HOPERF LoRa&Sub-1 GHz Solution

Lei Sun
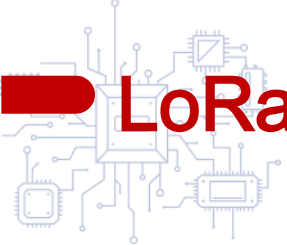
科技 创新 可持续发展
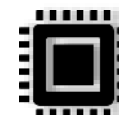
RF IC **IoT Module** **Signal Chain**

LoRa & Sub1GHz Chip Supplier

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SEMTECH®

LoRa

ASR MICROELECTRONICS

LoRaWAN

SILICON LABS

Sub-1GHz

HOPERF

LoRa & Sub1GHz Module
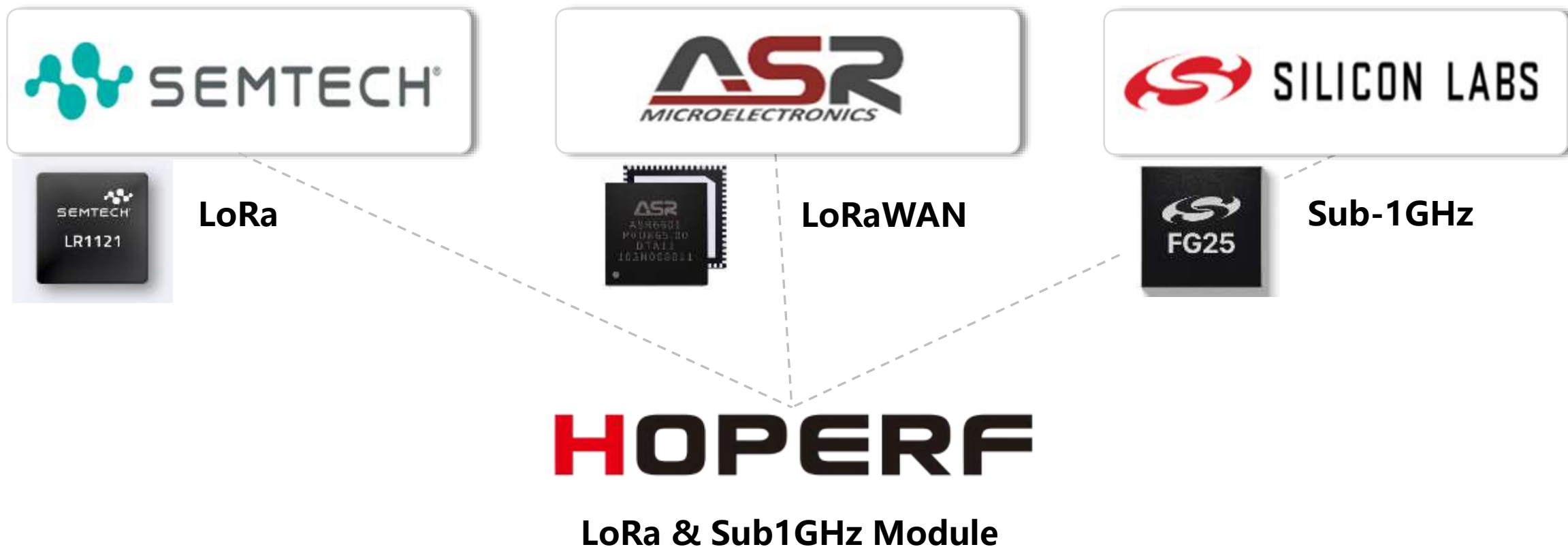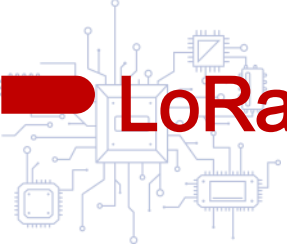
LoRa Technology Introduction

01 Long Distance

Thanks to the gain of spread spectrum modulation and forward error correction code, LoRa has about twice the communication distance of cellular technology. This long-distance advantage allows LoRa to use a star network topology.

