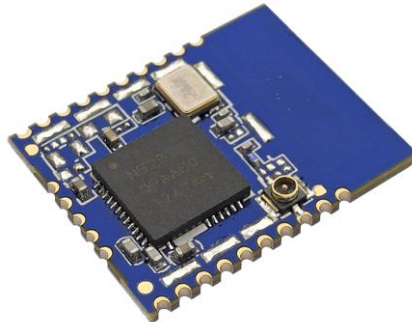


BLM-KTB523

Stand-alone Bluetooth 5 low energy module

Datasheet



Document information

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Subtitle	Stand-alone Bluetooth 5 low energy module	
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1 Functional description

The BLM-KTB523 is a powerful, highly flexible, ultra-low power Bluetooth Low energy module based on the nRF52832 SoC from Nordic Semiconductor. With an Arm® Cortex® -M4 with FPU 32-bit processor, embedded 2.4GHz transceiver, and iPEX connector for external antenna, the BLM-KTB523 provides a complete RF solution with no additional RF design, allowing faster time to market. Providing full use of the nRF52832's capabilities and peripherals, the BLM-KTB523 can power the most demanding applications, all while simplifying designs and reducing BOM costs. Regulatory pre-approvals reduce the burden to enter the market.

1.1 Features

- Based on the Nordic Semiconductor nRF52832 SoC
- Bluetooth 5 PHYs: LE 1M, LE 2M
- Bluetooth 5 features: Advertising Extensions, Channel Selection Algorithm #2
- Bluetooth Mesh
- Complete RF solution
- Nordic Semiconductor SoftDevice ready
- Over-the-Air (OTA) firmware updates
- No external components required
- Arm® Cortex®-M4 with FPU 32-bit processor
- 512 kB embedded flash memory
- 64 KB RAM
- -40 °C to +85 °C Temperature Range
- 19 General Purpose I/O Pins
- 12-bit/200 KSPS ADC
- Serial Wire Debug (SWD)
- Three SPI Master/Slave (8 Mbps)
- Two 2-wire Master/Slave (I2C compatible)
- UART (w/ CTS/RTS and DMA)
- Low power comparator
- Random number generator
- CPU independent Programmable Peripheral Interconnect (PPI)
- Quadrature Demodulator (QDEC)
- 128-bit AES HW encryption
- 5 x 32 bit, 3 x 24 bit Real Timer Counters (RTC)
- NFC-A tag interface for OOB pairing
- Dimensions: 17.4 x 13.7 x 1.9 mm

1.2 Applications

- Beacons – iBeacon™, Eddystone, etc.
- Low-power Sensors
- Climate control
- Lighting
- Safety and security
- Home appliances
- Access control
- Internet of Things
- Home health care
- Advanced remote controls
- Smart energy management
- Low-power sensor networks
- Interactive entertainment
- Key fobs
- Environmental monitoring
- Hotel automation
- Office automation

