



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

# LM6063HFW

## LCD Module User Manual

Prepared by:  Caiwei  Date:2023-03-28	Checked by:    Date:	Approved by:    Date:
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Rev.	Descriptions	Release Date
0.1	Preliminary release	2009-10-29
0.2	Add Terminal Definition and Interface setting	2010-06-04
0.3	Updated 1.3 Block Diagram、 1.4 Terminal Functions、 2.Supply Voltage、 3.1 DC Characteristics、 3.3 AC Characteristics、 4.1 Basic Setting、 4.2 The Serial Interface、 4.4 Display Memory Map and 4.5 Display Commands, add Outline Dwg	2023-03-28

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# 1. Basic Specifications

## 1.1 Display Specifications

- 1) LCD Display Mode : STN, Negative, Transmissive
- 2) Display Color : Display Data = "0" : Dark Blue(\*1)  
: Display Data = "1" : Light Gray (\*2)
- 3) Viewing Angle : 6H
- 4) Driving Method : 1/65 duty, 1/9 bias
- 5) Backlight : White LED backlight

Note:

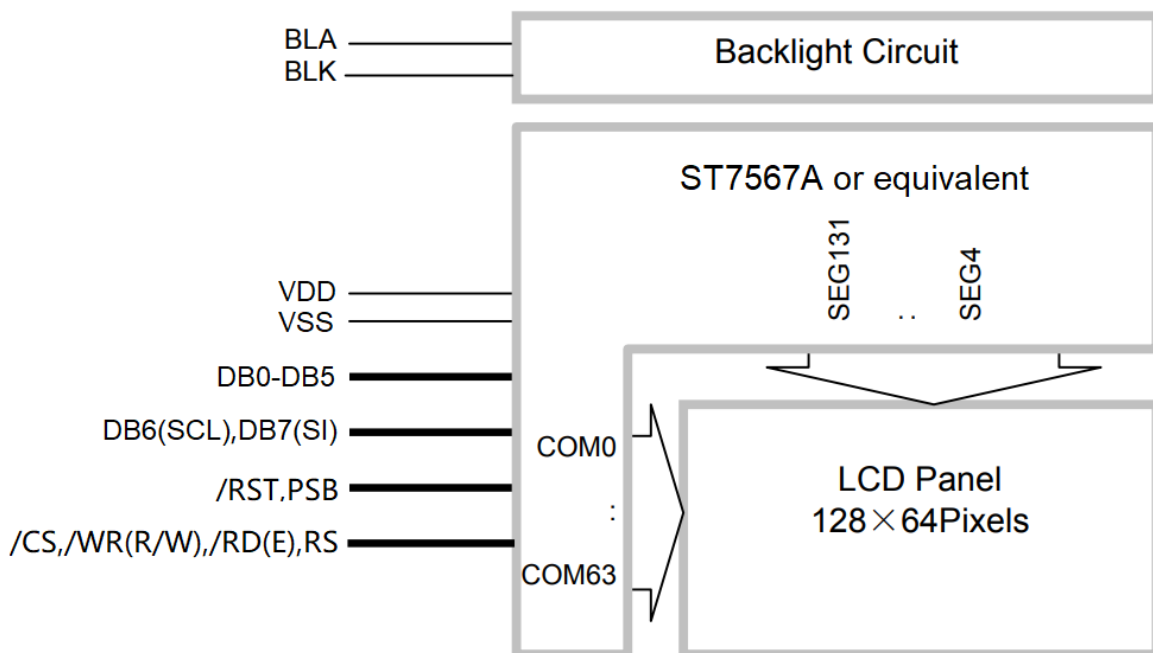
\*1. Color tone may slightly change by Temperature and Driving Condition.

