Sub-1G无线通信应用解决方案

深圳市小孔技术有限公司

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www.xiaokong.co

化繁为简 智联天下

01 运动DV/行车记录仪

02 无人机

03 电动窗帘/晾衣架

04 智能门铃/防丢器

05 智能马桶/马桶盖

运动DV
行车记录仪

TX/RX

拍照/摄像

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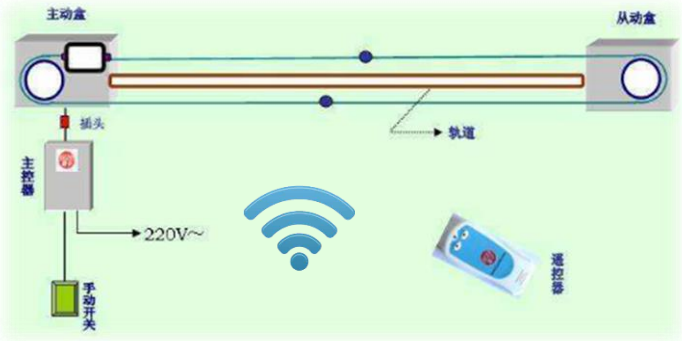
无人机

Transceiver

*拍照/摄像

*控制/反馈

电动窗帘
晾衣架



智能门铃
防丢器

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智能马桶翻盖

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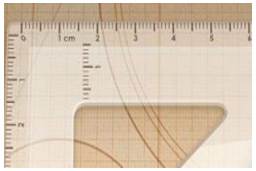
RF-设计挑战

