

nRF93M1 DK Hardware

v0.4.0

User Guide



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SEMICONDUCTOR

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Revision history

Date	Description
July 2026	Updated draft for sampling for DK v0.4.0: • Updated hardware figures and schematic drawings • Updated P5 and P6 connector naming and pinouts
March 2026	Draft release for sampling

Environmental and safety notices

Power supply

The nRF93M1 DK must be powered by a PS1 class (IEC 62368-1) power supply with maximum power less than 15 W.

Skilled persons

The nRF93M1 DK is intended for use only by skilled persons.

A skilled person is someone with relevant education or experience that enables them to identify potential hazards and takes appropriate action to reduce the risk of injury to themselves and others.



Hot surface

In the event of a fault, touchable surfaces can heat up significantly.



Electrostatic discharge

The nRF93M1 DK is susceptible to *Electrostatic Discharge (ESD)*.

To avoid damage to your device, it should be used in an electrostatic free environment, such as a laboratory.



Environmental Protection

Waste electrical products should not be disposed of with household waste.

Please recycle where facilities exist. Check with your local authority or retailer for recycling advice.

1 Introduction

The nRF93M1 DK is a hardware development platform used to design and develop *Long-Term Evolution (LTE)* Cat 1 bis cellular data transmission on the nRF93M1 cellular modem module, and *Bluetooth®* Low Energy functionality on the nRF54L15 *System on Chip (SoC)*.

Key features

- nRF93M1 – cellular modem module
 - 3GPP LTE release 14 Cat 1 bis compliant
 - *SubMiniature Version A (SMA)* antenna interface and antenna (included)
 - SIM card socket for nano-SIM (4FF SIM) and footprint for eSIM
 - Buck DC/DC regulator provides 3.8 V/1.5 A output for the nRF93M1 module
- nRF54L15 SoC – host MCU
 - Bluetooth Low Energy
 - 802.15.4, Thread®, Zigbee®, 2.4 GHz proprietary
 - External flash memory
 - User programmable buttons (2) and LEDs (1)
 - Onboard *Printed Circuit Board (PCB)* antenna
 - Unused I/O ports are extended
- nRF5340 SoC – interface MCU
 - *Serial Wire Debug (SWD)* debugging/programming and serial port functions through USB-C
 - SEGGER J-Link OB programmer/debugger
- nPM1300 – *Power Management Integrated Circuit (PMIC)*
 - Charging management
 - Power supply for the host MCU and interface MCU
 - Power supply from battery (3.3 V to 4.2 V) or 5V USB
- USB connections for debugging, programming, and power
- Trace interface
- Interfaces for current consumption measurements

Kit content

The nRF93M1 DK includes hardware, preprogrammed firmware, documentation, hardware schematics, and layout files.

The nRF93M1 DK comes with an LTE antenna.

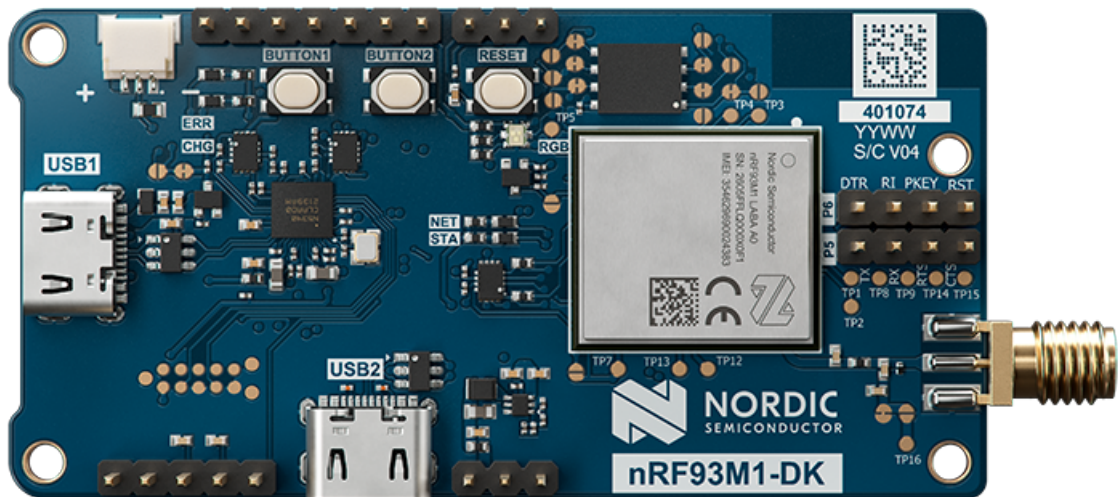


Figure 1: nRF93M1 DK kit content

The hardware design files include the following resources:

- Schematics
- PCB layout files
- Bill of materials
- Gerber files

2 Hardware description

The main components of the nRF93M1 DK include the nRF93M1 module and hardware peripherals that add functionality and configuration options.

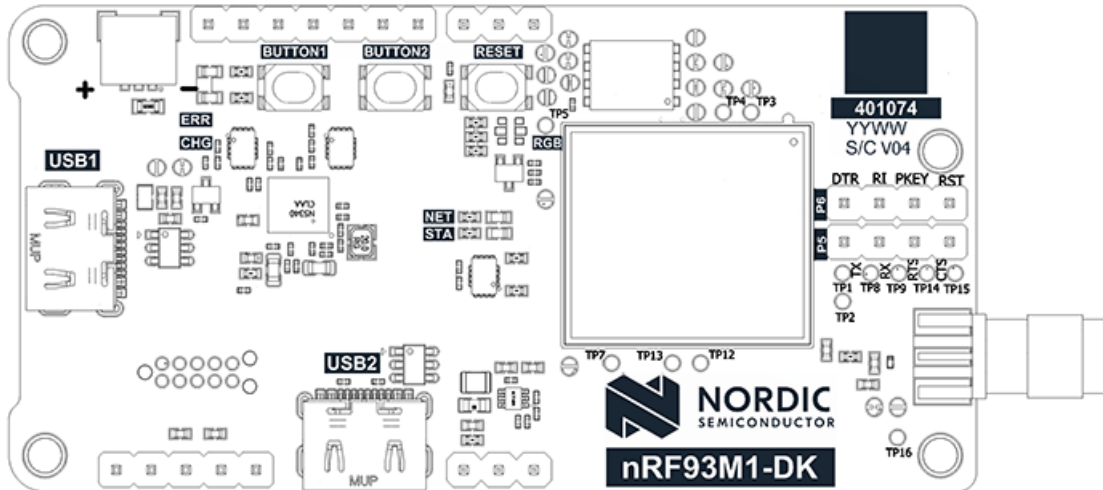


Figure 2: nRF93M1 DK front view

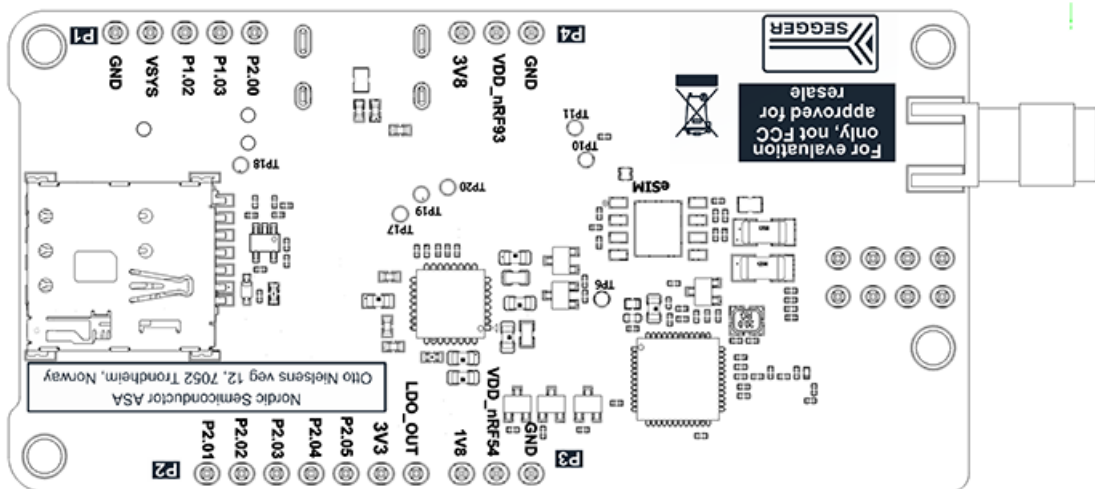


Figure 3: nRF93M1 DK back view

2.1 Block diagram

The block diagram illustrates the nRF93M1 DK functional architecture.

