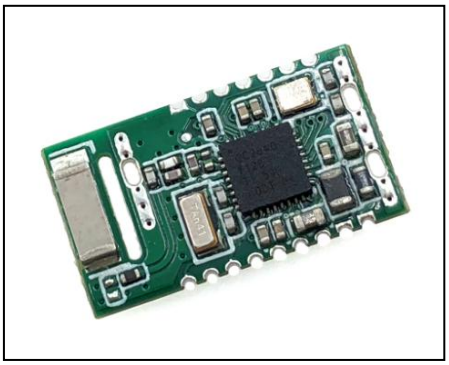


Customize service and solution for wireless transportation products

Bluetooth Low Energy Module Hardware Datasheet

BLE0602C2P

Chongqing JINOU Science and Technology Development Co., Ltd.

2015-7

Content

Revision History

Revision	Date	Description/Changes
1.0	2015-07-08	First release

1 Features

- Operating Frequency Band 2.40 GHz～2.48GHz unlicensed ISM Band
- Bluetooth low energy
- 6.5 mA TX at 0 dBm
- 5.9 mA RX
- 1 μA Low Power Mode (SRAM/CPU retention and RTC running)
- 100 nA Shutdown
- Active 70 μA / MHz CPU Current
- Cost optimized single ended or performance optimized differential RF interface
- Surface-mount, Size: 17.9mm×9.9mm

2 Product Description

The Device is a cost-effective, ultra-low power, 2.4 GHz RF product supporting multiple physical layers and standards.

Very low active and low power mode current consumption as well as fast mode transitions provide excellent battery lifetime and allows operation on small coin cell batteries and in energy harvesting applications.

A powerful 32-bit Cortex M3 running at 48 MHz has more than 30% more processing power per MHz than Cortex M0 based systems and significantly more than 8 and 16-bit processors.

The Bluetooth Low Energy Controller and 802.15.4 MAC are embedded into ROM and are partly running on a separate ARM Cortex M0 dedicated for radio purpose. This improves overall system performance and power consumption as well as frees up FLASH memory for the application.

Software stack support for this device is as follows:

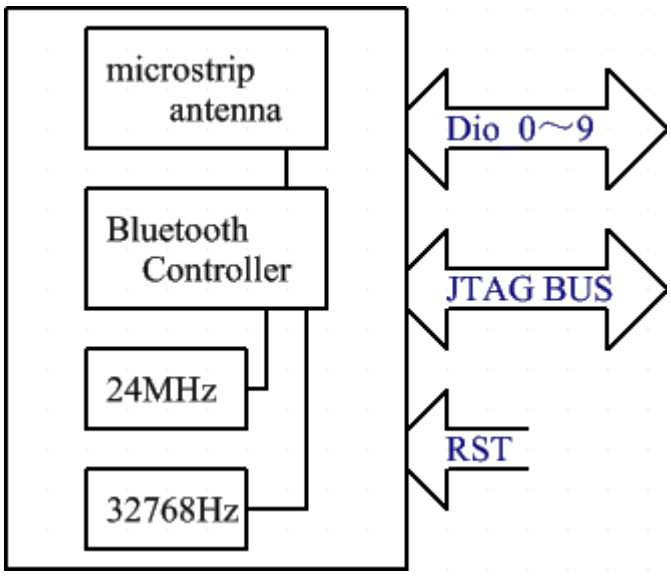
- IEEE 802.15.4 TI MAC
- ZigBee PRO stack
- ZigBee RF4CE stack
- Bluetooth Low Energy stack
- Open Source 6LoWPAN Contiki stack

3 Applications

- Consumer electronics
- Mobile phone accessories
- Sports & Fitness equipment
- HID applications
- Home and Building Automation
- Lighting Control
- Alarm and Security
- Electronic Shelf Labeling
- Proximity Tags
- Medical
- Remote Controls

- Wireless Sensor Networks

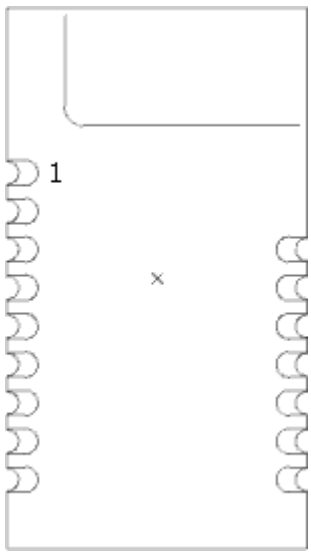
4 Block Diagram



Bluetooth Chip: CC26x0

5 Pin Descriptions

1. Device Terminal Functions

No.	Description		Description	No.
				
