

General Description



BDE-LE2340R5KP is a Bluetooth 2.4GHz wireless module series consisting of CC2340R52E0RKPR single-chip wireless microcontroller (MCU). In order to fulfil different application scenarios, we provide different variants for this module. They are listed as follows:

- BDE-LE2340R5KPA32 – Integrated ceramic chip antenna and on-board 32M-bit SPI flash
- BDE-LE2340R5KPU32 – Integrated U.FL connector and on-board 32M-bit SPI flash
- BDE-LE2340R5KPN32 – RF pad out for antenna and on-board 32M-bit SPI flash
- BDE-LE2340R5KPA0 – Integrated ceramic chip antenna and no on-board 32M-bit SPI flash
- BDE-LE2340R5KPU0 – Integrated U.FL connector and no on-board 32M-bit SPI flash
- BDE-LE2340R5KPN0 – RF pad out for antenna and no on-board 32M-bit SPI flash

The BDE-LE2340R5KP is a Bluetooth 2.4G wireless module that integrates an Arm® Cortex®-M0+ MCU, which supports Bluetooth® 5.3 Low Energy, ZigBee, SimpleLink™ TI 15.4-stack, Proprietary systems. This device is optimized for low-power wireless communication with on-chip dual image Over the Air Download (OAD) support in Building automation (wireless sensors, lighting control, beacons), asset tracking, medical, retail EPOS (electronic point of sale), ESL (electronic shelf label), and Personal electronics (toys, HID, stylus pens) markets.

The BDE-LE2340R5KP supports operation in the 2360 to 2510-MHz frequency band. It can support +8 dBm output power in 2.4GHz band, and a receive sensitivity of -102 dBm for 125-kbps Bluetooth® Low Energy Coded PHY. The BDE-LE2340R5KP has an ultra-low standby current less than 0.71 μ A with RTC operational and full RAM retention that enables significant battery life extension especially for applications with longer sleep intervals. The module supports for Bluetooth® 5 features: High Speed Mode (2 Mbps PHY), Long Range (LE Coded 125 kbps and 500 kbps PHYs), Privacy 1.2.1 and Channel Selection Algorithm #2, as well as backwards compatibility and support for key features from the Bluetooth® 4.2 and earlier Low Energy specifications.

The BDE-LE2340R5KP highly integrates radio, stack, profile and applications in a SoC, without the need of using an external MCU. The module also offers flexible hardware interfaces for the sensor application. It enables ultra-low power connectivity and data transfer for the applications that are sensitive to power consumption, size and cost.

Key Features

- BDE-LE2340R5KP is a Bluetooth 2.4GHz module consisting of CC2340R52E0RKPR single-chip wireless microcontroller (MCU)
- Fully integrated module includes all required clocks and passives
- Wireless microcontroller
 - Optimized 48-MHz Arm® Cortex®-M0+ processor
 - Integrated serial 32M-bit Flash
 - ✧ BDE-LE2340R5KPA32
 - ✧ BDE-LE2340R5KPU32
 - ✧ BDE-LE2340R5KPN32
 - 512KB of in-system programmable flash
 - 12KB of ROM for bootloader and drivers
 - 36KB of ultra-low leakage SRAM. Full RAM retention in standby mode
 - 2.4 GHz RF transceiver compatible with Bluetooth®5.3 Low Energy
 - Supports over-the-air upgrade (OTA)
 - Serial Wire Debug (SWD)
- Low power consumption
 - MCU consumption:
 - ✧ 2.6 mA active mode, CoreMark®
 - ✧ 53 µA/MHz running CoreMark®
 - ✧ <710 nA standby mode, RTC, 36KB RAM
 - ✧ 150 nA shutdown mode, wake-up on pin
 - Radio Consumption:
 - ✧ 5.3 mA RX
 - ✧ 5.1 mA TX at +0 dBm
 - ✧ <11.0 mA TX at +8 dBm
- Wireless protocol support
 - Bluetooth®5.3 Low Energy
 - Zigbee®
 - SimpleLink™ TI 15.4-stack
 - Proprietary systems
- High performance radio
 - -102 dBm for Bluetooth® Low Energy 125-kbps
 - -96.5 dBm for Bluetooth® Low Energy 1 Mbps
- Output power up to +8 dBm with temperature compensation
- Regulatory compliance (On-going)
 - Bluetooth
 - FCC
 - IC
 - CE-RED
- MCU peripherals
 - Up to 26 I/O Pads
 - ✧ 2 IO pads SWD, muxed with GPIOs
 - ✧ 2 IO pads LFXT, muxed with GPIOs (On-board LFXT populated by default, these two IOs are not exposed by default)
 - ✧ Up to 22 DIOs (analog or digital IOs)
 - Three 16-bit or one 124-bit general-purpose timers, quadrature decode mode support
 - 12-bit ADC, 1.2 Msps with external reference, 267 ksp/s with internal reference, up to 12 external ADC inputs
 - One low power comparator
 - UART, SPI, I2C
 - Real-time clock (RTC)
 - Integrated temperature and battery monitor
 - Watchdog timer
- Security enablers
 - AES 128-bit cryptographic accelerator
 - Random number generator from on-chip analog noise
- Operating range
 - On-chip buck DC/DC converter
 - 1.71-V to 3.8-V single supply voltage (None-SPI flash version)
 - 2.3-V to 3.6-V single supply voltage (SPI flash version)
 - -40 to +85°C
- Package
 - Dimension:
 - ✧ 11.5 mm x 13.5 mm x 2.0 mm (-A, -U)

