



**深圳市拓普微科技开发有限公司**

**SHENZHEN TOPWAY TECHNOLOGY CO.,LTD.**

# LM6082CFW

## LCD Module User Manual

|                 |             |              |
|-----------------|-------------|--------------|
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## 1. Basic Specifications

### 1.1 Display Specifications

- 1) LCD Display Mode : STN-Blue, 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.

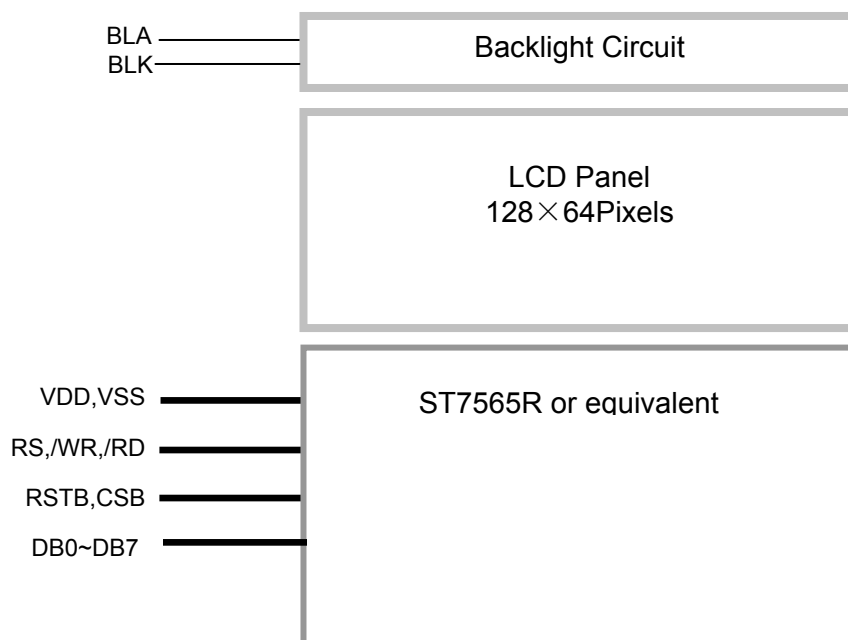
\*2. The Color is defined as the inactive / background color

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

### 1.2 Mechanical Specifications

- 1) Outline Dimension : 78.0 x 70.0 x 11.6mm (Max)  
(See attached Outline Drawing for details)

### 1.3 Block Diagram



## 1.4 Terminal Functions

| PIN NO | PIN Name  | I/O    | Descriptions                                                                                                              |                                                                                                                   |                                    |
|--------|-----------|--------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------|
|        |           |        | 8-bit parallel 8080 mode (Default)                                                                                        | 8-bit parallel 6800 mode                                                                                          | 4-wire Serial mode                 |
| 1      | NC        |        | No connection(leave open)                                                                                                 |                                                                                                                   |                                    |
| 2      | CSB       | Input  | Chip Select<br>CSB=L, enable access to the LCD module<br>CSB=H, disable access to the LCD module                          |                                                                                                                   |                                    |
| 3      | VSS       | Supply | Negative power supply,0V                                                                                                  |                                                                                                                   |                                    |
| 4      | VDD       | Supply | Positive power supply                                                                                                     |                                                                                                                   |                                    |
| 5      | NC        |        | No connection(leave open)                                                                                                 |                                                                                                                   |                                    |
| 6      | RS        | Input  | Register Select<br>RS = H, Transferring the Display Data<br>RS = L, Transferring the Control Data                         |                                                                                                                   |                                    |
| 7      | /WR (R/W) | Input  | /WR=L→H,<br>/RD=H;<br>Data or Instruction latch into the LCD module                                                       | R/W=H,E=H;<br>Data or Status read form the LCD module<br>R/W=L,E=H→L;<br>Data or Status latch into the LCD module | Not used,<br>Leave open or pull Hi |
| 8      | /RD (E)   | Input  | /WR=H, /RD=L;<br>Data or Status read form the LCD module                                                                  |                                                                                                                   |                                    |
| 9      | DB0       | I/O    | 8-bit Data bus;<br>Three state I/O terminal for display data or instruction data<br>when /CS=H,<br>DB0~DB7=High Impedance |                                                                                                                   | Not used,<br>Leave open            |
| :      | :         | I/O    |                                                                                                                           |                                                                                                                   |                                    |
| 14     | DB5       | I/O    |                                                                                                                           |                                                                                                                   |                                    |
| 15     | DB6(SCLK) | I/O    |                                                                                                                           |                                                                                                                   | Serial clock input                 |
| 16     | DB7(SDA)  | I/O    |                                                                                                                           |                                                                                                                   | Serial data input                  |
| 17     | BLA       | Power  | Positive power supply for LED backlight                                                                                   |                                                                                                                   |                                    |
| 18     | BLK       | Power  | Negative power supply for LED backlight, 0V                                                                               |                                                                                                                   |                                    |
| 19     | RSTB      | Input  | Reset signal<br>RSTB = L, Initialization is executed<br>RSTB= H, Normal running.                                          |                                                                                                                   |                                    |
| 20     | NC        |        | No connection(leave open)                                                                                                 |                                                                                                                   |                                    |