02 Spread Spectrum

LoRa is a spread spectrum modulation technology, wireless signals with different spreading factors are orthogonal. This is an important characteristic. Seven wireless signals with spreading factors from SF6 to SF12 on the same channel do not conflict with each other.
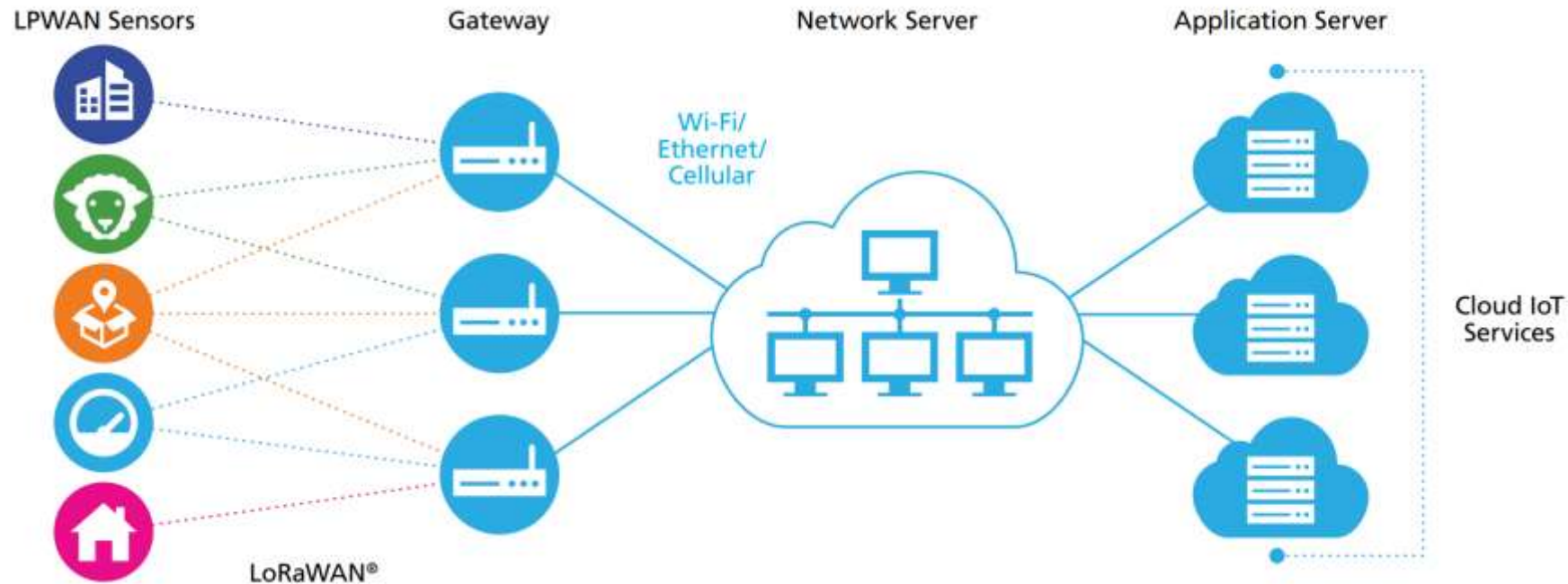
03 Low Power

LoRa module has deep sleep and wake-up functions. It can enter sleep mode when no communication is needed, greatly reducing power consumption. When communication is required, the module automatically wakes up to transmit data.

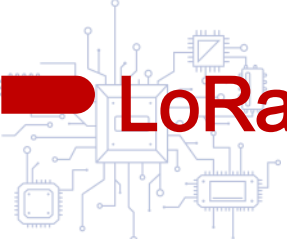LoRaWAN has a star-shaped network topology with high capacity, long range, and low power consumption. It is particularly suitable for LPWAN.

For low-cost WSNs powered by batteries, the LoRaWAN protocol is optimized to balance network latency and battery life.

