# NVC-MDCS71 Datasheet

– Bluetooth V4.0 Single Mode

Innovative Communication in Wireless World

**Version – V2.1**

Issue Date – Jun. 20, 2012

## Description:

NVC-MDCS71 is a single-mode *Bluetooth* 4.0 low power module. Based on CSR's uEnergy platform, it enables ultra low power connectivity and basic data transfer for applications previously limited by the power consumption, size constraints and complexity of other wireless standards. It contains everything required to create a Bluetooth low energy product with RF, baseband, MCU, qualified Bluetooth V4.0 stack and customized firmware on a single module.

The module can be power directly with a standard 3V coin cell batteries or pair of AAA batteries. In lowest power sleep mode it consumes only 600nA and will wake up in few hundred microseconds.

Typical Bluetooth low energy applications:

- Sports and fitness
- Healthcare
- Home entertainment
- Office and mobile accessories
- Automotive
- Commercial
- Watches
- Human interface devices

## Features:

- Single mode Bluetooth v4.0 low energy
- 4 dBm TX power/ -92.5dBm RX sensitivity, RSSI monitoring for proximity applications
- Supports master and slave
- Support GATT-based Profile: Proximity, Find Me, Heart Rate, HID and etc.
- UART/I2C master/SPI master interfaces
- 9 digital PIOs/3 analog IOs
- 10bit ADC IOs
- Wakeup interrupt and watchdog timer
- 19.20x12.00x2.2mm
- SMT pads for easy and reliable PCB mounting, Internal chip antenna
- BQB/FCC/CE Certified
- RoHS compliant

**Table 1： Ordering Information**

| Ordering Number | Package | Items in One Package | Comments |
|---|---|---|---|
| NVC-MDCS71 | Plastic tray | 100PCS | |

Please also supply the customer firmware code issued by NovaComm Technologies when you place the order.

**Release Record**

| Version | Release Date | Comments |
|---|---|---|
| 2.0 | Jan 03, 2012 | Release |
| 2.1 | Jun 20,2012 | increase I2C interface |
| | | |
| | | |

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## 1.1. Pin Configuration

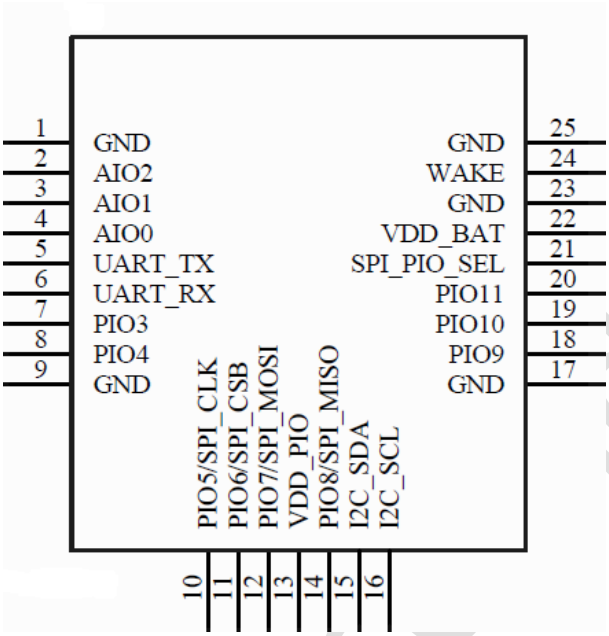


**Figure 1: Pinout of NVC-MDCS71**

**GND (pin 1, 9,17, 15, 23, 25)**

Connect GND pins to the ground plane of PCB.

**AIO0~AIO2 (pin 4, 3, 2)**

General purpose analog interface. Typically used for voltage measurements. Can be left not connected.

**UART_TX (pin 5)**

UART_TX is used to implement UART data transfer from NVC-MDCS71 to another device.

**UART_RX (pin 6)**

UART_RX is used to implement UART data transfer from another device to NVC-MDCS71.