## Interface setting:

| Setting | 8-bit parallel 6800 mode | 8-bit parallel 8080 mode (Default) | 4-wire Serial mode |
|---------|--------------------------|------------------------------------|--------------------|
| JP3     | OPEN                     | OPEN                               | CLOSE              |
| JP4     | CLOSE                    | CLOSE                              | OPEN               |
| JP5     | OPEN                     | CLOSE                              | —                  |
| JP6     | CLOSE                    | OPEN                               | —                  |

Cautions:

“—” indicates fixed to either “OPEN” or to “CLOSE”

## 2. Absolute Maximum Ratings

| Items                 | Symbol   | Min. | Max. | Unit | Condition       |
|-----------------------|----------|------|------|------|-----------------|
| Supply Voltage        | $V_{DD}$ | 0    | +3.6 | V    | $V_{SS} = 0V$   |
| Input Voltage         | $V_{IN}$ | 0    | +3.3 | 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  | $V_{DD}$ | 2.7                 | -    | 3.3                 | V    | VDD                         |
| Input High Voltage | $V_{IH}$ | $0.7 \times V_{DD}$ | -    | $V_{DD}$            | V    | RSTB, CSB, RS<br>SDA, SCLK  |
| Input Low Voltage  | $V_{IL}$ | $V_{SS}$            | -    | $0.3 \times V_{DD}$ | V    |                             |
| Operating Current  | $I_{DD}$ | -                   | 0.33 | 2.5                 | mA   | VDD                         |

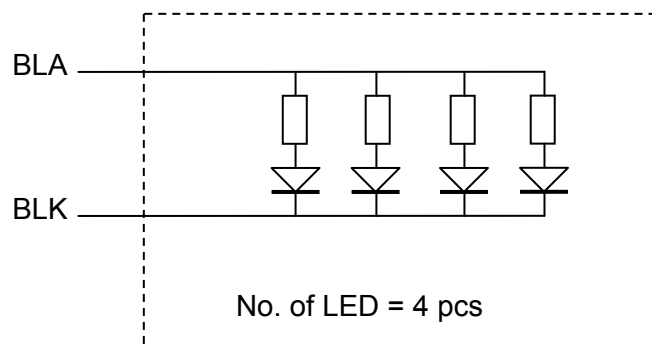
### 3.2 LED Backlight Circuit Characteristics

$BLK=0V, BLA=3.3V, T_{OP}=25^{\circ}C$

| Items           | Symbol    | MIN. | TYP. | MAX. | Unit | Applicable Pin |
|-----------------|-----------|------|------|------|------|----------------|
| Forward Voltage | BLA       | -    | 3.3  | -    | V    | BLA            |
| Forward Current | $I_{BLA}$ | -    | 46   | 80   | mA   | BLA            |