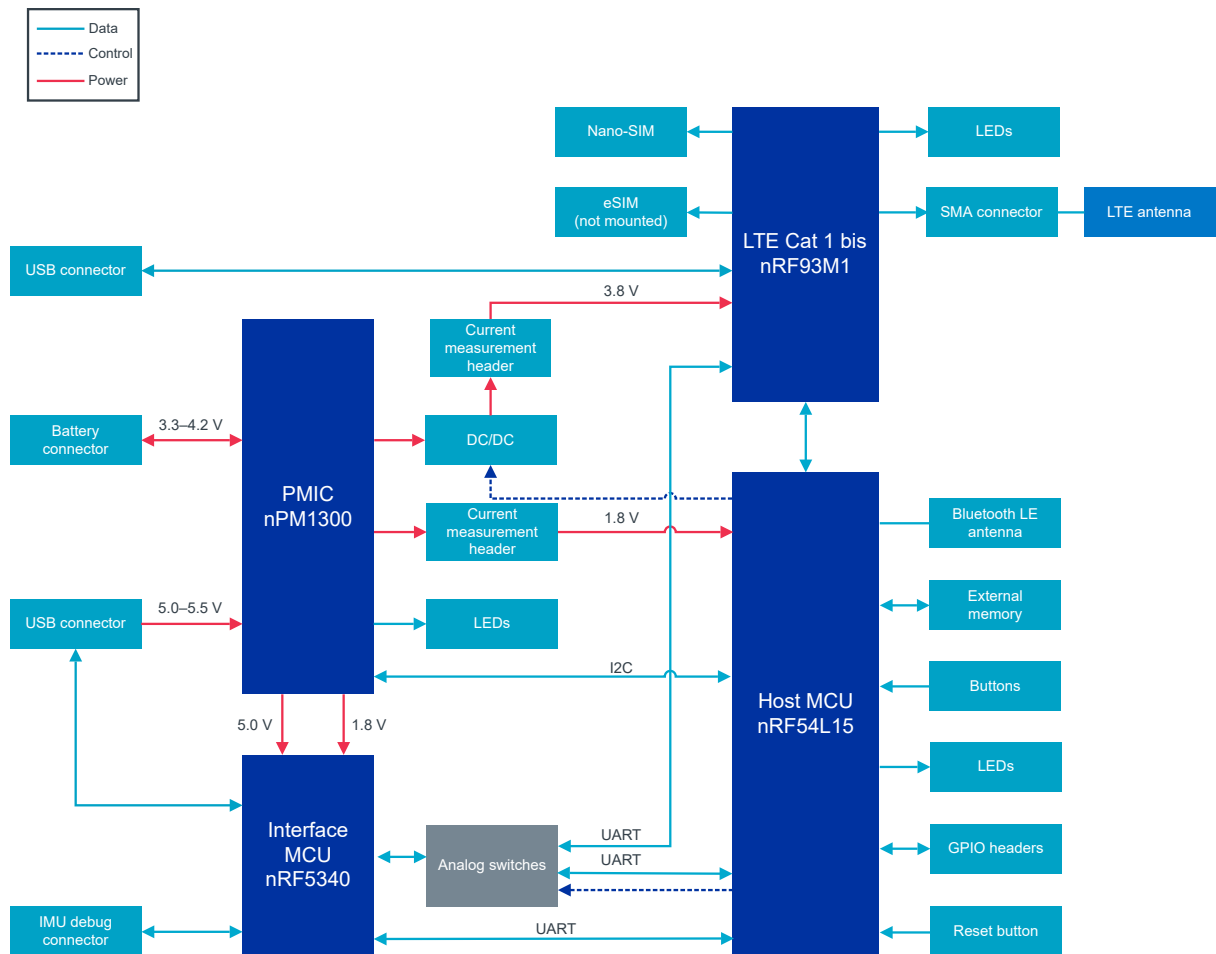


Figure 4: Block diagram

2.2 Power supply

The nRF93M1 DK has a flexible and configurable power supply system to allow software development and testing using different power sources and to facilitate accurate power consumption measurements.

The nRF93M1 DK is powered by either of the following sources:

- USB connector (**USB1**)
- Battery connector

The DK is primarily powered by 5 V from the USB connector. Alternatively, the DK can be powered by a battery.

Supply domain	Voltage supply range
USB connector (USB1)	5.0 V to 5.5 V
Battery connector	3.3 V to 4.2 V

Table 1: Voltage supply range

Note: To ensure correct operation as described in the nRF93M1 Datasheet, prevent any voltage drop or ripple on the nRF93M1 module **VDD** pins below 3.3 V.

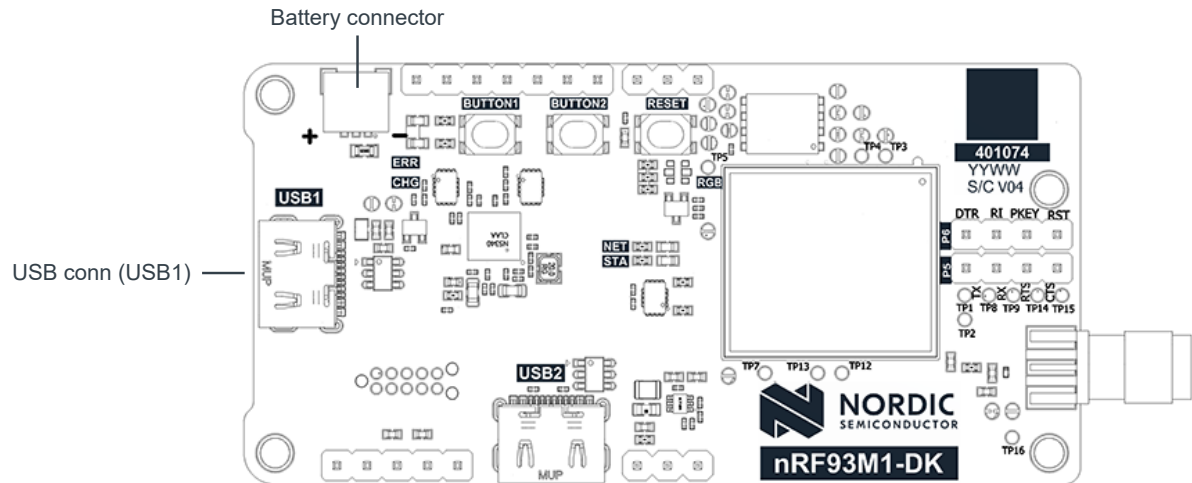


Figure 5: Power supply options

2.2.1 nPM1300 PMIC

The nPM1300 *PMIC* supplies power to the nRF93M1 module, nRF54L15, and nRF5340 on the nRF93M1 DK.

nPM1300 supplies power to the nRF93M1 module through the **VSYS** system regulator. nPM1300 also supplies nRF54L15 through the **VOU1** output and nRF5340 through the **VOU2** output.

Resistors **R4** and **R5** set the default output voltage of **VOU1** and **VOU2** to 1.8 V. These resistors connect to the **VSET1** and **VSET2** pins on the nPM1300.

The *Two-wire Interface (TWI)* of nPM1300 connects to nRF54L15. This interface can be used to configure the **VOU1** and **VOU2** output voltages. The TWI interface also allows enabling the nPM1300 battery charger. The charger is disabled by default.

nPM1300 receives power from **VBUS**. The **CC1** and **CC2** pins connect to the USB connector (**USB1**) for USB port and power-capability detection.

Note: Controlling nPM1300 through the TWI requires a dedicated application code running on the nRF54L15 application processor.

The following table describes the supply domains of the nPM1300 PMIC.

nPM1300 PMIC output	Supply domain	Domain voltage
VSYS	Main system supply	3.3 V to 5.5 V
VOU1	- Supply to nRF54L15 - External memory - Switch supply	1.8 V
VOU2	Supply to nRF5340	1.8 V
VOU1DO1	LEDs	3.3 V
VOU1DO2	Not used	Not used

Table 2: nPM1300 power rails

nPM1300 has two LEDs that show error status and charge status.

The following figure describes the circuitry of the nPM1300 PMIC.

