

BMD-345 Module for Bluetooth 5 and 802.15.4

The **BMD-345** is an advanced, highly flexible, ultra-low power multiprotocol SoM that enables **Bluetooth 5** (BLE) and **IEEE 802.15.4** (Thread and Zigbee) connectivity for portable, extremely low power embedded systems. With an ARM[®] Cortex™-M4F CPU, integrated 2.4GHz transceiver, and an integrated antenna, the **BMD-345** provides a complete RF solution allowing faster time to market with reduced development costs. Providing full use of the **Nordic nRF52840's** capabilities and peripherals, the **BMD-345** can power the most demanding applications, all while simplifying designs and reducing BOM costs. The **BMD-345** is an ideal solution for designs that require the latest **Bluetooth 5** features or 802.15.4 based networking for Thread. Increased integration with built in USB and 5.5V compatible DC/DC supply reduces design complexity and BOM cost, while expanding possible applications. **BMD-345** designs are footprint compatible with the **BMD-301**, providing low-cost flexibility for tiered product lineups.



1. Features

- Based on the Nordic nRF52840 SoC
- Bluetooth 5 Long Range, 2Mbps, and Advertising Extension support
- Extended range with PA + LNA
- Support for host board antenna and u.FL
- IEEE 802.15.4 with Thread and Zigbee support
- No external components required
- ARM[®] Cortex™-M4F 32-bit processor
- ARM[®] TrustZone[®] Cryptocell 310 security
- True Random Number Generator
- Serial Wire Debug (SWD)
- Nordic SoftDevice ready
- 1MB embedded flash memory
- 256kB RAM
- 48 General Purpose I/O Pins
- -40C to +85 Temperature Range
- FCC: **2AA9B11**
- 12-bit/200KSPS ADC
- One Full-Speed USB (12Mbps)
- Four SPI Master/Slave (8 Mbps)
- Quad SPI with Execute in Place (XIP)
- Low power comparator
- Temperature sensor
- Two 2-wire Master/Slave (I2C compatible)
- I2S audio interface
- Two UARTs (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: 15.0 x 10.2 x 1.9mm
- IC: **12208A-11**

