# DRF1212D10
## Low Power ISM RF Transceiver Module V4.10

### Features

- FSK transceiver Module
- 433Mhz ISM frequency band
- 40k bps FSK data rate
- Multiple channels
- 10dBm Max. output power
- Baud rate configurable
- Two 256 bytes data buffers
- Standby current < 1.5uA
- Supply voltage 2.1~3.6V

DRF1212D10-043A

### Application

- Home automation
- Security alarm
- Telemetry
- Automatic meter reading
- Contactless access
- Wireless data logger
- Remote motor control
- Wireless sensor network

DRF1212D10-043S1/S2

### DESCRIPTION

DRF1212D10 is a low-cost sub-1 GHz transceiver module designed for operations in the unlicensed ISM (Industrial Scientific Medical) and LPRD bands. FSK (Frequency Shift Keying) modulation/demodulation, multi-channel operation, high bandwidth efficiency and anti-blocking performance make DRF1212D10 modules easy to realize the robust and reliable wireless link.

The module can be configured to work in different channels with 200 KHz space. It adopts high efficient looped interleaving EDAC (Error Detection and correction) coding with coding gain up to 3dB which keeps in advance in error correction and coding efficiency over normal FEC (Forward Error Correction) coding. Because of its high reliability in correction, modules can filter error and fake information automatically and realize truly transparent wireless link, which makes DRF1212D10 very suitable in the rigid communication environment.

DRF1212D10 integrates two 256 bytes buffer. When the buffer is empty, users can transfer nearly

217 bytes data per time and even limitless data transfer can be achieved as long as RF data rate (RF module to RF module) is configured to be faster than UART data rate (MCU to RF module). DRF1212D10 provides standard UART/TTL interface. Users can choose seven data rates and three parity checks which make DRF1212D10 possibly tailor-made for different applications. DRF1212D10 operates at 2.1~3.6V with extra low power consumption. The current in sleep mode can be minimized to 1.5uA and the current in receive mode no more than 3mA makes modules very suitable for battery powered-up applications.

## PIN FUNCTIONS

| PIN | DIP-A | Function | SMD-S1/S2 | Description |
|---|---|---|---|---|
| 1 | GND | Ground | GND | Ground (0V) |
| 2 | VCC | Power | VCC | Power supply |
| 3 | SETA | Input | SETB | **SETA**: Parameter setting A; pull-up resistor: 47K Ohm |
| 4 | RXD | Input | AUX | **RXD**: UART input, TTL level; pull-up resistor:47K Ohm |
| 5 | TXD | Output | SETA | **TXD**: UART output, TTL level |
| 6 | AUX | Output | TXD | **AUX**: Data In/out indication |
| 7 | SETB | Input | RXD | **SETB**: Parameter setting B; pull-up resistor: 1M Ohm |
| 8 | --- | | GND | Ground (0V) |
| 9 | --- | | GND | Ground (0V) |
| 10 | --- | | ANT | Antenna Port |

**Table 1 DRF1212D10 Pin functions**

## ELECTRICAL SPECIFICATIONS

| Symbol | Parameter (condition) | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| VCC | Supply Voltage | 2.1 | | 3.6 | V |
| Temp | Operating temperature range | -20 | 25 | 70 | °C |
| RH | Operating relative humidity | 10 | | 90 | % |
| Freq | Frequency range | 430 | | 437 | MHz |
| $F_{DEV}$ | Modulation deviation | | 67 | | KHz |
| Mod | Modulation type | | FSK | | |
| $I_{DD}$ | Receive mode @1K bps | | 2.7 | | mA |
| | Receive mode @10K bps | | 3.0 | | mA |
| | Receive mode @40K bps | | 4.0 | | mA |
| | Transmit mode @ 0dBm | | 20 | | mA |
| | Transmit mode @ 10dBm | | 35 | | mA |
| | Sleep mode | | 1.5 | 2.5 | uA |
| Pout | Maximum output power | | | 10 | dBm |

