

Longer Range Bluetooth LE – Enabling Next Generation Industrial IoT

Ezurio’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 Ezurio’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 Ezurio’s simplification of your next Bluetooth design.



- Bluetooth v5.4 Bluetooth Low Energy plus NFC
- 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, I2C, 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 5.4 - 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 Ezurio’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.

Key Features



Next Generation of Direction Finding

Includes radio capable of Direction Finding with AoA / 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 utilized.



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

Specifications

Category	Feature	Specification	
Wireless Specification	Bluetooth®	v5.4	
	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 Mbps)
			-103 dBm (typical @ Bluetooth LE 125 kbps)
	Link Budget	103 dB (@ Bluetooth LE 1 Mbps), 111 dB (@ Bluetooth LE 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) 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	<ul style="list-style-type: none"> GATT client & GATT server - Any adopted/custom services Central/Peripheral roles Up to 8 Bluetooth LE connections (<i>smartBASIC</i>) 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	<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		UwTerminalX (multi-platform)	
		UWFlashX (multi-platform)	
		Nordic nRFConnect - Android and iOS applications	
		UART firmware upgrade	
Qualifications		Complete Declaration ID	
Regulatory		FCC, ISED, EU, UKCA, RCM, MIC, KC, AS/NZS- All BL653 series	

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

Ordering Information

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)