实时响应

低功耗

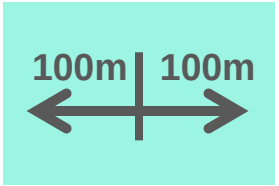
兼容性

小尺寸



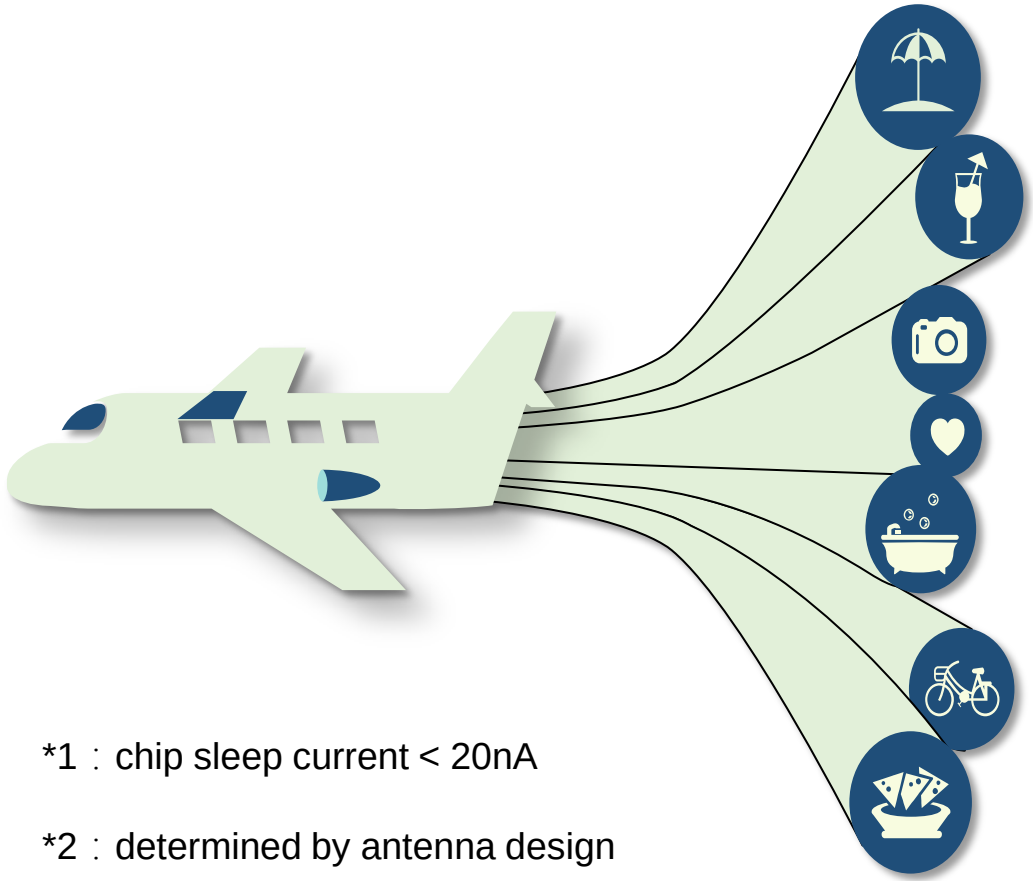
一致性

长距离



无方向性

RF通信解决方案



315/433/868/915 ISM波段可选

小体积**(SOT23-6&QFN16)**

超低功耗***1**

高效率，长距离（**30m**以上）***2**

灵活的天线设计，硬件设计**/**生产便利

无指向性

可客制化设计定制

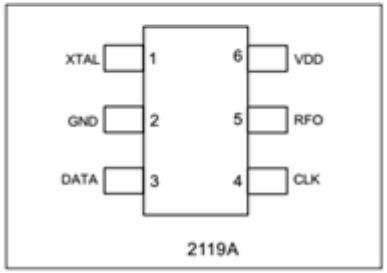
*1：chip sleep current < 20nA

*2：determined by antenna design

240 – 960 MHz (G)FSK/OOK Transmitter

Features

- Optional Chip Feature Configuration Schemes
  - On-Line Registers Configuration
  - Off-Line EEPROM Programming
- Frequency Range: 240 to 960 MHz
- FSK, GFSK and OOK Modulation
- Symbol Rate:
  - 0.5 to 100 ksps (FSK/GFSK)
  - 0.5 to 30 ksps (OOK)
- Deviation: 1.0 to 200 kHz
- Two-wire Interface for Registers Accessing and EEPROM Programming
- Output Power: -10 to +13 dBm
- Supply Voltage: 1.8 to 3.6 V
- Sleep Current: < 20 nA
- FCC/ETSI Compliant
- RoHS Compliant
- 6-pin SOT23-6 Package

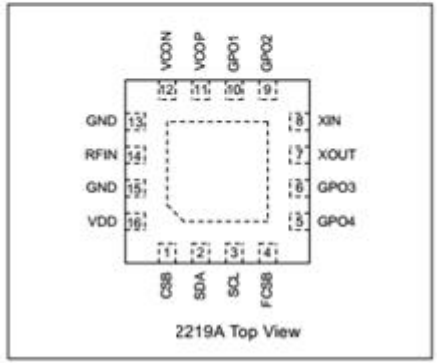


300 – 960 MHz OOK/(G)FSK Receiver

Features

- Optional Chip Feature Configuration Schemes
  - On-Line Registers Configuration
  - Off-Line EEPROM Programming
- Frequency Range: 240 to 960 MHz
- FSK, GFSK and OOK Modulation
- Symbol Rate:
  - 0.5 to 100 ksps (FSK/GFSK)
  - 0.5 to 30 ksps (OOK)
- Deviation: 1.0 to 200 kHz
- Two-wire Interface for Registers Accessing and EEPROM Programming
- Output Power: -10 to +13 dBm
- Supply Voltage: 1.8 to 3.6 V
- Sleep Current: < 20 nA
- FCC/ETSI Compliant
- RoHS Compliant
- 6-pin SOT23-6 Package

QFN16 (3x3)

