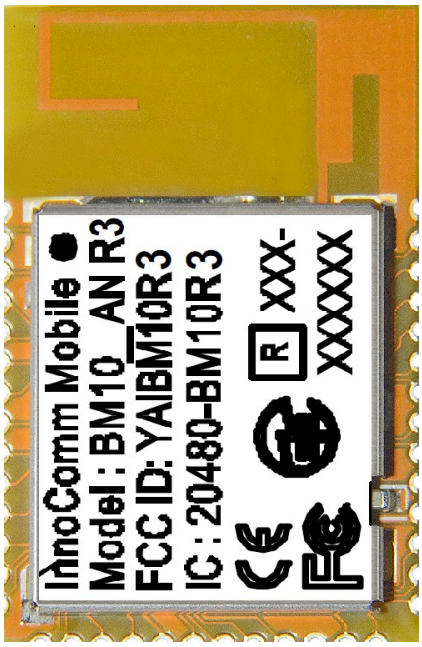

BM10_AN R3 BLE Single Mode Module
Product Specification

Model Name	BM10_AN R3
Project code	CBM10
Description	BLE Single Mode Module
Revision	1.0
Issue Date	2022/02/11

Approved by	Reviewed by	Issued by
Taka Wei	Sky He	Aaron Lai

Revision History

Revision	Released Date	Comments/Remark	Author
1.0	2022/02/11	Initial release	Aaron Lai

Disclaimer

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1. INTRODUCTION

Based on TI's outstanding CC2652R7 BLE technology, Innocomm's BM10_AN R3 module is a wireless microcontroller (MCU) targeting Bluetooth 5.2 low-energy applications.

With very low active RF and MCU current and low-power mode current consumption, it provides excellent battery life and allows for operation on small coin cell batteries and in energy-harvesting applications and embedded PCB antenna.

BM10_AN R3 module contains a powerful 32-bit Cortex M4F running up to 48 MHz as the main processor and a rich peripheral feature set that includes a unique ultra-low-power sensor controller.

Bluetooth low energy controller and host libraries are embedded in ROM and run partly on an ARM® Cortex®-M0 processor. This architecture improves overall system performance and power consumption and frees up significant amounts of flash memory for the application.

2. General Information

2.1 Key Features

RF

- 2.4 GHz RF transceiver compatible with Bluetooth 5.2 Low Energy and earlier LE specifications and IEEE 802.15.4 PHY and MAC
- Excellent receiver sensitivity -101 dBm for 125kbps LE Coded
- Programmable output power up to +5 dBm
- Suitable for systems targeting compliance with worldwide radio frequency regulations
  – ETSI EN 300 328, EN 300 440 Cat. 2 and 3
  – FCC CFR47 Part 15
  – ARIB STD-T66

Layout

- Few External Components
- 25.45 mm × 16.7 mm × 2.2 mm, 40 pin LCC Package

Low Power

- Wide supply voltage range: 1.9 – 3.8V
- Active-Mode RX: 6.4 mA
- Active-Mode TX at +5 dBm: 9.7 mA
- Active-mode CoreMark: 3.1 mA
- 0.9 µA standby mode, RTC, 144KB RAM
- 0.1 µA shutdown mode, wake-up on pin

