NORDIC SEMICONDUCTOR

nRF 52 SERIES

nRF52840

Advanced multi-protocol System-on-Chip
Supporting: Bluetooth low energy (Bluetooth 5), ANT/ANT+, 802.15.4 and 2.4GHz proprietary

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 (12Mbs) 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 low energy 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 2Mbs from 1Mbs in Bluetooth 4.x

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

Wide protocol support with addition of 802.15.4
The 802.15.4 PHY and MAC layers are supported natively on the nRF52840. This allows nRF52840 to be used in a wide range of home and industrial sensor network applications as it supports

KEY FEATURES

- Bluetooth 5 ready multi-protocol radio
- Bluetooth 5 datarate support: 2Mbs, 1Mbs, 500kbs, 125kbs
- 32-bit ARM Cortex-M4F @ 64MHz
- High speed 2Mbs data-rate
- Up to 111 dB link budget for Bluetooth long range mode
- Full-speed 12Mbs USB controller
- NFC-A on-chip
- 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 accelerator
- RSSI
- Wide supply voltage range +5.5v to 1.7v
- Full selection of interfaces SPI/UART/PWM
- 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

- **Advanced wearables**
  - Connected watches
  - Advanced personal fitness devices
  - Wearables with wireless payment
  - Connected Health
  - Virtual/Augmented Reality applications
- **IoT**
  - Smart Home sensors and controllers
  - Industrial IoT sensors and controllers
- **Interactive entertainment devices**
  - Advanced remote controls
  - Gaming controller

two of the most popular wireless sensor standards in use today, Bluetooth low energy and 802.15.4 derivatives. This adds to the already existing radio support for Bluetooth low energy, ANT/ANT+ and 2.4GHz for proprietary.

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 >110dBm 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.

Maximum re-use and easy migration

The nRF52840 has binary compatible peripherals with other devices in the nRF52 and nRF51 Series for most functions. The common hardware and software architectures mean use and porting of existing code is straightforward allowing developers to re-use firmware libraries they have developed previously with ease.

Nordic SoftDevices

The Nordic protocol stacks are known as SoftDevices and compliment the nRF52 Series SoCs. SoftDevices are pre-compiled link-free binaries and can be downloaded from Nordic Semiconductor. SoftDevices reside in separate memory space to the application and are interfaced by their API making the building of applications simpler and more predictable.

The S140 SoftDevice supports concurrent Bluetooth low energy 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.

nRF528340 compatible SoftDevices

S140	Multi-role, concurrent Bluetooth 5 protocol stack

SPECIFICATIONS

Frequency band	2.4GHz
On-air data rate	2Mbs/1Mbs/500kbs/125kbs - Bluetooth low energy 250kbs – 802.15.4 2Mbs/1Mbs – 2.4GHz proprietary
Output power	Programmable -20dBm to +8dBm
Sensitivity	Bluetooth 5: -103dBm at 125kbs, -99dBm at 500kbs, -96dBm at 1Mbs, -92dBm at 2Mbs 802.15.4: -100dBm at 250kbs ANT: -92.5dBm at 1Mbs 2.4GHz: -92.5dBm at 1Mbs, -89dBm at 2Mbs
Radio current consumption DC-DC at 3v	13.6mA - TX at +8dBm output power 8.7mA – TX at +4dBm output power 5.3mA – TX at 0dBm output power 6.4mA - RX at 1Mbs
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	400nA – No RAM retention, 0.7µA – All peripherals in IDLE mode, 1µA – All peripherals in IDLE mode with 32kHz XO and RTC running, 30nA 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 4, SPI slave x 4, 2-wire master x 2, 2-wire slave, UARTE x 2, Quadrature decoder, PDM, I²S
Peripherals	12-bit/200ksps ADC, RNG, LP comparator, WDT, PWM x 3
PPI	20
USB	USB 2.0 (12Mbs)
Power supply	LDO, DC-DC
Timers/counters	32-bit timers x 5, RTC x 3
Package options	AQFN73, 7x7mm
NFC	NFC-A

RELATED PRODUCTS

nRF52840 Preview DK	Development kit for nRF52840
S140 Soft-Device	Multi-role, concurrent Bluetooth low energy protocol stack
nRF5 SDK	Software Development Kit for nRF52 Series SoCs

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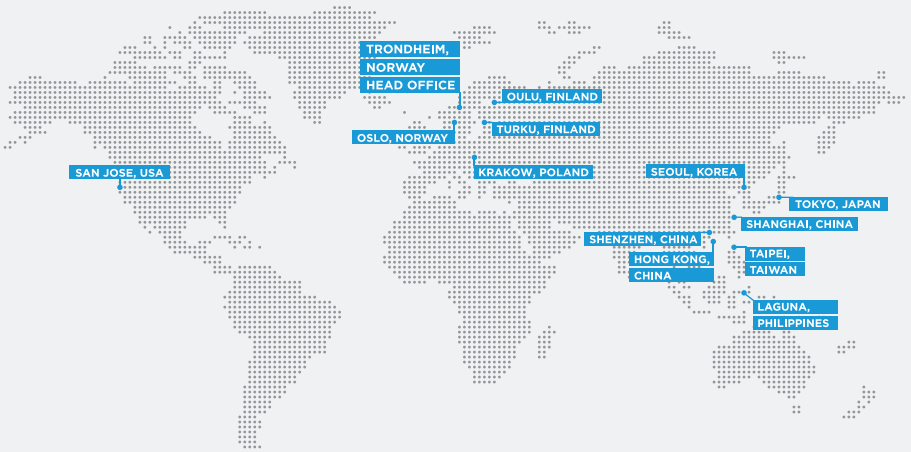

For more information
Visit **www.nordicsemi.com** for the complete product specification about this and any other wireless ULP products.

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.