

ARROW ARIS EDGE S3 Board

User's Guide

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Revisions

REVISION	DATE	DESCRIPTION	STATUS	AUTHOR	REVISER
1.0	12/02/2018	Document created and released	release	L. Dal Bello	A. Ricci
1.1	21/02/2018	Board programming details updated	release	L. Dal Bello	A. Ricci

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1. Introduction

1.1. Description

ARIS EDGE S3 board, developed by RELOC for Arrow Electronics, is a ready-to-use Internet of Things (IoT) hardware and software platform that enables users to get their IoT applications up and running quickly, exploiting the Renesas Synergy development framework.

Based on Renesas Synergy S3A3 MCU with a 48-MHz ARM Cortex-M4 core with floating point unit (FPU), the ARIS EDGE S3 board has a host of features that equip it for smart sensing, IoT operations and small HMI design. Communication with other devices and the cloud is enabled by means of a flexible multi-protocol radio module, supporting Bluetooth Low Energy, Thread and ZigBee stacks. Board sensing capabilities include motion detection via 9-degrees-of-freedom IMU with sensor fusion capabilities, environmental temperature, humidity, pressure and ambient light sampling.

The Renesas Synergy Platform helps to accelerate IoT and HMI designs: a proven combination of hardware and software makes development easier and faster, thus encouraging innovation and product differentiation. The combination of Arrow ARIS EDGE S3 board and Renesas Synergy software platform enables developers to reduce time-to-market and decreases the total cost of ownership of a product over its lifetime.

1.2. Kit contents

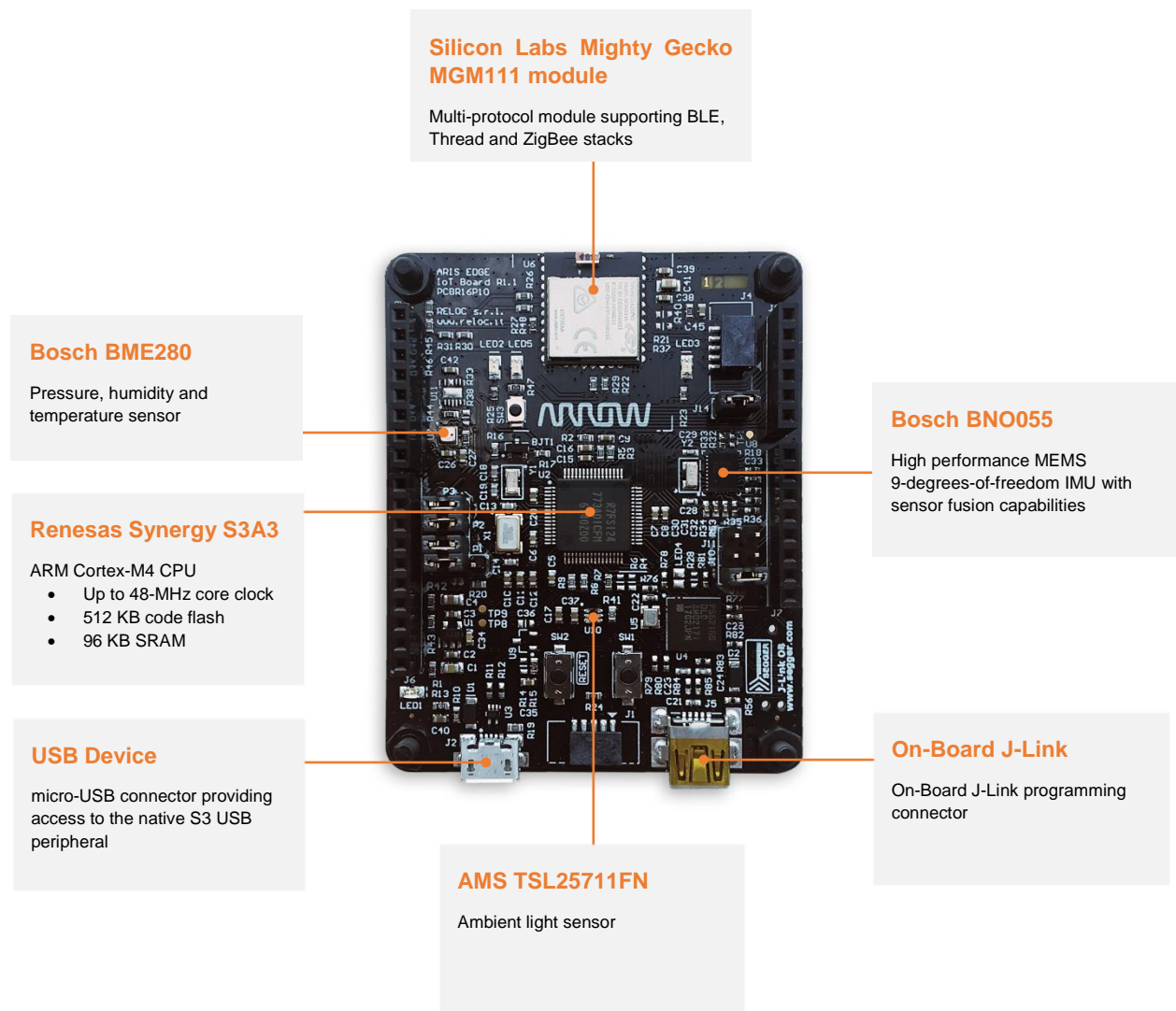
The following items are included in the box:

- 1x ARIS EDGE S3 board
- 1x USB type A-male to mini-B-male cable

2. System overview

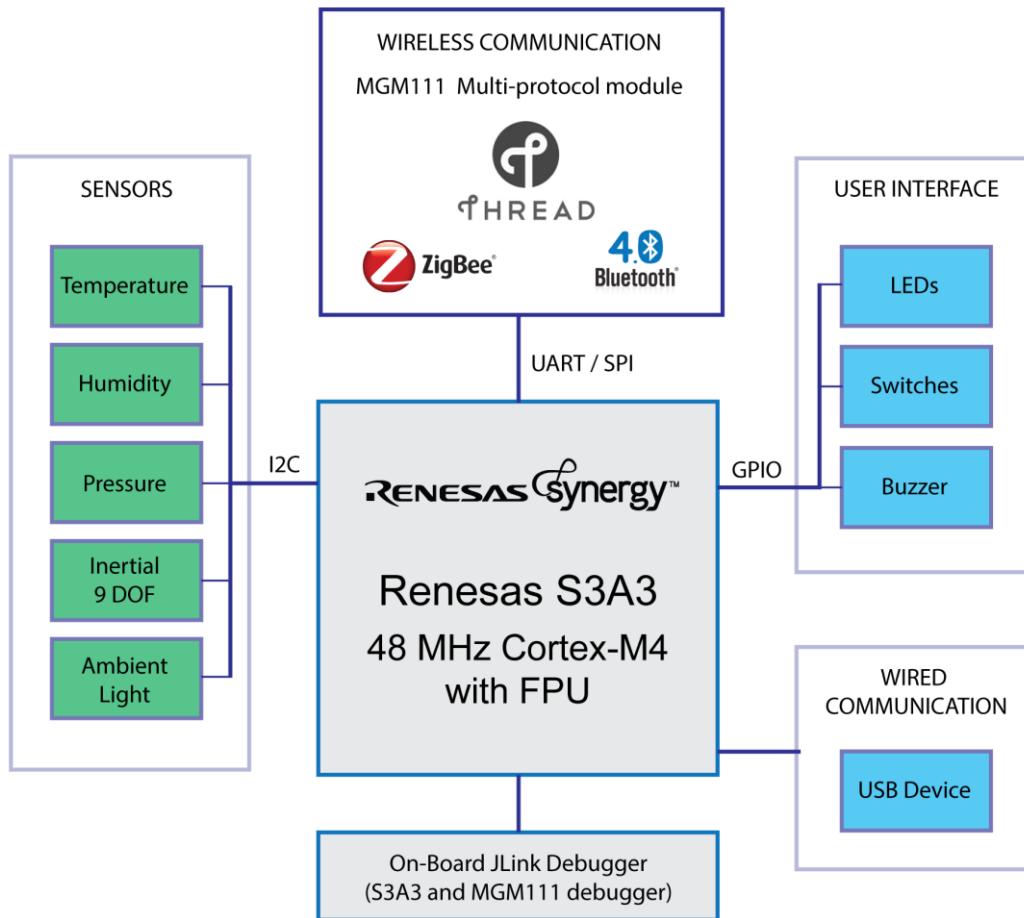
2.1. Board main features

ARIS EDGE S3 board main features are summarized in the picture below.



2.2. Block diagram

An overview of the functional blocks of ARIS EDGE S3 board is shown in the figure below.



3. Getting started

3.1. ARIS EDGE S3 pre-programmed demo

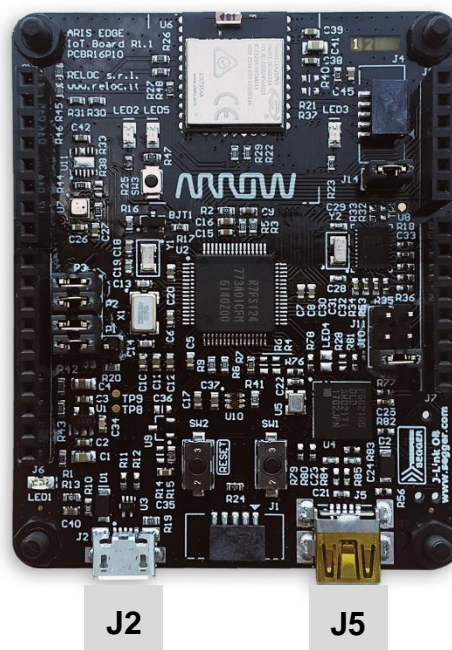
The ARIS EDGE S3 board is pre-programmed with a demo application which continuously monitors the on-board sensors and sends collected data on Bluetooth Low-Energy (BLE) network.

The Synergy S3 device takes care of sampling sensors data whereas the MGM111 multi-protocol module establishes the BLE communication with a BLE client.

Additional information about the internal demo software behavior can be found in “BLE Sensors demo” document.

In order to test ARIS EDGE S3 functionalities by means of pre-programmed demo application

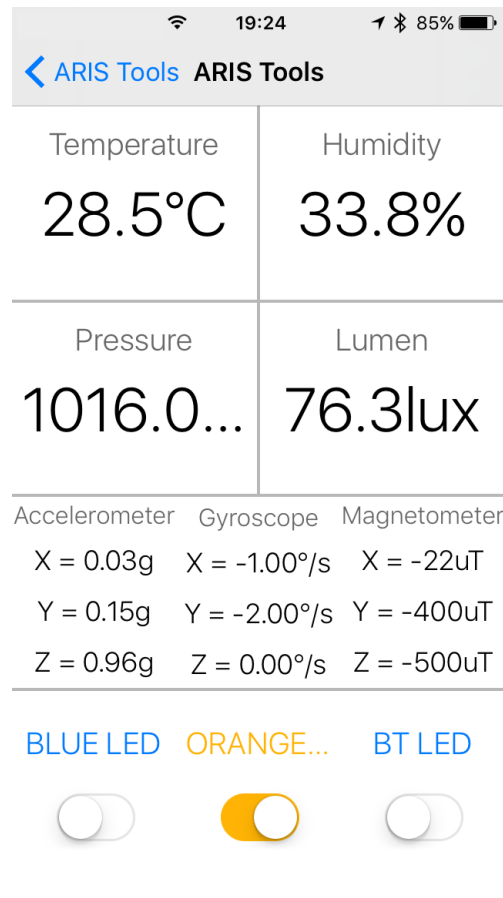
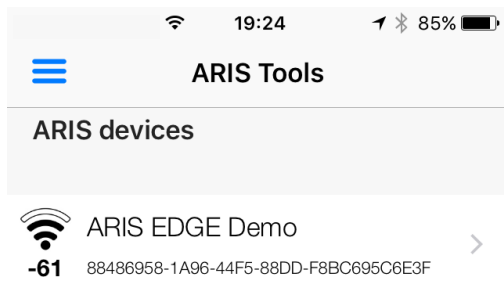
1. download the free ARIS Tools smartphone App from
 - a. Apple App Store™ (<https://itunes.apple.com/us/app/aris-tools/id1161792783>) or
 - b. Google Play™ (<https://play.google.com/store/apps/details?id=com.demo.rlc.arisapp>);
2. power supply the ARIS EDGE S3 board through either J2 or J5 USB connector



3. open the ARIS Tools smartphone App and select your ARIS EDGE S3 from the device list.

The application

- a. shows sensor values in real-time through the BLE communication channel,
- b. enables user to remotely control the board LEDs by means of App buttons.



3.2. Creating and debugging a sample “Blinky” project

3.2.1 Prerequisites

The following development tools should be installed before trying to either create a project or use any example based on ARIS board:

- e² studio v5.4.0.023 or later release
- Synergy Software Package v1.3.3 or later release

Please refer to the [Synergy Gallery](#) website for more information and for obtaining the required software.