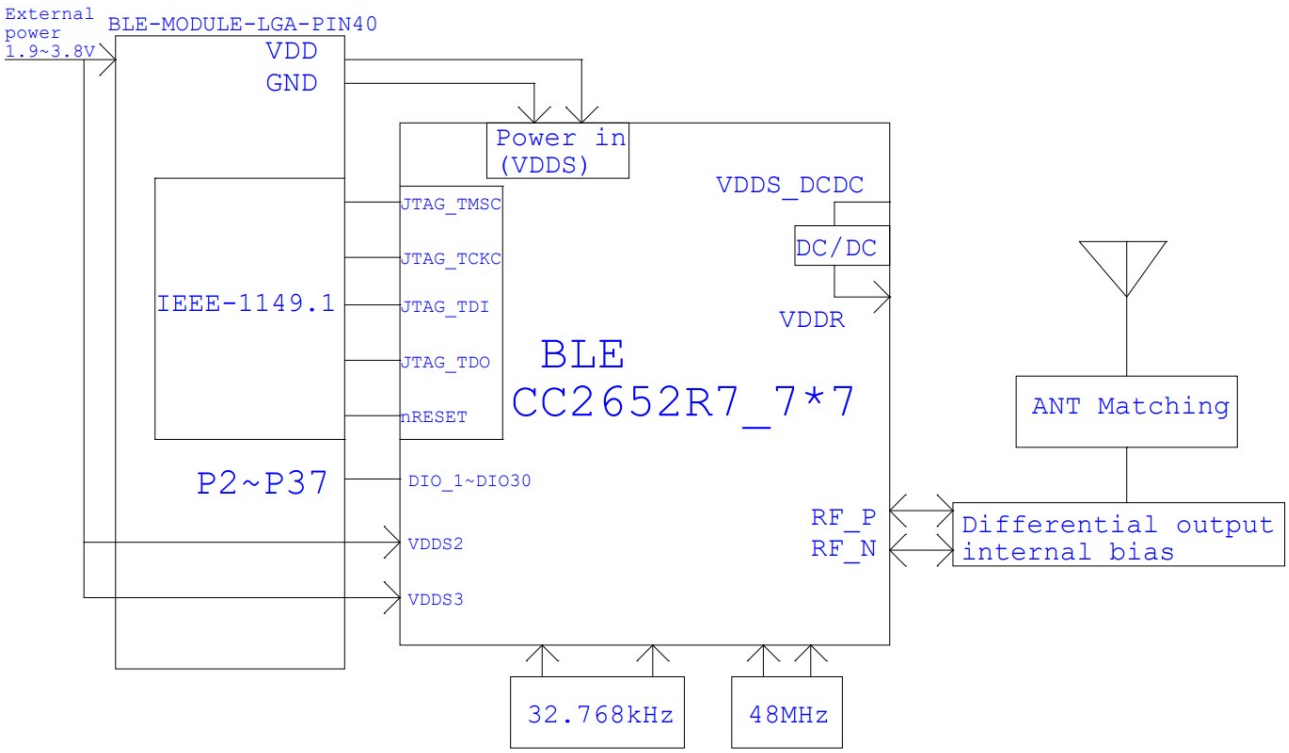
Peripherals

- Digital peripherals can be routed to any GPIO
- Four 32-bit or eight 16-bit general-purpose timers
- 12-bit ADC, 200k samples per second, 8 channels
- 8-bit DAC
- Two comparators
- Programmable current source
- Two UART, two SSI, I2C, I2S
- Real-time clock (RTC)
- Integrated temperature and battery monitor

Application

- 2400 to 2500 MHz ISM and SRD systems with down to 4 kHz of receive bandwidth
- Building Automation
  – Building security systems – motion detector, electronic smart lock, door and window sensor, garage door system, gateway
  – HVAC – thermostat, wireless environmental sensor, HVAC system controller, gateway
  – Fire safety system – smoke and heat detector, fire alarm control panel (FACP)
  – Video surveillance – IP network camera
  – Elevators and escalators – elevator main control panel for elevators and escalators
- Industrial transport – asset tracking
- Factory automation and control
- Medical
- Electronic point of sale (EPOS) – Electronic Shelf Label (ESL)
- Communication equipment
  – Wired networking – wireless LAN or Wi-Fi access points, edge router, small business router
- Personal electronics
  – Home theater & entertainment – smart-speakers, smart display, set-top box
  – Wearables (non-medical) – smart trackers, smart clothing