2. Block Diagram

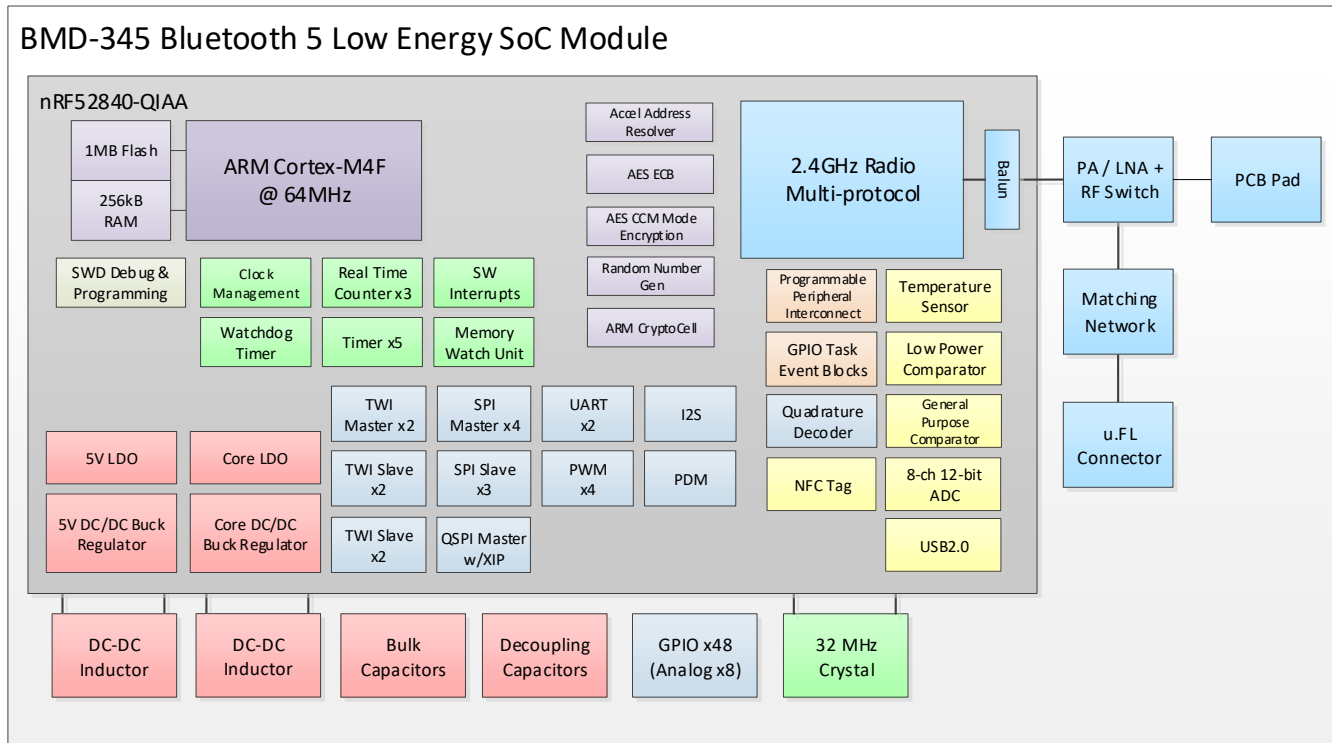


Figure 1 – Block Diagram

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3. Quick Specifications

Bluetooth		
Version	5.0 (<i>Bluetooth Smart</i>) Concurrent Central & Peripheral (S140)	
Security	AES-128	
LE connections	Up to 20 as Central, 1 as Peripheral, Observer, Broadcaster (S140)	
IEEE 802.15.4		
Thread Stack	OpenThread, Thread 1.1 certified	
Thread Security	AES-128, ARM® Cryptocell accelerated	
Zigbee Stack	Zigbee 3.0 (Certification Pending)	
Radio		
Frequency	2.402GHz to 2.480GHz	
Modulations	GFSK at 1 Mbps and 2Mbps, QPSK at 250kbps	
Transmit power	+15 dBm	
Receiver sensitivity	-103dBm (2Mbps), -105 dBm (1Mbps), -113 (125ksps BLE), -110 dBm (IEEE 802.15.4)	
Antenna	Integrated	
Dimensions		
BMD-345	Length	15.0 mm ± 0.3mm
	Width	10.2 mm ± 0.3mm
	Height	1.9 mm ± 0.1mm
Hardware		
Interfaces	SPI Master/Slave x4 Quad SPI x1 UART x2 Two-Wire Master/Slave (I2C) x2 GPIO x48	I2S x1 PWM x12 PDM x1 USB 2.0 x1 Analog input x8
Power supply	VDD: 2.0V to 3.6V VBUS: 4.35V to 5.5V (For USB operation)	
Temperature Range	-40 to +85°C	
Certifications		
FCC	FCC part 15 modular certification BMD-345 FCC ID: 2AA9B11	
IC	Industry Canada RSS-210 modular certification BMD-345 IC: 12208A-11	
CE	EN 60950-1: 2011-01 EN 301 489-1 V2.1.1& EN 301 489-17 V3.1.1 EN 300 328 V2.1.1	3.1 (a): Health and Safety of the User 3.1 (b): Electromagnetic Compatibility 3.2: Effective use of spectrum allocated
Australia / New Zealand	AS/NZS 4268 :2012+AMDT 1:2013, Radio equipment and systems – Short range devices	
Bluetooth	BMD-345 RF-PHY Component (Tested) – DID: D040774; QDID: 114712	

