# BMD-300 Module for Bluetooth 4.2 LE

The **BMD-300** from Rigado is a powerful, highly flexible, ultra-low power *Bluetooth* Smart module based on the nRF52832 SoC from Nordic Semiconductor. With an ARM® Cortex™ M4F CPU, embedded 2.4GHz transceiver, and integrated antenna, the **BMD-300** 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 **BMD-300** can power the most demanding applications, all while simplifying designs and reducing BOM costs. With an internal DC-DC converter and intelligent power control the **BMD-300** provides class-leading power efficiency, enabling ultra-low power sensitive applications.
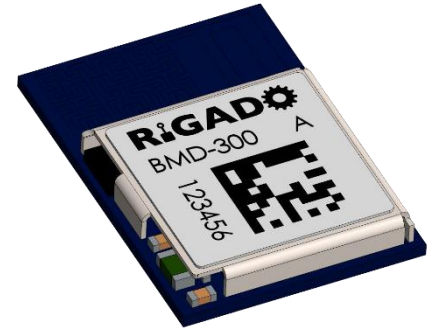
1   Features

- Based on the Nordic nRF52832 SoC
- Complete RF solution with integrated antenna
- Integrated DC-DC converter
- No external components required
- ARM® Cortex™-M4F 32-bit processor
- Serial Wire Debug (SWD)
- Nordic SoftDevice ready
- Over-the-Air (OTA) firmware updates
- 512kB embedded flash memory
- 64kB RAM
- 32 General Purpose I/O Pins
- 12-bit/200KSPS ADC
- -40C to +85 Temperature Range
- FCC ID: **TBD**

- Three SPI Master/Slave (8 Mbps)
- Low power comparator
- Temperature sensor
- Random Number Generator
- Two 2-wire Master/Slave (I2C compatible)
- I2S audio interface
- UART (w/ CTS/RTS and DMA)
- 20 channel CPU independent Programmable Peripheral Interconnect (PPI)
- Quadrature Demodulator (QDEC)
- 128-bit AES HW encryption
- 5 x 32bit, 3 x 24bit Real Timer Counters (RTC)
- NFC-A tag interface for OOB pairing
- Dimensions: 14 x 9.8 x 1.9mm
- IC: **TBD**

2   Applications

- Appcessories
- iBeacons™
- Low-Power Sensors
- Connected Appliances
- Lighting Products
- Fitness devices
- Wearables

3 Ordering Information

Email modules@rigado.com for quotes and ordering or visit www.rigado.com/BMD-300

Part Number	Description
BMD-300-A-CT	BMD-300 module, Rev A, Cut Tape
BMD-300-A-R	BMD-300 module, Rev A, Tape & Reel, 1000 piece multiples
BMD-300-EVAL-S	BMD-300 Evaluation Kit with Segger J-Link-OB programmer

