

aconno™

D A T A S H E E T

# ACN52832

Fully integrated, ultra-low power, Bluetooth Smart module



2 cm

**MA:DE IN  
GERMANY**

# Datasheet

## aconno ACN52832 V1.2



The ACN52832 is a fully integrated, ultra-low power, Bluetooth Smart (former BLE) module in a small form factor which features the advanced Nordic Semiconductor nRF52832 SoC. Its capabilities are tailored for the upcoming demands of sophisticated IoT devices where small size, low power, application performance and radio-range are essential.

Unlike many competitors it features a maker-friendly PCB scale package which allows a fast and easy integration without sacrificing access to its advanced peripherals and capabilities. The ACN52832 features a large number of GPIOs. Thanks to an on-board antenna its RF performance is excellent. To provide quick access to the programming interface of the SoC, the module also features a Tag-Connect connector.

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## 1. Overview and Features

- Based on Nordic Semiconductor's nRF52832 Bluetooth Smart SoC
- 32-bit ARM® Cortex™ M4F high performance 64 MHz processor core with 512kB Flash / 64 kB RAM
- On-board precision 32 MHz and 32.768 kHz crystal clocksources
- Tag-Connect SWD easy-to-use programming interface
- Up to 28 GPIOs with flexible module pin mapping
- Programmable peripherals for CPU-less operation
- SPI / UART / TWI (I2C)
- 200 ksps 12-bit ADC
- Low Power Comparator
- I2S and PDM peripherals for Audio
- Quadrature demodulator
- RGB LED
- Fully tuned RF on-board antenna for excellent performance and range
- -20 dBm to +4 dBm output power
- Ultra low power consumption
- Dimensions: 20.2 x 25 x 3 mm
- Temperature Range: -40°C to +85°C
- Wide supply voltage range: 1.7V to 3.6V
- 3V Lithium battery supported
- NFC-A tag for OOB Bluetooth Smart pairing and wakeup on field
- Multiprotocol 2.4 GHz radio

## 2. Applications

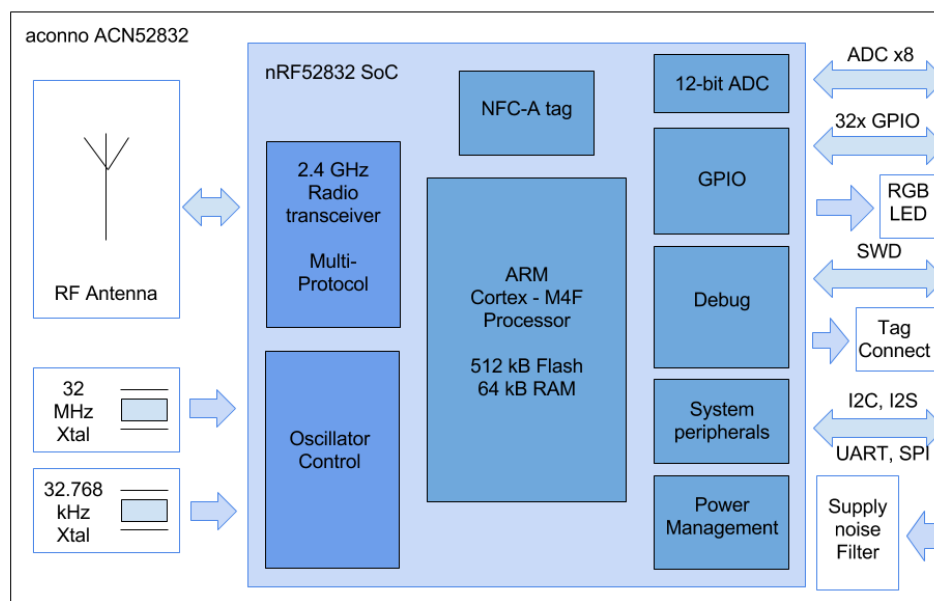
- IoT connected devices
- Bluetooth Smart Sensors
- Home Automation and Control
- Lighting
- Beacons
- Battery driven applications such as wearables

### 3. Block Diagram

The heart of the ACN52832 module is Nordic's highly integrated nRF52832 BLE SoC which contains a 2.4 GHz transceiver, a 32-bit ARM Cortex™-M4F CPU, a 512 kB flash memory and a 64 kB RAM analog as well as digital peripherals.