| | | | | | |
|---|---|---|---|---|---|
| Sen | Receiving sensitivity @1K bps | | -113 | | dBm |
| | Receiving sensitivity @10K bps | | -107 | | dBm |
| $DR_{FSK}$ | FSK data rate | 1 | | 40 | Kbps |
| $DR_{IN}$ | UART data rate | 1.2 | | 57.6 | Kbps |
| $T_R$(1) | Wake-up & Search preamble time .@1K bps | | 20 | | ms |
| | @2K bps | | 12 | | ms |
| | @5K bps | | 6.2 | | ms |
| | @10K bps | | 4.2 | | ms |
| | @20K bps | | 3.3 | | ms |
| | @40K bps | | 2.8 | | ms |
| $T_S$(2) | Switching time | | 20 | | us |
| $CH_{BW}$ | Channel spacing | | 200 | | KHz |
| $Z_{ANT}$ | Antenna Impedance | | 50 | | Ohm |

**Table 2 DRF1212D10 Electrical Specifications**

**Note:**

(1). If the receiver is configured to work in PWR-saving mode, it will wake up at fixed interval which can be set through MCU or configuration board. The parameter $T_R$ is the total time which includes the time that receiver resumes normal receive status from sleep mode (crystal, I/O port and other circuits are triggered) and the time (about 16-bit long) that receiver searches the preamble.

(2). When DRF1212D10 is in sleep mode, users can set the pin SETA of module to low to activate it. The parameter $T_S$ refers the time which the module wakes up from sleep mode and monitors the serial port if there is any data from MCU.

## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Min. | Max. | Units |
|---|---|---|---|---|
| VCC | Supply Voltage | -0.3 | 3.7 | V |
| $V_I$ | Input voltage | -0.3 | VCC+0.3 | V |
| $V_O$ | Output voltage | -0.3 | VCC+0.3 | V |
| $T_{ST}$ | Storage temperature | -55 | 125 | ℃ |

**Table 3 DRF1212D10 Maximum Ratings**

## APPLICATION INFORMATION

### 1. CODING FORMAT

| PREAMBLE | SYNCWORD | ID (only for S2) | DATA+FEC+CRC |
|---|---|---|---|

**Table 4 DRF1212D10 Coding Format**

The preamble is alternative “1010” codes which is used to make the clock of receiver synchronous with transmitter. In normal conditions, 32-bit preamble is enough for use. When DRF1212D10 works in power-saving mode, the preamble also can be functioned to wake up the receiver and it must be long enough in order to obtain such a function.

E.g. if the receiver is configured to wake up at the interval of one second, it wakes up every other second and searches the preamble for 16-bit long time. In this case the transmitter must be configured to work in mode 2 so longer preamble code plus synchronous word will be sent, which means the receiver can detect the preamble in wake-up period successfully.

## 2. WORKING MODE

DRF1212D10 can work in 4 different modes which can be configured through SETA and SETB pins.

| Mode | SETA | SETB | Description | Working Status |
|---|---|---|---|---|
| **1** | 0 | 0 | Normal | Serial port enabled. Module works in continuous receive conditions. When data comes from MCU, AUX pin is set to low and module is switched to transmit status; then 32bits preamble and synchronous word will be sent. After data is transferred, AUX pin will be sent to high and the module will enter into continuous receiver status again.<br>In this mode the preamble in transmitted data package is not long so the receiver module must work in Mode 1 or 2. When receiver module detects data in the present wireless channel, it will verify the data and set AUX pin to low and then output data to serial port after data is confirmed correctly. |
| **2** | 0 | 1 | Wake-up | Serial port enabled. Module works in continuous receive conditions. When data comes from MCU, AUX pin is set to low and module is switched to transmit status; then preamble [ 1 wake-up period (E.g. 1s)+ 32bits] and synchronous will be sent. After data is transferred, AUX pin will be sent to high and the module will enter into continuous receiver status again. Because the longer preamble is introduced, the receiver module can work in Mode1, 2 or 3.<br>When receiver module detects data in the present wireless channel, it will verify the data and set AUX pin to low and then output data to serial port after data is confirmed correctly. |
| **3** | 1 | 0 | PWR-saving | Serial port disabled. The receiver module wakes up at a preset period and search if there is any data coming in present channel. It will enter into sleep status when no signal is |