Table 1 – Quick Specifications

4. Pin Descriptions

4.1 BMD-345

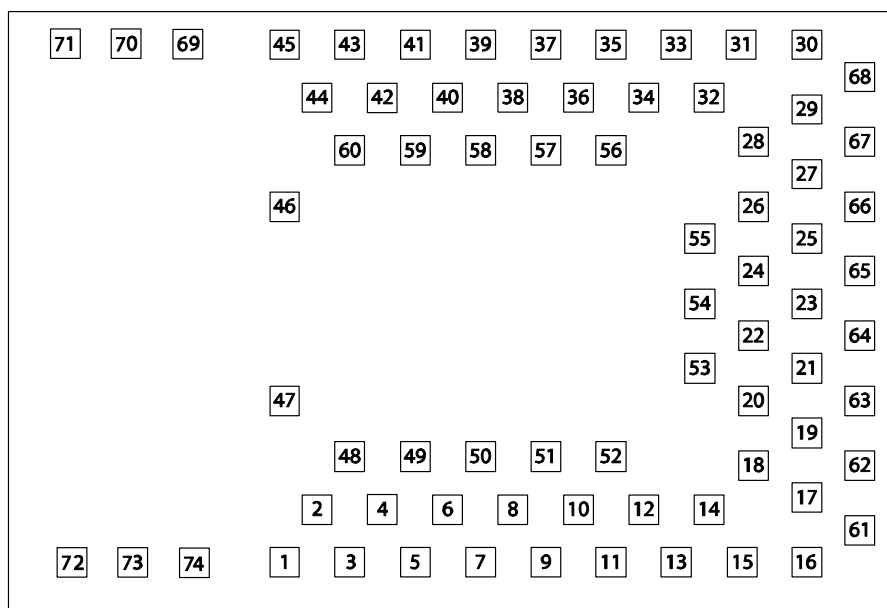


Figure 2 – BMD-345 Pin out (Top View)

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 ²
10	P0.29	In/Out	GPIO/AIN5 ²
11	P0.30	In/Out	GPIO/AIN6 ²
12	P0.31	In/Out	GPIO/AIN7 ²
13	P0.00	In/Out	GPIO/XTAL1 (32.768kHz)
14	P0.01	In/Out	GPIO/XTAL2 (32.768kHz)
15	P0.02	In/Out	GPIO/AINO ²
19	P0.03	In/Out	GPIO/AIN1 ²
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/TRACECLK
24	P0.08	In/Out	GPIO
25	P0.09	In/Out	GPIO/NFC1 ²
26	P0.10	In/Out	GPIO/NFC2 ²
27	P0.11	In/Out	GPIO/TRACEDATA[2]
28	P0.12	In/Out	GPIO/TRACEDATA[1]
31	P0.13	In/Out	GPIO
32	P0.14	In/Out	GPIO

Pin	Name	Direction	Description
33	P0.15	In/Out	GPIO
34	P0.16	In/Out	GPIO
35	P0.17	In/Out	GPIO
36	P0.21	In/Out	GPIO
37	P0.19	In/Out	GPIO
38	P0.20	In/Out	GPIO
39	P0.18	In/Out	GPIO/ <u>RESET</u>
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
48	P1.05	Out	PA_TX_EN
49	P1.06	Out	PA_RX_EN
50	P1.07	In/Out	GPIO ²
51	P1.08	In/Out	GPIO
52	P1.09	In/Out	GPIO/TRACEDATA[3]
53	P1.10	In/Out	GPIO ²
54	P1.11	In/Out	GPIO ²
56	P1.00	In/Out	GPIO/TRACEDATA[0]/SWO
57	P1.01	In/Out	GPIO ²
58	P1.02	Out	ANT_SEL
59	P1.03	In/Out	GPIO ²
60	P1.04	Out	PA_MODE
61	P1.12	In/Out	GPIO ²
62	P1.13	In/Out	GPIO ²
63	P1.14	In/Out	GPIO ²
64	P1.15	In/Out	GPIO ²
67	USB-D-	In/Out	USB Data -
68	USB-D+	In/Out	USB Data +
66	VBUS	Power	USB PHY supply: 4.35V to 5.5V in Connect to USB Host device 5V supply
17, 65	VCC ¹	Power In/Out	Connect to 2.0V to 3.6V DC supply
73	ANTA	RF Port	50Ω RF antenna port
1, 2, 3, 4, 5, 16, 18, 29, 30, 45, 46, 47, 55, 69, 70, 71, 72, 74	GND	Power	Electrical Ground

Note 1: An internal 4.7μF bulk capacitor is included on the module. However, it is good design practice to add additional bulk capacitance as required for your application, i.e. those with heavy GPIO usage and/or current draw.

Note 2: These pins are in close proximity to the nRF52 radio power supply and antenna pins. Radio performance parameters, such as sensitivity, may be affected by high frequency digital I/O with large sink/source current on these pins. Nordic recommends using only low frequency, low-drive functions when possible.

Note 3: In HV mode, VCC acts as a regulated supply that can power other external devices. The voltage output of VCC can be configured in software but is limited to no more than VCCH-0.3V. In System Off mode VCC can supply no more than 1mA.