It can support BLE, ANT/ANT+ and a range of proprietary 2.4 GHz protocols through so called SoftDevices from Nordic Semiconductor, which can be downloaded freely from Nordic's website.

Ultra low power consumption and advanced power management enables battery lifetimes up to several years on a coin cell battery. The 20.3 x 25 x 3 mm sized module integrates power supply decoupling capacitors, 32 MHz and 32.768 kHz crystals, load capacitors, a DC-DC converter, a RF matching circuit and an antenna in addition to the wireless SoC. The module also features a small RGB LED for optical feedback.

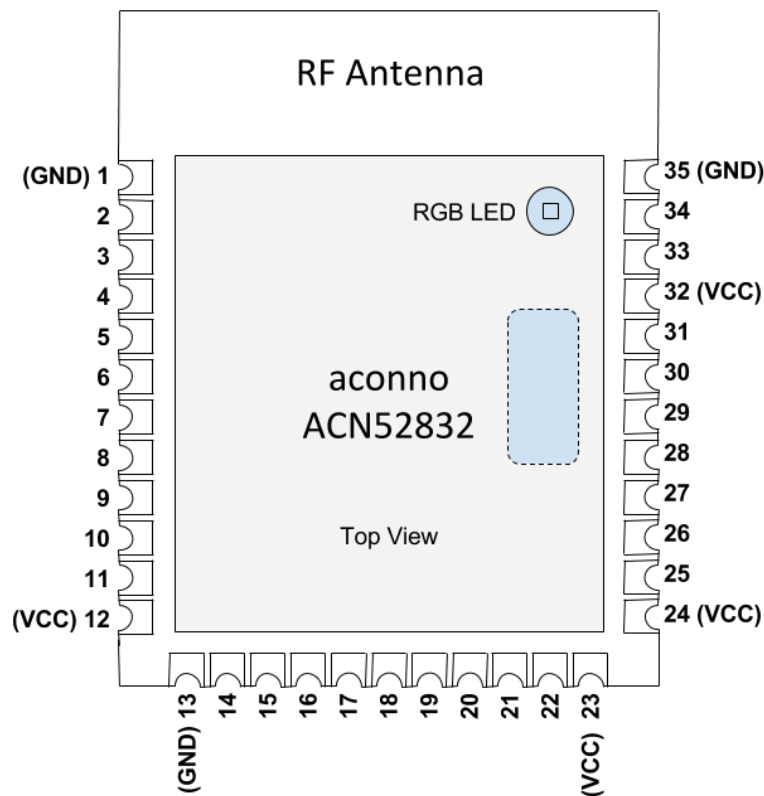


Solely the addition of a suitable DC power source is necessary for BLE and/or ANT connectivity. As a result of its Tag-Connect capabilities, the ease of application is increased further. Sensor applications require further addition of appropriate sensors.

The NFC tag antenna can be connected externally.

## 4. Pin Description

The module uses a user-friendly PCB with surrounding solder pads (1.4 mm pitch) in order to provide flexible, “through hole mounting” for rapid prototyping or, furthermore, a SMD mounting technique for a permanent implementation.



I/O Pins sorted by port name:

Pin	Name	Pin function	Description
1, 13, 35	GND	Ground	Should be connected to the ground potential of the application board
12, 23, 24, 32	VDD	Power	Power supply (1.7 V – 3.6 V)
33	SWDIO	Digital I/O	Serial Wire Debug I/O for debugging and programming
34	SWDCLK	Digital Input	Serial Wire Debug clock input for debugging and programming
9	P0.02 / AIN0	Digital I/o Analog In	GPIO / Analog Input 0
10	P0.03 / AIN1	Digital I/o Analog In	GPIO / Analog Input 1
11	P0.04 / AIN2	Digital I/o Analog In	GPIO / Analog Input 2
14	P0.05 / AIN3	Digital I/o Analog In	GPIO / Analog Input 3
15	P0.06	Digital I/O	GPIO
16	P0.07	Digital I/O	GPIO
17	P0.08	Digital I/O	GPIO
18	P0.09 / NFC1	Digital I/O NFC	GPIO / Connection to NFC-coil
19	P0.10 / NFC2	Digital I/O NFC	GPIO / Connection to NFC-coil
20	P0.11	Digital I/O	GPIO
21	P0.12	Digital I/O	GPIO
22	P0.14	Digital I/O	GPIO / Trace Data 3
25	P0.15	Digital I/O	GPIO / Trace Data 2
26	P0.16	Digital I/O	GPIO / Trace Data 1
27	P0.17	Digital I/O	GPIO / Trace Data 0

