

## 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 Connectivity'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 Connectivity'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 Connectivity'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

Our 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"> <li>▪ 2 UART (4 GPIO pins each)</li> <li>▪ 8 ADC channels (1 pin each)</li> <li>▪ 2 I2C (2 GPIO pins each)</li> <li>▪ 4 SPI Master (4 GPIO pins including CS each)</li> <li>▪ 2 PDM (2 GPIO pins each)</li> <li>▪ 2 I2S (5 GPIO pins)</li> <li>▪ 2 GPIO pins for 32.768 kHz crystal</li> <li>▪ 2 GPIO pins for NFC</li> <li>▪ PWM output on 16 pins</li> <li>▪ FREQ output on 16 pins</li> </ul>	
Key BLE Features	Bluetooth Low Energy	<ul style="list-style-type: none"> <li>▪ GATT client &amp; GATT server – Any adopted/custom services</li> <li>▪ Central/Peripheral roles</li> <li>▪ Up to 8 BLE connections (<i>smartBASIC</i>)</li> <li>▪ BLE mesh</li> <li>▪ CODED PHY</li> <li>▪ 2M PHY</li> <li>▪ LE advertising extensions</li> <li>▪ LE secure connections</li> <li>▪ Data packet length extensions</li> <li>▪ LE privacy v1.2</li> <li>▪ LE ping</li> <li>▪ vSP – Virtual Serial Port</li> <li>▪ Isochronous streams for audio (BT v5.2)</li> </ul>	
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 <a href="https://devzone.nordicsemi.com/">https://devzone.nordicsemi.com/</a>	
	Zephyr RTOS	Software/Support available from <a href="https://www.zephyrproject.org/">https://www.zephyrproject.org/</a>	
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
	Regulatory	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)