HOPERF ELECTRONIC

MCU with 100mW 433/470/868/915 MHz ISM Band Transceiver Module

（the purpose of this RFM50 spec covers mainly for the hardware and RF parameter info of the module, for MCU and software info please refer to RF50 chip data sheets, for RFM50' demo Please refer to RF(M)50 demo kit）

RFM50

General Introduction

RFM50 module series' design is based on the high performance RF50 SoC chip, It include a CIP-51 core' MCU and 100mW transceiver. It operate at 433/470/868/915 MHz ISM band, comply with FCC, ETSI regulation.

Features:

Ultra Low Power: 0.9 to 3.6 V Operation

-Typical sleep mode current < 0.1 μA; retains state and RAM contents over full supply range; fast wakeup of < 2 μs

-Less than 600 nA with RTC running

-Less than 1 μA with RTC running and radio state retained

-On-chip dc-dc converter allows operation down to 0.9 V.

-Two built-in brown-out detectors cover sleep and active modes

10-Bit Analog to Digital Converter

-Up to 300 ksps

-Up to 18 external inputs

-External pin or internal VREF (no external capacitor required)

-Built-in temperature sensor

-External conversion start input option

-Autonomous burst mode with 16-bit automatic averaging accumulator

Dual Comparators

-Programmable hysteresis and response time

-Configurable as interrupt or reset source

-Low current (< 0.5 μA)

On-Chip Debug

-On-chip debug circuitry facilitates full-speed, non-intrusive in-system debug (No emulator required)

-Provides breakpoints, single stepping

-Inspect/modify memory and registers

-Complete development kit

High-Speed 8051 μC Core

-Pipelined instruction architecture; executes 70% of instructions in 1 or 2 system clocks

-Up to 25 MIPS throughput with 25 MHz clock

-Expanded interrupt handler

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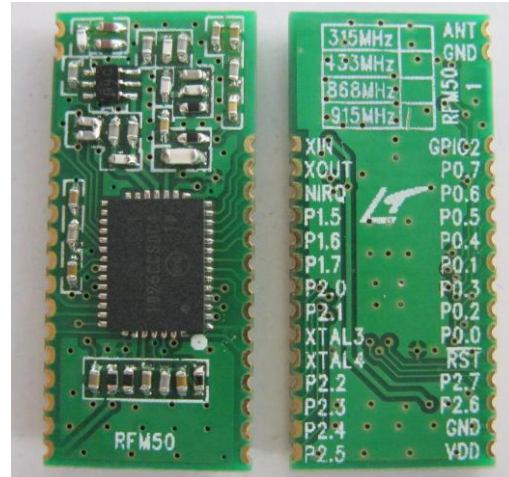
Memory

-4352 bytes internal data RAM (256 + 4096)

-64 kB Flash; In-system programmable in 1024-byte sectors—1024 bytes are reserved in the 64 kB devices

Transceiver

-Frequency range = 433,470,868,915 MHz ISM Band

-Sensitivity = –121 dBm

-FSK, GFSK, and OOK modulation

-Max output power = +20 dBm

-RF power consumption

- 18.5mA receive

-18 mA @+1 dBm transmit

- 40mA @+13 dBm transmit

- 100mA @+20 dBm transmit

-Data rate = 0.123 to 256 kbps

-Auto-frequency calibration (AFC)

- transmit/receive switch control

-Programmable packet handler

-TX and RX 64 byte FIFOs

-Frequency hopping capability

-On-chip crystal tuning

Digital Peripherals

-19 or 16 port I/O plus 3 GPIO pins; Hardware enhanced UART, SPI, and I2C serial ports available concurrently

-Low power 32-bit SmaRTClock

-Four general purpose 16-bit counter/timers; six channel programmable counter array (PCA)

Clock Sources

-Precision internal oscillators: 24.5 MHz with ±2% accuracy supports UART operation; spread-spectrum mode for reduced EMI; Low power 20 MHz internal oscillator

-External oscillator: Crystal, RC, C, CMOS clock

-SmaRTClock oscillator: 32.768 kHz crystal or self-oscillate

-Can switch between clock sources on-the-fly; useful in power saving modes and in implementing various power saving modes

I/O Port

-19 or 20 port I/O (5 V tolerant except for GPIO_2)

Package

-30-pin SMD　(11x25X2.0 mm)