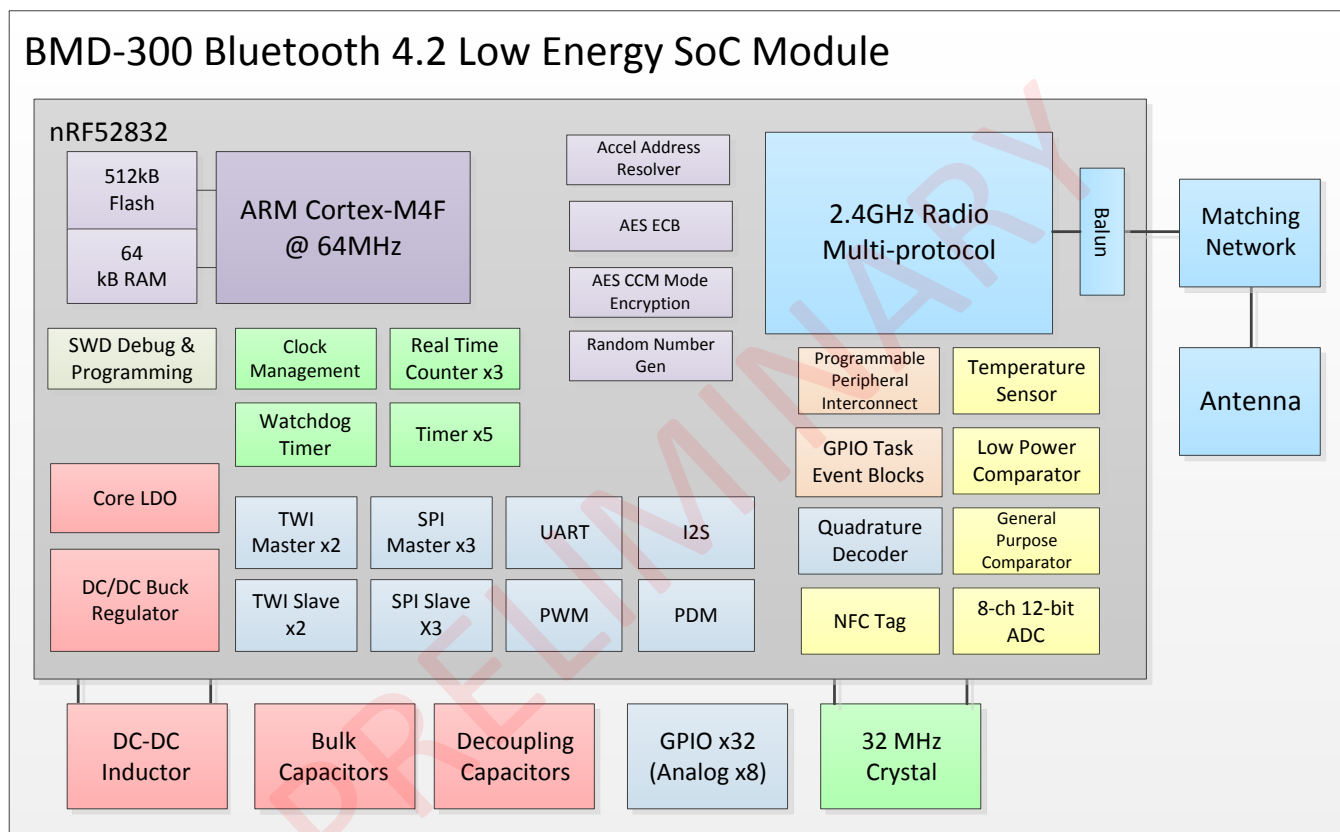*Table 1 – Ordering Part Numbers*

4 Block Diagram

Figure 1 – Block Diagram

Table of Contents

5   Quick Specifications

Bluetooth	
Version	4.2 (*Bluetooth* Smart) Concurrent Central & Peripheral (S132)
Security	AES-128
LE connections	up to 3 as Central, 1 as Peripheral, Observer, Broadcaster (S132)

Radio	
Frequency	2.360GHz to 2.500GHz
Modulations	GFSK at 1 Mbps (BLE), 2 Mbps data rates
Transmit power	+4 dBm
Receiver sensitivity	-96 dBm (BLE mode)
Antenna	Integrated

Current Consumption	
TX only @ +4 dBm, 0 dBm @ 3V, DCDC enabled	7.5 mA, 5.3 mA
TX only @ +4 dBm, 0 dBm	16.6 mA, 11.6 mA
RX only @ 1 Mbps @ 3V, DCDC enabled	5.4 mA
RX only @ 1 Mbps	10.4 mA
CPU @ 64MHz from flash, from RAM	7.4 mA, 6.7 mA
CPU @ 64MHz from flash, from RAM @ 3V, DCDC	3.3 mA, 3.1 mA
System Off , On	400 nA, 1.2 µA
Additional current for RAM retention	40 nA / 4K block

Dimensions	
Length	14.0 mm
Width	9.8 mm
Height	1.9 mm

Hardware	
Interface	SPI Master/Slave x 3 UART Two-Wire Master/Slave (I2C) x 2 I2S PWM PDM GPIO x 32
Power supply	1.7V to 3.6V
Temperature Range	-40 to +85°C

Certifications	
FCC	FCC part 15 modular qualification – FCC ID: TBD
IC	Industry Canada RSS-210 modular qualification – IC: TBD
CE	Pending: EN 60950-1: 2011-01 3.1 (a) : Health and Safety of the User Pending: EN 301 489-17 V2.2.1 3.1 (b) : Electromagnetic Compatibility Pending: EN 300 328 V1.8.1 3.2 :Effective use of spectrum allocated
Bluetooth	RF-PHY Component (Tested) – DID: TBD End Product with S132 – DID: TBD

Table 2 – Quick Specifications

6   Pin Descriptions
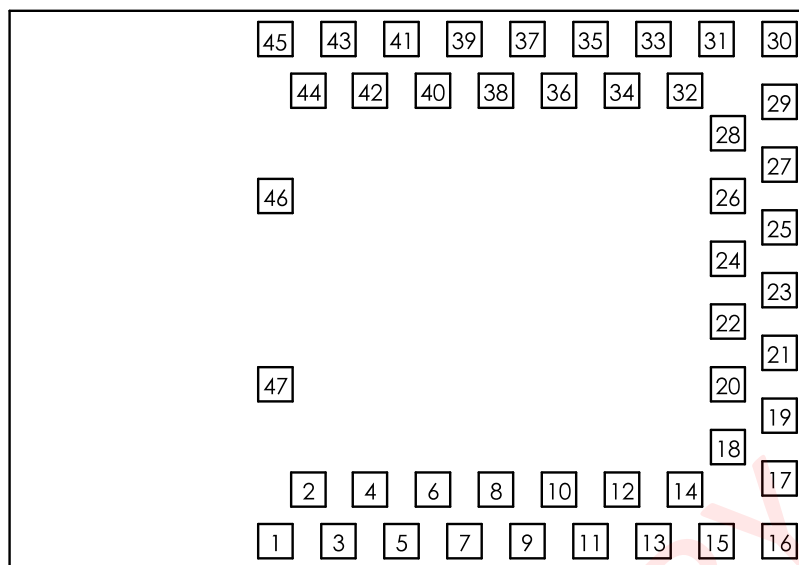
Figure 2 – Pin out (Top View)

Pin description

Pin	Name	Direction	Description
6	P0.25	In/Out	GPIO
7	P0.26	In/Out	GPIO
8	P0.27	In/Out	GPIO
9	P0.28	In/Out	GPIO/AIN4
10	P0.29	In/Out	GPIO/AIN5
11	P0.30	In/Out	GPIO/AIN6
12	P0.31	In/Out	GPIO/AIN7
13	P0.00	In/Out	GPIO/XTAL1 (32.768kHz)
14	P0.01	In/Out	GPIO/XTAL2 (32.768kHz)
15	P0.02	In/Out	GPIO/AIN0
19	P0.03	In/Out	GPIO/AIN1
20	P0.04	In/Out	GPIO/AIN2
21	P0.05	In/Out	GPIO/AIN3
22	P0.06	In/Out	GPIO
23	P0.07	In/Out	GPIO
24	P0.08	In/Out	GPIO
25	P0.09	In/Out	GPIO/NFC1
26	P0.10	In/Out	GPIO/NFC2
27	P0.11	In/Out	GPIO
28	P0.12	In/Out	GPIO
31	P0.13	In/Out	GPIO
32	P0.14	In/Out	GPIO/TRACEDATA[3]
33	P0.15	In/Out	GPIO/TRACEDATA[2]
34	P0.16	In/Out	GPIO/TRACEDATA[1]
35	P0.17	In/Out	GPIO

