

WH-LTE-7S1-E Hardware Manual

Document version: V1.0.0



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|---|----|
| WH-LTE-7S1-E Hardware Manual..... | 1 |
| 1. Overview..... | 3 |
| 2. Introduction..... | 3 |
| 2.1. Specifications..... | 3 |
| 2.2. System Diagram..... | 4 |
| 2.3. Pins Definition..... | 5 |
| 2.4. Evaluation Board..... | 6 |
| 3. Application Interfaces..... | 7 |
| 3.1. Power Interface..... | 7 |
| 3.2. USB Interface..... | 8 |
| 3.3. UART Interface..... | 8 |
| 3.4. SIM Interface..... | 9 |
| 3.5. Indicators..... | 11 |
| 3.6. Reset/Reload..... | 13 |
| 3.7. Turn on/off Module Using PWRKEY..... | 13 |
| 4. Electrical Characteristics..... | 14 |
| 4.1. Operating/Storage Temperature..... | 14 |
| 4.2. Power Supply..... | 14 |
| 4.3. IO Voltage Range..... | 14 |
| 4.4. IO Current Range..... | 15 |
| 5. Mechanical Characteristics..... | 15 |
| 5.1. Reflow Soldering..... | 15 |
| 5.2. Dimensions..... | 16 |

1. Overview

This document describes the pin definition, electrical characteristics and structural dimensions of the WH-LTE-7S1-E module.

Combined with this document and other application documents of WH-LTE-7S1-E module, users can quickly embed the module in various terminal devices to design mobile communication application schemes.

About the user manual and encapsulation library, please download in this link:

<https://www.pusr.com/products/LTE-Cat-1-module.html>

2. Introduction

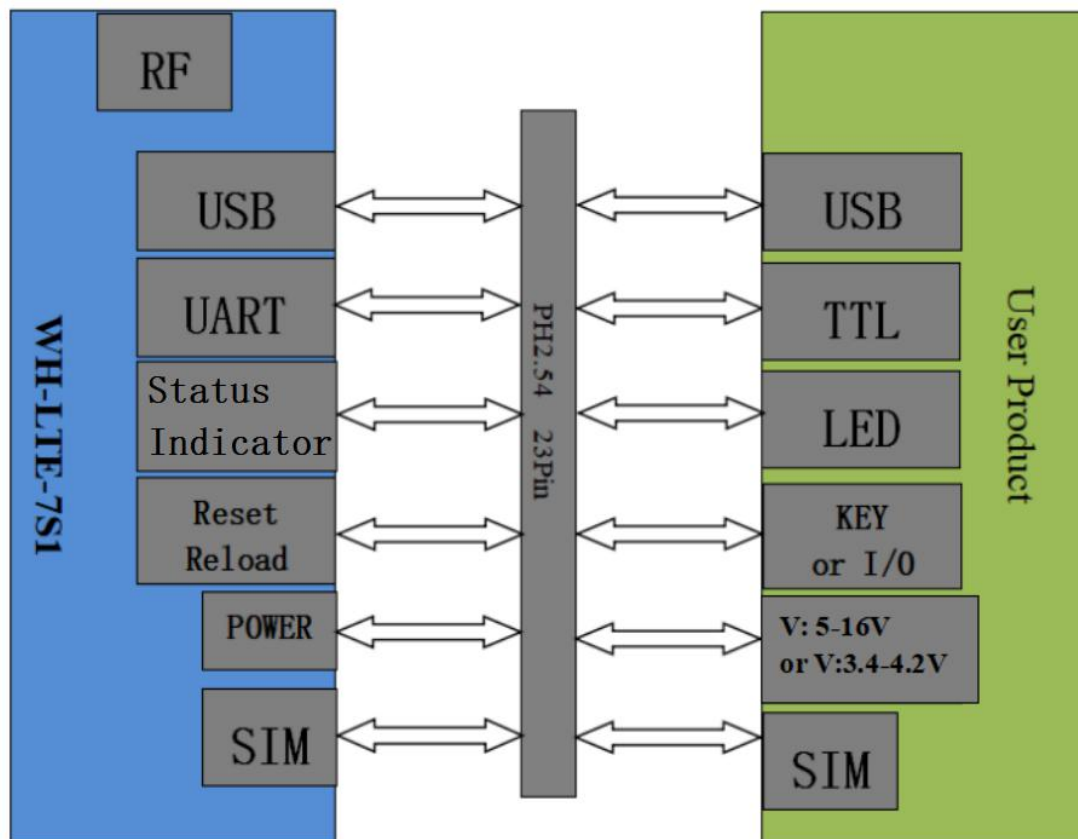
2.1. Specifications

| Parameters | | Description |
|--------------------|-----------------------|---|
| Basic Parameters | WH-LTE-7S1-E | Supports B1/B3/B7/B8/B20/B28 |
| | Encapsulation | DIP 23pin |
| | Power | 3.4V~4.2V / 5~16V (Not coexisting) |
| | Indicators | WORK, NET, LINKA, LINKB, DATA |
| | SIM/USIM | 3V/1.8V SIM slot, 2FF |
| | USB interface | USB 2.0 High speed |
| | UART interface | AT commands and data transmission, TTL-3.0V |
| | RF | IPEX |
| Environmental | Dimensions(mm) | 44.4mm×41.8mm×12.5mm |
| | Weight(g) | 15g |
| Temperature | Operating temperature | -30°C~ +75°C |
| | Expansion temperature | -40°C~ +85°C |
| | Storage temperature | -40°C~ +90°C |
| Humidity | Operating humidity | 5%~95% (non-condensing) |
| Transmission speed | LTE FDD Rel.13 | 10MbpsDL/5Mbps UL |
| | GPRS | 85.6KbpsDL/85.6Kbps UL(multi-slot class 12) |
| Bands | LTE FDD | B1/B3/B7/B8/B20 |
| | GSM | 900/1800MHz |
| TX Power | FDD:B1/3/7/8/20/28 | 23dBm±2dB |
| | GSM:900MHz | 33dBm±2dB |
| | GSM:1800MHz | 30dBm±2dB |
| Rx Sensitivity | GSM:900MHz | -109.5dBm |
| | GSM:1800MHz | -108dBm |

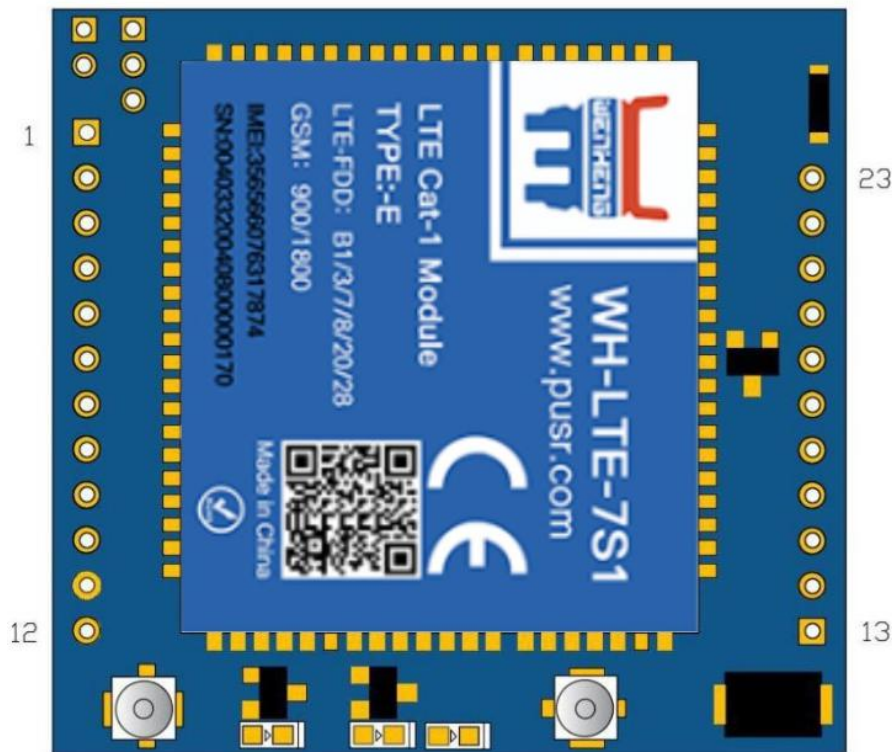
| | | |
|----------|------------------------------|--|
| | FDD:B1/3/20 | -98dBm |
| | FDD:B7 | -97.5dBm |
| | FDD:B8/B28 | -98.5dBm |
| Software | Operating mode | TCP/UDP/HTTPD/SMS transparent transmission |
| | Configuration command | AT+command |
| | Network protocol | TCP/UDP/DNS/FTP/HTTP |
| | Socket number | 4 |
| | User configuration | Serial/Network/SMS AT command |
| Features | Socket distribution protocol | Support |
| | FOTA self upgrade | Support |
| | Security | Support |
| | Base station geolocation | Support |
| | FTP upgrade | Support |
| | NTP | Support |

2.2. System Diagram

WH-LTE-7S1-E uses a double inline package design, offers multiple communication interfaces: POWER, Reset, Reload, work status indicators, SIM, USB, UART and so on.



