



USER MANUAL

ADRASTEIA-I FEATHERWING KIT

2615039336001

VERSION 1.3

DECEMBER 1, 2025

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

MUST READ

Check for firmware updates

Before using the product, make sure you use the most recent firmware version, data sheet, and user manual. This is especially important for Wireless Connectivity products that were not purchased directly from Würth Elektronik eiSos. A firmware update on these respective products may be required.

We strongly recommend including the possibility of a firmware update in the customer system design.

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1 Abbreviations

Abbreviation	Name	Description
CISPR	Comité International Spécial des Perturbations Radioélectriques	International Special Committee on Radio
CTS	Clear to Send	
EV	Evaluation	
ESD	Electro Static Discharge	
FOTA	Firmware Over The Update	
EMC	Electro Magnetic Compatibility	
GND	Ground	Ground signal level that corresponds to 0 V
HIGH	High signal level	Digital voltage level that is detected as high by the module
IDE	Integrated Development Environment	
IEC	International Electrotechnical Commission	
IEEE	Institute for Electrical and Electronic Engineers	
JTAG	Joint Test Action Group	Flash interface for the micro controller
LED	Light Emitting Diode	
Li-Po	Lithium-Polymer	
LOW	Low signal level	Digital voltage level that is detected as low by the module
MCU	Microcontroller Unit	
PC	Personal Computer	
PCB	Printed Circuit Board	
RAM	Random Access Memory	
RTS	Request to Send	
SDK	Software Development Kit	Collection of drivers and example codes
SIM	Subscriber Identity Module	
UMRF	Ultraminiature Radio Frequency	
USB	Universal Serial Bus	
VCC	Voltage Common Collector	Supply voltage
VDD	Voltage Drain Drain	Supply voltage

2 Revision history

Manual version	HW version	Notes	Date
1.0	2.0	Initial version	February 2024
1.1	2.0	<ul style="list-style-type: none">• Updated chapter Important notes• Updated chapter Legal notice	October 2024
1.2	2.0	<ul style="list-style-type: none">• Updated the document to include the changes corresponding to the addition of Sensor FeatherWing to the kit.	July 2025
1.3	2.0	<ul style="list-style-type: none">• Update chapter Terms of Use for Würth Elektronik eiSos GmbH & Co. KG EV-Boards, evaluation kits and evaluation modules.	November 2025

3 General description

3.1 Introduction

The Würth Elektronik eiSos Adrastea-I FeatherWing kit is an EV-Board set with open-source software that enables easy creation and evaluation of a secure end-to-end IoT solution.

This kit consists of the Adrastea-I FeatherWing and the Sensor FeatherWing 2501000201291 and all the necessary accessories required to get the system up and running.

This design kit offers a reliable hardware platform for rapid prototyping using FeatherWings. The Würth Elektronik eiSos's FeatherWing development boards are open source and fully compatible with the Feather form factor from Adafruit.

The open-source reference firmware and SDK available on *GitHub* enable easy integration with any IoT platform. Currently a connection to the following cloud platforms are supported out-of-the-box

- Eclipse Mosquitto broker
- AWS IoT Core
- Azure IoT Hub
- KaaloT

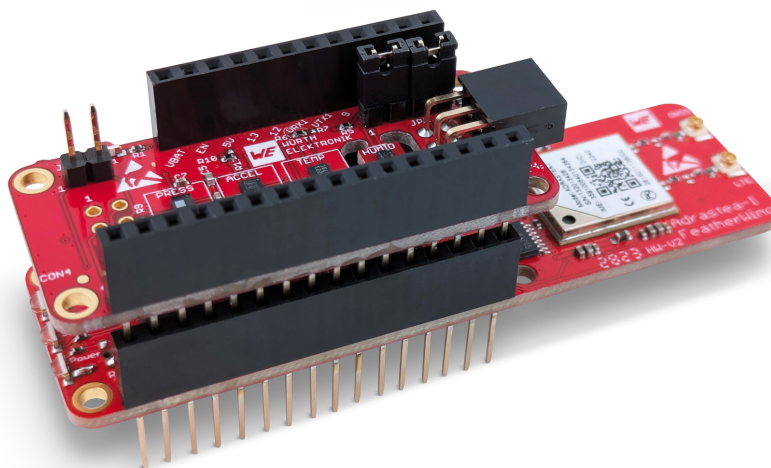


Figure 1: The WE Adrastea-I FeatherWing kit (2615039336001)

3.2 Adrastea-I FeatherWing

The Würth Elektronik eiSos Adrastea-I FeatherWing is a development board consisting of an Adrastea-I radio module. The Adrastea-I module is a compact LTE-M/NB-IoT cellular module with integrated GNSS, integrated ARM Cortex-M4 and 1MB flash memory for customer developed applications.

The Adrastea-I FeatherWing is fully compatible to the popular Adafruit Feather line of development boards and extends the Feathers with IoT connectivity.