1	DIO_0			
2	DIO_1			
3	DIO_2		GND	16
4	JTAG_TMSC		DIO_9	15
5	JTAG_TCKC		DIO_8	14
6	DIO_3		DIO_7	13
7	DIO_4		DIO_6	12
8	GND		DIO_5	11
9	VDD		RST	10

(3)Please refer to Bootstrap Loader (BSL) and JTAG Operation for usage with BSL and JTAG functions

(4)Please refer to JTAG Operation for usage with JTAG function.

2. Device Terminal Functions Description

Pio Port	Description
DIO_0	GPIO, ULP Sensor Interface, LED driving capability
DIO_1	GPIO, ULP Sensor Interface, LED driving capability
DIO_2	GPIO, ULP Sensor Interface, LED driving capability
DIO_3	GPIO, LED driving capability, JTAG_TDO
DIO_4	GPIO, LED driving capability, JTAG_TDI
DIO_5	GPIO, ULP Sensor Interface, Analog
DIO_6	GPIO, ULP Sensor Interface, Analog
DIO_7	GPIO, ULP Sensor Interface, Analog
DIO_8	GPIO, ULP Sensor Interface, Analog
DIO_9	GPIO, ULP Sensor Interface, Analog
JTAG_TMSC	JTAG TMSC
JTAG_TCKC	JTAG TCKC
RST	Reset, active-low. No internal pull-up
VDD	Power Supply
GND	Ground

6 Electrical Specifications

6.1 Absolute maximum ratings

Under no circumstances must the absolute maximum ratings be violated. Stress exceeding one or more of the limiting values may cause permanent damage to the device.

PARAMETER	CONDITIONS	VALUE	UNIT
Supply voltage	All supply pins must have the same voltage	-0.3 to 3.9	V
Voltage on any digital pin(1)		-0.3 to VDD+0.3, max 3.9	V
Input RF level		+10	dBm
Storage temperature range		-40 to +120	℃
Reflow soldering temperature	According to IPC/JEDEC J-STD-020	260	℃
ESD	Human Body Model,	1000	V
	Charged Device Model (RF pins)	300	V
	Charged Device Model (non-RF pins)	500	V

1) Including analog capable DIO

Caution! *ESD sensitive device. Precaution should be used when handling the device in order to prevent permanent damage.*

6.2 Recommended operating conditions

The operating conditions for JO-0508 are listed below.

PARAMETER	CONDITIONS	MIN	MAX	UNIT
Ambient temperature range		-40	85	C
Operating supply voltage	For operation in battery-powered and 3.3V systems (internal DC/DC can be used to minimize battery current)	3.0	3.8	V
Rising supply voltage slew rate		0	100	V/ms
Falling supply voltage slew rate		0	20	V/ms

6.3 Power consumption

Unless noted, all specifications are at 25 ℃ and VDD = 3.0 V.

PARAMETER	CONDITIONS	TYP	UNIT
Low Power Mode (LPM4.5)	Shutdown. No clocks running, no retention	100	nA
Low Power Mode (LPM3)	With RTC, CPU, RAM and (partial) register retention	1	μA
Power consumption radio RX(1)	With DC/DC	5.9	mA
Power consumption radio TX(1)	With DC/DC, 0 dBm output power	6.5	mA
Power consumption radio TX(2)	With DC/DC, 5 dBm output power	9.2	mA