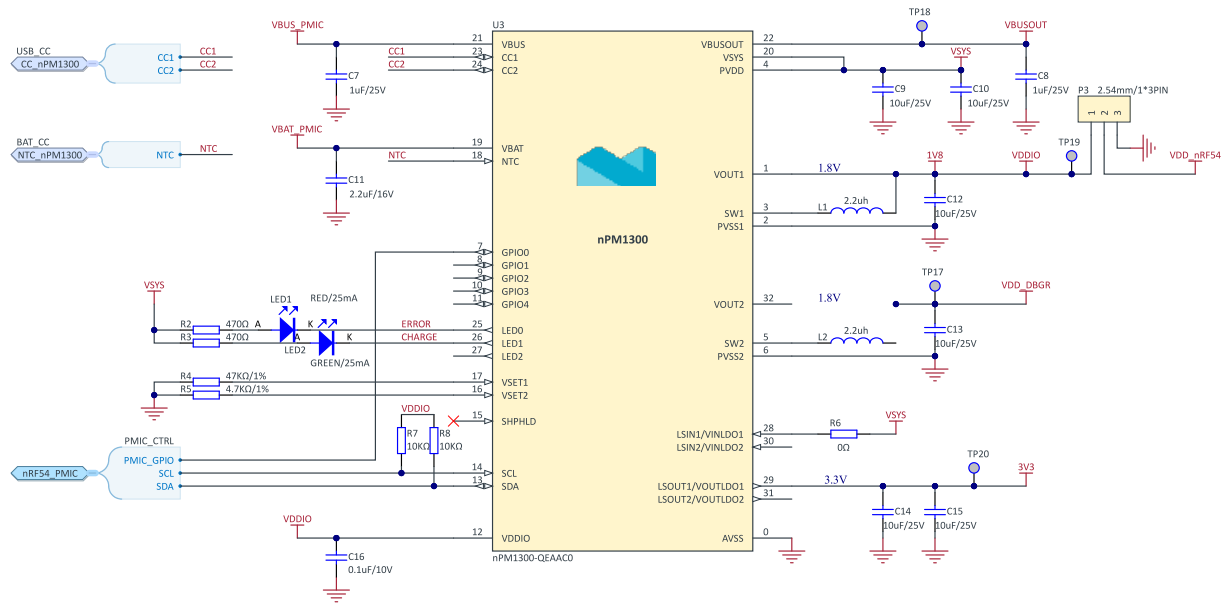


Figure 6: nPM1300 PMIC circuitry

By default, nRF54L15 is supplied from nPM1300 **VOUT1** through jumper **P3** on the DK. The nRF93M1 module is supplied from the DC/DC regulator output through jumper **P4**.

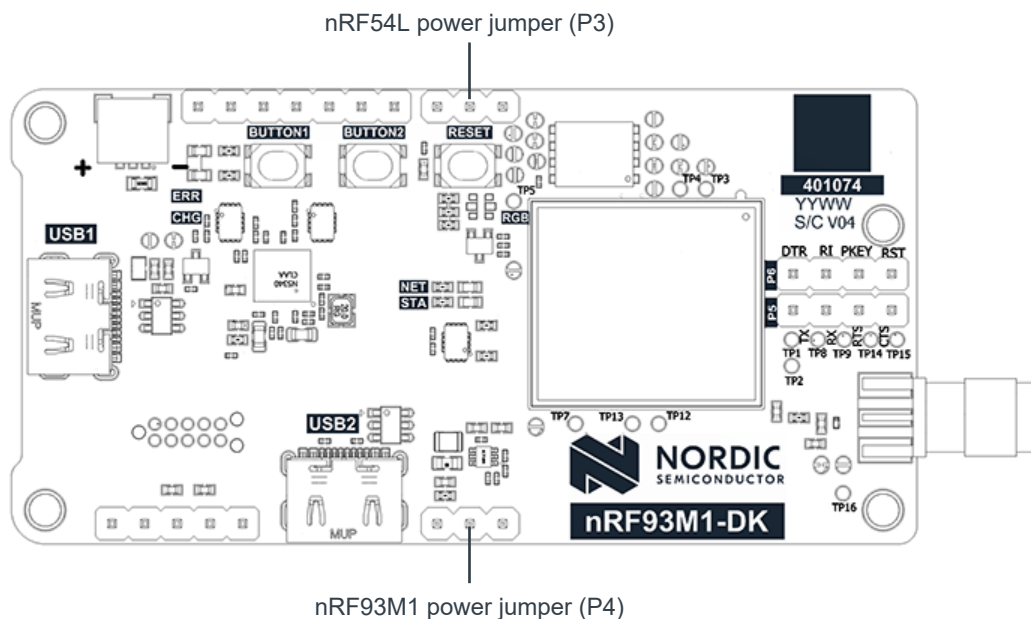


Figure 7: Power jumpers **P3** and **P4**

2.3 Antenna interfaces

The nRF93M1 DK has an *SMA* antenna interface for connecting the external *LTE* antenna to the nRF93M1 module.

An onboard Bluetooth Low Energy *PCB* antenna connects to the nRF54L15.

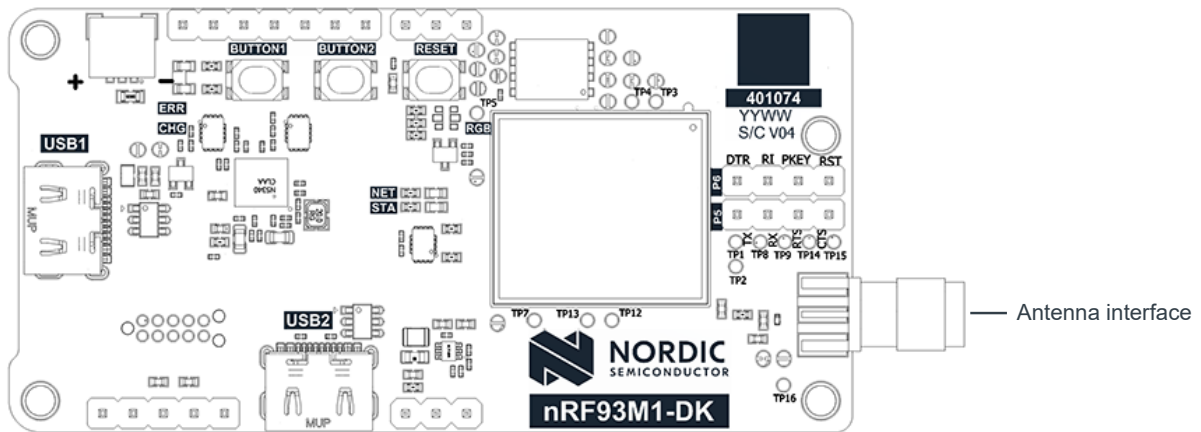


Figure 8: Antenna interface

2.4 Buttons and LEDs

Two buttons and one RGB LED on the nRF93M1 DK are connected to dedicated GPIOs on the nRF54L15 SoC.

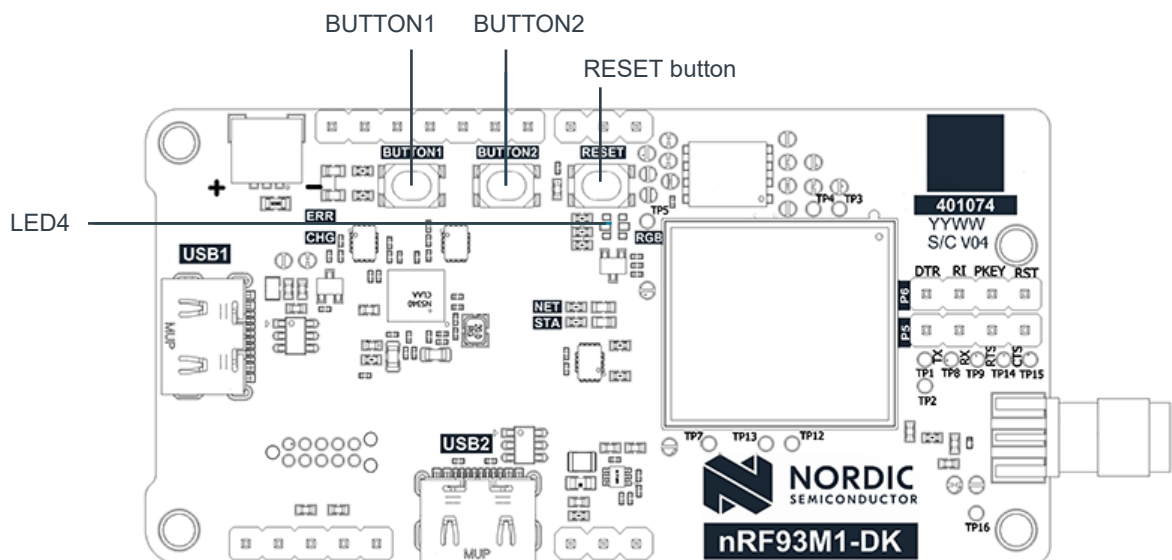


Figure 9: Buttons and LEDs

By default, the buttons and LED are connected to the nRF54L15 GPIOs as shown in the following table.

