# Wireless Transceiver Serial UART (1km Range) – HC-12 SI4438 Module

The **HC-12 SI4438 Wireless Transceiver** is a long-range communication module designed for reliable, low-power, and high-performance serial data transmission. With a communication range of up to **1 kilometer in open space**, this compact device is an ideal solution for engineers, hobbyists, and IoT developers who require stable wireless connectivity between microcontrollers or embedded systems.

Operating on the **433 MHz frequency band**, this module provides robust data transfer while maintaining low interference, making it perfect for projects that demand secure and consistent communication. Whether you're building a remote monitoring system, wireless sensor network, or automation project, the HC-12 offers both flexibility and efficiency.
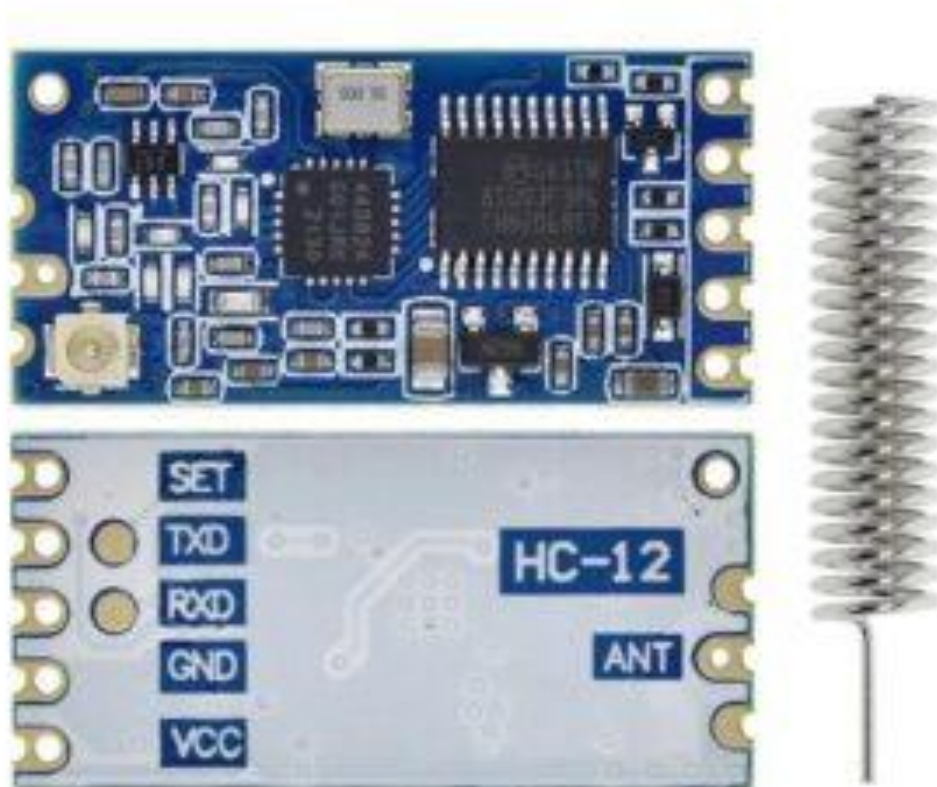
# 🔧 Key Features

- **Long-Range Communication** – Up to 1km in open space.
- **UART Interface** – Simple serial communication with microcontrollers and development boards.
- **Adjustable Baud Rate** – Supports multiple data rates for flexible project requirements.
- **Low Power Consumption** – Energy-efficient operation suitable for battery-powered projects.
- **Compact Size** – Easy to integrate into small electronics projects.
- **High Stability** – Built with the SI4438 chip for consistent performance.
- **Multiple Channels** – Supports up to 100 communication channels to minimize interference.
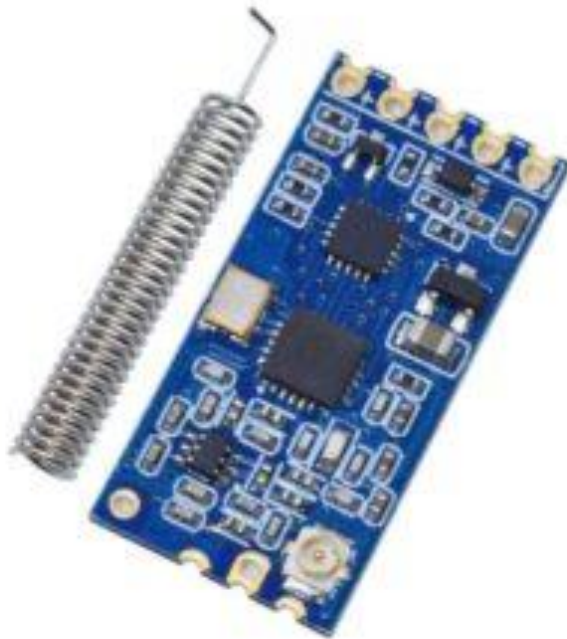


