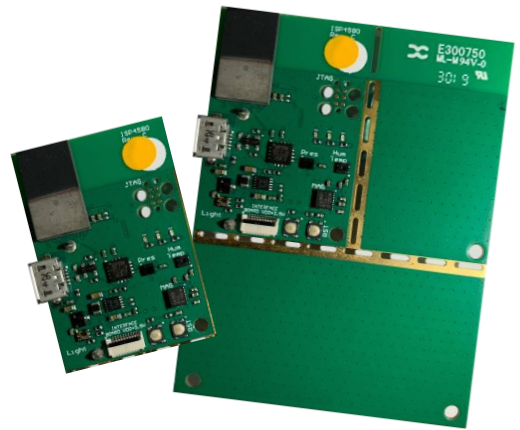


ISP4580

BLE & LoRa Multi Sensor

This small Multi Sensor demonstrator provides an example of the tremendous capabilities of the ISP4520 module based on the nRF52832 BLE Chip and the SX126x LoRa transceiver. With several sensors around a powerful Cortex™ M4 CPU, flash and RAM memory combined with optimized antennas, ISP4580 offers the best in class Bluetooth and LoRa performance with low power consumption.



Key Features

- Bluetooth v5.0 - 2.4GHz low energy RF Transceiver
- Based on Insight SiP 4520 Module
- 32bit ARM Cortex M4F CPU with 512KB Flash and 128KB RAM
- Fully integrated RF matching and Antennas
- Integrated 32 MHz and 32.768 kHz Clocks
- Low Power 3-Axis Accelerometer Detection
- Low Power Temperature/Humidity Detection
- Low Power Barometer Detection
- Low Power Light Detection
- Programmable controlled mini LEDs
- USB port interface
- Power supply on coin cell battery CR2032 or with USB interface
- Overall Size 43.5 x 30 mm²
- Temperature -25 to 85 °C

Applications

- Sport and fitness sensors
- Health care sensors
- Industrial sensors
- Gaming sensors
- Motion detection and transmission



Certifications

- FCC certification pending
- CE certification pending
- IC certification pending
- TELEC certification pending
- Bluetooth SIG certification pending
- RoHS compliant

Revision History

| Revision | Date | Ref | Change Description |
|----------|------------|-------|--------------------|
| R0 | 19/12/2019 | jf pg | Initial release |

