

LONGER RANGE BLE – ENABLING NEXT GENERATION INDUSTRIAL IOT



Laird Connectivity’s new BL653 series enables Industrial OEMs to robustly implement **longer range** BLE applications in the **harshest operating environments**. This series of secure low power, microcontroller modules with multi wireless capabilities is the future of wireless Industrial Internet of Things (IIoT) connectivity.

Powered by **Nordic’s nRF52833** silicon, the small form factor BL653 modules and DVKS provide for a secure, robust BLE and **Cortex -M4F** CPU for any OEM’s product design. The BL653 provides you with maximum development flexibility with programming options for the **Nordic SDK** or **Zephyr RTOS**, a simple, intuitive **AT command set**, as well as Laird’s own **smartBASIC** environment.

The BL653 series brings out all nRF52833 hardware features and capabilities including **USB access**, up to **+8 dBm** transmit power up to **5.5V** supply considerations, and **NFC tag (type 2 / 4)** implementation. Complete regulatory certifications enable faster time to market and reduced development risk completes Laird’s simplification of your next Bluetooth design!

- **Bluetooth v5.1** Bluetooth Low Energy (BLE) plus **NFC**
- **Bluetooth v5.2-** capable
- **802.15.4** radio (non-certified – Thread & ZigBee via Nordic SDK or Thread via Zephyr)
- **Widest range of configurable interfaces:** UART, I2C, SPI, ADC, GPIO, PWM, FREQ, USB, PDM, and NFC
- **Extended Industrial Temperature Rating** (-40° to +105 °C)
- **Ultra-small footprint** (15 mm x 10 mm x 2.2 mm)
- BLE Peripheral/Central roles supported
- 2 Mbps and **LE Long Range:** Support for 2 Mbps, 1 Mbps, & 125 kps coded
- Bluetooth 5.1 - Direction finding – **AoA and AoD**
- **Hostless operation** – Internal MCU reduces BOM
- **Powerful Core** Cortex-M4F (512kB Flash, 128 k RAM)
- Built on years of experience with Nordic (BL600 and BL652 Series)
- **Fully featured development kit** everything needed to start BLE development
- **Application design choice:** Leverage Laird’s *smartBASIC*, simple AT command set, Zephyr RTOS or utilize Nordic SDK directly
- **Nordic nRF52833** – 7x7 QFN with 42 GPIOs utilized.
- Mechanically same form factor as **BL654 Series**

FEATURES AT A GLANCE



NEXT GENERATION OF DIRECTION FINDING

Includes radio capable of Bluetooth v5.1 Direction Finding with AoA and AoD



SOFTWARE FLEXIBILITY AND SPEED TO MARKET

Simple AT Command set or easily write event-driven, automated applications, no toolchain required with *smartBASIC*. Alternatively utilize either Zephyr RTOS or the Nordic SDK directly – develop application SW your way



TRUE INDUSTRIAL OPERATING RANGE

Designed and certified to the highest industrial temperature range of -40 °C to +105 °C for every component utilised.



GLOBAL APPROVALS – MAKE YOURSELF AT HOME

Carries several modular FCC, IC, CE, RCM, MIC and Bluetooth SIG approvals.



PERSONAL SUPPORT FROM DESIGN TO MANUFACTURE

Laird’s industry-renowned support is passionate about helping you speed your design to market.