Table 2 – BMD-345 Pin Descriptions

4.2 Peripheral Pins

The BMD-345 features a pin muxing system that allows most internal peripherals, such as UART and SPI, to be used on any GPIO pin. This freedom in pin choice enables better optimization of designs and PCB layout. Note that only one peripheral signal can be muxed to a GPIO pin at a time. Some functions are restricted to certain pins due to additional internal circuitry required by the interface. These include: Trace signals, analog inputs, XTAL signals, USB signals, SWD interface, and reset. See [Table 3](#) below for details:

Peripheral	Signal	Pin Options
UART0, UART1	All	P0.00-P0.31, P1.00-P1.15
I2C0, I2C1		
SPI0, SPI1, SPI2, SPI3		
I2S0		
QSPI0		
PWM0, PWM1, PWM2, PWM3		
PDNO		
ADC, COMP, LPCOMP	All	P0.02-P0.05, P0.28-P0.31 (AIN0-AIN7)
NFC	NFC1	P0.09
	NFC2	P0.10
Reset	RESET	P0.18
Trace	TRACECLK	P0.07
	SWO/TRACEDATA[0]	P1.00
	TRACEDATA[1]	P0.12
	TRACEDATA[2]	P0.11
	TRACEDATA[3]	P1.09
SWD	SWD Clock	SWCLK
	SWD IO	SWDIO
32.768kHz Crystal	XTAL1	P0.00
	XTAL2	P0.01
USB	USB Data +	USB-D+
	USB Data -	USB-D-

Table 3 – Peripheral Pin Options

Note: Some peripherals on the BMD-345 share the same memory location for their registers. This means that only one of these peripherals can be used at a time. It is possible to switch between peripherals that share the same register location by clearing and reinitializing the associated configuration registers. See the Nordic Semiconductor nRF52840 Product Specification for details.

Peripheral ID	Base Address	Shared Peripherals	
3	0x40003000	SPI0	I2C0
4	0x40004000	SPI1	I2C1

Table 4 – Peripherals with Shared Registers

4.2.1 BMD-301 to BMD-345 Pad Differences

Due to changes in the nRF52840 SoC used by the BMD-345, not all functions (such as SWO/TRACE signals) are found on the same pins as on the BMD-301. Particularly of note is the reset pin function which on the BMD-345 is now available on P0.18 instead of P0.21 as on the BMD-301. To maintain pin for pin compatibility of the reset

signal, P0.18 and P0.21 have swapped pad locations on the BMD-345 footprint. These differences are detailed in [Table 5](#) below:

Pin	BMD-301 Name	BMD-301 Function	BMD-345 Name	BMD-345 Function
39	P0.21	GPIO/RESET	P0.18	GPIO/RESET
38	P0.20	GPIO/TRACECLK	P0.20	GPIO
36	P0.18	GPIO/TRACEDATA[0]/SWO	P0.21	GPIO
34	P0.16	GPIO/TRACEDATA[1]	P0.16	GPIO
33	P0.15	GPIO/TRACEDATA[2]	P0.15	GPIO
32	P0.14	GPIO/TRACEDATA[3]	P0.14	GPIO
23	P0.07	GPIO	P0.07	GPIO/TRACECLK
56	N/A	N/A	P1.00	GPIO/TRACEDATA[0]/SWO
28	P0.12	GPIO	P0.12	GPIO/TRACEDATA[1]
27	P0.11	GPIO	P0.11	GPIO/TRACEDATA[2]
52	N/A	N/A	P1.09	GPIO/TRACEDATA[3]

Table 5 – BMD-301 to BMD-345 Pad Differences

5. Electrical Specifications

5.1 Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit
V _{CC_MAX}	Voltage on VCC supply pin	-0.3	3.9	V
V _{BUS_MAX}	Voltage on VBUS Supply pin	-0.3	5.8	V
V _{IO_MAX}	Voltage on GPIO pins (V _{CC} > 3.6V)	-0.3	3.9	V
V _{IO_MAX}	Voltage on GPIO pins (V _{CC} ≤ 3.6V)	-0.3	V _{CC} + 0.3V	V
T _S	Storage Temperature Range	-40	125	°C

Table 6 – Absolute Maximum Ratings

5.2 Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{CC_IN}	VCC operating supply voltage in	2.0	3.0	3.6	V
V _{BUS_IN}	VBUS operating supply voltage in	4.35	5.0	5.5	V
T _{R_VCC}	VCC Supply rise time (0V to 2.0V)	-	-	60	ms
T _A	Operating Ambient Temperature Range	-40	25	85	°C

Table 7 – Operating Conditions

5.3 Power Configuration

5.3.1 USB Power

The BMD-345 USB PHY is powered by a dedicated, internal LDO regulator that is fed by the VBUS pin (66). This means that applying power to only the VBUS pin will not power the rest of the module. In order for the USB PHY to operate, VBUS must be externally powered.