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

## 1.2 Mechanical Specifications

- 1) Outline Dimension : 93.0 x 70.0 x 10.1MAX (mm)  
(See attached Outline Drawing for details)

## 1.3 Block Diagram



**1.4 Terminal Functions**

K3 Pin No.	K1 Pin No.	PIN Name	I/O	Descriptions(PSB=H)		Descriptions(PSB=L)
				8080 mode	6800 mode	SPI mode(default)
1	1	VSS	Power	Negative power supply,0V		
10	2	VDD	Power	Positive power supply		
3	3	NC	/	/		
6	4	RS	Input	Register Select RS = H, Transferring the Display Data RS = L, Transferring the Control Data		
/	5	/WR(R/W)	Input	/WR=L→H, /RD=H; Data or Instruction latch into the LCD module	R/W=H,E=H; Data or Status read from the LCD module	Not used, connect to VDD
/	6	/RD(E)	Input	/WR=H, /RD=L; Data or Status read form the LCD module	R/W=L,E=H→L; Data or Status latch into the LCD module	
/	7	DB0	I/O	8-bit Data bus; Three state I/O terminal for display data or instruction data when /CS=H, DB0~DB7=High Impedance		DB0-DB5 connect to VDD or VSS
/	:	:	:			
/	12	DB5	I/O			
2	13	DB6(SCL)	I/O			Serial clock input
5	14	DB7(SI)	I/O			Serial data input
/	15	PSB	Input	Parallel or SPI setting PSB=H, Parallel(8080 or 6800) mode PSB=L, SPI mode(Default)		
7	16	/CS	Input	Chip Select /CS=L, enable access to the LCD module /CS=H, disable access to the LCD module		
8	17	/RST	Input	Reset signal /RST = L, Initialization is executed /RST = H, Normal running.		
9	18	NC	/	/		
4	19	BLA	Power	Positive power for LED backlight		
/	20	BLK	Power	Negative power for LED backlight		

**Interface setting:**

Mode	install	No install
SPI mode(default)*	R3,R4	R2,R5
8080 mode	R2,R5	R3,R4
6800 mode	R3,R5	R2,R4

Note:

\*1 The installation parameter is 0R 0603 5% resistors.

\*2 SPI Interface Setting on K1 Terminal: PSB=L, use SPI Interface.

\*3 If want to use 8080/6800 mode of K1 Terminal, The following hardware must be changed.

Mode	install	No install
8080/6800 mode	R18,R21,R22,R23,R26,R29	R19,R20,R27,R28,R30,R31

## 2. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	$V_{DD}$	-0.3	+4.0	V	$V_{SS} = 0V$
Input Voltage	$V_{IN}$	-0.3	$V_{DD}+0.3$	V	$V_{SS} = 0V$
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.

## 3. Electrical Characteristics

### 3.1 DC Characteristics

$V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25^{\circ}C$

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition / Application Pin
Operating Voltage	$V_{DD}$	2.9	3.3	3.6	V	VDD
Input High Voltage	$V_{IH}$	$0.7 \times V_{DD}$	-	$V_{DD}$	V	/RST, /CS, RS, SI,
Input Low Voltage	$V_{IL}$	$V_{SS}$	-	$0.3 \times V_{DD}$	V	SCL
Operating Current	$I_{DD}$	-	0.36	1.25	mA	VDD

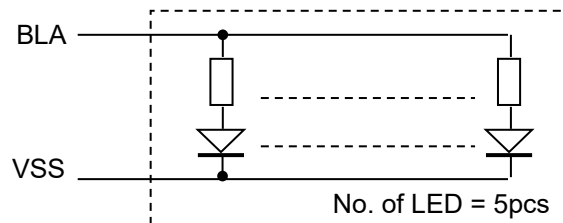
### 3.2 LED Backlight Circuit Characteristics

$V_{SS}=0V, I_{f_{BLA}}=55mA, T_{OP}=25^{\circ}C$

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Forward Voltage	$V_{f_{BLA}}$	-	3.3	-	V	BLA
Forward Current	$I_{f_{BLA}}$	-	55	100	mA	BLA

