Bluetooth® 4.0 Low Energy Dual Mode Class 1 SoC Module

*n*Blue™ BR-LE4.0-D2A (CC2564)

- ***AT HOME. AT WORK. ON THE ROAD. USING BLUETOOTH LOW ENERGY WIRELESS TECHNOLOGY MEANS TOTAL FREEDOM FROM THE CONSTRAINTS AND CLUTTER OF WIRES IN YOUR LIFE.***
- **FCC, IC, CE, RoHS, *and Bluetooth*® 4.0 Certified ISM 2.4GHz module.**
- **Utilizes the TI MSP430F5438A with 256K Flash, 16K RAM and the TI CC2564 baseband.**
- **Over 500 meter (1640 ft) line of site (LOS) distance over SPP with integrated antenna.**
- **Can be externally controlled via simple ASCII AT commands over the UART or programmed with custom applications embedded in the module.**
- **Available embedded *Bluetooth* Protocols and Profiles include: SPP, GAP, GATT, SMP, ATT, L2CAP, BAS, BLP, BLS, DIS, FMP, ANP, HIDS, HOGP, HID, HTP, HTS, HRP, HRS, IOP, IAS, LLS, PASP, PXP, SCPP, SCPS, TIP, TPS, and BRSP.**
- **The BR-LE4.0-D2 dual mode module has the same footprint as the nBlue single mode modules and is pin for pin compatible with the exception of a few extra PIOs.**
- **Supports both Low Energy and Classic BR/EDR Bluetooth.**

FEATURES

- Integrated AT.s command stack for external control via UART or RF, with master/slave support and serial (BRSP) and battery (BAS) profiles. BRSP allows the user to stream data over LE similar to the way SPP works on Classic *Bluetooth* devices, but at a much lower maximum data rate.
- Available Stonestreet One Bluetopia SDK for custom embedded applications on the module with approximately 100kB Flash and 4kB RAM available to the client application.
- UART (2 or 4 wire with CTS/RTS, 9600 to 460.8K baud), SPI, and I2C data interfaces.
- 12-Bit ADC with 8 channels, RTC, battery monitor, temperature sensor, watchdog timer.
- Software adjustable transmitter power (-23dBm to 10.5dBm) for short to long range applications.
- Low power consumption: *40mA 4dB TX, RX 38.5mA, 590uA idle w/ UART active, and 90uA deep sleep.*
- Secure and robust communication link:
  - ✓ FHSS (Frequency Hopping Spread Spectrum)
  - ✓ 24-bit CRC Error correction for guaranteed packet delivery
  - ✓ AES-128 bit encryption using CCM for encryption and authentication of packets.
- Firmware updates over two wire UART interface. Clients should make hardware accommodations for upgrading firmware on custom designs since modules shipped from the factory in tape and reel cannot be guaranteed to contain the latest firmware.
- Apple iOS and Android libraries, as well as a data terminal example application (nBlueTerm - with source code) provided free of charge. nBlueTerm supports connect, disconnect, pairing and sending data over BRSP.

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FIRMWARE OPTIONS

1. AT.s Command Set for external control via UART or RF.
2. Stonestreet One Bluetopia stack for custom embedded applications, which requires either the IAR Systems Compiler or TI Code Composer Studio.

APPLICATIONS

- **Telemedicine / Telehealth**
- **Medical Patient Monitoring**
- **Human Interface Devices (Keyboard, Mouse, Remote control)**
- **Sports and leisure equipment**
- **Mobile phone accessories**
- **Remote controls**
- **Consumer Electronics**
- **Remote monitoring and control**
- **Health Care and Medical**
- **Smart Grid**
- **Automated Meter Reading (AMR)**
- **Home/Building Automation**
- **Machine-to-Machine (M2M)**
- **Wireless Sensor Networks**
- **Wireless Alarms and Security**
- **Lighting and HVAC control**
- **Proximity and out of range detection**

LOW ENERGY VS CLASSIC BLUETOOTH

- **Broadcast support**
- **Connectionless always off technology**
- **Proximity and out of range detection**
- **10 msec. connect time and low data latency**
- **First low power wireless technology standard**

Bluetooth Low Energy, part of *Bluetooth* Ver. 4.0, specifies two types of implementation: **single** mode and **dual** mode. Single mode chips implement the low energy specification and consume just a fraction of the power of classic *Bluetooth,* allowing the short-range wireless standard to extend to coin cell battery applications for the first time. Dual mode chips combine low energy with the power of classic *Bluetooth* and are likely to become a de facto feature in almost all new *Bluetooth* enabled cellular phones and computers. Single mode *Bluetooth* 4.0 Low Energy is **NOT** backwards compatible with previous *Bluetooth* standards. Dual mode *Bluetooth* 4.0 Low Energy is backwards compatible but is not practical for low power devices but targeted to gateway products.

