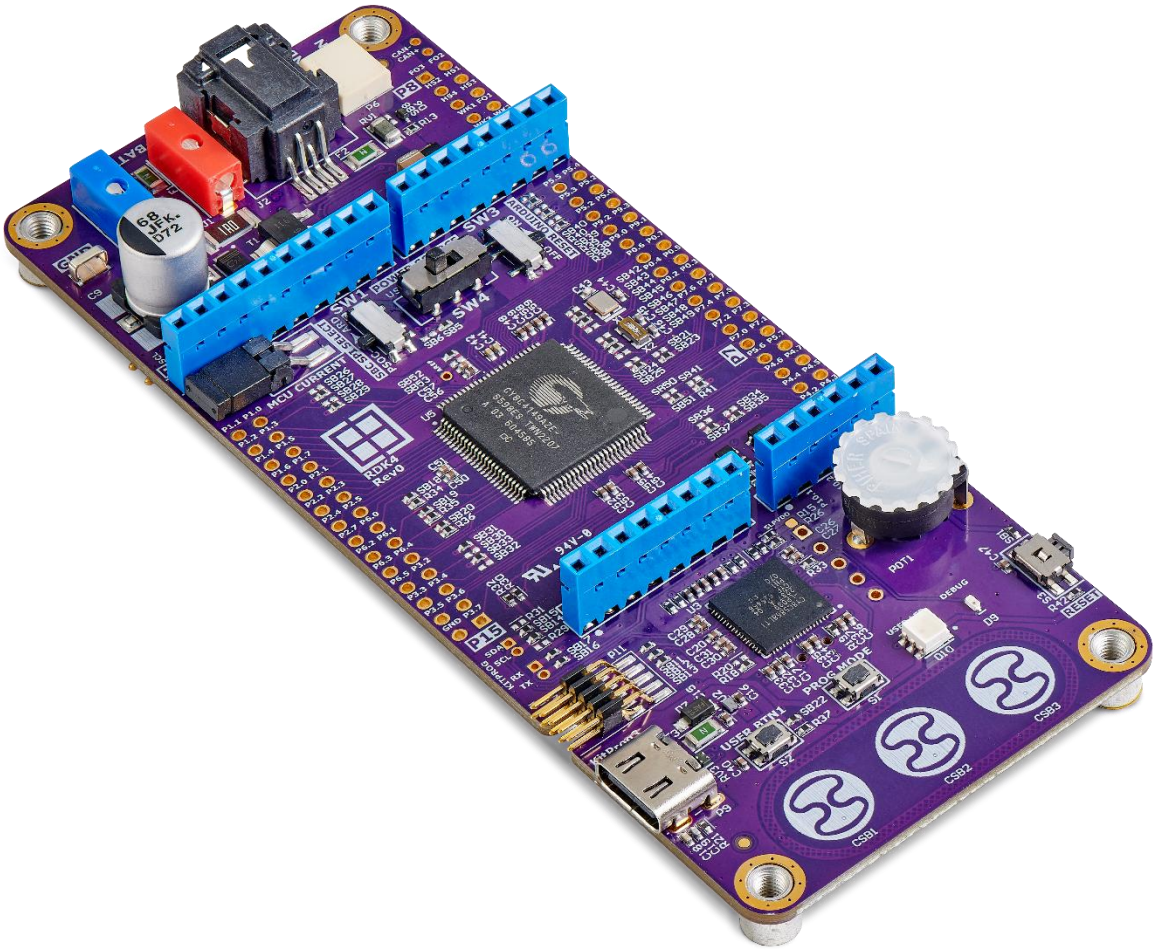
RDK4 User Manual



Versions

Version	Date	Rationale
0.1	November 07, 2022	First draft. Author: GDR
0.2	April 04, 2023	Rev1 Updates. Author: GDR
1.0	May 16, 2023	New structure, update of pictures. Author: KOA

Legal Disclaimer

The evaluation board is for testing purposes only and, because it has limited functions and limited resilience, is not suitable for permanent use under real conditions. If the evaluation board is nevertheless used under real conditions, this is done at one's responsibility;
any liability of Rutronik is insofar excluded.

Table of Contents

Overview

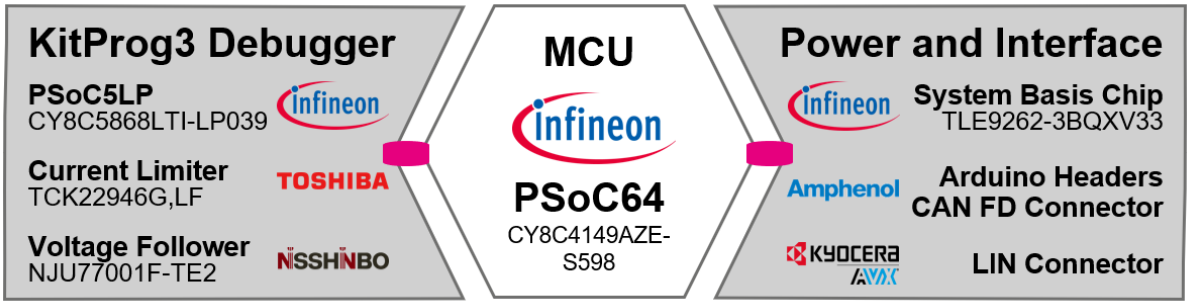
Features

The development kit RDK4 is based on an automotive PSoC 4100S Max microcontroller and TLE9262-3BQX System-Basis Chip. The RDK4 is a solution created by Rutronik that enables developers to evaluate and implement their ideas into their automotive or industrial projects.

