

RFM98PW/RFM95PW

Enhanced Power Long Range Transceiver Module

(The purpose of this RFM98PW/RFM95PW spec covers mainly for the hardware and RF parameter info of the module, For software info please refer to RF98/RF96 chip datasheets and demo program of HopeDuino™ Development Kit)

1. General Introduction

RFM98PW/RFM95PW module series' design is based on the high performance LoRa™ modulation technique RF98/RF96 chip, It operate at 169/433/470MHz (RFM98PW) and 868/915MHz(RFM95PW) ISM band , The low receive sensitivity(-136dBm) coupled with Enhanced +30dBm output power ensures extended range and improved link performance.



2. Features:

- LoRa™ Modem.
- 166dB maximum link budget.
- +30 dBm output power @433/470MHz band; +27 dBm output power @169 /868/915 MHz band.
- Programmable bit rate up to 300 kbps.
- High sensitivity: down to -136dBm.
- Low RX current of 13mA.
- FSK, GFSK, MSK, GMSK, LoRa™ and OOK modulation.
- Built-in bit synchronizer for clock recovery.
- Automatic RF Sense and CAD with ultra-fast AFC.
- Packet engine up to 256 bytes with CRC.
- Built-in temperature sensor and low battery indicator.
- SMD Package (35.4x18X3.85mm)

3. Typical Application:

- Long Range system
- Meter Reading
- Wireless data collection
- Automobile security system
- Home automation and security system

4. Pin Definition:

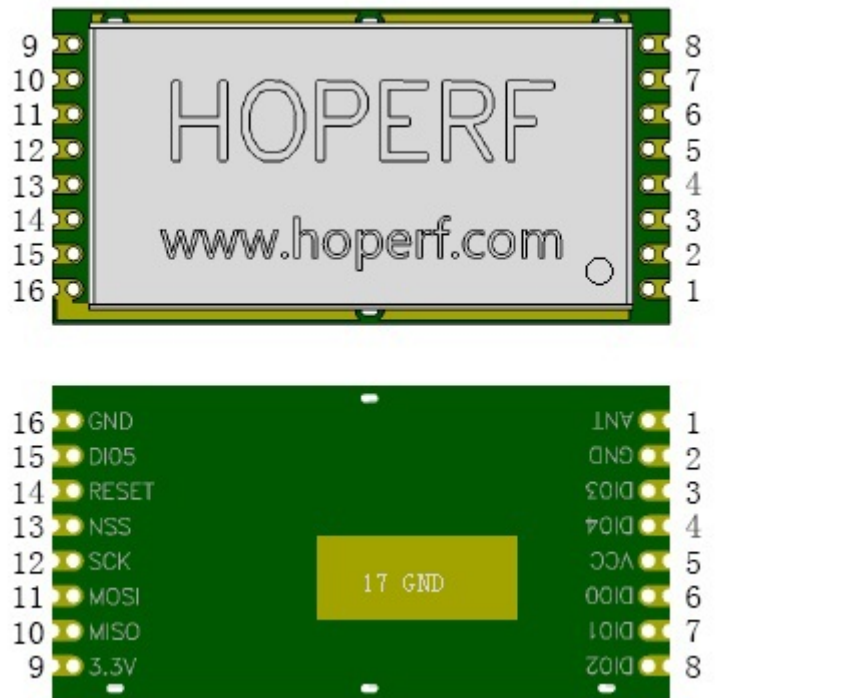


Figure 1. RFM98PW/RFM95PW Pin Definition

| Number | Definition | Type | Function |
|--------|------------|--------|---|
| 1 | ANT | AI/ AO | RF signal input/output. |
| 2 | GND | G | Power ground. |
| 3 | DIO3 | I/O | Digital I/O, software configured. |
| 4 | DIO4 | I/O | Digital I/O, software configured. |
| 5 | VCC | PI | Positive power supply, 5.0-6.4V. |
| 6 | DIO0 | I/O | Digital I/O, software configured. |
| 7 | DIO1/DCLK | I/O | Digital I/O, software configured. |
| 8 | DIO2/DATA | I/O | Digital I/O, software configured. |
| 9 | 3.3V | O | 3.3V Voltage output. For MCU VCC. |
| 10 | MISO | O | SPI Data output. |
| 11 | MOSI | I | SPI Data input. |
| 12 | SCK | I | SPI Clock input. |
| 13 | NSS | I | SPI Chip select input. |
| 14 | RESET | I/O | Reset trigger input. |
| 15 | DIO5 | I/O | Digital I/O, software configured. |
| 16 | GND | G | Power ground. |
| 17 | GND | G | Power ground, This area is connected to the GND network of the main board for heat radiation. |