| | | | | |
|---|---|---|---|---|
| | | | | detected. As soon as the preamble is sniffed out, the receiver module will keep in receive status and wait for the synchronous word; then it will verify the data and set AUX pin to low. After 5ms delay, the receiver module outputs data to serial port.<br>After data is transferred, the serial port is disabled and AUX pin is set to high. The module will enter into sleep status again and wait for the next wake-up when mode setting isn't changed |
| **4** | 1 | 1 | Sleep | Serial port disabled. The module stays in sleep status. In this mode. The RF circuit, the main clock circuit and peripherals are closed. The power consumption is extra low (about 1.5uA). |

**Table 5 DRF1212D10 Working Mode**

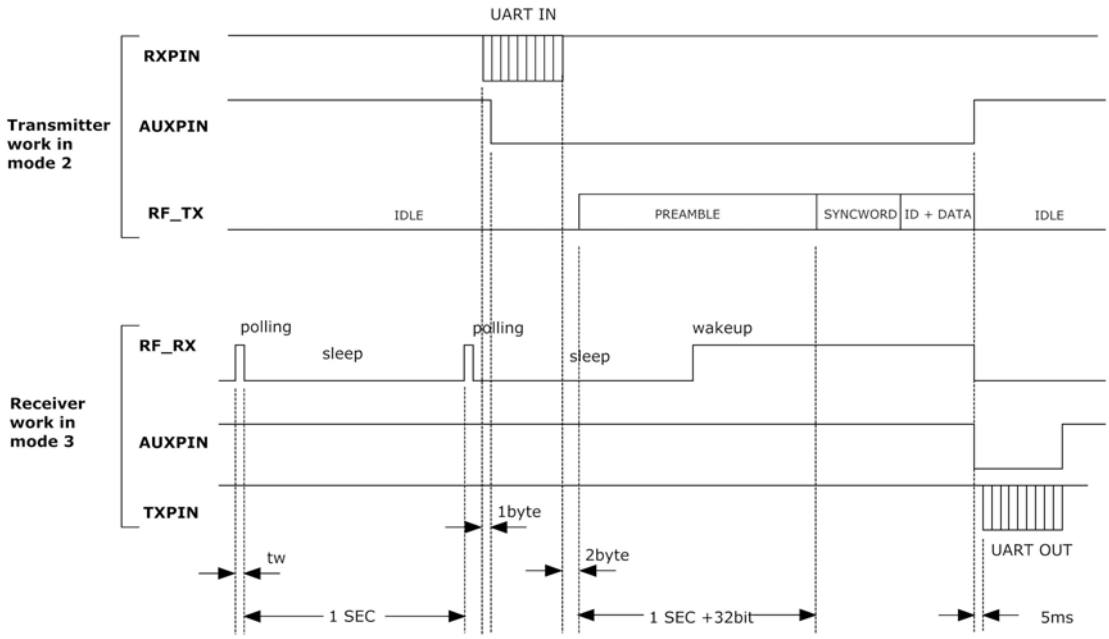


**Figure1: Transmit Module in Mode 2 and Receive Module in Mode 3**

DRF1212D10 module enters into sleep mode by software control. In sleep mode the levels of serial port are kept in corresponding status and can be switched to any other status. It only needs 20us to wake up the module from sleep mode, which means data can be output to serial port after SETA pin is set to low more than 20uS. When the module is in transmit or receive process, it only can enter PWR-saving or sleep mode after the transmitting or receiving process is finished even though the SETA pin is set to high. Users can take this advantage to set SETA pin to high and make the module enter into sleep status without waiting the finish of present transmit because the module will detect SETA pin after a data package is transferred.

## 3. PARAMETER SETTING

Users can configure the parameters (frequency, data rate, output power, etc.) of RF modules by MCU or PC through converter boards DAC01 or DAC02.

- **BY PC** This mode is only available for DIP package. The interface of DRF1212D10 is UART/TTL. If connecting it to PC, users need to use a level converter board to transform the different levels. Dorji Applied Technologies provides converter boards DAC01 (TTL-to-RS232) and DAC02 (TTL-to-USB) for configuration.