5.4 General Purpose I/O

The general purpose I/O is organized as two ports enabling access and control of the 48 available GPIO pins. The first port allows access of P0.00 to P0.31, similar to the one port available on the BMD-301. The second port, new to the BMD-345, allows access to P1.00 to P1.15. 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	k Ω
R_{PD}	Pull-down Resistance	11	13	16	k Ω

Table 8 – GPIO

5.5 Module RESET

GPIO pin P0.18 may be used for a hardware reset. In order to utilize P0.18 as a hardware reset, the UICR registers PSELRESET[0] and PSELRESET[1] must be set alike, to the value of 0x7FFFFFFD2. When P0.18 is programmed as RESET, the internal pull-up is automatically enabled. Rigado and Nordic example applications and development kits program P0.18 as RESET.

5.6 Debug & Programming

The BMD-345 supports the two pin Serial Wire Debug (SWD) interface and offers flexible and powerful mechanisms for non-intrusive debugging of program code. Breakpoints, single stepping, and instruction trace capture of code execution flow are part of this support.

The BMD-345 also supports ETM and ITM trace. Trace data from the ETM and the ITM is sent to an external debugger via a 4-bit wide parallel trace port. In addition to parallel trace, the TPIU supports serial trace via the Serial Wire Output (SWO) trace protocol.

5.7 Clocks

The BMD-345 requires two clocks, a high frequency clock and a low frequency clock.

The high frequency clock is provided on-module by a high-accuracy 32-MHz crystal as required by the nRF52840 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 and greatest accuracy. Using the internal RC oscillator with calibration provides acceptable performance for BLE applications at a reduced cost and slight increase in power consumption. Note: the ANT protocol requires the use of an external crystal.

32.768 kHz Crystal (LFXO)

Symbol	Parameter	Typ.	Max.	Unit
F _{NOM_LFXO}	Crystal frequency	32.768	-	kHz
F _{TOL_LFXO_BLE}	Frequency tolerance, BLE applications	-	±250	ppm
C _{L_LFXO}	Load Capacitance	-	12.5	pF
C _{O_LFXO}	Shunt Capacitance	-	2	pF
R _{S_LFXO}	Equivalent series resistance	-	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	-	0.7	1	μA
I _{LFSYNT}	Current for 32.768kHz Synthesized Oscillator	-	100	-	μA
f _{TOL_LFXO_BLE}	Frequency Tolerance, 32.768kHz Crystal Oscillator (BLE Stack) ¹	-	-	±250	ppm
f _{TOL_LFXO_ANT}	Frequency Tolerance, 32.768kHz Crystal Oscillator (ANT Stack) ¹	-	-	±50	ppm
f _{TOL_LFRC}	Frequency Tolerance, 32.768kHz RC Oscillator	-	-	±2	%
f _{TOL_CAL_LFRC}	Frequency tolerance, 32.768kHz RC after calibration	-	-	±250	ppm
f _{TOL_LFSYNT}	Frequency Tolerance, 32.768kHz Synthesized Oscillator	-	-	±48	ppm

Note 1: f_{TOL_LFXO_BLE} and f_{TOL_LFXO_ANT} are the max allowed for BLE and ANT applications. Actual tolerance depends on the crystal used.

Table 10 – 32.768 kHz Oscillator

5.8 MAC Address Info

The BMD-345 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.



Figure 3 – BMD-345 MAC Address on Label

The 6-byte BLE Radio MAC address is stored in the nRF52840 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. **Important:** If full memory protection is enabled, the UICR cannot be read via the SWD interface. If performing a full-erase, the MAC can then only be recovered from the 2D barcode and human-readable text.