5. Typical Application:

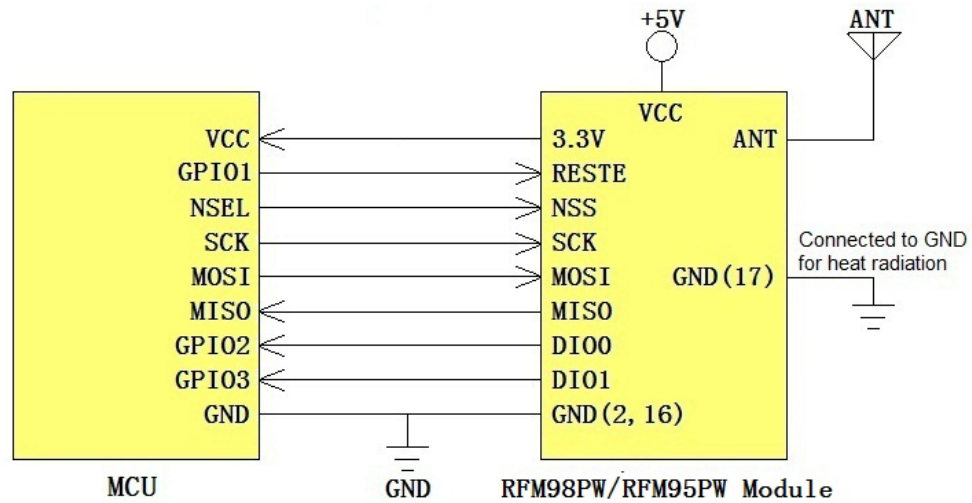


Figure 2. RFM98PW/RFM95PW Application

(For software info please refer to RF98/RF96 chip datasheets and demo program of HopeDuino™ Development Kit)

6. Electrical Parameter:

Maximum

| parameter | minimum | maximum | Unit |
|-----------------------------------|---------|-----------|------|
| Positive power supply | -0.3 | +6 | V |
| Voltage on Digital Control Inputs | -0.3 | 3.3 + 0.3 | V |
| Voltage on Analog Inputs | -0.3 | 3.3 + 0.3 | V |
| RX Input Power | - | +10 | dBm |
| Storage temperature | -55 | +125 | °C |
| Soldering temperature(10s) | - | +260 | °C |

Recommended working range

| parameter | minimum | maximum | Unit |
|-----------------------|---------|---------|------|
| Positive power supply | +5.0 | +6.0 | V |
| Working temperature | -20 | +70 | °C |

DC characteristic

| parameter | conditions | minimum | typical | maximum | Unit |
|--------------------|---------------------------------------|---------|---------|---------|------|
| TX Working current | 169MHz band, P _{out} =+27dBm | - | 300 | 400 | mA |
| | 433MHz band, P _{out} =+30dBm | - | 650 | 700 | |
| | 470MHz band, P _{out} =+30dBm | - | 650 | 700 | |
| | 868MHz band, P _{out} =+27dBm | - | 650 | 700 | |
| | 915MHz band, P _{out} =+27dBm | - | 650 | 700 | |
| RX Working current | 169MHz band, | - | 13 | 15 | mA |
| | 433MHz band, | - | 13 | 15 | |
| | 470MHz band, | - | 13 | 15 | |
| | 868MHz band, | - | 13 | 15 | |
| | 915MHz band, | - | 13 | 15 | |
| Sleep current | All band | - | 5 | 12 | uA |

Transmitter AC characteristic

| parameter | conditions | minimum | typical | maximum | Unit |
|----------------------------|--|---------|---------|---------|------|
| TX frequency range | 169 MHz band, | 159 | - | 175 | MHz |
| | 433 MHz band, | 410 | - | 450 | |
| | 470 MHz band, | 450 | - | 490 | |
| | 868 MHz band, | 862 | - | 888 | |
| | 915 MHz band, | 895 | - | 935 | |
| Bit rate, FSK Mode | Programmable | 1.2 | - | 300 | kbps |
| Bit rate, OOK Mode | Programmable | 1.2 | - | 32.768 | kbps |
| Bit rate, Long-Range Mode | From SF6, BW=500kHz to SF12, BW=125kHz | 0.183 | - | 37.5 | kbps |
| Frequency deviation, FSK | Programmable FDA + BR/2 ≤ 250 kHz | 0.6 | - | 200 | KHz |
| Frequency synthesizer step | FSTEP = FXOSC/219 | - | 61.0 | - | Hz |
| Output Power | 169/868/915MHz band | - | 27 | - | dBm |
| | 433/470MHz band | - | 30 | - | |