- versions)
- ◇ 11.5 mm x 9.70 mm x 2.0 mm (-N versions)
- RoHS-compliant package
- Antenna:
 - BDE-LE2340R5KPA32/BDE-LE2340R5KPA0: Ceramic chip antenna
 - BDE-LE2340R5KPU32/BDE-LE2340R5KPU0: U.FL connector for connecting external antenna
 - BDE-LE2340R5KPN32/BDE-LE2340R5KPN0: No antenna included, RF pad for connecting external antenna
- Additional integrated components:
 - 48.0-MHz crystal
 - 32.768-kHz crystal (RTC)
 - 32M-bit SPI Serial Flash
 - ◇ BDE-LE2340R5KPA32
 - ◇ BDE-LE2340R5KPU32
 - ◇ BDE-LE2340R5KPN32
 - RF filter and passive component

Applications

- Medical
- Building automation
- Lighting
- Factory automation and control
- Retail automation & payment – Electronic point of sale
- Communication equipment
- Personal electronics

Reference

[1] CC2340R5 resources: <https://www.ti.com/product/CC2340R5>

Contents

General Description	1
Key Features	2
Applications	3
Reference	4
Contents	5
1. Block Diagram	6
2. Pinout	8
2.1. Pinout Diagram	8
2.2. Pinout Description	8
3. Characteristics	10
3.1. Absolute Maximum Ratings	10
3.2. Recommended Operating Conditions	10
4. Mechanical Specifications	10
4.1. Dimensions	10
4.2. PCB Footprint	11
4.3 U.FL Connector Specification	13
5. Typical Reflow Profile	14
6. Reference Design and Guidelines	15
6.1 Block Diagram	15
6.2 Module Placement	16
6.2 Other Design Considerations	17
7. Ordering Information	17
8. Revision History	17
Important Notice and Disclaimer	18
Contact	18

1. Block Diagram

BDE-LE2340R5KP module is based on the TI Instruments CC2340R5 single chip wireless MCU. With clocks, other required passives and antenna/connector (optional) integrated, it allows faster time to market at reduced development cost.

The block diagram of the series modules can be seen in Figure 1-1 and 1-2, comprises of:

- 48-MHz XTAL
- 32.768-kHz XTAL
- 32M-bit SPI Flash (SPI flash versions)
- Power Inductors and Capacitors
- Pull-up Resistors
- Matching Circuit
- Ceramic antenna / U.FL connector for external antenna/ RF pad for external antenna