Pin	Name	Direction	Description
36	P0.18	In/Out	GPIO/TRACEDATA[0]
37	P0.19	In/Out	GPIO
38	P0.20	In/Out	GPIO/TRACECLK
39	P0.21	In/Out	GPIO/ $\overline{RESET}$[1]
40	P0.22	In/Out	GPIO
41	P0.23	In/Out	GPIO
42	P0.24	In/Out	GPIO
43	SWCLK	In	SWD Clock
44	SWDIO	In/Out	SWD IO
17	VCC	Power	+1.7V to +3.6V[2]
1, 2, 3, 4, 5, 16, 18, 29, 30, 45, 46, 47	GND	Power	Electrical Ground
Note 1: The $\overline{RESET}$ function can be assigned to another GPIO during programming. P0.21 is the default used by Rigado and Nordic example applications and development kits. Note 2: An internal 4.7µF capacitor is included on the BMD-300. However, it is good design practice to add additional bulk capacitance as required for your application, especially those with heavy GPIO usage and/or current draw.			

Table 3 – Pin Descriptions

6.1 RigDFU Pin Functions

Rigado RigDFU is programmed on the BMD-300 at the factory. Two GPIO pins are configured as UART pins for transferring new firmware images to the BMD-300. Pins are configured only when bootloader is running, and are fully available to the application firmware. RigDFU can be removed from the BMD-300 by performing a full-chip erase.

Pin	Name	Direction	RigDFU Functions
22	P0.06	Out	UART TX for bootloader *Hi-Z until bootloader activation message received on UART RX.*
24	P0.08	In	UART RX for bootloader *Internal 12kΩ pull-down enabled*

Table 4 – RigDFU Functions

6.2 BMDware Pin Functions

Rigado BMDware is programmed on the BMD-300 at the factory. BMDware provides UART-to-BLE Bridge, beaconing, and Direct Test Mode (DTM) functionality. The pins in Table 5 below describe the pin functionality in BMDware. DTM Mode, Beacon-Only Mode, and AT Command Mode pin states are checked at BMDware start-up to configure BMDware as required by the user, and are then set to Hi-Z to conserve power. For further details on BMDware operation, please see the BMDware Datasheet that can be found at www.rigado.com. BMDware can be overwritten by RigDFU with customer application firmware, or removed along with RigDFU by a full chip erase.

Pin	Name	Direction	BMDware Functions
21	P0.05	Out	Bridge UART RTS Disabled in Beacon-Only & DTM modes, N/C if not used.
22	P0.06	Out	Bridge UART TX Disabled in Beacon-Only & DTM modes, N/C if not used.

Pin	Name	Direction	BMDware Functions
23	P0.07	In	Bridge UART CTS Disabled in Beacon-Only & DTM modes, N/C if not used.
24	P0.08	In	Bridge UART RX Disabled in Beacon-Only & DTM modes, N/C if not used.
27	P0.11	Out	DTM UART TX Only enabled in DTM mode; N/C if not used.
28	P0.12	In	DTM UART RX / DTM Mode Only enabled in DTM mode; N/C if not used. On BMDware Start-up: **High** = Enter DTM mode; **Low** = Enter Normal Operation *Internal 12kΩ pull-down during BMDware start-up, then Hi-Z*
31	P0.13	In	Beacon Only Mode On BMDware Start-up: **High** = Bridge UART enabled; **Low** = Bridge UART disabled *Internal 12kΩ pull-up during BMDware start-up, then Hi-Z*
32	P0.14	In	UART AT Command Mode On BMDware Start-up: **High** = Full pass-through mode; **Low** = AT command mode *Internal 12kΩ pull-up during BMDware start-up, then Hi-Z*

Table 5 – BMDware Functions at Start-up

7 Electrical Specifications

7.1 Absolute 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	3.9	V
T_S	Storage Temperature Range	-40	125	°C

Table 6 – Absolute Maximum Ratings

7.2 Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Operating supply voltage	1.7	3.0	3.6	V
T_{R_VCC}	Supply rise time (0V to 1.7V)	-	-	60	ms
T_A	Operating Ambient Temperature Range	-40	25	85	°C

Table 7 – Operating Conditions

7.3 General Purpose I/O

The general purpose I/O is organized as one port enabling access and control of the 32 available GPIO pins through one port. Each GPIO can be accessed individually with the following user configurable features:

- Input/output direction
- Output drive strength
- Internal pull-up and pull-down resistors
- Wake-up from high or low level triggers on all pins
- Trigger interrupt on all pins
- 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
- All pins can be individually configured to carry serial interface or quadrature demodulator signals

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	$V_{CC} - 0.4$	-	V_{CC}	V
V_{OL}	Output Low Voltage	V_{SS}	-	$V_{SS}+0.4$	V
R_{PU}	Pull-up Resistance	11	13	16	kΩ
R_{PD}	Pull-down Resistance	11	13	16	kΩ

Table 8 – GPIO

7.4 Debug & Programming

The BMD-300 support the two pin Serial Wire Debug (SWD) interface and offers flexible and powerful mechanism for non-intrusive debugging of program code. Breakpoints, single stepping, and instruction trace capture of code execution flow are part of this support.

