RF-DG-40A Bluetooth Low Energy 5.0
nRF52840 USB Dongle

Version 1.0

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1 Device Overview

1.1 Description

The nRF52840 Dongle is a small, low-cost USB dongle that supports Bluetooth® Low Energy 5, Bluetooth mesh, Thread, ZigBee, 802.15.4, ANT and 2.4 GHz proprietary protocols. The Dongle is the perfect target hardware for use with nRF Connect for Desktop as it is low-cost but still support all the short range wireless standards used with Nordic devices. The dongle has been designed to be used as a wireless HW device together with nRF Connect for Desktop as well as programming through nRFUtil. For other use cases please do note that there is no debug support on the Dongle, only support for programming the device and communicating through USB.

It can also be used to develop code for the nRF52840 SoC mounted on the dongle. Programming is supported through a USB enabled bootloader. Connectors for external debuggers are available.

It is supported by most of the nRF Connect for Desktop APPs and will automatically be programmed if needed. In addition custom applications can be compiled and downloaded to the Dongle. It has a user programmable RGB LED, a green LED, a user programmable button as well as 15 GPIO accessible from castellated solder points along the edge. Example applications are available in the nRF5 SDK under the board name PCA10059.

1.2 Key Features

- Bluetooth 5 ready multiprotocol radio
  - 2 Mbps
  - Long Range
  - Advertising Extensions
  - Channel Selection Algorithm #2 (CSA #2)
- IEEE 802.15.4 radio support
  - Thread
  - Zigbee
- Arm® Cortex™-M4 with floating point support
- DSP instruction set
- Arm CryptoCell CC310 cryptographic accelerator
- 15 GPIO available via edge castellation
- USB interface direct to nRF52840 SoC
- Integrated 2.4 GHz PCB antenna
- 1 user-programmable button
- 1 user-programmable RGB LED
- 1 user-programmable LED
- 1.7 V ~ 5.5 V operation from USB or external
- NFC available

1.3 Application

- Advanced wearables
  - Advanced personal fitness devices
  - Connected health
- IoT
  - Connected home sensors and controllers
  - Industrial IoT sensors and controllers
- Interactive entertainment devices
  - Advanced remote controls
  - Gaming controllers
  - Virtual/Augmented Reality applications
2 Minimum Requirements

Before you start, check that you have the required hardware and software.

Hardware requirements

- PC with a standard type-A USB port

Software requirements

- nRF Connect for Desktop
- Operating system: macOS, Linux, or Windows 7 or later
3 Kit Content

The nRF52840 Dongle consists of hardware (RF-DG-40A), access to application firmware examples, documentation, hardware schematics, and layout files.

3.1 Hardware Content

The nRF52840 Dongle hardware consists of the board (RF-DG-40A).

![RF-DG-40A (Front)](image1)

Figure 1. RF-DG-40A (Front)

![RF-DG-40A (Back)](image2)

Figure 2. RF-DG-40A (Back)

3.2 Download Content

The nRF52840 Dongle downloadable content consists of a software tool, application firmware examples, and hardware files.

Software

- nRF Connect for Desktop
4 Getting Started

Complete a few steps to set up the hardware and install the required software.

Before you start, check Minimum requirements on page 3.

Connect the Dongle to a computer and get started with nRF Connect for Desktop.

1. Download and install nRF Connect for Desktop.

   This includes the driver for the nRF52840 USB Device Firmware Upgrade (DFU) feature. For documentation on the tool, see nRF Connect.

2. Insert the nRF52840 Dongle in a USB port on your computer.

   The status light (LD2) starts pulsing red, indicating that the Dongle is powered up and is in bootloader mode. After a few seconds, the computer will recognize the Dongle as a USB composite device. The driver needed for the nRF52840 USB DFU feature is also installed.

3. Optional: Download SEGGER Embedded Studio (SES).

   SES is needed for building application examples for the Dongle. It can be used free of charge with nRF devices.

4. Optional: Install nrfutil.

   nrfutil can be used for programming the Dongle from the command line.

5. Open an nRF Connect for Desktop app and select the serial number of the nRF52840 Dongle as the target.

   Applications that support the nRF52840 Dongle will display the serial numbers of any connected Dongles in the device drop-down list.

   If the app supports the Dongle but the correct firmware is missing, you will be asked to confirm that you want to have the Dongle programmed. Click OK.

   If the Dongle contains the correct firmware, the app will start immediately.

For further information on programming the nRF52840 Dongle, see Nordic Developer Zone.
5 Programming

The nRF52840 Dongle can be programmed through the built-in USB bootloader.

Before you start, check Getting started on page 3.

To program the Dongle, it must be in bootloader mode.

The Dongle can be made to enter bootloader mode in one of the two ways:

- Trigger the nRF52840 USB DFU endpoint.

  The firmware to support this is embedded in all nRF Connect for Desktop apps for the nRF52840 Dongle. If you add the DFU Trigger Library (USB) to your custom device firmware, you will be able to trigger the DFU from nRF Connect for Desktop without using any buttons. For documentation, see DFU Trigger Library (USB), which is part of the nRF5 SDK v15.2.0.

- For Dongles with applications missing the USB DFU endpoint: Press the RESET button.

When the nRF52840 Dongle has entered the bootloader mode, LD2 pulses red. The Dongle is now ready for programming.