**PIO3~PIO4 (pin 7, 8)**

Programmable digital I/O lines. All PIO lines can be configured through software to have either weak or strong pull-ups or pull-downs. Configuration for each PIO line depends on the application. Default configuration for all of the PIO lines is input with weak internal pull-up.

**PIO5~PIO8 or SPI (pin 10, 11, 12, 14)**

The four pins' function depends on SPI_PIO_SEL (pin 21).

When SPI_PIO_SEL is low, the four pins are programmable digital I/O lines. All PIO lines can be configured through software to have either weak or strong pull-ups or pull-downs. Configuration for each PIO line depends on the application. Default configuration for all of the PIO lines is input with weak internal pull-up.

When SPI_PIO_SEL is high, the four pins form a debug SPI slave interface. The interface is used to program, configure and debug the module. **Ensure the 4 SPI signals and the SPI_PIO_SEL are brought out to either test points or a header on PCB.**

**VDD_PIO (pin 13)**

1.2V~3.6V I/O supply voltage connection.

**PIO9~PIO11 (pin 18, 19, 20)**

Programmable digital I/O lines. All PIO lines can be configured through software to have either weak or strong pull-ups or pull-downs. Configuration for each PIO line depends on the application. Default configuration for all of the PIO lines is input with weak internal pull-up.

**SPI_PIO_SEL (pin 21)**

Set high to select the SPI slave debug interface. Set low to select PIOs. **Ensure the 4 SPI signals and the SPI_PIO_SEL are brought out to either test points or a header on PCB.**

**WAKE (pin 24)**

Set high to wake the module from hibernate. **Use an external pull-down for this pin.**

**I2C interface (SDA pin15, SCL pin16)**

I2C interface is used to communicate to external peripherals sensors.

# 2. Electrical Characteristics

## 2.1. Absolute Maximum Rating

**Table 2：Absolute Maximum Rating**

| Rating | Min | Max | Unit |
|---|---|---|---|
| Storage Temperature | -40 | +85 | °C |
| Battery (VDD_BAT) operation* | 1.8 | 3.6 | V |
| I/O supply voltage | -0.4 | +3.6 | V |
| Other Terminal Voltages except RF | Vss-0.4 | VDD+0.4 | V |

* Short-term operation up to a maximum of 10% of product lifetime is permissible without damage, but output regulation and other specifications are not guaranteed in excess of 4.2V.

### 2.2. Recommended Operation Conditions

**Table 3 Recommended Operation Conditions**

| Operating Condition | Min | Typical | Max | Unit |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Operating Temperature Range | -30 | -- | +70 | °C |
| Battery (VDD_BAT) operation | 1.8 | -- | +3.6 | V |
| I/O Supply Voltage (VDD_PIO) | 1.2 | -- | +3.6 | V |

## 2.3. I/O Characteristics

**Table 4 Digital I/O Characteristics**

| **Input Voltage Levels** | **Min** | **Typical** | **Max** | **Unit** |
|---|---|---|---|---|
| $V_{IL}$ input logic level low | -0.4 | - | 0.4 | V |
| $V_{IH}$ input logic level high | 0.7 x VDD | - | VDD + 0.4 | V |
| $T_r/T_f$ | - | - | 25 | ns |
| **Output Voltage Levels** | **Min** | **Typical** | **Max** | **Unit** |
| $V_{OL}$ output logic level low, $I_{OL}$ = 4.0mA | - | - | 0.4 | V |
| $V_{OH}$ output logic level high, $I_{OH}$ = -4.0mA | 0.75 x VDD | - | -- | V |
| $T_r/T_f$ | - | - | 5 | ns |
| **Input and Tri-state Current** | **Min** | **Typical** | **Max** | **Unit** |
| With strong pull-up | -150 | -40 | -10 | µA |
| With strong pull-down | 10 | 40 | 150 | µA |
| With weak pull-up | -5.0 | -1.0 | -0.33 | µA |
| With weak pull-down | 0.33 | +1.0 | 5.0 | µA |
| $C_I$ Input Capacitance | 1.0 | - | 5.0 | pF |