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)

6. Recommended PCB Land Pads

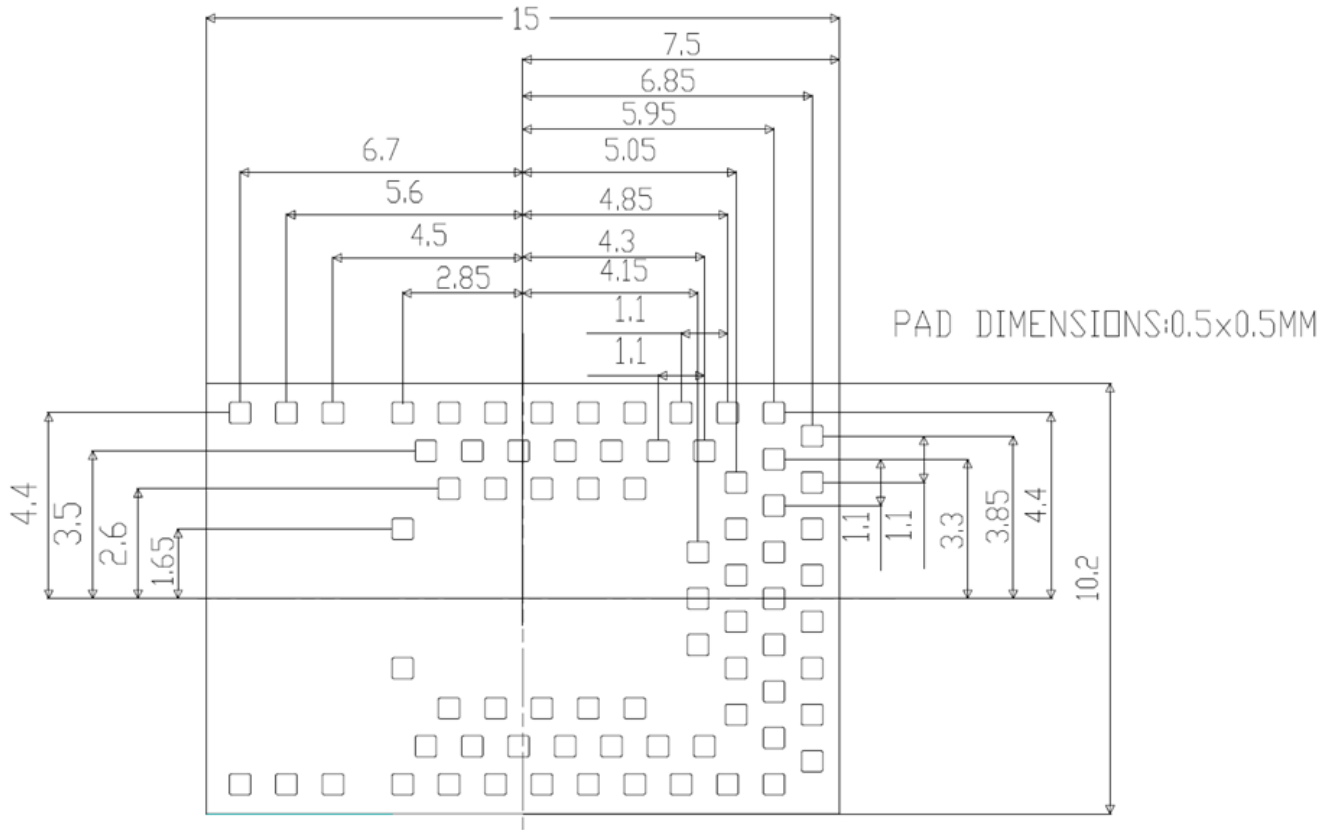


Figure 4 – BMD-345 Dimension (Top View)
(All dimensions are in mm)

7. Bluetooth Qualification

The BMD-345 Series modules will be qualified as a Bluetooth Component (tested) for RF-PHY. This allows customers to use different SoftDevices that have been qualified by Nordic without the need to complete additional RF-PHY testing. To achieve Bluetooth End Product qualification, the Rigado RF-PHY QDID can be combined with Nordic QDIDs for the SoftDevice used when filing on the Bluetooth SIG website. The only testing required is for the Bluetooth profiles supported by the customer's product. Products with only custom profiles do not require any additional testing.

- BMD-345: RF-PHY Component(Tested) Declaration ID D040774/ QDID 114712

8. Regulatory Statements

8.1 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.

8.2 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 should be installed and operated with a minimum distance of 20 centimeters between the radiator and any human 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 this document.

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 transmitter antenna.

(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 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 end product 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:

- BMD-345: “Contains **FCC ID: 2AA9B11**”
- 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)).

8.3 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 incontrôlé environnement. L'antenne (s) utilisée pour ce transmetteur ne doit pas être co-localisés ou fonctionner en conjonction avec toute autre antenne ou transmetteur .