1) Single-ended RF mode optimized for size and power consumption

2) Differential RF mode optimized for performance

6.4 Peripherals

Unless noted, all specifications are at 25 ℃ and Vbat = 3.0 V.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
SPI SCLK frequency	Master mode			4	MHz
SPI SCLK frequency	Slave mode			4	MHz
SPI slave SCLK frequency	Dedicated SPI slave			6	MHz
UART rate				3	Mbaud
I2C speed				TBD	kbps
ADC number of bits			12		Bits
ADC sampling period		5			μs
Analog comparator current			TBD		nA
Analog comparator offset voltage			TBD		mV
Capacitive sensing current	Average, per button		TBD		μA

7 Electrical Characteristics

Tc=25℃, VDD = 3.0 V, f_{RF} = 2440MHz. Measured on CC26xxEM reference design including external matching components.

7.1 1 Mbps GFSK (Bluetooth low energy)

Unless noted, all specifications are at 25 ℃ and VDD = 3.0 V.

RX

PARAMETER	CONDITIONS	TYP	MAX	UNIT
Receiver sensitivity	Differential mode, measured in 50Ω single-ended through balun, BER=10^{-3}	-97		dBm
Receiver sensitivity	Single-ended mode, measured in 50Ω single-ended, BER=10^{-3}	-94		dBm
Receiver saturation	Differential mode, measured in 50Ω single-ended through balun, BER=10^{-3}	0		dBm
Co-channel rejection	Wanted signal @-67 dBm, modulated interferer in channel, BER = 10^{-3}	-7		dB
Selectivity, ±1 MHz	Wanted signal @-67 dBm, modulated interferer at ±1 MHz, BER = 10^{-3}	3		dB
Selectivity, + 2 MHz	Wanted signal @-67 dBm, modulated interferer at ±2 MHz, BER = 10^{-3}	38		dB
Selectivity, +3 MHz	Wanted signal @-67 dBm, modulated interferer at ±3 MHz, BER = 10^{-3}	39		dB
Selectivity, Image frequency	Wanted signal @-67 dBm, modulated interferer at image frequency, BER = 10^{-3}	28		dB
Selectivity, Image frequency - 1 MHz	Wanted signal @-67 dBm, modulated interferer at ±1 MHz from image frequency, BER = 10^{-3}	29		dB
Selectivity, ±4 MHz	Wanted signal @-67 dBm, modulated interferer at ±4 MHz, BER = 10^{-3}	32		dB
Selectivity, ±5 MHz or more	Wanted signal @-67 dBm, modulated interferer at	39		dB

	±5 MHz or more, BER = 10^{-3}			
Out-of-band blocking	30 MHz - 2000 MHz	-30		dBm
Out-of-band blocking	2003 - 2399 MHz	-35		dBm
Out-of-band blocking	2484 - 2997 MHz	-35		dBm
Out-of-band blocking	3000 MHz - 12.75 GHz	-30		dBm
Intermodulation	Wanted signal at 2440MHz, -64dBm. Two interferers at 2403 and 2406MHz respectively, at the given power level	TBD		dBm
Spurious emission 30-1000 MHz	Conducted measurement in a 50Ω single ended load. Complies with EN 300 328, EN 300 440 class 2, FCC CFR47, Part 15 and ARIB STD-T-66		-57	dBm
Spurious emission 1-12.75 GHz	Conducted measurement in a 50Ω single ended load. Complies with EN 300 328, EN 300 440 class 2, FCC CFR47, Part 15 and ARIB STD-T-66		-47	dBm

