FR8012 Datasheet

Bluetooth Low Energy SOC with SIG Mesh integrated

FREQCHIP 富芮坤

目录

DESCRIPTION

FR8012 is a SOC (system on chip) for rapid development of Bluetooth Low Energy related products. It contains Bluetooth V4.2 (LE Mode) fully compliant system with Freqchip designed firmware and software stack. Users can develop various applications based on embedded 32-bits high performance MCU.

With Freqchip's innovational technology, FR8012 integrates RF, , PMU, Baseband, SPI, IIC, UART, GPIO, ADC, PWM and Keyboard scan train all in a single chip, which provides customer with:

1. competitive power consumption
2. stable connection
3. low-cost BOM

The Bluetooth Smart firmware includes the L2CAP service layer protocols, Security Manager (SM), Attribute Protocol (ATT), the Generic Attribute Profile (GATT) and the Generic Access Profile (GAP). Furthermore, application profiles such as Proximity, Health Thermometer, Heart Rate, Blood Pressure, Glucose, Human Interface Device (HID) and SDK (include drivers, OS API, etc.) are supported. The SDK has integrated SIG Mesh for networking application.

FEATURES

- Compliant with Bluetooth Specification V4.2 LE
- Embedded 32-bits Processor
  - 12~48Mhz speed
- Internal mask ROM, up to 78KB SRAM used for user code and data
- Internal 2M SPI Flash contains user space software and data
- Integrated Battery Charger
- Integrated DC-DC Regulator
- Interface:
  - GPIO
  - UART
  - SPI
  - I2C
  - PWM
  - I2S
  - LED
- ROM Software:
  - BLE Profile & Protocol: GATT, LM, LC, etc.
  - Driver API
  - SIG Mesh

APPLICATIONS

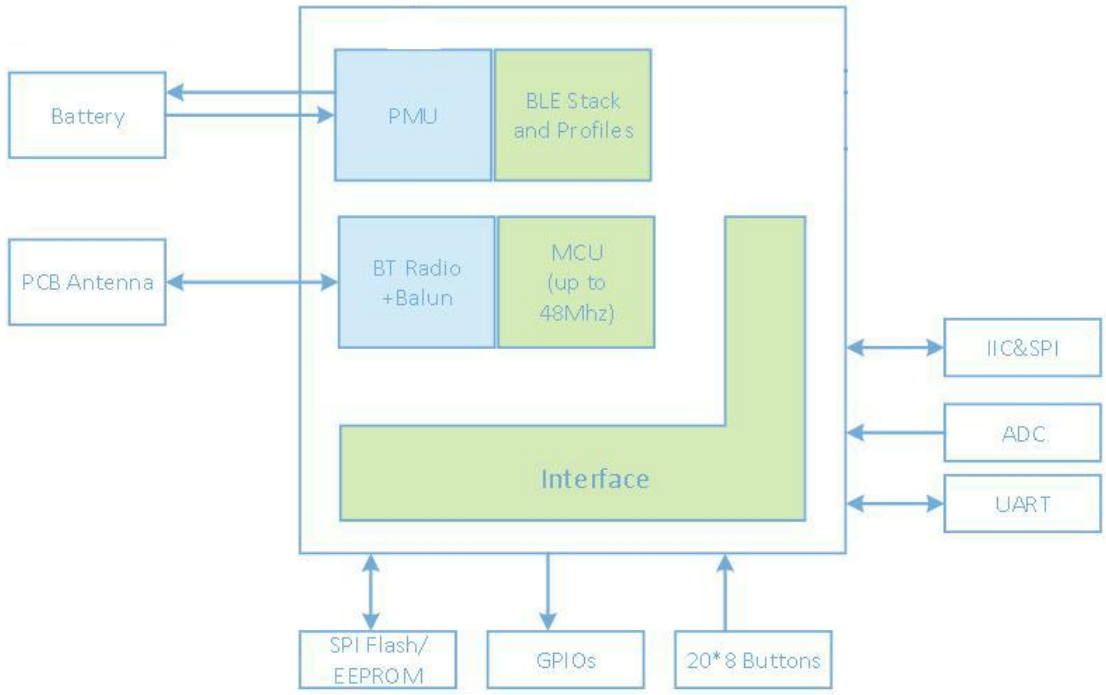
- smart toy
- led control
- SIG Mesh application
- etc.