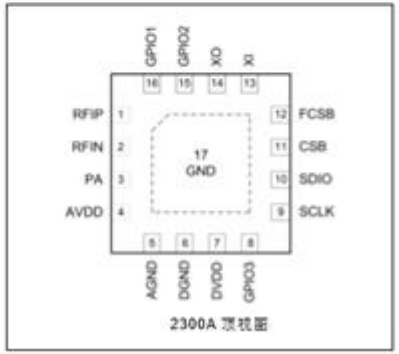


2219A Top View

Ultra Low Power Sub-1GHz Transceiver

Features

- Frequency Range: 213 to 960 MHz
- Modulation: OOK, (G)FSK 和(G)MSK
- Data Rate: 0.5 to 250 kbps
- Sensitivity: -120 dBm at 2.4 kbps, F_{RF} = 433.92 MHz
  -109 dBm at 50 kbps, F_{RF} = 840 MHz
  -109 dBm at 50 kbps, F_{RF} = 920 MHz
- Voltage Range: 1.8 至 3.6 V
- Tx Current: 27 mA @ 13 dBm, 920 MHz, FSK
- Rx Current: 6.9 mA @ 433.92 MHz, FSK
- Support Super Low Power Mode
- Sleep Current
  - 300 nA when sleep timer is off
  - 800 nA when sleep timer is on
- 4-wire SPI Interface
- Support Direct Mode and Packet Mode
- Configurable Packet Handler and 64-Byte FIFO
- Manchester, Data Whitening and Forward Error Correction
- 16 Pin QFN 3x3 Package



超低功耗 Sub-1GHz 无线收发单片机

MCU 特性

- 增强型 1-T 80C51 内核
- 16 kB Flash，密码保护程序区访问。默认空间配置：
  - AP 程序空间(13.5 kB, 0000h ~ 35FFh)
  - IAP 数据空间(1.0 kB, 3600h ~ 39FFh)
  - ISP 引导码空间(1.5 kB, 3A00h ~ 3FFFh)
- 1 kB 数据存储器
  - 256 字节高速缓存
  - 768 字节扩展 RAM (XRAM)
  - 扩展 RAM (XRAM)支持页访问
- 片上调试接口 (OCD)
- 25 个通用 IO 可用
- 多种功耗控制模式：掉电模式， 空闲模式，慢频模式，副频模式，RTC 模式，watch 模式和 monitor 模式
  - 所有的中断能唤醒空闲(IDLE)模式
  - 10 个中断源能唤醒掉电模式
  - 慢频模式和副频模式支持低速 MCU 运转
  - RTC 模式在掉电模式下支持实时时钟(RTC)恢复 CPU

射频特性

- 工作频率： 127 - 1020 MHz
- 调制解调方式： (G)FSK，(G)MSK，OOK
- 数据率： 0.5 - 300 kbps
- 灵敏度： -121 dBm @ 434 MHz，FSK
- 接收电流： 8.5 mA @ 434 MHz，FSK
- 发射电流： 72 mA @ 20 dBm, 434 MHz
- 最大可配置 64 Byte FIFO

系统特性

- 工作电压：1.8 – 3.6 V
- 工作温度：-40 – 85 ^{0}C
- QFN48 6x6 封装

应用

- 自动抄表
- 家居安防及楼宇自动化
- 无线传感节点及工业监控
- ISM 频段数据通讯

通用遥控器解决方案对比

	2.4GHz *X2452	Sub 1G(RF)	IR	BT
Voltage	1.9V ~ 3.6V	1.8V ~ 3.6V		
Frequency	2.4GHz	240M ~ 960MHz	λ=0.76 ~ 1.5μm	2.4GHz
Modulation	FSK/GFSK	FSK/GFSK/OOK		
Data rate	250K~2Mbps	0.5K ~ 100Kbps		
Distance（@13dBm）	Nm	Nm	≤10m	≤10m
Power consumption	22.5mA@4dBm	12mA@0dBm / 30mA@13dBm	20mA	Ultra-low
Sleep current	≈6uA	≈0.8uA*1		
Dorection	no	no	Yes	no
Penetration	weak	Strong	No	weak
Others	A longer delay.	Complaint withFCC/ETSI，low-data rate，Low Power consumption		Just for short distance.