Pin	Name	Pin function	Description
28	Po.18	Digital I/O	GPIO
29	Po.19	Digital I/O	GPIO
30	Po.20	Digital I/O	GPIO / Trace Clock
31	Po.21	Digital I/O RESET	GPIO / System Reset / Low Drive / Low Frequency
2	Po.25	Digital I/O	GPIO / Low Drive / Low Frequency
3	Po.26	Digital I/O	GPIO / Low Drive / Low Frequency
4	Po.27	Digital I/O	GPIO / Low Drive / Low Frequency
5	Po.28	Digital I/o Analog In	GPIO / Analog Input 4 / Low Drive / Low Frequency
6	Po.29	Digital I/o Analog In	GPIO / Analog Input 5 / Low Drive / Low Frequency
7	Po.30	Digital I/o Analog In	GPIO / Analog Input 6 / Low Drive / Low Frequency
8	Po.31	Digital I/o Analog In	GPIO / Analog Input 7



## 5. Module Specifications

The specifications of the aconno ACN52832 module follow those of the nRF52832 SoC.  
The following high-level parameters are valid for the module.



### 5.1 Absolute Maximum Ratings

	Min	Typ	Max	Unit
<b>Supply Voltages</b>				
VDD	-0.3		+3.9	V
VSS			0	V
<b>I/O Pin Voltage</b>				
V <sub>I/O</sub> , VDD < 3.6V	-0.3		VDD + 0.3	V
V <sub>I/O</sub> , VDD > 3.6V	-0.3		3.9	V
<b>NFC antenna pin current</b>				
I <sub>NFC 1/2</sub>			80	mA
<b>Radio</b>				
RF input level			10	dBm
<b>Environmental<sup>1</sup></b>				
Storage Temperature	-40		+125	°C
Moisture Sensitivity Level			2	
ESD Human Body Model			4000	V
ESD Charged Device Model			750	V
<b>Flash memory<sup>2</sup></b>				

Endurance	10.000			cycles
Retention	10 years at 40°C			

- 1) Ratings are accurate for the nRF52832 QFN48, 6x6mm package
- 2) At Endurance and Retention periods are estimated at sea level

## 5.2. Recommended Operating Conditions

	Min	Typ	Max	Unit
<b>Supply Voltages</b>				
VDD (LDO Regulator Operation)	1.7	3.0	+3.6	V
VDD (DC/DC Regulator Operation)	2.1	3.0	+3.6	V
<b>Supply rise time (0V to 1.7V) <sup>1</sup></b>				
t <sub>R_VDD</sub>			60	ms
<b>Operating Temperature</b>				
TA	-40	25	85	°C

- 1) The on-chip power-on reset circuitry may not function properly for rise times longer than the specified maximum.

## 5.3 Current Consumption

The measurements below were taken under following common conditions:

**VDD:** 3V      **Temperature:** 25°C      **CPU:** WFI / WFE Sleep  
**Regulator:** DC/DC      **Peripherals:** All idle      **Clock:** Not running

	Min	Typ	Max	Unit
<b>Radio</b>				
0 dBm TX @ 1Mb/s Bluetooth Low Energy mode, Clock = HFXO		7.1		mA
-40 dBm TX @ 1Mb/s Bluetooth Low Energy mode, Clock = HFXO		4.1		mA
Radio RX @ 1Mb/s Bluetooth Low Energy mode, Clock = HFXO		6.5		mA
<b>Radio and CPU running CoreMark</b>				
CPU running CoreMark from Flash, Radio 0 dBm TX @ 1 Mb/s Bluetooth Low Energy mode, Clock = HFXO, Cache enabled		9.6		mA
CPU running CoreMark form Flash, Radio RX @ 1 Mb/s Bluetooth Low Energy Mode, Clock = HFXO, Cache enabled		9.0		mA
<b>Ultra-low power</b>				
System ON, No RAM retention, Wake on any event		1.2		μA
System ON, Full RAM retention, Wake on any event		1.5		μA
System OFF, No RAM retention, Wake on LPCOMP		1.9		μA
System OFF, No RAM retention, Wake on GPIO		1.2		μA
System OFF, Full RAM retention, Wake on reset		0.7		μA
System OFF, No RAM retention, Wake on NFC		0.7		μA