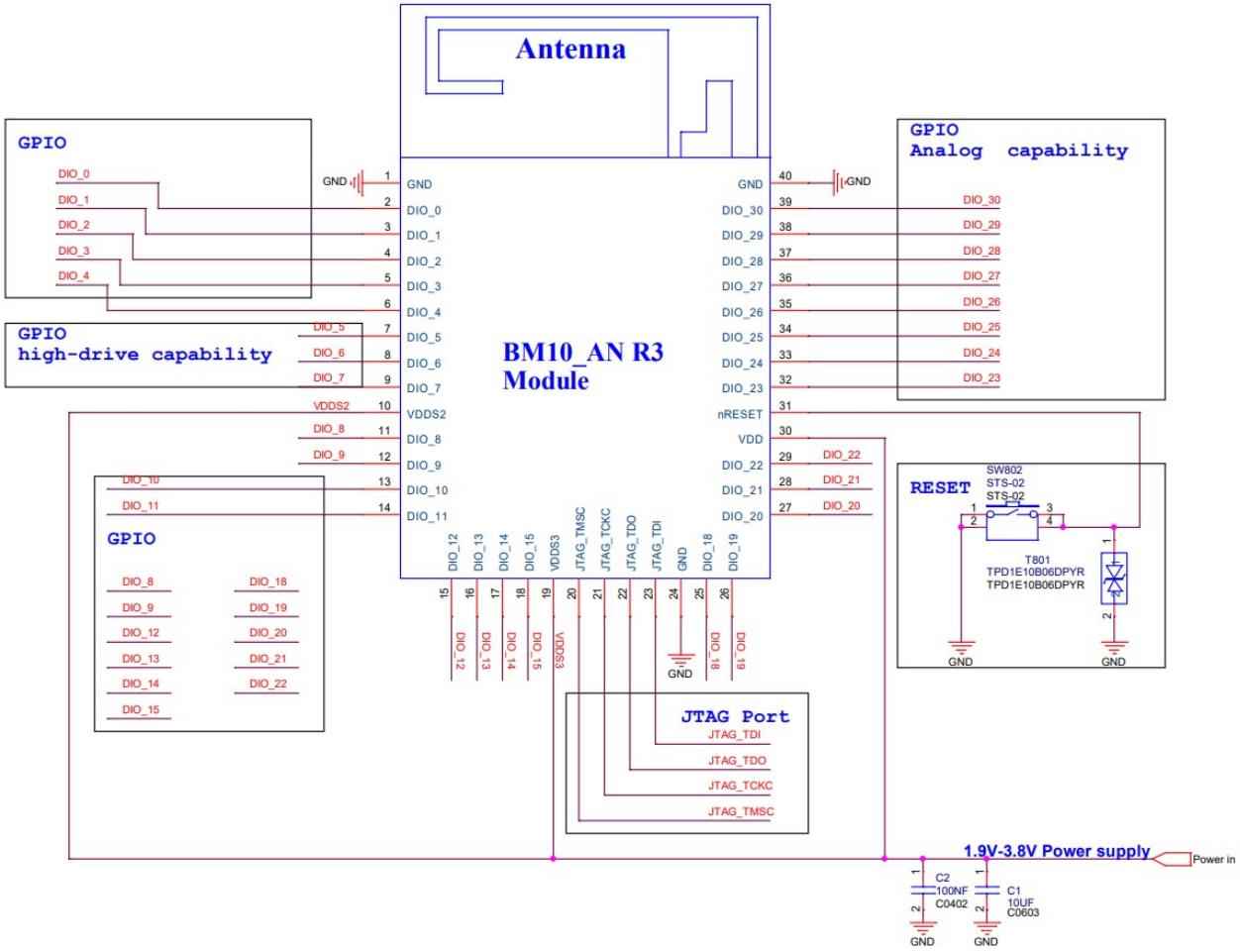
2.2 Block Diagram



3. PIN Map and Signal Description

Pin #	Pin Name	Direction/Type	Description
1	GND	Power	Ground
2	DIO_0	Digital	GPIO
3	DIO_1	Digital	GPIO
4	DIO_2	Digital	GPIO
5	DIO_3	Digital	GPIO
6	DIO_4	Digital	GPIO
7	DIO_5	Digital	GPIO, high-drive capability
8	DIO_6	Digital	GPIO, high-drive capability
9	DIO_7	Digital	GPIO, high-drive capability
10	VDDS2	Power	1.9V to 3.8V DIO supply
11	DIO_8	Digital	GPIO
12	DIO_9	Digital	GPIO
13	DIO_10	Digital	GPIO
14	DIO_11	Digital	GPIO
15	DIO_12	Digital	GPIO
16	DIO_13	Digital	GPIO
17	DIO_14	Digital	GPIO
18	DIO_15	Digital	GPIO
19	VDDS3	Power	1.9V to 3.8V DIO supply
20	JTAG_TMSC	Digital I/O	JTAG_TMSC, high-drive capability
21	JTAG_TCKC	Digital I/O	JTAG_TCKC
22	DIO_16	Digital I/O	GPIO, JTAG_TDO, high-drive capability
23	DIO_17	Digital I/O	GPIO, JTAG_TDI, high-drive capability
24	GND	Power	Ground
25	DIO_18	Digital	GPIO
26	DIO_19	Digital	GPIO
27	DIO_20	Digital	GPIO
28	DIO_21	Digital	GPIO
29	DIO_22	Digital	GPIO
30	VDD	Power	1.9V to 3.8V main chip supply
31	nRESET	Digital	Reset, active-low, with internal pull-up
32	DIO_23	Digital or Analog	GPIO, Analog capability
33	DIO_24	Digital or Analog	GPIO, Analog capability
34	DIO_25	Digital or Analog	GPIO, Analog capability
35	DIO_26	Digital or Analog	GPIO, Analog capability
36	DIO_27	Digital or Analog	GPIO, Analog capability
37	DIO_28	Digital or Analog	GPIO, Analog capability
38	DIO_29	Digital or Analog	GPIO, Analog capability
39	DIO_30	Digital or Analog	GPIO, Analog capability
40	GND	Power	Ground

3.1 Reference Circuit



4. ELECTRICAL CHARACTERISTICS

4.1 Recommended Operating Range

PARAMETER	CONDITIONS	MIN	NOM	MAX	UNIT
Operating ambient temperature range, T_A		–40		85	°C
Operating supply voltage	For operation in battery-powered and 3.3V systems	1.9		3.8	V

4.2 Power Consumption

Unless noted, all specifications are at 25 °C and Vbat = 3.0 V.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reset and Shutdown	1. Reset. RESET_N pin asserted or VDDSbelo power-on-reset threshold 2. Shutdown. No clocks running, no retention		100		nA
Standby with cache retention	RTC running, CPU, 144KB RAM, and (partial) register retention. XOSC_LF		2.4		uA
Power consumption radio RX	With DC/DC		6.4		mA
Power consumption radio TX	With DC/DC, 0 dBm output power		7.3		mA
Power consumption radio TX	With DC/DC, 5 dBm output power		9.7		mA