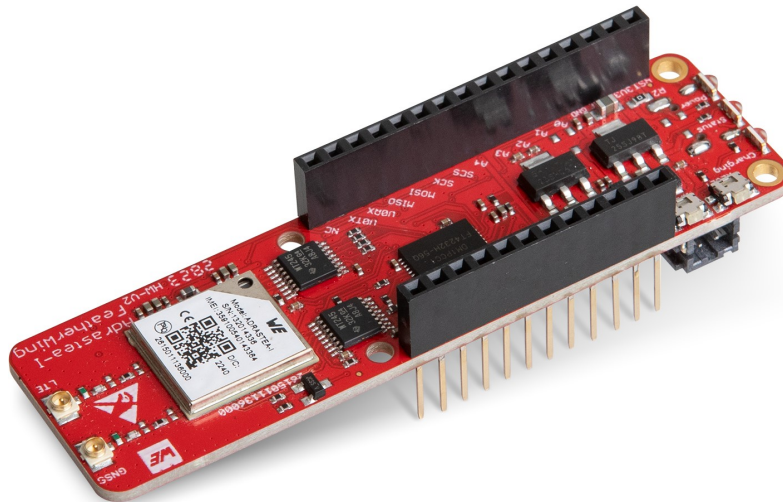


Figure 2: The WE Adrastea-I FeatherWing

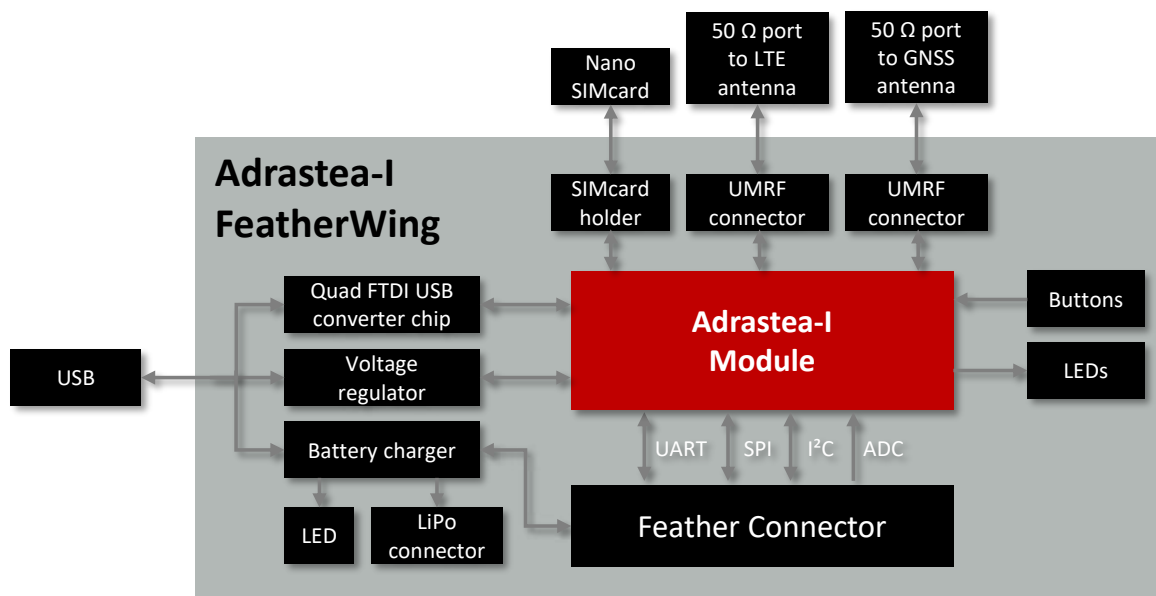


Figure 3: Block diagram - Adrastea-I FeatherWing

3.3 Sensor FeatherWing

The Würth Elektronik eiSos Sensor FeatherWing is a sensor development board fully compatible to the popular Adafruit Feather line of development boards. It consists of the following four sensors,

- WSEN-PADS - Absolute pressure sensor (2511020213301)
- WSEN-ITDS - 3-axis acceleration sensor (2533020201601)
- WSEN-TIDS - Temperature sensor (2521020222501)
- WSEN-HIDS - Humidity sensor (2525020210002)

All four sensors are connected over the shared I²C bus and hence can be connected to any of the Feather microcontroller boards. The Arduino (C/C++) drivers and examples (see chapter 6) made available make it easy to build a prototype to kick-start the application development.

The Sensor FeatherWing also has the 4-pin JST QWIIIC[®] connector on-board. This enables easy connection to the QWIIIC[®] ecosystem of development boards. Additionally, a 6 pin connector enables extension of the FeatherWing with a host of EV-Boards from Würth Elektronik eiSos.