Typical Application：

• Internet of Things

• Meter Reading

• Wireless sensor

• Wireless data collection

• Automobile security system

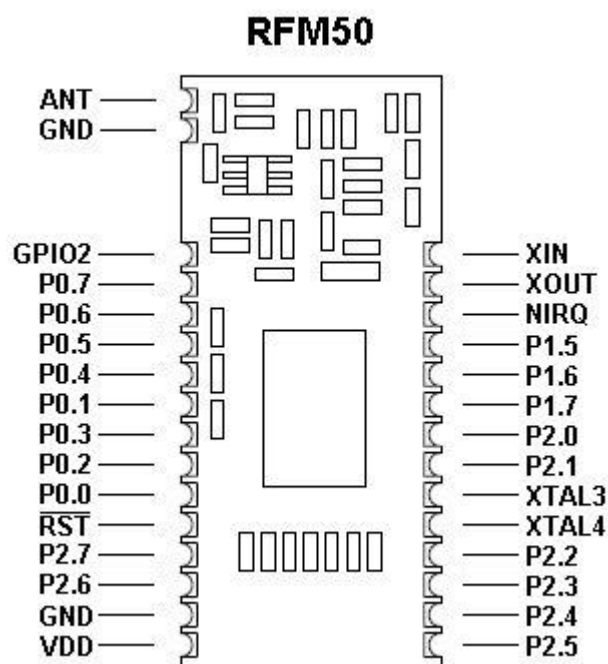• Home automation and security system

Pin Definition：

Figure 1. RFM50 Pin Definition(TOP VIEW)

definition	Type	Function
ANT	AI/ AO	RF signal input/output port, Connect 50 OHM antenna
GND	G	Power ground
GPIO2	DI/DO or AI/AO	General Purpose I/O controlled by the RF22 periph-eral. May be configured through the RF22 registers to perform various functions including: Clock Output, FIFO status, POR, Wake-Up Timer, Low Battery Detect, TRSW, AntDiversity control, etc. See the RF22 GPIO Con-figuration Registers for more information.
P0.7	D I/O or A I	Port 0.7. See RF50 Port I/O section for a complete description.
IREF0	AO	IREF0 Output. See RF50 IREF section for complete description.
P0.6	D I/O or A I	Port 0.6. See RF50 Port I/O section for a complete description.
CNVSTR	DI	External Convert Start Input for ADC0. See RF50 ADC0 section for a complete description.
P0.5	D I/O or A I	Port 0.5. See RF50 Port I/O section for a complete description.
RX	DI	UART RX Pin. See RF50 Port I/O section.
P0.4	D I/O or A I	Port 0.4. See RF50 Port I/O section for a complete description.
TX	DO	UART TX Pin. See RF50 Port I/O section.

P0.1	D I/O or A I	Port 0.1. See Port I/O Section for a complete description. Optional
AGND	G	Analog Ground. See VREF chapter.
P0.3	D I/O or A In	Port 0.3. See RF50 Port I/O Section for a complete description.
XTAL2	A O	External Clock Output. This pin is the excitation driver for an external crystal or resonator.
	DI	External Clock Input. This pin is the external clock input in external CMOS clock mode.
	AI	External Clock Input. This pin is the external clock input in capacitor or RC oscillator configurations.
		See RF50 Oscillator section for complete details.
P0.2	D I/O or A I	Port 0.2. See RF50 Port I/O Section for a complete description.
XTAL1	AI	External Clock Input. This pin is the external oscillator return for a crystal or resonator. See RF50 Oscillator section.
P0.0	D I/O or A I	Port 0.0. See RF50 Port I/O section for a complete description.
VREF	AI	External VREF Input.
	AO	Internal VREF Output. External VREF decoupling capacitors are recommended. See RF50 Voltage Reference section.
RST/	D I/O	Device Reset. Open-drain output of internal POR or VDD monitor. An external source can initiate a system reset by driving this pin low for at least 15 µs. A 1–5 k☐ pullup to VDD_MCU is recommended. See Reset Sources section for a complete description.
C2CK	D I/O	Clock signal for the C2 Debug Interface.
P2.7/	D I/O	Port 2.7. This pin can only be used as GPIO. The Crossbar cannot route signals to this pin and it cannot be configured as an analog input. See RF50 Port I/O section for a complete description.
C2D	D I/O	Bi-directional data signal for the C2 Debug Interface.
P2.6	D I/O or A I	Port 2.6. See RF50 Port I/O section for a complete description.
GND	G	Power ground
VDD	PI	Positive power supply, 1.8 to 3.6 V.
P2.5	D I/O or A I	Port 2.5. See RF50 Port I/O section for a complete description.
P2.4	D I/O or A I	Port 2.4. See RF50 Port I/O section for a complete description.
P2.3	D I/O or A I	Port 2.3. See RF50 Port I/O section for a complete description.
P2.2	D I/O or A I	Port 2.2. See RF50 Port I/O section for a complete description.
XTAL4	AO	SmaRTClock Oscillator Crystal Output.
XTAL3	AI	SmaRTClock Oscillator Crystal Input.
P2.1	D I/O or A I	Port 2.1. See RF50 Port I/O section for a complete description.
P2.0	D I/O or A I	Port 2.0. See RF50 Port I/O section for a complete description.
P1.7	D I/O or A I	Port 1.7. See RF50 Port I/O section for a complete description.
P1.6	D I/O or A I	Port 1.6. See RF50 Port I/O section for a complete description.
P1.5	D I/O or A I	Port 1.5. See RF50 Port I/O section for a complete description.