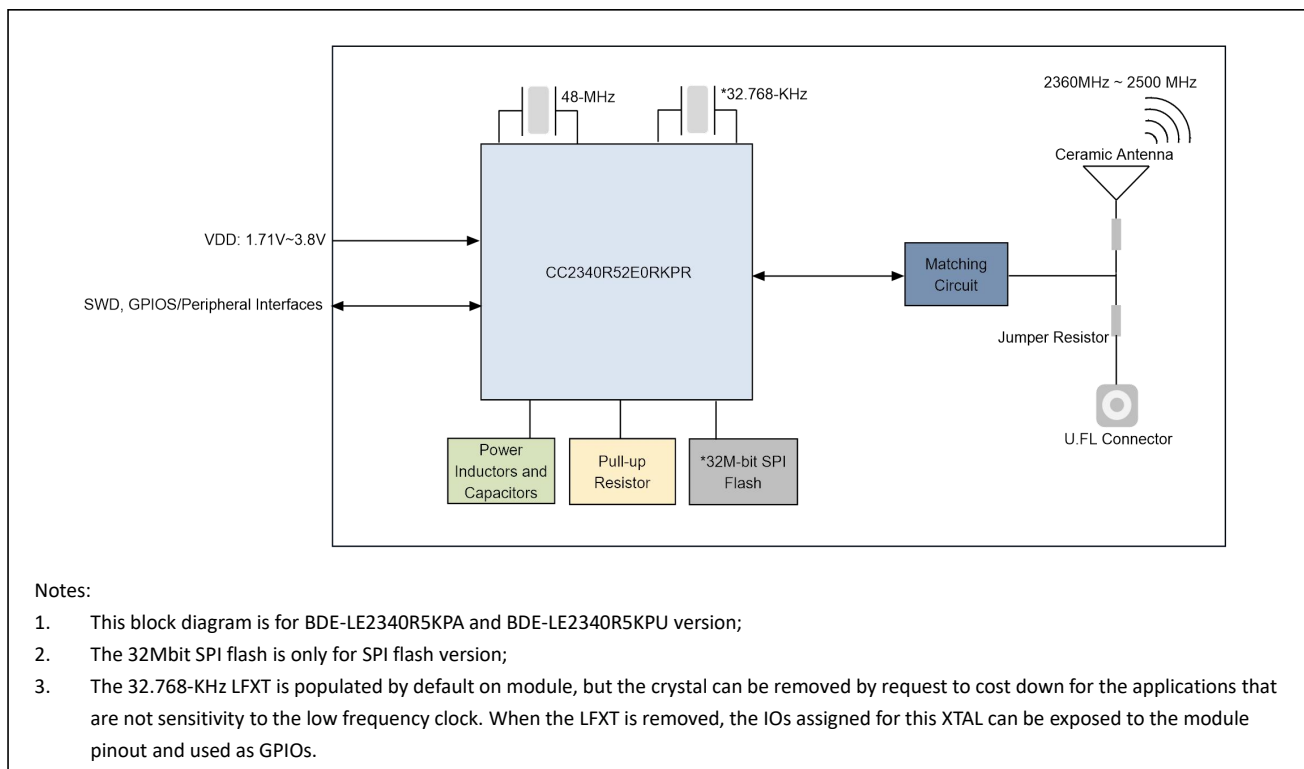


Figure 1-1. The block diagram of BDE-LE2340R5KPA and BDE-LE2340R5KPU

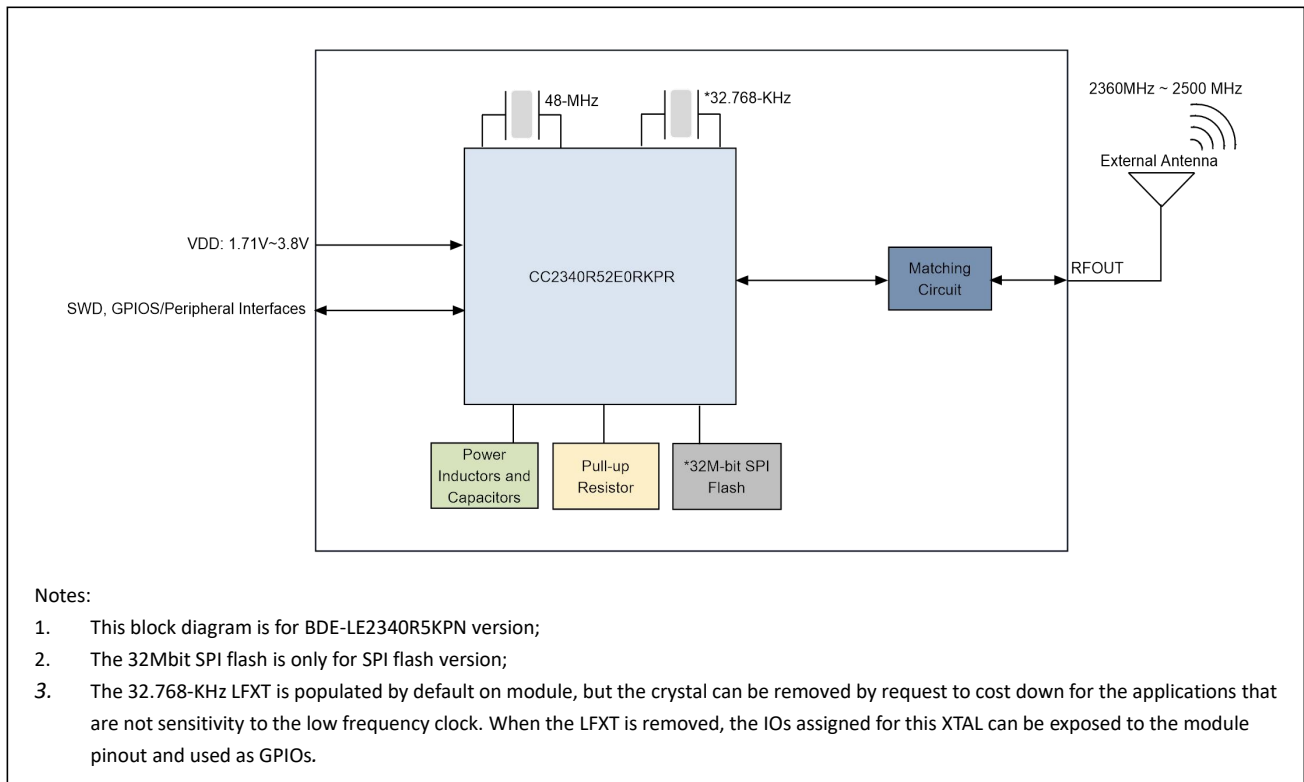


Figure 1-2. The block diagram of BDE-LE2340R5KPN

2. Pinout

2.1. Pinout Diagram

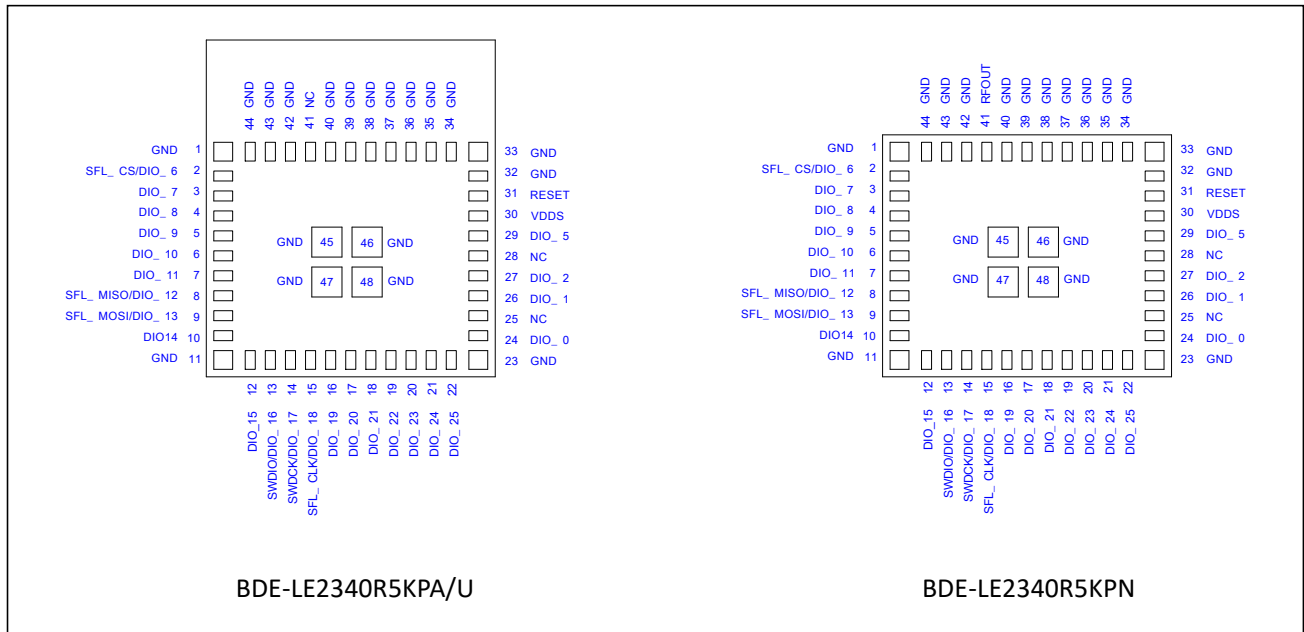


Figure 2-1. Pinout Diagram of BDE- LE2340R5KP Top View

2.2. Pinout Description

Table 2-1 describes the definitions of the pins of the module. Pin number of CC2340R5 chip is also stated here, because the VQFN pin is referred to in the software design kit (SDK).