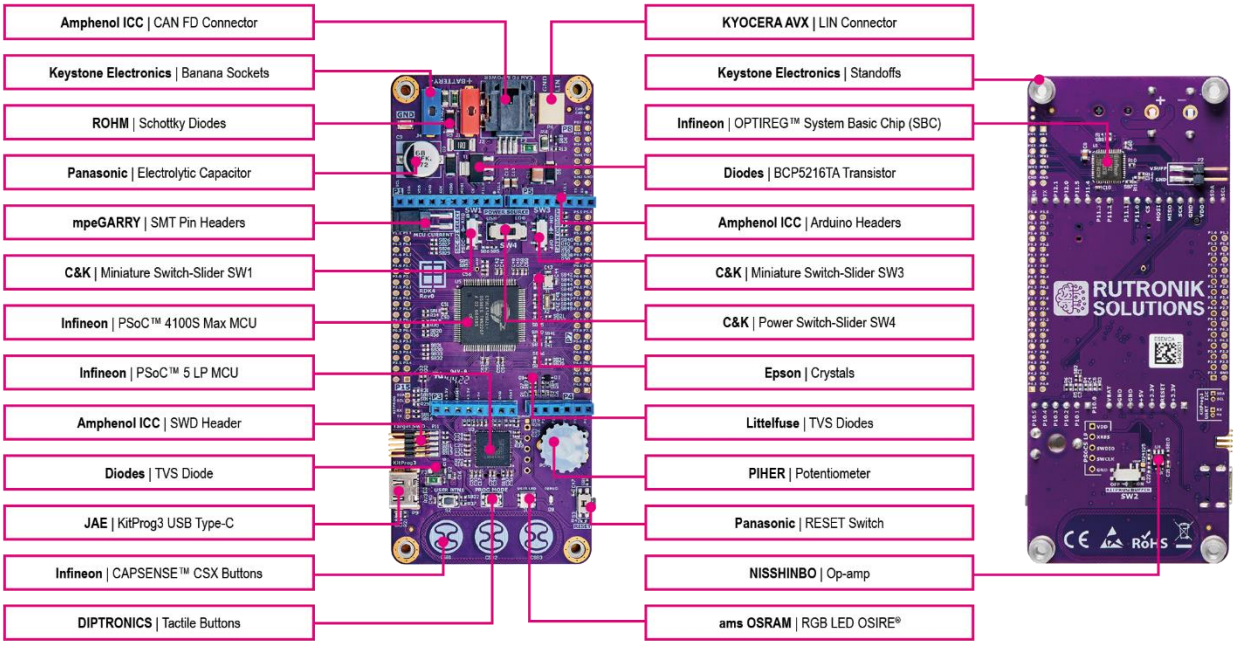
Key features of RDK4:

- CY8C4149AZE-S598 – Infineon's Arm® Cortex™-M0+ AEC-Q100 compliant MCU.
- All CY8C4149AZE-S598 GPIOs are accessible via onboard headers.
- TLE9262-3BQXV33 - Infineon's System Basis Chip for automotive applications.
- On-board debugger KitProg3 with I2C and UART USB bridge.
- 10-pin Amphenol ICC SWD header for J-Link.
- JAE USB Type-C connector for the KitProg3 debugger.
- Minitek MicroSpace™ CAN FD connector.
- On-board capacitive buttons based on CapSense® CSX technology.
- TOPLED® E1608 and OSIRE® E3635 OSRAM LEDs.
- Diodes Inc. automotive PNP Power Transistor BCP5216TA for the SBC LDO circuit.
- Keystone Electronics Corp. P/N5019 GND test point.
- TOSHIBA Load Switch (with the current limiting capability) TCK22946G,LF.
- NISSHINBO low power amplifier NJU77001F.
- DIPTRONICS tactile buttons.
- Panasonic Right-angled RESET switch.
- C&K Slider switches for power supply selection and hardware configuration.
- PIHER Potentiometer for ADC peripheral evaluation.
- Passive components from Samsung EM, Yageo, and ASJ.

Block Diagram



Component Placement



Delivery Set

The delivery set of RDK4 includes:

- RDK4 development board.
- On-board debugger KitProg3 with I2C and UART USB bridge.
- USB 2.0 Cable A Male to C Male to connect the board to PC.
- Two solder tip plugs P/N 6006 for the battery power supply connection through the banana sockets J1 and J4.

Applicable Boards

To be updated

Hardware

Microcontroller

Automotive PSoC® 4 MCU platform has an AEC-Q100 qualification established by Automotive Electronics Council (AEC).

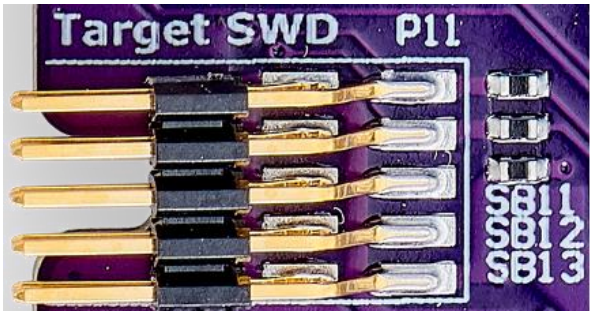
32-bit MCU subsystem includes:

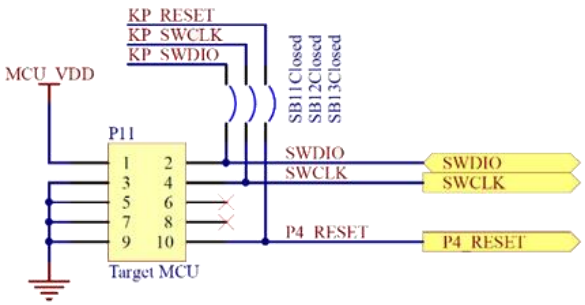
- 48-MHz Arm Cortex-M0+ CPU.
- Up to 384 KB of flash with accelerator, coupled to the CPU to improve average access times from the flash block.
- Up to 32 KB of SRAM with zero wait-state access at 48 MHz.
- 16-channel Direct Memory Access engine.

CapSense is supported on all pins in PSoC 4100S Max via a Multi-Sensing Converter that can be connected to any pin via the Analog Mux Busses that any GPIO pin can be connected to.

Programming Using External Connector

Users may use third-party programming devices to connect the CY8C4149AZE-S598 target via the P11 SWD connector. The onboard “KitProg3” debugger should not be powered while using an external JTAG connector.

