Blue Radios
A Wireless World

4.0 Bluetooth low energy
www.*Blue*Radios.com

Secure, Versatile
and Award Winning
Network Radio Devices.

Bluetooth® 4.0 Low Energy Single Mode SoC *nano* ampere *network* module

RoHS **nBlue™ BR-LE4.0-S2#**

TEXAS INSTRUMENTS

OUTLINE

- *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.*

- Three types of models: With/without RF chip antenna, or U.FL connector.

- FCC, IC, CE, RoHS, *and Bluetooth®* Ver 4.0 compliant ISM 2.4GHz band module.

- Code space for client applications (130kB Flash / 50kB w/parser, 2.5kB RAM)

- UART, SPI, USB data interface (2-wire or 4-wire with CTS/RTS).

- Analog, RTC, battery monitor, temperature sensor, watchdog timer.

- Includes integrated software stack, profiles, and AT modem like commands.

- Embedded *Bluetooth* Stack Protocols and Profiles Include: GAP, GATT, SMP, ATT, L2CAP, BATT.
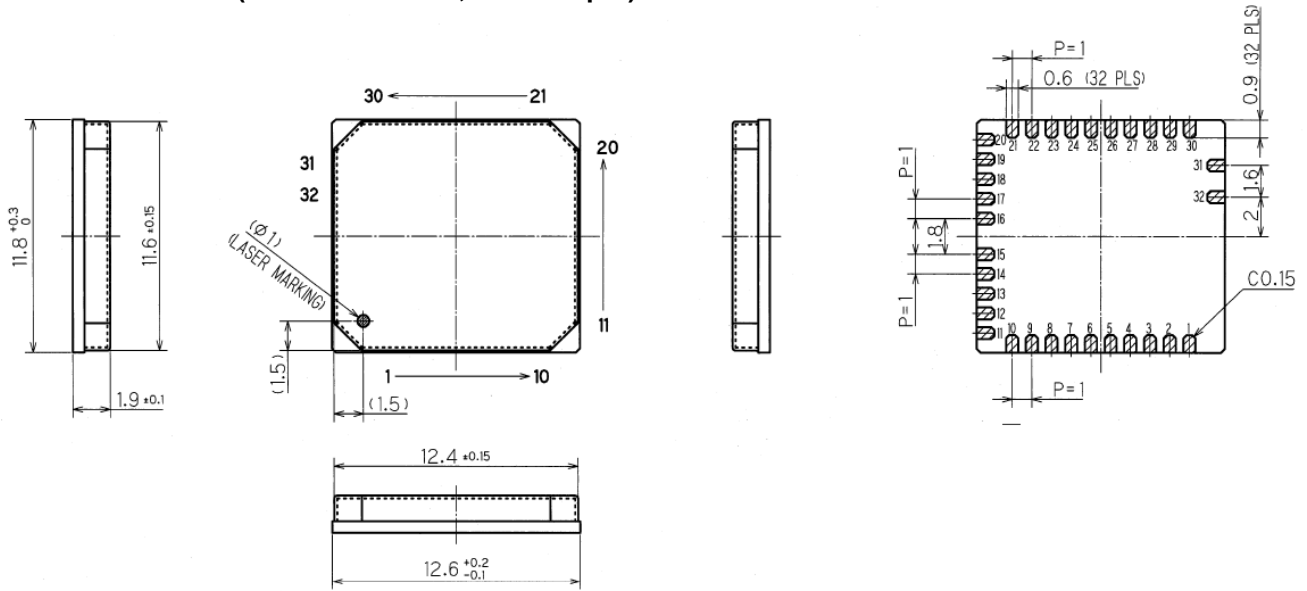
FEATURES

- The *BlueRadios* serial radio modems can be configured, commanded, and controlled through simple ASCII strings over the *Bluetooth* RF link or directly through the hardware serial SPI (Master/Slave), UART or Full-Speed USB 2.0.
- UART baud rate speeds: 9600bps up to 460.8Kbps.
- +150 meter (500 feet) est. distance (LOS) with chip antenna
- Software adjustable transmitter power from short to long range applications
- Low power consumption *(30mA TX, 18mA RX, 0.22mA idle mode, and 0.5uA deep sleep timer)*
- Small-form factor SMT radio modem that requires no external components
- Operating temperature range: -40~+85ºC.
- Secure and robust communication link with billions of unique codes
  - ✓ 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.