  Firstly users need to insert module into converter board and connect converter board to PC by cable, then open DORJI RF software. After that the status column of tool should display "Found Device". Users then can read/write the module. For more details, please check the operation manuals of converter boards on accessory page.

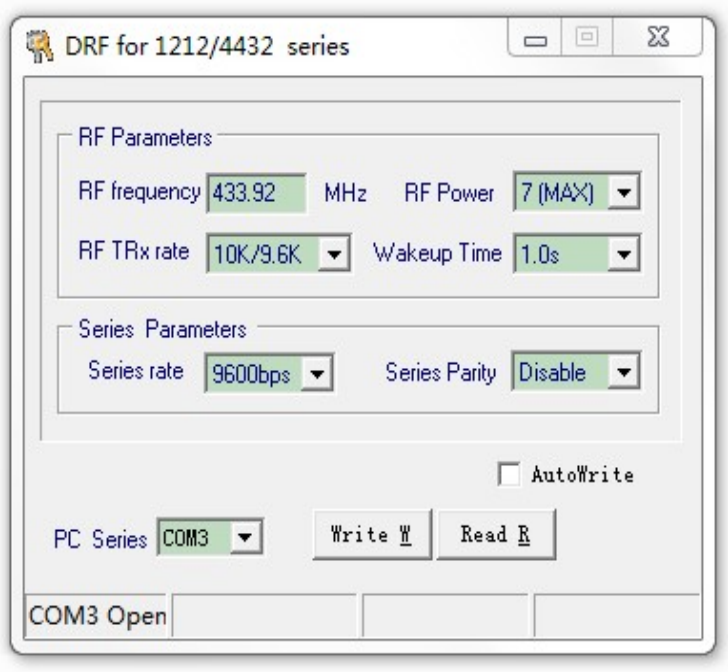


**Figure 2: DRF TOOL for DRF1212D10-043A Module**

- **BY MCU**. The module can work normally after powering on for 50ms (T1) or more. When configuring the module, users need to switch it to Mode 4 and monitor AUX pin which should be in high level without any transmit or receive. The module then can be configured after it enters into sleep mode for 10uS or more (T2).

  When commands are output to RXD pin, the module will be waken up no matter what status of UART interface is in and it will use 9600 bps (data rate) and no parity check as default format to configure parameters. If the commands are set correctly, the module will feed back the written commands; then it will be reset and initialized. After 100ms (T4),

the module will work with the new parameters. Please note that if the commands are set incorrectly, the module will give no feedback but it will still be reset and initialized. Users can take this advantage to wake up modules in long-term sleep or reset the modules.