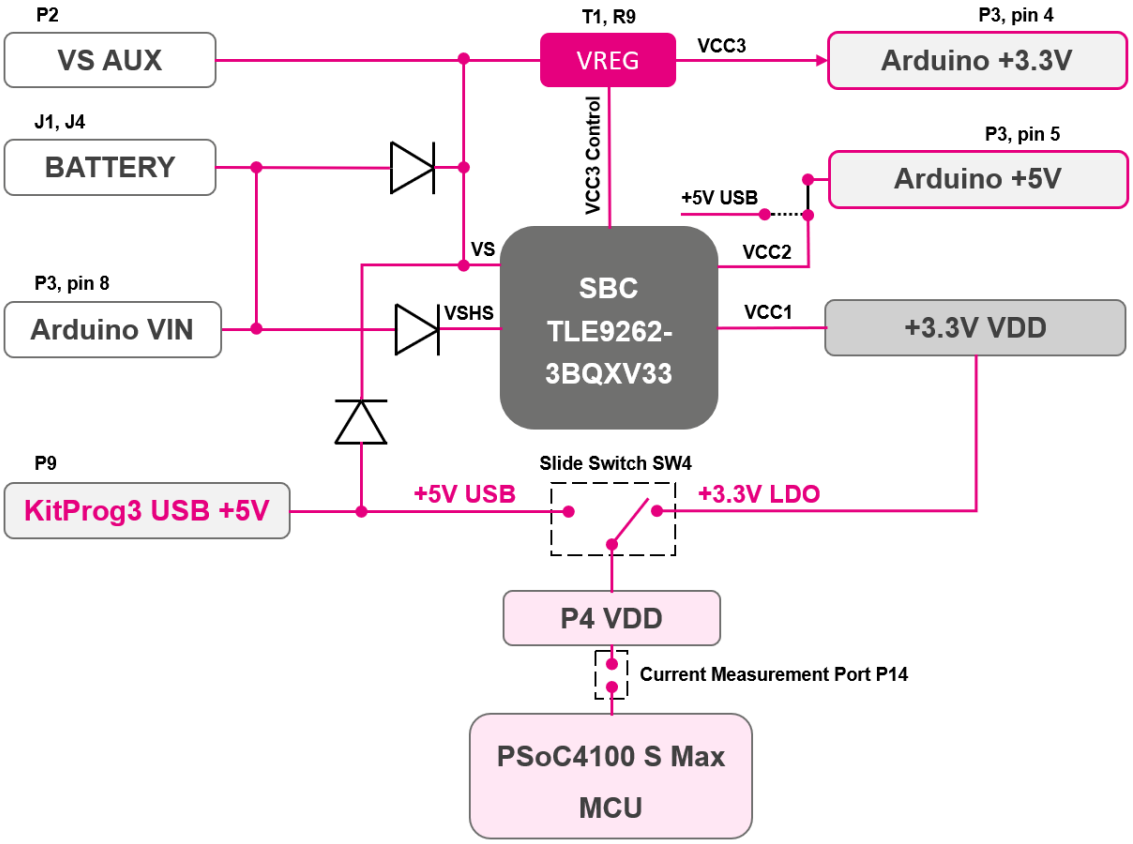




Power Sources

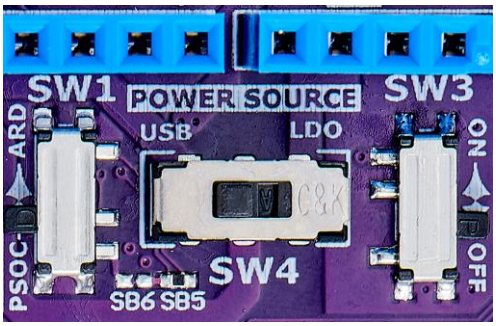
There are four ways to provide power for the MCU in RDK4:

1. KitProg3 USB Type-C port 5.5V maximum.
2. Arduino connector P3 pin 8 [VIN] 26V maximum.
3. VS AUX header P2 26V maximum.
4. Battery banana sockets J1 and J4 26V maximum.



Power Distribution Diagram

Select the main power supply using SW4 – the KitProg3 USB Type-C port **USB** or the 3.3V System Basis Chip VCC1 **LDO** output.



Insertion and Extraction of Wire from AVX 9296 Connectors

The RDK4 board has two AVX 9296 2-pin connectors for the Li-ion battery and load connection (P13 and P6). The 20/22/24/26AWG wires are recommended to be striped from 3.5mm to 4.5mm before insertion. Once inserted it can be extracted without any tools. Gently rotate the wire while pulling until the extraction is complete. Please refer to the application note 201-01-167 provided by the AVX for more detailed information.

Spare GPIOs

All GPIOs of CY8C4149AZE-S598 MCU are available at sockets P7, P8, and P15. Some may need to be configured using solder bridges.

Socket P7 Pinout				Socket P15 Pinout			
Pin No.	**Name**	**Name**	**Pin No.**	**Pin No.**	**Name**	**Name**	**Pin No.**
1	P4.1	P4.0	2	1	P3.7	GND	2
3	P4.3	P4.2	4	3	P3.6	P3.5	4
5	P4.5	P4.4	6	5	P3.4	P3.3	6
7	P4.7	P4.6	8	7	P3.2	P6.5	8
9	P5.7	P5.6	10	9	P6.4	P6.3	10
11	P7.1	P7.0	12	11	P6.1	P6.2	12
13	P7.3	P7.2	14	13	P6.0	P10.5	14
15	P7.5	P7.4	16	15	P10.3	P10.4	16
17	P7.7	P7.6	18	17	P10.1	P10.2	18
19	P0.3	P0.2	20	19	P2.7	P10.0	20
21	P0.5	P0.4	22	21	P1.7	P1.6	22
23	P0.7	P0.6	24	23	P1.5	P1.4	24
25	P9.1	P9.0	26	25	P1.3	P1.2	26
27	P9.3	P9.2	28	27	P1.0	P1.1	28
29	P5.0	P5.1	30				
31	P5.2	P5.3	32				
33	P5.4	P5.5	34				

Socket P8 Pinout			
Pin No.	**Name**	**Name**	**Pin No.**
1	FO_OUT3	FO_OUT2	2
3	HS_OUT2	HS_OUT1	4
5	HS_OUT4	HS_OUT3	6
7	WAKEUP1	FO_OUT1	8
9	WAKEUP3	WAKEUP2	10
11	SBC RESET	GND	12

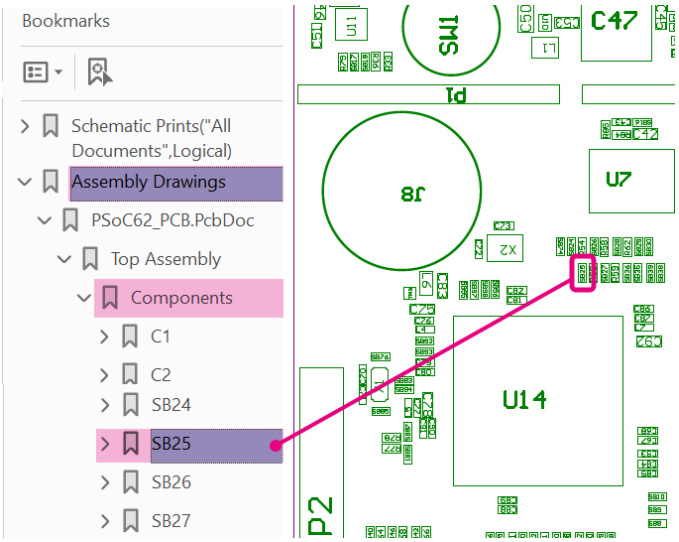
Solder Bridges

Name	Circuit	Default
SB1	P4_VDD_BUF Supply for the Potentiometer	Closed
SB2	Potentiometer Output with ADC5 P2.4	Closed
SB3	TVS protector with ADC1 P2.0	Closed
SB4	TVS protector with ADC2 P2.1	Closed
SB5	Arduino SPI CS with SBC CS (over SW1)	Closed
SB6	MCU SPI CS with Arduino SPI CS	Opened
SB7	Ignition Circuit with SBC WK3 pin	Closed