Table 2-1. Pin Description

Module Pin #	Pin Name	Type	CC2340R5 Pin #	Description
1	GND	Ground	-	Ground
2	SFL_CS/DIO_6	I/O	32	SFL_CS ⁽²⁾ / GPIO ⁽¹⁾
3	DIO_7	I/O	33	GPIO ⁽¹⁾
4	DIO_8	I/O	2	GPIO ⁽¹⁾
5	DIO_9	I/O	3	GPIO ⁽¹⁾
6	DIO_10	I/O	4	GPIO ⁽¹⁾
7	DIO_11	I/O	5	GPIO ⁽¹⁾
8	SFL_MISO /DIO_12	I/O	6	SFL_MISO ⁽²⁾ / GPIO ⁽¹⁾ , High-drive Capability
9	SFL_MOSI/DIO_13	I/O	7	SFL_MOSI ⁽²⁾ / GPIO ⁽¹⁾
10	DIO_14	I/O	9	GPIO ⁽¹⁾

Module Pin #	Pin Name	Type	CC2340R5 Pin #	Description
11	GND	Ground	-	Ground
12	DIO_15	I/O	10	GPIO ⁽¹⁾
13	SWDIO/DIO_16	I/O	11	GPIO ⁽¹⁾ , SWDIO, high-drive Capability
14	SWCLK/DIO_17	I/O	12	GPIO ⁽¹⁾ , SWCLK, high-drive Capability
15	SFL_SCLK/DIO_18	I/O	13	SFL_SCLK ⁽²⁾ /GPIO ⁽¹⁾ , High-drive Capability
16	DIO_19	I/O	14	GPIO ⁽¹⁾ , High-drive Capability
17	DIO_20	I/O	15	GPIO ⁽¹⁾
18	DIO_21	I/O	16	GPIO ⁽¹⁾
19	DIO_22	I/O	18	GPIO ⁽¹⁾
20	DIO_23	I/O	19	GPIO ⁽¹⁾
21	DIO_24	I/O	20	GPIO ⁽¹⁾ , High-drive Capability
22	DIO_25	I/O	21	GPIO ⁽¹⁾
23	GND	Ground	-	Ground
24	DIO_0	I/O	22	GPIO ⁽¹⁾
25	NC	-	-	NC ⁽⁴⁾
26	DIO_1	I/O	23	GPIO ⁽¹⁾
27	DIO_2	I/O	24	GPIO ⁽¹⁾
28	NC	-	-	NC ⁽⁴⁾
29	DIO_5	I/O	29	GPIO ⁽¹⁾
30	VDDS	Power		1.71-V to 3.8-V Analog Supply
31	RESET	I	25	Reset, Active Low.
32	GND	Ground	-	Ground
33	GND	Ground	-	Ground
34	GND	Ground	-	Ground
35	GND	Ground	-	Ground
36	GND	Ground	-	Ground
37	GND	Ground	-	Ground
38	GND	Ground	-	Ground
39	GND	Ground	-	Ground
40	GND	Ground	-	Ground
41	RFOUT/NC	-	-	RFOUT ⁽³⁾ /NC
42	GND	Ground	-	Ground
43	GND	Ground	-	Ground
44	GND	Ground	-	Ground
45	GND	Ground	-	Ground
46	GND	Ground	-	Ground
47	GND	Ground	-	Ground
48	GND	Ground	-	Ground

Note ⁽¹⁾: For pin multiplexing details, refer to the [CC2340R5 SimpleLink™ 32-bit Arm® Cortex®-M0+ Bluetooth® Low Energy wireless MCU](#).

Note ⁽²⁾: These four pins can be used as GPIOs in None SPI flash version modules BDE-LE2340R5KPA0, BDE-LE2340R5KPU0 and LE2340R5KPN0; these four pins are used as SPI for 32M-bit flash in SPI flash version modules BDE-LE2340R5KPA32, BDE-LE2340R5KPU32 and BDE-LE2340R5KPN32.

Note ⁽³⁾: Pin 46 used as RFOUT in modules BDE-LE2340R5KPN32 and BDE-LE2340R5KPN0; Leave NC in other modules.

Note ⁽⁴⁾: Pin 25 (DIO_3) and pin 28 (DIO_4) are assigned as LFXT pins by default. They can be used as GPIOs if the on-board LFXT are unpopulated (by request).

3. Characteristics

3.1. Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, so functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification are not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

Table 3-1. Absolute Maximum Ratings

PARAMETER	MIN	MAX	UNIT	Notes
VDDS	-0.3	4.1	V	
Other Digital Terminals	-0.3	VDDS+0.3≤4.1	V	
Voltage on ADC input	0	VDDS	V	Voltage scaling enabled
Storage Temperature	-40	125	°C	

3.2. Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

Table 3-2. Recommended Operating Conditions

PARAMETER	MIN	TYP	MAX	UNIT
VDDS ⁽¹⁾	1.71	3.3	3.8	V
Operating Temperature	-40		85	°C
Rising supply voltage slew rate	0		100	mV/μs
Falling supply voltage slew rate	0		1	mV/μs