7.5 Clocks

The BMD-300 module requires two clocks, a high frequency clock and a low frequency clock.

The high frequency clock is provided internally by a high-accuracy 32-MHz crystal as required by the nRF52832 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 (LFXO)

Symbol	Parameter	Typ.	Max.	Unit
F_{NOM_LFXO}	Crystal frequency	32.768	-	kHz
$F_{TOL\_LFXO\_BLE}$	Frequency tolerance, Bluetooth low energy applications	-	±250	ppm
C_{L_LFXO}	Load Capacitance	9	12.5	pF
C_{0_LFXO}	Shunt Capacitance	1	2	pF
R_{S_LFXO}	Equivalent series resistance	60	100	kΩ
C_{pin}	Input Capacitance on XL1 & XL2 pads	4	-	pF

Table 9 – 32.768 kHz Crystal

32.768 kHz Oscillator Comparison

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{LFXO}	Current for 32.768kHz Crystal Oscillator	-	0.23	-	µA
I_{LFRC}	Current for 32.768kHz RC Oscillator	0.5	0.6	0.9	µA
I_{LFSYNT}	Current for 32.768kHz Synthesized Oscillator	-	100	-	µA
$f_{TOL\_LFXO\_BLE}$	Frequency Tolerance, 32.768kHz Crystal Oscillator (BLE Stack)	-	-	±250	ppm
$f_{TOL\_LFXO\_ANT}$	Frequency Tolerance, 32.768kHz Crystal Oscillator (ANT Stack)	-	-	±100	ppm
f_{TOL_LFRC}	Frequency Tolerance, 32.768kHz RC Oscillator	-	-	±2	%
f_{TOL_LFSYNT}	Frequency Tolerance, 32.768kHz Synthesized Oscillator	-	±8	-	ppm

Table 10 – 32.768 kHz Oscillator

8   Firmware

8.1 Factory Image

All modules are shipped with factory programmed firmware. The factory programmed firmware version is indicated on the label, see Figure 3 – MAC Address on Label.

8.1.1 Firmware Version 'AA'

Factory firmware version 'AA' contains the Rigado RigDFU OTA and Serial bootloader, Nordic S132 SoftDevice, and BMDware. Modules can be programmed with customer code via BLE and UART interfaces using Rigado provided tools. Examples apps for iOS and Android are provided that utilize the Rigablue Library for easy OTA updates. Visit the BMD Software Suite page at www.rigado.com for more information. Note: A full chip erase will clear the Rigado assigned MAC address from memory; see section 8.3 "MAC Address Info" on how to retain it.

8.2 SoftDevices

Nordic Semiconductor protocol stacks are known as SoftDevices. SoftDevices are pre-compiled, pre-linked binary files. SoftDevices can be programmed in nRF52 series SoCs and are downloadable from the Nordic website. The BMD-300 with the nRF52832 SoC supports the S132 (BLE Central & Peripheral) and S212 (ANT) SoftDevices and the upcoming S312 SoftDevice with ANT and BLE support.

8.2.1 S132

The S132 SoftDevice is a Bluetooth® low energy (BLE) Central and Peripheral protocol stack solution supporting up to three Central and one Peripheral simultaneous connections and concurrent Observer and Broadcaster roles. It integrates a low energy Controller and Host, and provides a full and flexible API for building Bluetooth low energy System on Chip (SoC) solutions.

Key Features

- *Bluetooth 4.2 compliant low energy single-mode protocol stack suitable for Bluetooth Smart products*
- *Concurrent Central, Observer, Peripheral, and Broadcaster roles with up to:*
  - *Three connections as a central*
  - *One connection as a peripheral*
  - *Observer*
  - *Broadcaster*
- *Link layer*
- *L2CAP, ATT, and SM protocols*
- *GATT and GAP APIs*
- *GATT Client and Server*
- *Complementary nRF52 SDK including Bluetooth profiles and example applications*
- *Master Boot Record for over-the-air device firmware update*

- *Memory isolation between application and protocol stack for robustness and security*
- *Thread-safe supervisor-call based API*
- *Asynchronous, event-driven behavior*
- *No RTOS dependency*
  - *Any RTOS can be used*
- *No link-time dependencies*
  - *Standard ARM® CortexTMM4F project configuration for application development*
- *Support for concurrent and non-concurrent multiprotocol operation*
  - *Concurrent with the Bluetooth stack using concurrent multiprotocol timeslot API*
- *Alternate protocol stack in application space*

8.2.2 S212

The S212 SoftDevice is an ANT protocol stack solution that provides a full and flexible Application Programming Interface (API) for building ANT System on Chip (SoC) solutions for the nRF52832 chip. The S212 SoftDevice simplifies combining the ANT protocol stack and an application on the same CPU.