5. RF Characteristics

125 kbps LE Coded

Unless noted, all specifications are at 25 °C, Vbat = 3.0 V and fRF = 2440MHz.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
RX Receiver sensitivity	Differential mode. BER = 10–3		-101		dBm

500 kbps LE Coded

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
RX Receiver sensitivity	Differential mode. BER = 10–3		-98		dBm

2 Mbps GFSK

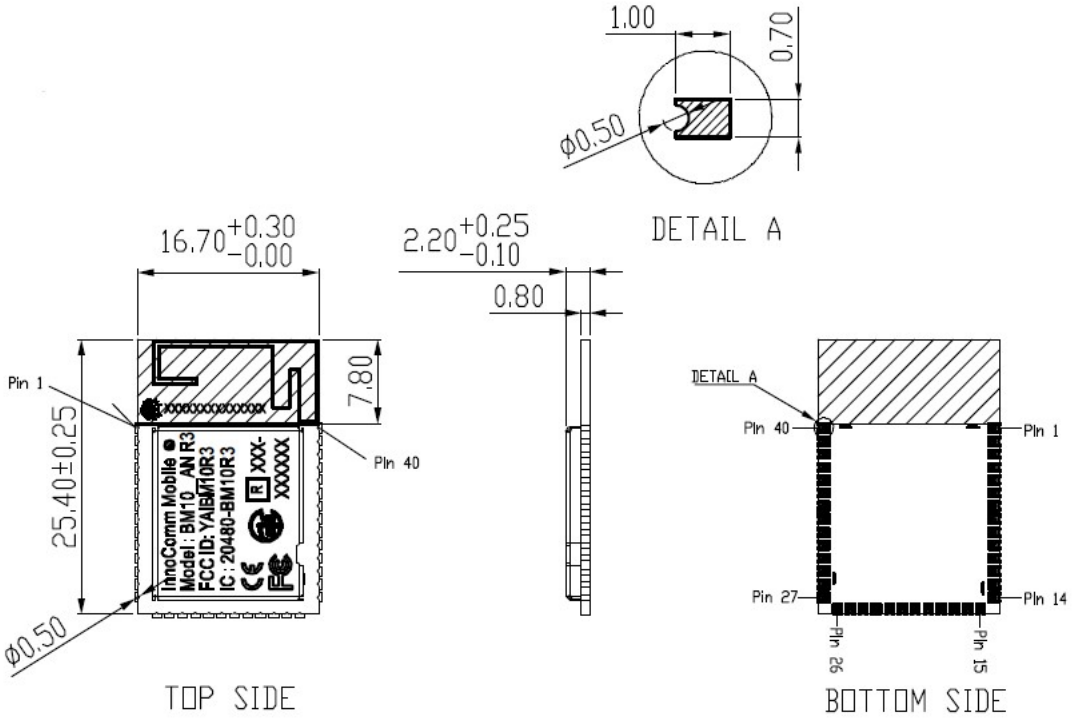
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
RX Receiver sensitivity	Differential mode, measured in 50Ω single-ended, BER=10-3		-91		dBm