ORDERING INFORMATION

FR8012 -40°C ~ +105°C

1. Hardware Details

1.1 Block Diagram



1.2 Bluetooth Radio

- On-chip balun (50Ω impedance in TX and RX modes)
- No external trimming is required in production
- Qualified to Bluetooth v4.2 LE specification
- Up to 6dBm RF transmit power
- -90dBm receiver sensitivity
- Integrated channel filters
- Digital demodulator for improved sensitivity and co-channel rejection
- Real time digitized RSSI
- Fast AGC for enhanced dynamic range

1.3 Bluetooth Controller

- All device classes support (Broadcaster, Central, Observer, Peripheral)
- All packet types (Advertising / Data / Control)
- Encryption (AES / CCM)

- Bit stream processing (CRC, Whitening)
- Frequency hopping calculation
- Low power modes supporting internal 32.0 kHz or external 32.768 kHz
- Supports power down of the baseband during the protocol's idle periods

1.4 Peripheral Interfaces

- UART port for Debugging and AT Commands
- IIC interface to support external EEPROM or other devices (like G-SENSOR)
- One more SPI interface to support other device (like OLED controller)
- Up to 14 general purpose IOs (14 IOs can be set in interrupt mode)
- General purpose 10-bits ADC used for ADKey and other analog input
- PWM controller
- Hardware LED controller
- General purpose programmable timer for various task
- Watchdog used for tracking unexpected exception

1.5 Integrated Power Control and Regulation

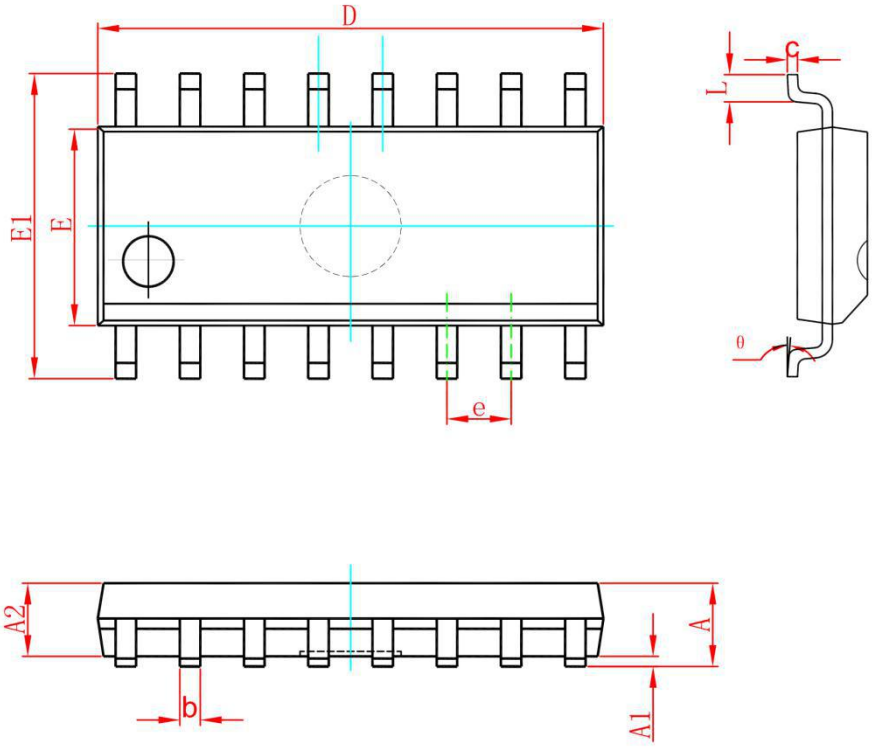
- Embedded Power-On-Reset
- Support ONKEY (switch or long press) power on and power off logic
- Low power 0.9v core voltage
- On-chip high efficiency switch-mode power supply, 2.4v to 4.3v input direct from battery and programmable output voltage
- On-chip Low Dropout (LDO) Linear Regulator for internal Digital, RF and Analog circuit
- Power management features include software shutdown and hardware wake-up
- Power-on-reset cell detects low supply voltage
- Internal voltage level detector

1.6 Battery Charger

- Lithium ion/Lithium polymer battery charger
- Embedded LVD(low voltage detect)
- Programmable charging current. Fast charging support up to 200mA with no external components

2. Package and Pin Information

2.1 Package Physical Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	9.800	10.200	0.386	0.402
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

2.2 Pins Description

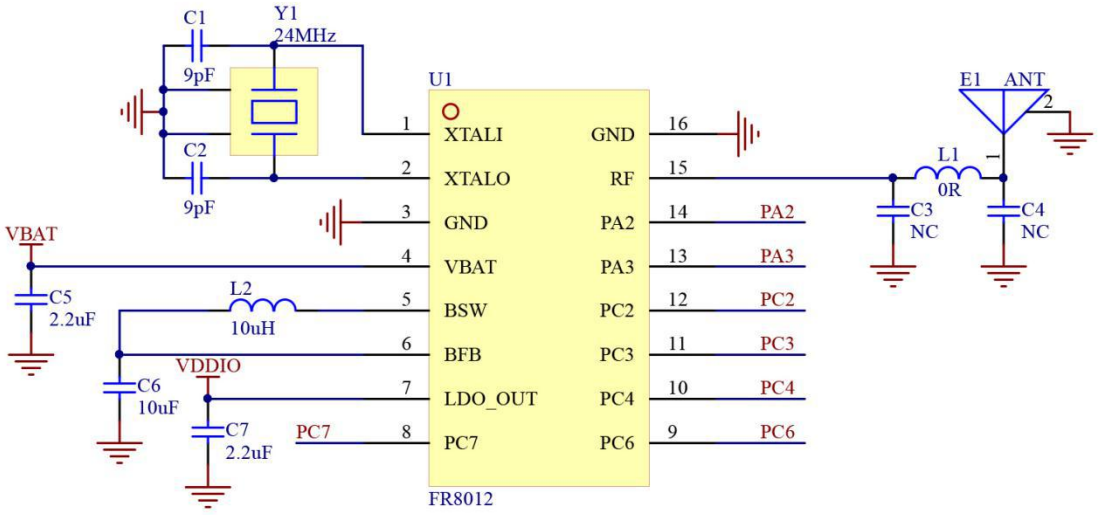
FR8012 is a CMOS device. Floating level on input signals will cause unstable device operation and abnormal current consumption. Pull-up or Pull-down resistors should be used appropriately for input or bidirectional pins.