**Table 5 AIO Characteristics**

| **Input Voltage Levels** | **Min** | **Typical** | **Max** | **Unit** |
|---|---|---|---|---|
| AIO | 0 | - | 1.3 | V |

**Table 6 ESD Protection**

| **Condition** | **Class** | **Max Rating** |
|---|---|---|
| Human Body Model Contact Discharge per JEDEC EIA/JESD22-A114 | 2 | 2000V (all pins) |
| Machine Model Contact Discharge per JEDEC EIA/JESD22-A115 | 200V | 200V (all pins) |
| Charged Device Model Contact Discharge per JEDEC EIA/JESD22-C101 | III | 500V (all pins) |

## 2.4. Power Consumption

The current consumption are measured at the VDD_BAT.

**Table 7 Current Consumption**

| Mode | Description | Total typical current at 3V |
|---|---|---|
| Dormant | All functions are shutdown. To wake up toggle the WAKE pin | <600nA |
| Hibernate | VDD_PIO = ON, REFCLK = OFF, SLEEPCLK = ON | <1.5uA |
| Deep sleep | VDD_PIO = ON, REFCLK = OFF, SLEEPCLK = ON, RAM = ON, digital circuits = ON, 1ms wake-up time | <5uA |
| Idle | VDD_PIO = ON, REFCLK = ON, SLEEPCLK = ON, RAM = ON, digital circuits = ON, 1us wake-up time | ~1mA |
| RF RX /TX active | - | ~16mA @3V peak |

# 3. Physical Interfaces

## 3.1. Power Supply

The module integrates internal regulators so simply connect a 3V coin battery with a >100uF capacitor at pin VDD_BAT can power the module.

## 3.2. Internal Antenna

The module integrates an on-board chip antenna so there's no need to use antenna on customer's PCB. Simply pay attention to leave enough clearance for the antenna.

## 3.3. PIO

9 PIOs are provided (4 are multiplexed with SPI debug interface). They are powered from VDD_PIO.

PIO lines are software-configurable as weak pull-up, weak pull-down, strong pull-up or strong pull-down.

**Note:**

At reset all PIO lines are inputs with weak pull-downs.

Any of the PIO lines can be configured as interrupt request lines or as wake-up lines from sleep modes.

## 3.4. AIO

3 AIOs are provided. Their functions depend on software. They can be used to read or output a voltage between 0V to 1.35V. They can also be used as a digital PIO.

## 3.5. UART

This is a standard UART interface for communicating with other serial devices. The UART interface provides a simple mechanism for communicating with other serial devices using the RS232 protocol.

The UART CTS and RTS signals can be assigned to any PIO pin by the on-chip firmware.

**Table 8 Possible UART Settings**

| Parameter | | Possible Values |
|---|---|---|
| Baud Rate | Minimum | 1200 baud (≤2%Error) |
| | | 9600 baud (≤1%Error) |
| | Maximum | 2M baud (≤1%Error) |
| Flow Control | | RTS/CTS or None |
| Parity | | None, Odd or Even |
| Number of Stop Bits | | 1 or 2 |
| Bits per Byte | | 8 |

## 3.6. I2C Master

The module can act as an I2C master when configured by software. Any two PIOs can be configured as I2C_SCL and I2C_SDA.

## 3.7. SPI Master

The module can act as an SPI master (mode 0) when configured by software. Any four PIOs can be configured as SPI_CLK, SPI_CS#, SPI_DIN and SPI_DOUT. The clock rate of the software SPI is around 470kHz.

## 3.8. SPI Debug

The SPI Debug interface is chosen when SPI_PIO_SEL is high. The interface is used to program and debug the module. So always place test points or header on PCB for this interface and SPI_PIO_SEL.