1 Mbps GFSK

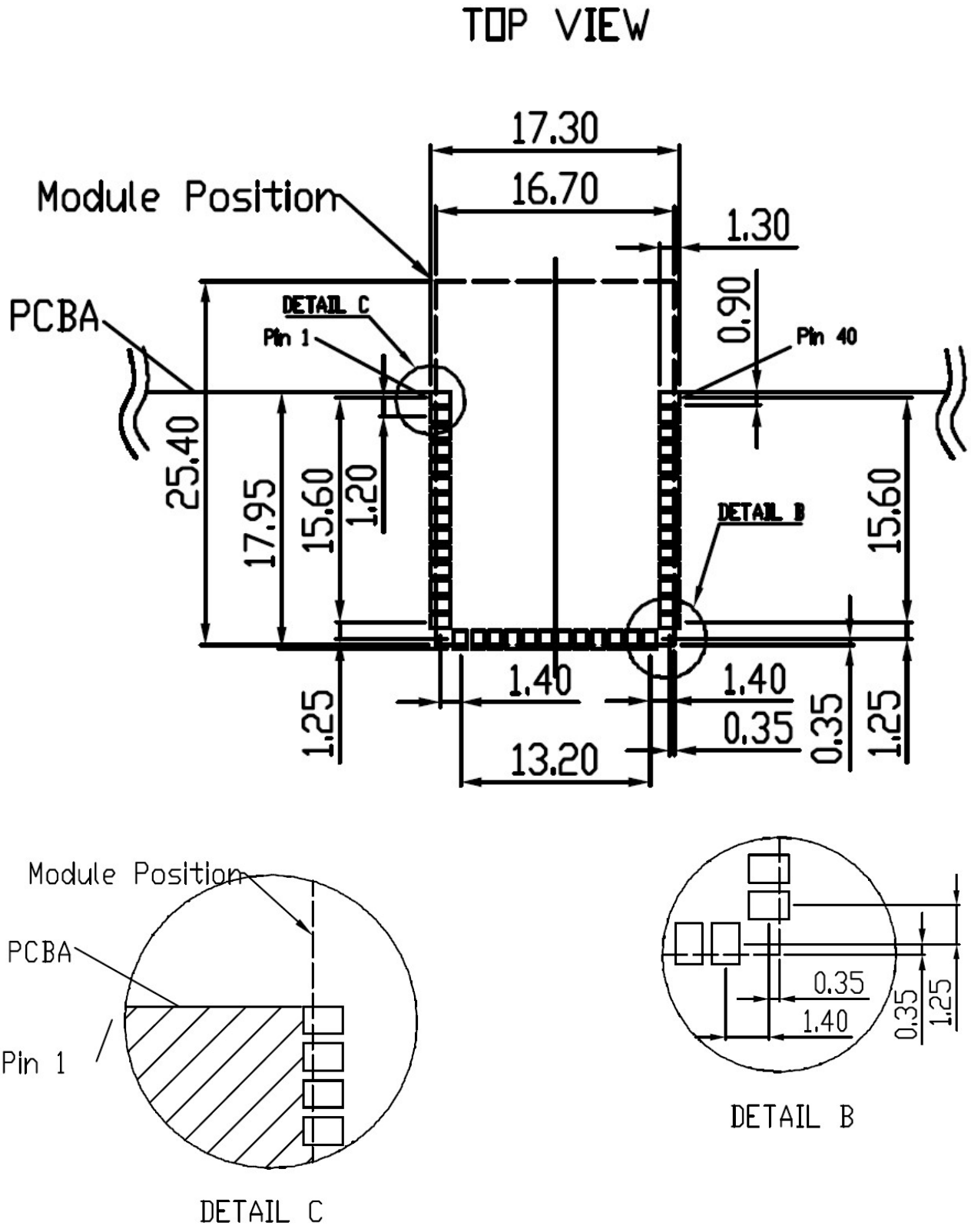
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
RX Receiver sensitivity	Differential mode, measured in 50Ω single-ended, BER=10-3		-96		dBm
Max output power	Differential mode, delivered to a single-ended 50 Ω load through a balun		+5		dBm
Output power programmable range	Delivered to a single-ended 50-Ω load through a balun		26		dBm
Spurious emission conducted measurement	f < 1 GHz, outside restricted bands		<-36		dBm
	f < 1 GHz, restricted bands ETSI		<-54		dBm
	f < 1 GHz, restricted bands FCC		<-55		dBm
	f > 1 GHz, including harmonics		<-42		dBm

Note:
(1) BM10_AN R3 module is with “Internal bias” mode design and related SW setting need to match with “Internal bias” mode.
(2) Suitable for systems targeting compliance with worldwide radio-frequency regulations ETSI EN 300 328 and EN 300 440 Class 2(Europe)and 3, FCC CFR47 Part 15 (US), and ARIB STD-T66 (Japan).
(3) To review TI measured of documentation, navigate to the device product folder on **ti.com (CC2652R7)**

