



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LM1076BFW-1

LCD Module User Manual

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Rev.	Descriptions	Release Date
0.1	Preliminary release	2017-03-09

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1. Basic Specifications

1.1 Display Specifications

- 1) LCD Display Mode : STN-Blue, Negative, Transmissive
- 2) Display Color : Display Data = "1" : Light Gray(*1)
: Display Data = "0" : Dark Blue (*2)
- 3) Viewing Angle : 6H
- 4) Driving Method : 1/128 duty, 1/12 bias
- 5) Backlight : White LED backlight

Note:

*1. Color tone may slightly change by Temperature and Driving Condition.

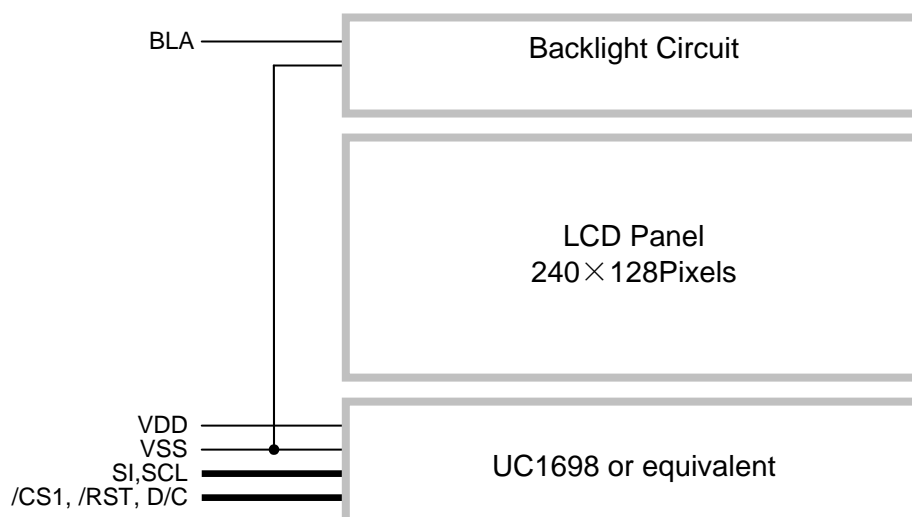
*2. The Color is defined as the inactive / background color

*3. Fine Contrast adjustment function is necessary in the application design for optimal display result

1.2 Mechanical Specifications

- 1) Outline Dimension : 84.7 x 50.7 x 9.5MAX (mm)
(See attached Outline Drawing for details)

1.3 Block Diagram



1.4 Terminal Functions

1.41 Serial Interface

Pin No.	PIN Name	I/O	Descriptions
			Display Serial 4Wire
1	VSS	Supply	Negative power supply,0V
2	VDD	Supply	Positive power supply
3	SI	I/O	Serial data input
4	SCL		Serial clock input
5	D/C	Input	Register Select D/C = H, Transferring the Display Data D/C = L, Transferring the Control Data
6	/RST	Input	Reset signal /RST = L, Initialization is executed /RST = H, Normal running.
7	/CS1	Input	Chip Select /CS0=L, enable access to the LCD module /CS0=H, disable access to the LCD module
8	BLA	Supply	Positive power for LED backlight

1.4.2 Parallel Interface

Pin No.	PIN Name	I/O	Descriptions	
			Display	
			8-bit parallel 80mode	8-bit parallel 68mode
1	VSS	Supply	Negative power supply,0V	
2	VDD	Supply	Positive power supply	
3	D7	I/O	8-bit Data bus; Three state I/O terminal for display data or instruction data when /CS0=H, D7~D0=High Impedance	
:	:			
9	D1	I/O		
10	D0			
11	/RD <E>	Input	/WR=H,/RD=L→H; Data or Status read form the LCD module	In read mode R/W=H,E=H; Data or Status read form the LCD module
12	/WR (R/W)	Input	/WR=L→H,/RD=H; Data or Status read form the LCD module	InWrite mode R/W=L,E=H→L; Data or Status read form the LCD module
13	D/C	Input	Register Select D/C = H, Transferring the Display Data D/C = L, Transferring the Control Data	
14	/RST	Input	Reset signal /RST = L, Initialization is executed /RST = H, Normal running.	
15	/CS0	Input	Chip Select /CS0=L, enable access to the LCD module /CS0=H, disable access to the LCD module	
16	BLA	Supply	Positive power for LED backlight	