1.3 Block diagram

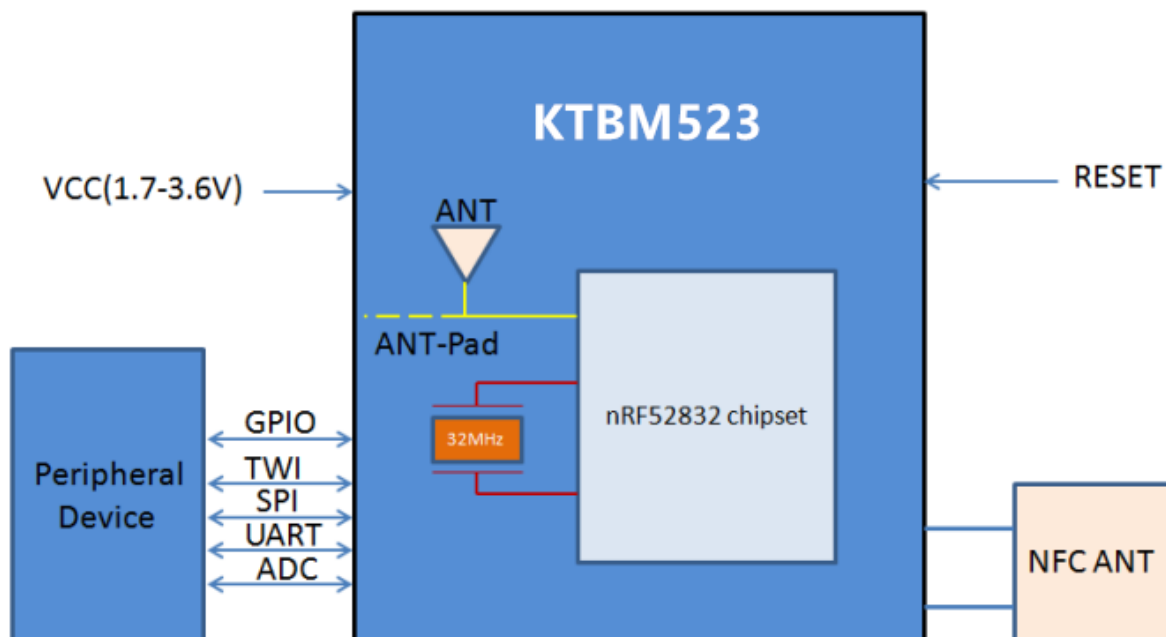


Figure 1: Block diagram

1.4 Product specifications

Detail	Description
Bluetooth	
Bluetooth version	Bluetooth 5 low energy, Concurrent Central & Peripheral (S132), 2M LE PHY, 1M LE PHY, Advertising Extensions, CSA #2 Bluetooth Mesh
Security	AES-128
LE connections	Concurrent central, observer, peripheral, and broadcaster roles with up to twenty concurrent connections along with one Observer and one Broadcaster (S132)
Radio	
Frequency	2.360 GHz to 2.500 GHz
Modulations	GFSK at 1 Mbps, 2 Mbps data rates
Transmit power	+4 dBm maximum
Receiver sensitivity	−96 dBm (Bluetooth low energy mode)
Antenna	iPEX connector for external antenna
Dimensions	
BLM-KTB523	Length: 17.4 mm ± 0.2 mm
	Width: 13.7mm ± 0.2 mm
	Height: 1.9 mm ± 0.1mm
Hardware	
Interfaces	SPI SWD UART ADC/ LPCOMP Two-Wire Interface (I2C) PWM 19 GPIO
Power supply	1.7 V to 3.6 V
Temperature range	−40 °C to +85 °C
Certifications	
USA (FCC)	FCC compliance
Europe (CE)	CE compliance
China (SRRC)	SRRC compliance
ROSH/REACH	ROSH/REACH compliance
Radio chip	
Nordic Semiconductor nRF52832	

Table 1: Product specifications

2 Pin definition

2.1 Pin assignment

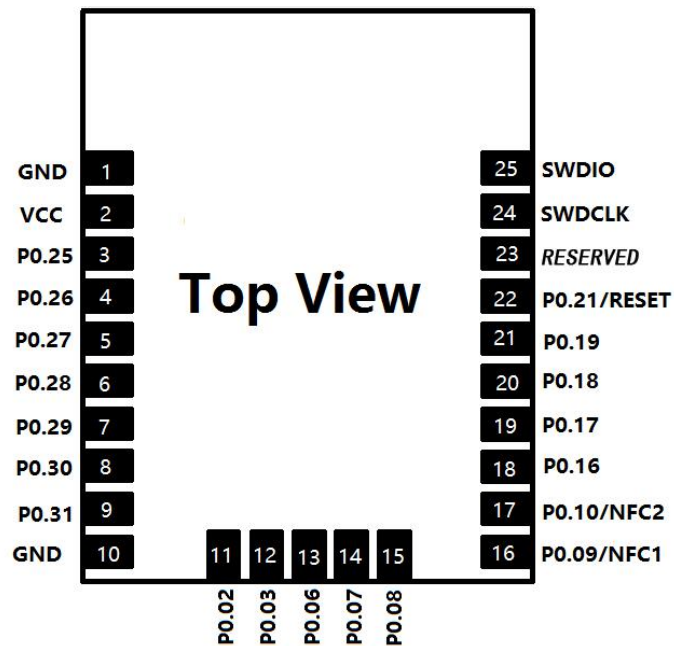


Figure 2: BLM-KTB523 Pin assignment (top view)

2.2 Pin Description

Pin No.	Pin Name	Description	Remark
1	GND	Ground	
2	VCC	Main Power Supply	1.7V to 3.6V
3	P0.25	General Purpose I/O	Digital I/O
4	P0.26	General Purpose I/O	Digital I/O
5	P0.27	General Purpose I/O	Digital I/O
6	P0.28	Digital I/O; Analog input	ADC/LPCOMP input 4
7	P0.29	Digital I/O; Analog input	ADC/LPCOMP input 5
8	P0.30	Digital I/O; Analog input	ADC/LPCOMP input 6