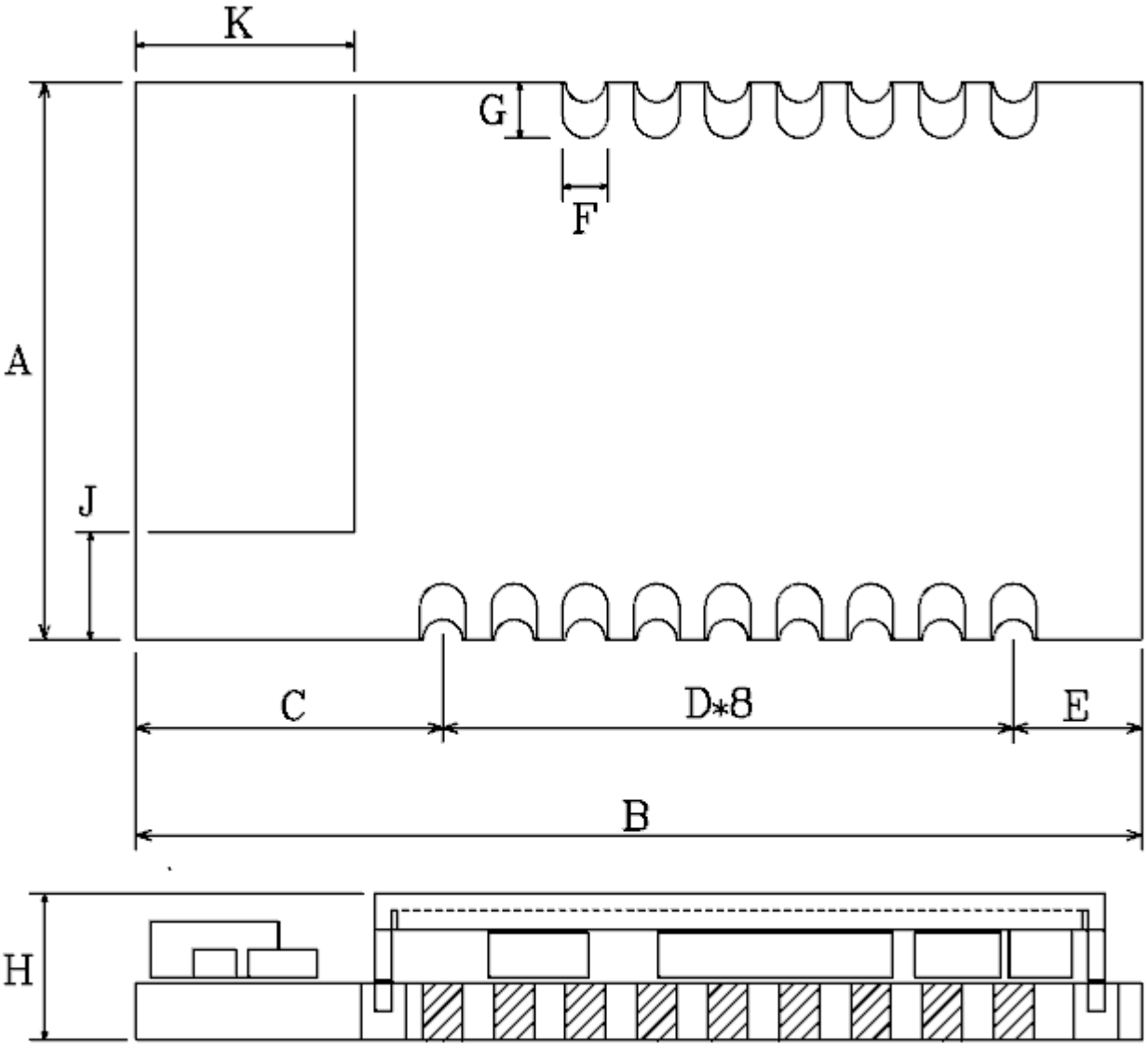
TX

PARAMETER	CONDITIONS	TYP	UNIT
Output power, highest setting	Differential mode, delivered to a single ended 50 Ω load through a balun	+5	dBm
Output power, highest setting	Single-ended mode, delivered to a single-ended 50 Ω load	+2.4	dBm
Output power, lowest setting	Delivered to a single ended 50Ω load through a balun	-20	dBm

Common RX/TX

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
TX/RX transition time			150		μs
Frequency error tolerance	Difference between centre frequency of the received RF signal and local oscillator frequency.	-300		+300	kHz
Data rate error tolerance		-100		+100	ppm

