



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LM6071CCW

LCD Module User Manual

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|--|----------------------------------|-----------------------------------|
| Prepared by: Wei Date:2012-09-20 | Checked by: Date: | Approved by: Date: |
|--|----------------------------------|-----------------------------------|

| Rev. | Descriptions | Release Date |
|------|---------------------------------|--------------|
| 0.1 | Preliminary release | 2010-10-22 |
| 0.2 | Update AC Character information | 2012-09-20 |
| | | |
| | | |

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1. Basic Specifications

1.1 Display Specifications

- 1) LCD Display Mode : FSTN, Positive, Transflective
- 2) Display Color : Display Data = "1" : Dark Gray (*1)
: Display Data = "0" : Light Gray (*2)
- 3) Viewing Angle : 6H
- 4) Driving Method : 1/65 duty, 1/9 bias
- 5) Backlight : While LED backlight

Note:

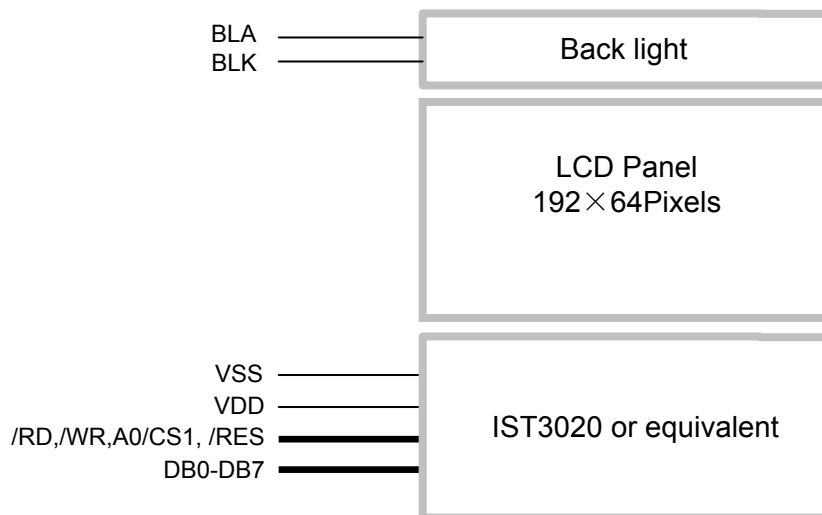
*1. Color tone may slightly change by Temperature and Driving Condition.

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

1.2 Mechanical Specifications

- 1) Outline Dimension : 100.0 x 60.0 x 10.8MAX (mm)
(See attached Outline Drawing for details)

1.3 Block Diagram



1.4 Terminal Functions

| PIN NO. | PIN Name | I/O | Descriptions | | |
|---------|------------|-------------|--|--|----------------------------|
| | | | Parallel mode | | Serial mode |
| | | | 80 mode<default> | 68 mode | |
| 1 | DB7 (SID) | I/O (Input) | 8-bit bi-directional data bus | | Serial Data Input |
| 2 | DB6 (SCLK) | I/O (Input) | | | Serial Clock Input |
| : | : | : | | | |
| 8 | DB0 | I/O | | | |
| 9 | /RD(E) | Input | Read enable input, active LOW | In read mode R/W = H; Data read from the LCD module, data appears at DB0 – DB7 and can be read by the host while, E = H and the device is being selected | Not used, pull high or low |
| 10 | /WR(R/W) | Input | Write enable input, active LOW | In write mode R/W = L; Data write to the LCD module, data appears at DB0 – DB7 will be written into the LCD module at E = H→L and device is being selected | |
| 11 | A0 | Input | Register Select A0 = H, Transferring the Display Data A0 = L, Transferring the Control Data | | |
| 12 | NC | - | No connection (leave open) | | |
| 13 | VDD | Power | Positive power supply | | |
| 14 | VSS | Power | Negative power supply,0V | | |
| 15 | /CS1 | Input | Chip Select /CS1=L, enable access to the LCD module /CS1=H, disable access to the LCD module | | |
| 16 | NC | - | No connection (leave open) | | |
| 17 | NC | - | No connection (leave open) | | |
| 18 | /RES | Input | Reset signal /RES = L, Initialization is executed /RES = H, Normal running. | | |
| 19 | BLA | Power | Positive Power Supply for LED backlight | | |
| 20 | BLK | Power | Negative Power Supply for LED backlight | | |

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} | -0.2 | $V_{DD}+0.2$ | 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