Receiver AC characteristic

| parameter | conditions | minimum | typical | maximum | Unit |
|-----------------------------------|--|---------|---------|---------|------|
| RX Frequency Range | 169 MHz band, | 159 | - | 175 | MHz |
| | 433 MHz band, | 410 | - | 450 | |
| | 470 MHz band, | 450 | - | 490 | |
| | 868 MHz band, | 862 | - | 888 | |
| | 915 MHz band, | 895 | - | 935 | |
| RX Sensitivity FSK Mode | FDA = 35 kHz, BR = 0.6 kb/s, All band | - | -117 | - | dBm |
| RX Sensitivity OOK Mode | BR = 4.8 kb/s, All band | - | -117 | - | dBm |
| RX Sensitivity Long-Range Mode | SF12, BW=125kHz, All band | - | -136 | - | dBm |
| Single Side channel filter BW | Programmable | 2.7 | - | 250 | kHz |

7. Mechanical Dimension

(All units in mm)

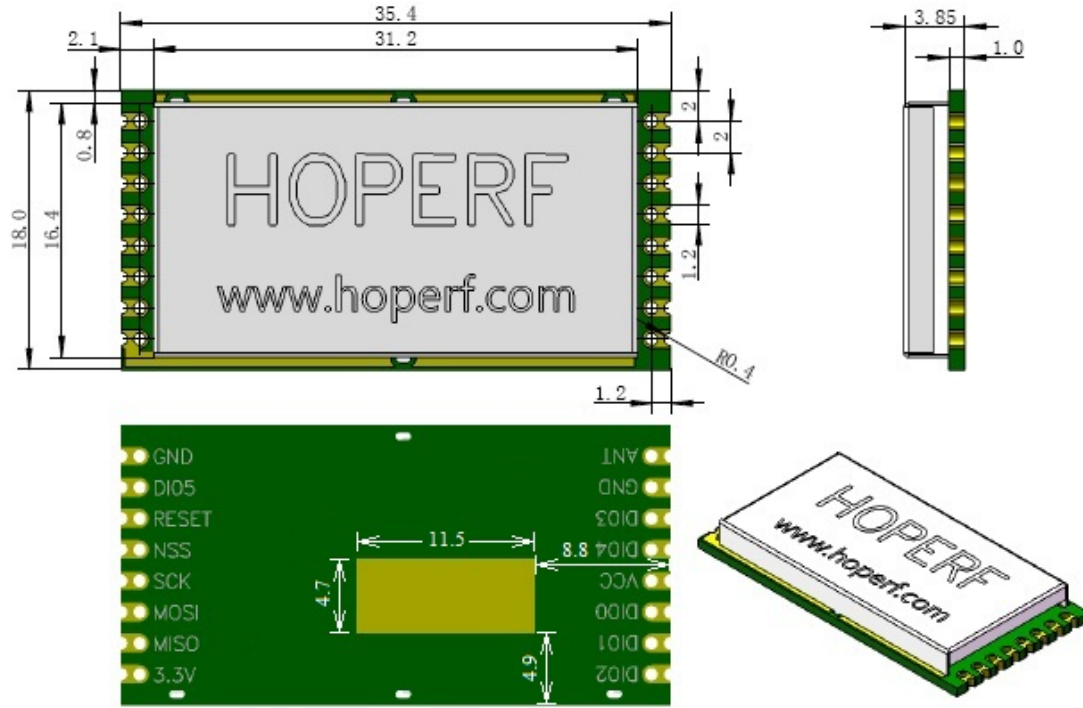


Figure3. RFM98PW/RFM95PW Mechanical Dimension

8. Order information

| Model | Frequency band | Output power |
|---------------|----------------|--------------|
| RFM98PW-169S2 | 169MHZ | +27dBm |
| RFM98PW-433S2 | 433MHZ | +30dBm |
| RFM98PW-470S2 | 470MHZ | +30dBm |
| RFM95PW-868S2 | 868MHZ | +27dBm |
| RFM95PW-915S2 | 915MHZ | +27dBm |

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