SB8	LIN 1K pull-up resistor	Opened
SB9	CAN FD Termination	Closed
SB10	Op-amp NJU77001F (U4) +Input	Closed
SB11	KitProg3 SWDIO with MCU SWDIO	Closed
SB12	KitProg3 SWCLK with MCU SWCLK	Closed
SB13	KitProg3 RESET with MCU RESET	Closed
SB14	KitProg3 I2C SCL with MCU I2C SCL	Closed
SB15	KitProg3 I2C SDA with MCU I2C SDA	Closed
SB16	KitProg3 UART TX with MCU UART RX	Closed
SB17	KitProg3 UART RX with MCU UART TX	Closed
SB18	D10 RGB GREEN LED with P6.0	Closed
SB19	D10 RGB RED LED with P6.0	Closed
SB20	D10 RGB BLUE LED with P6.4	Closed
SB21	Header P7 pin 20 with MCU P0.2	Closed
SB22	USER BUTTON Circuit with MCU P6.3	Closed
SB23	CAN FD RX with MCU P0.2	Closed
SB24	Header P7 pin 19 with MCU P0.3	Closed
SB25	CAN FD TX with MCU P0.3	Closed
SB26	Header P15 pin 27 with MCU P1.0	Opened
SB27	MCU P1.0 with KitProg3 UART TX	Closed
SB28	Header P15 pin 28 with MCU P1.1	Opened
SB29	MCU P1.1 with KitProg3 UART RX	Closed
SB30	Header P15 pin 7 with MCU P3.2	Opened
SB31	KitProg3 SWDIO with MCU P3.2	Closed
SB32	Header P15 pin 6 with MCU P3.3	Opened
SB33	KitProg3 SWCLK with MCU P3.3	Closed
SB34	Header P7 pin 12 with MCU P7.0	Opened
SB35	LIN RX with MCU P7.0	Closed
SB36	Header P7 pin 11 with MCU P7.1	Opened
SB37	LIN TX with MCU P7.1	Closed
SB38	Header P7 pin 32 with MCU P5.3	Opened
SB39	Header P7 pin 33 with MCU P5.4	Opened
SB40	Header P7 pin 34 with MCU P5.5	Opened
SB41	Header P7 pin 10 with MCU P5.6	Opened
SB42	Header P7 pin 23 with MCU P0.7	Opened
SB43	MCU P0.7 with X1 pin 3	Closed
SB44	MCU P0.6 with X1 pin 1	Closed
SB45	Header P7 pin 24 with MCU P0.6	Opened
SB46	Header P7 pin 21 with MCU P0.5	Opened
SB47	MCU P0.5 with X1 pin 2	Closed
SB48	MCU P0.5 with X1 pin 1	Closed
SB49	Header P7 pin 22 with MCU P0.4	Opened
SB50	Header P7 pin 9 with MCU P5.7	Opened
SB51	SBC Interrupt INT with MCU P5.7	Closed
SB52	MCU_VDD with MCU VDDA	Closed

SB53	AREF (analog reference) input with MCU VDDA	Opened
SB54	+5V ARDUINO with +5V USB Power Source.	Opened
SB55	+5V ARDUINO with +5V SBC Power Source.	Closed

The locations of the solder bridges can be found in 3D model and assembly drawings of RDK4.



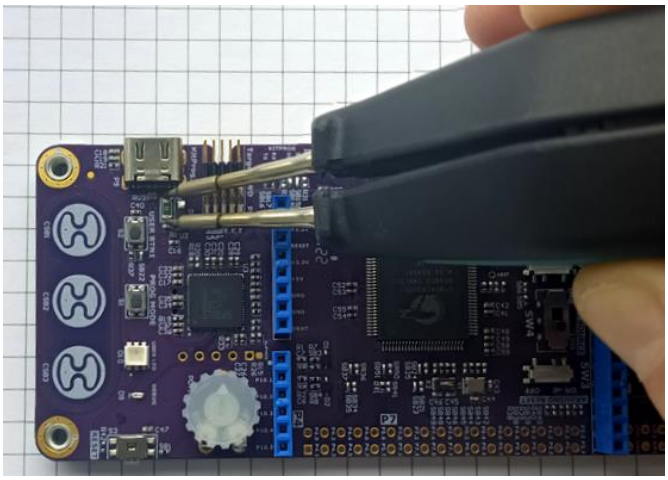
How to find a component on the layout

Fuses

The RDK4 board has two 2A fast-acting fuses F1 and F2 in a 1206 package; part No: CC12H2A-TR „Eaton“.

Changing the Fuses or Solder Bridges

The SMD „Chipping Tool“ is recommended to use for SMD solder bridges or fuses soldering on the RDK4 development board.