Part	nRF54L15 GPIO
LED4	P2.09 (blue) P2.08 (red) P2.10 (green)
BUTTON1	P0.04
BUTTON2	P1.09

Table 3: Button and LED connections

The LEDs are active high which means that writing a logical one (1) to the output pin turns on the LED. The LEDs are not directly connected to the nRF54L15 GPIOs but are buffered by a transistor. The transistor gate has a 1 M Ω resistor to **GND**.

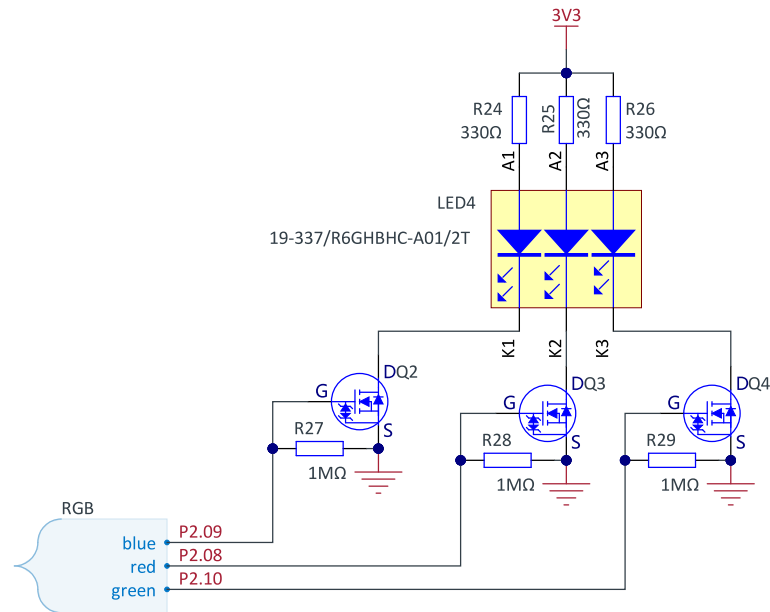


Figure 10: LED configuration

The nRF93M1 DK has four LEDs that show DK status.

The buttons are active low, which means that the input is connected to ground when the button is pressed. The buttons do not have an external pull-up resistor. Pins **P0 . 04** and **P1 . 09** must be configured as an input with an internal pull-up resistor to register that a button is pressed.

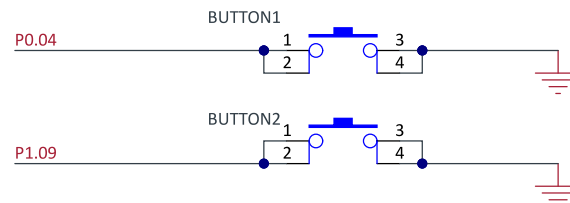


Figure 11: Button configuration

2.5 External memory

The nRF93M1 DK has a 64 Mb external flash memory. The memory is a multi-I/O memory supporting both *Serial Peripheral Interface (SPI)* and *Quad Serial Peripheral Interface (QSPI)*.

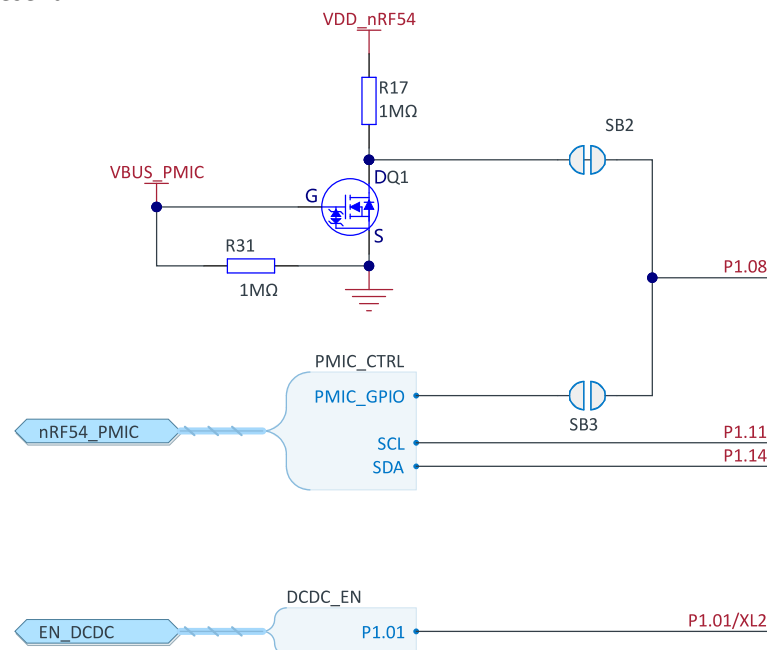
The memory is connected to the nRF54L15 using the following GPIOs.

nRF54L15 GPIO	Flash memory pin	Solder bridge for memory use (default closed)	Solder bridge for GPIO use (default open)
P2.05	CS	SB17	SB13
P2.01	CLK	SB18	SB9
P2.02	SIO_0/SI	SB19	SB10
P2.04	SIO_1/SO	SB20	SB12
P2.03	SIO_2/WP	SB21	SB11
P2.00	SIO_3/HOLD	SB22	SB8

Table 4: Flash memory GPIO usage and connecting solder bridges

2.6 VBUS detect

To determine the power supply mode, nRF54L15 detects a rising edge on I/O pin **P1.08** to confirm that **VBUS** voltage is present.

Figure 12: **VBUS** detect

2.7 Signal routing switches

Several of the *General-Purpose Input/Output (GPIO)* signals of the nRF93M1 DK are routed through analog switches for onboard functionality.

2.7.1 Switches for UART interface

UART1 from the nRF93M1 module routes to either the interface MCU nRF5340 or nRF54L15. nRF54L15 controls the switches through pin **P2.06**.

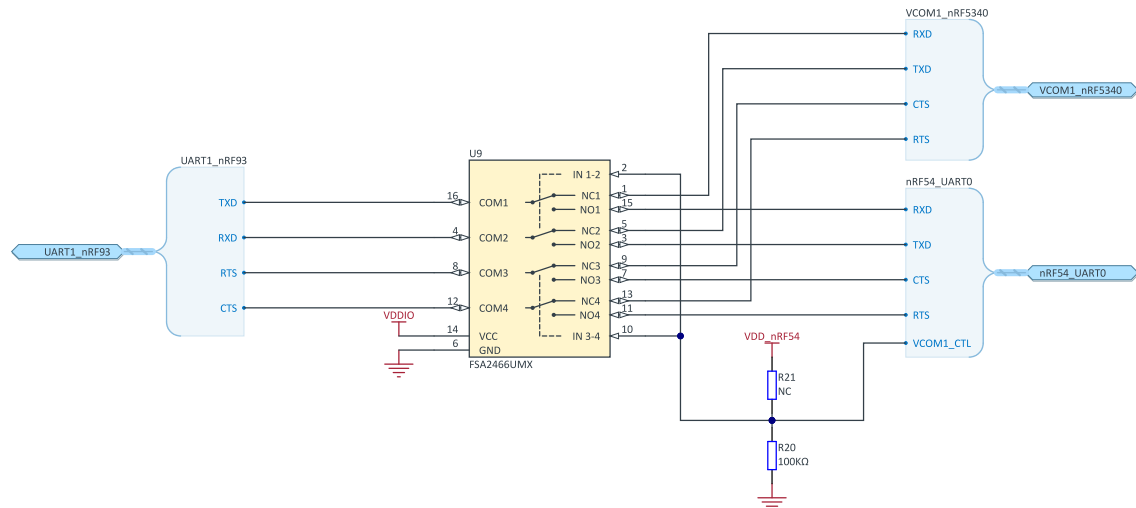


Figure 13: UART interface switches

2.7.2 Enable DC/DC regulator for the nRF93M1 module

Pin **P1.01** on nRF54L15 enables or disables the DC/DC regulator output for the nRF93M1 module. By default, the DC/DC regulator output is off.