NIRQ	D O	RF22 peripheral interrupt status pin. Will be set low to indicate a pending RF22 interrupt event. See the RF22 Control Logic Registers for more details. This pin is an open-drain output with a 220 k☐ internal pullup resistor. An external pull-up resistor is recommended.
XOUT	AO	RF22 peripheral crystal oscillator output. Connect to an external 30 MHz crystal or leave floating if driving the XIN pin with an external signal source.
XIN	AI	RF22 peripheral crystal oscillator input. Connect to an external 30 MHz crystal or to an external source. If using an external clock source with no crystal, dc coupling with a nominal 0.8 VDC level is recommended with a minimum ac amplitude of 700 mVpp.

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Electrical Parameter：

Maximum

parameter	minimum	maximum	Unit
Positive power supply	-0.3	+3.6	V
Voltage on Digital Control Inputs	-0.3	VDD + 0.3	V
Voltage on Analog Inputs	-0.3	VDD + 0.3	V
RX Input Power		+10	dBm
Storage temperature	-55	+125	℃
Soldering temperature(10s)		+260	℃

Recommended working range

parameter	minimum	maximum	Unit
Positive power supply	2.2	+3.6	V
Working temperature	-40	+85	℃

DC characteristic

parameter	conditions	minimum	typical	maximum	Unit
Supply current (TX mode, P_{out} =+20dBm)	433,470,868,915MHZ band		100		mA
Supply current (TX mode, P_{out} = +13 dBm)	433,470,868,915MHZ band		40		mA
Supply current (TX mode, P_{out} = +1dBm)	433,470,868,915MHZ band		18		mA
Supply current (RX mode)	433,470,868,915MHZ band		18.5		mA
Standby current	Low Power Digital Regulator ON (Register values retained) and Main Digital Regula-tor, and RC Oscillator OFF		450	800	nA
Sleep current	RC Oscillator and Low Power Digital Reg-ulator ON (Register values retained) and Main Digital Regulator OFF		1		uA

Transmitter AC characteristic

parameter	conditions	minimum	typical	maximum	Unit
TX frequency range	433 MHz band,	413		453	MHz
	470 MHz band,	450		490	
	868 MHz band,	848		888	
	915 MHz band,	895		935	
FSK Data Rate		0.123		256	Kbps
OOK Data Rate		0.123		40	Kbps

Modulation Deviation	433,470MHZ	±0.625		±320	KHz
	868,915MHZ	±0.625		±160	
Modulation Deviatioṇ Resolution			0.625		KHz
Output Power Range		+1		+20	dBm
TX RF Output Steps	controlled by txpow[2:0]		3		dBm