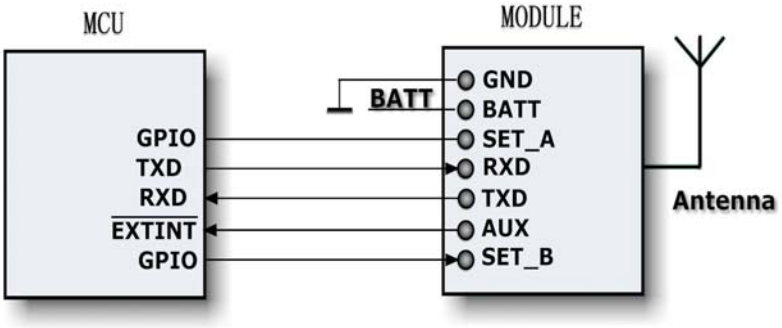


**Figure 3: Connecting Diagram Between DRF1212D10 and MCU**

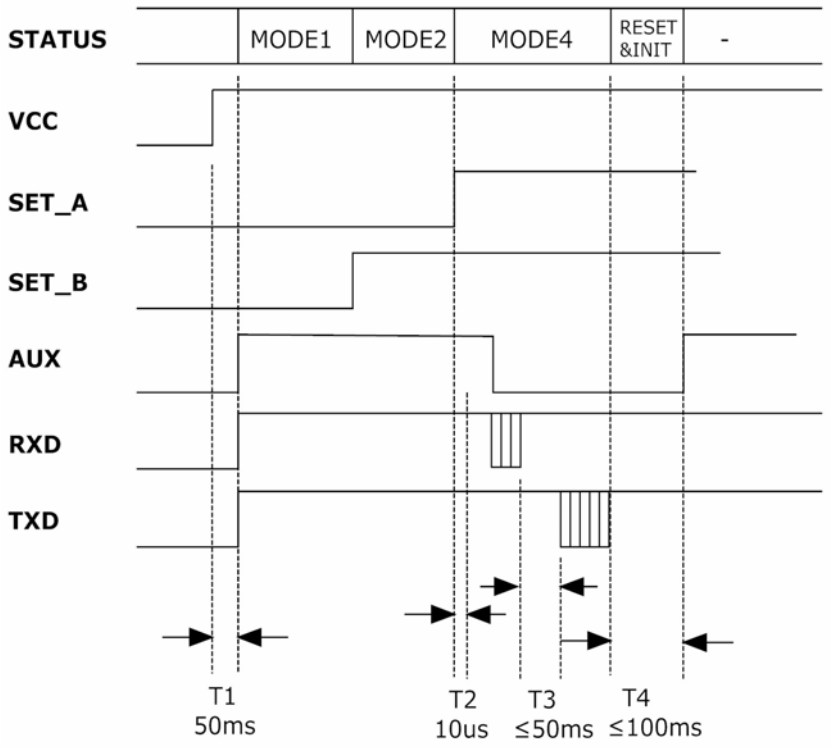


**Figure 4: Timing Sequence for Setting Parameters**

The commands of DRF1212D10 are in HEX format. The configuring data rate is 9600 bps and no parity check included. The command set include two commands: Read command and Write command.

SMD package DRF1212D10-043S1 and DRF1212D10-043S2 type are the same in dimensions. The only difference in function is that DRF1212D10-043S2 has group ID which means only modules with the same ID can communicate. DRF1212D10-043S1 doesn't contain ID so it's fully compatible with DIP package DRF1212D10-043D.

**1. DIP & S1 package**

**Read command:** 0xFF,0x56,0xAE,0x35,0xA9,0x55,0xF0
*Response:* 0x24, 0x24, 0x24+Freq+DR$_{FSK}$+P$_{OUT}$+DR$_{IN}$+Parity+T$_W$

**Write command:** 0xFF,0x56,0xAE,0x35,0xA9,0x55,0x90+Freq+DR$_{IN}$+P$_{OUT}$+DR$_{FSK}$+Parity+T$_W$
*Response:* 0x24, 0x24, 0x24+Freq+DR$_{FSK}$ +P$_{OUT}$+ DR$_{IN}$+Parity+T$_W$

**2. S2 package**

**Read command:** 0xFF,0x56,0xAE,0x35,0xA9,0x55,0xF0
*Response:* 0x24, 0x24, 0x24+Freq+DR$_{FSK}$+P$_{OUT}$+DR$_{IN}$+Parity+T$_W$+ID

**Write command:** 0xFF,0x56,0xAE,0x35,0xA9,0x55,0x90+Freq+DR$_{IN}$+P$_{OUT}$+DR$_{FSK}$+Parity+T$_W$+ID
*Response:* 0x24, 0x24, 0x24+Freq+DR$_{FSK}$ +P$_{OUT}$+ DR$_{IN}$+Parity+T$_W$+ID

| Parameter | Unit | Length | Explanation |
|---|---|---|---|
| Freq. | KHz | 3 | 433.92MHz = 0x06, 0x9F, 0x00 |
| DRFSK | K bps | 1 | 1, 2, 5,10, 20, 40 equals to 0x00,0x01,0x02,0x03,0x04,0x05 |
| POUT | dB | 1 | From 0 to 7 represents 0x00 to 0x07. One increment increases 3dBm. "0x07" equals to the Max. output power (10dBm). |
| DRIN | Kbps | 1 | 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6 equals to 0x00,0x01,0x02,0x03,0x04,0x05,0x06 |
| Parity | | 1 | 0x00: No parity; 0x01: Even parity; 0x02: Odd parity |
| TW | S | 1 | 0.05, 0.1, 0.2, 0.4, 0.6, 1, 1.5, 2, 2.5, 3, 4, 5 corresponding to 0x00~0x0b |
| ID | | 3 | 000001~FFFFFF, only available for S2 type |