# ⚡ Technical Specifications

- **Model:** HC-12 (SI4438)
- **Operating Frequency:** 433.4–473.0 MHz
- **Communication Range:** Up to 1km (open environment)
- **Interface:** UART (serial, TTL level)
- **Baud Rate:** 1200 to 115200 bps (default 9600 bps)

- **Modulation Type:** GFSK
- **Supply Voltage:** 3.2V – 5.5V
- **Transmit Power:** Up to 100mW (20dBm)
- **Antenna:** External antenna included for maximum performance
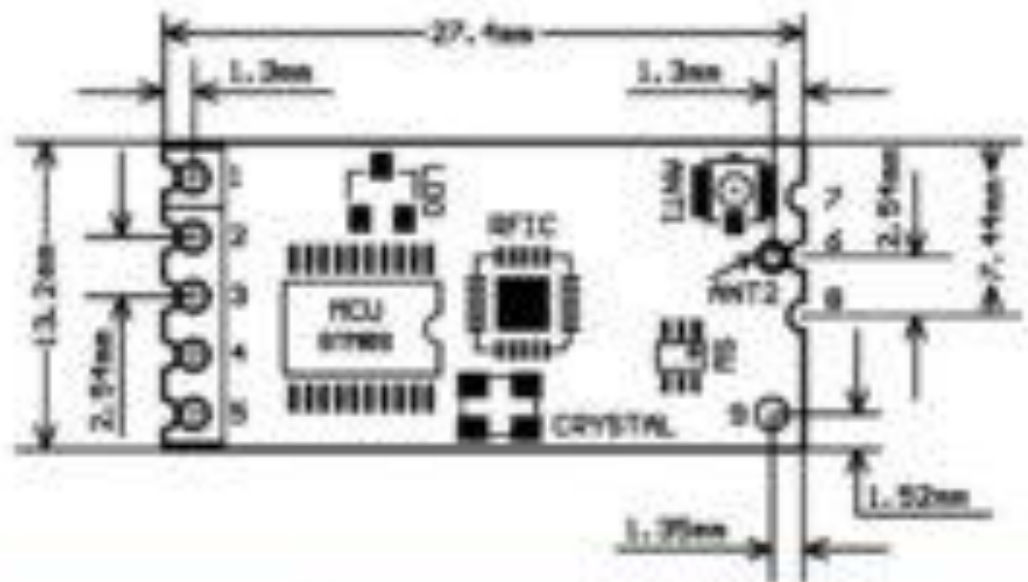- **Dimensions:** Compact PCB design for easy integration

# 🌐 Applications

The HC-12 module is a flexible solution for a wide range of projects that need reliable wireless communication:

1. **IoT Networks** – Connect sensors and devices wirelessly for smart home or smart city projects.
2. **Remote Monitoring Systems** – Collect and transmit data from remote locations such as farms, weather stations, or industrial plants.
3. **Robotics** – Enable wireless control and communication between robots and controllers.
4. **Wireless Data Logging** – Send real-time sensor data to a central hub without physical wiring.

5. **Automation** – Integrate into smart agriculture, greenhouse monitoring, or industrial automation setups.
6. **Education** – Excellent for students and researchers learning about wireless communication protocols.