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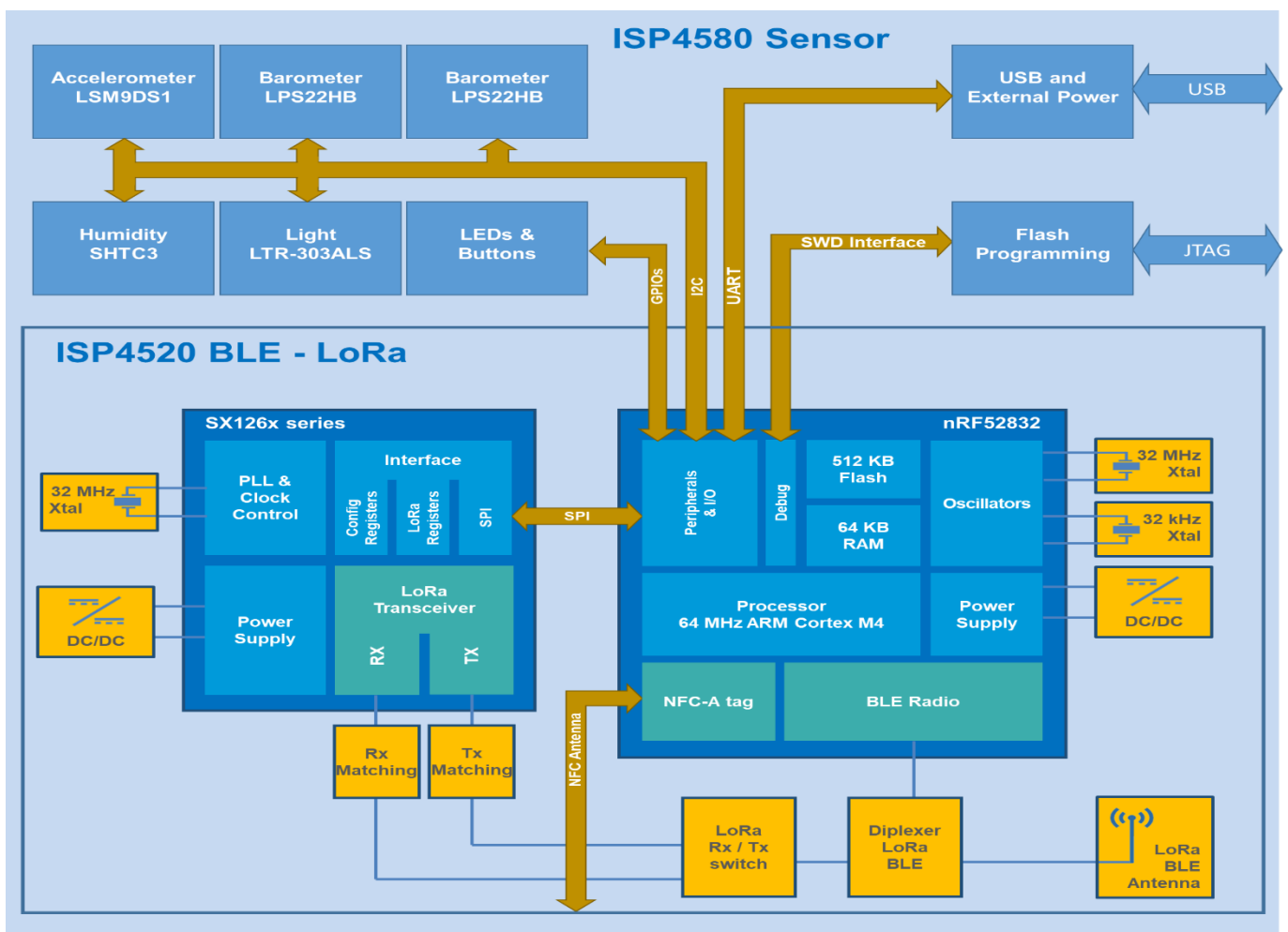
1. Block Diagram

ISP4580 is an autonomous low-power device for wireless acceleration, temperature, humidity, barometer and light detection and transmission. Overall size of the device is 43.5 x 30 mm² (74.8 x 55.3 mm² if using extended ground plane).

The complete device makes use of Insight SiP ISP4520 BLE & LoRa module together with low power 3-axis Accelerometer, Temperature / Humidity and Barometer and Light sensors connected to a primary button cell battery CR2032.

The host processor that handles the autonomous sensor application, the BLE protocol stack, the LoRa drivers and the communication with the sensors is a low power 32-bit MCU (ARM Cortex-M4F based), integrating 512 KB Flash memory and 128 KB RAM.

The ST Micro LSM9DS1 3-axis linear accelerometer / magnetometer is used to detect acceleration and is combined with the ST Micro LPS22HB Barometer, the LITEON LTR-303ALS Light sensor and the SHTC3 Sensirion Humidity / Temperature sensors. 3 mini-LEDs are also part of the board and are available to be controlled by software.



2. Specifications

2.1. Sensor Performances

This chart summarizes main sensor ranges, sensitivities and accuracies. For more detailed information, please refer to the manufacturer datasheet.

| Parameter | Min | Typ | Max | Unit |
|--|-------|------|-------|---------------------------|
| Linear Acceleration range | ±2 | | ±16 | g (9.81m/s ²) |
| Linear Acceleration sensitivity | 0.061 | | 0.732 | mg/LSB |
| Linear Acceleration accuracy @ ±8g range | | ±90 | | mg |
| Magnetic measurement range | ±4 | | ±16 | Gauss |
| Magnetic measurement sensitivity | 0.14 | | 0.58 | mG/LSB |
| Angular rate range | ±245 | | ±2000 | dps |
| Angular rate sensitivity | 8.75 | | 70 | mdps/LSB |
| Barometer range | 800 | | 1100 | hPa |
| Barometer sensitivity | | 4096 | | LSB/hPa |
| Barometer accuracy | | ±0.1 | | hPa |
| Relative Humidity range | 0 | | 100 | %RH |
| Relative Humidity accuracy | | ±2 | | %RH |
| Temperature range | -25 | | +85 | °C |
| Temperature accuracy | | ±0.2 | | °C |

