

## *Blumod BMD-200 Module for Bluetooth 4.0 LE*

The blumod **BMD-200** from Rigado is a powerful, highly flexible *Bluetooth* Smart module based on the nRF51822 SoC from Nordic Semiconductor. With a ARM® Cortex™ M0 CPU, embedded 2.4GHz transceiver, and on-module chip antenna, the **BMD-200** provides a complete RF solution with no additional RF design, allowing faster time to market. The **BMD-200** provides full use of the nRF51822's on-chip peripherals, allowing for a wide range of applications without the need for an external host microcontroller; simplifying designs and reducing BOM costs. With an internal DC-DC converter and a voltage supply range of 2.1V to 3.6V, the **BMD-200** can be powered directly from a coin cell or two AAA batteries with ultra-low power consumption.

## Features

- Based on the Nordic nRF51822 SoC
- Complete RF solution with integrated chip antenna
- Integrated DC-DC converter
- No external components required
- ARM® Cortex™-M0 32 bit processor
- Serial Wire Debug (SWD)
- S100 series SoftDevice ready
- 256 kB embedded flash program memory
- 16 kB RAM
- 8/9/10 bit ADC - 8 configurable channels
- 15 General Purpose I/O Pins
- One 32 bit and two 16 bit timers with counter mode
- SPI Master/Slave (4 Mbps)
- Low power comparator
- Temperature sensor
- Two-wire Master (I2C compatible)
- UART (w/ CTS/RTS)
- CPU independent Programmable Peripheral Interconnect (PPI)
- Quadrature Decoder (QDEC)
- AES HW encryption
- Real Timer Counter (RTC)

## Applications

- Accessories
- iBeacons™
- Low-Power Sensors
- Connected Appliances
- Lighting Products
- Health/Fitness devices
- Wearables

# Quick Specifications

<b>Bluetooth</b>	
Version	4.0 ( <i>Bluetooth Smart</i> )
Security	AES-128
LE connections	up to 8

<b>Radio</b>	
Frequency	2.402GHz to 2480GHz
Modulations	GFSK at 250 kbps, 1 Mbps, 2 Mbps data rates
Transmit power	+4 dBm
Receiver sensitivity	-93 dBm
Typical line-of-sight range	30 - 150 meters
Antenna	Integrated ceramic chip

<b>Current Consumption</b>	
TX only @ +4 dBm, 0 dBm, -4 dBm	16 mA, 10.5 mA, 8 mA
RX only @ 2 Mbps, 1 Mbps, 250 kbps	13.4 mA, 13 mA, 12.6 mA
CPU @ 16MHz from flash, from RAM	4.4 mA, 2.4 mA
System Off , w/ 16K RAM, 8K RAM, no RAM retention	1.8 uA, 1.2 uA, 0.6 uA

<b>Dimensions</b>	
Length	17.00 mm
Width	17.00 mm
Height	2.89 mm

<b>Hardware</b>	
Interface	SPI Master/Slave, UART, Two-Wire Master, GPIO
Power supply	2.1V to 3.6V

<b>Certifications</b>	
FCC	FCC part 15 modular qualification

# Absolution Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit
$V_{CC\_MAX}$	Voltage on supply pin	-0.3	3.9	V
$V_{IO\_MAX}$	Voltage on GPIO pins	-0.3	$V_{CC} + 0.3$	V
$T_S$	Storage Temperature Range	-40	125	°C

# Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{CC}$	Operating supply voltage	2.1	3.0	3.6	V
$T_{R\_VCC}$	Supply rise time (0V to 1.8V)	-	-	60	ms
$T_A$	Operating Ambient Temperature Range	-25	25	75	°C

# GPIO Specifications

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{IH}$	Input High Voltage	$0.7 \times V_{CC}$	-	$V_{CC}$	V
$V_{IL}$	Input Low Voltage	$V_{SS}$	-	$0.3 \times V_{CC}$	V
$V_{OH}$	Output High Voltage	$V_{CC} - 0.3$	-	$V_{CC}$	V
$V_{OL}$	Output Low Voltage	$V_{SS}$	-	0.3	V
$R_{PU}$	Pull-up Resistance	11	13	16	kΩ
$R_{PD}$	Pull-down Resistance	11	13	16	kΩ

Note: GPIO have a standard drive strength of 0.5 mA, and a high drive strength of 5 mA. Maximum number of high drive strength pins is 3.