9	P0.31	Digital I/O; Analog input	ADC/LPCOMP input 7
10	GND	Ground	
11	P0.02	Digital I/O; Analog input	ADC/LPCOMP input 0
12	P0.03	Digital I/O; Analog input	ADC/LPCOMP input 1
13	P0.06	General Purpose I/O	Digital I/O
14	P0.07	General Purpose I/O	Digital I/O
15	P0.08	General Purpose I/O	Digital I/O
16	P0.09/NFC1	Digital I/O;NFC1	Digital I/O;NFC1
17	P0.10/NFC2	Digital I/O;NFC2	Digital I/O;NFC2
18	P0.16	General Purpose I/O	Digital I/O
19	P0.17	General Purpose I/O	Digital I/O
20	P0.18	General Purpose I/O	Digital I/O
21	P0.19	General Purpose I/O	Digital I/O
22	P0.21/RESET	Digital I/O;System Reset (Active low)	Digital I/O; Reset
23	NC	Not Connect	
24	SWDCLK	Hardware debug and Flash program I/O	Digital input
25	SWDIO	Hardware Debug and Flash Program I/O	Digital I/O

Table 2: BLM-KTB523 pin-out

3 Interfaces

3.1 Power Supply

Regulated power for the BLM-KTB523 is required. The input voltage V_{cc} range should be 1.7V to 3.6V. Suitable decoupling must be provided by external decoupling circuitry (10uF and 0.1uF). It can reduce the noise from power supply and increase power stability.

3.2 System Function Interfaces

3.2.1 GPIOs

The general purpose I/O is organized as one port with up to 19 I/Os enabling access and control of up to 19 pins through one port. Each GPIO can be accessed individually with the following user configurable features:

- 1、 Input/output direction
- 2、 Output drive strength
- 3、 Internal pull-up and pull-down resistors
- 4、 Wake-up from high or low level triggers on all pins
- 5、 Trigger interrupt on all pins
- 6、 All pins can be used by the PPI task/event system; the maximum number of pins that can be interfaced through the PPI at the same time is limited by the number of GPIOTE channels
- 7、 All pins can be individually configured to carry serial interface or quadrature demodulator signals
- 8、 All pins can be configured as PWM signal.
- 9、 There are 6 ADC/LPCOMP input in the 19 I/Os.

3.2.2 Two-wire Interface (I2C Compatible)

The two-wire interface can communicate with a bi-directional wired-AND bus with two lines (SCL, SDA). The protocol makes it possible to interconnect up to 127 individually addressable devices. The interface is capable of clock stretching, supporting data rates of 100 kbps ,250kbps and 400 kbps. The module has 2 TWI ports and they properties like following table.

Instance	Master/Slave
TWI0	Master
TWI1	Master

Table3-1: TWI Pin Share Scheme

Note : I2C:Inter - Integrated Circuit

3.2.3 Flash Program I/Os

The module has two programmer pins, respectively SWDCLK pin and SWDIO pin. The two pin Serial Wire Debug (SWD) interface provided as a part of the Debug Access Port (DAP) offers a flexible and powerful mechanism for non-intrusive debugging of program code. Breakpoints and single stepping are part of this support.

3.2.4 Serial Peripheral Interface

The SPI interfaces enable full duplex synchronous communication between devices. They support a three-wire (SCK, MISO, MOSI) bi-directional bus with fast data transfers. The SPI Master can communicate with multiple slaves using individual chip select signals for each of the slave devices attached to a bus. Control of chip select signals is left to the application through use of GPIO signals. SPI Master has double buffered I/O data. The SPI Slave includes EasyDMA for data transfer directly to and from RAM allowing Slave data transfers to occur while the CPU is IDLE. The GPIOs are used for each SPI interface line can be chosen from any GPIOs on the device and configed independently. This enables great flexibility in device pinout and efficient use of printed circuit board space and signal routing.

The SPI peripheral support SPI mode 0,1,2,and 3.The module have 3 SPI ports and theirs they properties are as below:

Instance	Master/Slave
SPI0	Master
SPI1	Master
SPIS1	Slave

Table3-2: SPI Properties

3.2.5 UARTs

The Universal Asynchronous Receiver/Transmitter offers fast, full-duplex, asynchronous serial communication with built-in flow control (CTS, RTS), support in hardware up to 1 Mbps baud. Parity checking is supported. Support the following baudrate in bps unit:

1200/2400/4800/9600/14400/19200/28800/38400/57600/76800/115200.

Note: The GPIOs are used for each SPI/TWI/UART interface line can be chosen from any GPIOs on the device and configed independently.