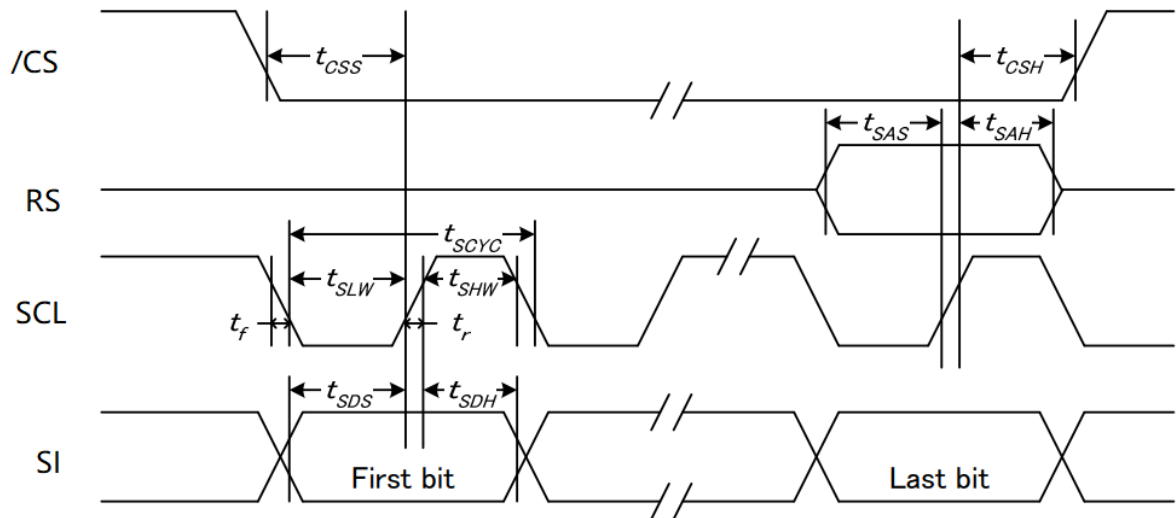
Cautions:

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



**3.3 AC Characteristics**

**3.3.1 SPI Mode System Bus Timing**



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

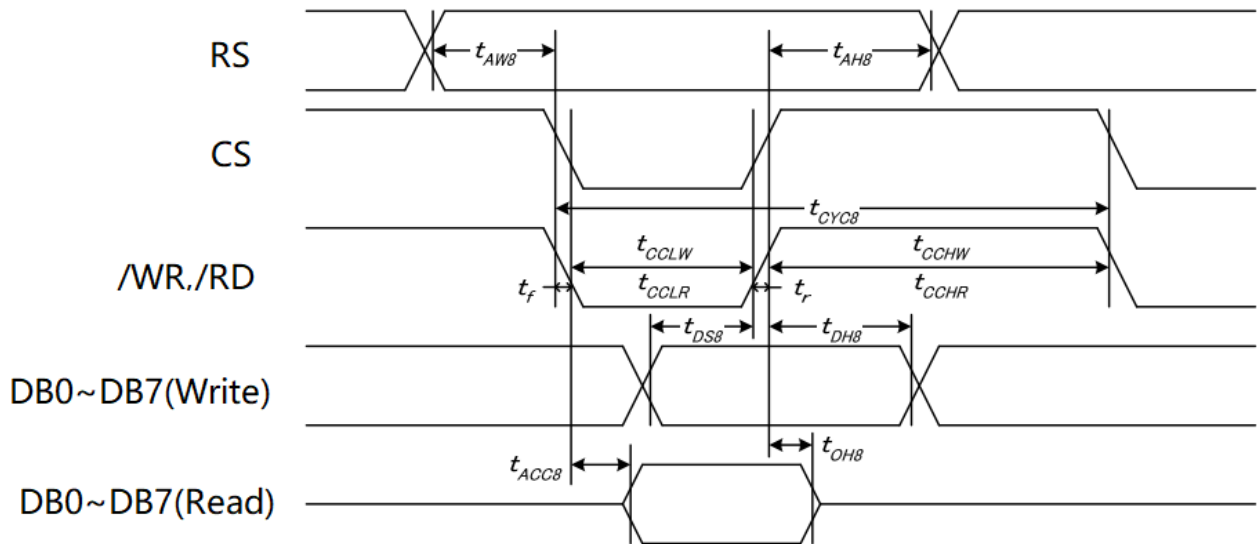
Item	Symbol	MIN.	TYP.	MAX.	Unit
Serial clock cycle time(SCL)	$t_{SCYC}$	50	-	-	ns
SCL HIGH pulse width(SCL)	$t_{SHW}$	25	-	-	ns
SCL LOW pulse width(SCL)	$t_{SLW}$	25	-	-	ns
Address setup time (RS)	$t_{SAS}$	20	-	-	ns
Address hold time (RS)	$t_{SAH}$	10	-	-	ns
Data setup time(SDA)	$t_{SDS}$	20	-	-	ns
Data hold time(SDA)	$t_{SDH}$	10	-	-	ns
/CS-SI time(/CS)	$t_{CSS}$	20	-	-	ns
/CS-SI time(/CS)	$t_{CSH}$	40	-	-	ns

Note:

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

\*2.All timing is using 20% and 80% of VDD as the reference.