3.2.2 ARIS EDGE S3 BSP

ARIS EDGE S3 Board Support Package (BSP) provides a default configuration for ARIS EDGE S3 board peripherals.

ARIS EDGE S3 BSP is available for download at the following link:

http://www.reloc.it/download/products/ARIS-EDGE-S3/reloc.aris_edge3.1.3.3.zip

In order to install it, please unzip the archive and copy the file “Reloc.Aris_Edge3.1.3.3.pack” in the following directory:

`%e2_studio_install_dir%\internal\projectgen\arm\Packs`

where

`%e2_studio_install_dir%` is typically the folder “C:\Renesas\e2_studio\”

3.2.3 Creating and building a demo project

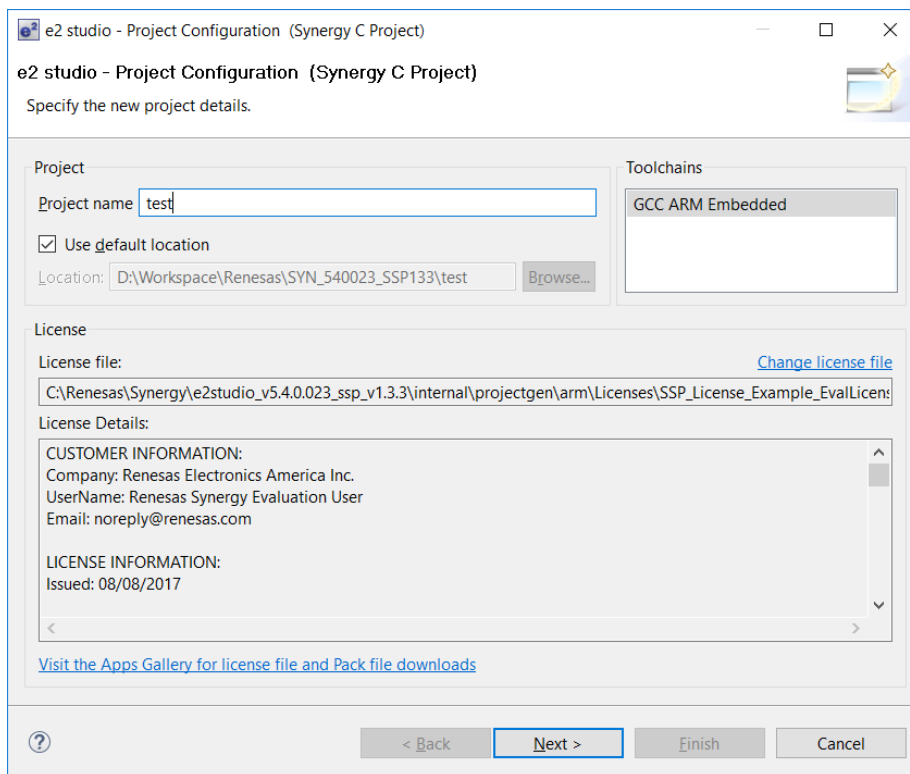
To create a Synergy project with the ARIS EDGE S3 board as a target, please follow the following steps within e² studio:

- Select **File** → **New** → **Synergy C Project** in the e² studio main menu
- Assign a new project name and select GCC toolchain

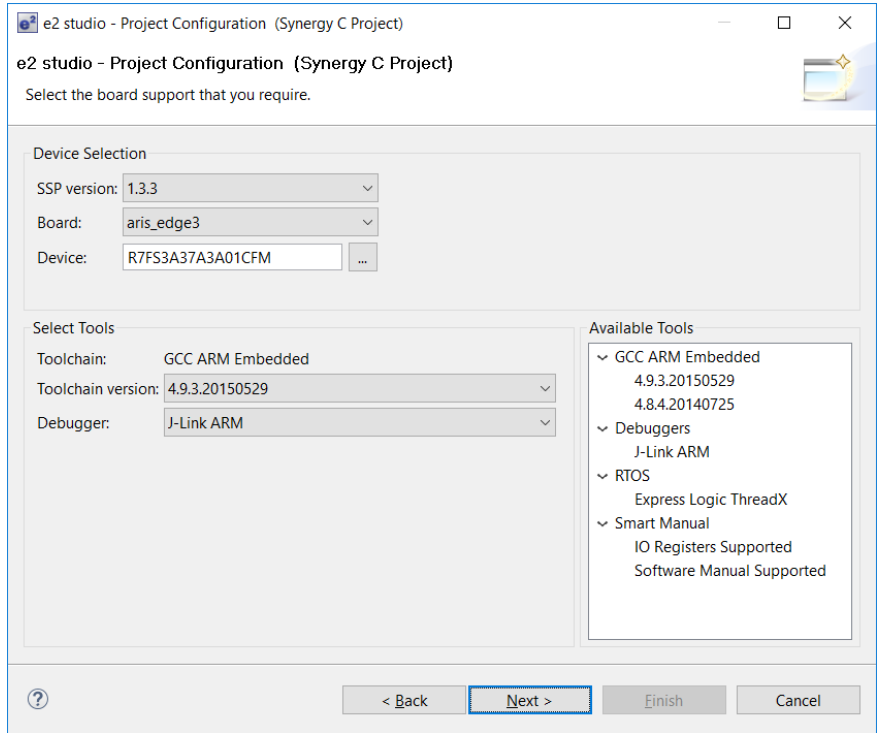
A license file is required for using Synergy platform; an evaluation license is provided with SSP in the following directory:

`%e2_studio_install_dir%\internal\projectgen\arm\Licenses`

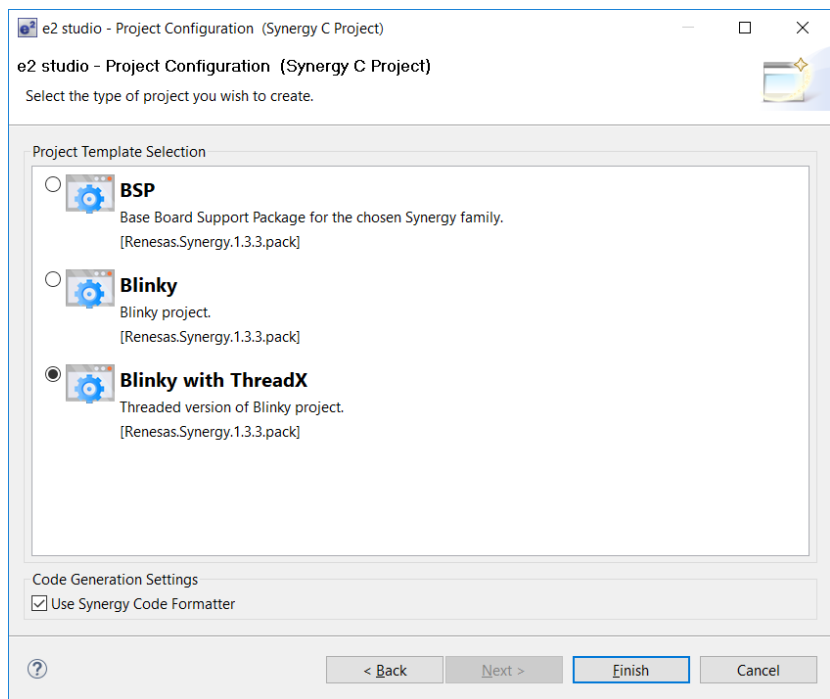
Please refer to [Synergy Gallery](#) website for additional information about obtaining development and production licenses.