3.2.6 Analog to Digital Converter (ADC)

The 12 bit incremental Analog to Digital Converter (ADC) enables sampling of up to 8 external signals through a front-end multiplexer. The ADC has configurable input and reference prescaling, and sample resolution (8,10, and 12 bit).

Note: The ADC module uses the same analog inputs as the LPCOMP module. Only one of the modules can be enabled at the same time.

BLM-KTB523 Pin Number	Pin Number	Description
6	P0.28	Digital I/O; Analog input 4
7	P0.29	Digital I/O; Analog input 5
8	P0.30	Digital I/O; Analog input 6
9	P0.31	Digital I/O; Analog input 7
11	P0.02	Digital I/O; Analog input 2
12	P0.03	Digital I/O; Analog input 3

Table3-3: ADC Pins

3.2.7 Low Power Comparator (LPCOMP)

In System ON, the block can generate separate events on rising and falling edges of a signal, or sample the current state of the pin as being above or below the threshold. The block can be configured to use any of the analog inputs on the device. Additionally, the low power comparator can be used as an analog wakeup source from System OFF or System ON. The comparator threshold can

be programmed to a range of fractions of the supply voltage.

3.2.8 Reset

The reset pin of the BLM-KTB523 module is in the internal pull-high state, when the reset pin of the module is input a low level, the module will be automatically reset. After the reset pin is used, the parameters of the current setting will not be ANT.

3.2.9 NFC

The NFC peripheral (referred to as the 'NFC peripheral' from now on) supports communication signal interface type A and 106 kbps bit rate from the NFC Forum.

With appropriate software, the NFC peripheral can be used to emulate the listening device NFC-A as specified by the NFC Forum.


Listed here are the main features for the NFC peripheral:


- NFC-A listen mode operation
- 13.56 MHz input frequency
- Bit rate 106 kbps
- Wake-on-field low power field detection (SENSE) mode
- Frame assemble and disassemble for the NFC-A frames specified by the NFC Forum
- Programmable frame timing controller
- Integrated automatic collision resolution, CRC and parity functions

BLM-KTB523 Pin Number	Pin Number	Description
16	P0.09	Digital I/O; NFC1
17	P0.10	Digital I/O; NFC2

Table3-4: ADC Pins

4 Electrical specifications


 Stressing the device above one or more of the ratings listed in the Absolute maximum rating section may cause permanent damage. These are stress ratings only. Operating the module at these or at any conditions other than those specified in the Operating conditions section of this document should be avoided. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

 Operating condition ranges define those limits within which the functionality of the device is guaranteed. Where application information is given, it is advisory only and does not form part of the specification.


4.1 Absolute maximum ratings


Symbol	Description	Min	Max	Unit
VESD	ESD Protection	-	4000	V
VCC	Supply Voltage	-0.3	3.9	V
VIO	Voltage on GPIO pins	-0.3	3.63	V
TS	Storage Temperature Range	-40	125	°C

Table 4-1: Absolute maximum ratings

 The product is not protected against over voltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection devices.

4.2 Operating conditions

 Unless otherwise specified, all operating condition specifications are at an ambient temperature of 25 °C and a supply voltage of 3.0 V.

 Operation beyond the specified operating conditions is not recommended and extended exposure beyond them may affect device reliability.

Symbol	Parameter	Min	Typ.	Max	Unit
VCC	Operating supply voltage	1.7	3.0	3.6	V
VIL	Input Low Voltage	0	-	0.3*VCC	V
VIH	Input High Voltage	0.7*VCC	-	VCC	V
TA	Operating ambient Temperature range	-40	25	85	°C

Table 4-2: Operating conditions

4.3 Operating currents

System State	TX Peak @4dBm	RX Peak	Sleep Mode (avg)	Idle Mode (avg)
Current (peak)@3V	7.5 mA	5.4 mA	0.4uA	1.2uA