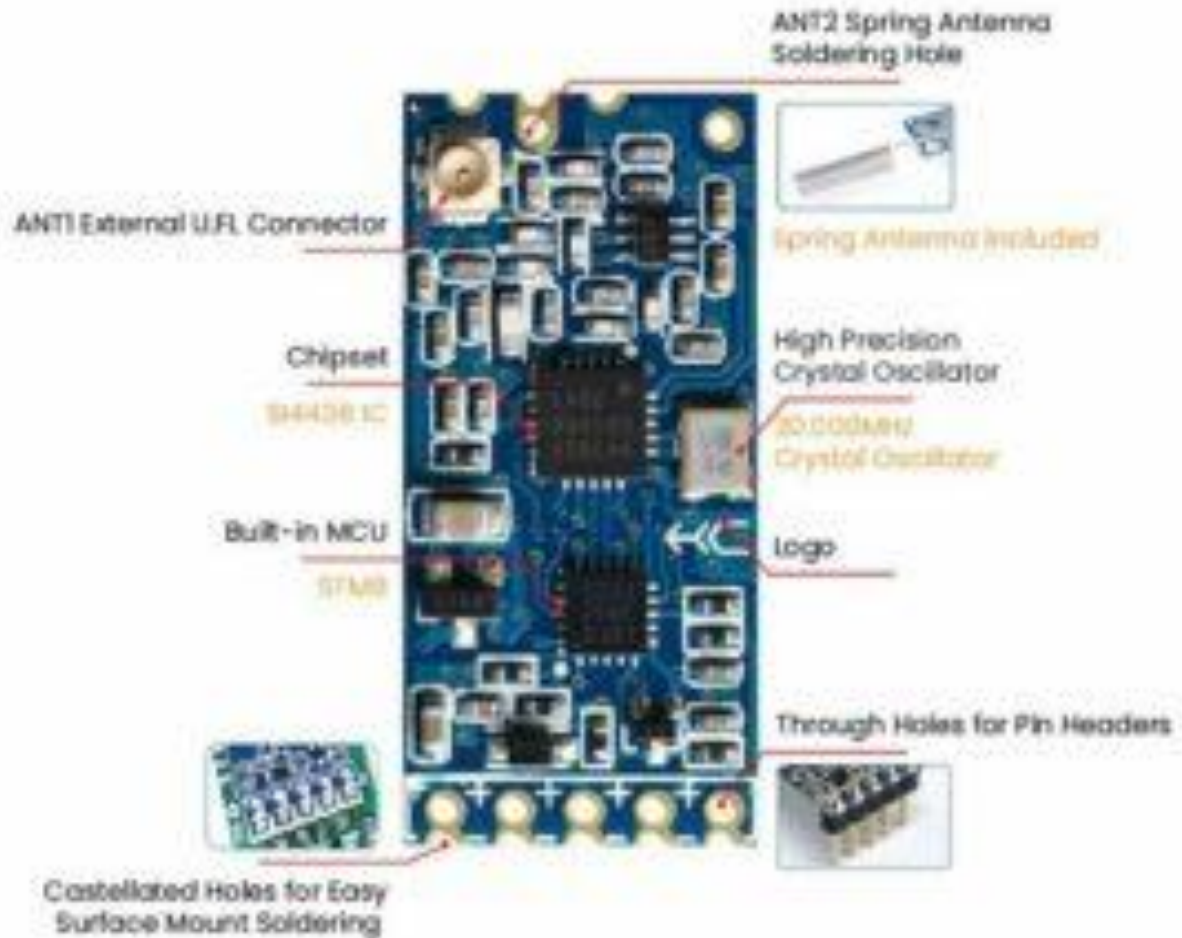| Pin | Definition | I/O direction | Explain |
|---|---|---|---|
| 1 | VCC | | Power input, DC3.2V-5.5V, the load capacity is more than 200mA.(Note: if the module needs to work in state for a long time, it is recommended to connect in series when the power supply voltage exceeds 4.5 heating of the module's built-in LDO.) |
| 2 | GND | | Public land |
| 3 | RXD | Input, internal 3.3k pull-up resistor | URAT input port, TTL level, internally connected w high-speed diode |
| 4 | TXD | Output | URAT output port, TTL level, 200 Ω resistor conne in series internally |
| 5 | SET | Input, internal 10k pull-up resistor | Parameter setting control pin, effective at low level 1k Ω resistor connected in series internally |
| 6 | ANT | RF input/output | 433MHz antenna pin |
| 7 | GND | | Public land |
| 8 | GND | | Public level |
| 9 | NC | | No connection, for fixing, compatible with HC-11 m |
| ANT1 | ANT | RF input/output | IPEX20279-001E-03 antenna socket |
| ANT2 | ANT | RF input/output | 433MHz spring antenna welding hole |

# 🔒 Reliability and Performance

One of the standout advantages of the HC-12 SI4438 module is its **long-range communication combined with low power consumption**. This makes it particularly useful for projects where devices are spread out over a wide area but must maintain efficient energy usage.

The built-in error detection mechanism ensures that data packets are transmitted and received accurately, reducing the chances of data loss even in noisy environments. Additionally, its support for multiple channels means you can avoid interference by selecting the most stable frequency for your project.

## ✅ Why Choose This Wireless UART Module?

- Simple serial interface makes it easy to use with **Arduino, ESP8266, ESP32, STM32, Raspberry Pi**, and other microcontrollers.
- Long-distance capability without the need for Wi-Fi or GSM.
- Reliable communication in both DIY and professional applications.
- Affordable, compact, and easy to implement.

ANT2 Spring Antenna
Soldering Hole

Spring Antenna Included

ANT1 External U.FL Connector

High Precision
Crystal Oscillator

20.000MHz
Crystal Oscillator

Chipset

SI4438 IC

Built-in MCU

STM8

Logo

Through Holes for Pin Headers

Castellated Holes for Easy
Surface Mount Soldering

# Conclusion

The **HC-12 SI4438 wireless transceiver module** is a powerful and dependable choice for anyone needing long-range UART communication. With its **1km range, low power operation, and high stability**, it's suitable for IoT projects, automation, robotics, and educational purposes. Its compatibility with a wide range of development boards makes it an excellent addition to your electronics toolkit.

Whether you are creating a wireless sensor network, developing a remote control system, or simply learning about RF communication, this module provides the **perfect balance of performance, affordability, and ease of use**.