2.3. Pins Definition



| Pin | Name | Direction | Description |
|-----|-----------|-----------|--|
| 1 | LINKA | O | Output high level when socket A connection is established. |
| 2 | LINKB | O | Output high level when socket B connection is established. |
| 3 | USB_DM | I/O | USB- |
| 4 | USB_DP | I/O | USB+ |
| 5 | V_PAD | P | 3.0V IO Power domain. |
| 6 | UTXD1 | O | UART data out, data output from module to user device (3.0V) |
| 7 | URXD1 | I | UART data in, data input from user device to module (3.0V) |
| 8 | VBUS | P | USB Power |
| 9 | WORK | O | Working status indicator, flashes. The high and low level change every second. |
| 10 | POWER KEY | I | Power on and off, low level off. |
| 11 | GND | P | Power GND. |
| 12 | GND | P | Power GND. |
| 13 | DCIN | P | 5-16V power. |
| 14 | DCIN | P | 5-16V power. |

| | | | |
|----|---------|-----|---|
| 15 | NET | O | Network status indicator. |
| 16 | VCAP | P | Power supply: 3.4~4.2V, recommend 3.8V. Can not use with DCIN simultaneously. |
| 17 | NC | | |
| 18 | RELOAD | I | Pull down 3~15s to restore to factory settings. |
| 19 | RESET | I | Reset, module should restart when this pin is pulled down. |
| 20 | VSIM | P | SIM card power. |
| 21 | SIM_DAT | I/O | SIM card data. |
| 22 | SIM_CLK | I/O | SIM card clock. |
| 23 | SIM_RST | O | SIM card control. |

Note:

1. "P" means power supply pin, "I" means the input pin, "O" means the output pin.
2. LINKA, LINKB, WORK, NET pin: high level is 1.8V, if need to be compatible with 7S2, 7S3 design, please pay attention to level matching to avoid damage module.
3. POWER_KEY and RESET have the same function to control the power on and off of the module.
4. RELOAD and RST pins are compatible with 3.3V and 5V input.
5. NC: pin is not in use.
6. I/O stands for bidirectional data transfer pins.

2.4. Evaluation Board

In order to facilitate application development with 7S1-E conveniently, we supplies the evaluation board (EVB)--USR-7SX-EVK.

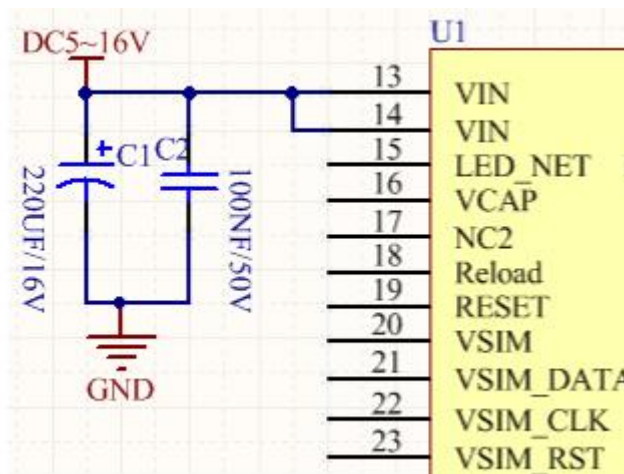
3. Application Interfaces

3.1. Power Interface

WH-LTE-7S1-E supports DC 5~16V or DC 3.4~4.2V power supply.

3.1.1. DC 5~16V Power Supply

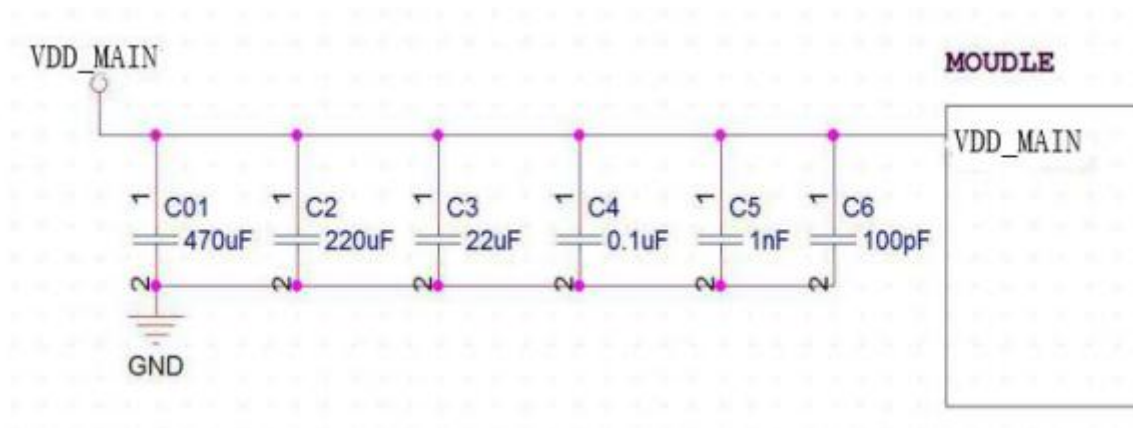
Connecting pins 13 and 14 with 5~16V power supply. When designing the product, please ensure that the peripheral circuit can provide sufficient power supply capacity, and strictly control it within 5V ~ 16V. It is recommended to add 220uF electrolytic capacitor at the front end of the pin interface to increase the stability of the power supply. Reference circuits are as follows:



3.1.2. DC 3.4~4.2V Power Supply

Connecting pin 16 with 3.4-4.2V power supply (Recommend 3.8V, cannot exceed the range), please place a large capacitor behind DC/DC or LDO to prevent the voltage drop of the external power supply during the pulse current period. Bypass capacitors stabilize the input voltage.