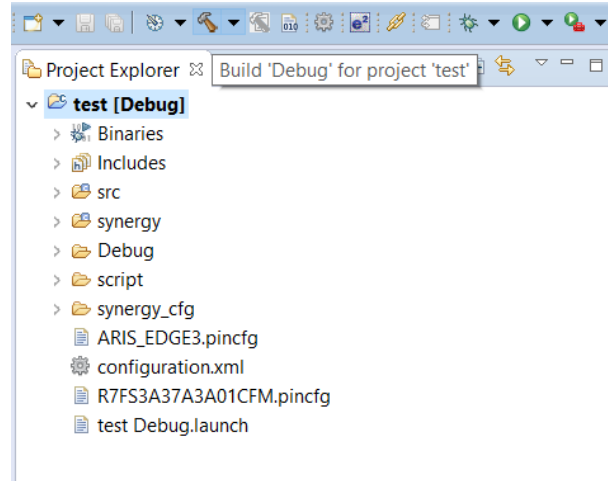
- Select the “aris_edge3” board and verify the other parameters accordingly to the picture below



- Select the “Blinky with ThreadX” project template and confirm with the Finish button:



- You should now be able to build the project by clicking on the `Build` button:



Compilation should end without any error or warning.

3.2.4 Board configuration and connection

Connect the ARIS EDGE S3 board to your PC through the mini-USB port - J5: this connection provides board with power supply and represents the interface for project flashing and debugging via on-board J-Link programmer.

Ensure that J15 jumper is open, i.e. the on-board J-Link debugger is connect to the S3 MCU.

Jumpers P1, P2 and P3 (populated in the default configuration) route power to the Synergy MCU and to peripheral components. P1 can also be used to measure the current consumption of the S3 device.

Please refer to following chapters for additional information about the board power supply distribution.

3.2.5 Program and debug S3 project

In order to check the correct behavior of the sample “Blinky” application start the Debug by selecting `Run` → `Debug` from the menu; if there are no errors the “Blinky” application will be downloaded to the ARIS EDGE S3 board and the development environment will automatically switch to the `Debug Perspective`.

Click on `Resume` (F8) two times in order to execute the application. LED2 and LED3 should start blinking.

3.3. Flashing a binary firmware on MGM111 multi-protocol radio module

MGM111 device can be programmed through either the on-board J-Link debugger or using an external SEGGER J-Link programmer connected to J4 connector. In order to use the on-board J-Link debugger ensure that J15 jumper is short, i.e. the on-board J-Link debugger is connect to the MGM111 module.

In terms of software, SEGGER J-Link Software Pack can be used for flashing MGM111 device. SEGGER pack includes J-Link Commander, a command-line based tool, and J-Flash, a GUI-based software.

Please download and install the latest J-Link Software and Documentation Pack from the following link:

<https://www.segger.com/downloads/jlink/#J-LinkSoftwareAndDocumentationPack>

3.3.1 J-Link Commander tool

J-Link Commander (JLink.exe) is a free command-line based utility that allows to download a binary firmware into the flash memory of a target microcontroller. It supports simple commands, such as memory program and dump, application launch, halt, step, etc. J-Link Commander is part of the J-Link Software and Documentation package and, after SEGGER software installation, it can be found at

```
%j-link_install_dir%\JLink.exe
```

where

`%j-link_install_dir%` is the J-Link software installation folder (e.g. "C:\Program Files\SEGGER\JLink_V630d").

In order to download a binary file into MGM111 module

- using the on-board J-Link debugger
 - connect the ARIS EDGE J5 mini-USB port to the PC
 - short J15 jumper
- otherwise, using an external SEGGER J-Link debugger
 - connect J-Link to the PC
 - supply ARIS EDGE S3 with power, e.g. via J2 micro-USB port
 - connect J-Link debugger to target ARIS EDGE via J4 port
- remove jumper J14 (preventing S3 to control MGM111 reset signal)
- start J-Link Commander
- enter the requested settings (e.g. target device, interface settings, etc.) and launch programming procedure using the following commands

```
Device EFR32MG1PxxxF256
```

```
si SWD
speed a
erase
loadfile "%path_to_binaries%/firmware.srec"
exit
```

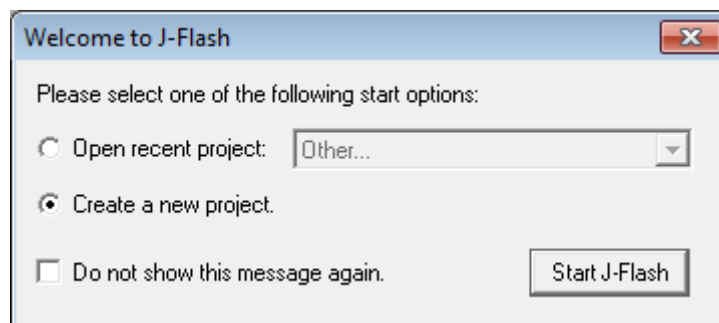
where %path_to_binaries% is the path to application firmware

- J-Link Commander executes the flash download and prints out the time statistics on success
- restore J14 jumper.

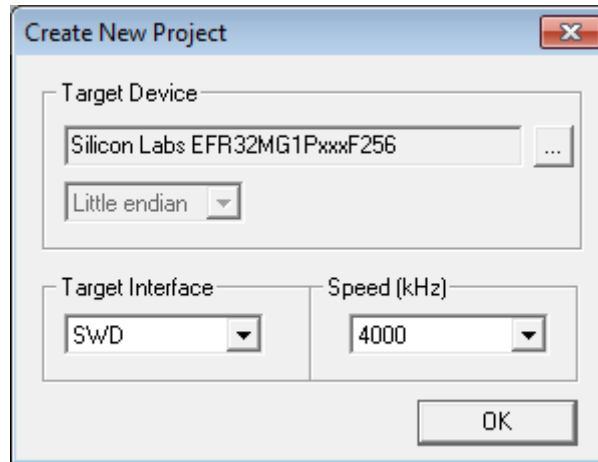
3.3.2 J-Flash tool

The J-Flash software is a separate software tool from SEGGER which requires an extra license. In particular, J-Flash license is bound to the serial number of a J-Link programmer. If you own a license bounded to a SEGGER J-Link debugger, exploit J4 connector to connect the external SEGGER programmer to the MGM111 module.