3.3.2 8080 Mode System Bus Timing



$V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25^{\circ}C$

Item	Symbol	MIN.	TYP.	MAX.	Unit
System cycle time	$t_{CYC8}$	240	-	-	ns
Address setup time (RS)	$t_{AW8}$	0	-	-	ns
Address hold time (RS)	$t_{AH8}$	10	-	-	ns
Control LOW pulse width (/WR)	$t_{CCLW}$	80	-	-	ns
Control LOW pulse width (/RD)	$t_{CCLR}$	140	-	-	ns
Control HIGH pulse width (/WR)	$t_{CCHW}$	80	-	-	ns
Control HIGH pulse width (/RD)	$t_{CCHR}$	80	-	-	ns
Data setup time	$t_{DS8}$	40	-	-	ns
Data hold time	$t_{DH8}$	20	-	-	ns
/RD access time (*2)	$t_{ACC8}$	-	-	70	ns
Output disable time (*2)	$t_{OH8}$	5	-	50	ns

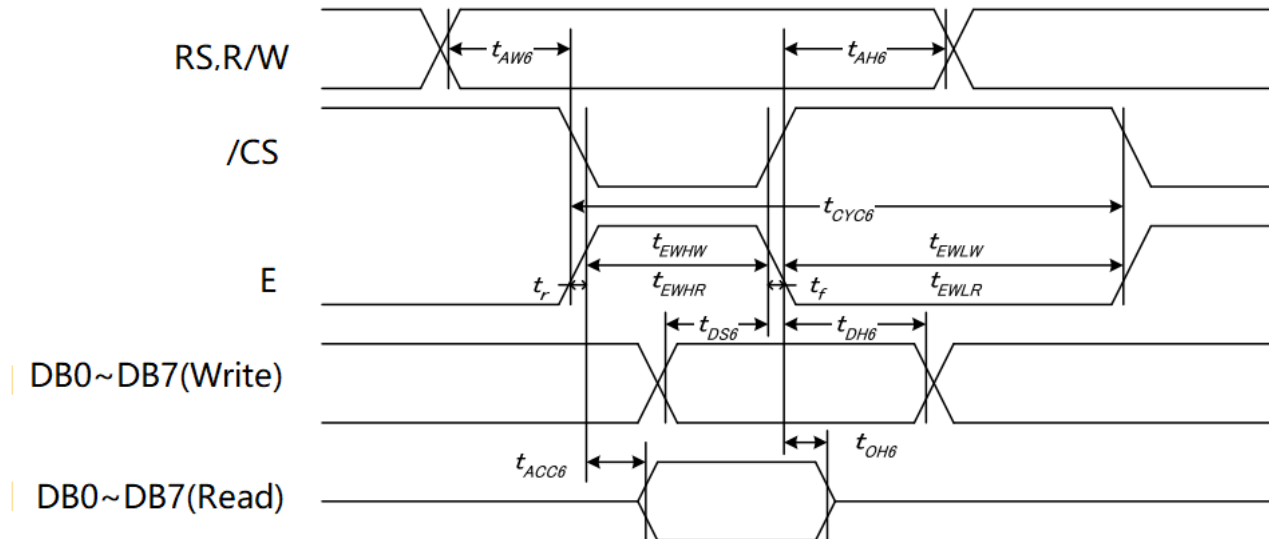
Note:

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

\*2. CL=16pF

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

3.3.3 6800 Mode System Bus Timing



V<sub>SS</sub>=0V, V<sub>DD</sub>=3.3V, T<sub>OP</sub>=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
System cycle time	t <sub>CYC6</sub>	240	-	-	ns
Address setup time (RS)	t <sub>AW6</sub>	0	-	-	ns
Address hold time (RS)	t <sub>AH6</sub>	10	-	-	ns
Control LOW pulse width (E)	t <sub>EWLR</sub>	80	-	-	ns
Control LOW pulse width (R/W)	t <sub>EWLW</sub>	80	-	-	ns
Control HIGH pulse width (E)	t <sub>EWHR</sub>	140	-	-	ns
Control HIGH pulse width (R/W)	t <sub>EWHW</sub>	80	-	-	ns
Data setup time	t <sub>DS6</sub>	40	-	-	ns
Data hold time	t <sub>DH6</sub>	10	-	-	ns
/RD access time (*2)	t <sub>ACC6</sub>	-	-	70	ns
Output disable time (*2)	t <sub>OH6</sub>	5	-	50	ns

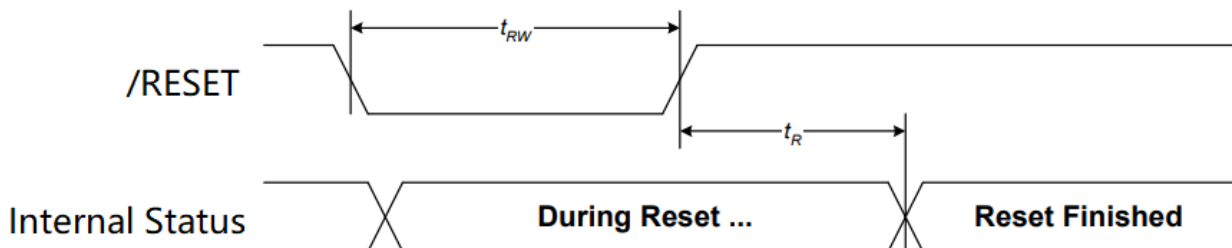
Note:

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

\*2. CL=16pF

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

3.3.4 Reset Timing



V<sub>SS</sub>=0V, V<sub>DD</sub>=3.0V, T<sub>OP</sub>=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Reset time	t <sub>R</sub>	10	-	-	ms
Reset LOW pulse width	t <sub>RW</sub>	3	-	-	μs

Note:

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



## 4. Function specifications

### 4.1 Basic Setting

To drive the LCD module correctly and provide normally display, please use the following setting

- MX = 1 (reverse)
- MY = 0 (normal)
- LCD Bias Select = 1/9
- Initial Display Line = 0
- Entire Display ON/OFF = OFF (normal)
- Reverse Display ON/OFF = OFF (normal)
- Set Power Control Set:  
voltage follower = ON, voltage converter = ON, voltage regulator = ON
- Display ON/OFF = ON

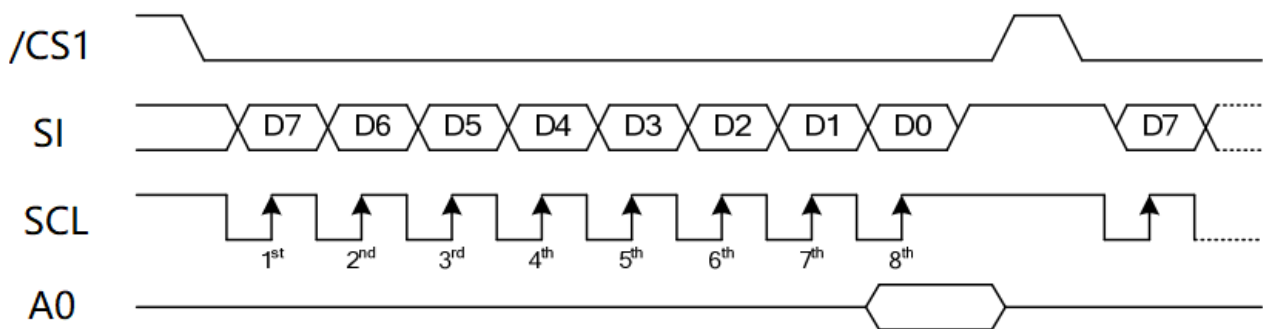
Note:

\*1. These setting/commands should issue the LCD module while start up.

\*2. See the Display Commands section for details.