Reference circuit is as follows:



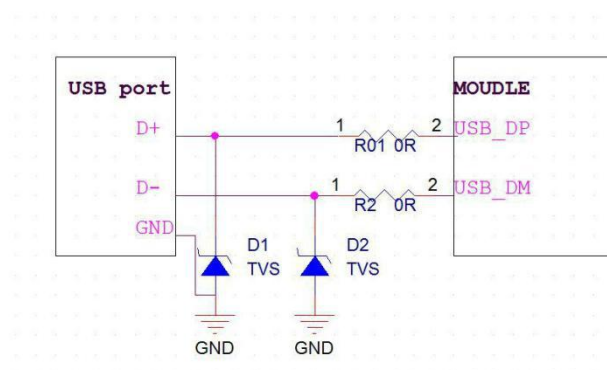
3.2. USB Interface

7S1-E module provides a standard USB2.0 interface, supports both High Speed (480Mbps) and Full Speed (12Mbps) circuits, supports suspend and resume, and can work in HOST mode and DEVICE mode. The USB interface can map multiple serial ports on the PC by cooperating with the driver. The recommended circuit is shown in the figure below. The typical voltage of USB interface power supply (USB_VCC) is 5V (range: 4.75 ~ 5.25V). According to the different requirements of application products, should consider different requirements of ESD and EMI. Design recommendations:

1. We recommend a common-mode suppression filter or 0 ohm resistor in the USB circuit to facilitate subsequent debugging.
2. When used as an operation interface or debugging interface, the protection of ESD interface must be considered on the USB signal line, the junction capacitance of ESD is not more than 3pF. TVS recommends SEMTECH's RClamp0521P.TCT or INFINEO's ESD0P2RF-02LRHE6327. Other devices of the same specification can also be selected according to the parameters.
3. USB_DP and USB_DM must be in differential signal, try to keep the two lines the same length, keep the differential impedance at 90ohm.
4. USB_DP and USB_DM need to be protected by the ground.

| PIN | Symbol | Description | Type voltage |
|-----|--------|------------------|--------------|
| 3 | USB_DM | USB D- | |
| 4 | USB_DP | USB D+ | |
| 8 | VBUS | USB Power supply | 5V |

Reference circuit:



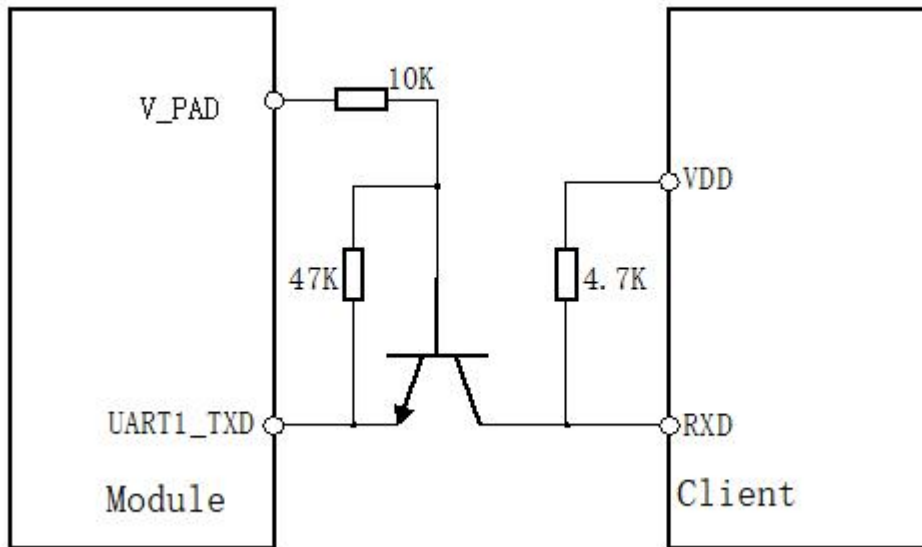
3.3. UART Interface

WH-LTE-7S1-E supports below baud rate:

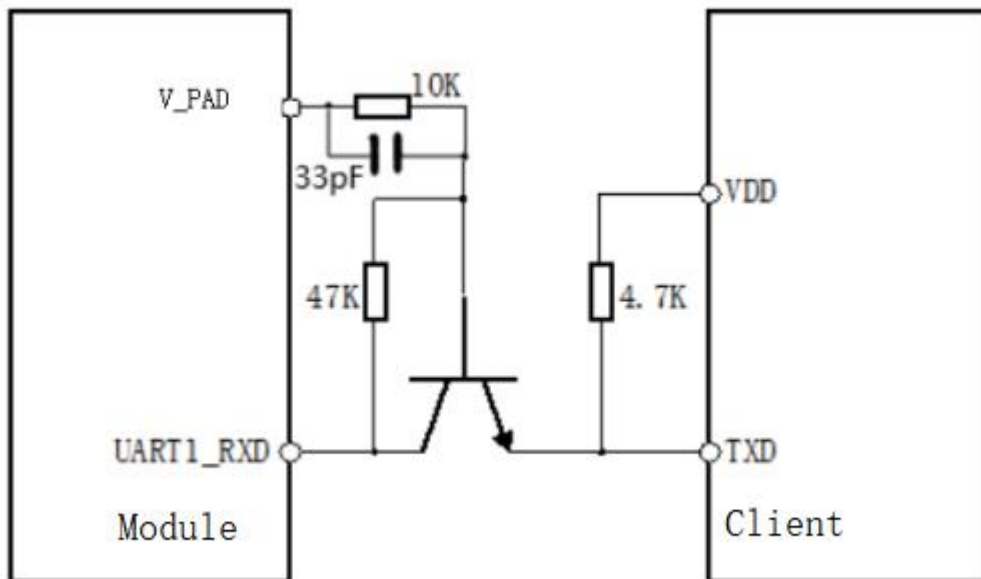
1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600

When the I/O of the user's MCU is not 3.0V, level matching is needed to achieve communication with WH-LTE-7S1-E module. The conversion circuit is as follows:

TXD:



RXD:



V_PAD is the module serial power pin (3.0V). VDD is the user's MCU level. For triodes, S9014/J6 of JCET Group is recommended, or other devices of the same specification.

3.4. SIM Interface

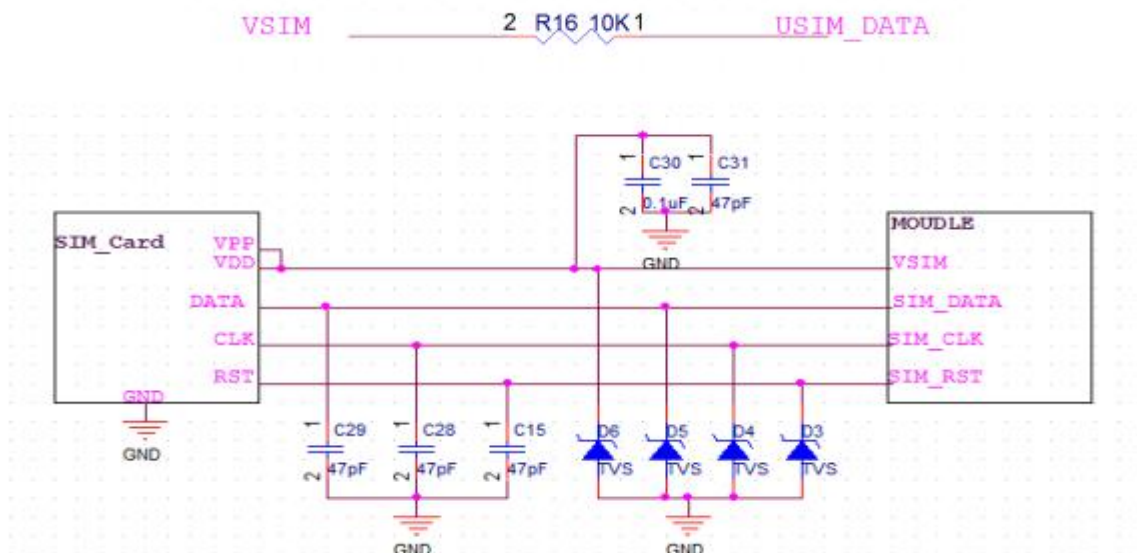
The module provides an ISO 7816-3 standard SIM card interface that automatically recognizes 3.0V and 1.8V SIM cards.

WH-LTE-7S1-E has integrated SIM card function and can be used directly, users can also design according to the needs with the SIM pins.