Receiver AC characteristic

parameter	conditions	minimum	typical	maximum	Unit
RX Frequence Range	433 MHz band,	413		453	MHz
	470 MHz band,	450		490	
	868 MHz band,	848		888	
	915 MHz band,	895		935	
RX Sensitivity	(BER < 0.1%) (2 kbps, GFSK, BT = 0.5, $\Box$ f = $\Box$ 5 kHz)3		−121		dBm
	(BER < 0.1%) (40 kbps, GFSK, BT = 0.5, $\Box$ f = $\Box$ 20 kHz)3		−108		dBm
	(BER < 0.1%) (125 kbps, GFSK, BT = 0.5, $\Box$ f = $\Box$ 62.5 kHz)		−101		dBm
	(BER < 0.1%) (4.8 kbps, 350 kHz BW, OOK)3		−110		dBm
	(BER<0.1%)(1.2Kbps, FD=35KHz,BW=105KHz,		-116		dBm
RX Channel Bandwidth		2.6		620	KHz
RSSI Resolutio			±0.5		dB
RSSI Range		-120		20	dB

Mechanical Dimension

（All units in mm）
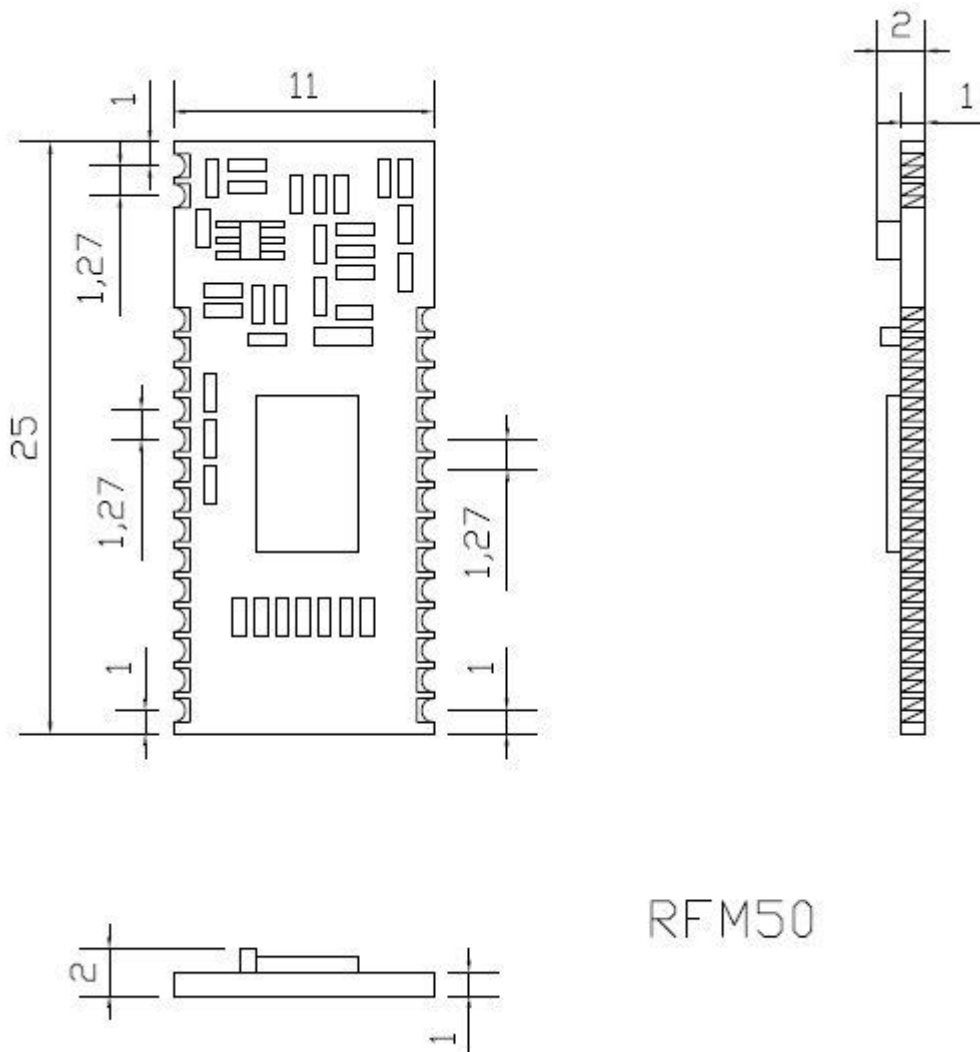
RFM50

Order information

model=modul type -operation_band

RFM50 – 433

module type   operation band

example：1，RFM50 module at 433MHz band,   RFM50-433。

Model	operation band
RFM50-433	433MHZ
RFM50-470	470MHZ
RFM50-868	868MHZ
RFM50-915	915MHZ