6. Mechanical Information

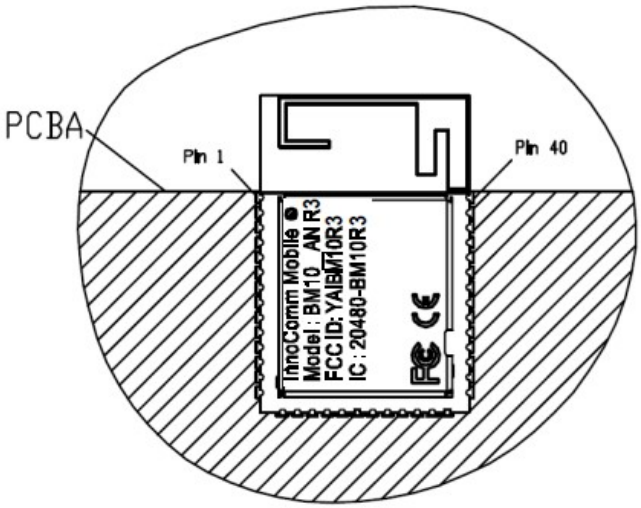


7. PCB Layout Recommendation

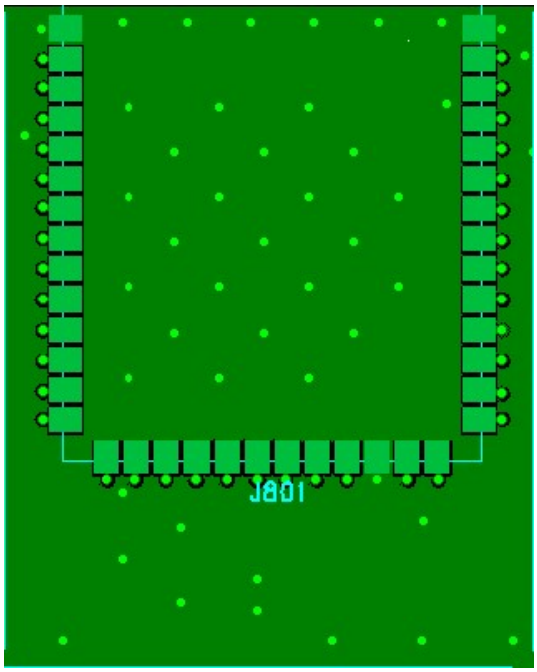


8. Module Placement and Layout Guide

Placement Note: Please refer to “BM10_AN R3 Module_Placement guideline v1.0.pdf”



Layout Note: Do not route any trace under the module to avoid interference.



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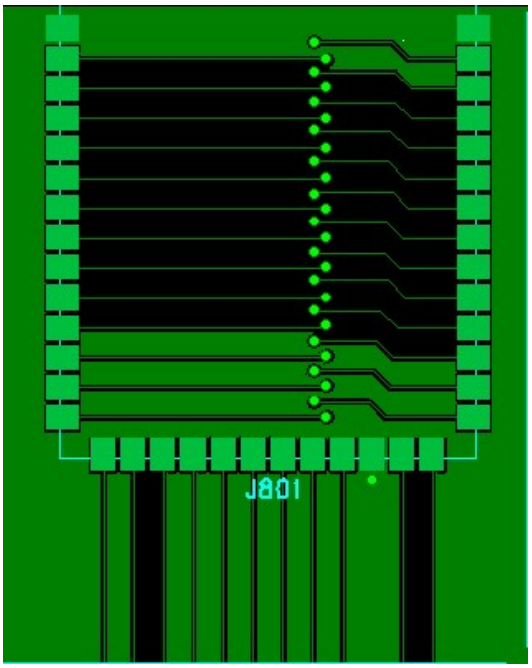

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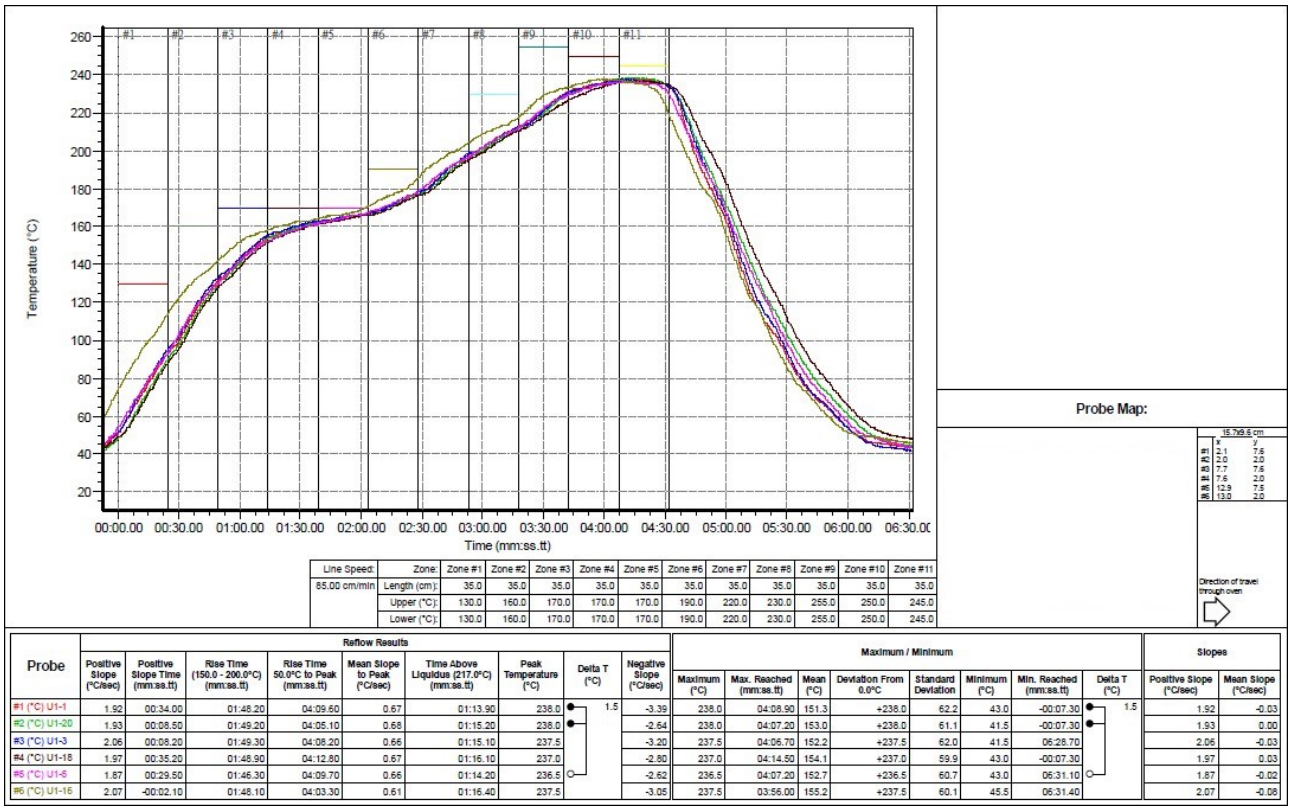
9. SMT Solder Reflow Recommendation