Recommendations:

1. In order to prevent the damage of USIM card and chip caused by static electricity, it is necessary to add TVS tube for electrostatic protection. Please select devices with rated reverse working voltage VRWM =5V and junction capacitance CJ < 10 pF. The reference ground of the antistatic device and the module must be connected.
2. It is suggested to use VSIM power to pull up SIM_DATA 10K to ensure that SIM_DATA has a stable high level in three states, so as to improve the driving ability and the edge characteristics of its waveform.
3. In order to meet the requirements of 3GPP TS 51.010-1 protocol and EMC certification, it is recommended to place the SIM card holder close to the SIM card interface of the module to avoid serious distortion of the waveform and influence of signal integrity due to too long wiring.
4. SIM_CLK and SIM_DAT should be protected by the ground.
5. Please parallel a capacitor of 0.1uF and 33pF between VSIM and GND, and a capacitor of 33pF between SIM_CLK, SIM_RST, SIMA_DAT and GND to filter the interference of RF signals.
6. The ESD protection device should be placed close to the SIM card slot.

| PIN | Symbol | Description | Type(V) |
|-----|---------|---------------|---------|
| 20 | VSIM | SIM power | 1.8/3.0 |
| 21 | SIM_DAT | SIM data I/O | 1.8/3.0 |
| 22 | SIM_CLK | SIM clock I/O | 1.8/3.0 |
| 23 | SIM_RST | SIM reset I/O | 1.8/3.0 |



3.5. Indicators

WH-LTE-7S1-E provides LED to display the working status of the module.

| PIN | Symbol | Description | Type voltage |
|-----|--------|--------------------|--------------|
| 1 | LINKA | Socket A status | 3.0V |
| 2 | LINKB | Socket B status | 3.0V |
| 9 | WORK | Module work status | 3.0V |
| 15 | NET | Network status | 3.0V |

WH-LTE-7S1-E itself provides 3 status indicator lights:

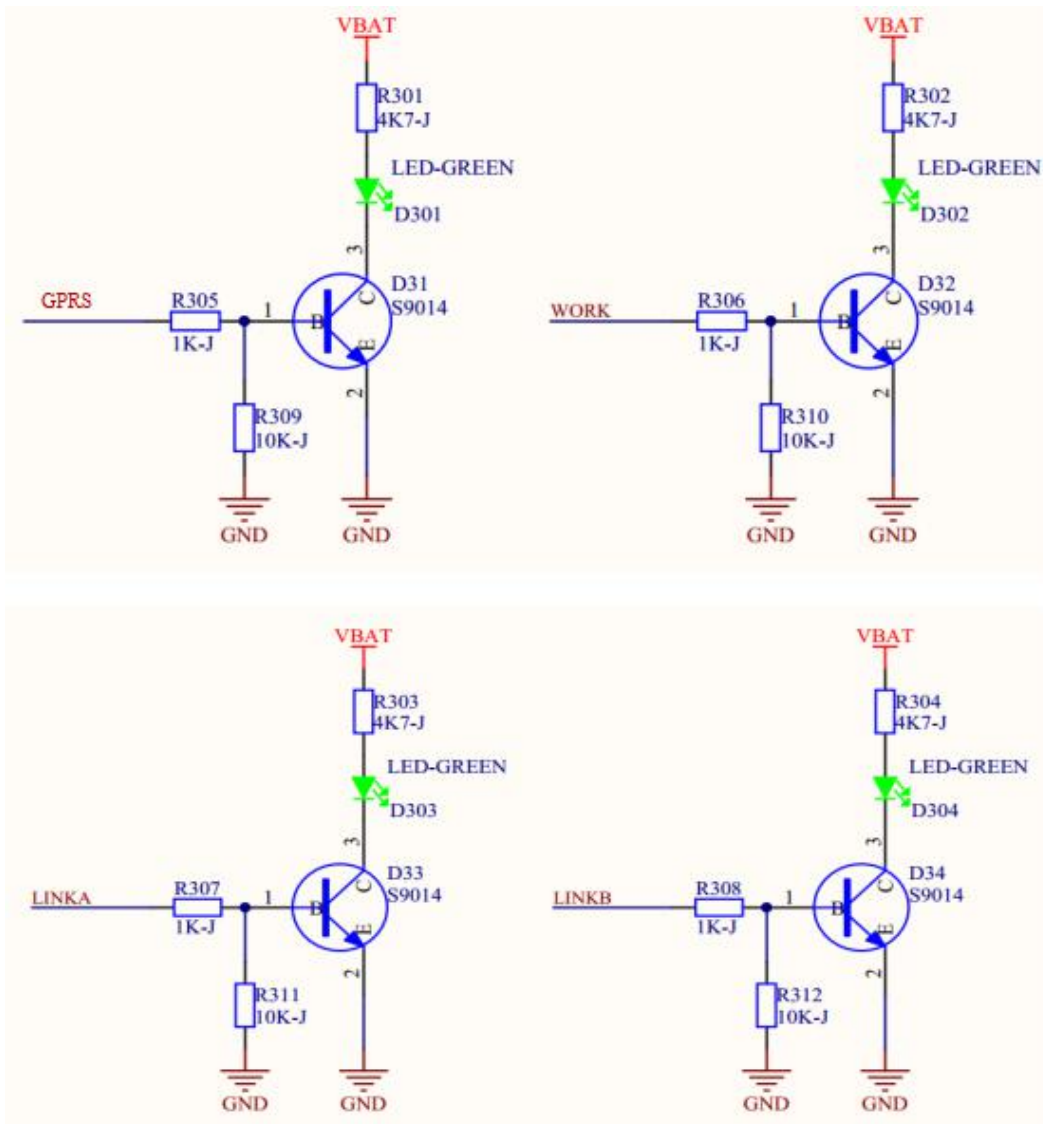
POWER: Always on after the module is powered on.