2.2. RF Specifications

The performance of Bluetooth radio is related to the ISP4520 specification.

| Parameter | Min | Typ | Max | Unit |
|---|-------|------|------|------|
| BLE Frequency Range | 2402 | | 2480 | Mhz |
| BLE Channel 0 to 39 Spacing | | 2 | | Mhz |
| BLE Output Power Channels0 to 39 | -20 | | 4 | dBm |
| BLE Rx sensitivity Level for BER <0,1% ideal Tx | | -96 | | dBm |
| BLE Antenna Gain | | -3.6 | | dBi |
| BLE EIRP | -23.6 | | 0.4 | dBm |
| BLE Range Open field @1m height | | 70 | | m |

The performance of LoRa radio is related to the ISP4520 specification.

| Parameter – EU version | Min | Typ | Max | Unit |
|---|------|------|-----|------|
| LoRa Frequency Band (EU) | 863 | | 870 | Mhz |
| LoRa Rx sensitivity Level for BER <1% ⁽³⁾ | -137 | | | dBm |
| LoRa Output Power at transceiver output | | +14 | | dBm |
| LoRa Antenna Gain in band ^{(1) (5)} | | -2.6 | | dBm |
| LoRa Load impedance | | 50 | | Ω |
| LoRa Range Open field @ 1 m height ^{(1) (3) (5)} | | 15 | | km |
| LoRa Range Open field @ 1 m height ^{(2) (3)} | | 20 | | km |

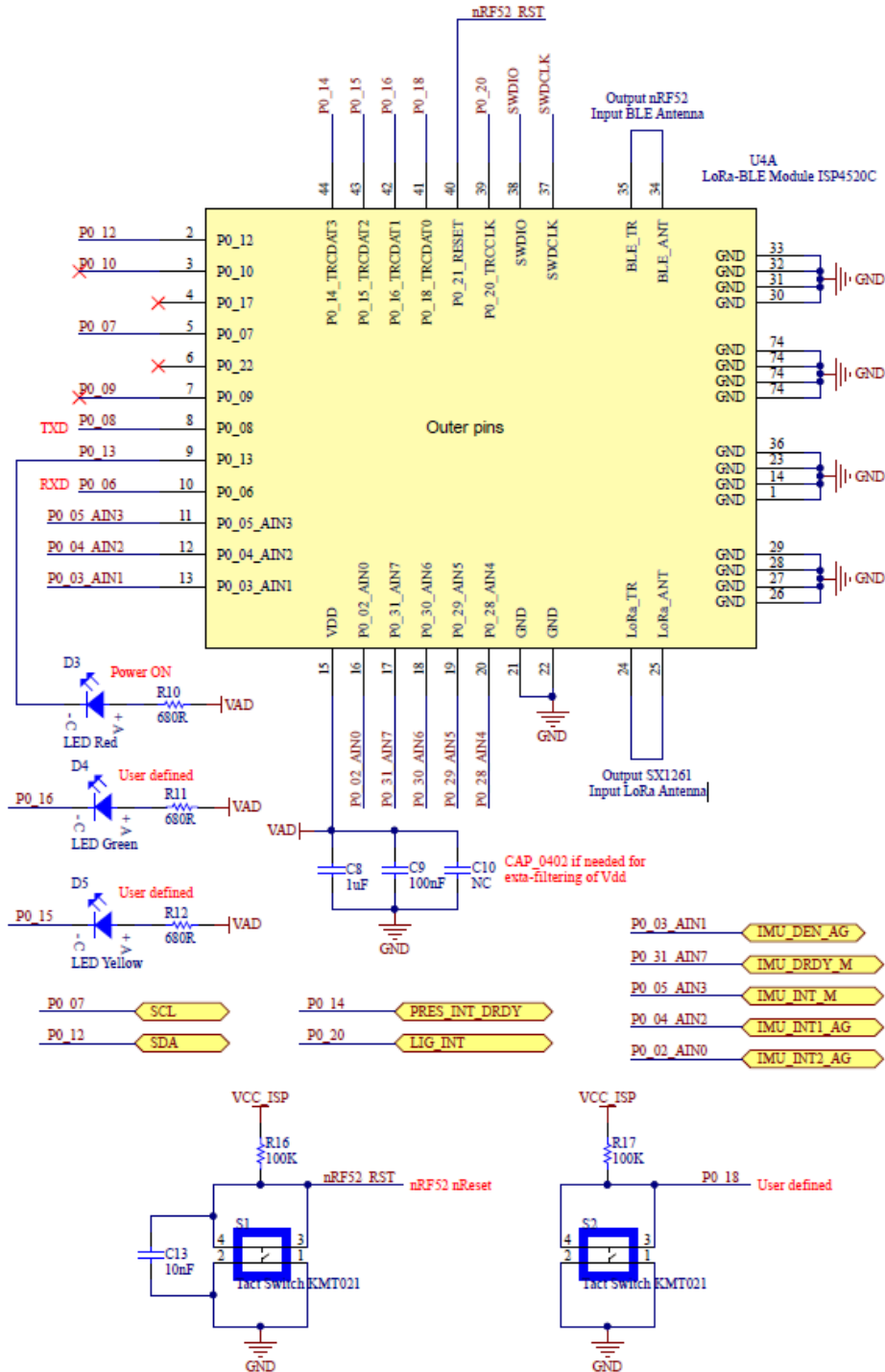
| Parameter – US version | Min | Typ | Max | Unit |
|---|------|------|-----|------|
| LoRa Frequency Band (US) | 902 | | 928 | Mhz |
| LoRa Rx sensitivity Level for BER <1% ⁽³⁾ | -137 | | | dBm |
| LoRa Output Power at transceiver output | | +22 | | dBm |
| LoRa Antenna Gain in band ^{(1) (5)} | | -1.9 | | dBm |
| LoRa Load impedance | | 50 | | Ω |
| LoRa Range Open field @ 1 m height ^{(1) (3) (5)} | | 17 | | km |
| LoRa Range Open field @ 1 m height ^{(2) (3)} | | 20 | | km |