An ***n*Blue** single mode module communicating over BLE once a second consumes ~30µA on average. To put this in perspective, 30µA corresponds to 330 days of battery life using a CR2032 coin cell. BLE is not recommended for data streaming applications but is ideal for efficient short (20 byte or less) packet bursts.

In LE, GAP defines four specific roles: Broadcaster, Observer, Peripheral, and Central. A device may support multiple LE GAP roles provided that the underlying Controller supports those roles or role combinations. However, only one LE GAP role may be supported at a given time. The **Broadcaster** role is optimized for transmitter only applications. Devices supporting the broadcaster role use advertising to broadcast data. The broadcaster role does not support connections. The **Observer** role is optimized for receiver only applications. Devices supporting the observer role are the complementary device for a broadcaster and receives broadcast data contained in advertisements. The observer role does not support connections. The **Peripheral** role is optimized for devices that support a single connection and are less complex than central devices. Devices supporting the peripheral role only require Controllers that support the Controller's slave role. The **Central** role supports multiple connections and is the initiator for all connections with devices in the peripheral role. Devices supporting the central role require a Controller that supports the Controller's master role and generally supports more complex functions compared to the other LE GAP roles.

SPECIFICATIONS SUMMARY

Operating Conditions Summary

Item	Specifications
Supply voltage (VDD)	2.4-3.6 V
VDD ripple	100 mV Max
Max voltage on any pin	VDD + .3 V **(Not 5V Tolerant)**
Ambient Temperature Range	-40 – 85 ℃

Current Consumption Summary

Measurements done at TA = 25℃, VDD = 3 V on BR-LE4.0-D2A running AT.s 3.3.0.0-D2

Item	Specifications
Power Modes	
Power Mode 3 (5µs Wake-Up) AT.s in idle state with sleep mode enabled (MSP in LPM3).	90 µA
Active AT.s in idle state (MSP in LPM0).	590 µA
Peak RF Consumption	
RX	38.5 mA
TX -23 dBm	28.5 mA
TX -6 dBm	32.0 mA
TX 0 dBm	36.5 mA
TX 4 dBm	40.0 mA
TX 10 dBm	72.0 mA

General RF Specifications Summary

Item	Specifications
Receive Sensitivity (w/chip antenna)	-95 dBm
Output Power	10.5 dBm max
Link Budget	Up to 105.5 dB
RX/TX Turnaround	150 us