Best solution for INSTANT remote control

*1：with MCU

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RF related rule/regulation-FCC

The following table summarises the regulations for unlicensed operation below 1 GHz.

Frequency band	Output power	Duty cycle limits	Measurement method fundamental power	Spurious emissions
260 – 470 MHz (15.231), except: 240 – 285 MHz 322 – 335.4 MHz 399.9 – 410 MHz (15.205)	Frequency dependent, see text 6 mV/m at 3 m or -19.6 dBm EIRP* at 315 MHz 11mV/m at 3 m or -14 dBm EIRP* at 433 MHz	YES, see text	Average detector or CISPR quasi-peak detector (15.231)	<200 μV/m at 3 m below 960 MHz (-49.2 dBm), <500 μV/m at 3 m above 960 MHz (-41.2 dBm). Use quasi-peak detector below 1 GHz, and use averaging detector above 1 GHz. (15.35, 15.209)
902 – 928 MHz (15.249)	50mV/m at 3 m or -1 dBm EIRP*	NO	CISPR quasi-peak detector (15.35)	
902 – 928 MHz, spread spectrum (15.247)	0.5 W or 1 W depending on spreading technique plus a 6 dBi antenna	NO		

* The actual specification is limiting the field strength. Here the field strength is converted to dBm EIRP (Effective Isotropic Radiated Power).

433MHz band is permitted for intermittent operation remote controller.

RF related rule/regulation-ETSI

Table 1: Frequency bands commonly designated to Short Range Devices within 25 MHz to 1 000 M

	Frequency Bands/frequencies	Applications
Transmit and Receive	26,995 MHz, 27,045 MHz, 27,095 MHz, 27,145 MHz, 27,195 MHz, 34,995 MHz to 35,225 MHz, 40,665 MHz, 40,675 MHz, 40,685 MHz, 40,695 MHz	Model control
Transmit and Receive	26,957 MHz to 27,283 MHz	Non-specific use
Transmit and Receive	40,660 MHz to 40,700 MHz	Non-specific use
Transmit and Receive	138,200 MHz to 138,450 MHz	Non-specific use
Transmit and Receive	169,400 MHz to 169,475 MHz	Tracking, tracing and data acquisition and meter reading
Transmit and Receive	169,475 MHz to 169,4875 MHz	Social alarms
Transmit and Receive	169,5875 MHz to 169,6000 MHz	Social alarms
Transmit and Receive	433,050 MHz to 434,790 MHz	Non-specific use
Transmit and Receive	863,000 MHz to 870,000 MHz	Non-specific use

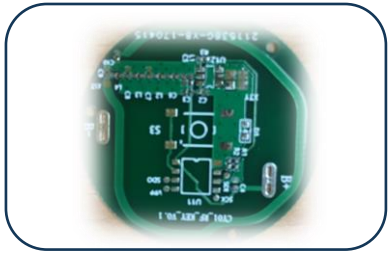
non-specific use: any type of application.

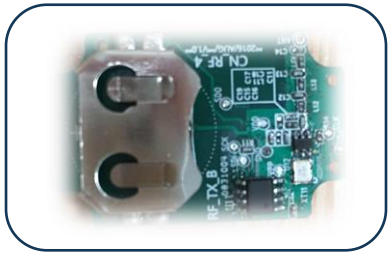
The ECC recommendation 70-03 defines both the maximum transmit power and limits to the duty cycle and the bandwidth of the transmitter for each allocated frequency band. Table 9 lists the frequencies and the limits for non-specific short range devices for the frequency range between 433 MHz and 2.4835 GHz.