SPECIFICATIONS

Item		Specifications
Frequency		2402 ~ 2480MHz
Modulation		GFSK, 250 KHz deviation
Channel intervals		Programmable 1 MHz steps
Number of channels		40CH: 37 AFH data channels. 3 discoverable, connectable and broadcasting channel
Power supply voltage		2.0 to 3.6Vdc and < 10mVp-p noise
Current consumption		30mA worst case peak @4dBm
Transmission rate (over the air)		1Mbps
Receive sensitivity		-93dBm typ.
Output Power (Class2)		4dBm max.
RX/TX turnaround		150 usec. with 97dBm link budget
Dimensions	Without antenna	11.8(W)X12.6(L)X1.9(H)mm
	With antenna	11.8(W)X17.6(L)X1.9(H)mm

7173 S. Havana Street, Suite 600 • Englewood, CO 80112 • USA • Tel (303) 957-1003
www.*Blue*Radios.com

DIMENSIONS

● **BR-LE4.0-S2N (Without Antenna, SMD Output)**

● **BR-LE4.0-S2A (With Antenna)**

2 dBi TDK ANT8030-2R4-01
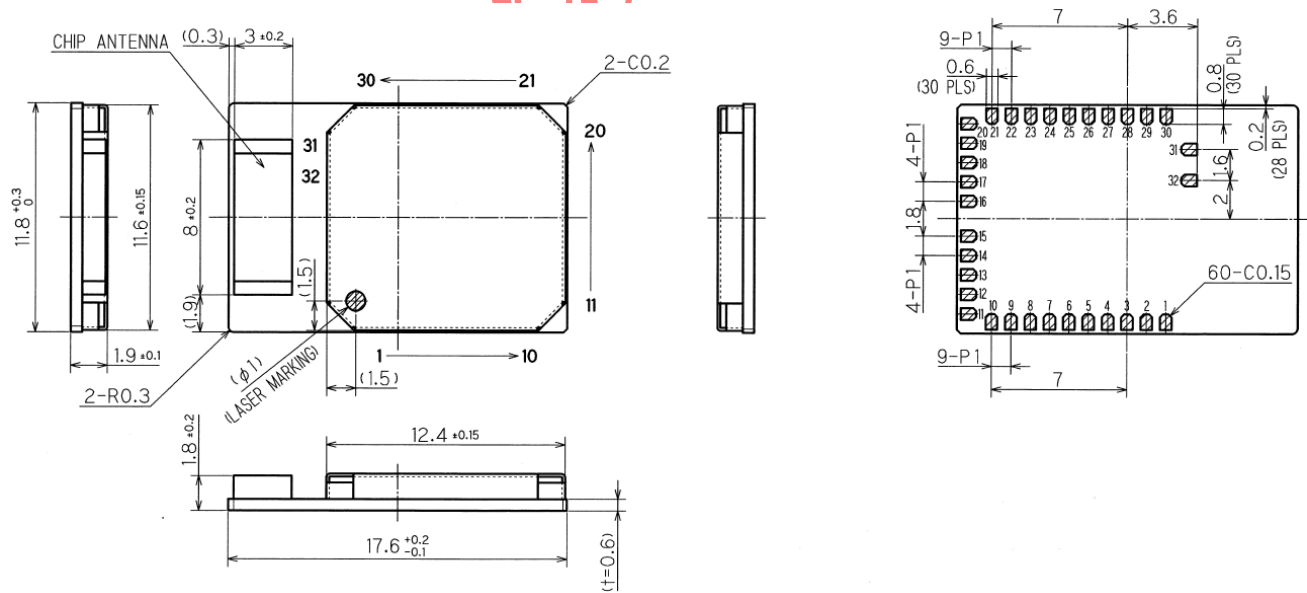
Unit: mm

*For technical details of the products in this page, refer to Sales Dept., BlueRadios, Inc.

