

## RELIABLE BLUETOOTH CONNECTIVITY FOR IOT – JUST A FRACTION OF THE SIZE



Laird Connectivity's latest range of Nordic nRF52833 based modules specifically targets OEMs where space is constrained in their designs. Yet still the **miniaturized BL653 $\mu$  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 Internet of Things (IoT) connectivity.

Powered by **Nordic's nRF52833 WLCSP** silicon, the small form factor BL653 $\mu$  modules provide for a secure, robust Bluetooth Low Energy and **Cortex -M4F** CPU for any OEM's product design. The BL653 $\mu$  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 $\mu$  series brings out key 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 small form factor Bluetooth design!

- **Ultra-small footprint**
  - Integrated Antenna (6.3 mm x 8.6 mm x 1.6 mm)
  - Trace Pad Option (6.3 mm x 5.6 mm x 1.6mm)
- **Bluetooth v5.1** Bluetooth Low Energy (BLE) plus **NFC**
- **802.15.4** radio (non-certified) –ZigBee / Thread via nRF Connect SDK or Thread via Zephyr)
- **Widest range of configurable interfaces:** UART, I2C, I2S, SPI, ADC, GPIO, PWM, FREQ, USB, PDM, and NFC
- **Extended Industrial Temperature Rating** (-40° to +105 °C)
- Bluetooth Low Energy - Peripheral/Central roles supported
- **2 Mbps and LE Long Range:** Support for 2 Mbps, 1 Mbps, & 125 Kbps coded PHY
- 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, BL652 & BL654 Series)
- **Application design choice:** Leverage Laird Connectivity's *smartBASIC*, simple AT command set, Zephyr RTOS or utilize Nordic SDK directly
- **Nordic nRF52833** – 3.175 x 3.175mm WLCSP with 32 GPIOs utilized.

## FEATURES AT A GLANCE



### TINY FOOTPRINT YET STILL HIGH PERFORMANCE

Nearly 24% reduction in overall module footprint compared to standard BL653 series.



### 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 nRF Connect SDK, Thread via Zephyr
	Frequency	2.402 - 2.480 GHz
	Transmit Power	+ 8 dBm (maximum). Configurable down to -40 dBm
	Receive Sensitivity	-96 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	Integrated chip antenna or RF 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	USB 2.0 full speed device
	Other	32 multifunction GPIO's that can provide: 2 UART (4 GPIO pins each) 8 ADC channels (1 pin each) 2 I2C (2 GPIO pins each) Up to 4 SPI Master / 3 SPI slave with easyDMA (4 GPIO pins including CS each) 2 PDM (2 GPIO pins each)
		1 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	GATT client & GATT server – Any adopted/custom services Central/Peripheral roles Up to 8 BLE connections ( <i>smartBASIC</i> ) BLE Mesh – nRFConnect SDK / Zephyr CODED PHY 2M PHY LE advertising extensions LE secure connections Data packet length extensions LE privacy v1.2 LE ping vSP – Virtual Serial Port DTM Firmware (Test Modes) – Built In
Programmability Options	<i>smartBASIC</i>	On-board BASIC event driven programming language
	AT Command Set	Simple AT Hayes-style command protocol
	Nordic nRFConnect 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 (SWD)
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	6.3 mm x 8.6 mm x 1.6mm (Integrated Antenna), 6.3 mm x 5.6 mm x 1.6mm (Trace Pad variant)
Environmental	Temp Range	-40°C to +105°C
Miscellaneous	Lead Free	Lead-free and RoHS-compliant
	Development Kit	None available – utilise larger BL653 DVK – part # 453-00039-K1 or 453-00041-K1
Development Tools	Utilities	UwTerminalX and UWFlashX (Multi-platform), Nordic nRFConnect (Android/iOS applications)
Qualifications	Bluetooth®	Complete Declaration ID
Regulatory	Approvals	FCC/IC/CE/MIC/RCM - All BL653μ Series

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

PART #	DESCRIPTION
453-00059R	BL653μ - Micro Bluetooth Low Energy module (Nordic nRF52833) – Integrated antenna (Tape/Reel)
453-00060R	BL653μ - Micro Bluetooth Low Energy module (Nordic nRF52833) – Trace pin (Tape/Reel)
453-00059C	BL653μ - Micro Bluetooth Low Energy module (Nordic nRF52833) – Integrated antenna (Cut Tape)
453-00060C	BL653μ - Micro Bluetooth Low Energy module (Nordic nRF52833) – Trace pin (Cut Tape)