### 4.2 The Serial Interface

When the serial interface has been selected then when the chip is in active state the serial data input(SI) and the serial clock(SCL) can be received. The serial data is read from the serial data input pin in the rising edge of the serial clock . When "A0"="H", the data is display data, and when "A0"="L", the data is command.



### 4.3 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).

**4.4 Display Memory Map**

Page address	data	LCD Display (front view)		
0	D0 : D7			
1	D0 : D7			
2	D0 : D7			
3	D0 : D7			
4	D0 : D7			
5	D0 : D7			
6	D0 : D7			
7	D0 : D7			
Column Address		00h	→	7Fh

Note:

- \*1. MX = 1 (reverse)
- \*2. MY = 0 (normal)
- \*3. Initial Display Line = 0

**4.5 Display Commands**

INSTRUCTION	A0	/RD	/WR	COMMAND BYTE								DESCRIPTION
				D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	D	D=1, display ON D=0, display OFF
(2) Set Start Line	0	1	0	0	1	S5	S4	S3	S2	S1	S0	Set display start line
(3) Set Page Address	0	1	0	1	0	1	1	Y3	Y2	Y1	Y0	Set page address
(4) Set Column Address	0	1	0	0	0	0	1	X7	X6	X5	X4	Set column address (MSB)
	0	1	0	0	0	0	0	X3	X2	X1	X0	Set column address (LSB)
(5) Read Status	0	0	1	0	MX	D	RST	0	0	0	0	Read IC Status
(6) Write Data	1	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
(7) Read Data	1	0	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
(8) SEG Direction	0	1	0	1	0	1	0	0	0	0	MX	Set scan direction of SEG MX=1, reverse direction MX=0, normal direction
(9) Inverse Display	0	1	0	1	0	1	0	0	1	1	INV	INV =1, inverse display INV =0, normal display
(10) All Pixel ON	0	1	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
(11) Bias Select	0	1	0	1	0	1	0	0	0	1	BS	Select bias setting 0=1/9; 1=1/7 (at 1/65 duty)
(12) Read-modify-Write	0	1	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
(13) END	0	1	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode
(14) RESET	0	1	0	1	1	1	0	0	0	1	0	Software reset
(15) COM Direction	0	1	0	1	1	0	0	MY	-	-	-	Set output direction of COM MY=1, reverse direction MY=0, normal direction
(16) Power Control	0	1	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
(17) Regulation Ratio	0	1	0	0	0	1	0	0	RP1	RP1	RP0	Select regulation resistor ratio
(18) Set EV	0	1	0	1	0	0	0	0	0	0	1	Double command!! Set electronic volume (EV) level
	0	1	0	0	0	EV5	EV4	EV3	EV2	EV1	EV0	
(19) Set Booster	0	1	0	1	1	1	1	1	0	0	0	Double command!! Set booster level:
	0	1	0	0	0	0	0	0	0	0	BL	BL=0: 4X BL=1: 5X
(20) Power Save	0	1	0	Compound Command								Display OFF + All Pixel ON
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	No operation
(22) Set N-Line	0	1	0	1	0	0	0	0	1	0	1	Set N-Line inversion
	0	1	0	0	0	0	NL4	NL3	NL2	NL1	NL0	
(23) Release N-Line	0	1	0	1	0	0	0	0	1	0	0	Exit N-Line inversion
(24) SPI Read Status	0	0	1	1	1	1	1	1	1	0	0	SPI read status command
	0	0	1	0	MX	D	RST	ID3	ID2	ID1	ID0	
(25) SPI Read DDRAM	0	0	1	1	1	1	1	1	1	0	1	SPI read DDRAM command
	1	0	1	D7	D6	D5	D4	D3	D2	D1	D0	

Note: \*1. Do not use any other command not listed, or the system malfunction may result.  
\*2. For the details of the Display Commands, please refer to ST7567A data sheet.