TERMINALS	
1. GND	17. USB_DP
2. N.C.	18. USB_DM
3. RESET	19. PIO_14
4. ADC_1	20. GND
5. SPI_MISO	21. ADC_0
6. SPI_CSB	22. PIO_9 (4mA)
7. SPI_CLK	23. PIO_2 (20mA)
8. SPI_MOSI	24. PIO_5 (20mA)
9. VDD(2.0-3.6V)	25. PIO_6 (4mA)
10. GND	26. PIO_3 (4mA)
11. UART_CTS	27. PIO_8 (4mA)
12. UART_RTS	28. PIO_4 (Program)
13. UART_TX	29. PIO_7 (Program)
14. UART_RX	30. GND
15. USB_VBUS	31. N.C. (RF_Test:ANT)
16. USB_GND	32. N.C. (RF_Test:GND)

Part is not 5Vdc tolerant.
Reset is active **low**; pulse 1usec. (min)
PIO Sink Current is 4mA max except for PIO(2&5)
12-Bit ADC with Eight Channels and
configurable Resolution

Power-up Sequence

Allow 100msec for module to fully reboot from initial power up (cold start).
Power management sleep modes:
   PM1 – 220uA, 4uS wakeup
    PM2 – 1uA, 120uS wakeup
    PM3 – 0.5uA, 120uS wakeup

Please refer to BlueRadios Specification BR-LE4.0_AT_COMMANDS-**200** hardware and software interface definition.

Firmware Options

- **AT Command**
    - **Multi-point / Broadcast**
    - **Point-to-point**
    - **Repeater**
- **HCI only**
- **Application Protocol Interface (API)**
- **Custom**

Programming interface tool TI CC-DEBUGGER and programmer (HPL15195U), pictured below. Tool is not needed if you are just upgrading *nBlue* firmware over module UART interface to the Texas Instruments CC2540.
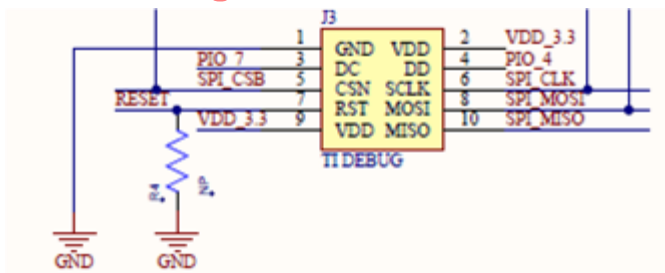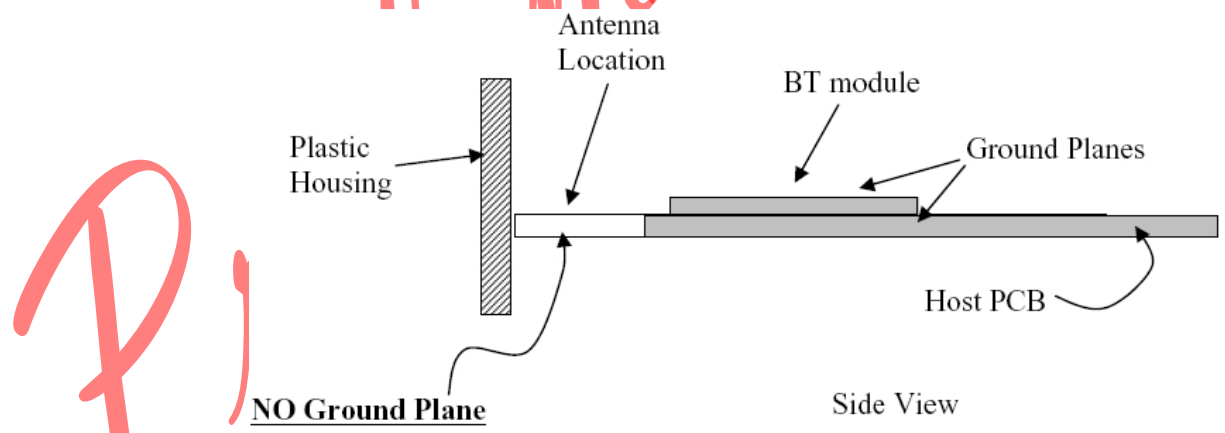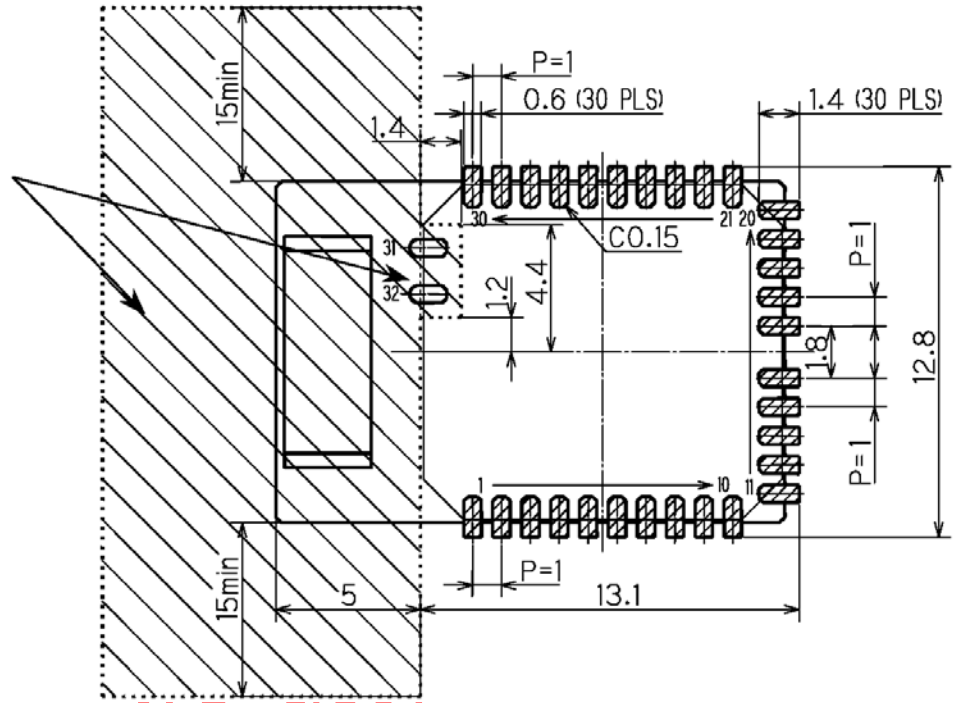