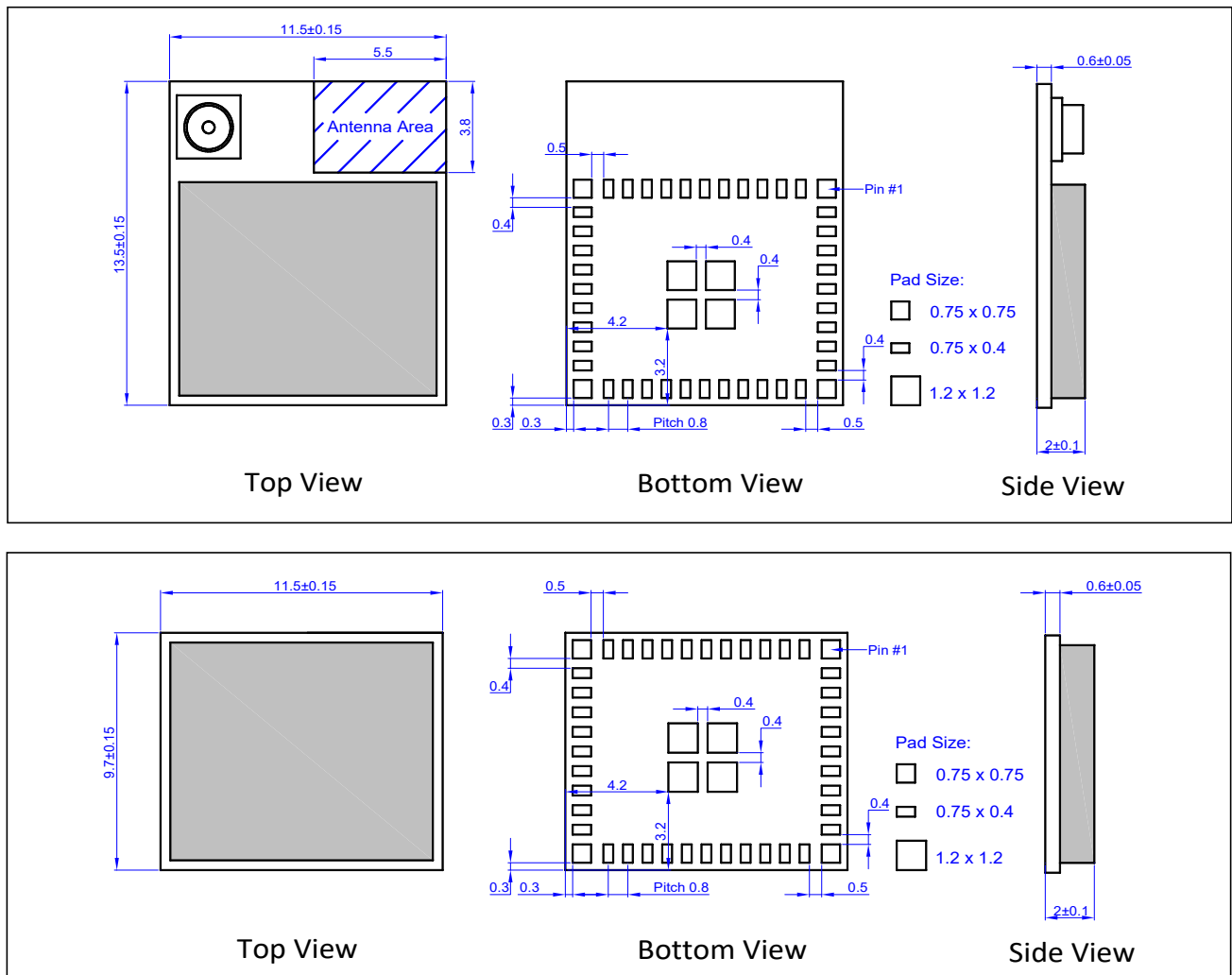
Note ⁽¹⁾: The operating voltage is 2.3V to 3.6V if on-board SPI flash versions are selected.

4. Mechanical Specifications

The following pages include mechanical, footprint drawings, and marking information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document.

4.1. Dimensions

The module dimensions are presented in the following figure:



Note: All dimensions are in millimeter

Figure 4-1. Mechanical Drawing for BDE-LE2340R5KP

4.2. PCB Footprint

The recommended footprint for the PCB is presented in the following figure:

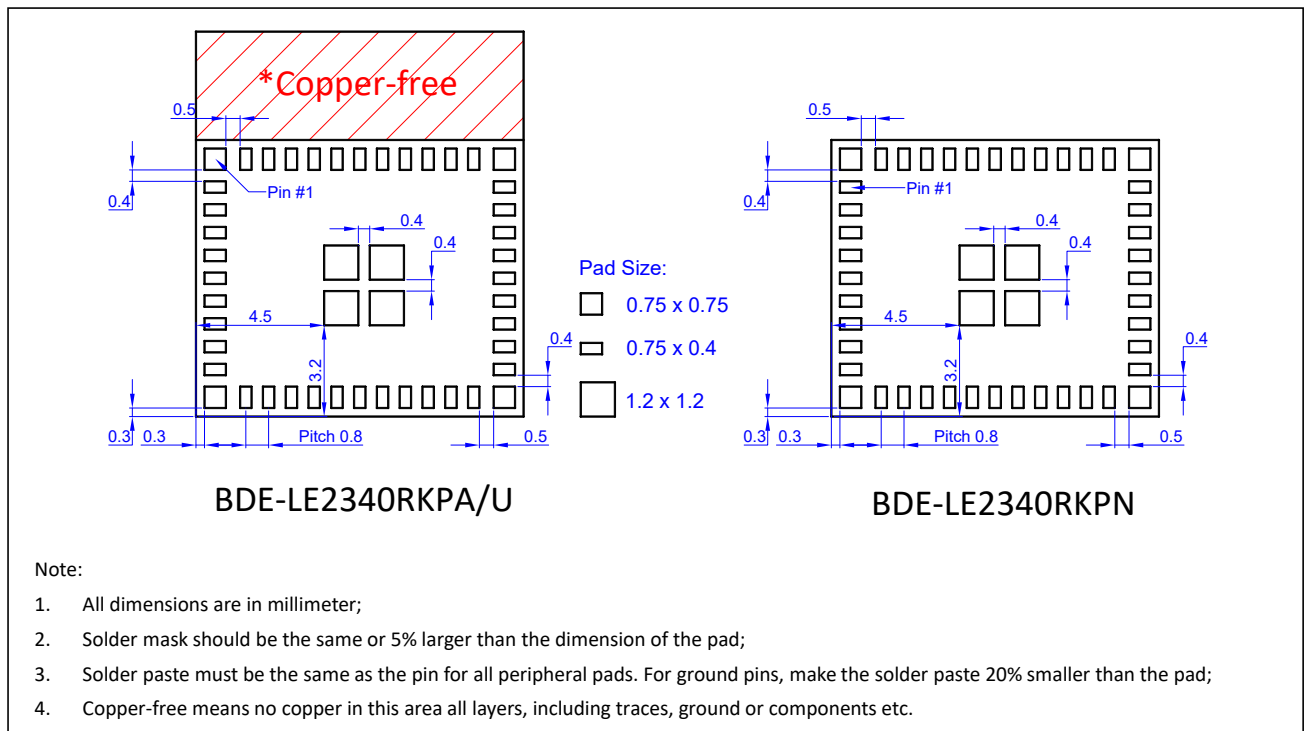
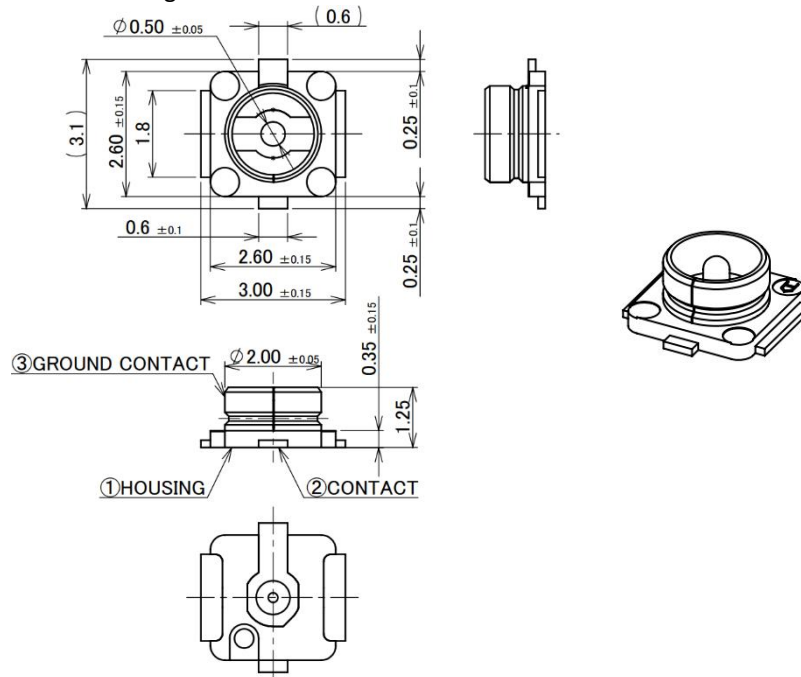


