Laird CONNECTIVITY

LONGER RANGE BLUETOOTH LE – ENABLING NEXT GENERATION INDUSTRIAL IOT

Laird Connectivity's new BL653 series enables Industrial OEMs to robustly implement **longer range** Bluetooth Low Energy (LE) 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 Bluetooth LE 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 *smart*BASIC 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 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)
- Bluetooth Low Energy - 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 (512 kB Flash, 128 k RAM)
- Built on years of experience with Nordic (BL600, BL652, & BL654 Series)
- **Fully featured development kit** everything needed to start Bluetooth LE development
- **Application design choice:** Leverage Laird Connectivity's *smart*BASIC, 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 s*mart*BASIC. 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 ºC to +105 ºC for every component utilised.

GLOBAL APPROVALS – MAKE YOURSELF AT HOME
Carries several modular FCC, ISED, EU, RCM, MIC, KC, AS/NZS, 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	-96 dBm (typical @ Bluetooth LE 1 Mpbs)	
		-103 dBm (typical @ Bluetooth LE 125 kbps)	
	Link Budget	103 dB (@ Bluetooth LE I Mbps), 111 db (@ Bluetooth LE 125 kpbs)	
	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:	
		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) 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 Bluetooth LE Features	Bluetooth Low Energy	- GATT client & GATT server – Any adopted/custom services - Central/Peripheral roles - Up to 8 Bluetooth LE connections (*smart*BASIC) - Bluetooth LE 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) - DTM Firmware (Test Modes) – Built In
Programmability Options	*smart*BASIC	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) UWFlashX (Multi-platform) Nordic nRFConnect - Android and iOS applications UART firmware upgrade	
Qualifications	Bluetooth®	Complete Declaration ID	
Regulatory	Approvals	FCC, ISED, EU, UKCA, RCM, MIC, KC, AS/NZS- All BL653 series	

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

PART #	DESCRIPTION
453-00039R	Bluetooth Low Energy module (Nordic nRF52833) – Integrated antenna (Tape/Reel)
453-00041R	Bluetooth Low Energy module (Nordic nRF52833) – Trace pin (Tape/Reel)
453-00039C	Bluetooth Low Energy module (Nordic nRF52833) – Integrated antenna (Cut Tape)
453-00041C	Bluetooth Low Energy 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)