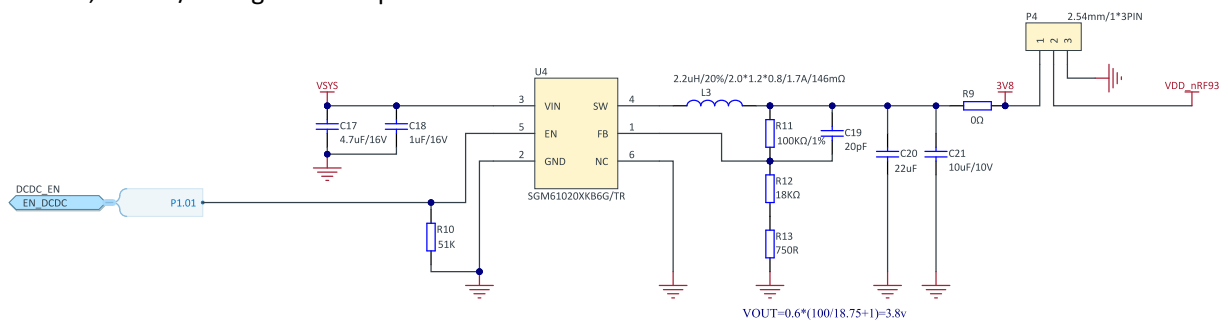


Figure 14: Enable DC/DC regulator

2.8 SIM and eSIM

The nRF93M1 DK is designed to support regular *Subscriber Identity Module (SIM)* and *Embedded SIM (eSIM)*. For this purpose, it has a pluggable SIM card socket (**J2**) for a nano-sized SIM (4FF) and a non-populated footprint for an eSIM (**U13**).

There is one **SIM_VOUT** power domain. Both SIMs use the same supply and operate at the same voltage level, either 1.8 V or 3.0 V.

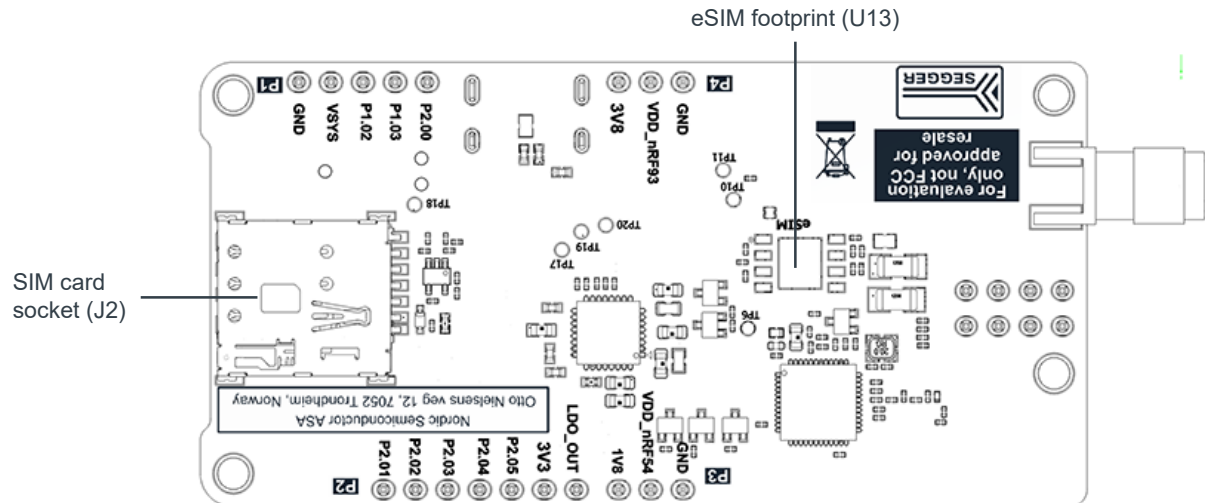


Figure 15: SIM card connector and eSIM

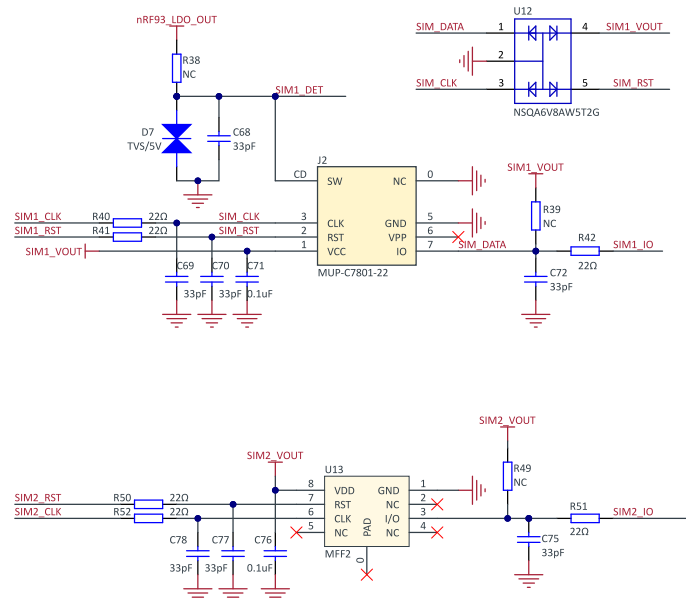


Figure 16: SIM card connector and eSIM

Note: The nano-SIM card is inserted with the electrical interface down in the SIM card holder (J2).

2.9 GPIO interface

Access to the nRF54L15 GPIOs and key power domains on the nRF93M1 DK is available from headers **P1** and **P2**.

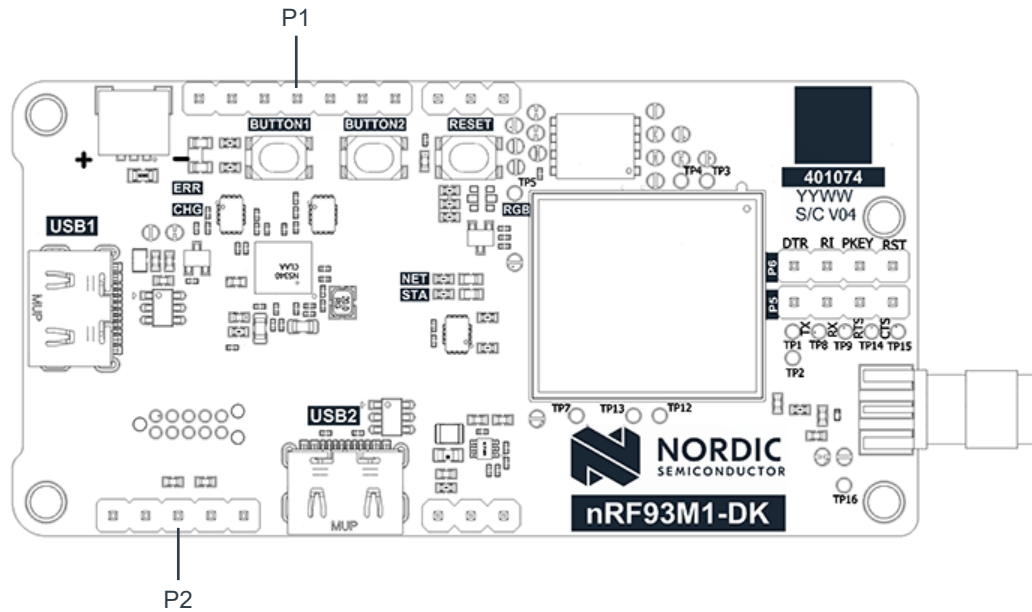


Figure 17: nRF93M1 DK GPIO headers **P1** and **P2**

The pinouts of the **P1** and **P2** pin headers are shown in the following tables.

Pin number	Label	Function	Default connected on P1
1	GND	Ground	Yes.
2	VBUS	Power	Yes.
3	P1 . 02	nRF54L15 GPIO	Yes.
4	P1 . 03	nRF54L15 GPIO	Yes.
5	P2 . 00	nRF54L15 GPIO	No. Solder bridges must be configured.