Classic Bluetooth RF Specifications Summary

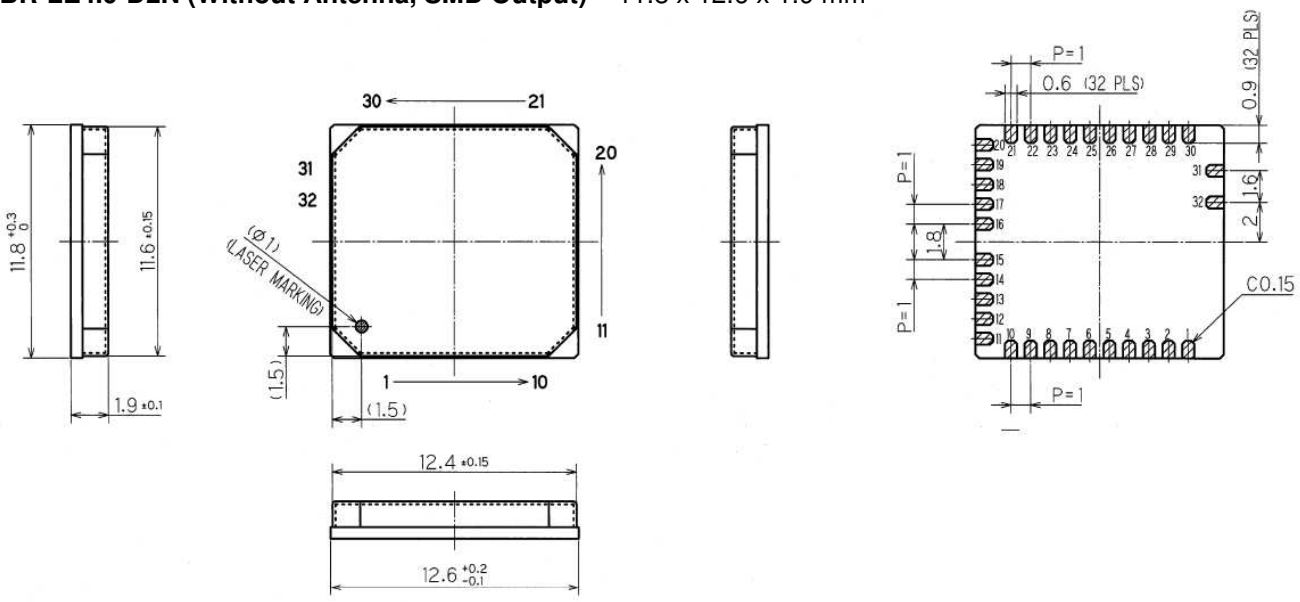
Item	Specifications
Frequency	2402 – 2480 MHz in 1 Mhz steps
Data Rate and Modulation	BR:1 Mbps, GFSK / EDR: 2-3 Mbps PSK
Number of Channels	79

Low Energy RF Specifications Summary

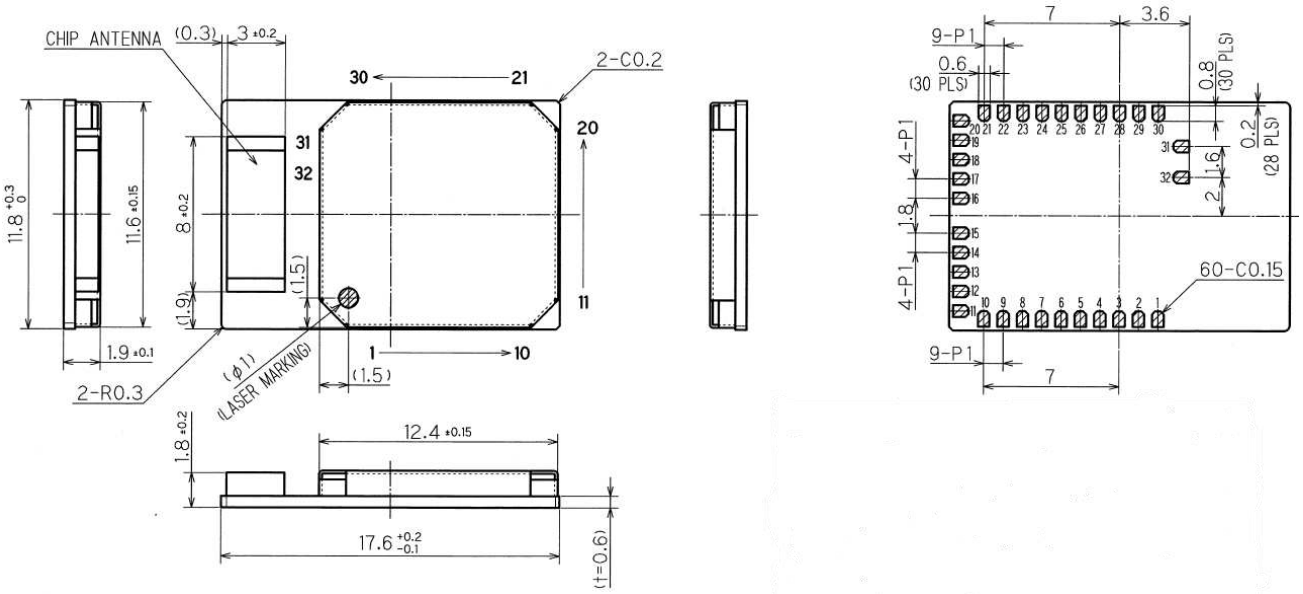
Item	Specifications
Frequency	2402 - 2480 MHz in 2 Mhz steps
Data Rate and Modulation	1 Mbps, GFSK
Number of Channels	40: 37 data / 3 advertising (0,12,39)