Key Features

Advanced ANT stack

- *Simple to complex network topologies:*
    - *Peer-to-peer, Star, Tree, Star-to-star and more*
- *Up to 15 logical channels, each with configurable:*
    - *Channel type, ID and period*
    - *RF frequency*
    - *Networks*
- *Broadcast, Acknowledged, and Burst Data modes*
- *Device search, pairing and proximity support*
- *Enhanced ANT features:*
    - *Advanced Burst Transfer mode (up to 60 kbps)*
    - *Up to 15 channels encryption (AES-128) support*
    - *Additional networks – up to 8*
    - *Event Filtering and Selective Data Updates*
    - *Asynchronous Transmission*
    - *Fast Channel Initiation*

SoftDevice features

- *Built-in NVM access and radio coexistence management*
- *Master Boot Record for over-the air device firmware update*
- *Memory isolation between application and protocol stack for robustness and security*
- *Thread-safe supervisor-call based API*
- *Asynchronous, event-driven behavior*
- *No RTOS dependency*
    - *Any RTOS can be used*
    - *No link-time dependencies*
    - *Standard ARM® Cortex™ -M4F project configuration for application development*
- *Support for concurrent and non-concurrent multiprotocol operation*
- *Concurrent multiprotocol timeslot API*
- *Alternate protocol stack running in application space*

8.3 MAC Address Info

The BMD-300 module comes preprogrammed with a unique MAC address from the factory. The MAC address is also printed on a 2D barcode on the top of the module.

Label Image TBD

Figure 3 – MAC Address on Label

The 6-byte BLE Radio MAC address is stored in the nRF52832 UICR at NRF_UICR_BASE+0x80 LSB first. Please read the MAC Address Provisioning application note if you are not using the built in bootloader to avoid erasing/overwriting the MAC address during programming.

UICR Register:
NRF_UICR + 0x80 (0x10001080): MAC_Addr [0] (0xZZ)
NRF_UICR + 0x81 (0x10001081): MAC_Addr [1] (0xYY)
NRF_UICR + 0x82 (0x10001082): MAC_Addr [2] (0xXX)
NRF_UICR + 0x83 (0x10001083): MAC_Addr [3] (0x93)
NRF_UICR + 0x84 (0x10001084): MAC_Addr [4] (0x54)
NRF_UICR + 0x85 (0x10001085): MAC_Addr [5] (0x94)

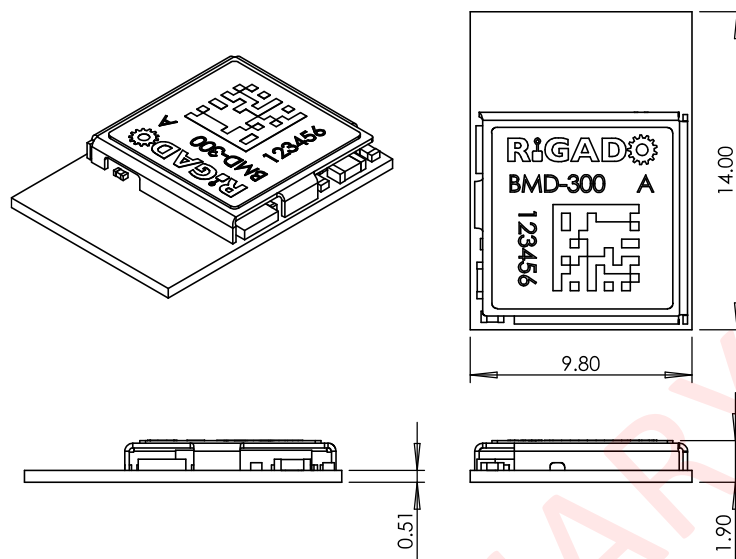# 9 Mechanical Data

9.1 Module Dimensions

Figure 4 – Module Dimensions

(All dimensions are in mm)