Table 5: **P1** pin map

Pin number	Label	Function	Default connected on P2
1	P2 . 01	nRF54L15 GPIO	No. Solder bridges must be configured.
2	P2 . 02	nRF54L15 GPIO	No. Solder bridges must be configured.
3	P2 . 03	nRF54L15 GPIO	No. Solder bridges must be configured.
4	P2 . 04	nRF54L15 GPIO	No. Solder bridges must be configured.
5	P2 . 05	nRF54L15 GPIO	No. Solder bridges must be configured.
6	3V3	Power	Yes.
7	VOUT1	Power	Yes.

Table 6: **P2** pin map

UART0 and **UART2** of the nRF93M1 module connect to pin headers **P5** and **P6**.

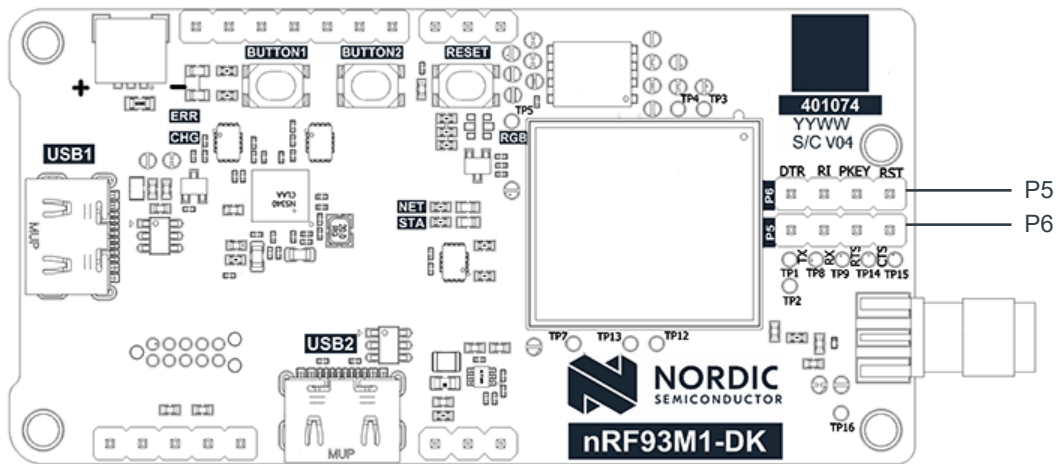


Figure 18: P5 and P6 headers

The pinouts of the P5 and P6 pin headers are shown in the following tables.

Pin number	Label	Function	Default connected on P5
1	TX	UART0_TX	Yes
2	RX	UART0_RX	Yes
3	RTS	Ground	Yes
4	CTS	Ground	Yes

Table 7: P5 pin map

Pin number	Label	Function	Default connected on P6
1	DTR	UART2_TX	Yes
2	RI	UART2_RX	Yes
3	PKEY	UART2_RTS	Yes
4	RTS	UART2_CTS	Yes

Table 8: P6 pin map

Other GPIOs

Other GPIOs used on nRF54L15 are shown in the following table.

nRF54L15 GPIO	Function	Note
P2 . 07	MAIN_DTR	nRF93M1 module
P1 . 10	MAIN_RI	nRF93M1 module
P1 . 12	Reset	nRF93M1 module
P1 . 13	POWERKEY	nRF93M1 module
P1 . 14	SDA	nPM1300
P1 . 11	SCL	nPM1300

Table 9: Other GPIOs for nRF54L15

2.10 Solder bridge configuration

The nRF93M1 DK has a range of solder bridges for enabling or disabling functionality on the nRF93M1 DK. Changes to these are not needed for normal use of the DK.

The following table is an overview of the solder bridges on the nRF93M1 DK.

Solder bridge	Default	Function
SB17	Closed	Cut to disconnect CS of external memory from nRF54L15.
SB18	Closed	Cut to disconnect CLK of external memory from nRF54L15.
SB19	Closed	Cut to disconnect SIO0 of external memory from nRF54L15.
SB20	Closed	Cut to disconnect SIO1 of external memory from nRF54L15.
SB21	Closed	Cut to disconnect SIO2 of external memory from nRF54L15.
SB22	Closed	Cut to disconnect SIO3 of external memory from nRF54L15.
SB13	Open	Short to connect P2 . 05 of nRF54L15 from P2.
SB9	Open	Short to connect P2 . 01 of nRF54L15 from P2.
SB10	Open	Short to connect P2 . 02 of nRF54L15 from P2.
SB12	Open	Short to connect P2 . 04 of nRF54L15 from P2.
SB11	Open	Short to connect P2 . 03 of nRF54L15 from P2.
SB8	Open	Short to connect P2 . 00 of nRF54L15 from P1.
SB2	Closed	Cut to disconnect VBUS_DET from nRF54L15.
SB3	Open	Short to connect VBUS_DET from nPM1300.
SB1	Open	Short to connect GND from nRF93M1 module PWRKEY.
SB15	Open	Short to connect VDD_EXT from nRF93M1 module BOOT.

Table 10: Solder bridge configuration

3 Operating modes

The following section describes the modes of operation of the nRF93M1 DK.

3.1 Firmware development mode

The primary interface for programming and debugging the nRF93M1 DK is the *Universal Serial Bus (USB)* port (**USB1**). The USB port is connected to an interface MCU which embeds a [SEGGER J-Link-OB](#) (onboard) debug probe.

The following figure shows the interfaces used in firmware development mode.

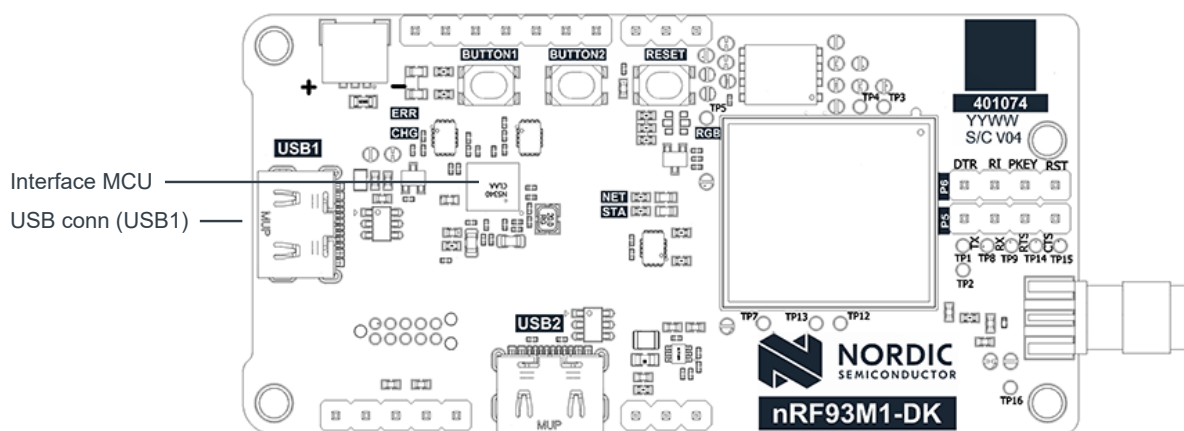


Figure 19: Firmware development mode

3.1.1 Device programming

The nRF93M1 DK supports *SWD* programming interfaces for nRF54L15 through USB port **USB1**.

USB port **USB2** provides a trace connection to the nRF93M1 module.

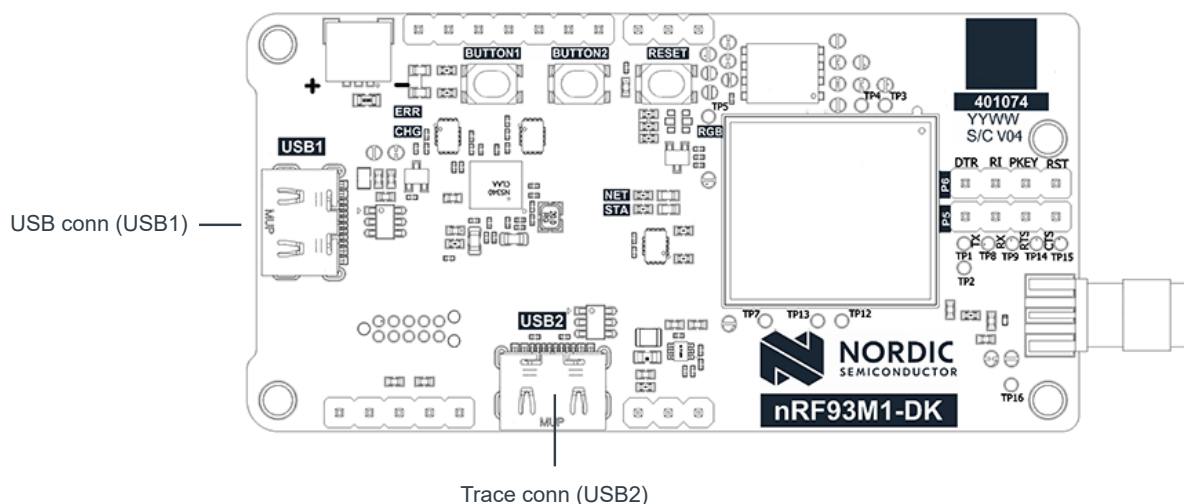


Figure 20: Debug connectors

3.1.2 Virtual serial port

The interface MCU features *Universal Asynchronous Receiver/Transmitter (UART)* interfaces through two virtual serial ports.