Line Speed:	Zone:	Zone #1	Zone #2	Zone #3	Zone #4	Zone #5	Zone #6	Zone #7	Zone #8	Zone #9	Zone #10	Zone #11
65.00 cm/min	Length (cm):	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
	Upper (°C):	130.0	160.0	170.0	170.0	170.0	190.0	220.0	230.0	255.0	250.0	245.0
	Lower (°C):	130.0	160.0	170.0	170.0	170.0	190.0	220.0	230.0	255.0	250.0	245.0

Probe	Reflow Results									Maximum / Minimum								Slopes	
	Positive Slope (°C/sec)	Positive Slope Time (mm:ss.tt)	Rise Time (150.0 - 200.0°C) (mm:ss.tt)	Rise Time 50.0°C to Peak (mm:ss.tt)	Mean Slope to Peak (°C/sec)	Time Above Liquidus (217.0°C) (mm:ss.tt)	Peak Temperature (°C)	Delta T (°C)	Negative Slope (°C/sec)	Maximum (°C)	Max. Reached (mm:ss.tt)	Mean (°C)	Deviation From 0.0°C	Standard Deviation	Minimum (°C)	Min. Reached (mm:ss.tt)	Delta T (°C)	Positive Slope (°C/sec)	Mean Slope (°C/sec)
#1 (°C) U1-1	1.92	00:34.00	01:48.20	04:09.60	0.67	01:13.90	238.0	1.5	-3.39	238.0	04:08.90	151.3	+238.0	62.2	43.0	-00:07.30	1.5	1.92	-0.03
#2 (°C) U1-20	1.93	00:08.50	01:49.20	04:05.10	0.68	01:15.20	238.0		-2.64	238.0	04:07.20	153.0	+238.0	61.1	41.5	-00:07.30		1.93	0.00
#3 (°C) U1-3	2.06	00:08.20	01:49.30	04:08.20	0.66	01:15.10	237.5		-3.20	237.5	04:06.70	152.2	+237.5	62.0	41.5	06:28.70		2.06	-0.03
#4 (°C) U1-18	1.97	00:35.20	01:48.90	04:12.80	0.67	01:16.10	237.0		-2.80	237.0	04:14.50	154.1	+237.0	59.9	43.0	-00:07.30		1.97	0.03
#5 (°C) U1-5	1.87	00:29.50	01:46.30	04:09.70	0.66	01:14.20	236.5		-2.62	236.5	04:07.20	152.7	+236.5	60.7	43.0	06:31.10		1.87	-0.02
#6 (°C) U1-16	2.07	-00:02.10	01:48.10	04:03.30	0.61	01:16.40	237.5		-3.05	237.5	03:56.00	155.2	+237.5	60.1	45.5	06:31.40		2.07	-0.08

Note: Allowable reflow soldering times: 2 times based on recommended reflow profile.

10. Product and Documentation Support

10.1. Development Support

TI offers an extensive line of development tools, including tools to evaluate the performance of the processors, generate code, develop algorithm implementations, and fully integrated and debug software and hardware modules.

The following products support the development of the CC2652 R7 device applications:

Tools and Software:
The CC2652R7 device is supported by a variety of software and hardware development tools.

Development Kit:

The CC2652R7 LaunchPad™ Development Kit enables the development of high-performance wireless applications that benefit from the low-power operation. The kit features the CC2652R7 SimpleLink Wireless MCU, which allows you to quickly evaluate and prototype 2.4-GHz wireless applications such as Bluetooth 5 Low Energy, Zigbee, and Thread, plus combinations of these. The kit works with the LaunchPad ecosystem, easily enabling additional functionality like sensors, display, and more. The built-in EnergyTrace™ software is an energy-based code analysis tool that measures and displays the application's energy profile and helps to optimize it for ultra-low-power consumption. See Table 5-1 for guidance in selecting the correct device for single-protocol products.

Software:

The SimpleLink CC13xx and CC26xx Software Development Kit (SDK) provide a complete package for the development of wireless applications on the CC13XX / CC26XX family of devices. The SDK includes a comprehensive software package for the CC2652R7 device, including the following protocol stacks:

- Bluetooth Low Energy 4 and 5.2
- Thread (based on OpenThread)
- Zigbee 3.0
- Wi-SUN®
- TI 15.4-Stack - an IEEE 802.15.4-based star networking solution for Sub-1 GHz and 2.4 GHz
- Proprietary RF - a large set of building blocks for building proprietary RF software
- Multiprotocol support - concurrent operation between stacks using the Dynamic Multiprotocol Manager (DMM)

The SimpleLink CC13XX-CC26XX SDK is part of TI's SimpleLink MCU platform, offering a single development environment that delivers flexible hardware, software, and tool options for customers developing wired and wireless applications. For more information about the SimpleLink MCU platform, visit http://www.ti.com/simplelink.