# Clocks

The BMD-200 module requires two clocks, a high frequency clock and a low frequency clock.

The high frequency clock is provided internally by a high-accuracy 16-MHz crystal as required by the nRF51822 for radio operation.

The low frequency clock can be provided internally by an RC oscillator or synthesized from the fast clock; or externally by a 32.768 kHz crystal. An external crystal provides the lowest power consumption.

### 32.768 kHz Crystal Specification Requirements

Symbol	Parameter	Typ.	Max.	Unit
$f_{nom}$	Crystal frequency	32.768	-	kHz
$F_{TOL,BLE}$	Frequency tolerance, Bluetooth low energy applications.	$\pm 250$	-	ppm
$C_l$	Load Capacitance	-	12.5	pF
$C_o$	Shunt Capacitance	-	2	pF
$R_s$	Equivalent series resistance	50	80	k $\Omega$
$C_{pin}$	Input Capacitance on XTAL1 & XTAL2	5	-	pF

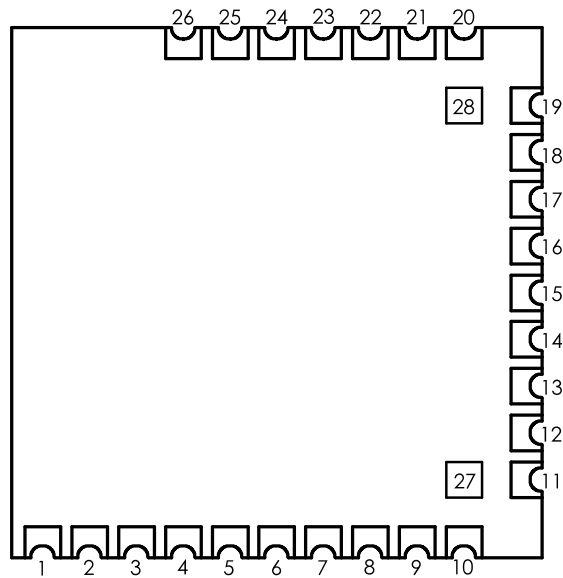
### 32.768 kHz Oscillator Comparison

Symbol	Parameter	Typ.	Max.	Unit
$I_{X32k}$	Current for 32.768kHz Crystal Oscillator	0.4	1	$\mu A$
$I_{RC32k}$	Current for 32.768kHz RC Oscillator	0.8	1.1	$\mu A$
$I_{SYNT32k}$	Current for 32.768kHz Synthesized Oscillator	15	-	$\mu A$
$F_{TOL,X32k}$	Frequency Tolerance, 32.768kHz Crystal Oscillator	-	$\pm 250$	ppm
$F_{TOL,RC32k}$	Frequency Tolerance, 32.768kHz RC Oscillator	$\pm 2$	-	%
$F_{TOL,SYNT32k}$	Frequency Tolerance, 32.768kHz Synthesized Oscillator	$\pm 34$	-	ppm

**Note:**  $F_{TOL,X32k}$  is max tolerance allowed for BLE applications. Actual tolerance depends on the crystal used.

# Pinout

Top View



Pin description (PRELIMINARY)

Name	Pin	Direction	Description
P0.24	5	In/Out	GPIO
P0.25	6	In/Out	GPIO
P0.26	8	In/Out	GPIO/AIN1/XTAL2 (32.768kHz)
P0.27	9	In/Out	GPIO/AIN0/XTAL1(32.768kHz)
P0.00	11	In/Out	GPIO/AREF0
P0.01	12	In/Out	GPIO/AIN2
P0.02	13	In/Out	GPIO/AIN3
P0.03	14	In/Out	GPIO/AIN4
P0.04	15	In/Out	GPIO/AIN5
P0.05	16	In/Out	GPIO/AIN6
P0.06	17	In/Out	GPIO/AIN7/AREF1
P0.08	20	In/Out	GPIO
P0.09	21	In/Out	GPIO
P0.10	22	In/Out	GPIO
P0.11	23	In/Out	GPIO
SWDIO	24	In/Out	SWD IO/ $\overline{\text{RESET}}$
SWDCLK	25	In	SWD Clock <sup>1</sup>
VCC	18	Pwr	+2.1 to +3.6VDC input <sup>2</sup>
GND	1, 2, 3, 4, 7, 10, 19, 26, (27, 28 opt.)	Pwr	Electrical Ground