# 4. Software Stacks

NVC-MDCS71 is a single mode Bluetooth 4.0 module. It can support all GATT-based profiles. Several profiles have been developed such as Healthy Thermometer Profile. Contact with the sales agent for support for more profiles and applications with iNovaLE stack.

## 4.1. iNovaLE Stack

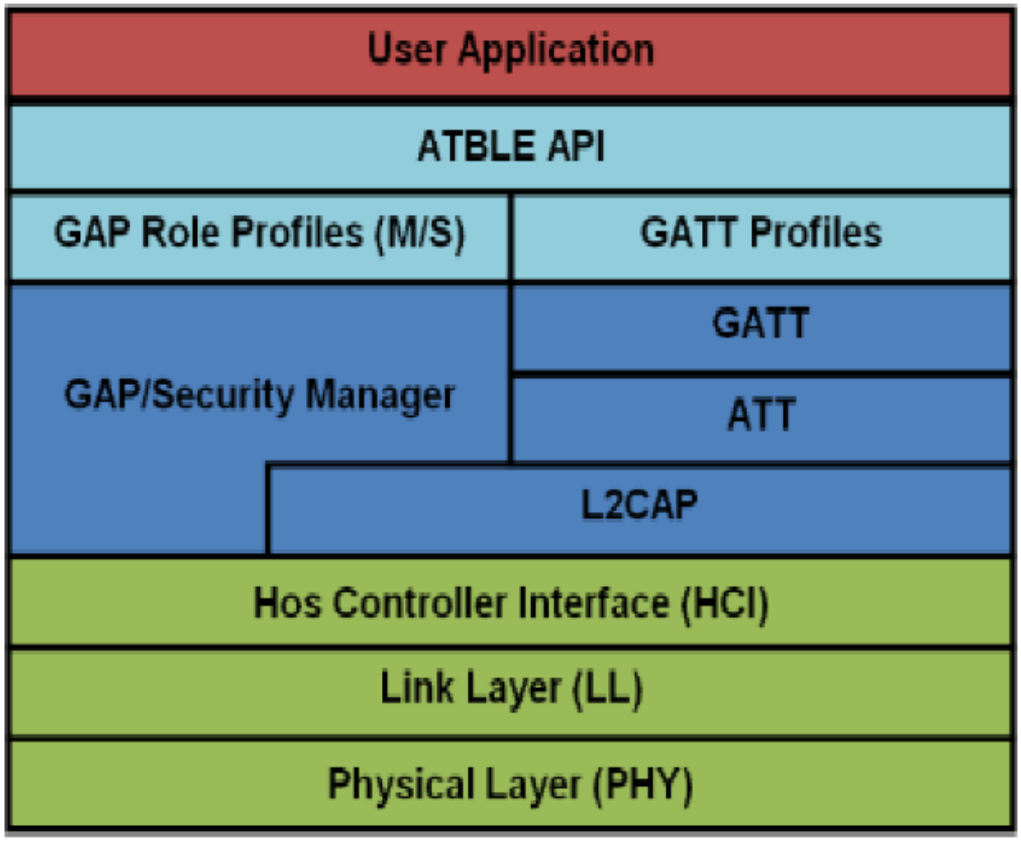


**Figure 2： iNovaLE Stack**

# 5. Reference Design

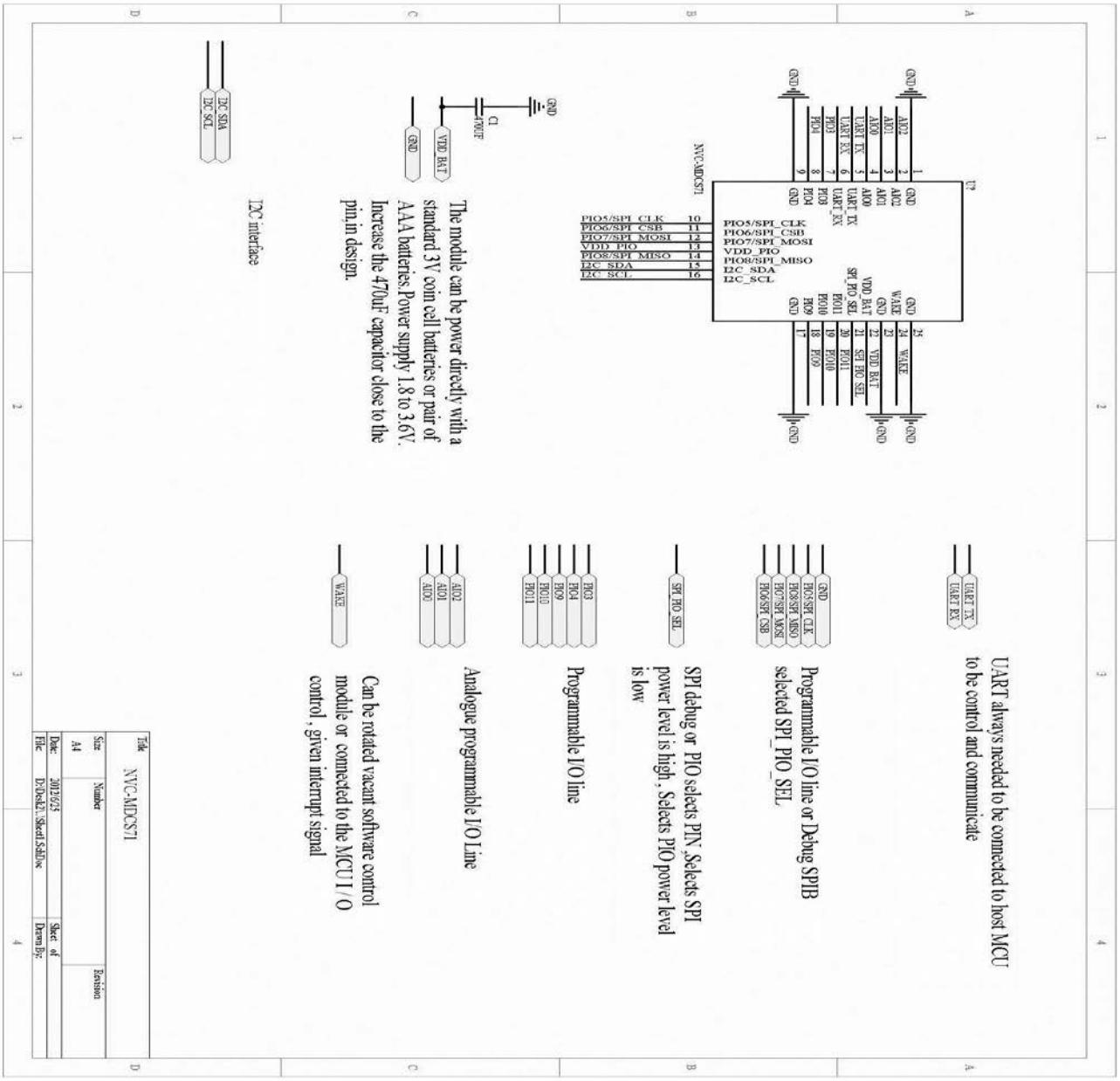


**Figure 3： Reference Design**

# 6. Layout and Soldering Considerations

## 6.1. Soldering Recommendations

NVC-MDCS71 is compatible with industrial standard reflow profile for Pb-free solders. The reflow profile used is dependent on the thermal mass of the entire populated PCB, heat transfer efficiency of the oven and particular type of solder paste used. Consult the datasheet of particular solder paste for profile configurations.

NovaComm Technologies will give following recommendations for soldering the module to ensure reliable solder joint and operation of the module after soldering. Since the profile used is process and layout dependent, the optimum profile should be studied case by case. Thus following recommendation should be taken as a starting point guide.