Table 9. Frequency Bands For Non-Specific Short Range Devices in Europe

Frequency Band	ERP	Duty Cycle	Channel Bandwidth	Remarks
433.05 – 434.79 MHz	+10 dBm	<10%	No limits	No audio and voice
433.05 – 434.79 MHz	0 dBm	No limits	No limits	≤– 13 dBm/10 kHz, no audio and voice
433.05 – 434.79 MHz	+10 dBm	No limits	<25 kHz	No audio and voice
868 – 868.6 MHz	+14 dBm	< 1%	No limits	
868.7 – 869.2 MHz	+14 dBm	< 0.1%	No limits	
869.3 – 869.4 MHz	+10 dBm	No limits	< 25 kHz	Appropriate access protocol required
869.4 – 869.65 MHz	+27 dBm	< 10%	< 25 kHz	Channels may be combined to one high speed channel
869.7 -870 MHz	+7 dBm	No limits	No limits	
2400 – 2483.5 MHz	+7.85 dBm	No limits	No limits	Transmit power limit is 10-dBm EIRP

RF-发射模块案例

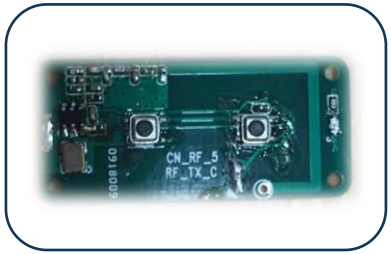


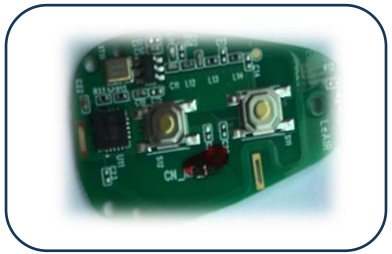


Remarks：

1.Aboves are MP Module.

2.Customized design is available.





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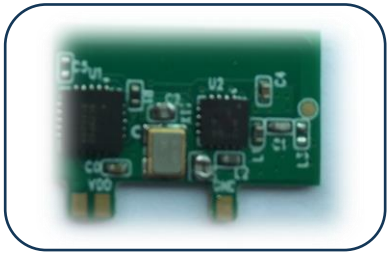
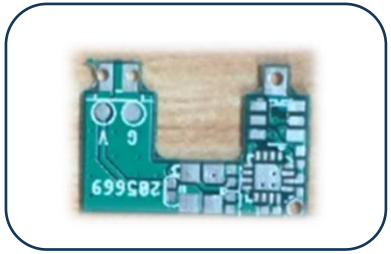
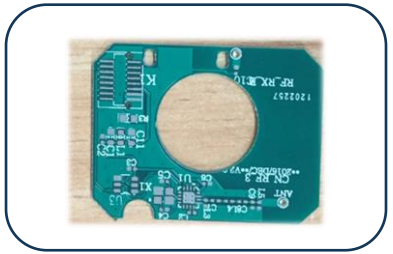
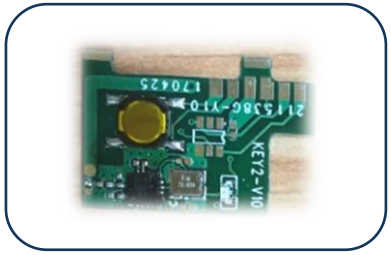
RF-接收模块案例

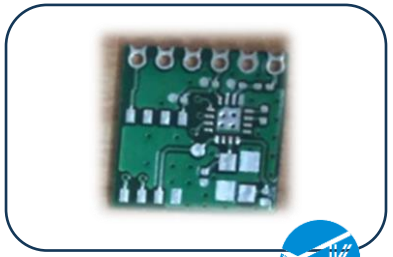
Remarks：
1.Aboves are MP Module.
2.Customized design is available.