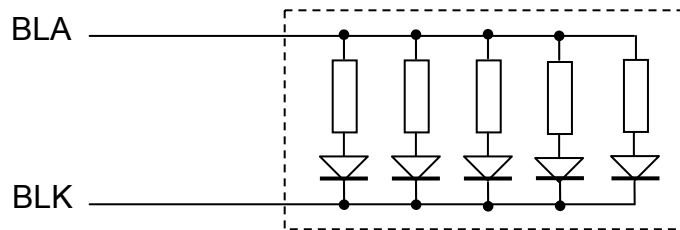
$V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25^{\circ}C$

| Items | Symbol | MIN. | TYP. | MAX. | Unit | Condition / Application Pin |
|--------------------|----------|----------------------|------|----------------------|------|-----------------------------|
| Operating Voltage | V_{DD} | 3.0 | 3.3 | 3.6 | V | VDD |
| Input High Voltage | V_{IH} | $0.85 \times V_{DD}$ | - | V_{DD} | V | /CS1,/RES,/RD, |
| Input Low Voltage | V_{IL} | V_{SS} | - | $0.15 \times V_{DD}$ | V | /WR,A0 DB0-DB7 |
| Operating Current | I_{DD} | - | 0.35 | 2.6 | mA | VDD |

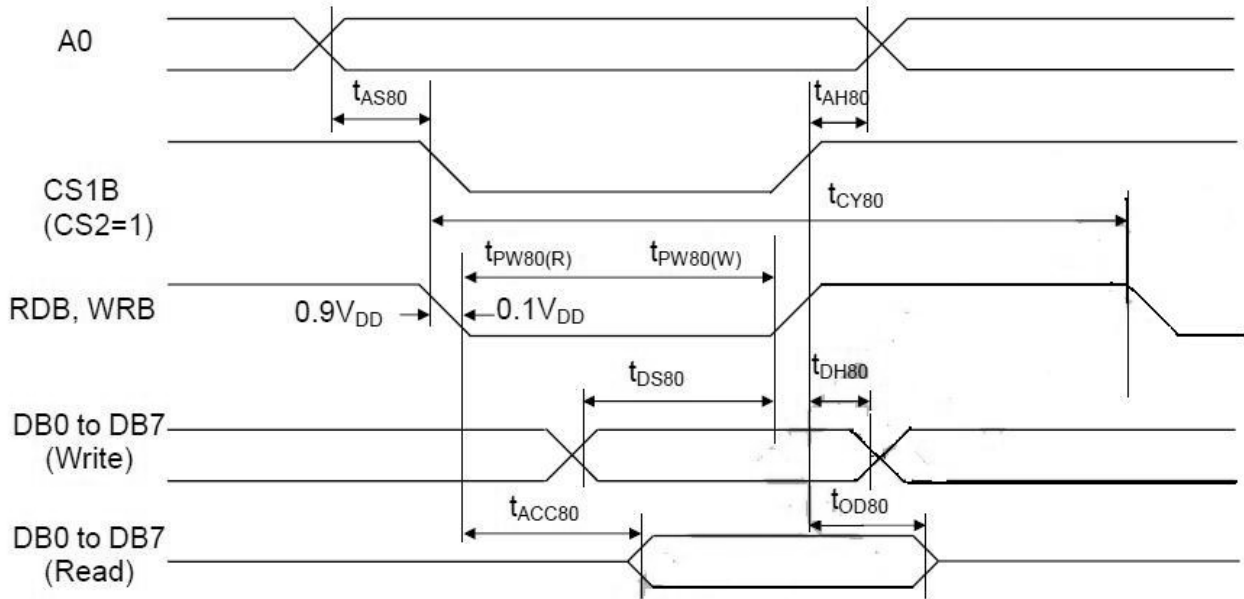
3.2 LED Backlight Circuit Characteristics

$V_{DD}=3.3V, I_{f_{VLED-}}=85mA, T_{OP}=25^{\circ}C$

| Items | Symbol | MIN. | TYP. | MAX. | Unit | Applicable Pin |
|-----------------|-----------------|------|------|------|------|----------------|
| Forward Voltage | $V_{f_{VLED-}}$ | - | 3.3 | - | V | BLA |
| Forward Current | $I_{f_{VLED-}}$ | - | 85 | 110 | mA | BLA |