LoRa Product Roadmap

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Product

RFM95(T/P)   RFM96(T)   RFM97(C)   RFM98(P)

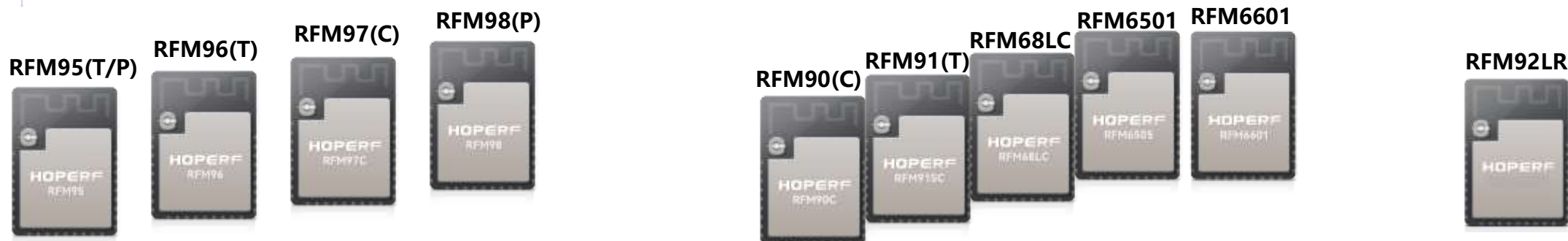RFM90(C)   RFM91(T)   RFM68LC   RFM6501   RFM6601

RFM92LR

2014   2016   2018   2020   2024

Semtech

Gen 1

SX1272
SX1276

Gen 2

SX126x

LLCC68

SX1280

Gen 3

LR1120

LR1121

ASR

ASR650X

ASR6601

LoRa Module Portfolio

|	RFM90C	RFM91SC	RFM68LC	RFM95C	RFM95P	RFM98	RFM98P
Chip	SX1262	SX1268	LLCC68	SX1276	SX1276	SX1278	SX1278
Modulation	LoRa/GFSK/FSK	LoRa/GFSK/FSK	LoRa/GFSK/FSK	LoRa/GFSK/FSK	LoRa/GFSK/FSK	LoRa/GFSK/FSK	LoRa/GFSK/FSK
Voltage	1.8-3.7V	1.8-3.7V	1.8-3.7V	1.8-3.7V	5-6V	1.8-3.7V	5-6V
Frequency	150-960MHz	433/470/780MHz	433/470/868/915MHz	915MHz	868/915MHz	169/433/470MHz	169/433/470MHz
SF	5-12	5-12	5-11	6-12	6-12	6-12	6-12
Data rate	62.5kbps	62.5kbps	62.5Kbps	37.5Kbps	37.5Kbps	37.5Kbps	37.5Kbps
TX	118mA	135mA	125mA	134mA	650mA(+30dBm)	130mA	650mA(+30dBm)
RX	8.8mA	8.8mA	8.8mA	12.5mA	13mA	10.3mA	13mA
Sensitivity	-137dBm	-137dbm	-129dbm	-138dBm	-136dBm	-140dBm	-136dBm
Tx power	22dBm	22dBm	22dBm	18.3dBm	30dBm	20dBm	30dBm
Dimensions	16*16*2.8mm	16*16*2.8mm	11.5*12*2.3mm	16*16*2.7mm	35.4*18*3.85mm	16*16*1.8mm	35.4*18*3.85mm
P/N	RFM90C-433S2 RFM90C-868S2 RFM90C-915S2	RFM91(SC)-433S2 RFM91(SC)-470S2 RFM91(SC)-780S2	RFM68LC-433S2 RFM68LC-470S2 RFM68LC-868S2 RFM68LC-915S2	RFM95C-915S2	RFM95P-868S2 RFM95P-915S2	RFM98-169S2 RFM98-433S2 RFM98-470S2	RFM98P-169S2 RFM98P-433S2 RFM98P-470S2
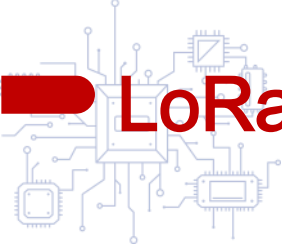
LoRaWAN Module Portfolio