**Table 6: DRF1212D10 Parameter Coding**

E.g. If the user wants to set the module work at Freq (433.92MHz), DR$_{FSK}$ (10K bps), P$_{OUT}$ (10 dBm), DR$_{IN}$ (9.6k bps), Parity (no parity), T$_W$ (1second wake-up period), the command for DIP or S1 type could be written as below:

**Write Command:** 0xFF,0x56,0xAE,0x35,0xA9,0x55,0x90, 0x06,0x9F,0x00, 0x03, 0x07, 0x03, 0x00,0x05

*Response:* 0x24,0x24,0x24, 0x06,0x9F,0x00, 0x03,0x07,0x03,0x00,0x05

For S2 type with ID 0x000001

**Write Command:** 0xFF,0x56,0xAE,0x35,0xA9,0x55,0x90, 0x06,0x9F,0x00, 0x03, 0x07, 0x03, 0x00,0x05, 0x00, 0x00, 0x01

*Response:* 0x24,0x24,0x24, 0x06,0x9F,0x00, 0x03,0x07,0x03,0x00,0x05, 0x00, 0x00, 0x01

DRF1212D10 module can monitor the field strength (RSSI) dynamically. If DRF1212D10 is in receive mode (SETA is low) and a positive pulse with width more than 200us is imposed on SETB, the module will output one byte field value at the falling edge of the pulse. The picture below shows the timing sequence.

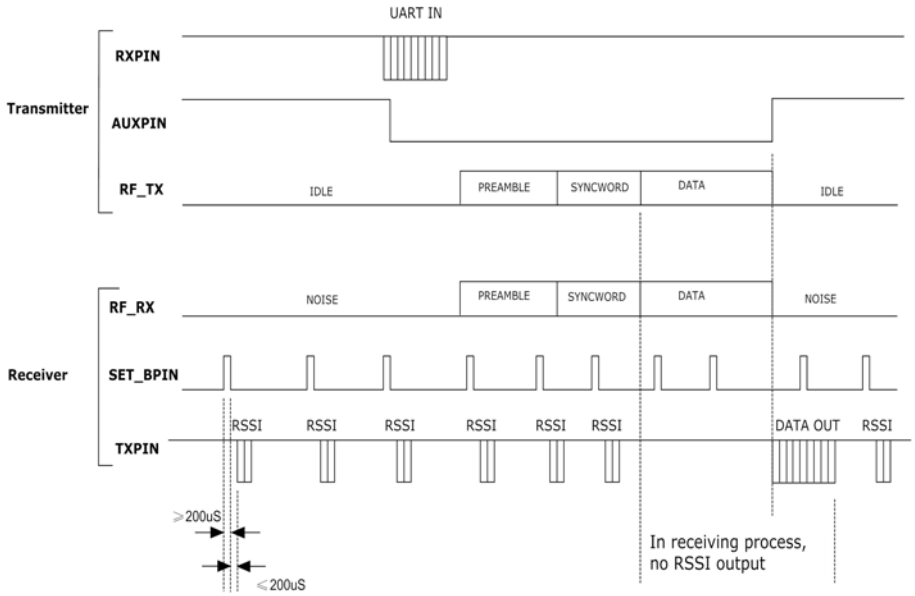


**Figure 5: RSSI Timing Sequence**

Even though the positive pulse is imposed on SETB, it does not guarantee the DRF1212D10 will output field value when it is in any of the conditions below:

1). the module is receiving data from MCU or is transmitting data.
2). the module has detected the syncword in receive mode and begin to receive data from other modules
3). The module received a data package and is transferring to external device by serial port.