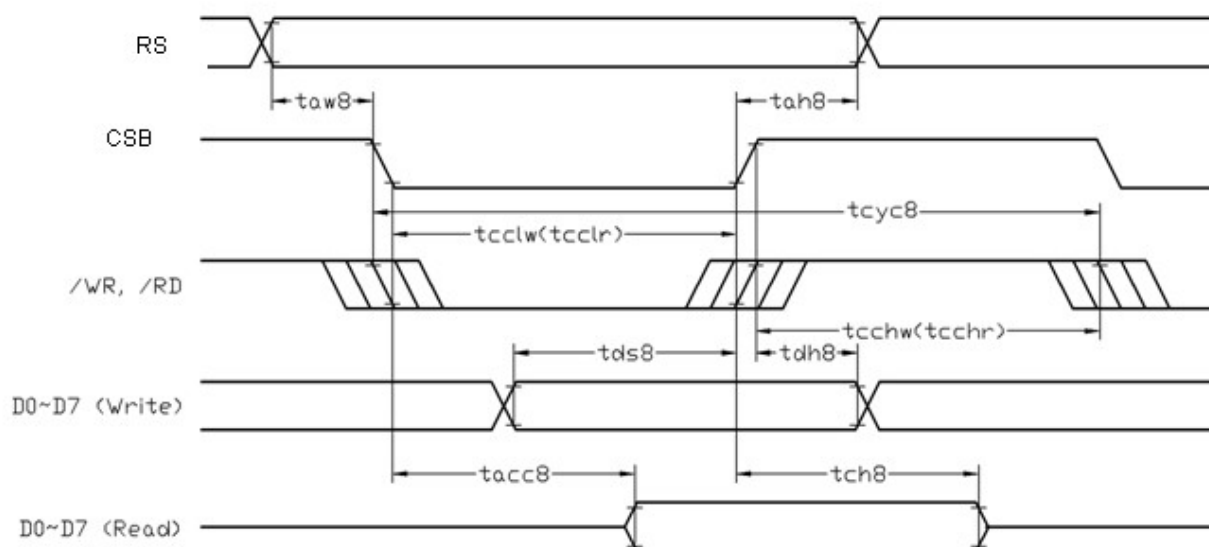
Cautions:

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



### 3.3 AC Characteristics

#### 3.3.1 8080 Mode System Bus Timing



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

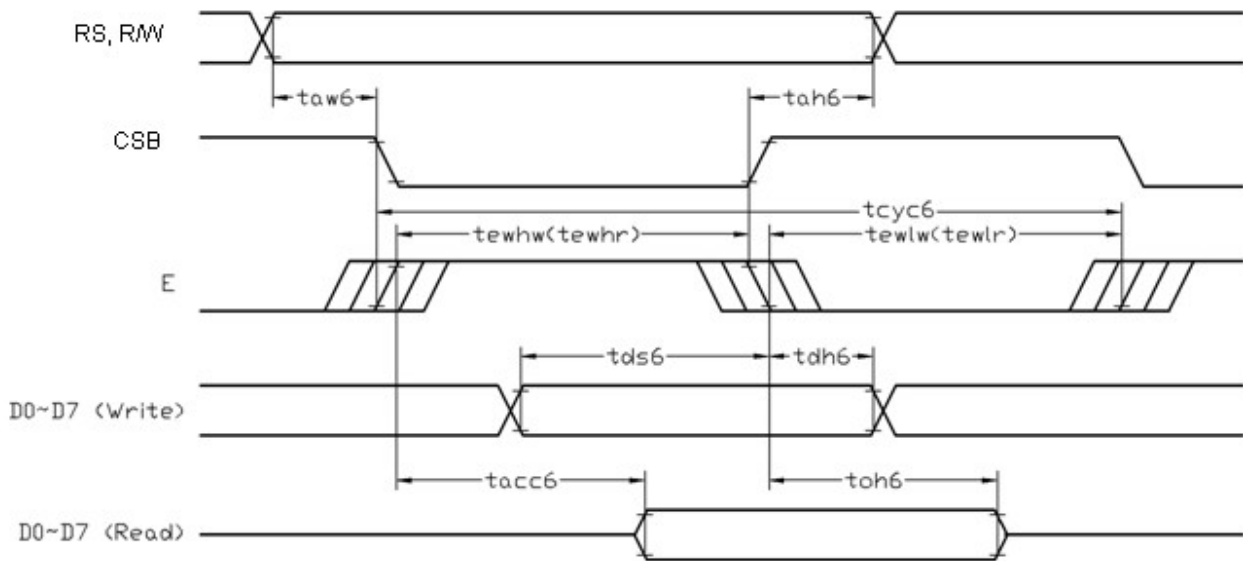
| Item                          | Symbol | MIN. | TYP. | MAX. | Unit |
|-------------------------------|--------|------|------|------|------|
| System cycle time             | tcyc8  | 312  | -    | -    | ns   |
| Address setup time (RS)       | taw8   | 10   | -    | -    | ns   |
| Address hold time (RS)        | tah8   | 13   | -    | -    | ns   |
| Control LOW pulse width (RD)  | tcclr  | 182  | -    | -    | ns   |
| Control LOW pulse width (WR)  | tcclw  | 104  | -    | -    | ns   |
| Control HIGH pulse width (RD) | tcchr  | 104  | -    | -    | ns   |
| Control HIGH pulse width (WR) | tcchw  | 104  | -    | -    | ns   |
| Data setup time               | tds8   | 52   | -    | -    | ns   |
| Data hold time                | tdh8   | 13   | -    | -    | ns   |
| /RD access time (*2)          | tacc8  | -    | -    | 91   | ns   |
| Output disable time (*2)      | tch8   | 7    | -    | 65   | 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 6800 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            | tcyc6  | 312  | -    | -    | ns   |
| Address setup time (RS)      | taw6   | 13   | -    | -    | ns   |
| Address hold time (RS)       | tah6   | 13   | -    | -    | ns   |
| Control LOW pulse width (E)  | tewlw  | 104  | -    | -    | ns   |
| Control LOW pulse width (E)  | tewlw  | 104  | -    | -    | ns   |
| Control HIGH pulse width (E) | tewhr  | 182  | -    | -    | ns   |
| Control HIGH pulse width (E) | tewhw  | 104  | -    | -    | ns   |
| Write data setup time        | tds6   | 52   | -    | -    | ns   |
| Write data hold time         | tdh6   | 13   | -    | -    | ns   |
| /RD access time (*2)         | tacc6  | -    | -    | 91   | ns   |
| Output disable time (*2)     | tch6   | 7    | -    | 65   | ns   |