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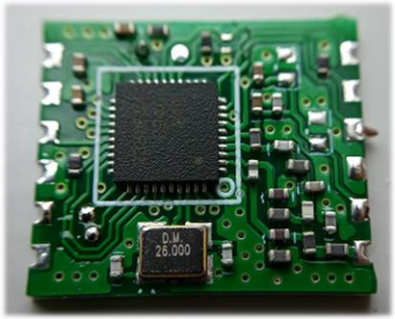
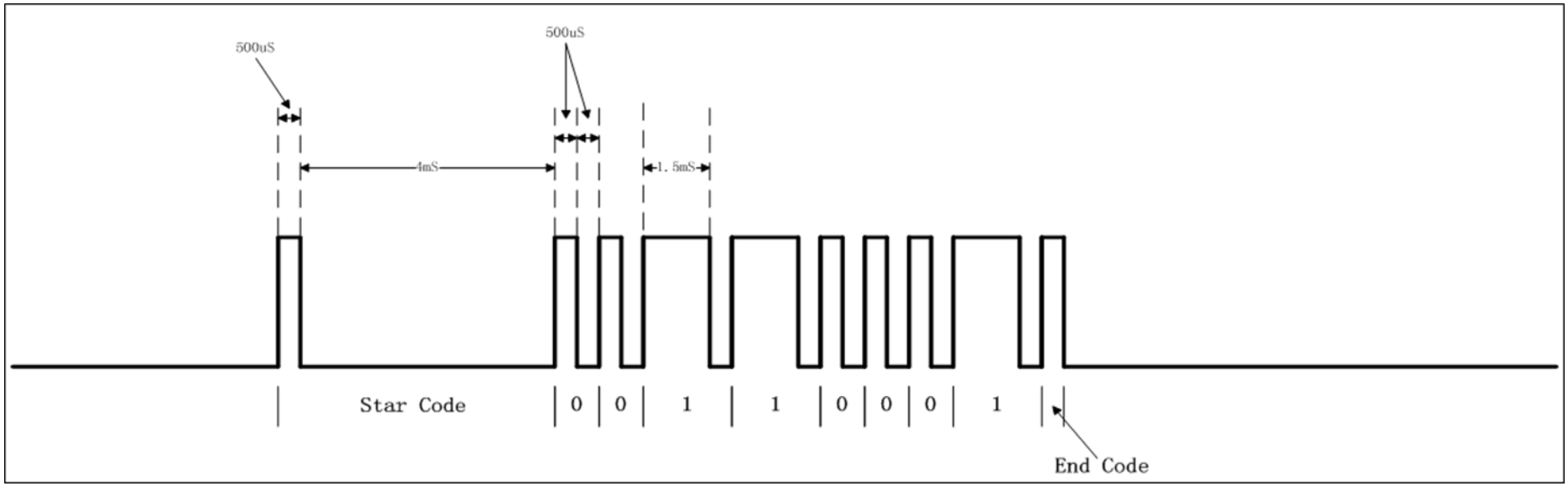
RF-收发双向模块案例



Remarks：
1.Aboves are MP Module.
2.Customized design is available.

通信格式示例



*Conmunication with MAIN MCU, PWM/IO/UART is available。

*Above is IR format, PWM signal。

09

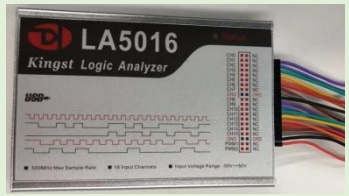
信赖性测试设备

◆频谱仪

◆信号源

◆示波器

◆逻辑分析仪



◆高低温箱

◆ESD静电测试仪 >30KV

◆浪涌测试仪

◆台式万用表

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合作伙伴


Joyoung 九阳


GEELY


ARROW
箭牌卫浴


A-OK


Haier 海尔


FOTILE 方太


CNSTAR
ELECTRONICS


BDW

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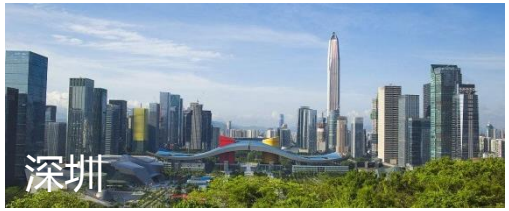

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