



**NORDIC**  
SEMICONDUCTOR



# nRF52840

High-end multiprotocol Bluetooth 5 SoC

Supporting: Bluetooth 5/Bluetooth mesh/Thread/802.15.4/ANT/2.4GHz

## Ready for Bluetooth 5 and high grade IoT security

The nRF52840 is an advanced, highly flexible single chip solution for today's increasingly demanding ULP wireless applications for connected devices on our person, connected living environments and the IoT at large. It is designed ready for the major feature advancements of Bluetooth® 5 and takes advantage of Bluetooth 5's increased performance capabilities which include long range and high throughput modes. Inherent industry-grade security is essential in today's applications. The nRF52840 adds best-in-class security for Cortex™-M Series with on-chip ARM® CryptoCell cryptographic accelerator.

## Advanced performance, lowest power consumption

The nRF52840 employs the same hardware and software architecture as existing nRF52 Series SoCs. At its core is an ARM Cortex-M4F processor allowing quicker and more efficient computation of complex functions for DSP and those requiring floating point math. There is extensive memory availability in both flash and RAM, 1MB/256kB respectively. The combination of Cortex-M4F and memory availability offers unparalleled capabilities for true single chip applications.

A full-speed (12Mbps) USB 2.0 controller is included on-chip. An extensive range of peripherals are available with a number of high performance digital interfaces such as high speed SPI (32MHz) and quad SPI (32MHz) to allow direct interfacing to displays and external memory sources. The nRF52840 can operate from +5.5v down to 1.7v supply voltages allowing direct supply from rechargeable batteries and USB supplies.

## Bluetooth 5 – Bluetooth Low Energy further and faster

The nRF52840 is ready to take advantage of the considerable performance improvements for Bluetooth LE with the arrival of the Bluetooth 5 specification. Of greatest importance is the support for longer range (up to x4 compared to Bluetooth 4.x) and doubling of on-air data-rate, up to 2Mbps from 1Mbps in Bluetooth 4.x

Bluetooth 5 data rates	2Mbps (New)	High throughput
	1Mbps	Existing BLE data rate
	500kbs (New)	Longer range
	125kbs (New)	Longest range

## Thread certified and 802.15.4 support

The nRF52840 is a Thread certified component and as such is ideal for home networking products using the Thread mesh stack. The radio supports 802.15.4 PHY and MAC layers and makes it suitable for additional stacks using 802.15.4 such as Zigbee.

## KEY FEATURES

- Bluetooth 5 ready multi-protocol radio
  - 2Mbps
  - Long range
  - Advertising extensions
  - Improved coexistence (CSA #2)
- IEEE 802.15.4 radio support
  - Thread
  - Zigbee
- 32-bit ARM Cortex-M4F @ 64MHz
- Up to 111 dB link budget for Bluetooth long range mode
- Full-speed 12Mbps USB controller
- NFC Tag-A
- Software stacks available as downloads
- Application development independent of protocol stack
- Programmable output power from +8dBm to -20dBm
- -96dBm Sensitivity for Bluetooth low energy
- On-air compatible with nRF51, nRF24L and nRF24AP Series
- Arm CryptoCell CC310 cryptographic security module
- High-precision RSSI
- Wide supply voltage range + 1.7V to 5.5V
- QSPI/SPI/2-wire/I<sup>2</sup>S/PDM/QDEC
- Programmable Peripheral Interface - PPI
- High speed SPI interface 32MHz
- Quad SPI interface 32MHz
- EasyDMA for all digital interfaces
- RAM mapped FIFO using EasyDMA
- 12bit/200K SPS ADC
- 128 bit AES/ECB/CCM/AAR co-processor
- Single-ended antenna output (on-chip balun)
- On-chip DC-DC buck converter
- Quadrature demodulator
- Regulated supply for external components up to 25mA

## APPLICATIONS

- IoT
  - Smart Home products
  - Industrial mesh networks
  - Smart city infrastructure
- Advanced wearables
  - Connected watches
  - Advanced personal fitness devices
  - Wearables with wireless payment
  - Connected Health
  - Virtual/Augmented Reality applications
- Interactive entertainment devices
  - Advanced remote controls
  - Gaming controller

### High link budget for in-home applications

The nRF52840 is the ideal solution for smart connected home applications. It supports both Bluetooth 5's long range feature and also 802.15.4 which is already a popular technology for home networking protocols. With a maximum output power of 8dBm a total link budget of >111dBm is achievable for achieving robust communications through objects within the home.