9.2 Recommended PCB Land Pad
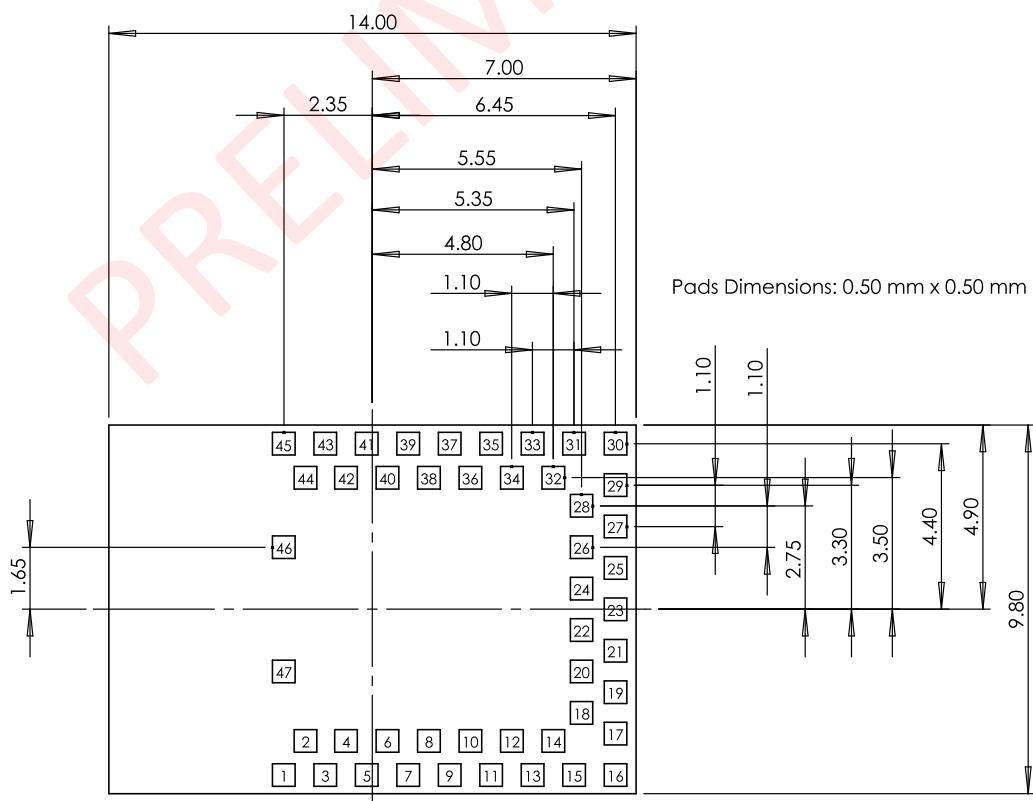

Pads Dimensions: 0.50 mm x 0.50 mm

Figure 5 – Module Dimensions

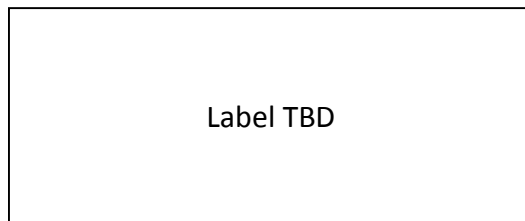**(All dimensions are in mm)**

10 Module Marking

Figure 6 – Module Marking – Rev A – BMD-300

11 RF Design Notes

11.1 Recommended RF Layout & Ground Plane

The integrated antenna requires a suitable ground plane to radiate effectively. Reducing the ground plane from that shown in Figure 7 will reduce the effective radiated power.
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.
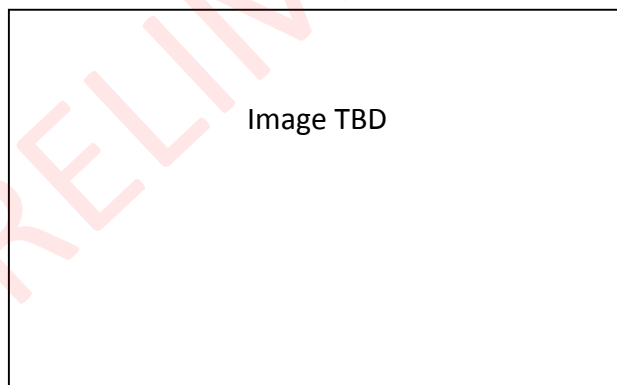

Figure 7 – Recommended RF Layout

11.2 Mechanical Enclosure

Care should be taken when designing and placing the module into an enclosure. Metal should be kept clear from the antenna area, both above and below. Any metal around the module can negatively impact RF performance.
The module is designed and tuned for the antenna and RF components to be in free air. Any potting, epoxy fill, plastic over-molding, or conformal coating can negatively impact RF performance and must be evaluated by the customer.

11.3 Antenna Pattern

Antenna patterns are based off of the BMD-300 Evaluation board v**TBD** with a ground plane size of **TBD**mm x **TBD**mm. X-Y-Z orientation is shown in Figure 8.

Figure 8 – XYZ Antenna Orientation

11.3.1   XY-plane

Figure 9 – XY-plane Radiation Pattern

11.3.2   XZ-plane

Figure 10 – XZ-plane Radiation Pattern

11.3.3   YZ-plane

Figure 11 – YZ-plane Radiation Pattern

12 Evaluation Boards

Rigado has developed full featured evaluation boards that provide a complete I/O pin out to headers, on-board programming and debug, 32.768 kHz crystal, power and virtual COM port over USB, an RGB LED, and three user buttons. The evaluation boards also provide the option to be powered off of a CR2032 coin cell battery, and have a current sensor resistor and header to allow for convenient current measurements. An Arduino Uno R3 header is provided to allow that use of compatible Arduino shields.

13 Custom Development

Project specific firmware and hardware for the BMD-300 can be created or modified for customers.   Custom embedded development is available upon request. Please contact Rigado at info@rigado.com or 1-866-6-RIGADO for custom engineering options and fees.

14 Bluetooth Certification (*pending*)

The BMD-300 module is certified as a Bluetooth End Product with Declaration ID TBD using Nordic's S132 SoftDevice (Bluetooth 4.2). The BMD-300 has also been certified as a Component (tested) for RF-PHY with Declaration ID TDB. This allows customers to use different SoftDevices that have been certified by Nordic without the need to complete additional RF-PHY testing, provided that the design is not changed.

15 Regulatory Statements (*pending*)

Note: Regulatory Statements are for reference only pending the completion of testing and approvals.

15.1 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.

Note: Modification to this product will void the users' authority to operate this equipment.

15.2 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 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.

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 and transmitter must not be co-located with any other transmitter 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 the two (2) conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements with this module installed (for example, digital device emission, PC peripheral requirements, etc.)

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.

Caution!
The OEM is still responsible for verifying compliance with FCC Part 15, subpart B limits for unintentional radiators through an accredited test facility.

(4) End product labeling :
The final end product must be labeled in a visible area with the following: "Contains **FCC ID: TBD**".
Any similar wording that expresses the same meaning may be used.

The FCC Statement below should also be included on the label. When not possible, the FCC Statement should be included in the User Manual of the host device.

> "This device complies with part 15 of the FCC rules.
> Operation is subject to the following two conditions. (1) This device may not cause harmful interference. (2) This device must accept any interference received, including interference that may cause undesired operation."

(5) Information regarding 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 (Section 15.2(4)).

15.3 IC Statement:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF exposure warning: The equipment complies with RF exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Avertissement d'exposition RF: L'équipement est conforme aux limites d'exposition aux RF établies pour un incontrôlés environnement. L'antenne (s) utilisée pour ce transmetteur ne doit pas être co-localisés ou onctionner en conjonction avec toute autre antenne ou transmetteur .