DIMENSIONS

BR-LE4.0-D2N (Without Antenna, SMD Output) – 11.8 x 12.6 x 1.9 mm

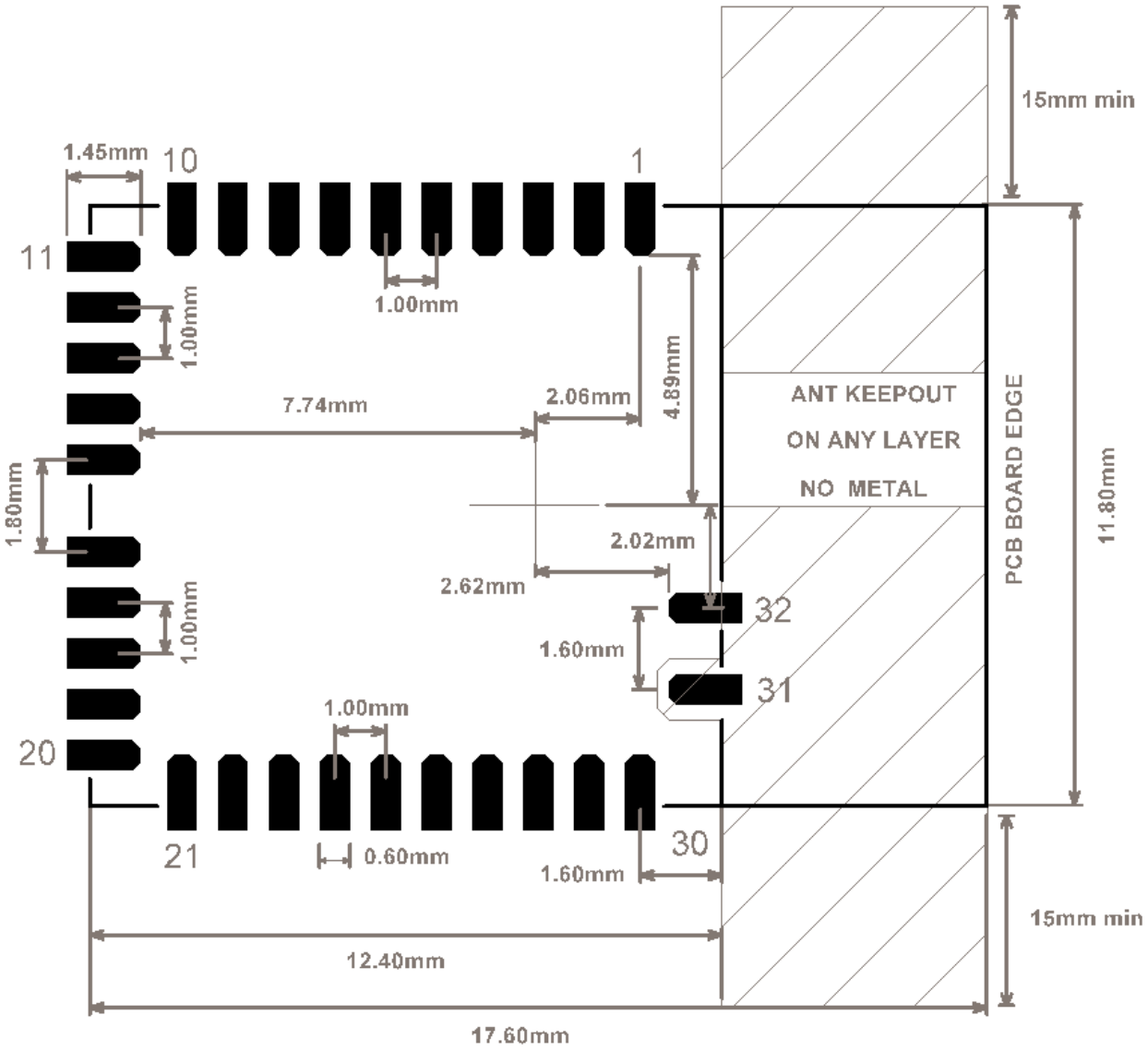


BR-LE4.0-D2A (With 2 dBi TDK ANT8030-2R4-01 Antenna) – 11.8 x 17.6 x 1.9 mm



Units: mm

STANDARD LAND DIMENSIONS (WITH ANTENNA)



Note: Radio requires a RF ground plane on the rest of the Printed Circuit Board (PCB) area. This can be located on any layer of the PCB. Extend the RF ground plane parallel to module pins 31 and 32 the entire length of your board. Connect all ground pins and do not notch the ground plane around the module. Bottom of module is grounded so be careful of vias or conductive traces located under the modules that are not soldered masked to prevent shorting. Keep metallic components, connectors, copper traces, internal layers, and ground planes away from the antenna area in 3D space!