	RFM6601	RFM6601SE	RFM6505	RFM6501
Chip	ASR6601	ASR6601SE	ASR6505	ASR6501
Modulation	LoRa/(G)FSK/(G)MSK	LoRa/(G)FSK/(G)MSK	LoRa/(G)FSK/(G)MSK	LoRa/(G)FSK/(G)MSK
Voltage	1.7-3.7V	1.7-3.7V	2.4-3.7V	2.4-3.7V
Frequency	433/470/868/915MHz	433/470/868/915MHz	433/470/868/915MHz	433/470/868/915MHz
SF	5-12	5-12	5-12	5-12
Data rate	62.5Kbps	62.5Kbps	62.5Kbps	62.5Kbps
TX	108mA	108mA	105mA(22dBm)	107mA(22dBm)
RX	10mA	9.2mA	10mA	9mA
Sensitivity	-138dBm	-138dBm	-137dBm	-137dBm
TX power	22dBm	22dBm	22dBm	22dBm
Dimensions	18*16*2.8mm	19*19*2mm	16*20*2.8mm	16*16mm
Interface	UART	UART	UART	UART
Class	Class A/B/C	Class A/B/C	Class A/B/C	Class A/B/C
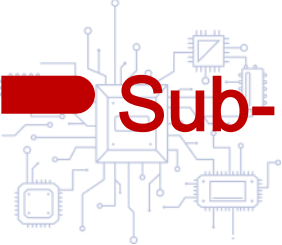
Sub-1GHz Module Portfolio

	RFM69	RFM23A020	RFM25A12	RFM92LR
Chip	SX1231	EFR32FG23	EFR32MG25	LR1121
Modulation	FSK/GFSK/MSK/GMSK/OOK	OOK,(G)FSK,(G)MSK,OQPSK	2(G)FSK,O-QPSK,Wi-SUN OFDM	LoRa/FSK/GFSK
Voltage	1.8-3.6V	1.8-3.8V	1.71-3.8V	1.8-3.7V
Frequency	433/868/915MHz	433/470/868/915MHz	470/868/915MHz	434/868/915MHz
TX	45mA(+13dBm)	77mA(20dBm)	70mA(16dBm)	110mA(22dBm)
RX	16mA	5mA	10mA	8mA
Sensitivity	-120dBm	-118dBm	-110dBm	-138dBm
TX power	13dBm	20dBm	16dBm	22dBm
Dimensions	19.7*16*2.8mm	19*16.5*2mm	24*19*1.85mm	23*17.5*2mm
Interface	SPI	UART/SPI	UART/SPI	SPI
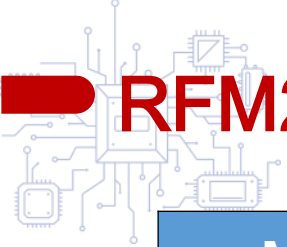
RFM23A020