8 Physical Dimensions

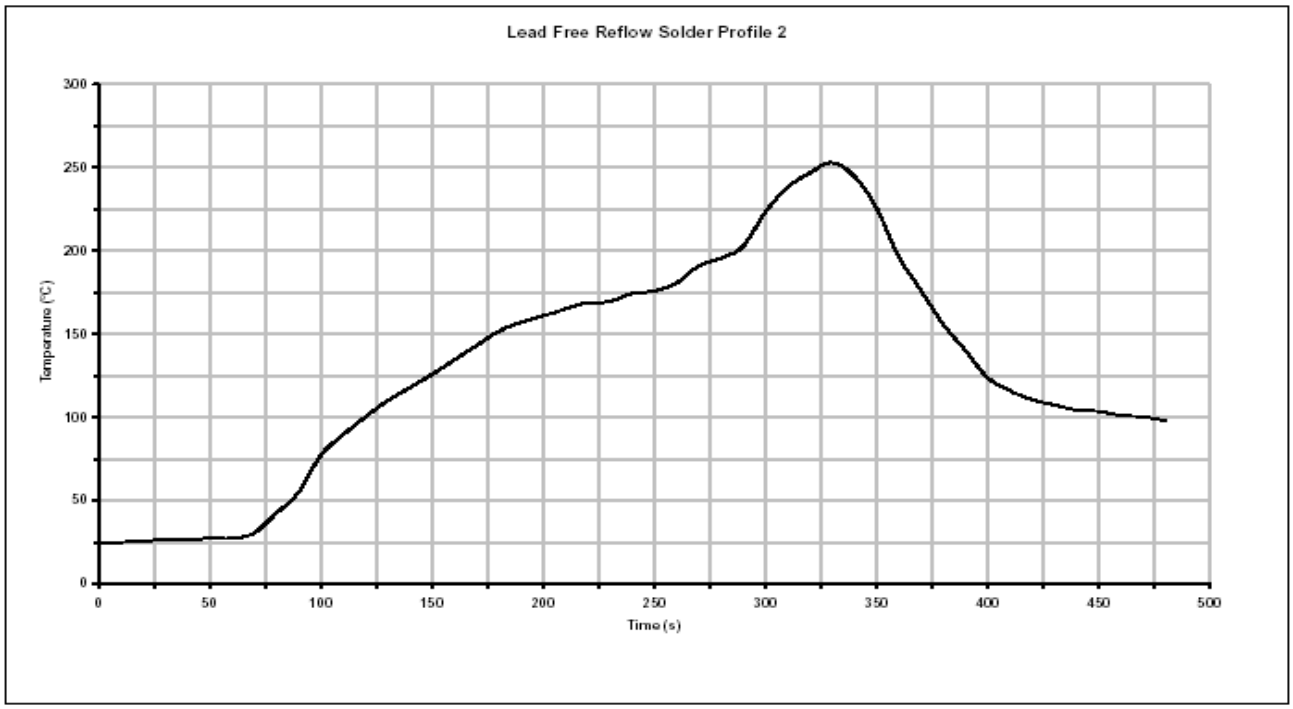


A	B	C	D	E	F	G	H	J	K	
9.91	17.91	5.46	1.27	2.29	0.81	0.99	2.59	75	153	mm
390	705	215	50	90	32	39	102	1.91	3.89	mil

Error: ±0.2mm

9 Solder Profiles

Composition of the solder ball: Sn 95.5%, Ag 4.0%, Cu 0.5%



Typical Lead-Free Re-flow Solder Profile

Key features of the profile:

Initial Ramp = 1-2.5 ℃/sec to 175 ℃±25 ℃ equilibrium

Equilibrium time = 60 to 180 seconds

Ramp to Maximum temperature (250 ℃) = 3 ℃/sec max.

Time above liquidus temperature (217 ℃): 45-90 seconds

Device absolute maximum reflow temperature: 260 ℃

Devices will withstand the specified profile. Lead-free devices will withstand up to three reflows to a maximum temperature of 260 ℃.

Notes：They need to be baked prior to mounting。

10 Guide for Antenna Radiation

In order to achieve longest communication range, please keep the area surrounding antenna free of grounding or metal housing.