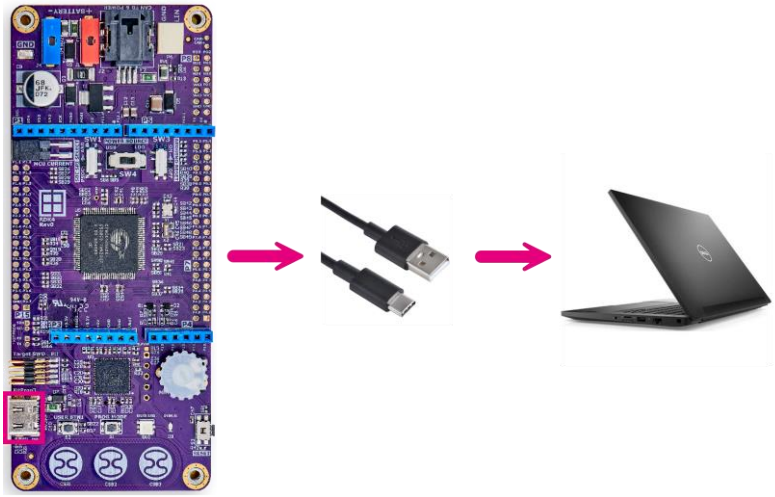


Soldering the RDK4’s fuse

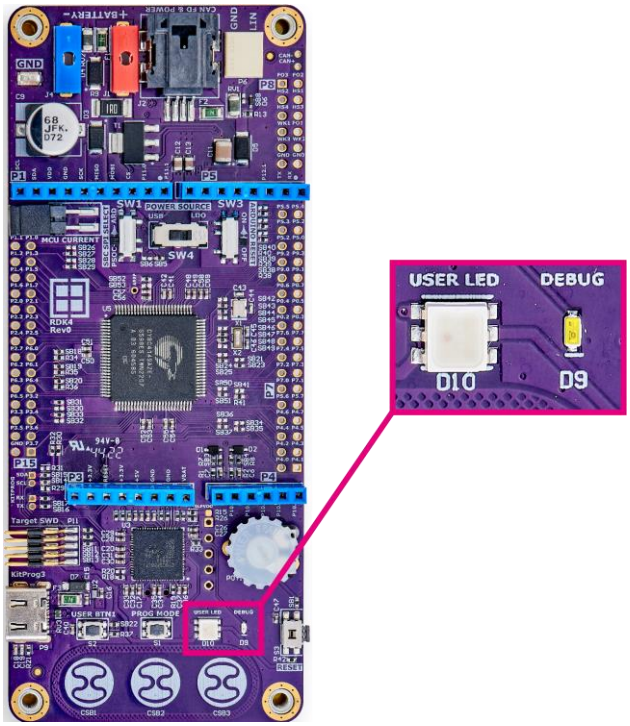
Software and Firmware

Getting Started

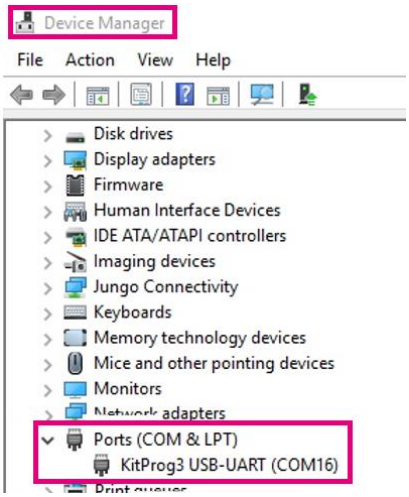
1. Register or/and login at Infineon website (myInfineon tab). License generation takes up to several days.
2. Download and install the latest version of ModusToolbox™ software.
3. *[Optional]* Download and install your preferred terminal emulator, for example: PuTTY, Tera Term, etc.
4. Connect your board (USB-C socket with a marking “KitProg3”) and a PC via USB Type-C cable.



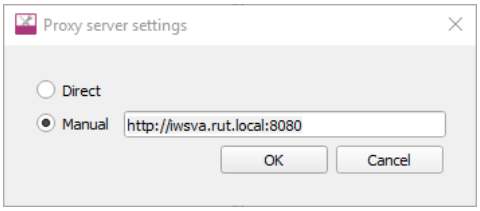
5. Check if RDK4 is ready. Its **DEBUG** yellow LED should shine constantly.



6. The “KitProg3” port must be seen in MS Windows Device Manager window.

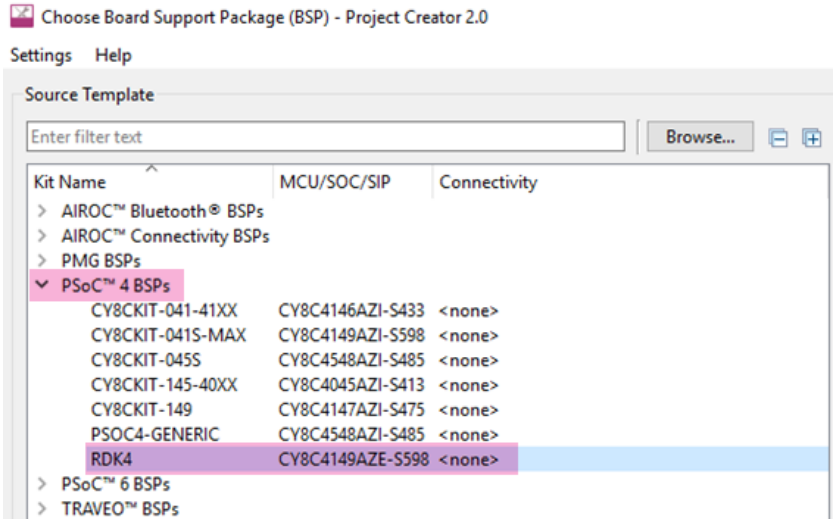


7. *[For Rutronik laptops only]* Run **File** – **New** – **ModusToolbox Application** – **Settings** – **Proxy server settings** and enter the proxy address: http://iwsva.rut.local:8080

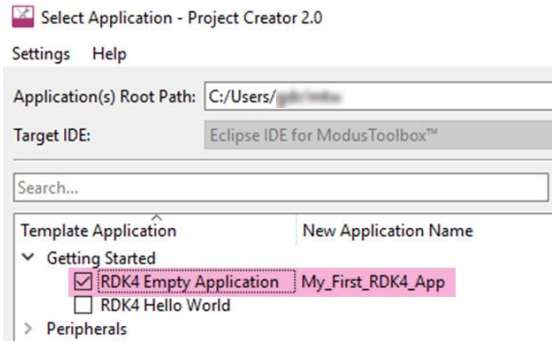


Creating New Project

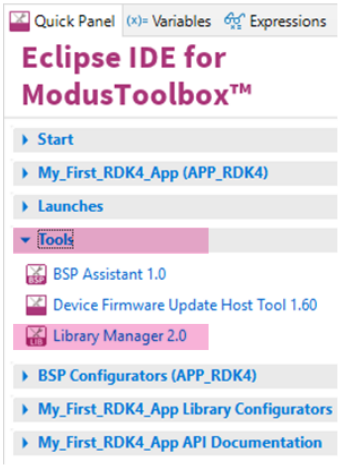
1. Run **File** – **New** – **ModusToolbox Application**. Wait for a while, open **PSoC™ 4 BSPs** block, select **RDK4** and press **Next** after that.

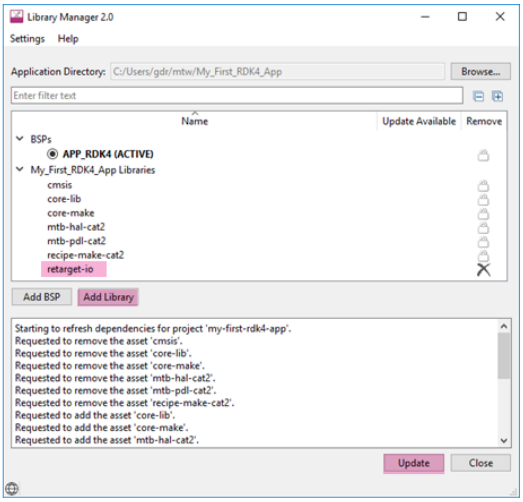


2. Open **Getting Started** block, check **RDK4 Empty Application**, insert the **New Application Name** and click **Create**. Wait for a while until project creation is finished.