All the nRF Connect for Desktop apps require specific firmware to be present on the nRF52840 Dongle to function correctly. The apps will update the firmware if needed. If you want to upload a custom firmware to the Dongle, you can do this by using the dedicated Programmer programming app, or nrfutil.
6 Hardware Description

The nRF52840 Dongle can be used as a development platform for the nRF52840 SoC. It features user configurable LEDs and a button as well as multiple GPIOs available along the board edges. In addition to radio communication, the nRF5240 SoC can communicate with a computer through USB.

6.1 Hardware Drawings

The nRF52840 Dongle hardware drawings show both sides of the RF-DG-40A board.

Figure 3. RF-DG-40A Dongle (Front)

Figure 4. RF-DG-40A Dongle (Back)
The PCB footprint is as follow:

![PCB Footprint Diagram]

**Figure 5. RF-DG-40A PCB Footprint**

### 6.2 Block Diagram

The block diagram illustrates the nRF52840 Dongle functional architecture.

![Block Diagram Diagram]

**Figure 6. Block Diagram of RF-DG-40A**
6.3 Power Supply

The nRF52840 Dongle can be powered from different sources.

6.3.1 Internal Regulator

The default power supply of the nRF52840 Dongle is the USB interface. The USB interface supplies power to the on-chip high voltage regulator of the nRF52840 SoC. The output of the regulator supplies the SoC and the LEDs. The USB power connection (VBUS) is also available along the board edge. Next to VBUS, there is a connection point for VDD OUT, which is the output of the nRF52840 SoC high voltage regulator. For maximum power draw from this pad, see nRF52840 Product Specification, and take into account the power draw of the onboard nRF52840 and the LEDs.

![Diagram of USB power connection and SoC high voltage regulator output](image)

*Figure 7. USB power connection (VBUS) and SoC high voltage regulator output (VDD OUT)*

By using the on-chip high voltage regulator, the VDD voltage level can be set in the REGOUT0 register in UICR. See nRF52840 Product Specification.

6.3.2 External Regulated Source

The nRF52840 Dongle can also be configured to be supplied from an external regulated 1.8–3.6 V source through the VDD OUT connection point. To enable this, SB2 must be cut and SB1 must be soldered.

*CAUTION: Do not have both SB1 and SB2 connected at the same time as this will damage the nRF52840 SoC.*
6.4 Buttons and LEDs

The nRF528540 Dongle is equipped with a green LED (LD1), a multicolor RGB LED (LD2), a user configurable button (SW1), and a reset button (SW2).

The LEDs and buttons are connected to dedicated I/Os on the nRF52840 SoC.
### 6.5 32.768 kHz Crystal

The nRF52840 Dongle is equipped with a 32.768 kHz crystal (X2) for high accuracy and low average power consumption.

*Note: The 32.768 kHz crystal (X2) is required for correct operation when using ANT/ANT*.+

### 6.6 USB

The nRF52840 Dongle features a USB-A-type connector printed on the circuit board.

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<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>GPIO</th>
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<tr>
<td>SW1</td>
<td>Button</td>
<td>P1.06</td>
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<tr>
<td>SW2</td>
<td>Reset</td>
<td>P0.18</td>
</tr>
<tr>
<td>LD1</td>
<td>Green</td>
<td>P0.06</td>
</tr>
<tr>
<td>LD2</td>
<td>Red</td>
<td>LD2</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>LD2</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>LD2</td>
</tr>
</tbody>
</table>

Note: SW2 is also connected to P0.19, P0.21, P0.23, and P0.25. This is done to simplify PCB routing. These GPIOs should not be used and should be left as input with no pull or be disconnected by firmware.

The buttons are active low, which means that the input will be connected to ground when the button is activated. The SW1 button has no external pull-up resistor, but the reset button (SW2) has a 10 k pull-up resistor. To use SW1, P1.06 must be configured as an input with an internal pull-up resistor.

The LEDs are active low, which means that writing a logical zero '0' to the output pin will illuminate the LED.
6.7 SWD Interface

On the back side of the nRF52840 Dongle, there are connection points for the SWD interface. The dongle is equipped with a footprint for two different connectors. On footprint P1, a standard 2×5-pin pin header with a 1.27 mm pitch can be soldered. On footprint J2, it is possible to connect a TC2050 cable from Tag-Connect.

![Figure 11. SWD Interface Connectors](image)

For instance, a Nordic development kit can be used as a programmer for the Dongle.

6.8 External Connections

The nRF52840 Dongle has 15 GPIOs in addition to the ground, power, and SWD connections along the castellated edges. The castellated edge holes have a pitch of 0.1 inches (2.54 mm) and a row spacing of 0.6 inches (15.24 mm), making it suitable for stripboard connection. Test points for additional nine GPIOs are available on the back side of the circuit board, leaving a total of 24 GPIOs accessible.

*Note: There is no reverse voltage protection on the power connections.*

*The SWD connections are located 0.2 inches (5.08 mm) away from the GPIOs with a row spacing of 0.4 inches (10.16 mm)*
7 Revision History

<table>
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<th>Date</th>
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<th>Description</th>
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<td>2020.03.26</td>
<td>V1.0</td>
<td>The initial version is released.</td>
<td>Aroo Wang</td>
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8 Contact Us

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