The virtual serial ports are the following:

- VCOM0 – Connected to the nRF54L15 UART1
- VCOM1 – Connected to the nRF54L15 UART2 or nRF93M1 DK MAIN UART

The virtual serial ports have the following features:

- Flexible baud rate settings up to 1 Mbps
- *Request to Send (RTS)/Clear to Send (CTS)-style Hardware Flow Control (HWFC)*

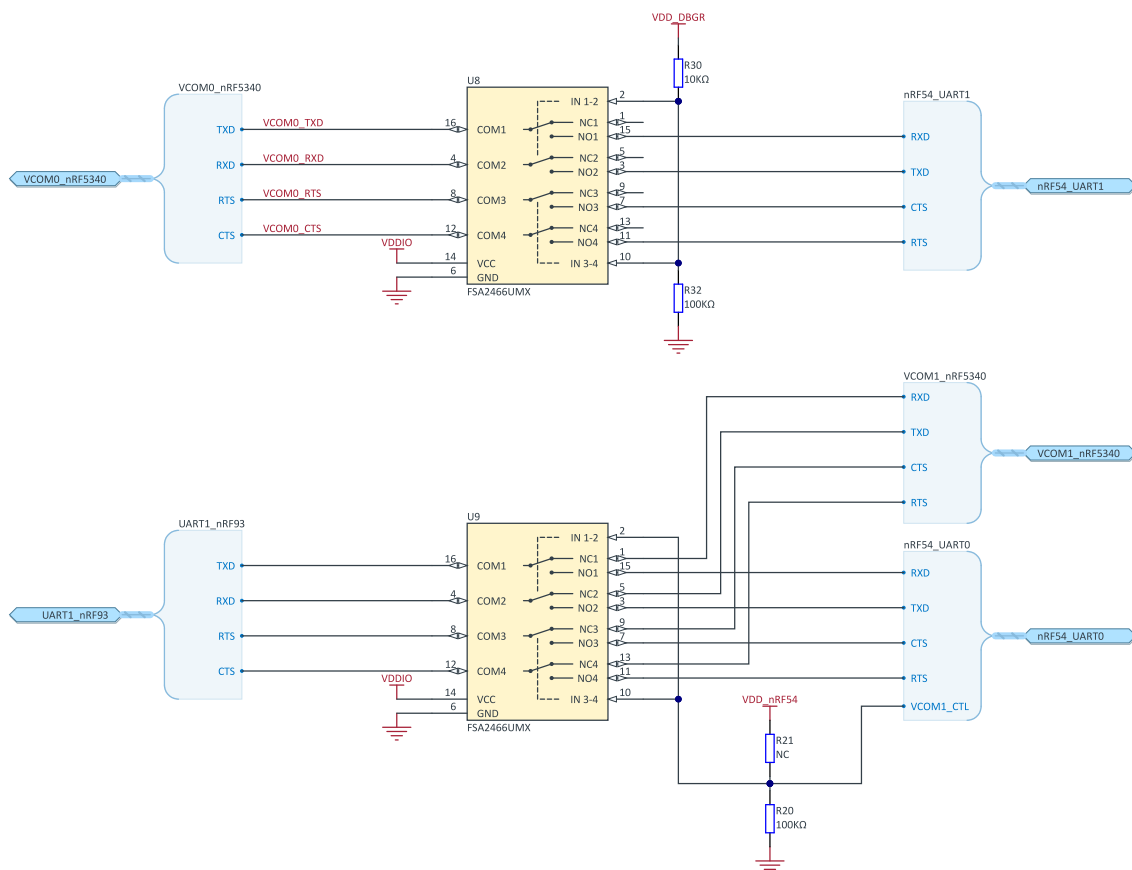


Figure 21: Virtual serial port

3.1.3 Reset

The nRF93M1 DK is equipped with a **RESET** button.

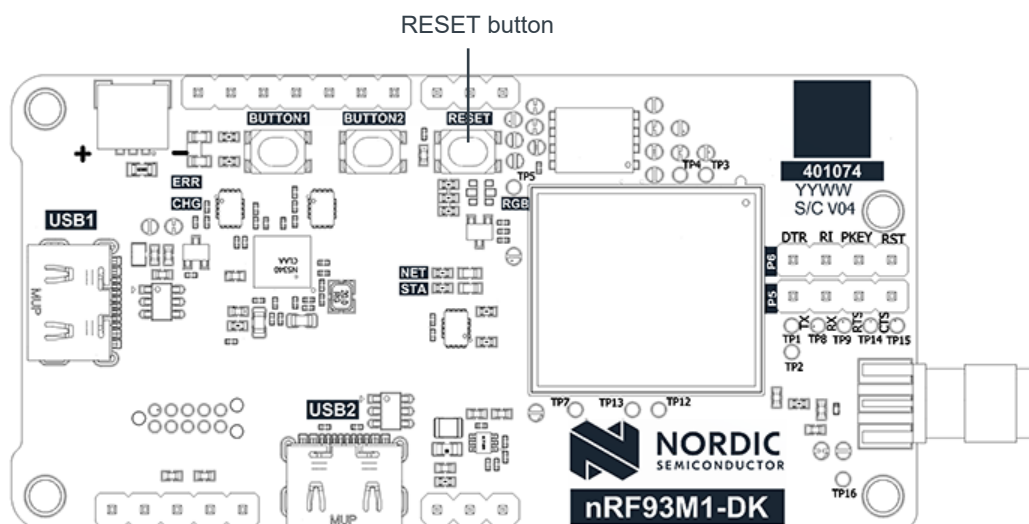


Figure 22: Reset button

4 Measurements

Current and RF signal can be measured on the nRF93M1 DK.

4.1 Current measurements

The current drawn by the nRF93M1 module and nRF54L15 SoC can be monitored on the nRF93M1 DK.

Current can be measured using any of the following test instruments:

- Power Profiler Kit II (PPK2)
- Ampere meter

The following sections provide information on the nRF93M1 DK measurement setup. If the PPK2 is used for measuring current, see [Power Profiler Kit II](#) for more information.

For more information on current measurement, see [Current measurement guide: Introduction](#).

4.1.1 Set up the DK

Perform the following tasks to set up the nRF93M1 DK for minimal current consumption.

Set up DK to measure nRF54L15

To measure the current consumption of nRF54L15, you must first remove the jumper from **P3**. This disconnects nRF54L15 from the DK's power supply.

To restore normal kit functionality after measurement, apply the jumper on **P3**.

Set up DK to measure nRF93M1 module

To measure the current consumption of the nRF93M1 module, you must first remove the jumper from **P4**. This disconnects the nRF93M1 module from the DK's power supply.

To restore normal kit functionality after measurement, apply the jumper on **P4**.