3. Run **Library Manager** tool, select **retarget-io** library, then press **Add Library** and **Update**.

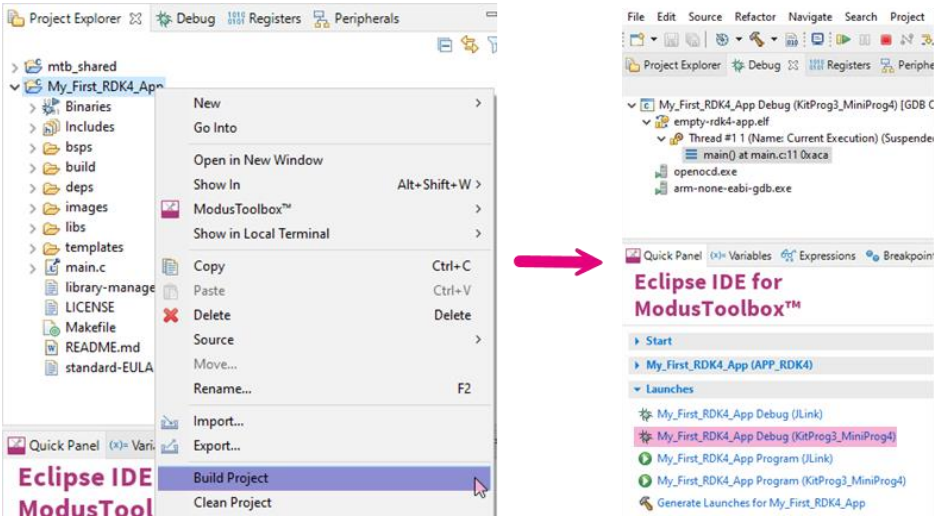




4. Copy, paste and save the code example to the “main.c” file.

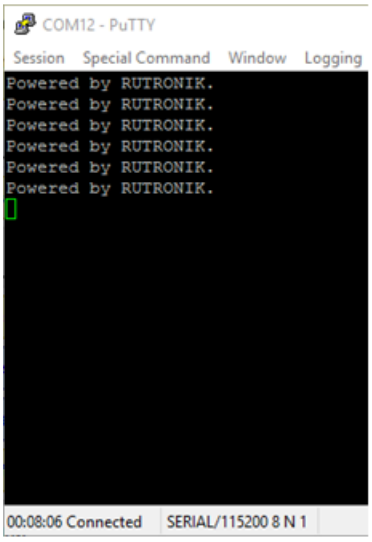
```
#include "cy_pdl.h"
#include "cyhal.h"
#include "cybsp.h"
#include "cy_retarget_io.h"
int main(void)
{
    cy_rslt_t result;
    /* Initialize the device and board peripherals */
    result = cybsp_init();
    if (result != CY_RSLT_SUCCESS)
    {
        CY_ASSERT(0);
    }
    __enable_irq();
    /*Initialize GREEN LED*/
    result = cyhal_gpio_init( USER_LED_GREEN, CYHAL_GPIO_DIR_OUTPUT, CYHAL_GPIO_DRIVE_STRONG, CYBSP_LED_STATE_OFF);
    if (result != CY_RSLT_SUCCESS)
    {CY_ASSERT(0);}
    /*Enable debug output via KitProg UART*/
    result = cy_retarget_io_init( KITPROG_TX, KITPROG_RX, CY_RETARGET_IO_BAUDRATE);
    if (result != CY_RSLT_SUCCESS)
    {CY_ASSERT(0);}
    printf("\x1b[2J\x1b[;H");
    for (;;)
    {
    /*Delay 500 milliseconds*/
    Cy_SysLib_Delay(500);
    printf("Powered by RUTRONIK.\r\n");
    cyhal_gpio_toggle(USER_LED_GREEN);
    }
}
```

5. **Build** and **Debug** the active project.

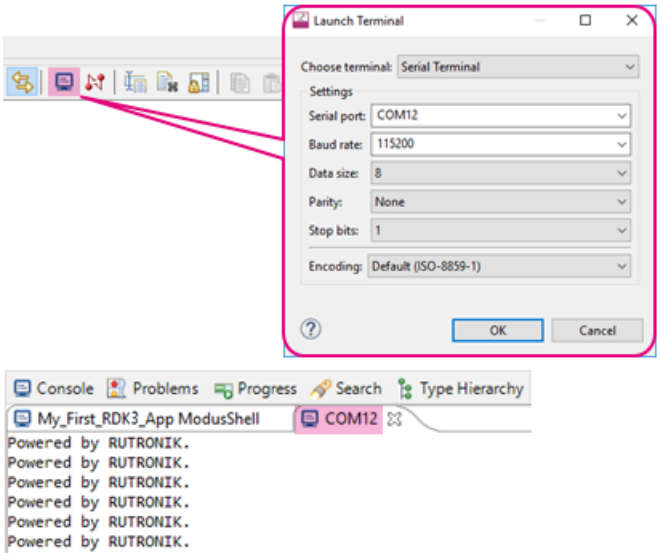


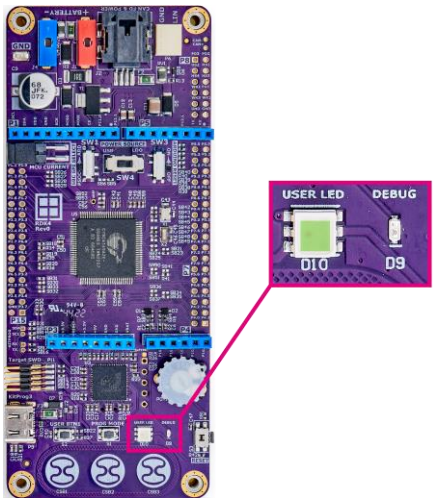
6. The final result is a blinking green LED on the RDK4 board and text on the terminal window.

