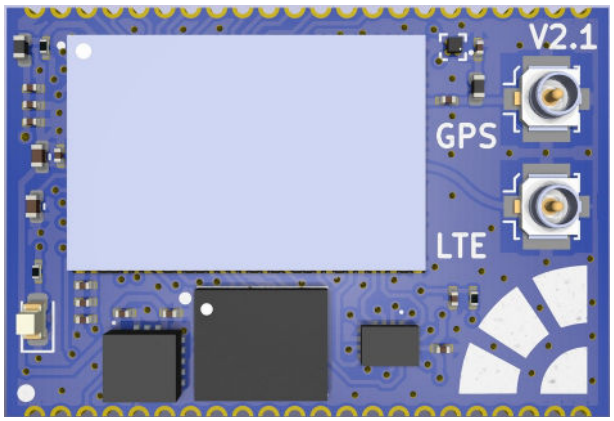
Octopus SoM



Overview

Octopus SoM is a System on Module (SoM) built around the nRF9160 SiP offering NB-IoT and LTE-M connectivity, GPS and accelerometer. It supports on board eSIM and external nano SIM connector. It's purpose is to provide flexible hardware platform for IoT applications.

Features

- **Application processor:**
  - ARM® Cortex M33 with 1 MB Flash and 256 kB RAM
  - ARM® Trustzone®, ARM® Cryptocell 310
- **LTE-M / NB-IoT modem**
  - LTE Cat-M1, LTE CAT-NB1 (NB-IoT) with Global Coverage
  - Throughput (DL / UL): LTE-M: 300/375 kbps, NB-IoT: 30/60 kbps
  - SSL / TLS & Secure FOTA support
  - PSM and eDRX support
  - On-board eSIM & switching circuit for external SIM
  - GPS (L1 C/A)
- **ADXL362 3-axis low-power accelerometer**
- **Power:**
  - Application processor and RF modem powered through VnRF pin, can be powered directly from a battery
  - GPIO and onboard peripherals powered through single 3.3 VDD pin
- **Peripherals:**
  - 4x SPI / UART / I2C
  - 4x PWM, PDM, I2S
  - up to 8 12-bit, 200ksps ADC
  - 3x TIMER, 2x RTC, WDT
  - SWD programming pins
- **Features castellated pads and SMD footprint for integration into other products**

Contents

Recommended Operating Conditions

Parameter	MIN	TYP	MAX	UNITS
Operating Temperature	-20	25	85	°C
VnRF	3.0*	3.8	5.5	V
VDD	1.8		3.6	V

(*) RF Product Specification operating temperature

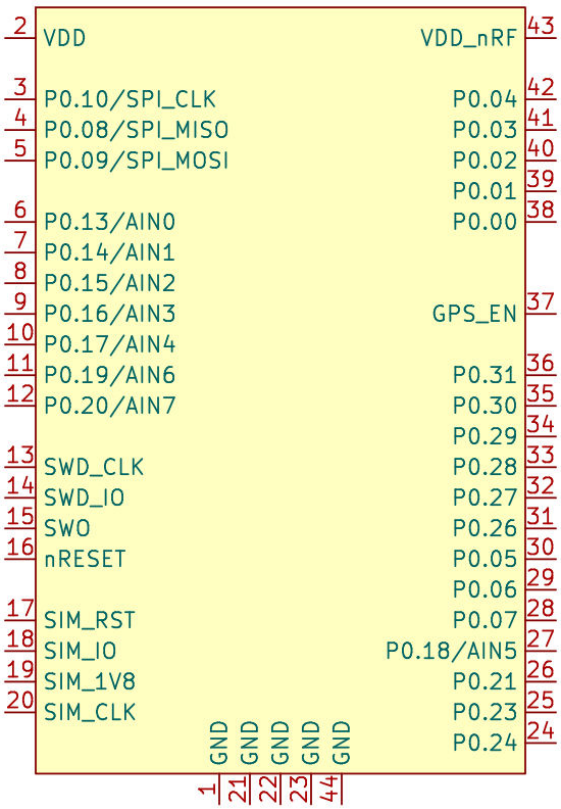
Dimensions

Parameter	Value
Height	19.1 mm
Width	28.1 mm

Pin Diagram

See norik.com for interactive pin diagram.