15.4 IC Important Notes:

1. 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 manual of the end product.
The user manual which is provided by OEM integrators for end users must include the following information in a prominent location.

2. To comply with IC RF exposure compliance requirements, the antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with IC multi-transmitter product procedures.

3. The final system integrator must ensure there is no instruction provided in the user manual or customer documentation indicating how to install or remove the transmitter module except such device has implemented two-ways authentication between module and the host system.

4. The host device shall be properly labelled to identify the module within the host device. The final end product must be labeled in a visible area with the following: "Contains **IC: TBD**.
Any similar wording that expresses the same meaning may be used.

The IC Statement below should also be included on the label. When not possible, the IC Statement should be included in the User Manual of the host device.

"This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le onctionnement."

15.5 CE Regulatory:

This device will be tested and compliant against the following standards. OEM integrators should consult with qualified test house to verify all regulatory requirements have been met for their complete device.
From Directive 2006/95/EC:
- EN 60950-1: 2006 + A11: 2009 + A1: 2010 + A12: 2011

From R&TTE Directive 1999/5/EC:
- ETSI EN 300 328 V 1.8.1

From Directive 2004/108/EC:
- ETSI EN 301 489-1 V1.9.2
- EN 61000-3-2: 2014, EN 61000-3-3:2013
- ETSI EN 301 489-17 V2.2.1

Declarations of Conformity and supporting test reports are available at www.rigado.com.

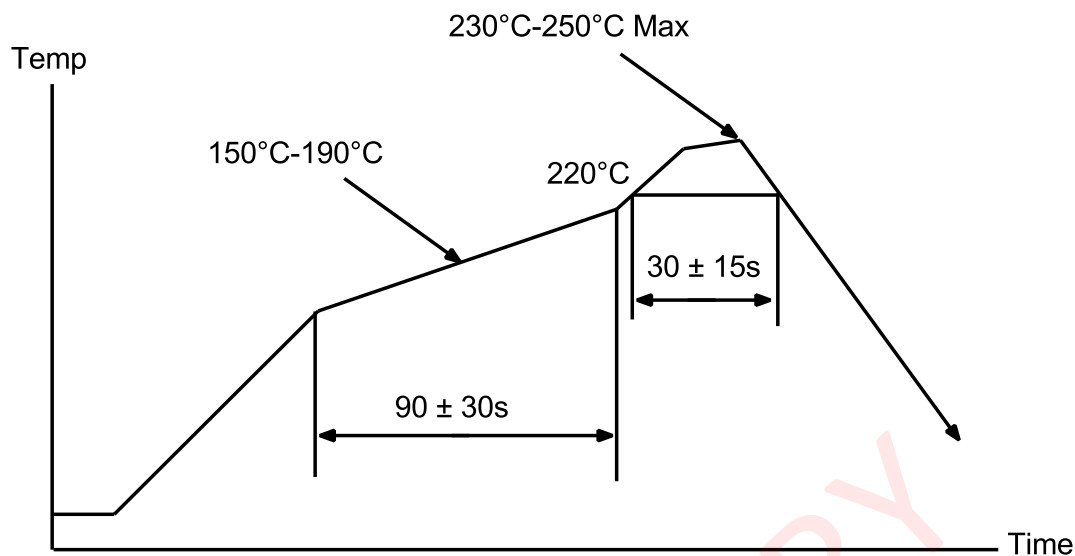# 16 Solder Reflow Temperature-Time Profile