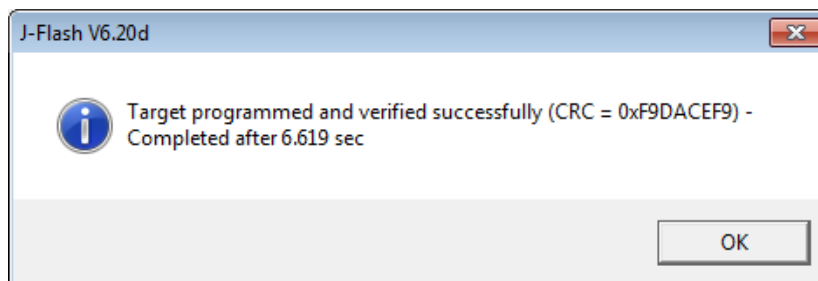
- Remove jumper J14 (preventing S3 to control MGM111 reset signal). Start J-Flash software, select the option to create a new project and press Start J-Flash button:



- select EFR32MG1PxxxF256 as a target device and confirm the choice:



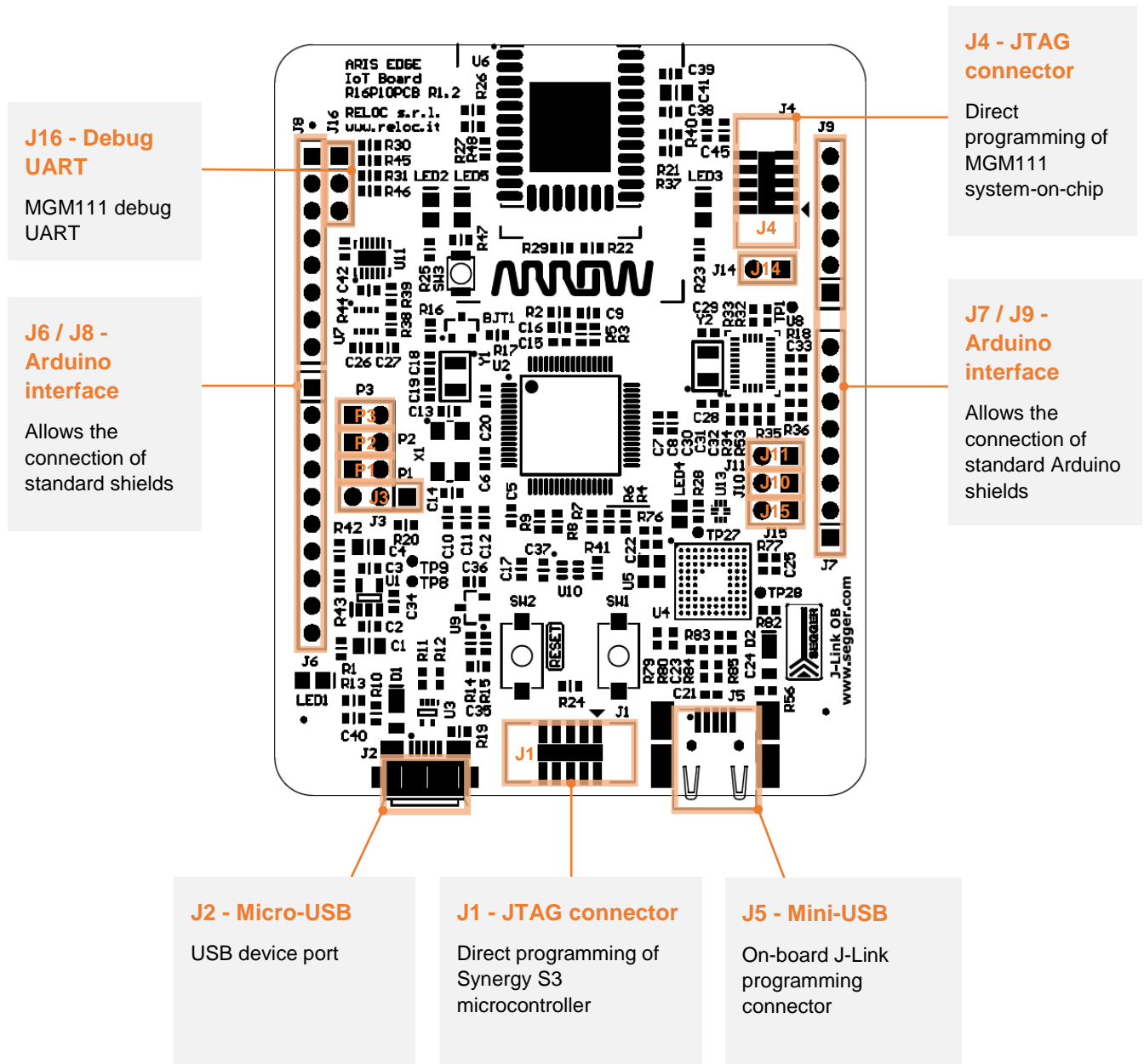
- from J-Flash menu:
 - **Select File** → Open data file in order to select the desired firmware file;
 - **Select Target** → Connect;
 - **Select Target** → Manual Programming → Program & Verify.
- if the operation is successful, the following confirmation message will be displayed:

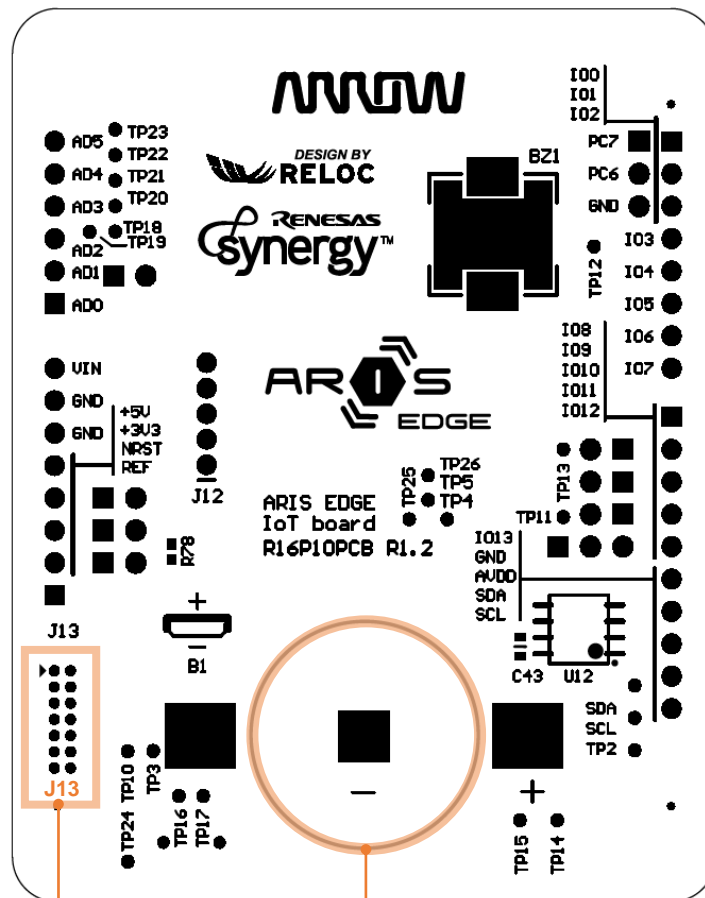


- restore J14 jumper.

4. Connectors

This chapter gives an overview of ARIS EDGE S3 connectors placement and their functionalities.





J13 - Auxiliary E1 connector

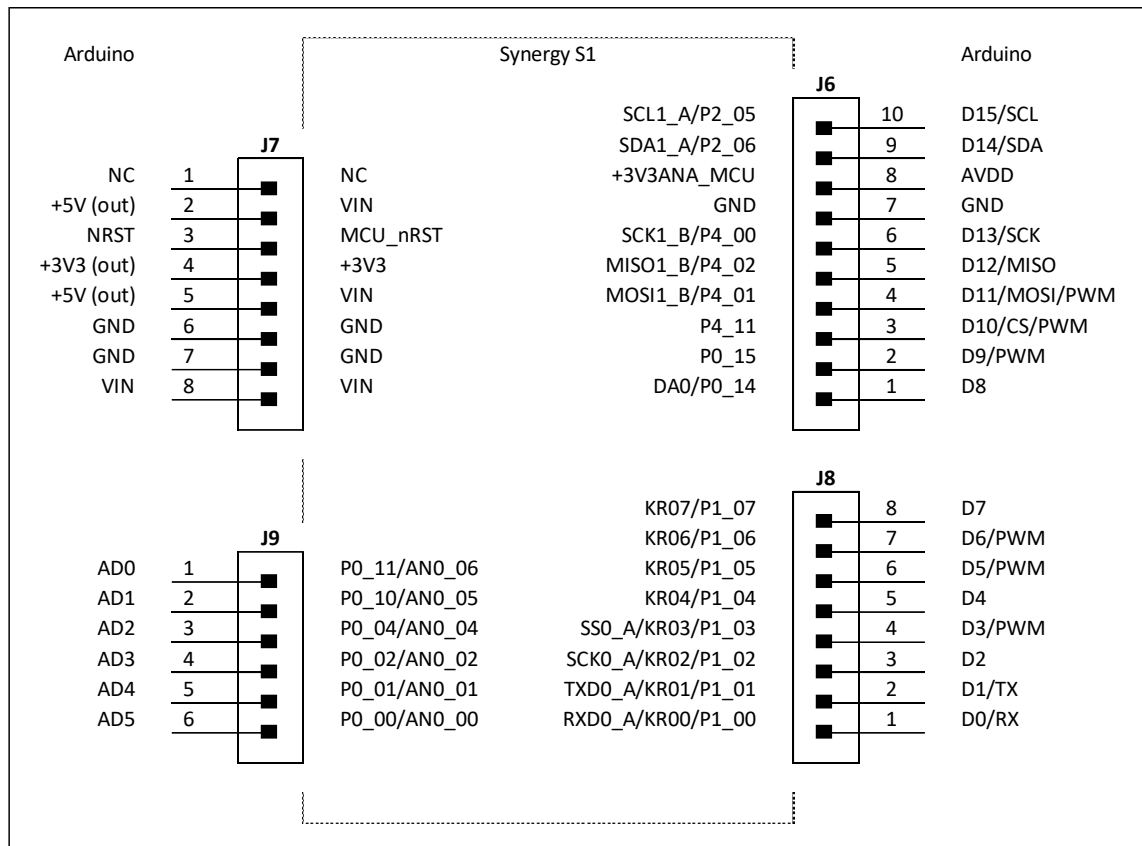
RX621 E1 debug connector (board manufacturing support connector)

B1 - Coin battery

Power supply ARIS EDGE S3 by means of a coin battery

4.1. Arduino expansion connector

Connectors J6, J7, J8 and J9 provide user with a standard Arduino shield expansion slot.



Signal	Description
NC	Not connected
VIN	Input voltage
MCU_nRST	MCU reset signal (active low)
+3V3	+3.3V power supply
GND	Ground connections
PO_00-04, PO_10-11	Analog inputs directly connected to MCU
P2_05-06	I2C interface (IIC1_A) shared with on-board sensors
+3V3ANA_MCU	Analog reference
P4_00-22, P4_11	SPI port (SCI1_B); GPIO P4_11 is used as SPI chip select signal
P0_15	GPIO shared with Light Sensor interrupt
P0_14	Digital to analog converter (DAO)
P1_04-07	GPIOs directly connected to MCU
P1_02-03	SPI port (SCIO_A) slave select and clock signals; P1_01-02 ports can be used as MOSI / MISO terminals
P1_00-01	SCIO_A uart transmitter and receiver signals