## 5.4 Clock Sources

	Min	Typ	Max	Unit
Internal High Frequency Clock for RF Stability: 32 MHz Crystal Frequency Tolerance			± 50	ppm
Internal Low Frequency Clock for BLE Sync: 32,768 kHz Crystal Frequency Tolerance			± 100	ppm
Internal Low Frequency Clock for BLE Sync: RC Oscillator <sup>1</sup>			± 250	ppm
RF Frequency Tolerance: For BLE operation Channels 0 to 39			± 100	ppm

- 1) Frequency tolerance after calibration

## 5.5 Radio Specifications

	Min	Typ	Max	Unit
Frequency Range	2402		2480	MHz
Channel 0 to 39 Spacing		2		MHz
Output Power <sup>1</sup>	-20		+4	dBm
Receiver Sensitivity - BLE			-96 dBm	
Data Rate <sup>2</sup>	250	1000	2000	kbps
RSSI Range	-90		-20	dBm
RSSI Resolution		1		dBm

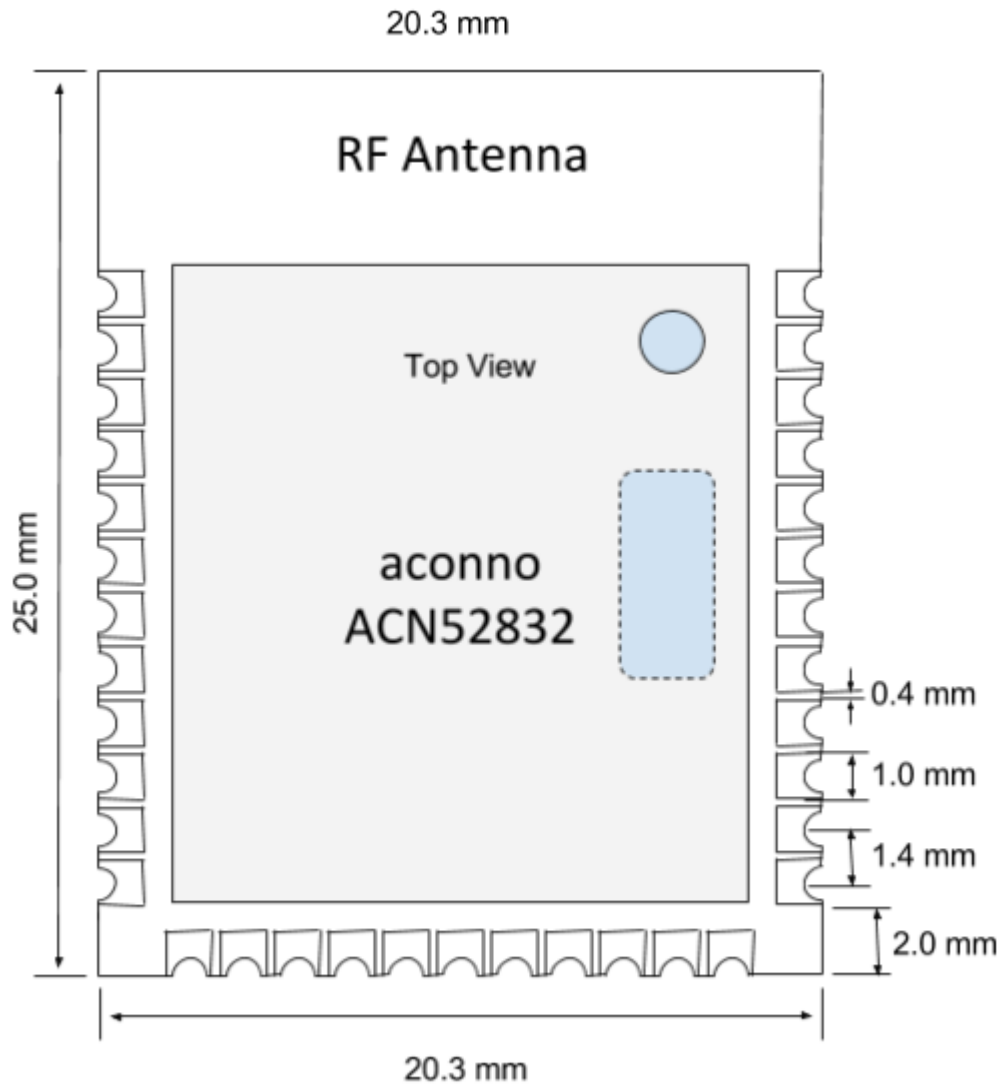
- 1) Transmit output power is specified by design
- 2) 1Mbps is the only modulation available for Bluetooth LE. 250kbps used in proprietary mode.  
2Mbps can be used for proprietary and is available for future BLE PHY specifications.