PINOUT

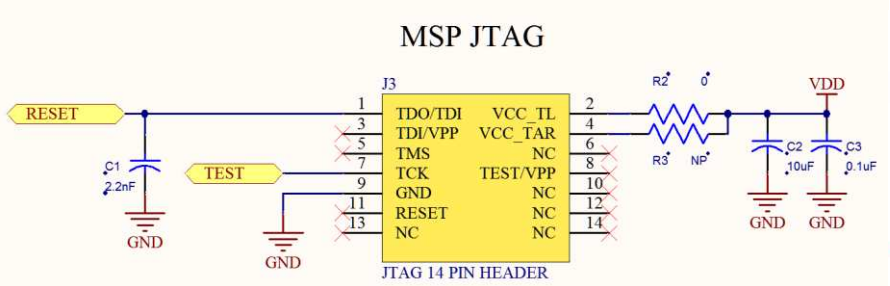
Pin	Pin Name	Pin	Pin Name
1	GND	17	PIO_21
2	TEST / SBWTCK (Spy-Bi-Wire)	18	PIO_22
3	RESET (Active Low / Spy-Bi-Wire)	19	PIO_14
4	ADC_1	20	GND
5	SPI_MISO	21	ADC_0
6	SPI_CSB	22	PIO_9
7	SPI_CLK	23	PIO_2
8	SPI_MOSI	24	PIO_5
9	VDD (2.4-3.6V)	25	PIO_6
10	GND	26	PIO_3
11	UART_CTS	27	PIO_8
12	UART_RTS	28	PIO_4
13	UART_TX	29	PIO_7
14	UART_RX	30	GND
15	PIO_19	31	NC (RF Test Antenna)
16	PIO_20	32	NC (RF Test Ground)

DEBUGGING

SBWTCK (TEST) and SBWTDIO (Reset) allow the module to be connected to a TI MSP-FET430UIF for debugging and programming via SPY-Bi Wire. See the MSP-FET430UIF User's Guide for more information http://www.ti.com/lit/ug/slau278j/slau278j.pdf.

An ***n*Blue** Interace Board (IB) is also available and allows the user to debug, program, update firmware and have UART communications with any of the ***n*Blue** modules through a single or double row 10 pin header. See the ***n*Blue** Module User's Guide for more information.

A MSP-FET430UIF is only needed for writing a custom application for a module and not using the AT.s command set.



ORDERING INFORMATION

Pricing and ordering information can be found at:
http://www.blueradios.com/orderinfo_new.htm

PART NUMBER

BR-LE4.0-D2#

BR = BlueRadios
LE = Low Energy
4.0 = *Bluetooth* LE version
D = Dual Mode
2 = Class 1 SoC Module +500 meter (CC2564)

= A (Antenna)
= U (U.FL RF Connector) built to order, not a stock item, 5K minimum
= N (No Antenna, SMD Output) built to order, not a stock item, 5K minimum

	Part Number	Description
1.	BR-LE4.0-D2A	*Bluetooth* Low Energy v4.0 Dual Mode with Antenna
2.	BR-LE4.0-D2U	*Bluetooth* Low Energy v4.0 Dual Mode with U.FL RF Connector
3.	BR-LE4.0-D2N	*Bluetooth* Low Energy v4.0 Dual Mode No Antenna, SMD Output

STANDARD PACKAGING

Tape and Reel (T&R) 500 or 1,000 piece 340mm x 25mm reel sizes

DEVELOPMENT KIT (BR-EVAL-LE4.0-D2A)

Development kit available containing everything required to set up a connection quickly and evaluate range and performance of the BR-LE4.0-D2A: http://www.blueradios.com/hardware_EVAL-LE4.0-D2.htm

CUSTOM FIRMWARE

The AT.s command interface can be modified for high volume customers and custom embedded software development is available upon request

ADDITIONAL DOCUMENTATION

Complete Documentation can be found at: http://www.blueradios.com/forum.