Table4-3: Power Consumption in Different States

5 Mechanical specifications

5.1 PCB Footprint and Dimensions

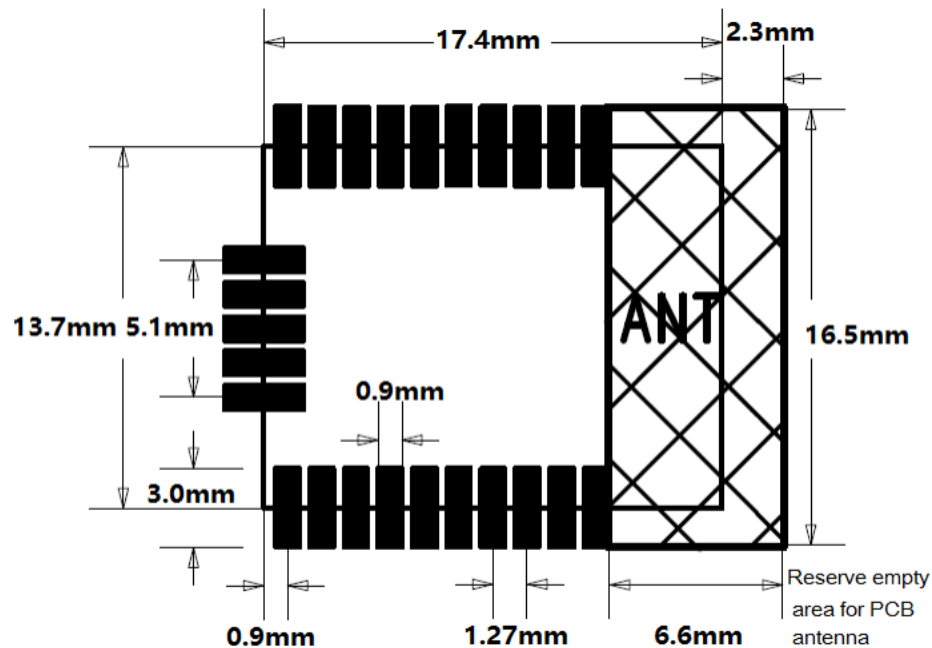


Figure 5: BLM-KTB523 mechanical drawing

5.2 PCB Design Guide

Please reserve empty area for PCB Antenna when you are going to design a device's board, the empty range minimum size 16.5*6.6mm, please kindly check the "PCB footprint and Dimensions" for reference.

6 Product handling

6.1 Packaging

BLM-KTB523 modules are put into tray and 528 units per tray. Each tray is 'dry' and vacuum packaging.

6.2 Moisture sensitivity level

The BLM-KTB523 is rated for MSL 3, 168-hour floor life after opening.

6.3 Reflow soldering

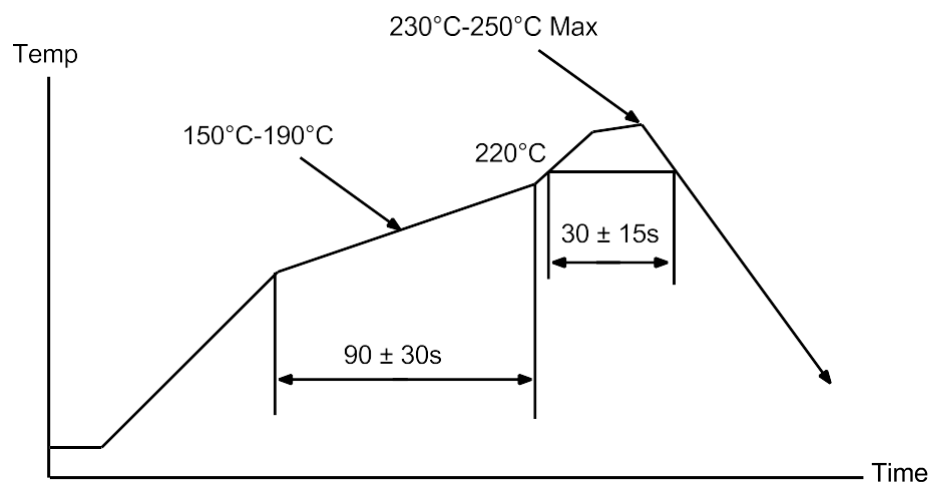


Figure 6-1: Reflow profile for lead free solder

6.4 ESD precautions

⚠ The BLM-KTB523 module contains highly sensitive electronic circuitry and is an Electrostatic Sensitive Device (ESD). Handling the BLM-KTB523 module without proper ESD protection may destroy or damage them permanently.

Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates the BLM-KTB523 module. Failure to observe these recommendations can result in severe damage to the device.

7 Ordering information

Module No.	Crystal	Shielding	ANTenna	Temperature Grade
BLM-KTB523	No	No	PCB	Industry
BLM-KTB523-A	32.768K	Shielding	PCB	Industry

Table 7: Product ordering codes

8 Revision history

Revision	Date	Name	Comments
1.0	06-Aug-2020		Initial preliminary release.

9 Contact

For complete contact information, visit us at www.blmworld.com

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