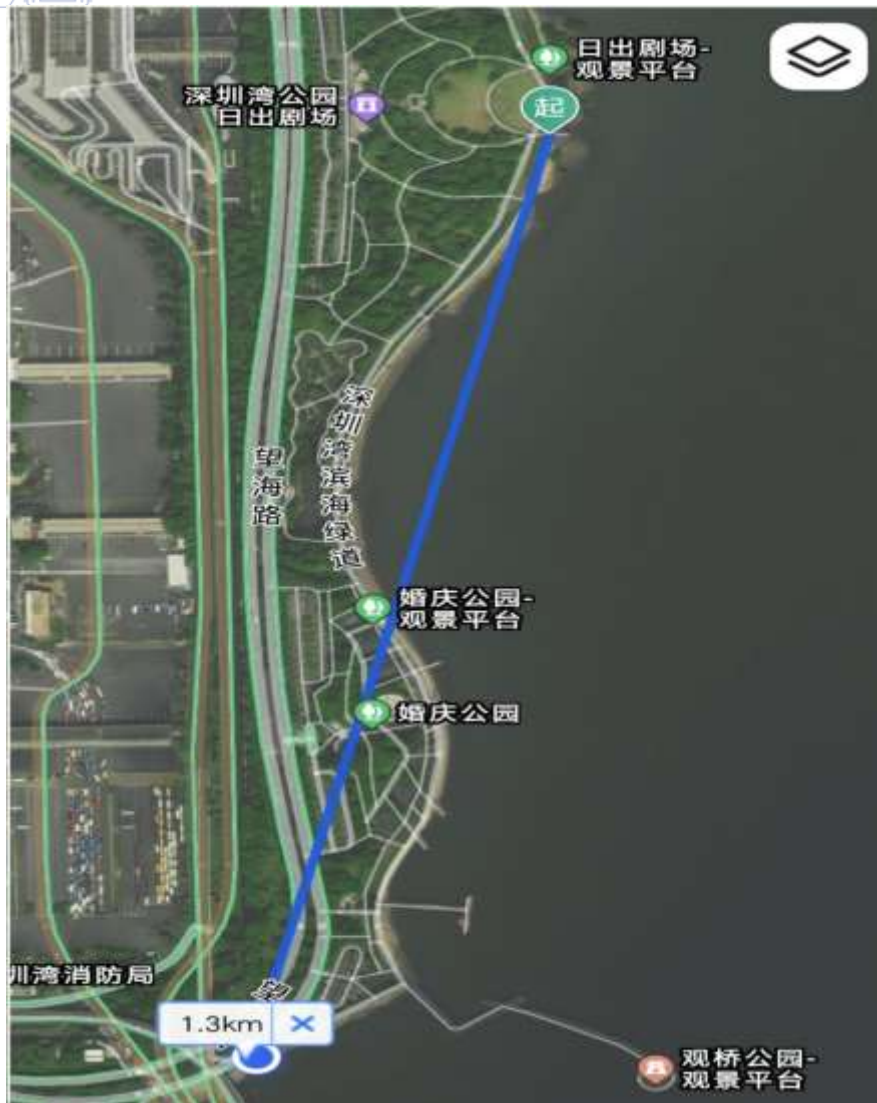| Module Model	Working Frequency
RFM23A020-433S2	433MHz
RFM23A020-470S2	470MHz
RFM23A020-868S2	868MHz
RFM23A020-915S2	915MHz
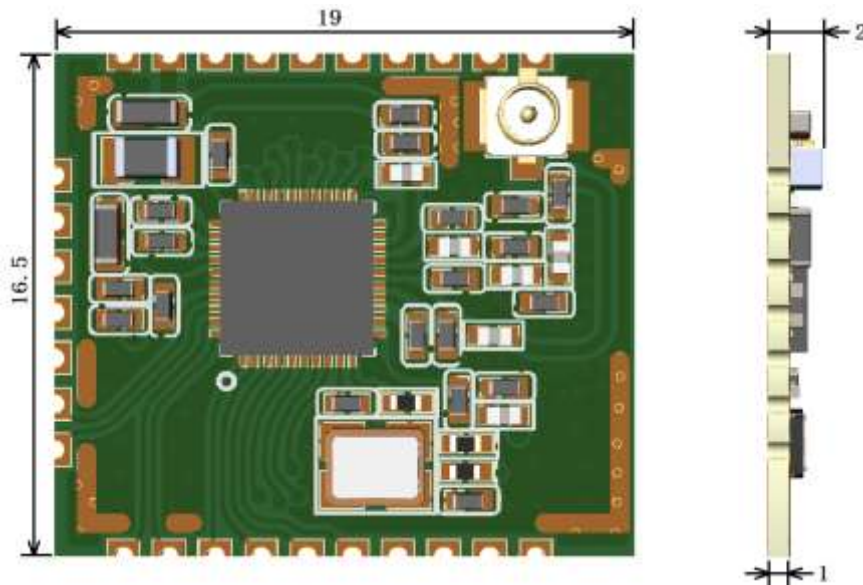
Main Features