APPLICATION AREAS



Professional Lighting



Direction Finding / AoA / AoD



Secure Medical Peripherals



Industrial IoT Sensors

KEY SPECIFICATIONS

| CATEGORY | FEATURE | SPECIFICATION | |
|--------------------------------|----------------------|--|--------------------------------------|
| Wireless Specification | Bluetooth® | v5.1 | |
| | 802.15.4 | Thread and Zigbee support via Nordic SDK | |
| | Frequency | 2.402 - 2.480 GHz | |
| | Transmit Power | + 8 dBm (maximum). Configurable down to -40 dBm | |
| | Receive Sensitivity | -95 dBm (typical @ BLE 1 Mbps) -103 dBm (typical @ BLE 125 kbps) | |
| | Link Budget | 103 dB (@ BLE 1 Mbps), 111 dB (@ BLE 125 kbps) | |
| | Antenna Options | PCB trace antenna or trace pin for external antennas | |
| | Raw Data Rates (Air) | 1 Mbps, 2 Mbps, 125 kbps | |
| Host Interface and Peripherals | UART Interface | TX, RX, CTS, RTS, DTR, DSR, DCD, RI (GPIO) Default: 115200, N, 8, 1. Configurable from 1200 bps to 1 Mbps | |
| | USB Interface | 2 pins - CDC/Audio/HID & mass storage virtual interfaces | |
| | Other | 42 multifunction GPIO's that can provide: <ul style="list-style-type: none"> ▪ 2 UART (4 GPIO pins each) ▪ 8 ADC channels (1 pin each) ▪ 2 I2C (2 GPIO pins each) ▪ 4 SPI Master (4 GPIO pins including CS each) ▪ 2 PDM (2 GPIO pins each) ▪ 2 I2S (5 GPIO pins) ▪ 2 GPIO pins for 32.768 kHz crystal ▪ 2 GPIO pins for NFC ▪ PWM output on 16 pins ▪ FREQ output on 16 pins | |
| Key BLE Features | Bluetooth Low Energy | <ul style="list-style-type: none"> ▪ GATT client & GATT server – Any adopted/custom services ▪ Central/Peripheral roles ▪ Up to 8 BLE connections (<i>smartBASIC</i>) ▪ BLE mesh ▪ CODED PHY ▪ 2M PHY ▪ LE advertising extensions ▪ LE secure connections ▪ Data packet length extensions ▪ LE privacy v1.2 ▪ LE ping ▪ vSP – Virtual Serial Port ▪ Isochronous streams for audio (BT v5.2) | |
| Programmability Options | <i>smartBASIC</i> | On-board BASIC event driven programming language | |
| | AT Command Set | Simple AT Hayes-style command protocol | |
| | Nordic SDK | Software/Support available from Nordic directly https://devzone.nordicsemi.com/ | |
| | Zephyr RTOS | Software/Support available from https://www.zephyrproject.org/ | |
| FW upgrade | | Via UART or JTAG | |
| Supply Voltage | | 1.7V – 5.5V | |
| Power Consumption | Current | Max Peak Radio Current (@ +8 dBm TX) – 14.1 mA (DCDC at 3V) | |
| | | Max Peak Radio Current (@ 0 dBm TX) – 4.9 mA (DCDC at 3V) | |
| | | Standby Doze – 2.6 µA | |
| | | Deep Sleep – 0.6 µA (external signal wake-up) | |
| Physical | Dimensions | 15 mm x 10 mm x 2.2 mm (modules) | |
| Environmental | Temp Range | -40°C to +105°C | |
| Miscellaneous | Lead Free | Lead-free and RoHS-compliant | |
| | Development Kit | Development board and free software tools | |
| Development Tools | Utilities | UwTerminalX (Multi-platform) Nordic nRFConnect - Android and iOS applications UART firmware upgrade | |
| | Qualifications | Bluetooth® | Complete Declaration ID |
| | Regulator | Approvals | FCC/IC/CE/MIC/RCM - All BL653 Series |

For full specifications on BL653 modules, please see the appropriate datasheet.

| PART # | DESCRIPTION |
|--------------|--|
| 453-00039R | BLE module (Nordic nRF52833) – Integrated antenna (Tape/Reel) |
| 453-00041R | BLE module (Nordic nRF52833) – Trace pin (Tape/Reel) |
| 453-00039C | BLE module (Nordic nRF52833) – Integrated antenna (Cut Tape) |
| 453-00041C | BLE module (Nordic nRF52833) – Trace pin (Cut Tape) |
| 453-00039-K1 | Development kit for Bluetooth + 802.15.4 + NFC module – Integrated antenna |
| 453-00041-K1 | Development kit for Bluetooth + 802.15.4 + NFC module – Trace pin (external antenna) |