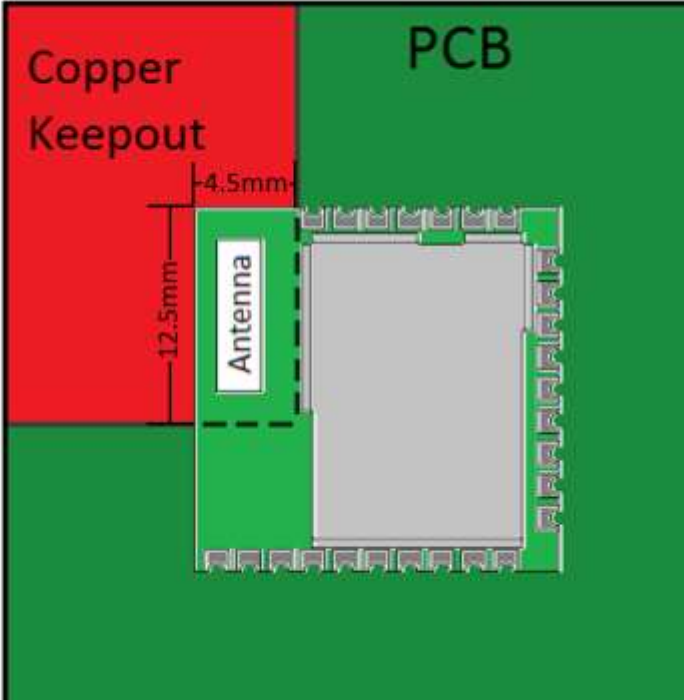
Note 1: SWDCLK has a 12 k $\Omega$  pull-down resistor.

Note 2: An external capacitor for V<sub>CC</sub> is not strictly required, however using a 1 $\mu$ F - 4.7 $\mu$ F ceramic capacitor is recommended.



# Recommended Copper Keepout

The area under and extending out from the antenna portion of the module should be kept clear of copper and other metal. The module should be placed at the edge or, ideally, at the corner of the PCB with the antenna edge facing out.



# FCC Certification

The BMD-200 module has a certification from the FCC to be used as a modular transmitter. Devices that include the BMD-200 must state on the label that it “Contains FCC ID: 2AA9B01”.

## FCC Statement

This device has been tested and found to comply with part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Operation is subjected to the following two conditions: (1) This device may no cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Note: Modification to this product will void the user’s authority to operate this equipment.

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## FCC Important Notes:

### (1) FCC Radiation Exposure Statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter should be installed and operated with a minimum distance of 20 Centimeter between the radiator and your body and must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment complies with Part 15 of the FCC Rules. Operation is subject the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.



The devices must be installed and used in strict accordance with the manufacturer’s instructions as described in the user documentation that comes with the product. Modular could be only used in mobile or fix device, and could not be used in any portable device.

**Caution!**

The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modification could void the user authority to operate the equipment.

**(2) Co-location Warning:**

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

**(3) OEM integration instructions :**

This device is intended only for OEM integrators under the following conditions:

The antenna must be installed such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmit or antenna. The module shall be only used with the integral antenna(s) that has been originally tested and certified with this module.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirement with this module installed(for example, digital device emission, PC peripheral requirements, etc.)

**(4) OEM integration instructions :**

In the event that these conditions cannot be met (for example certain laptop configuration or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these and circumstance, the OEM integrator will be responsible for re-evaluating. The end product (including the transmitter) and obtaining a separate FCC authorization.

**(5) End product labeling :**

This transmitter module is authorization only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following:

“Contains Transmitter Module **FCC ID: 2AA9B01**

**(6) Information that must be placed in the end user manual :**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.