Development Tools:

Code Composer Studio is an integrated development environment (IDE) that supports TI's Microcontroller and Embedded Processors portfolio. Code Composer Studio comprises a suite of tools used to develop and debug embedded applications. It includes an optimizing C/C++ compiler, source code editor, project build environment, debugger, profiler, and many other features. The intuitive IDE provides a single user interface taking you through each step of the application development flow. Familiar tools and interfaces allow users to get started faster than ever before. Code Composer Studio combines the advantages of the Eclipse® software framework with advanced embedded debug capabilities from TI resulting in a compelling feature-rich development environment for embedded developers.
CCS has support for all SimpleLink Wireless MCUs and includes support for EnergyTrace™ software (application energy usage profiling). A real-time object viewer plugin is available for TI-RTOS, part of the SimpleLink SDK.
Code Composer Studio is provided free of charge when used in conjunction with the XDS debuggers included on a LaunchPad Development Kit.

Code Composer Studio (CCS) Cloud is a web-based IDE that allows you to create, edit and build CCS and Energia™ projects. After you have successfully built your project, you can download and run it on your connected LaunchPad. Basic debugging, including features like setting breakpoints and viewing variable values, is now supported with CCS Cloud.
IAR Embedded Workbench® is a set of development tools for building and debugging embedded system applications using assembler, C and C++. It provides a completely integrated development environment that includes a project manager, editor, and build
tools. IAR has support for all SimpleLink Wireless MCUs. It offers broad debugger support, including XDS110, IAR I-jet™, and Segger J-Link™. A real-time object viewer plugin is available for TI-RTOS, part of the SimpleLink SDK. IAR is also supported out-of-the-box on most software examples provided as part of the SimpleLink SDK.
A 30-day evaluation or a 32 KB size-limited version is available through iar.com.
SmartRF™ Studio is a Windows® application that can be used to evaluate and configure SimpleLink Wireless MCUs from Texas Instruments. The application will help designers of RF systems to easily evaluate the radio at an early stage in the design process. It is especially useful for the generation of configuration register values and practical testing and debugging of the RF system. SmartRF Studio can be used either as a standalone application or together with applicable evaluation boards or debug probes for the RF device. Features of the SmartRF Studio include:

- Link tests - transmit and receive packets between nodes
- Antenna and radiation tests - set the radio in continuous wave TX and RX states
- Link Export radio configuration code for use with the TI SimpleLink SDK RF driver
- Custom GPIO configuration for signaling and control of external switches

Sensor Controller Studio is used to write, test and debug code for the Sensor Controller peripheral. The tool generates a Sensor Controller Interface driver, a set of C source files compiled into the System CPU application. These source files also contain the Sensor Controller binary image and allow the System CPU application to control and exchange data with the Sensor Controller. Features of the Sensor Controller Studio include:

- Ready-to-use examples for several common use cases
- Full toolchain with built-in compiler and assembler for programming in a C-like programming language
- Provides rapid development by using the integrated sensor controller task testing and debugging functionality, including visualization of sensor data and verification of algorithms

CCS UniFlash is a standalone tool used to program on-chip flash memory on TI MCUs. UniFlash has a GUI, command line, and scripting interface. CCS UniFlash is available free of charge.

For a complete listing of development-support tools for the CC2652R7 platform, visit the Texas Instruments website athttp://www.ti.com. Contact InnoComm Mobile Technology Corporation sales office or authorized distributor for information on pricing and availability.

10.2. Documentation Support

To receive notification of documentation updates on data sheets, errata, application notes, and similar, navigate to the device product folder on ti.com/product/CC2652R7. In the upper right corner, click on Alert me to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.
The current documentation that describes the CC2652R7 devices, related peripherals, and other technical collateral is listed in the following.

TI Resource Explorer
Software examples, libraries, executables, and documentation are available for your device and development board.
Errata
The silicon errata describes the known exceptions to the functional specifications for each silicon revision of the device and description on how to recognize a device revision.

Application Reports

All application reports for the CC2652R7 device are found on the device product folder at: ti.com/product/CC2652R7/#tech-docs.

Technical Reference Manual (TRM)

The TRM provides a detailed description of all modules and peripherals available in the device family.

10.3. Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

TI Embedded Processors Wiki ***Texas Instruments Embedded Processors Wiki.*** Established to help developers get started with Embedded Processors from Texas Instruments and to foster innovation and growth of general knowledge about the hardware and software surrounding these devices.