1.5 Jumper Functions

Interface selection is available by the jumper on the back side of the LCD module

JP1	JP2	JP3	JP4	Interface Mode
OPEN	CLOSE	CLOSE	OPEN	6800 Mode
OPEN	CLOSE	OPEN	CLOSE	8080 Mode
CLOSE	OPEN	OPEN	CLOSE	4 Wire spi<default>

2. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V_{DD}	-0.3	+3.6	V	$V_{SS} = 0V$
Input Voltage	V_{IN}	-0.3	$V_{DD}+0.3$	V	$V_{SS} = 0V$
Operating Temperature	T_{OP}	-25	+70	°C	No Condensation
Storage Temperature	T_{ST}	-35	+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.

3. Electrical Characteristics

3.1 DC Characteristics

$V_{SS}=0V, V_{DD}=3.0V, T_{OP}=25^{\circ}C$

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition / Application Pin
Operating Voltage	V_{DD}	2.7	3.0	3.3	V	VDD
Input High Voltage	V_{IH}	$0.8 \times V_{DD}$	-	V_{DD}	V	/RST, /CS0, D/C,
Input Low Voltage	V_{IL}	V_{SS}	-	$0.2 \times V_{DD}$	V	DB7~DB0, /RD, /WR
Operating Current	I_{DD}	-	1.2	3.4	mA	VDD

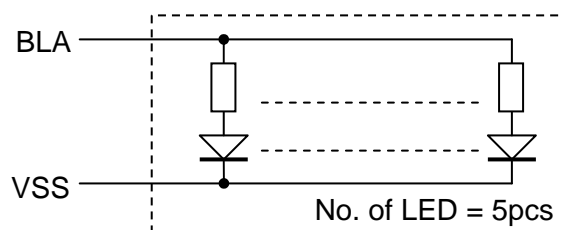
3.2 LED Backlight Circuit Characteristics

$V_{SS}=0V, I_{f_{BLA}}=85mA, T_{OP}=25^{\circ}C$

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Forward Voltage	$V_{f_{BLA}}$	-	3.3	-	V	BLA
Forward Current	$I_{f_{BLA}}$	-	85	100	mA	BLA

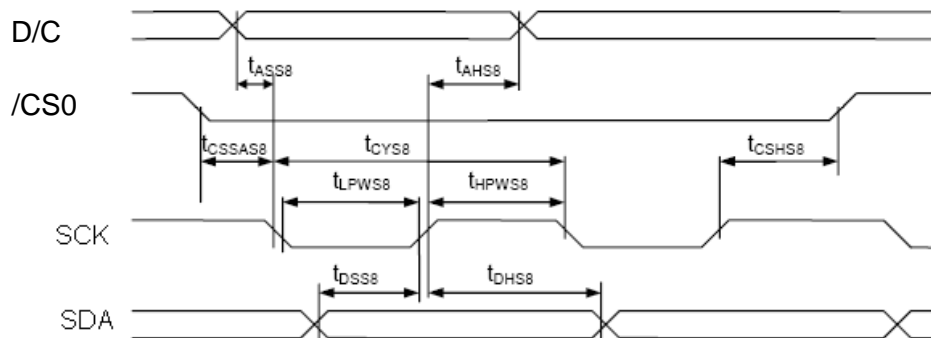
Cautions:

Exceeding the recommended driving current could cause substantial damage to the backlight and shorten its lifetime.