Pin Description



#	Label	Description	Device-tree node
1	GND	Ground power input	-
2	VDD	GPIO power input	-
3	P0.10/SPI_CLK	SPI CLK pin	spi3
4	P0.08/SPI_MISO	SPI MISO pin	spi3
5	P0.09/SPI_MOSI	SPI MOSI pin	spi3
6	P0.13/AIN0	nRF9160 P0.13 / AIN0	gpio0
7	P0.14/AIN1	nRF9160 P0.14 / AIN1	gpio0
8	P0.15/AIN2	nRF9160 P0.15 / AIN2	gpio0
9	P0.16/AIN3	nRF9160 P0.16 / AIN3	gpio0
10	P0.17/AIN4	nRF9160 P0.17 / AIN4	gpio0
11	P0.19/AIN6	nRF9160 P0.19 / AIN6	gpio0
12	P0.20/AIN7	nRF9160 P0.20 / AIN7	gpio0
13	SWD_CLK	SWDCLK programming pin	-
14	SWD_IO	SWDIO programming pin	-
15	SWO	SWO programming pin	-
16	nRESET	nRF9160 Reset	-
17	SIM_RST	External SIM Reset	-
18	SIM_IO	External SIM IO	-
19	SIM_1V8	External SIM VDD	-
20	SIM_CLK	External SIM CLK	-
21	GND	GPIO power input	-
22	GND	GPIO power input	-
23	GND	GPIO power input	-
24	P0.24	nRF9160 P0.24	gpio0
25	P0.23	nRF9160 P0.23	gpio0
26	P0.21	nRF9160 P0.21	gpio0
27	P0.18/AIN5	nRF9160 P0.18 / AIN5	gpio0
28	P0.07	nRF9160 P0.07	gpio0
29	P0.06	nRF9160 P0.06	gpio0
30	P0.05	nRF9160 P0.05	gpio0
31	P0.26	nRF9160 P0.26	gpio0
32	P0.27	nRF9160 P0.27	gpio0
33	P0.28	nRF9160 P0.28	gpio0
34	P0.29	nRF9160 P0.29	gpio0
35	P0.30	nRF9160 P0.30	gpio0
36	P0.31	nRF9160 P0.31	gpio0
37	GPS_EN	nRF9160 GPS Enable	-
38	P0.00	nRF9160 P0.00	gpio0
39	P0.01	nRF9160 P0.01	gpio0
40	P0.02	nRF9160 P0.02	gpio0

#	Label	Description	Device-tree node
41	P0.03	nRF9160 P0.03	gpio0
42	P0.04	nRF9160 P0.04	gpio0
43	VDD_nRF	nRF9160 power input	-
44	GND	Ground power input	-

GPIO pins are not 5V tolerant.

User available internal pins

nRF9160 Pin	Function	Device-tree node
P0.07	LED	gpio0
P0.11	ADXL362 CS pin	gpio0
P0.12	ADXL362 INT1	gpio0
P0.25	SIM select pin	gpio0

Peripherals

The Octopus SoM features multiple peripherals that are connected to the nRF9160 on the board or internally in the SiP.

Accelerometer

On board accelerometer is the **ADXL362** from Analog Devices. It's an ultra-low-power 3-axis accelerometer that is connected to nRF9160 via SPI and features an interrupt pin. The interrupt pin is connected to `P0.12`. It can be configured for multiple purposes, described in ADXL362 datasheet.

The accelerometer is defined in Octopus SoM device-tree under `spi3` node with `adxl362` sub-node and `accel0` alias.

See Accelerometer sample for an example on how to read the accelerometer data.

eSIM

The Octopus SoM provides the users 2 options for SIM. Option 1 is on board eSIM. Option 2 is external nano SIM, which can be connected to the board via castellated pads. User can switch between these two options using on-board switch that is controlled via `P0.25` pin:

Selection pin	Selected SIM
HIGH	External nano SIM
LOW	On-board eSIM

SIM select configuration

The SIM can be selected through device-tree using a device-tree overlay file in your project.

1. Create a new directory in your project named **`boards`**:

```
$ cd <your-project-directory>
$ mkdir boards
$ cd boards
```

1. Create an overlay file with the **exact** name of the board:

```
$ touch octopus_som_ns.overlay
```

1. Add the following device-tree node to the overlay file:

```
&sim_select {
        sim = "external"
}
```

By changing the value of `sim` to **`on-board`** you select on-board eSIM. By changing the value to **`external`** you select external nano SIM.

GPS

The GPS receiver is integrated into the RF modem of the nRF9160. To receive location data from satellites, active external GPS antenna must be connected to the on-board GPS u.fl connector. Taoglas Active Patch Antenna is an example of an compatible antenna.

nRF9160 controls the powering of the antenna using a MAGPIO pin. This saves power when the antenna isn't active.

See the GPS sample for more information regarding the use of GPS receiver.

LED

The Octopus SoM board features on-board LED that is defined using `led0` device-tree alias.

To test this LED see the blinky sample.

LTE-M / NB-IoT

The cellular modem is integrated into the nRF9160 SiP. **Compatible antenna MUST be attached to the on-board LTE u.fl connector to prevent the damage to the modem.** An example of such antenna is Taoglas Flexible Wideband Antenna.

Reference Design/Application Circuit