Figure 4-2. Module Footprint for BDE-LE2340R5KP Top View

4.3 U.FL Connector Specification

The drawing and specification of the U.FL connector utilized in the card is as below for reference. The dimension unit in below drawing is millimeter.



RATING VOLTAGE	60 V AC (R.M.S)	
RATING FREQUENCY	DC~9GHz	
OPERATING TEMPERATURE	233~363K (-40°C~+90°C)	
VSWR	RECEPTACLE: 1.3 MAX. AT 0.1~3 GHz, 1.4 MAX. AT 3~6 GHz, 1.8 MAX. AT 6~9 GHz	
MAIN CONTACT RESISTANCE	INITIAL: 20 mohm MAX. / AFTER TEST: \angle R 20 mohm MAX.	
GROUND CONTACT RESISTANCE	INITIAL: 20 mohm MAX. / AFTER TEST: \angle R 100 mohm MAX.	
INSULATION RESISTANCE	INITIAL: 500 Mohm MIN. / AFTER TEST: 100 Mohm MIN.	
DIELECTRIC WITHSTANDING VOLTAGE	200 V AC, 1 MINUTE	
DURABILITY	30 CYCLES	
UNMATING FORCE (INITIAL / AFTER TEST)	INITIAL: 5 N MIN. AFTER TEST: 3 N MIN.	INITIAL: 4 N MIN. AFTER TEST: 2 N MIN.

Figure 4-3. U.FL Connector Drawing and Specification

5. Typical Reflow Profile

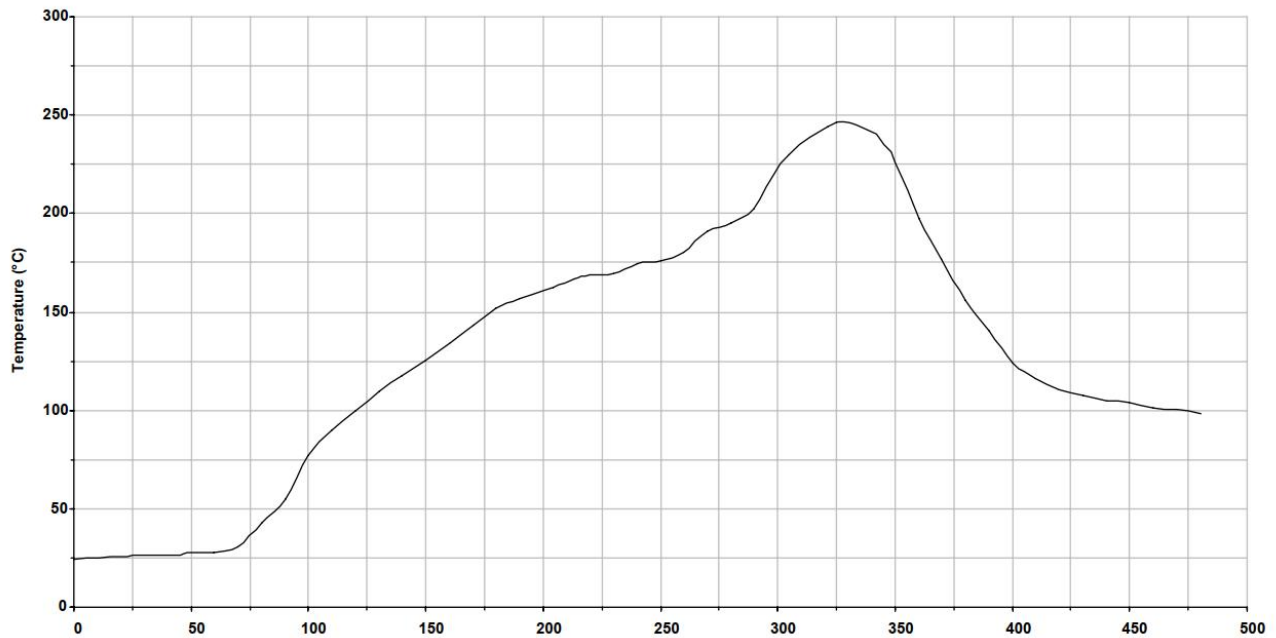


Figure 5-1. Typical Reflow Profile

Key features of the profile:

- Initial ramp = 1-2.5°C/sec to 175°C ±25°C equilibrium
- Equilibrium time = 60 to 180 seconds
- Ramp to maximum temperature (245°C) = 3°C/sec max.
- Time above liquidus temperature (217°C): 45-90 seconds
- Device absolute maximum reflow temperature: 260°C

6. Reference Design and Guidelines

6.1 Block Diagram

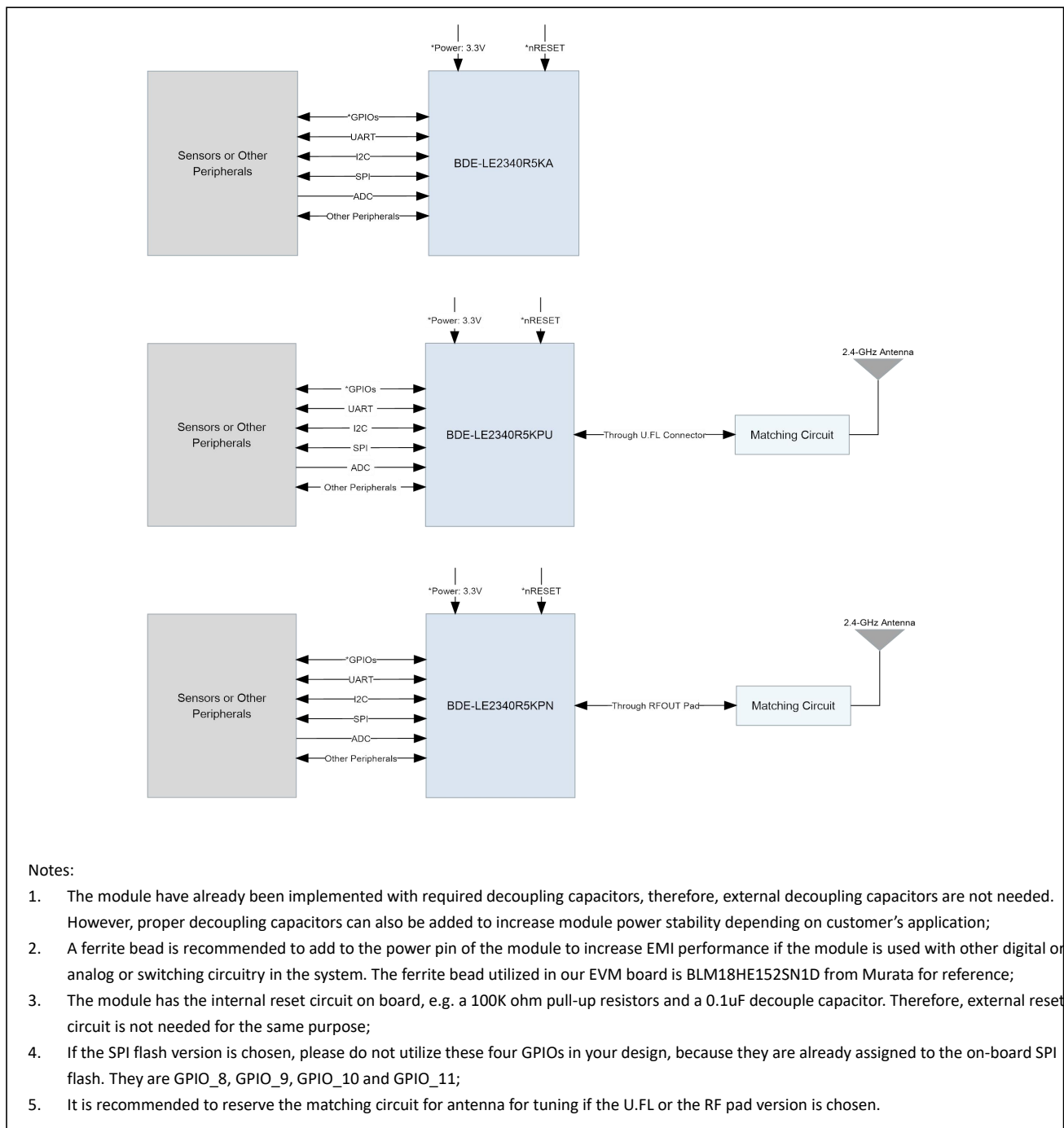


Figure 6-1. High-Level System Block Diagram

6.2 Module Placement

The placement of the module in the base board is critical in your design. Improper placement can lead to poor antenna performance. BDE recommend following closely to below best practice placement to achieve best antenna performance.