3.3 AC Characteristics

3.3.1 4-Write serial <default>



$V_{SS}=0V, V_{DD}=3.0V, T_{OP}=25^{\circ}C$

Item	Symbol	MIN.	TYP.	MAX.	Unit
Address setup time (D/C)	tass8	5	-	-	ns
Address hold time (D/C)	tahs8	5	-	-	ns
System cycle time (8bit)	tcys8	145	-	-	ns
SCLK low pulse width	tlpws8	107	-	-	ns
SCLK high pulse width	thpws8	65	-	-	ns
SDA data setup time	tdss8	63	-	-	ns
SDA data hold time	tdhs8	67	-	-	ns
Chip select setup time	tcssas8	7	-	-	ns
Chip select hold time	tchshs8	7	-	-	ns

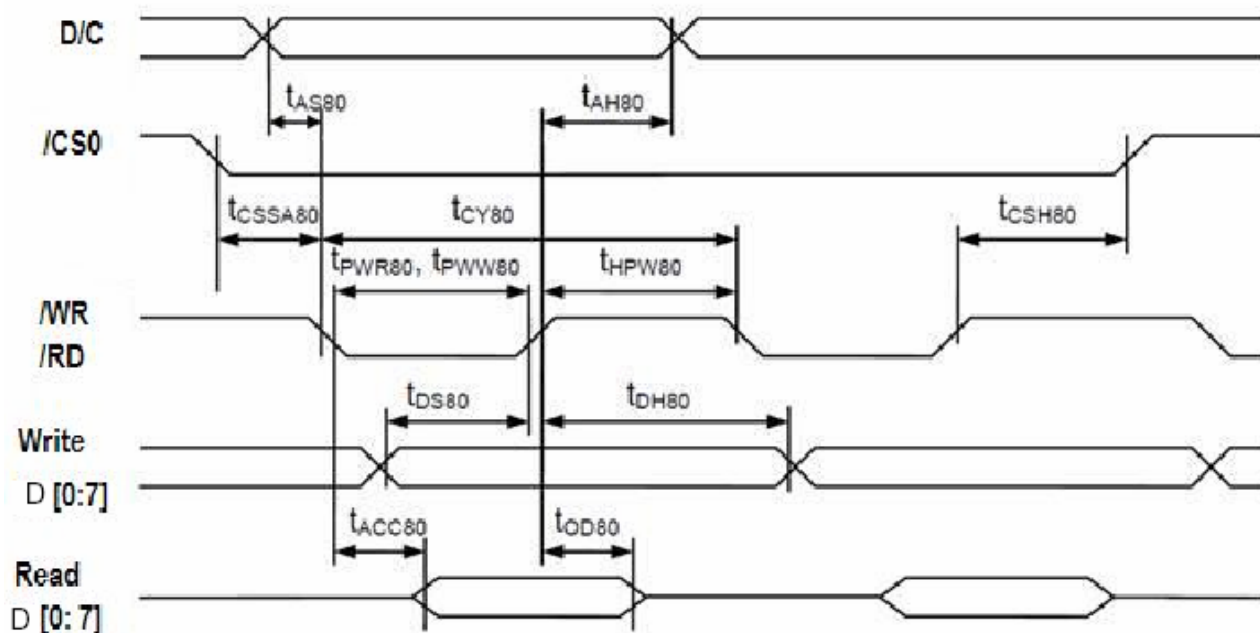
Note:

*1. Input signal rise/fall time should be less than 15ns .

*2. CL=100pF

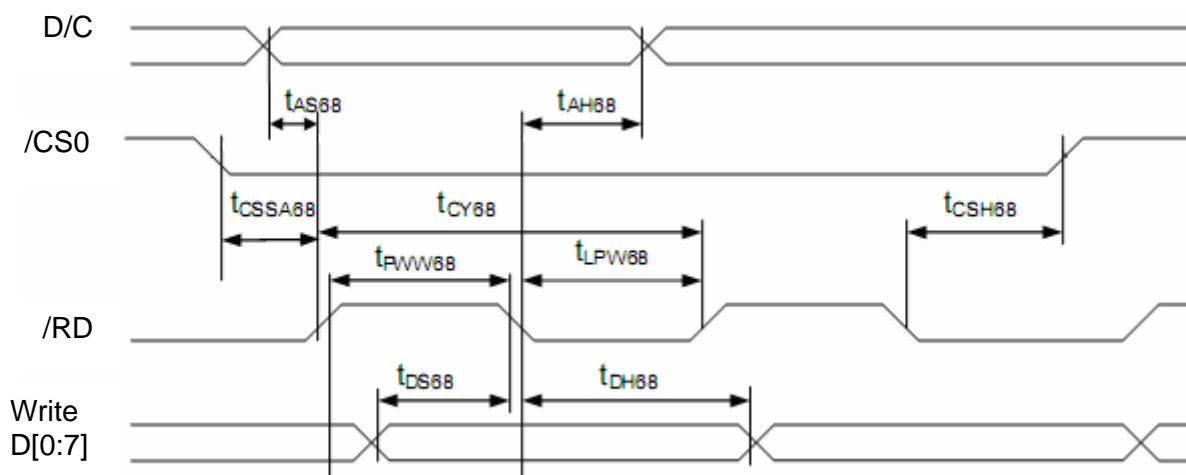
*3.All timing is using 20% and 80% of VDD as the reference.