**4.5.1 Power off the LCD Module**

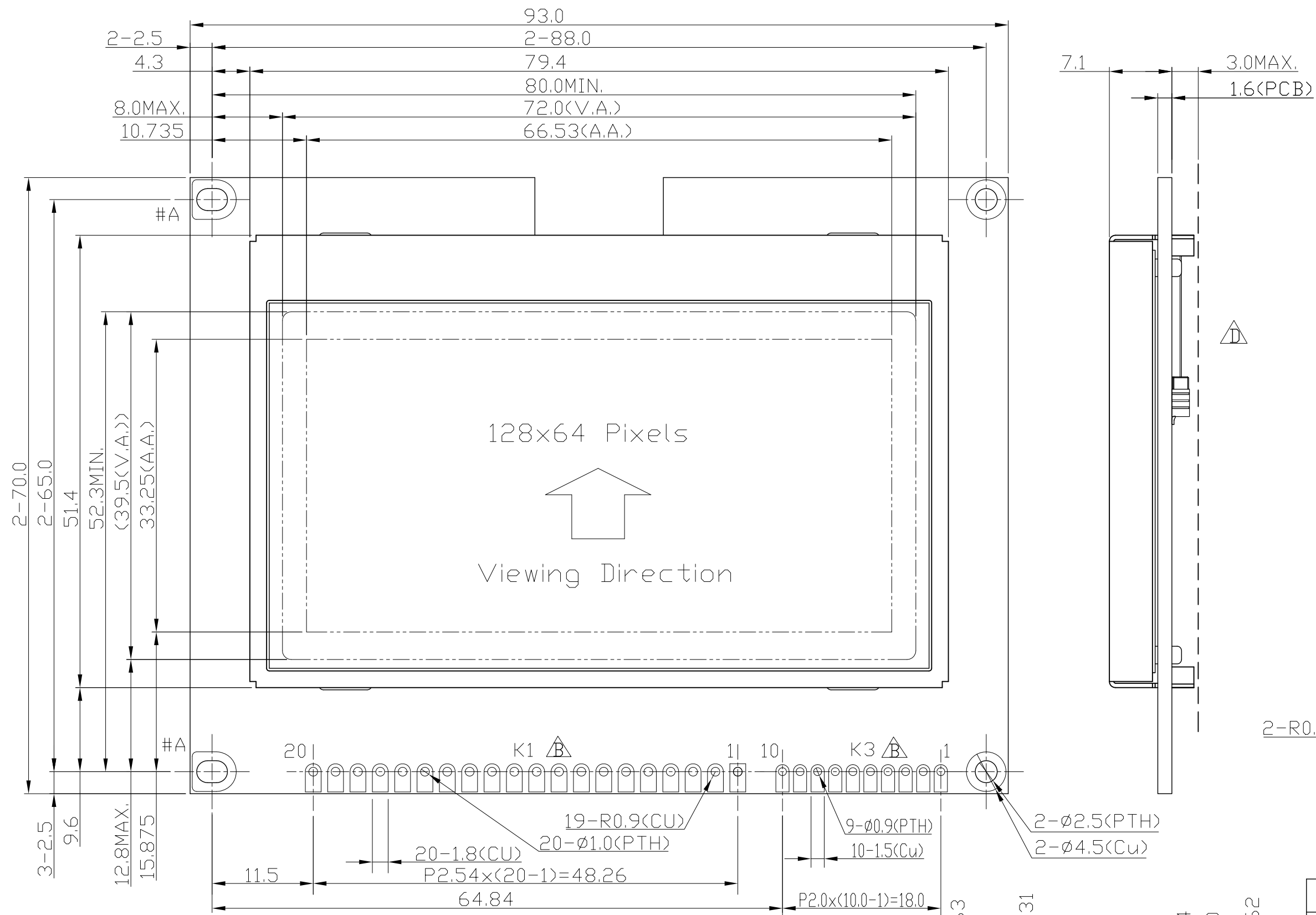
It recommends that enter Sleep Mode before power off the LCD module.