| Parameter – JP version | Min | Typ | Max | Unit |
|---|------|------|-----|------|
| LoRa Frequency Band (JP) | 920 | | 923 | Mhz |
| LoRa Rx sensitivity Level for BER <1% ⁽³⁾ | -137 | | | dBm |
| LoRa Output Power at transceiver output | | +14 | | dBm |
| LoRa Antenna Gain in band ^{(1) (5)} | | -1.9 | | dBm |
| LoRa Load impedance | | 50 | | Ω |
| LoRa Range Open field @ 1 m height ^{(1) (3) (5)} | | 13 | | km |
| LoRa Range Open field @ 1 m height ^{(2) (3)} | | 16 | | km |

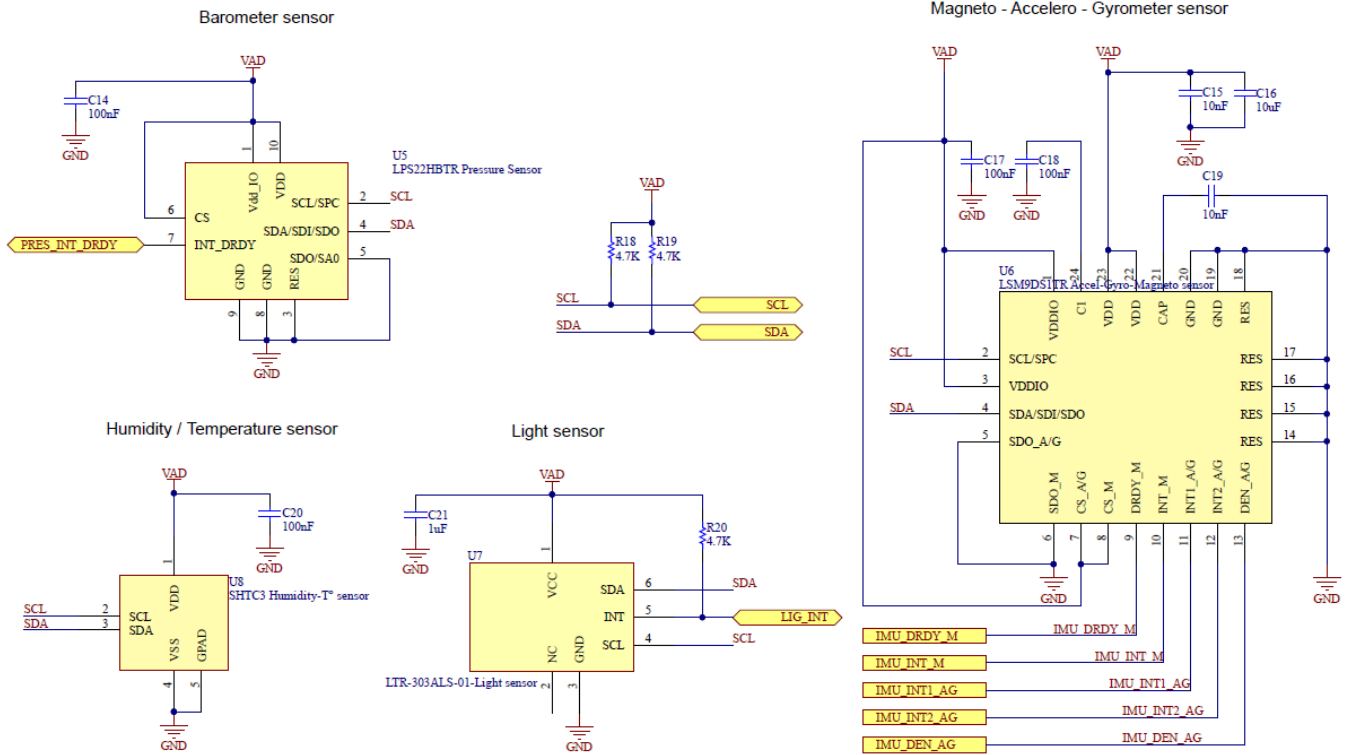
- (1) With internal LoRa antenna / Outdoor
- (2) With external LoRa antenna / Outdoor
- (3) Lower data rate DR0 SF12/125kHz, Rx boosted gain(EU & JP)
- (4) Lower data rate DR0 SF10/125kHz, Rx boosted gain(US)
- (5) Measured Front side of ISP4520