3.3.2 8080 Mode System Bus Timing


 $V_{SS}=0V, V_{DD}=3.0V, T_{OP}=25^{\circ}C$

Item	Symbol	MIN.	TYP.	MAX.	Unit
Address setup time (D/C)	tas80	5	-	-	ns
Address hold time (D/C)	tah80	5	-	-	ns
System cycle time (8bit)	tcy80	145	-	-	ns
Read pulse width	tpwr80	107	-	-	ns
Write pulse width	tpww80	65	-	-	ns
High pulse width (read)	thpw80	63	-	-	ns
High pulse width (write)	thpw80	67	-	-	ns
Data setup time	tds80	38	-	-	ns
Data hold time	tdh80	5	-	-	ns
Data access time	tacc80	-	-	75	ns
Data output disable time	tod80	15	-	38	ns
Chip select setup time	tcssa80	7	-	-	ns
Chip select hold time	tcsh80	7	-	-	ns

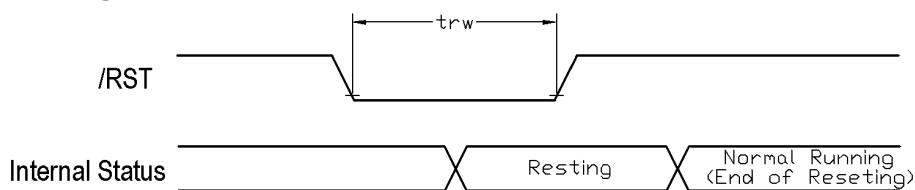
3.3.3 6800 Mode System Bus Timing



$V_{SS}=0V, V_{DD}=3.0V, T_{OP}=25^{\circ}C$

Item	Symbol	MIN.	TYP.	MAX.	Unit
Address setup time (D/C)	tAS68	5	-	-	ns
Address hold time (D/C)	tAH68	5	-	-	ns
System cycle time (8bit)	tCY68	145	-	-	ns
Pulse width	tPWW68	107	-	-	ns
Low pulse width	tLPW68	65	-	-	ns
Data setup time	tDS68	38	-	-	ns
Data hold time	tDH68	5	-	-	ns
Chip select setup time	tCSSA68	7	-	-	ns
	tCSH68	5	-	-	ns

3.3.4 Reset Timing



$V_{SS}=0V, V_{DD}=3.0V, T_{OP}=25^{\circ}C$

Item	Symbol	MIN.	TYP.	MAX.	Unit
Reset LOW pulse width	trw	4	-	-	ms
Internal Resetting time	trd	13	-	-	

Note:

*1.All timing is using 20% and 80% of VDD as the reference.

4. Function specifications

4.1 Adjusting the Display Contrast

This LCD module equipped with latest digital contrast adjustment function.

Its display contrast could be adjusted by MCU command.

(please see the command tables for details)

It is recommended to provide a contrast adjustment interface for end-user, where the best display result could meet the individual preference in mass production.

4.2 Resetting the LCD module

The LCD module should be initialized by using /RST terminal.