NET: Flashes after connecting to the network.

WORK: Flashes after the module works normally.

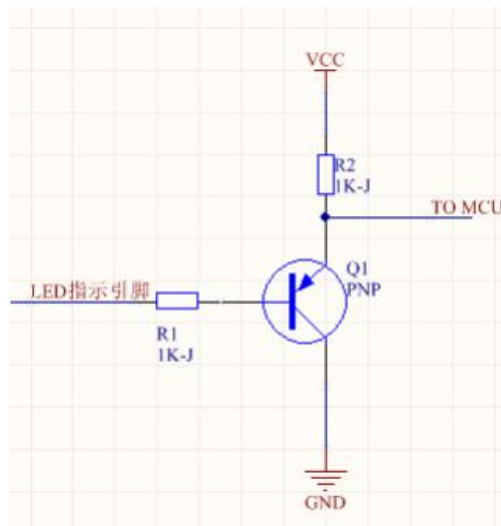
It is recommended to drive the indicator light through a triode, and connect the positive pole of the light with a stable voltage.

Reference circuit:



Note:

If the user needs to read the indicator light level, cannot directly connect the MCU pins to the module's indicator light pins, need to do the level matching. VCC is the user level.



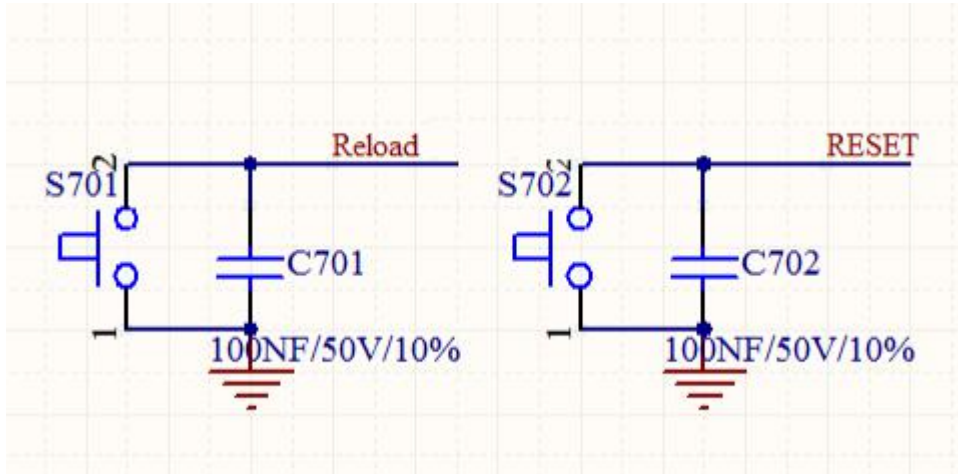
3.6. Reset/Reload

WH-LTE-7S1-E supports hardware reset and restore the factory settings:

RESET: Pull down the "RESET" pin for 0.5s, then pull up or open it.

Reload: Pull down for 3~15s, then pull up or open it to restore the factory settings.

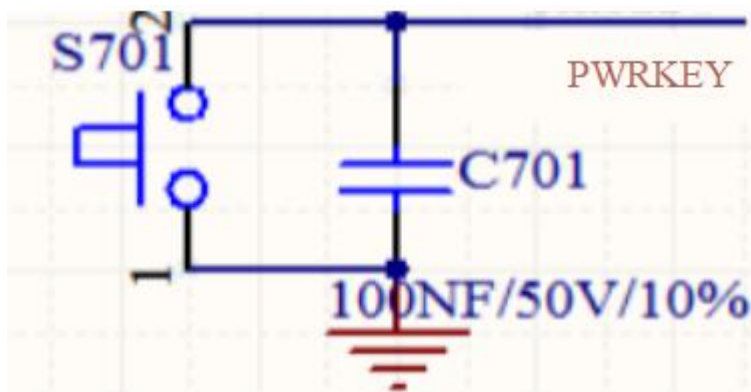
Reference circuit:



3.7. Turn on/off Module Using PWRKEY

If unused, must keep this pin open. When the module is powered on, can pull down the PWRKEY pin to restart the module. Reference circuit is as follows:

| PIN | Symbol | Description | Type voltage |
|-----|--------|--------------------------------|--------------|
| 10 | PWRKEY | Power pin, pull up by default. | VBAT |



4. Electrical Characteristics

4.1. Operating/Storage Temperature

| Parameter | Min | Max |
|-----------------------|-------|-------|
| Operating temperature | -35°C | +75°C |
| Expansion temperature | -40°C | +85°C |
| Storage temperature | -40°C | +90°C |

Note:

When the module works in the operating temperature range, the related performance meets the requirements of 3GPP standard.