Figure 12 – Reflow Profile for Lead Free Solder

17 Packaging and Labeling
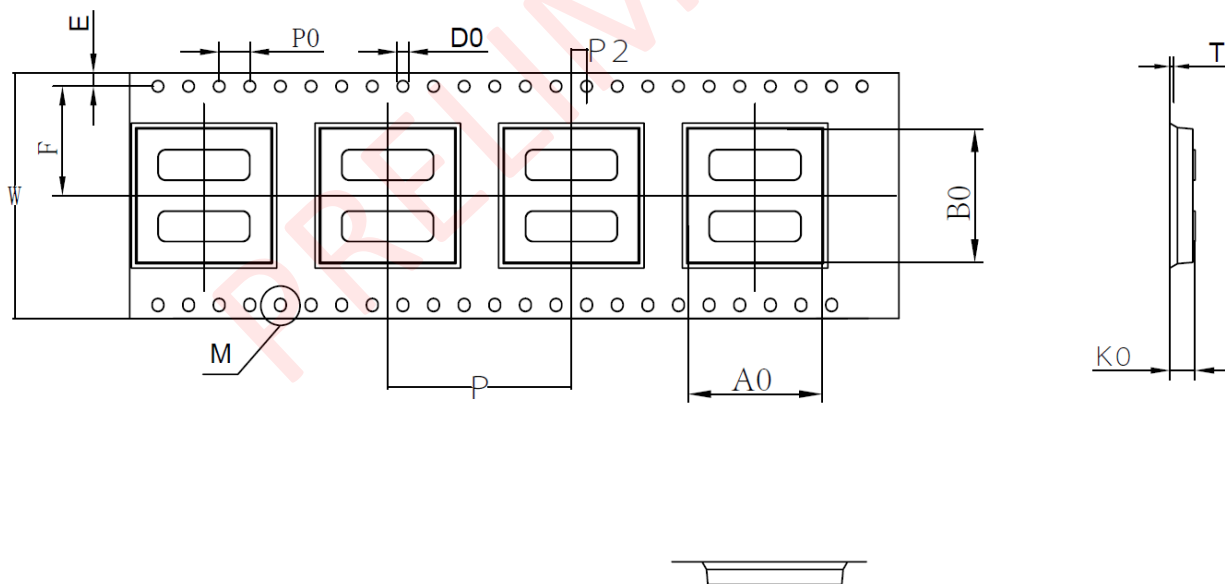
17.1 Carrier Tape Dimensions

TBD

Figure 13 – Carrier Tape Dimensions

17.2 Reel Packaging

Modules come on 330mm reels loaded with 1000 modules. Each reel is placed in an antistatic bag with a desiccant pack and humidity card and placed in a 340x350x65mm box. On the outside of the bag an antistatic warning and reel label are adhered.
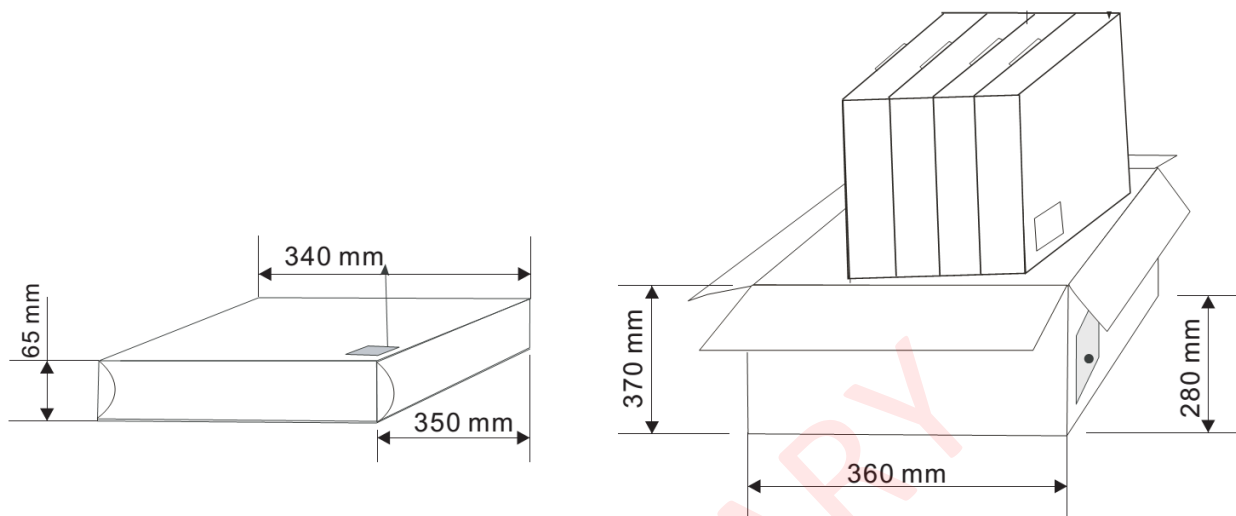

Figure 14 – Reel Cartons

17.3 Packaging Label

Figure 15 – Packaging Label

18 Cautions

1) The guidelines of this document should be followed in order to assure proper performance of the module.
2) This product is for use in office, business, and residential applications, but not medical devices.
3) This module may short-circuit. If a short circuit can result in serious damage or injury then failsafe precautions should be used. This could be accomplished by redundant systems and protection circuits.
4) Supply voltage to the module should not be higher than the specified inputs or reversed. Additionally, it should not contain noise, spikes, or AC ripple voltage.
5) Avoid use with other high frequency circuits.
6) Use methods to eliminate static electricity when working with the module as it can damage the components.
7) Contact with wires, the enclosure, or any other objects should be avoided.
8) Refer to the recommended pattern when designing for this module.
9) If hand soldering is used, be sure to use the precautions outlined in this document.
10) This module should be kept away from heat, both during storage and after installation.
11) Do not drop or physically shock the module.
12) Do not damage the interface surfaces of the module.
13) The module should not be mechanically stressed at any time (storage, handling, installation).
14) Do not store or expose this module to:
    - Humid or salty air conditions
    - High concentrations of corrosive gasses.
    - Long durations of direct sunlight.
    - Temperatures lower than -40°C or higher than 125°C.

19 Life Support Policy

This product is not designed to be used in a life support device or system, or in applications where there is potential for a failure or malfunction to, directly or indirectly, cause significant injury. By using this product in an application that poses these risks, such as described above, the customer is agreeing to indemnify Rigado for any damages that result.

20 Document History

Revision	Date	Changes / Notes
0.8	11/06/2015	Initial preliminary release
0.8.1	11/10/2015	Updated Table 5, Figure 5, Section 7.5 Corrected antenna references
0.8.2	11/11/2015	Updated Figure 1
0.8.3	11/20/2015	Updated current ratings from nRF52832 OPC v0.6.3 Corrected Table 3

21 Related Documents

Rigado Documents:

- BMD-300-AN-1: MAC Address Provisioning *(unreleased)*
- BMD-300-AN-2: Programming Guide *(unreleased)*
- BMD-300-EVAL-UG: Evaluation Kit User Guide *(unreleased)*
- RIGDFU-DS-1: RigDFU Secure Bootloader Datasheet
- BMDWARE-DS-1: BMDware Datasheet

Nordic Documents:

- nRF52832-OPS: nRF52832 Objective Product Specification
- S132-SDS: nRF52832 S132 SoftDevice Specification
- S212-SDS: nRF52832 S212 SoftDevice Specification