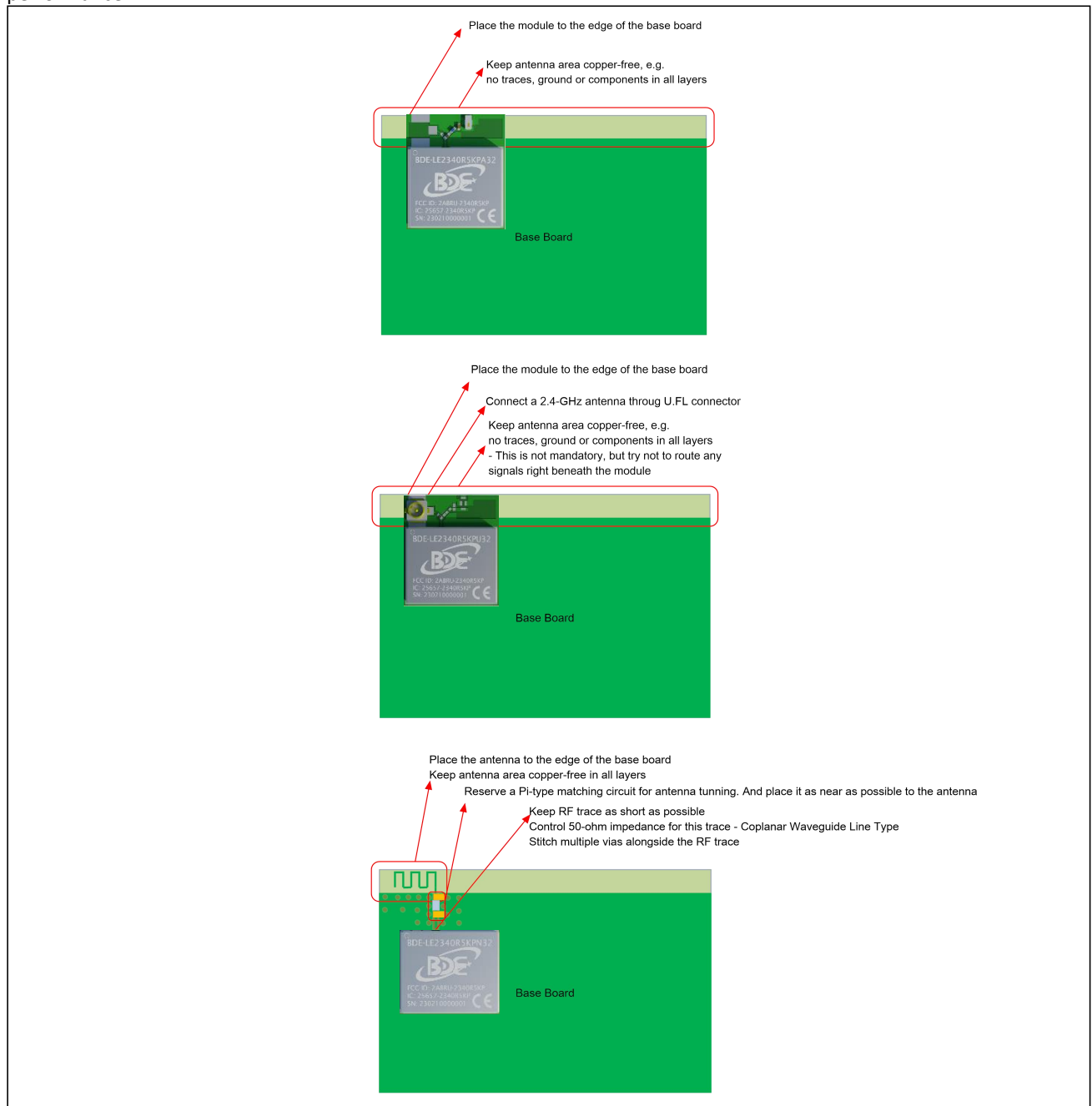


Figure 6-2. Module Placement Recommendations

6.2 Other Design Considerations

Besides the above mentioned design guides, below listed some other design considerations while integrating the module to the system.

1. BDE recommends using double-shielded coaxial RF cable to connect with the U.FL connector with antenna if the U.FL versions are selected;
2. Do not place or run the RF cable right above or below the card or module;
3. Consider the enclose materials. Do not place the antenna close to the metal;
4. Do not place high speed signal beneath the module;
5. If there are some other radio besides this card in the system, try to place them apart as far as possible. And Ensure there is at least 25 dB isolation between the antenna port of every radio;
6. Make VDDS traces as short as possible and as wide as possible to reduce the inductance and resistance of the traces, 20mil as least is recommended;
7. Proper decoupling capacitors are recommended for the module;

7. Ordering Information

Part Number	Description	Size (mm)	Package	MOQ
BDE-LE2340R5KPA32	BDE Bluetooth 5.3 Low Energy Wireless Module Based on CC2340R5, with Ceramic Chip Antenna and On-board 32Mbit SPI Flash	11.5 x 13.5 x 2.0	Tape & Reel	TBD
BDE-LE2340R5KPU32	BDE Bluetooth 5.3 Low Energy Wireless Module Based on CC2340R5, with U.FL Connector and On-board 32Mbit SPI Flash	11.5 x 13.5 x 2.0	Tape & Reel	TBD
BDE-LE2340R5KPN32	BDE Bluetooth 5.3 Low Energy Wireless Module Based on CC2340R5, with RFOUT Pad and On-board 32Mbit SPI Flash	11.5 x 9.70 x 2.0	Tape & Reel	TBD
BDE-LE2340R5KPA0	BDE Bluetooth 5.3 Low Energy Wireless Module Based on CC2340R5, with Ceramic Chip Antenna and without On-board 32Mbit SPI Flash	11.5 x 13.5 x 2.0	Tape & Reel	TBD
BDE-LE2340R5KPU0	BDE Bluetooth 5.3 Low Energy Wireless Module Based on CC2340R5, with U.FL Connector and without On-board 32Mbit SPI Flash	11.5 x 13.5 x 2.0	Tape & Reel	TBD
BDE-LE2340R5KPN0	BDE Bluetooth 5.3 Low Energy Wireless Module Based on CC2340R5, with RFOUT Pad and without On-board 32Mbit SPI Flash	11.5 x 9.70 x 2.0	Tape & Reel	TBD

8. Revision History

Revision	Date	Description
V0.1	16-May-2023	Preliminary, draft
V0.2	11-Aug-2023	Modified module pinout and dimensions, added reference and design considerations

You can find the latest documentation in this [Link](#).

Important Notice and Disclaimer

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