### ARM Cryptocell 310

The nRF52840 features an on-chip ARM CryptoCell 310 cryptographic hardware accelerator. CryptoCell offers a wide range of ciphers and security features for building solid security into applications from the ground up. Use of CryptoCell also makes associated security operations run faster and uses less processing time and power than equivalent operation carried out in software by the CPU.

### OTA DFU

The nRF52840 is supported by Over-the-Air Device Firmware Upgrade (OTA-DFU). This allows for in the field updates of application and/or protocol stack.

### Nordic SoftDevices

Nordic protocol stacks are known as SoftDevices. SoftDevices are pre-compiled binaries without runtime dependencies. They reside in a separate memory location to your application and offer safer, easier, and more secure application development. The nRF52840 is supported by the S140 SoftDevice which supports 20 links operating concurrently.

### S140 SoftDevice

The S140 SoftDevice supports 20 Bluetooth LE links in concurrent operation for all 4 roles (Central/Peripheral/Broadcaster/Observer). The S140 is a Bluetooth 5 qualified stack and as such supports the latest long range and high throughput features introduced in Bluetooth 5.

### nRF52840 compatible SoftDevices

S140	20-link concurrent Bluetooth 5 protocol stack
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### RELATED PRODUCTS

nRF52840 DK	Development kit for nRF52840
S140 Soft-Device	20-link concurrent Bluetooth 5 protocol stack
nRF5 SDK	Software Development Kit for nRF52 Series SoCs
nRF5 SDK for HomeKit	SDK for Apple HomeKit applications
nRF5 SDK for Thread	SDK for Thread applications
nRF5 SDK for mesh	SDK for Bluetooth mesh applications

### SPECIFICATIONS

Frequency band	2.4GHz
On-air data rate	2Mbps/1Mbps/500kbs/125kbs - Bluetooth low energy 250kbs – 802.15.4 2Mbps/1Mbps – 2.4GHz proprietary
Output power	Programmable -20dBm to +8dBm
Sensitivity	Bluetooth 5: -103dBm at 125kbs, -99dBm at 500kbs, -96dBm at 1Mbps, -92dBm at 2Mbps 802.15.4: -100dBm at 250kbs ANT: -92.5dBm at 1Mbps 2.4GHz: -92.5dBm at 1Mbps, -89dBm at 2Mbps
Radio current consumption DC-DC at 3v	4.8mA TX at 0dBm, DC/DC at 3V 14.8mA TX at +8dBm, DC/DC at 3V 9.6mA TX at +4dBm, DC/DC at 3V 4.6mA RX at 1Mbps
Microcontroller	ARM Cortex-M4F
Program memory	1MB Flash with cache
RAM	256kB
Oscillators	32MHz crystal oscillator, 64MHz RC oscillator, 32kHz crystal oscillator, 32kHz RC oscillator
System current consumption	0.5µA at 3V System OFF mode, no RAM retention 1.5µA System ON mode, no RAM retention 0.7µA All peripherals in IDLE mode 0.03µA per 4kB RAM retention
Hardware security	128-bit AES ECB/CCM/AAR co-processor
Cryptography	ARM CryptoCell 310
GPIO	48 configurable
Digital I/O	QSPI x 1, SPI master x 3, SPI slave x 3, 2-wire master x 2, 2-wire slave, UARTe x 2, Quadrature decoder, PDM, I <sup>2</sup> S
Peripherals	12-bit/200ksps ADC, RNG, LP comparator, WDT, PWM x 4
PPI	20
USB	USB 2.0 (12Mbps)
Power supply	LDO, DC-DC
Timers/counters	32-bit timers x 5, RTC x 3
Package options	AQFN73, 7x7mm
NFC	NFC-A

## WORLD WIDE OFFICE LOCATIONS

Headquarters:  
Trondheim, Norway  
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### For more information

Visit [www.nordicsemi.com](http://www.nordicsemi.com) for the complete product specification about this and any other wireless ULP products.

### About Nordic Semiconductor

Nordic Semiconductor is a fabless semiconductor company specializing in ULP short-range wireless communication. Nordic is a public company listed on the Norwegian stock exchange.



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