**4.5.2 Refreshing The LCD Module**

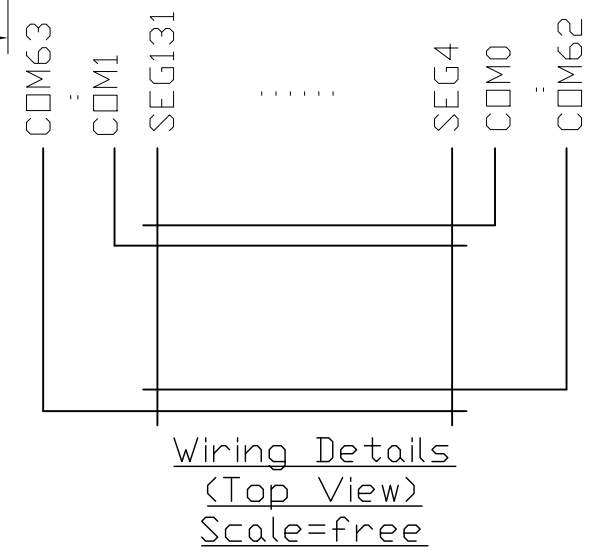
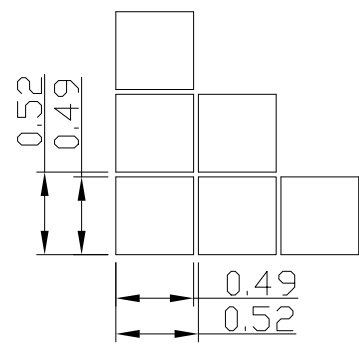
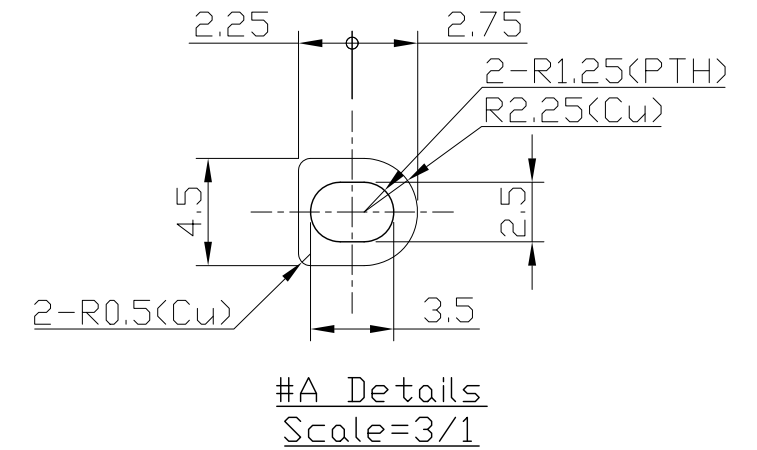
It recommends that the operating modes and display contents be refreshed periodically to prevent the effect of unexpected noise.

## 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.



K1 Terminal		K3 Terminal	
No.	Pin Name	No.	Pin Name
1	VSS	1	GND
2	VDD	2	SCL
3	NC	3	NC
4	RS	4	BLA
5	/WR(R/W)	5	SI
6	/RD(E)	6	RS $\triangle$
7	DB0	7	/CS $\triangle$
8	DB1	8	RESET
9	DB2	9	NC
10	DB3	10	VDD
11	DB4		
12	DB5		
13	DB6(SCL)		
14	DB7(SI)		
15	PSB		
16	/CS		
17	/RST		
18	NC		
19	BLA		
20	BLK		



- Note:
- \*1. Display Type : STN, Negative, Transmissive
  - \*2. Viewing Direction : 6H
  - \*3. Duty : 1/65, Bias : 1/9
  - \*4. Operating Voltage : 3.3V
  - \*5. Backlight Color : White
  - \*6. Backlight Supply : 3.3V TYP.
  - \*7. Operating Temperature : -20°C~70°C  $\triangle$
  - \*8. Storage Temperature : -30°C~80°C  $\triangle$
  - \*9. Default Interface : Serial (K1 or K3)  $\triangle$

D	Typing Correction	Luo Lin	2023-02-15
C	Typing Correction	Zhou	2013-10-09
B	Typing Correction	Zhou Hui Fang	2010-01-19
A	Add K1 Terminal Definition	Zhou Hui Fang	2009-11-19
Rev	Note	Date	
Dwg Title LM6063HFW Outline Dwg			
Dwg No.	MK-003110d-1-1	Date	2009-10-20
Scale	2/1	Tol.	±0.5
Unit	mm	Paper Size	A3
Approved	Checked	Drawn	Zhou Hui Fang

**TOPWAY**