8.4 IC Important Notes

1. The OEM integrator must 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 be installed to provide a separation distance of at least 20 cm from all persons and 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 end product must be labeled in a visible area with the following:

- BMD-345: "Contains **IC: 12208A-11**"

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 fonctionnement."

8.5 CE Regulatory

The BMD-345 module is being tested and is expected to be 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.

EU - Radio Equipment Directive 2014/53/EU

- ETSI EN 300 328 V 2.1.1
- ETSI EN 301 489-1 V2.1.1
- ETSI EN 301 489-17 V3.1.1

Pending completion of testing, Declarations of Conformity and supporting test reports will be available at www.rigado.com.

8.6 Australia / New Zealand

The BMD-345 module is to be tested to comply with the AS/NZS 4268 :2012+AMDT 1:2013, Radio equipment and systems – Short range devices – Limits and methods of measurement. Pending test completion, the report may be downloaded from www.rigado.com, and may be used as evidence in obtaining permission to use the RCM.

Information on registration as a Responsible Party, license and labeling requirements may be found at the following websites:

Australia: <http://www.acma.gov.au/theACMA/radiocommunications-short-range-devices-standard-2004>

New Zealand: <http://www.rsm.govt.nz/compliance>

The A-Tick and C-Tick marks are being migrated to the Regulatory Compliance Mark (RCM). Only Australian-based and New Zealand-based companies who are registered may be granted permission to use the RCM. An Australian-based or New Zealand-based agent or importer may also register as a Responsible Party to use the RCM on behalf of a company not in Australia or New Zealand.

