in four corners or four sides.
- The mounting structure so provide even force on to LCD module. Uneven force (ex. Twisted stress) should not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- It is suggested to attach a transparent protective plate to the surface in order to protect the polarizer. It should have sufficient strength in order to the resist external force.
- The housing should adopt radiation structure to satisfy the temperature specification.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. Never rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer

Operating

- The spike noise causes the mis-operation of circuits. It should be within the ±200mV level (Over and under shoot voltage)
- Response time depends on the temperature.(In lower temperature, it becomes longer.)
- Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- When fixed patterns are displayed for a long time, remnant image is likely to occur.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference

Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

Storage

When storing modules as spares for a long time, the following precautions are necessary.

- Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

Protection Film

- When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt tore main on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.
- When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

Transportation

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