3.3 AC Characteristics Serial Mode Interface



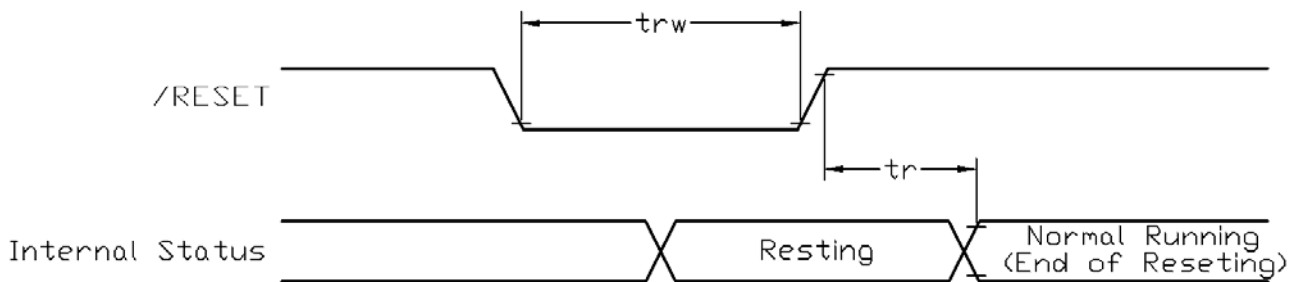
$V_{SS}=0V, V_{DD}=3.3V, T_{OP}=25^{\circ}C$

| Item | Symbol | MIN. | TYP. | MAX. | Unit |
|---------------------|---------------|------|------|------|------|
| Address setup time | t_{AS80} | 0 | - | - | ns |
| Address hold time | t_{AH80} | 0 | - | - | ns |
| System cycle time | t_{CY80} | 375 | - | - | ns |
| Pulse width(WRB) | $t_{PW80(W)}$ | 75 | - | - | ns |
| Pulse width(RDB) | $t_{PW80(R)}$ | 75 | - | - | ns |
| Data setup time | t_{DS80} | 50 | - | - | ns |
| Data hold time | t_{DH80} | 19 | - | - | ns |
| Read access time | t_{ACC80} | - | - | 112 | ns |
| Output disable time | t_{OD80} | 13 | - | 80 | 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 V_{DD} as the reference.

3.4 Reset Timing



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

| Item | Symbol | MIN. | TYP. | MAX. | Unit |
|-----------------------|----------|------|------|------|---------|
| Reset time | t_r | - | - | 1.5 | μs |
| Reset LOW pulse width | t_{rw} | 1.5 | - | - | μs |

Note:

- *1. All timing is using 20% and 80% of V_{DD} as the reference.

4. Function specifications

4.1 Basic Setting

Basic Setting

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

- ADC = 1 (reverse)
- SHL select = 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
- Built-in OSC = 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 Resetting the LCD module

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

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

4.3 Interfacing Setting

Jumpers could be used to change bus interfacing family

| Jumper | | | | | Function Description |
|--------|-------|-------|-------|------------|----------------------------|
| JP1 | JP2 | JP3 | JP4 | JP7 - JP14 | |
| open | close | close | open | open | 80 mode selected <default> |
| close | open | close | open | open | 68 mode selected |
| open | close | open | close | close | serial mode selected |

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 | → BFH |

Note:

- *1. ADC = 1 (reverse)
- *2. SHL Selection = 0 (normal)
- *3. Initial Display Line = 0