- Refer to technical documentations of particular solder paste for profile configurations
- Avoid using more than one flow.
- Reliability of the solder joint and self-alignment of the component are dependent on the solder volume. Minimum of 150 □m stencil thickness is
- Aperture size of the stencil should be 1:1 with the pad size.
- A low residue, “no clean” solder paste should be used due to low mounted height of the component.

## 6.2. Layout Guidelines

It is strongly recommended to use good layout practices to ensure proper operation of the module. Placing copper or any metal near antenna deteriorates its operation by having effect on the matching properties. Metal shield around the antenna will prevent the radiation and thus metal case should not be used with the module. Use grounding vias separated max 3 mm apart at the edge of grounding areas to prevent RF penetrating inside the PCB and causing an unintentional resonator. Use GND vias all around the PCB edges. Figure 4 illustrates recommended PCB design around the antenna of NVC-MDCS71 when the module is placed at the edge of a PCB.

Do not place copper on the top layer under the module, as shown in Figure 4. The module has vias on the area shown, which can cause short circuit if there is copper underneath. Any metal placed closer than 20 mm in any direction from the antenna changes the matching properties and thus will considerably deteriorate the RF performance of the module.

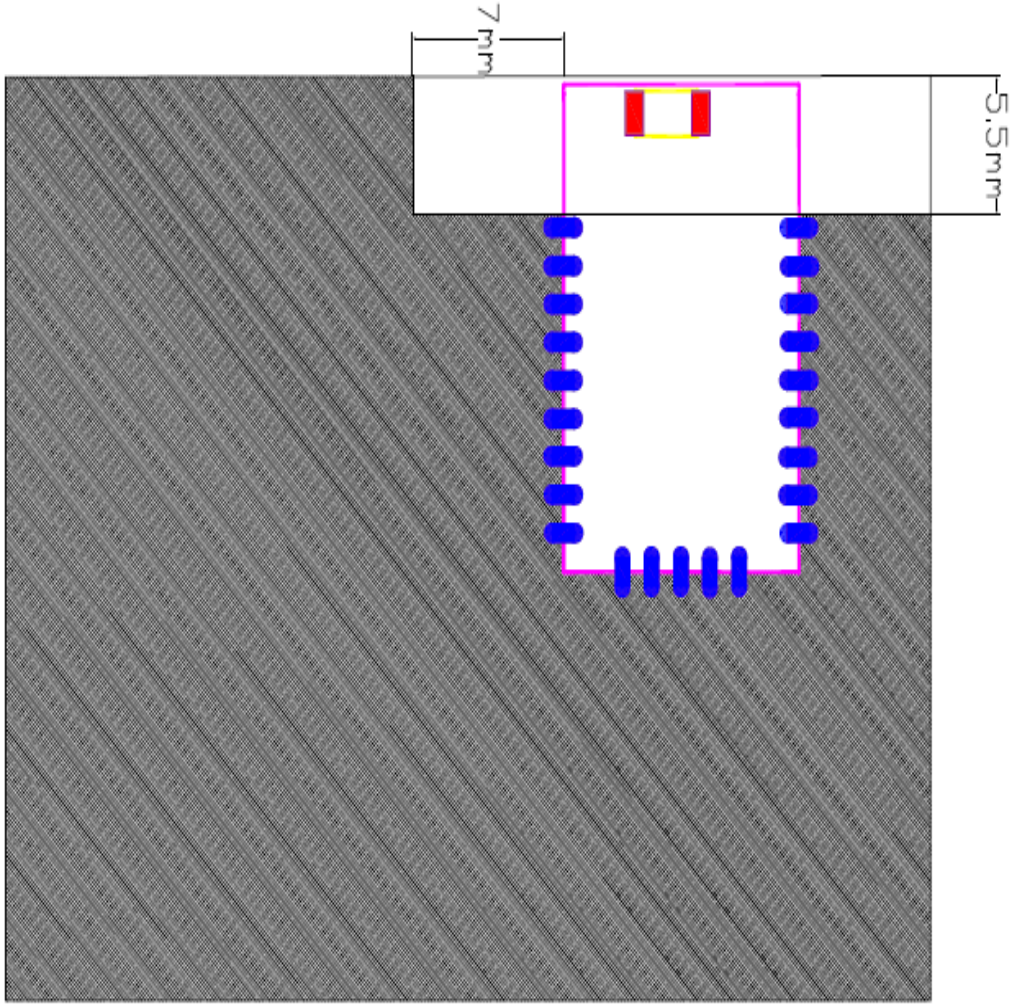


**Figure 4: Placement of the Module on a Main Board**

# 7. Physical Dimensioins

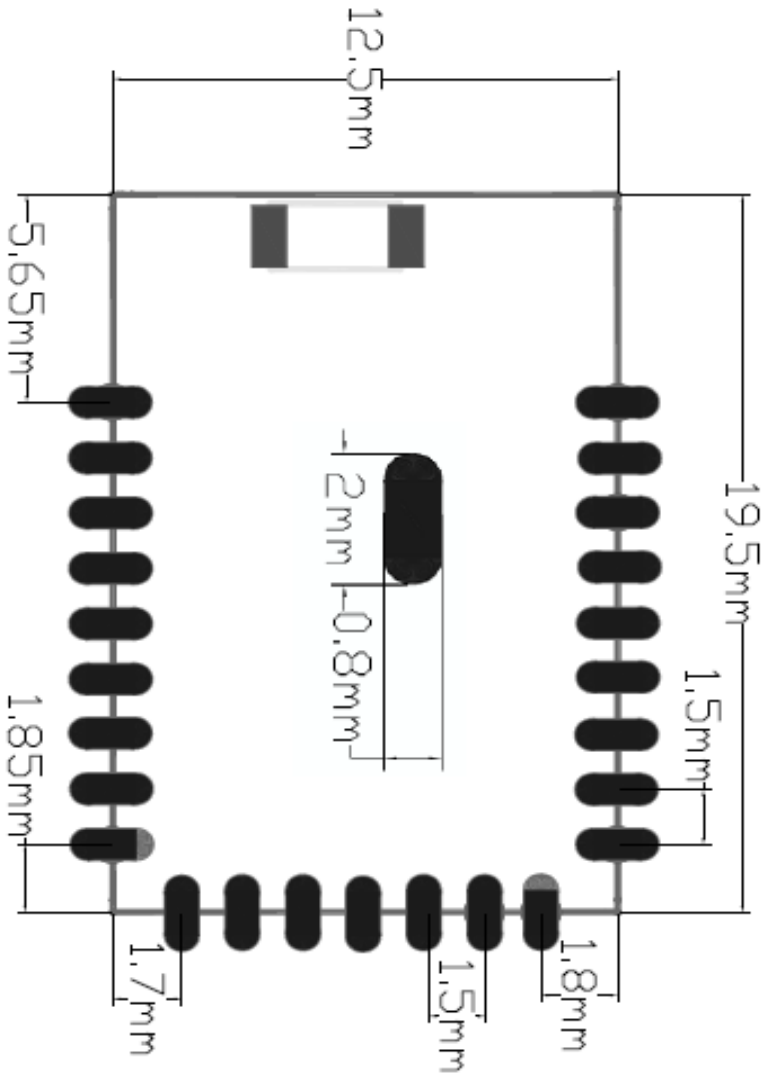


**Figure 5： Physical Dimensions and Recommended Footprint (Unit: mm, Deviation:0.02mm)**

# 8. Package

# 9. Contact Information

Sales: sales@novacomm.cn

Technical support: support@novacomm.cn

Orders: orders@novacomm.cn

Phone: +86 21 60453799

Fax: +86 21 60453796

Street address: 902A, #560 Shengxia Rd., ZJ Inno Park, Shanghai 201203, China