While turning on the VDD and VSS power supply, maintain /RST terminal at LOW level. After the power supply stabilized, release the reset terminal (/RST=HIGH)

4.2.1 Display Memory Map

ROW no.	LCD Display (front view)									
1 st										
2 nd										
3 rd										
:										
126 th										
127 th										
128 th										
Column Address						00h	01h	→	4fh	50h

Note:

*1. This mono LCM is driven by a color LCD driver.

Every three dots are being driven by R G B segment driver.

*2. The above is based on:

- 4R4G4B setting, each dot will be driven by 4bit; LC[7:6]=0:1, DC[4]=1
- Mirror Y direction; LC[2]=0
- Normal X direction; LC[1]=1
- Color Mapping as BGR; LC[5]=0

*3. For details please refer to UC1698 datasheet

4.3 Display Commands

The LCD module contains register, which control the operation. These register can be modified by commands.

The following table is a summary of the control registers, their meaning and their default value.

4.3.1 Command Table

The following is the list of host command supported.

	Command	D/C	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default	
1	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A	
2	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A	
3	Get Status & PM	0	1	GE	MX	MY	WA	DE	WS	MD	MS	Get {Status, Ver, PMO, Product Code, PID, MID}	N/A	
				Ver	PMO[6:0]						Product Code (8h)			PID[1:0]
4	Set Column Address LSB	0	0	0	0	0	0	#	#	#	#	Set CA[3:0]	0	
	Set Column Address MSB	0	0	0	0	0	1	0	#	#	#	Set CA[6:4]	0	
5	Set Temp. Compensation	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	0	
6	Set Power Control	0	0	0	0	1	0	1	0	#	#	Set PC[1:0]	10b	
7	Set Adv. Program Control (double-byte command)	0	0	0	0	1	1	0	0	0	R	Set APC[R][7:0], R = 0 or 1	N/A	
		0	0	#	#	#	#	#	#	#	#			
8	Set Scroll Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]	0	
	Set Scroll Line MSB	0	0	0	1	0	1	#	#	#	#	Set SL[7:4]	0	
9	Set Row Address LSB	0	0	0	1	1	0	#	#	#	#	Set RA[3:0]	0	
		0	0	0	1	1	1	#	#	#	#			
10	Set V _{BIAS} Potentiometer (double-byte command)	0	0	1	0	0	0	0	0	0	1	Set PM[7:0]	40H	
		0	0	#	#	#	#	#	#	#	#			
11	Set Partial Display Control	0	0	1	0	0	0	0	1	0	#	Set LC[8]	0	
12	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b	
13	Set Fixed Lines	0	0	1	0	0	1	0	0	0	0	Set {FLT, FLB}	0	
		0	0	#	#	#	#	#	#	#	#			
14	Set Line Rate	0	0	1	0	1	0	0	0	#	#	Set LC[4:3]	10b	
15	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0	
16	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0	
17	Set Display Enable	0	0	1	0	1	0	1	#	#	#	Set DC[4:2]	110b	
18	Set LCD Mapping Control	0	0	1	1	0	0	0	#	#	#	Set LC[2:0]	0	
19	Set N-Line Inversion	0	0	-	-	-	#	#	#	#	#	Set NIV[4:0]	1DH	
20	Set Color Pattern	0	0	1	1	0	1	0	0	0	#	Set LC[5]	0 (BGR)	
21	Set Color Mode	0	0	1	1	0	1	0	1	#	#	Set LC[7:6]	10b	
22	Set COM Scan Function	0	0	1	1	0	1	1	#	#	#	Set CSF[2:0]	000b	
23	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A	
24	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A	
25	Set Test Control (double-byte command)	0	0	1	1	1	0	0	1	TT		For testing only. Do not use.	N/A	
		0	0	#	#	#	#	#	#	#	#			
26	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	11b: 12	
27	Set COM End	0	0	1	1	1	1	0	0	0	1	Set CEN[6:0]	159	
		0	0	-	#	#	#	#	#	#	#			
28	Set Partial Display Start	0	0	1	1	1	1	0	0	1	0	Set DST[6:0]	0	
		0	0	-	#	#	#	#	#	#	#			
29	Set Partial Display End	0	0	1	1	1	1	0	0	1	1	Set DEN[6:0]	159	
		0	0	-	#	#	#	#	#	#	#			
30	Set Window Program Starting Column Address	0	0	1	1	1	1	0	1	0	0	Shared with MTP commands	Set WPC0	0
		0	0	-	#	#	#	#	#	#	#		Set WPP0	0
31	Set Window Program Starting Row Address	0	0	1	1	1	1	0	1	0	1	Shared with MTP commands	Set WPC1	127
		0	0	#	#	#	#	#	#	#	#		Set WPP1	159
32	Set Window Program Ending Column Address	0	0	1	1	1	1	0	1	1	0	Shared with MTP commands	Set WPC1	127
		0	0	-	#	#	#	#	#	#	#		Set WPP1	159
33	Set Window Program Ending Row Address	0	0	1	1	1	1	0	1	1	1	Shared with MTP commands	Set WPC1	127
		0	0	#	#	#	#	#	#	#	#		Set WPP1	159
34	Window Program Mode	0	0	1	1	1	1	1	0	0	#	Set AC[3]	0: Inside	
35	Set MTP Operation control	0	0	1	0	1	1	1	0	0	0	Set MTPC[4:0]	10H	
36	Set MTP Write Mask	0	0	1	0	1	1	1	0	0	1	Set MTPM[6:0] MTPM1[1:0]	0	
		0	0	-	#	#	#	#	#	#	#			
37	Set V _{MTP1} Potentiometer	0	0	1	1	1	1	0	1	0	0	Shared with Window Program commands	Set MTP1	N/A
		0	0	#	#	#	#	#	#	#	#		Set MTP2	N/A
38	Set V _{MTP2} Potentiometer	0	0	1	1	1	1	0	1	0	1	Shared with Window Program commands	Set MTP2	N/A
		0	0	#	#	#	#	#	#	#	#		Set MTP3	N/A
39	Set MTP Write Timer	0	0	1	1	1	1	0	1	1	0	Shared with Window Program commands	Set MTP3	N/A
		0	0	#	#	#	#	#	#	#	#		Set MTP4	N/A
40	Set MTP Read Timer	0	0	1	1	1	1	0	1	1	1	Shared with Window Program commands	Set MTP4	N/A
		0	0	#	#	#	#	#	#	#	#			