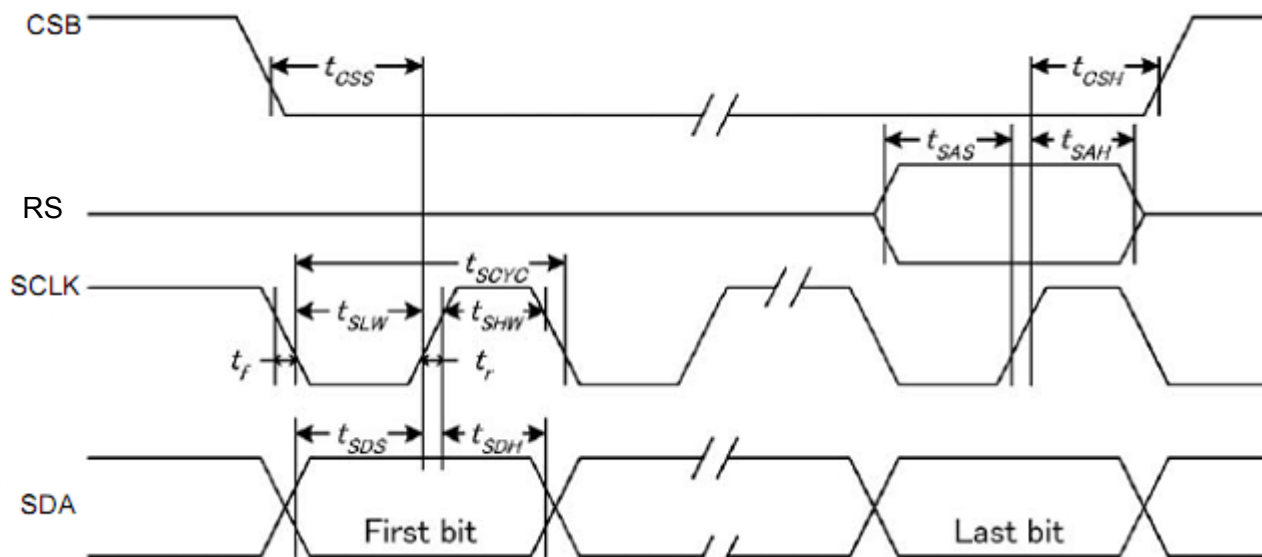
Note:

\*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.