Notation	Description
I	Digital Input
O	Digital Output
AI	Analog input
AO	Analog output
IO	Bidirectional(digital)
OD	Open Drain
PWR	Power
GND	Ground

Pin name	Pin#	Type	Description
XTALI	1	AI	crystal oscillator input
XTALO	2	AO	crystal oscillator output
GND	3	GND	Ground
VBAT	4	PWR	Positive power supply for DC/DC
BSW	5	AO	DC/DC output terminal
BFB	6	AI	DC/DC feedback input terminal
LDO_OUT	7	AO	Analog linear regulator output
PORTC7	8	I/O	I2S_DIN/I2C1_DAT/PWM7/SPI1_DIN/ SPI0_DIN/ UART1_TX/UART0_TX/ADC7*/SW_DIO
PORTC6	9	I/O	I2S_DOUT/I2C1_CLK/ PWM6/ SPI1_DOUT/ SPI0_DOUT/UART1_RX/UART0_RX/ADC6*/SW_TCK
PORTC4	10	I/O	I2S_CLK/I2C0_CLK/ PWM4/ SPI1_CLK/ SPI0_CLK/ UART0_RX/UART1_RX/ADC4*
PORTC3	11	I/O	I2C1_DAT/I2S_DIN/PWM3/SSP0_DIN/SSP1_DIN/UART1_TXD /UART0_TXD/ADC3*
PORTC2	12	I/O	I2C1_CLK/I2S_DOUT/PWM2/SSP0_DOUT/SSP1_DOUT/UART 1_RXD/UART0_RXD/ADC2*
PORTA3	13	I/O	I2S_DIN/I2C1_DAT/ PWM3/ SPI0_DIN/ SPI1_DIN/ UART1_TX/UART0_TX/UART1_RTS/
PORTA2	14	I/O	I2S_DOUT/I2C1_CLK/ PWM2/ SPI0_DOUT/ SPI1_DOUT/ UART1_RX/UART0_RX/UART1_CTS/
RF	15	AI/O	RF input and output
GND	16	GND	Ground

2.3 Application circuit

FR8012



设计说明：
1、PA2 PA3默认为UART口，PC6 PC7默认为J-Link口。
2、建议选用频率公差正负10PPM的晶振，晶振负载电容值根据调试结果确定。
3、L2和C6布局时靠近芯片的BSW脚放置，走线尽量短和宽。L2选用绕线电感或功率叠层电感，饱和电流大于50mA，直流电阻小于1Ω。
4、晶振与电感L2摆放时不能靠得太近。
5、电路中所有的稳压滤波电容务必靠近芯片引脚放置。
6、天线区域净空处理，射频走线走50Ω阻抗线，走线尽量短。预留π型匹配网络，使用高频物料。
7、如果用到内部充电功能，VCHG脚需要对地放置160Ω电阻，避免插拔充电器打坏芯片。
8、VBAT和VCHG脚的电容，耐压值大于10V。

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Continuous operation at or beyond these conditions may permanently damage the device.

Rating		Min	Max	Unit
Storage Temperature		-40	105	℃
Core Supply Voltage		0.9	1.3	V
I/O Voltage	ALDO_OUT	2.1	3.3	V
Supply Voltage	VBAT	2.5	4.3	V

3.2 Recommended Operating Conditions

Operating Condition		Min	Typ	Max	Unit
Operating Temperature Range		-40	20	105	℃
Core Supply Voltage		0.9	1.2	1.3	V
I/O Voltage	ALDO_OUT	2.1	2.9	3.3	V
Supply Voltage	VBAT	2.5	3.7	4.3	V

3.3 Power Consumption

Operation Mode	Average	Maximum	Unit
TX peek current (0dB)		8	mA
RX peek current		9.7	mA
Deep sleep current (include 80K retention RAM)	16.7		μA
Deep sleep current (include 8K retention RAM)	7.2		μA
Power off	5.1		μA

3.4 Crystal oscillator

CLOCK SOURCE	Min	Typ	Max	Unit
Main Crystal OSC(12M/24Mhz) for Bluetooth RF application				
Clock Frequency	24	24	24	MHz
Digital rim range		7.5		pf
Trim step size		0.1		pf
Tolerance		+-10		ppm
Note: XTAL Load capacitance = 7.5pf				