## 5.6 GPIO Specifications

	Min	Typ	Max	Unit
Input High Voltage	$0.7 * VDD$	-	VDD	V
Input Low Voltage	VSS	-	$0.3 * VDD$	V
Drive Current, standard drive (VDD = 3.0V)		6.2		mA
Drive Current, high drive (VDD = 3.0V)		25		mA
Sink Current, standard drive (VDD = 3.0V)		6.2		mA
Sink Current, high drive (VDD = 3.0V)		25		mA
Pull Up Resistance	11	13	16	kOhm
Pull Down Resistance	11	13	16	kOhm

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## 7. Mechanical Outlines



## 8. Firmware

The ACN52832 module can be used in various applications, it supports an extensive array of protocols. For Bluetooth LE Applications the Bluetooth stack and other functionality is provided by the S132 SoftDevice.

A SoftDevice is a binary image provided and certified by Nordic Semiconductor to comply with the Bluetooth Specifications. The SoftDevice runs along with the application. Using a standardized interface and APIs, the application can configure and run the Bluetooth or another stack.

Considering that the ACN52832 supports multiple protocols, several SoftDevices are available:

SoftDevice	
S132	BLE Concurrent Peripheral + Central
S212 (1)	ANT Protocol Stack
S312 (2)	ANT and BLE

(1) S212 ANT Protocol Stack is available directly from ANT: [www.thisisant.com](http://www.thisisant.com)

(2) S312 is preliminary and not yet available. Please contact Nordic Semiconductor for further information:

<http://www.nordicsemi.com/>



## 8.1 S132 BLE SoftDevice

The S132 SoftDevice is used to create a full Single Mode BLE solution and has the following features:

- Bluetooth 4.2 compliant low energy single-mode protocol stack suitable for Bluetooth Smart products
  - Concurrent Central, Observer, Peripheral, and Broadcaster roles with up to:
    - Three connections as a central
    - One connection as a peripheral
    - Observer
    - Broadcaster
  - Link layer
  - L2CAP, ATT, and SM protocols
  - GATT and GAP APIs
  - GATT Client and Server
- Memory isolation between application and protocol stack for robustness and security
- Thread-safe supervisor-call based API
- Asynchronous, event-driven behavior
- No RTOS dependency (any RTOS can be used)
- No link-time dependencies
  - Standard ARM® CortexTM M4F project configuration for application development
- Support for concurrent and non-concurrent multiprotocol operation
  - Concurrent with the Bluetooth stack using concurrent multiprotocol timeslot API
  - Alternate protocol stack in application space

## 8.2 S212 ANT SoftDevice

The S212 is a fully ANT compliant stack enabling customers to create mesh networks with extremely low power. ANT and ANT/Bluetooth Smart combo SoftDevices for the nRF52 series are obtained directly from ANT.