### 3.3.3 Serial Mode Interface



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

| Item                    | Symbol | MIN. | TYP. | MAX. | Unit |
|-------------------------|--------|------|------|------|------|
| Serial Clock Period     | tscyc  | 65   | -    | -    | ns   |
| SCLK "H" pulse width    | tshw   | 33   | -    | -    | ns   |
| SCLK "L" pulse width    | tslw   | 33   | -    | -    | ns   |
| Address setup time (RS) | tsas   | 26   | -    | -    | ns   |
| Address hold time (RS)  | tsah   | 13   | -    | -    | ns   |
| Data setup time         | tsds   | 26   | -    | -    | ns   |
| Data hold time          | tsdh   | 13   | -    | -    | ns   |
| CSB-SCL time            | tcss   | 26   | -    | -    | ns   |
| CSB-SCL time            | tcsH   | 52   | -    | -    | ns   |

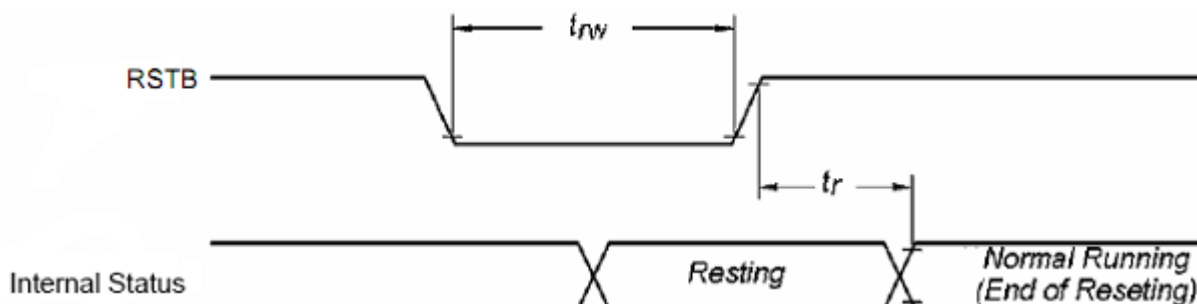
Note:

\*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.

### 3.3.4 Reset Timing



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

| Item                  | Symbol | MIN. | TYP. | MAX. | Unit    |
|-----------------------|--------|------|------|------|---------|
| Reset time            | tr     | -    | -    | 2.5  | $\mu s$ |
| Reset LOW pulse width | trw    | 2.5  | -    | -    | $\mu s$ |

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 Basic Setting

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

- ADC = 0 (normal)
- SHL select = 1 (reverse)
- 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
- Booster Set = 4x
- 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.

### 4.3 Resetting the LCD module

The LCD module should be initialized by using RSTB terminal.

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

### 4.4 Display Memory Map

| Page address   | data            | LCD Display (front view) |   |     |
|----------------|-----------------|--------------------------|---|-----|
| 0              | DB0<br>:<br>DB7 |                          |   |     |
| 1              | DB0<br>:<br>DB7 |                          |   |     |
| :              | :               |                          |   |     |
| :              | :               |                          |   |     |
| :              | :               |                          |   |     |
| 6              | DB0<br>:<br>DB7 |                          |   |     |
| 7              | DB0<br>:<br>DB7 |                          |   |     |
| Column Address |                 | 00h                      | → | 7Fh |

Note:

\*1. ADC = 0 (normal)

\*2. SHL Selection = 1 (reverse)