PuTTY Terminal



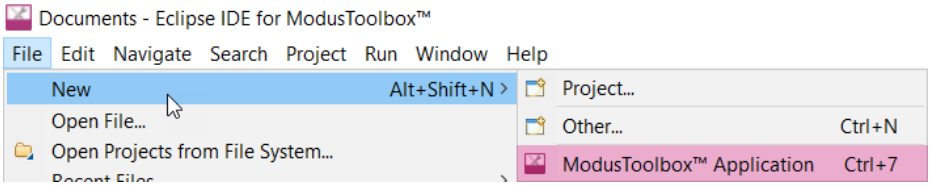
ModusToolbox Terminal

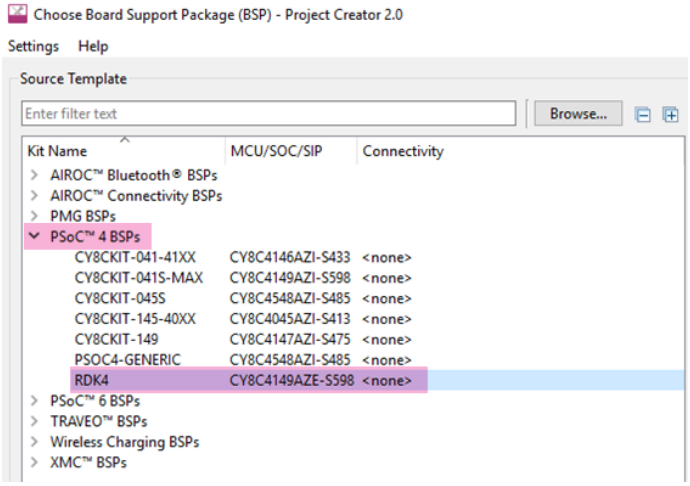




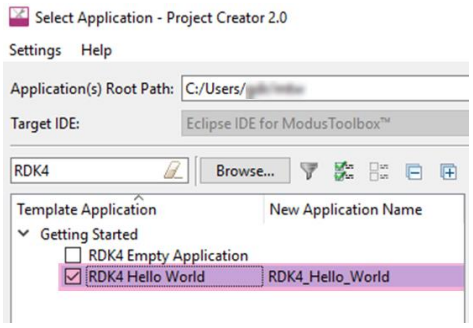
Running Existing Project

1. Run **File** – **New** – **ModusToolbox Application**. Wait for a while, open **PSoC™ 4 BSPs** block, select **RDK4** and press **Next** after that.

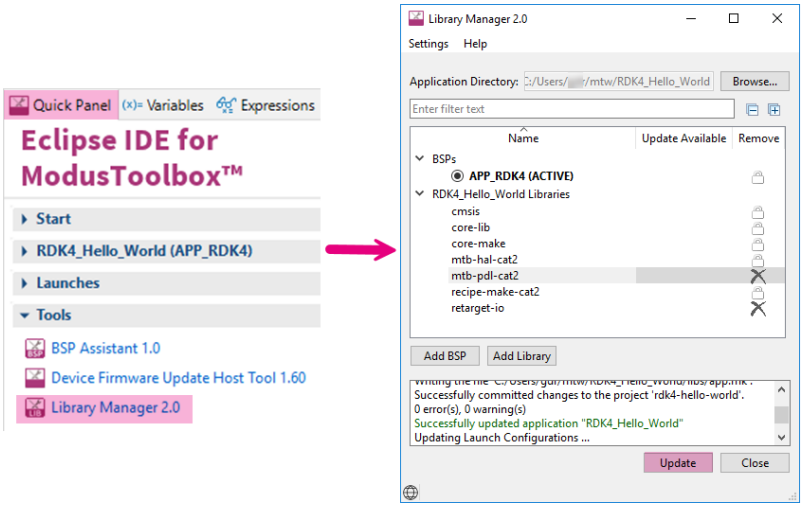




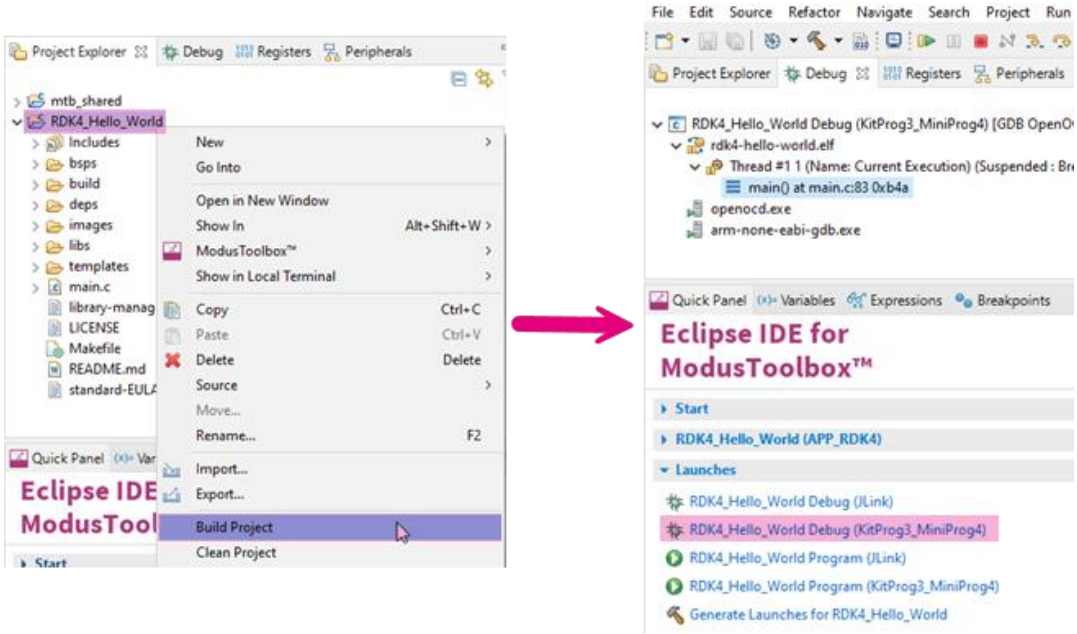
2. Type *RDK4* in the search field. Select the example in the list and click **Create**.



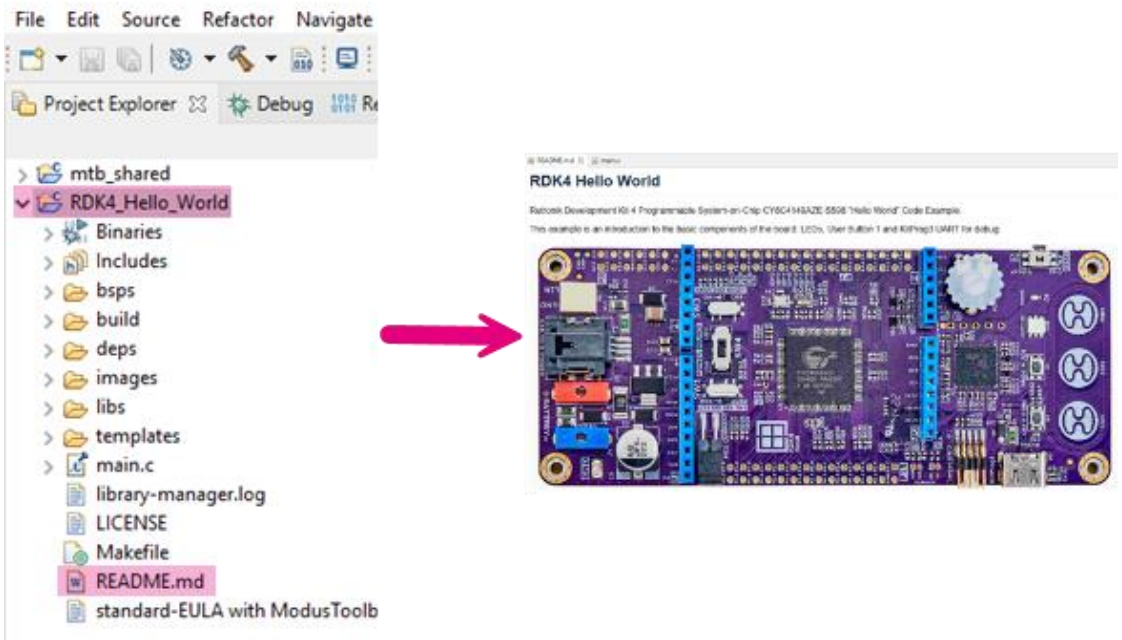
3. After project creation is finished, update the libraries with **Library Manager** tool.