For more information on this please contact: [ANTstacks@thisisant.com](mailto:ANTstacks@thisisant.com)

A few features of the ANT stack and its capabilities:

- Advanced ANT stack
  - Simple to complex network topologies:
    - Peer-to-peer, Star, Tree, Star-to-star and more
  - Up to 15 logical channels, each with configurable:
    - Channel type, ID and period
    - Networks
  - Broadcast, Acknowledged, and Burst Data modes
  - Device search, pairing and proximity support
  - Enhanced ANT features:
    - Advanced Burst Transfer mode (up to 60 kbps)
    - Up to 15 channels encryption (AES-128) support
    - Additional networks – up to 8
    - Event Filtering and Selective Data Updates
    - Asynchronous Transmission
    - Fast Channel Initiation
- Built-in NVM access and radio coexistence management
- Memory isolation between application and protocol stack for robustness and security
- Thread-safe supervisor-call based API
- Asynchronous, event-driven behavior
- No RTOS dependency (any RTOS can be used)
- No link-time dependencies
  - Standard ARM® Cortex™ M4F project configuration for application development
- Support for concurrent and non-concurrent multiprotocol operation
  - Concurrent multiprotocol timeslot API
  - Alternate protocol stack in application space

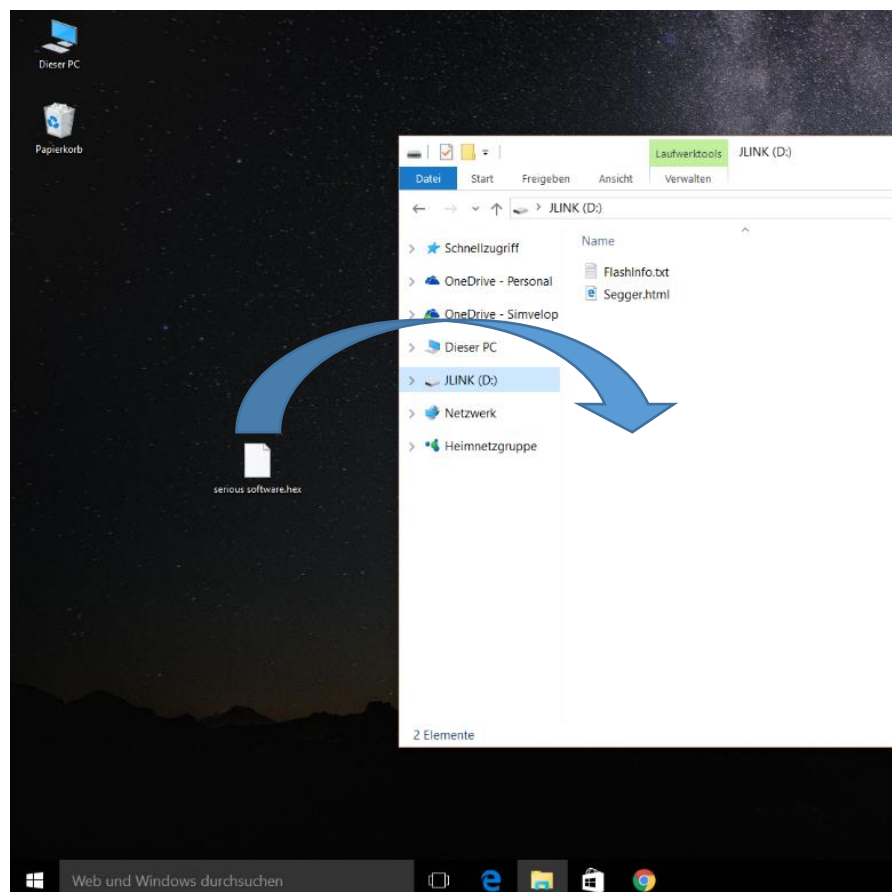
## 9. Programming / Flashing with Tag Connect

Since the ACN52832 incorporates a genuine Segger J-Link debugging device with drag & drop programming functionality, there are two ways of programming it: Using drag & drop in your OS or within an IDE.

Without an IDE it is possible to create your firmware e.g. using the mbed online developing tool. After you created the \*.hex file, simply put it into the "J-Link" called mass storage device.

During the programming process, the J-Link device will shortly disappear. When it shows up again, the programming process is finished and your module is ready to go.

For programming inside and IDE please refer to the manual of the IDE used.



## 10. Revision History

Here you will find the current and the previous version of the document you are now reading. Also, the web-site for your device is listed. Be sure to check it after your purchase for the latest available updates and examples.

Revision	Changes	Modified page #
1.0	Initial release	all
1.1	Power consumption, schematic	11 , 14

## 11. Contact Information

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