4.2. JTAG connectors

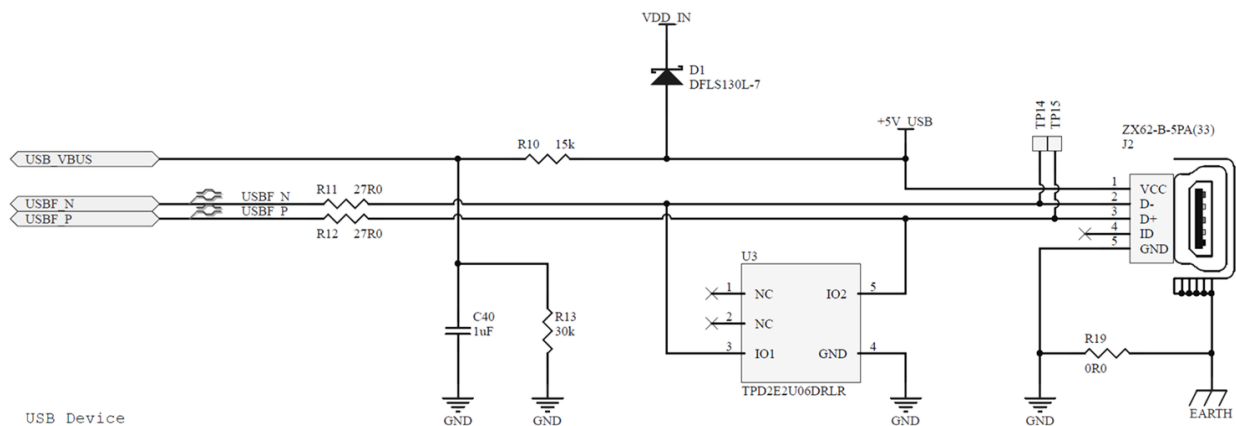
The ARIS EDGE S3 development kit features an on-board SEGGER J-Link debugger (see J5 mini-USB port), which can be used to program and debug both the Synergy S3 microcontroller and MGM111 module.

The ARIS EDGE S3 board includes additional JTAG connectors, detailed below for reference:

- J1 – JTAG connector which can be used to program and debug Synergy S3 with an external J-Link debugger;
- J4 – JTAG connector routed to the Silicon Labs Mighty Gecko system-on-chip (MGM111 module);
- J13 – E1 programmer connector routed to the Renesas RX621 chip. Such a chip provides users with the on-board SEGGER J-Link facility, thus it should not be erased and/or re-programmed.

4.3. USB device port

The ARIS EDGE S3 board is equipped with a USB Full-Speed (12 Mbps) device port on J2 connector. ARIS EDGE S3 can be powered through this interface (see diode D1).



5. Usage

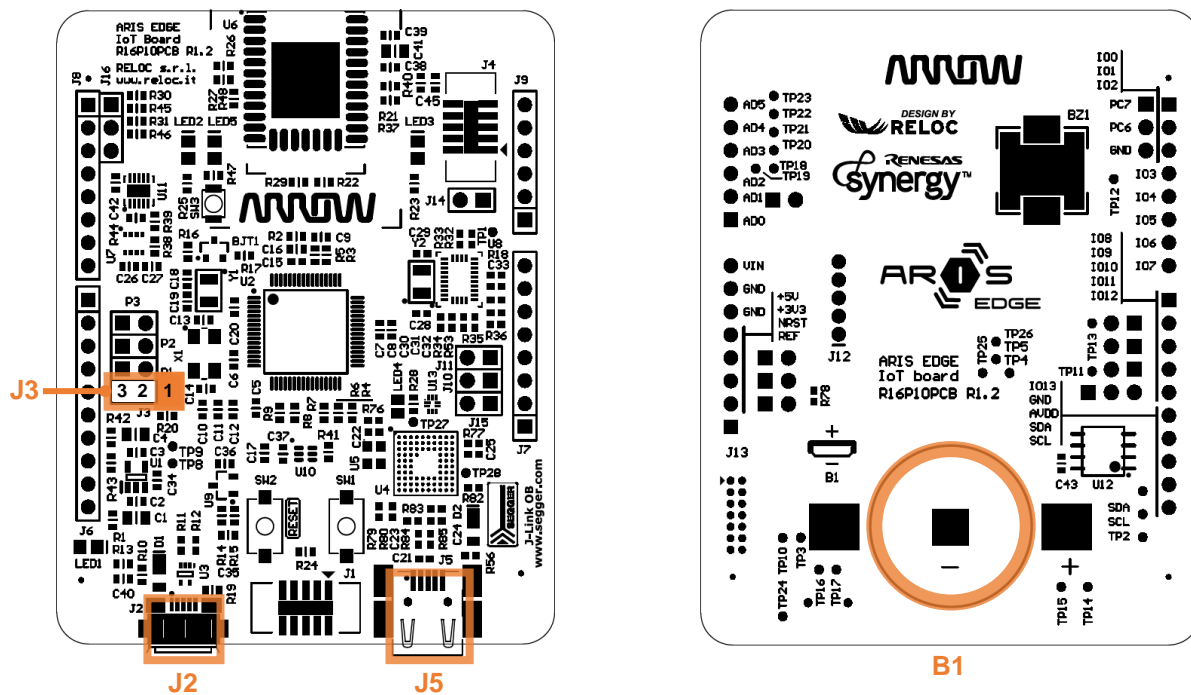
This chapter describes how to connect, configure and interact with the ARIS EDGE S3 board.

5.1. Power supply

The ARIS EDGE S3 board can be supplied with power from

- the mini-USB port J5,
- the micro-USB port J2,
- or the battery connector B1.

Please Note: it is not recommended to use more than one power supply source at the same time.

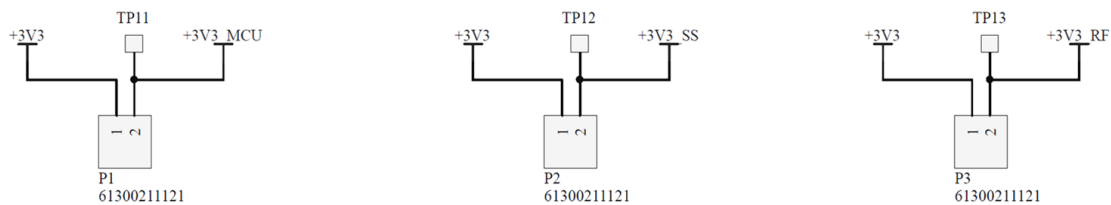


In order to power supply ARIS EDGE S3 board either from J2 or J5, short J3 pins 2 and 3 (populated in the default configuration). Otherwise, short J2 pins 1 and 2 to exploit battery connector B1.