4. Select the project. Build and debug it.



5. Check README.md file before starting to explore the code example. You may find important hints and other information that are needed to have firmware running properly.



Firmware Examples

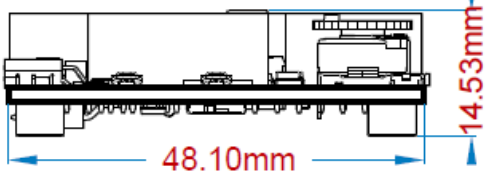
All these examples can be found at GitHub.

RDK4_CapSense_Buttons	This example demonstrates how to use CapSense CSX Buttons on RDK4.
RDK4_Arduino_ADC_HAL	This example demonstrates how to use the HAL library to measure all the ADC channels on the Arduino ADC header.
RDK4_I2C_Scanner	This application is used to find all the devices connected to the I2C.
RDK4_Hello_World	This example is an introduction to the basic components of the board: LEDs, User Button 1 and KitProg3 UART for debugging.
TARGET_RDK4	This project is needed as a board support package while creating a new project with the RDK4 development kit.
RDK4_SBC_LIN_Example	This code example demonstrates a LIN 2.2 ISO17987 connectivity using TLE9262-3BQX System Basis Chip.
RDK4_SBC_Power_Management	This is a code example of programmable System-on-Chip CY8C4149AZE-S598 "SBC Power Management".
RDK4_SBC_OBDII_Example	This application is a reference firmware example used for a quick-start with PSoC4100S Max and System Basis Chip TLE9262-3BQXV33 CANFD OBD-II protocol.
RDK4_EnvironmentMonitoringStation	This is a demonstration of the sensors SHT41 [temperature and humidity], DPS310 [atmospheric pressure], SGP40 [air quality index], SCD41 [CO2 concentration], and the smart display GEN4-ULCD-43DCT-CLB connected to RDK4 board.
RDK4_SBC_WAKEUP	This is a code example of programmable System-on-Chip CY8C4149AZE-S598 "SBC Ignition Signal Wake Up".

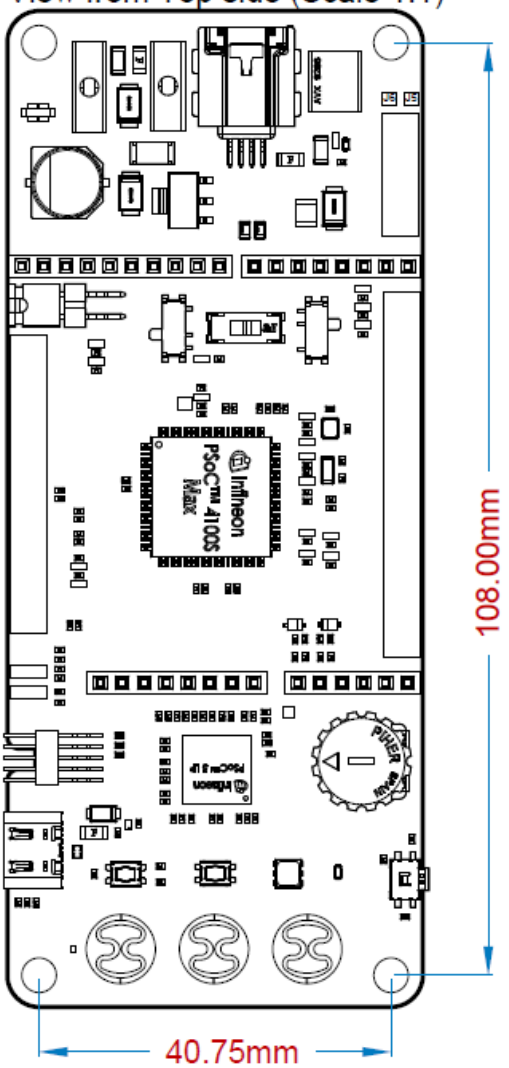
Production Data

Mechanical Layout

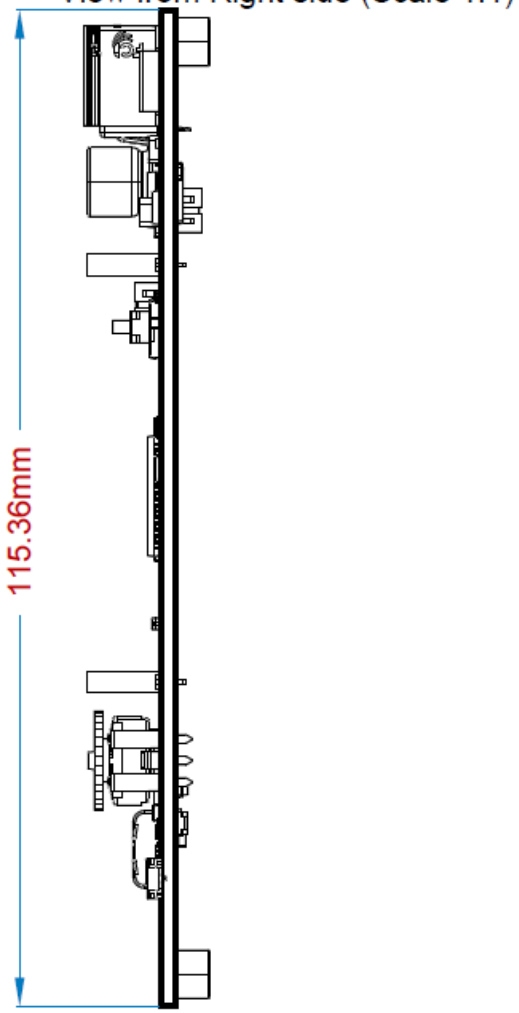
View from Front side (Scale 1:1)



View from Top side (Scale 1:1)



View from Right side (Scale 1:1)



Schematics

You'll find the schematics of RDK4 here.

BOM

You'll find the BOM for RDK4 here.

RDK4 Electromagnetic Compatibility

RDK4 was tested for electromagnetic disturbances and meets the requirements as in normative documents listed below.

Electromagnetic disturbances:
Radiated disturbance to 1 GHz.
IEC 61000-4-20