When works in the expansion temperature, the module can still keep the normal working state and has the functions of voice, SMS and data transmission. There will be no irreversible failure, the radio frequency spectrum and network are basically unaffected. Only a few parameters, such as output power, may be outside the range of the 3GPP standard. When the temperature returns to the normal operating temperature range, all the indicators of the module still meet the 3GPP standard.

4.2. Power Supply

| Paramete | Pin | Min. | Typ. | Max. |
|---------------|--------|------|------|------|
| Input Voltage | 13、 14 | 5V | 12V | 16V |
| Input Voltage | 16 | 3.4V | 3.8V | 4.2V |

4.3. IO Voltage Range

For SIM power pin USIM_VDD:

1.8V U(S)IM: Class C, USIM_VDD=1.8V

3.0V U(S)IM: Class B, USIM_VDD=3.0V

For RST, POWER KEY and others:

1.8V I/O voltage parameters:

| Symbol | Parameter | Min | Typ | Max | Unit |
|-----------------|---------------------------|------|-----|------|------|
| V _{IH} | High-level input voltage | 1.17 | 1.8 | 1.8 | V |
| V _{IL} | Low-level input voltage | -0.4 | 0 | 0.63 | V |
| V _{OH} | High-level output voltage | 1.35 | 1.8 | 1.8 | V |
| V _{OL} | Low-level output voltage | 0 | 0 | 0.45 | V |

3.0V I/O voltage parameters:

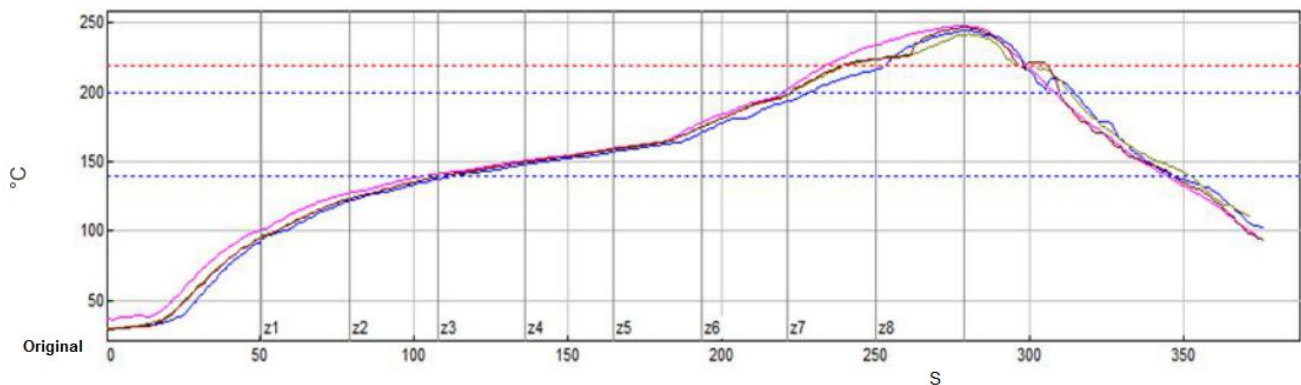
| Symbol | Parameter | Min | Typ | Max | Unit |
|-----------------|---------------------------|-----|-----|------|------|
| V _{IH} | High-level input voltage | 2.1 | 3.0 | 3.0 | V |
| V _{IL} | Low-level input voltage | 0 | 0 | 0.6 | V |
| V _{OH} | High-level output voltage | 2.1 | 3.0 | 3.1 | V |
| V _{OL} | Low-level output voltage | 0 | 0 | 0.45 | V |

4.4. IO Current Range

| IO pin | Maximum input current | Maximum drive current |
|------------|-----------------------|-----------------------|
| IO current | 4mA | 4mA |

5. Mechanical Characteristics

5.1. Reflow Soldering



| TCs | Soak time 140~200°C | Reflow time/220°C | Max temperature | Slope 1 |
|------------------|---------------------|-------------------|-----------------|---------|
| 2 | 116.7 26% | 65.2 -83% | 248.6 24% | 2.1 15% |
| 3 | 116.0 24% | 45.4 -149% | 245.3 2% | 2.3 25% |
| 4 | 114.0 20% | 55.1 -116% | 242.6 -16% | 2.1 10% |
| 6 | 113.7 19% | 64.5 -85% | 247.3 15% | 2.1 12% |
| Temp. difference | 3.04 | 19.82 | 6.00 | 0.15 |

5.2. Dimensions

Unit: mm
Error: +/-0.2mm