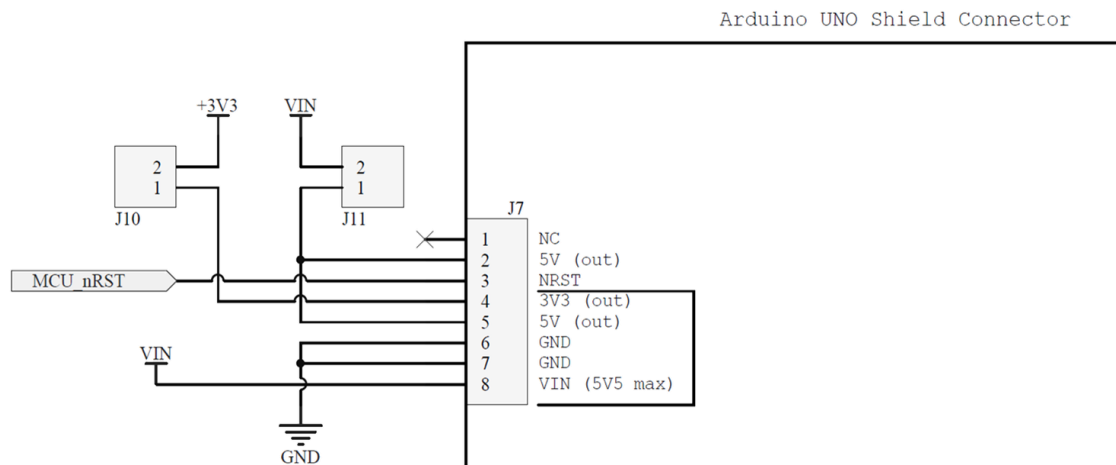
5.2. Power enable and measurement

P1, P2 and P3 (populated in the default configuration) provide power to the Synergy S3 MCU, sensors and radio module, respectively (i.e. connect the input power sources to the board loads).

They can also be used to measure the current consumption of the ARIS EDGE S3 circuitry sections.



J10 and J11 (*not* populated in the default configuration) could be used to provide power to the Arduino connectors; before placing a jumper please check that current consumption of the shield is within maximum values provided by the +5V input and +3.3V regulated power supply.

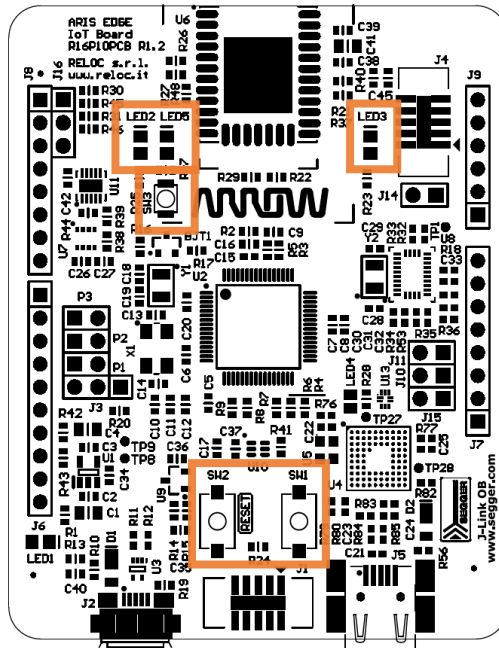


5.3. Push buttons, LEDs and buzzer

ARIS EDGE S3 developer is provided with a basic user interface, including buttons, LEDs and buzzer.

Buttons and LEDs are directly connected to both Renesas Synergy S3 MCU (SW1, SW2, LED2, LED3) and Silicon Labs Mighty Gecko module (SW3, LED5).

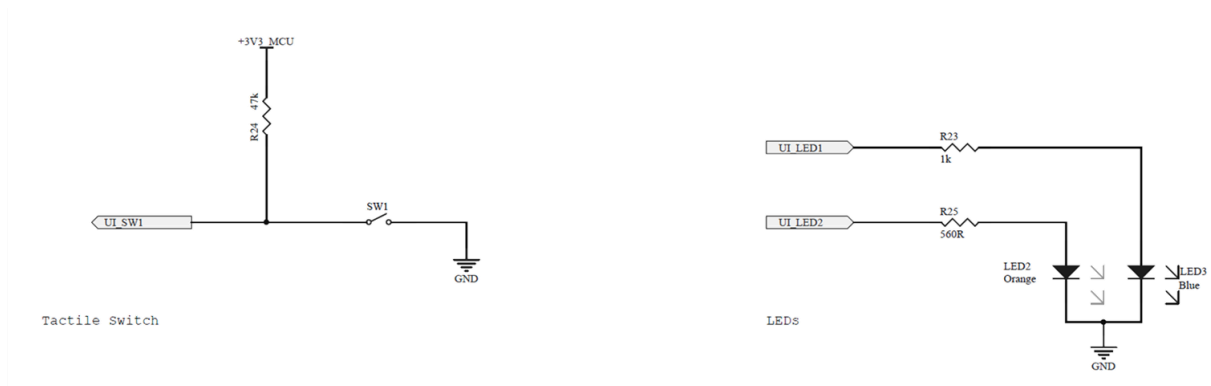
Buttons and LEDs positions are highlighted in the picture below.



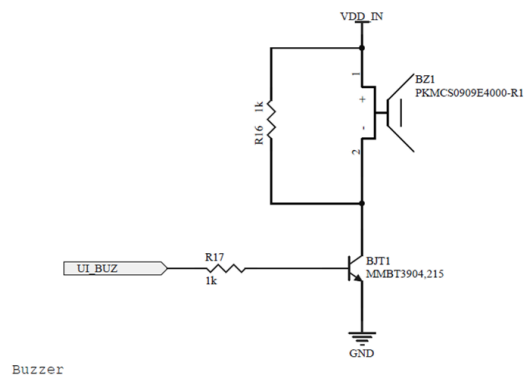
Mapping of the user interface to the S3 microcontroller and MGM111 module pins is provided below.

Device	Port	Schematic Signal	Description
Synergy S3	P3_01	UI_SW1	SW1 tactile switch
	RES#	MCU_nRST	SW2 tactile switch connected to MCU reset signal (active low)
	P1_13	UI_LED1	LED3 Blue LED
	P3_03	UI_LED2	LED2 Orange LED
	P5_01	UI_BUZ	BZ1 buzzer
Mighty Gecko module	PA3	RF_SW	SW3 tactile switch
	PA4	RF_LED	LED5 Blue LED

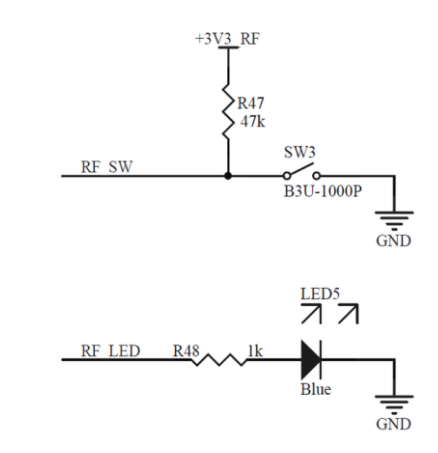
Schematic extracts are provided as an additional reference.



Synergy S3 tactile switch and LEDs.



Synergy S3 buzzer.



Mighty Gecko tactile switch and LED.