Note:

Please refer to UC1698 data sheet for details

5. Design and Handling Precaution

1. The LCD panel is made by glass. Any mechanical shock (eg. dropping from high place) will damage the LCD module.
2. Do not add excessive force on the surface of the display, which may cause the Display color change abnormally.
3. The polarizer on the LCD is easily get scratched. If possible, do not remove the LCD protective film until the last step of installation.
4. Never attempt to disassemble or rework the LCD module.
5. Only Clean the LCD with Isopropyl Alcohol or Ethyl Alcohol. Other solvents (eg. water) may damage the LCD.
6. When mounting the LCD module, make sure that it is free from twisting, warping and distortion.
7. Ensure to provide enough space (with cushion) between case and LCD panel to prevent external force adding on it, or it may cause damage to the LCD or degrade the display result.
8. Only hold the LCD module by its side. Never hold LCD module by add force on the heat seal or TAB.
9. Never add force to component of the LCD module. It may cause invisible damage or degrade of the reliability.
10. LCD module could be easily damaged by static electricity. Be careful to maintain an optimum anti-static work environment to protect the LCD module.
11. When peeling off the protective film from LCD, static charge may cause abnormal display pattern. It is normal and will resume to normal in a short while.
12. Take care and prevent get hurt by the LCD panel sharp edge.
13. Never operate the LCD module exceed the absolute maximum ratings.
14. Keep the signal line as short as possible to prevent noisy signal applying to LCD module.
15. Never apply signal to the LCD module without power supply.
16. IC chip (eg. TAB or COG) is sensitive to the light. Strong lighting environment could possibly cause malfunction. Light sealing structure casing is recommend.
17. LCD module reliability may be reduced by temperature shock.
18. When storing the LCD module, avoid exposure to the direct sunlight, high humidity, high temperature or low temperature. They may damage or degrade the LCD module