PIO_4 and PIO_7 have dual modes and when not used for programming inputs.

STANDARD LAND DIMENSIONS

- **BR-LE4.0-S2# (With Antenna)**

In this area, you should not locate any parts or GND plane / Patterns on surface or internal layer.

Antenna Location

Plastic Housing

BT module

Ground Planes

Host PCB

NO Ground Plane

Side View

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!

nBlue module communicating 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 over the standard defined profiles like GAP & GATT. BLE is ideal for efficient short (22 byte or less) packet burst technology.

APPLICATIONS

- Telemedicine / Telehealth
- Medical Patient Monitoring
- Human Interface Devices (Keyboard, Mouse, Remote control)
- Sports and leisure equipment
- Mobile phone accessories
- Remote control for computers, MP3 playe
- 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

Development Kit (BR-EVAL-LE4.0-S2A)

New Development kit containing everything required to set up a connection quickly and evaluate range and performance of the BR-LE4.0-S2A.

AT-style software interface command dictionary can be modified for high volume customers. Custom software development available upon request.

AT-Style Commands Reference (BlueRadios_ATBLE_Commands_Rev)

Benefits of BLE over traditional *Bluetooth*

IP aware, automatically interacts directly with the web application, phone PC, STB, or gateway is a pass through no special applications required on the Gateway which is a transparent pipe from device to an IP address.

- 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

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. Each role specifies the requirements for the underlying Controller. This allows for Controllers to be optimized for specific use cases.

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.

7173 S. Havana Street, Suite 600 • Englewood, CO 80112 • USA • Tel (303) 957-1003
www.*Blue*Radios.com

PART NUMBER ORDERING: BR-LE4.0-S2#

BR = BlueRadios
LE = Low Energy
4.0 = *Bluetooth* **LE version**
  S = Single Mode
  2 = Class2 +100 meter
  # = A (Antenna)
  # = U (U.FL RF Connector)
  # = N (No Antenna, SMD Output)

	Part Number	Description
1)	BR-LE4.0-S2A	*Bluetooth* Low Energy v4.0 Single Mode with Antenna
2)	BR-LE4.0-S2U	*Bluetooth* Low Energy v4.0 Single Mode with U.FL RF Connector
3)	BR-LE4.0-S2N	*Bluetooth* Low Energy v4.0 Single Mode No Antenna, SMD Output

STANDARD PACKAGING

Tape and Reel (T&R) 500 or 1,000 piece 330mm x 25mm reel sizes

  1) **BR-LE4.0-S2A**
  2) **BR-LE4.0-S2U**
  3) **BR-LE4.0-S2N**

Price and Order information

http://www.blueradios.com/orderinfo_new.htm

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.

Note: 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.