3. Electrical Schematic

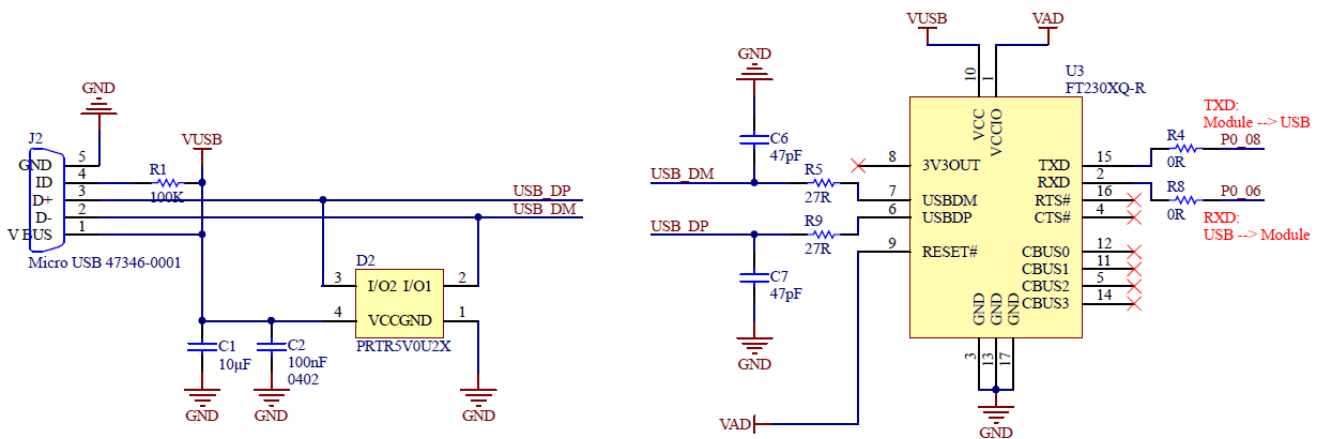
ISP4520 Connections



Sensor connections



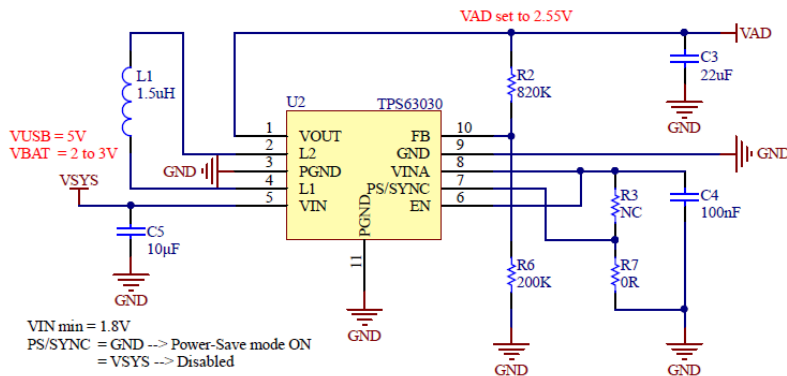
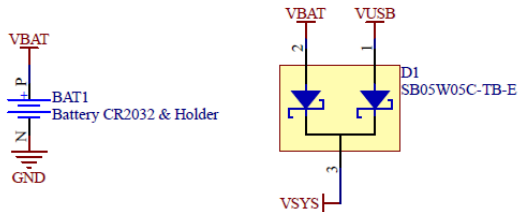
USB Connections



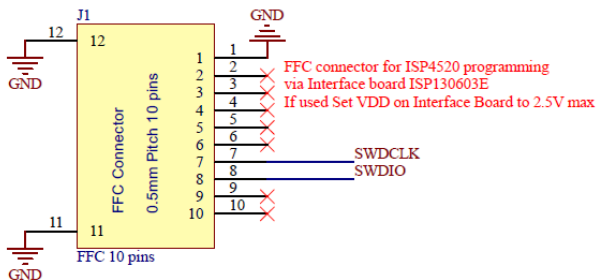
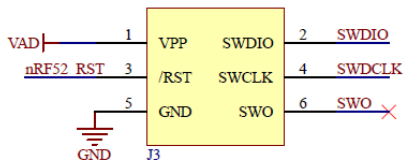
Power Supply & SWD

Schottky diode for low $V_f = 0.35V @ 100mA$
 $2V < VSYS_{min} < 4.6V$

VUSB > VBAT
 USB used as Power supply
 Battery disconnected



JTAG connector for ISP4520
 programming via JTAG Interface



4. Product Development Tools

Hardware

For further specific development, it is also possible to acquire an Evaluation Board containing:

- + One Interface Board with J-Link Seeger integrated
- + One ISP4520 Tx Test Board / Mote
- + One ISP4520 Rx Test Board / Gateway
- + Cables

Using this evaluation board, product developers can use a working solution as starting point to develop their own applications. Please refer to the documentation for more information:

http://www.insightsip.com/fichiers_insightsip/pdf/ble/ISP4520/isp_lora_DS4520_DK.pdf

http://www.insightsip.com/fichiers_insightsip/pdf/ble/ISP4520/isp_lora_AN190301.pdf

Firmware

ISP4520 supports Bluetooth Low Energy protocol stack S132 SoftDevice. It also provides extensive software support for ANT and THREAD applications as well as 2.4 GHz protocol stacks, including Gazell. All are available as downloads at www.nordicsemi.com.

Additional development tools and software are recommended for using and testing ISP4520:

- + Nordic Semiconductor nRFgo Studio or nRF Connect for Desktop:
Downloadable at:
<https://www.nordicsemi.com/Software-and-Tools/Development-Tools/nRFgo-Studio> or
<https://www.nordicsemi.com/Software-and-tools/Development-Tools/nRF-Connect-for-desktop>
- + Debugging and IDE:
SEGGER Embedded Studio (SES):
Downloadable from <https://www.segger.com/products/development-tools/embedded-studio/>
- + Segger J-Link:
Downloadable from <http://www.segger.com/jlink-software.html>
- + nRF52 Software Development Kit (SDK). It can be downloaded after registering at www.nordicsemi.com. It contains example applications and provides source codes, precompiled HEX files, SES, Keil and IAR project files
- + LoRa and LoRaWan examples:
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