9. Solder Reflow Temperature-Time Profile

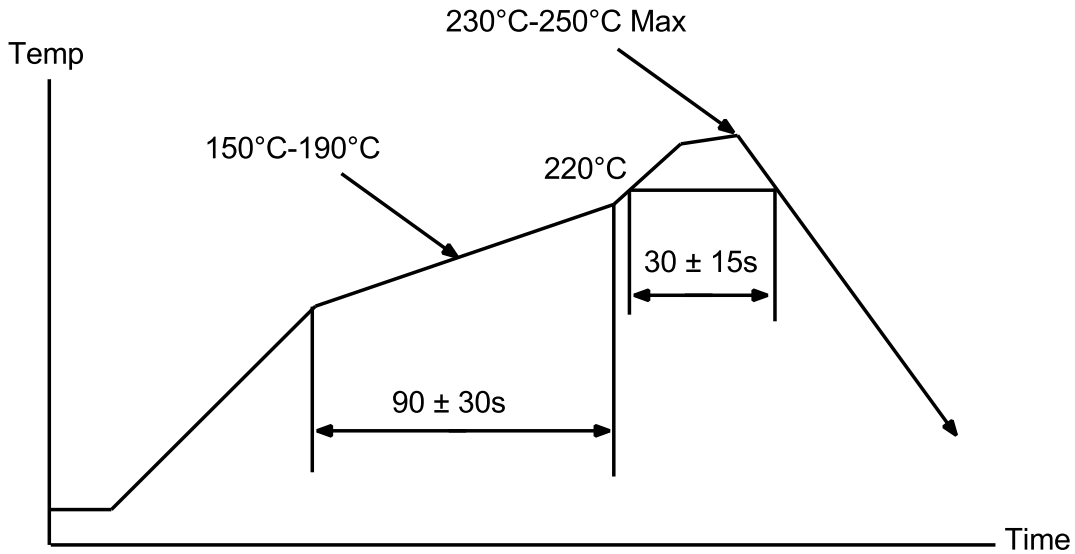


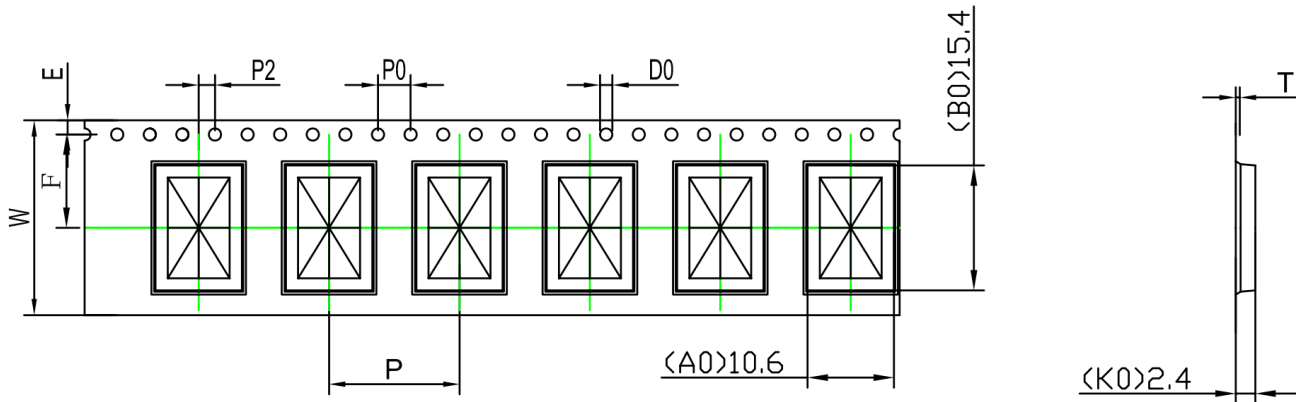
Figure 5 – Reflow Profile for Lead Free Solder

9.1 Moisture Sensitivity Level

The BMD-345 is rated for MSL 3, 168-hour floor life after opening.

10. Packaging and Labeling

10.1 Carrier Tape Dimensions



ITEM	W	A ₀	B ₀	K ₀	K ₁	P	F	E	D ₀	D ₁	P ₀	P ₂	T
DIM	24.0 ^{+0.30} _{-0.30}	10.60 ^{+0.10} _{-0.10}	15.4 ^{+0.10} _{-0.10}	2.40 ^{+0.10} _{-0.10}	0.00 ^{+0.00} _{-0.00}	16.0 ^{+0.10} _{-0.10}	11.5 ^{+0.10} _{-0.10}	1.75 ^{+0.10} _{-0.10}	1.50 ^{+0.10} _{-0.00}	0.00 ^{+0.10} _{-0.00}	4.00 ^{+0.10} _{-0.10}	2.00 ^{+0.10} _{-0.10}	0.30 ^{+0.05} _{-0.05}
ALTERNATE													

Figure 6 - BMD-345 Tape Dimensions

10.2 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.

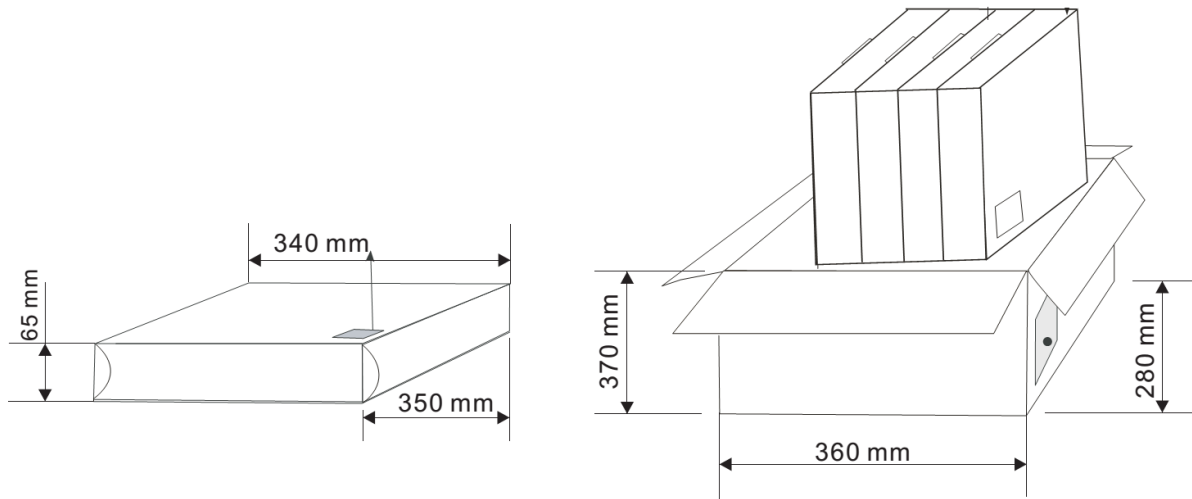


Figure 7 – Reel Packaging

11. 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.

12. 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.

13. Document History

Revision	Date	Changes / Notes
1.0	7/11/2017	Initial Release