4.5 Display Commands

× : Don't care

| INSTRUCTION | A0 | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description |
|---------------------------------------|----|----|------------|------|--------|--------|-----|-----|-----|------|--|
| Display ON / OFF | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | DON | Turn on/off LCD panel When DON = 0 : display OFF When DON = 1 : display ON |
| Initial display line | 0 | 0 | 0 | 1 | ST5 | ST4 | ST3 | ST2 | ST1 | ST0 | Specify DDRAM line for COM0 |
| Set page address | 0 | 0 | 1 | 0 | 1 | 1 | P3 | P2 | P1 | P0 | Set page address |
| Set column address MSB | 0 | 0 | 0 | 0 | 0 | 1 | Y7 | Y6 | Y5 | Y4 | Set column address MSB |
| Set column address LSB | 0 | 0 | 0 | 0 | 0 | 0 | Y3 | Y2 | Y1 | Y0 | Set column address LSB |
| Read status | 0 | 1 | BUSY | ADCB | ON/OFF | RESETB | 0 | 0 | 0 | 0 | Read the internal status |
| Write display data | 1 | 0 | Write data | | | | | | | | Write data into DDRAM |
| Read display data | 1 | 1 | Read data | | | | | | | | Read data from DDRAM |
| ADC select | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | ADC | Select SEG output direction When ADC = 0 : normal direction (SEG0 → SEG223) when ADC = 1 : reverse direction (SEG223 → SEG0) |
| Reverse display ON / OFF | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | REV | Select normal / reverse display When REV = 0 : normal display When REV = 1 : reverse display |
| Entire display ON / OFF | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | EON | Select normal / entire display ON When EON = 0 : normal display When EON = 1 : entire display ON |
| LCD bias select | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | BIAS | Select LCD bias |
| Set modify-read | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Set modify-read mode |
| Reset modify-read | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | Release modify-read mode |
| Reset | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | Initialize the internal functions |
| SHL select | 0 | 0 | 1 | 1 | 0 | 0 | SHL | × | × | × | Select COM output direction When SHL = 0 : normal direction (COM0 → COM63) When SHL = 1 : reverse direction (COM63 → COM0) |
| Power control | 0 | 0 | 0 | 0 | 1 | 0 | 1 | VC | VR | VF | Control power circuit operation |
| Regulator resistor select | 0 | 0 | 0 | 0 | 1 | 0 | 0 | R2 | R1 | R0 | Select internal resistance ratio of the regulator resistor |
| Set reference voltage mode | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Set reference voltage mode |
| Set reference voltage mode | 0 | 0 | × | × | SV5 | SV4 | SV3 | SV2 | SV1 | SV0 | Set reference voltage register |
| Set static indicator mode | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | SM | Set static indicator mode |
| Set static indicator register | 0 | 0 | × | × | × | × | × | × | S1 | S0 | Set static indicator register |
| Power save | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | SAV | Select power save mode When SAV = 0 : Stand-by When SAV = 1 : Sleep |
| Power save reset | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | Reset power save |
| Set n-Line reversal drive register | 0 | 0 | 0 | 0 | 1 | 1 | NL3 | NL2 | NL1 | NL0 | Set the number of line reversal drive line |

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 IST3020 data sheet.

4.6 Display Commands (continue)

| | | | | | | | | | | | |
|------------------------------|---|---|------------|------------|------|------|------|------|------|------|---|
| n-Line reversal drive reset | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | Reset the line reversal drive |
| Built-in oscillator ON | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | Start the built-in oscillator circuit |
| External capacitor discharge | 0 | 0 | 0 | 1 | 1 | 1 | 0 | DISC | | | DISC = 000 (enable) DISC = 111 (disable) |
| NOP | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | Non-Operation command |
| Test | 0 | 0 | 1 | 1 | 1 | 1 | x | x | x | x | Don't use this instruction |
| Set OTP program | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | Set OTP program mode |
| OTP program control | 0 | 0 | OTPA DJ | OTPP ON | x | x | x | x | x | x | OTP control option OTPADJ = 1:OTP use OTPADJ = 0:OTP ignore OTPPON = 1:OTP program enable OTPPON =0:OTP program disable |
| Set contrast offset (1) | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Set contrast offset mode (1) |
| | 0 | 0 | x | x | CTA5 | CTA4 | CTA3 | CAT2 | CAT1 | CTA0 | Set contrast offset register (1) |
| Set contrast offset (2) | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | Set contrast offset mode (2) |
| | 0 | 0 | x | x | x | CTB4 | CTB3 | CTB2 | CTB1 | CTB0 | Set contrast offset register (2) |
| Set contrast offset (3) | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | Set contrast offset mode (3) |
| | 0 | 0 | x | x | x | CTC4 | CTC3 | CTC2 | CTC1 | CTC0 | Set contrast offset register (3) |
| Read contrast offset(1) | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | Set contrast offset read mode (1) |
| | 0 | 1 | x | x | CTA5 | CTA4 | CTA3 | CTA2 | CTA1 | CTA0 | Read contrast offset(1) |
| Read contrast offset(2) | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | Set contrast offset read mode (2) |
| | 0 | 1 | x | x | x | CTB4 | CTB3 | CTB2 | CTB1 | CTB0 | Read contrast offset(2) |
| Read contrast offset(3) | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | Set contrast offset read mode (3) |
| | 0 | 1 | x | x | x | CTC4 | CTC3 | CTC2 | CTC1 | CTC0 | Read contrast offset(3) |

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 IST3020 data sheet.

4.6.1 Power off the LCD Module

It recommends that enter Power Save mode before power off the LCD module.

4.6.2 Refreshing The LCD Module

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

4.7 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