\*3. Initial Display Line = 0

## 4.5 Display Commands

| No. | Instructions                      | Code |     |     |            |     |     |     |     |               |     |                                 |                                                                                                                                                                       | Function |
|-----|-----------------------------------|------|-----|-----|------------|-----|-----|-----|-----|---------------|-----|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|     |                                   | A0   | /RD | /WR | DB7        | DB6 | DB5 | DB4 | DB3 | DB2           | DB1 | DB0                             |                                                                                                                                                                       |          |
| 1   | Display ON/OFF                    | 0    | 1   | 0   | 1          | 0   | 1   | 0   | 1   | 1             | 1   | DON                             | DON=0, display off<br>DON=1, display on                                                                                                                               |          |
| 2   | Set Start Line                    | 0    | 1   | 0   | 0          | 1   | S5  | S4  | S3  | S2            | S1  | S0                              | Sets the display RAM display start line address                                                                                                                       |          |
| 3   | Set Page Address                  | 0    | 1   | 0   | 1          | 0   | 1   | 1   | Y3  | Y2            | Y1  | Y0                              | Set the display RAM page address                                                                                                                                      |          |
| 4   | Set Column Address (Upper-4-bits) | 0    | 1   | 0   | 0          | 0   | 0   | 1   | X7  | X6            | X5  | X4                              | Set the upper-4-bit of column address counter                                                                                                                         |          |
|     | Set Column Address (Lower-4-bits) | 0    | 1   | 0   | 0          | 0   | 0   | 0   | X3  | X2            | X1  | X0                              | Set the lower-4-bit of column address counter                                                                                                                         |          |
| 5   | Read Status                       | 0    | 0   | 1   | Status     |     |     |     | 0   | 0             | 0   | 0                               | Read the status data                                                                                                                                                  |          |
| 6   | Write Data                        | 1    | 1   | 0   | Write data |     |     |     |     |               |     | Write data into the display RAM |                                                                                                                                                                       |          |
| 7   | Read Data                         | 1    | 0   | 1   | Read Data  |     |     |     |     |               |     | Read data form the display RAM  |                                                                                                                                                                       |          |
| 8   | ADC Select                        | 0    | 1   | 0   | 1          | 0   | 1   | 0   | 0   | 0             | 0   | ADC                             | Sets the display RAM address SEG output correspondence<br>ADC= 0, normal. ADC=1, reverse                                                                              |          |
| 9   | Normal/Reverse Display            | 0    | 1   | 0   | 1          | 0   | 1   | 0   | 0   | 1             | 1   | REV                             | REV=0, Normal display<br>REV=1, Reverse display                                                                                                                       |          |
| 10  | Entire Display ON/OFF             | 0    | 1   | 0   | 1          | 0   | 1   | 0   | 0   | 1             | 0   | EON                             | EON=0, Normal display<br>EON=1, Entire display ON                                                                                                                     |          |
| 11  | Set LCD Bias                      | 0    | 1   | 0   | 1          | 0   | 1   | 0   | 0   | 0             | 1   | BIAS                            | Set the LCD driving voltage bias<br>BIAS=0, 1/9 BIAS<br>BIAS=1, 1/7 BIAS                                                                                              |          |
| 12  | Set Read-Modify-Write             | 0    | 1   | 0   | 1          | 1   | 1   | 0   | 0   | 0             | 0   | 0                               | Enter the “Read-Modify-Write” mode<br>column address counter will increase in each “Write Display Data”,<br>and will not increase in each “Read Display Data command” |          |
| 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  | SHL Select                        | 0    | 1   | 0   | 1          | 1   | 0   | 0   | SHL | *             | *   | *                               | Set the COM scanning direction<br>SHL=0, Normal display<br>SHL=1, Flipped in y direction<br>* = don't care terms                                                      |          |
| 16  | Power Control Set                 | 0    | 1   | 0   | 0          | 0   | 1   | 0   | 1   | VC            | VR  | VF                              | Set the power circuit operation mode<br>VF: LCD Supply Voltage Follower<br>VR: LCD Supply Voltage Regulator<br>VC: LCD Supply Voltage Converter<br>(1=ON, 0=OFF)      |          |
| 17  | Regulator Resistor Select         | 0    | 1   | 0   | 0          | 0   | 1   | 0   | 0   | Radio setting |     |                                 | Set the built-in resistor ratio (R1/R2)                                                                                                                               |          |

## 4.5 Display Commands (continue)

| No. | Instructions                   | Code |     |     |     |     |             |             |             |             |             |             | Function                                                   |
|-----|--------------------------------|------|-----|-----|-----|-----|-------------|-------------|-------------|-------------|-------------|-------------|------------------------------------------------------------|
|     |                                | A0   | /RD | /WR | DB7 | DB6 | DB5         | DB4         | DB3         | DB2         | DB1         | DB0         |                                                            |
| 18  | Electronic volume mode set     | 0    | 1   | 0   | 1   | 0   | 0           | 0           | 0           | 0           | 0           | 1           | Set reference voltage mode                                 |
|     | Electronic volume register set | 0    | 1   | 0   | *   | *   | E<br>V<br>5 | E<br>V<br>4 | E<br>V<br>3 | E<br>V<br>2 | E<br>V<br>1 | E<br>V<br>0 | Set reference voltage register<br>(Display contrast value) |
| 19  | Booster Ratio Set              | 0    | 1   | 0   | 1   | 1   | 1           | 1           | 1           | 0           | 0           | 0           | Select booster ratio                                       |
|     |                                | 0    | 1   | 0   | 0   | 0   | 0           | 0           | 0           | 0           | step        |             | 00=2x, 3x, 4x; 01=5x. 11=6x                                |
| 20  | Power Save                     | -    | -   | -   | -   | -   | -           | -           | -           | -           | -           | -           | Compound Instruction:<br>Display OFF + Entire Display ON   |
| 21  | NOP                            | 0    | 1   | 0   | 1   | 1   | 1           | 0           | 0           | 0           | 1           | 1           | No operation                                               |

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 ST7565R 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