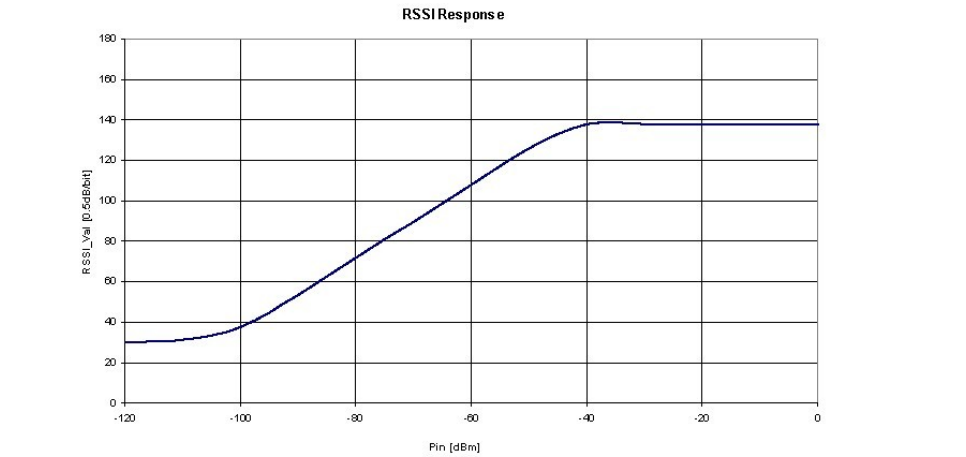


**Figure 6: RSSI Value vs Input Power**

Users can use this function to monitor frequency carrier simply. It can reduce the data bumping to some extent and improve the reliability of wireless communication link.

## MECHANICAL DATA

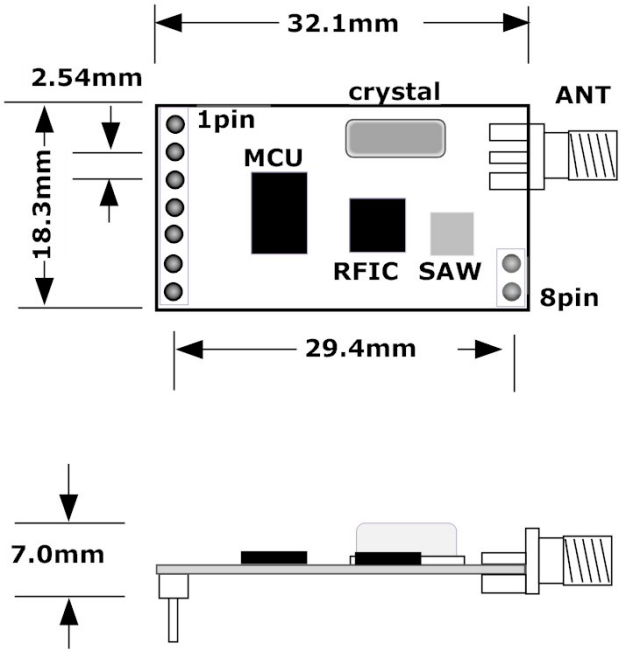


**Figure 5: DIP Package**

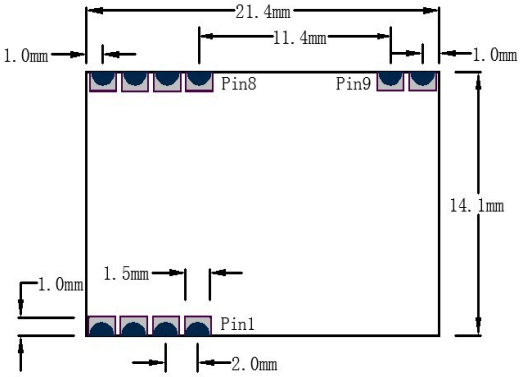


**Figure 6: SMD Package (S1 &S2)**

## ORDERING INFORMATION

**DRF 1212 D 10 — 043 A**
① ② ③④ ⑤ ⑥

| Num | Symbol | Meaning |
|---|---|---|
| ① | RF module | RF FSK module |
| ② | IC Type | SX1212 |
| ③ | Module Function | Data transmission |
| ④ | Power | 10dBm output power |
| ⑤ | Freq. Band | 043: 433MHz |
| ⑥ | Package | A: DIP package with SMA connector<br>S1: SMD package without ID<br>S2: SMD package with ID |

**Table 7: Ordering Information**

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