- High-performance SUBG SOC wireless transceiver module
- Rich resources, 22 GPIO pins (PC7 not led out), supports secondary development
- CPU: 32-bit ARM Cortex®-M33, main frequency 78MHz
- Storage: 512KB FLASH, 64KB RAM
- CONNECT networking, Sidewalk, WM-BUS
- Supports OOK, (G)FSK, (G)MSK, O-QPSK, DSSS
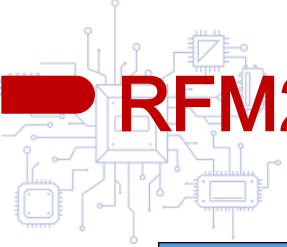- Maximum transmission power 20dBm

Application Scenarios

- Smart metering
- Smart home
- Building security system
- Smart city/municipal infrastructure
- Industrial applications/building automation/street lighting

Communication Distance Test

- Test conditions: operating voltage 3.3V, temperature 25℃, humidity 74%, oscillator frequency 39MHz, operating frequency 915MHZ, modulation mode OQPSK

- Rate 9.6kbps. The antenna is a rubber antenna with a gain of 3dBi. The actual measured communication distance is 1.3km.

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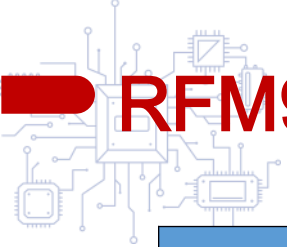| Module Model	Working Frequency
RFM25A12-470S2	470MHz
RFM25A12-868S2	868MHz
RFM25A12-915S2	915MHz
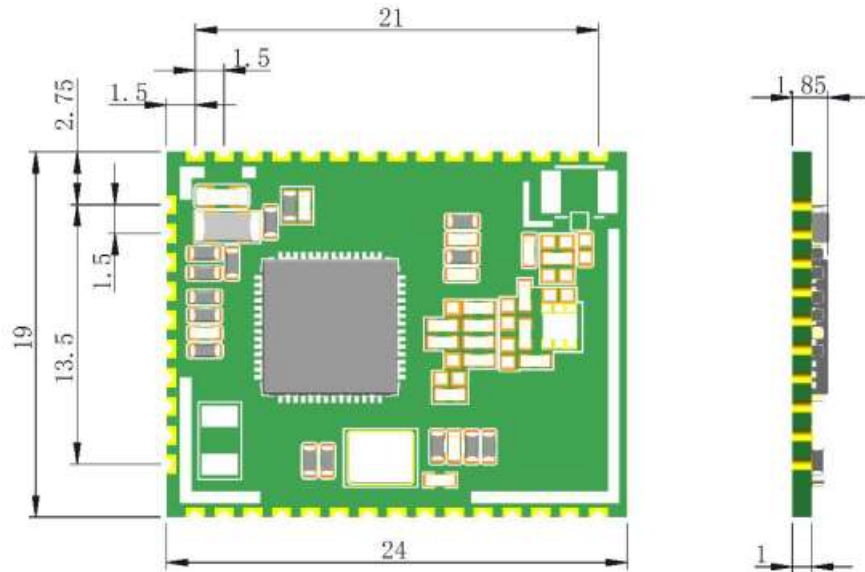
Main Features

- High-performance SUBG SOC wireless transceiver module
- Rich resources, 35 GPIO pins led out, supports secondary development
- CPU: 32-bit ARM Cortex®-M33, main frequency 97.5MHz
- Storage: 1152KB FLASH, 256KB RAM
- The module reserves a 32.768KHz low-frequency crystal oscillator soldering point
- Supports 2(G)FSK, O-QPSK, Wi-SUN OFDM
- Maximum transmission power 16dBm

Application Scenarios

- Smart metering
- Smart home
- Building security system
- Smart city/municipal infrastructure
- Industrial applications/building automation/street lighting