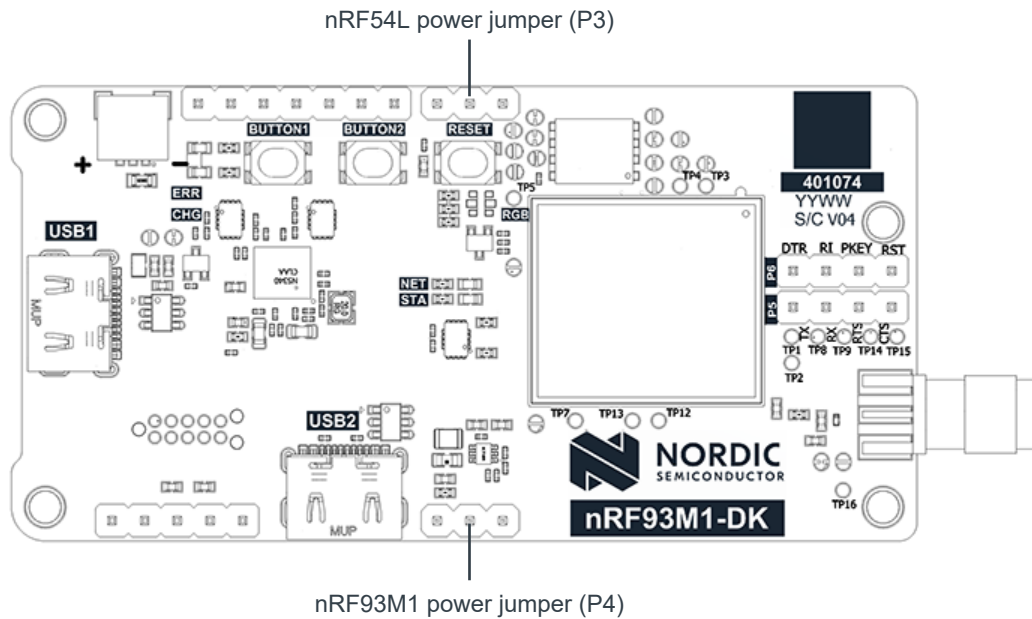


Figure 23: Power jumpers **P3** and **P4**

4.1.2 Measure average current with an ampere meter

The current drawn by the nRF93M1 DK can be measured using an ampere meter.

4.1.2.1 Measure nRF54L15 average current with an ampere meter

Before you start, make sure you have prepared the nRF93M1 DK as described in [Set up the DK](#) on page 22.

Complete the following steps to measure the average current drawn by the nRF54L15 SoC.

1. Connect an ampere meter between pin 1 and pin 2 on header **P3**.
2. Set the average timing of the ampere meter to an interval that is 1 s or longer.
3. Set the dynamic range of the ampere meter between 1 μ A and approximately 15 mA so that it is wide enough to provide accurate measurements.

4.1.2.2 Measure nRF93M1 module average current with an ampere meter

Before you start, make sure you have prepared the nRF93M1 DK as described in [Set up the DK](#) on page 22.

Complete the following steps to measure the average current drawn by the nRF93M1 module.

1. Connect an ampere meter between pin 1 and pin 2 on header **P4**.
2. Set the average timing of the ampere meter to an interval that is 1 s or longer.
3. Set the dynamic range of the ampere meter between 1 μ A and approximately 1 A so that it is wide enough to provide accurate measurements.

4.1.3 Measure current with Power Profiler Kit II in Ampere Meter mode

The nRF93M1 DK's power consumption can be measured by using the Power Profiler Kit II (PPK2) as an ampere meter. When PPK2 is used in Ampere Meter mode, the DK must be supplied power from an external source.

4.1.3.1 Measure nRF54L15 current with Power Profiler Kit II in Ampere Meter mode

Before you start, make sure you have prepared the nRF93M1 DK as described in [Set up the DK](#) on page 22.

Complete the following steps to connect nRF54L15 to the PPK2 in Ampere Meter mode.

1. Connect **P3** header's pin 2 on nRF93M1 DK to **VOUT** on the PPK2.
2. Connect **P3** header's pin 1 on nRF93M1 DK to **VIN** on the PPK2.
3. Connect **P3** header's pin 3 on nRF93M1 DK to **GND** on the PPK2.

For more information, see [Power Profiler Kit II](#).

4.1.3.2 Measure nRF93M1 module current with Power Profiler Kit II in Ampere Meter mode

Before you start, make sure you have prepared the nRF93M1 DK as described in [Set up the DK](#) on page 22.

Complete the following steps to connect the nRF93M1 module to the PPK2 in Ampere Meter mode.

1. Connect **P4** header's pin 2 on nRF93M1 DK to **VOUT** on the PPK2.
2. Connect **P4** header's pin 1 on nRF93M1 DK to **VIN** on the PPK2.
3. Connect **P4** header's pin 3 on nRF93M1 DK to **GND** on the PPK2.

For more information, see [Power Profiler Kit II](#).

4.1.4 Measure current with Power Profiler Kit II in Source Meter mode

The nRF93M1 DK's power consumption can be measured with the Power Profiler Kit II (PPK2) in Source Meter mode. When the PPK2 is used in Source Meter mode, the DK is supplied power by the PPK2.

4.1.4.1 Measure nRF54L15 current with Power Profiler Kit II in Source Meter mode

Before you start, make sure you have prepared the nRF93M1 DK as described in [Set up the DK](#) on page 22.

Complete the following steps to connect nRF93M1 DK to the PPK2 in Source Meter mode.

1. Connect **P3** header's pin 2 on nRF93M1 DK to **VOUT** on the PPK2.
2. Connect **P3** header's pin 3 on nRF93M1 DK to **GND** on the PPK2.

For more information, see [Power Profiler Kit II](#).

4.1.4.2 Measure nRF93M1 module current with Power Profiler Kit II in Source Meter mode

Before you start, make sure you have prepared the nRF93M1 DK as described in [Set up the DK](#) on page 22.

Complete the following steps to connect the nRF93M1 DK to the PPK2 in Source Meter mode.

1. Connect **P4** header's pin 2 on nRF93M1 DK to **VOUT** on the PPK2.
2. Connect **P4** header's pin 3 on nRF93M1 DK to **GND** on the PPK2.

For more information, see [Power Profiler Kit II](#).

4.2 RF measurements

The nRF93M1 DK is equipped with an *SMA* connector for external antennas for radiated or conducted RF measurements.

RF instruments with RF connectors can be connected to the SMA connector for conducted measurements through adapter cables. The instruments must comply with the impedance, frequency range, and power range of the nRF93M1 module. The SMA connector on the nRF93M1 DK is impedance matched for 50 Ω .

Glossary

Clear to Send (CTS)

In flow control, the receiving end is ready and telling the far end to start sending.

Development Kit (DK)

A hardware development platform used for application development.

Electrostatic Discharge (ESD)

A sudden discharge of electric current between two electrically charged objects.

Embedded SIM (eSIM)

A form of programmable *SIM* that is embedded directly into a device.

General-Purpose Input/Output (GPIO)

A digital signal pin that can be used as input, output, or both. It is uncommitted and can be controlled by the user at runtime.

Hardware Flow Control (HWFC)

A handshaking mechanism used to prevent an overflow of bytes in modems. It uses two dedicated pins on the RS-232 connector, Request to Send and Clear to Send.

Long-Term Evolution (LTE)

A wireless broadband communication standard for mobile devices and data terminals, based on the GSM/EDGE and UMTS/HSPA technologies.

Onboard (OB)

A function that is delivered on the chip microcontroller.

Power Management Integrated Circuit (PMIC)

A chip used for various functions related to power management.

Printed Circuit Board (PCB)

A board that connects electronic components.

Quad Serial Peripheral Interface (QSPI)

A Serial Peripheral Interface (SPI) controller that allows the use of multiple data lines.

Request to Send (RTS)

In flow control, the transmitting end is ready and requesting the far end for a permission to transfer data.

Serial Peripheral Interface (SPI)

Synchronous serial communication interface specification used for short-distance communication.

Serial Wire Debug (SWD)

A standard two-wire interface for programming and debugging Arm[®] CPUs.

SubMiniature Version A (SMA)

A semi-precision coaxial RF connector for coaxial cables with a screw-type coupling mechanism.

Subscriber Identity Module (SIM)

A card used in User Equipment (UE) containing data for subscriber identification.

System on Chip (SoC)

A microchip that integrates all the necessary electronic circuits and components of a computer or other electronic systems on a single integrated circuit.

Two-wire Interface (TWI)

An I²C compatible serial communication protocol that enables devices to exchange data by using a two-wire bus system, allowing multiple devices to be connected and controlled by a master device.

Universal Asynchronous Receiver/Transmitter (UART)

A hardware device for asynchronous serial communication between devices.

Universal Serial Bus (USB)

An industry standard that establishes specifications for cables and connectors and protocols for connection, communication, and power supply between computers, peripheral devices, and other computers.

Recommended reading

In addition to the information in this document, you may need to consult other documents.

Nordic documentation

- nRF93M1 Datasheet
- nRF93M1 Hardware Design and Verification
- Getting started with the nRF93M1 DK
- nRF93M1 AT Command Reference Guide

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