RFM92LR

| Module Model	Working Frequency
RFM92LR-434S2	434MHz & 2.4G
RFM92LR-868S2	868MHz & 2.4G
RFM92LR-915S2	915MHz & 2.4G
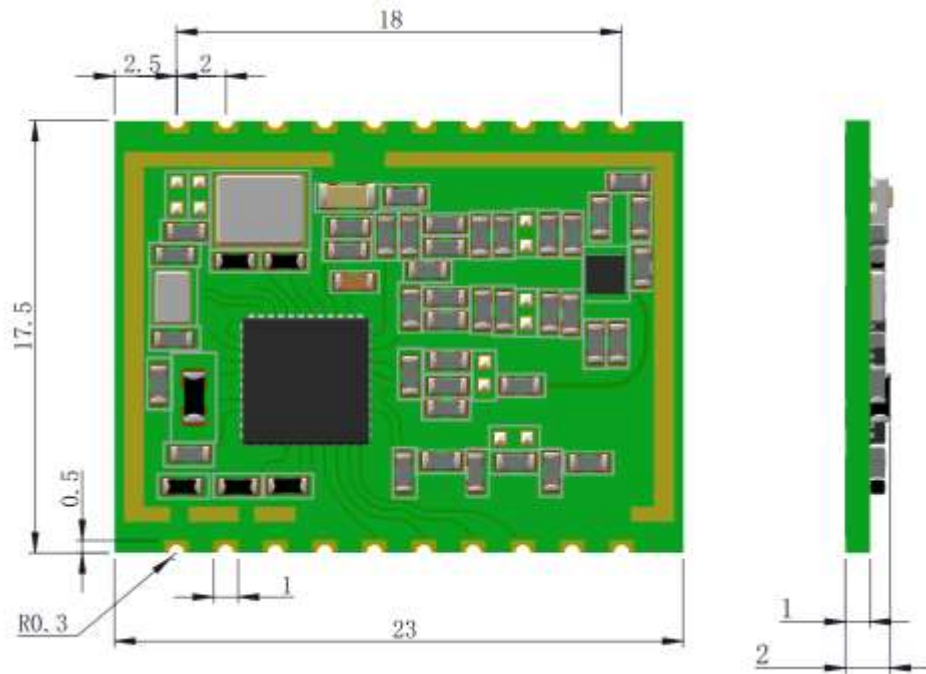
Main Features

- Supports both SUB-G and 2.4G bands, with dual antenna interfaces
- LoRa and (G)FSK modulation in sub-GHz is compatible with SX126x and SX127x series
- LoRa and (G)FSK modulation in 2.4GHz is compatible with SX128x series
- Supports satellite communications S-band (1.9-2.1GHz)
- Supports LoRaWAN, Sigfox protocols

Application Scenarios

- Smart metering
- Smart home
- Building security system
- Smart city/municipal infrastructure
- Industrial applications/building automation/street lighting
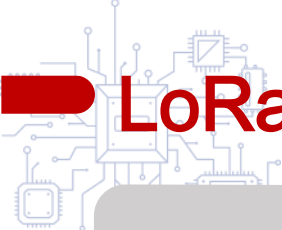
LoRa & Sub-1GHz Typical Application

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Street Lighting
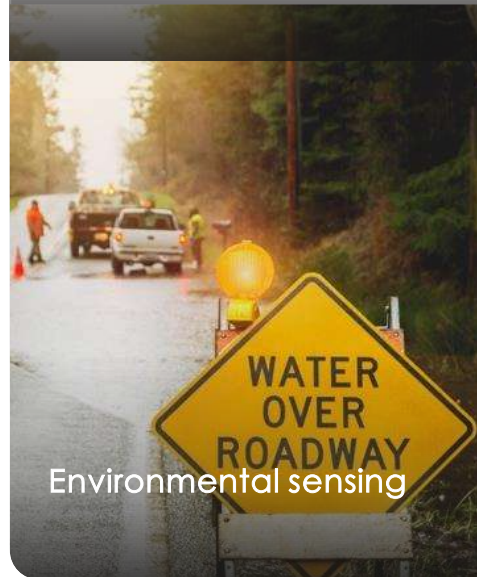
Energy management

Traffic control/Parking lot

Energy exploitation

Smart meter

Environmental sensing

Smart City

Smart Industry

Smart warehousing and distribution chain

Smart farming

THANKS

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