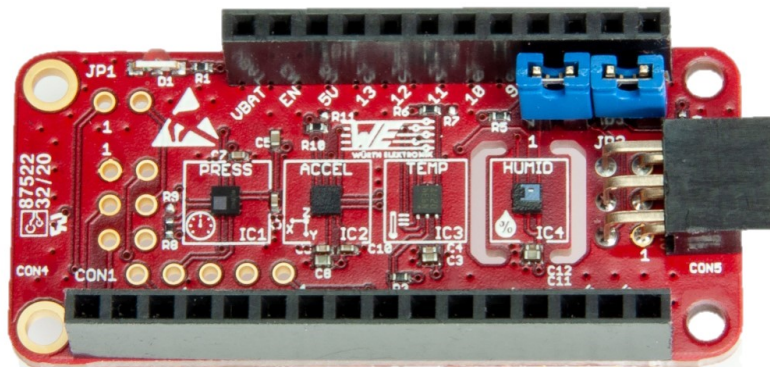


Figure 4: The WE Sensor FeatherWing (2501000201291)

3.4 Contents

Description	Quantity
WE Adrastea-I FeatherWing	1
WE Sensor FeatherWing	1
LTE dipole antenna	1
GNSS dipole antenna	1
WR-UMRF SMA Bulkhead Jack to UMRF Right Angle Plug	2
Packaging: ESD safe cardboard Box (230mmx230mmx78mm)	1

Table 3: Contents 2615039336001



A SIM card is not included in this kit. LTE-M/NB-IoT enabled SIM card in nano formfactor is required for cellular operation.

3.5 Usage

There are two ways of prototyping using the Adrastea-I FeatherWing kit.

3.5.1 Using the on-board application MCU

The Adrastea-I cellular module comes with an integrated ARM Cortex-M4 and 1MB flash memory for customer developed applications. In order to develop prototypes using the on-board MCU, use the source code and examples provided in the following GitHub Pages

- *Adrastea SDK*
- *Quick Start guide*

3.5.2 Using an external MCU

It is also possible to use an external MCU to implement your end-application. In this case the host MCU sends AT-style commands to configure and control the Adrastea-I FeatherWing. Würth Elektronik eiSos FeatherWing SDK provides source code and examples on the Adafruit M0 Feather Platform.

The SDK can be accessed on Github at <https://github.com/WurthElektronik/FeatherWings>.

4 Functional description

The Adrastea-I FeatherWing was designed with rapid prototyping in mind. Being fully compatible with the Adafruit ecosystem, this FeatherWing allows the user the flexibility to choose the preferred host microcontroller.

The inherent modularity of the ecosystem allows the FeatherWing to be easily integrated into any project.

The next sections provide a brief introduction to Adafruit's Feather ecosystem and details on the Adrastea-I module.

Feel free to check our YouTube channel:

www.youtube.com/user/WuerthElektronik/videos for video tutorials, hands-ons and webinars relating to our products.

4.1 Adafruit Feather

The Adafruit Feather ecosystem consists of two types of boards apart from a host of accessories:

- **Feather:** Adafruit Feathers are a complete line of development boards from Adafruit that are standalone and stackable. They can be powered either over the on-board micro-USB plugs or using a Li-Po battery. Feathers are portable, flexible and light as their namesake.
- **FeatherWing:** FeatherWings are stackable boards that when used along with a Feather add a certain functionality to the system.

The Feather system with more than 50+ Wings, several different types of accessories and arduino/circuit python based code support, provides a perfect ecosystem for rapid prototyping. Please refer to adafruit.com/feather for more details on the Adafruit Feather ecosystem.

4.2 Adrastea-I cellular module (2615011136000)

The Adrastea-I module is a compact LTE-M/NB-IoT cellular module with integrated GNSS, integrated ARM Cortex-M4 and 1MB flash memory for customer developed applications.

Based on the Sony Altair ALT1250 chipset, the Adrastea-I module provides AT-Command based multi-band configurability, enabling international multi-regional coverage in LTE Cat M1 / NB1 radio access technologies.

Adrastea-I includes a fully integrated global navigation satellite system solution that supports GPS and GLONASS positioning systems.

The ARM Cortex-M4 processor is exclusively designed for user application software and it offers 1 MB of flash and 256 kB of RAM dedicated to this use.

The compact 13.4 mm x 14.6 mm x 1.85 mm design allows the module to fit in small-size applications.

The module can be operated through one of two available cellular communication technologies:

- LTE-Cat.M or
- LTE-Cat.NB-IoT.

The module comes with the declaration of conformity (CE), is compliant to RoHS, REACH. The Adrastea-I module is GCF and Deutsche Telekom certified.

4.2.1 Module Key Features

Feature	Description
Physical Dimensions	13.4mm x 14.6mm x 1.85mm
Supported Networks	- LTE-Cat.M - LTE-Cat.NB-IoT
LTE Supported Bands	LTE-Cat.M: B2/B3/B4/B5/B8/B12/B20/B25/B26/B28 LTE-Cat.NB-IoT: B3/B5/B8/B20/B28
Module Interfaces	- USIM - UART - I ² C Master - SPI Master - GPIO - ADC - JTAG
Integrated GNSS	The Adrastea-I includes a fully integrated global navigation satellite system solution that supports GPS and GLONASS positioning system.
Integrated User MCU	User MCU is exclusively for user application software: - ARM Cortex-M4 - 1 MB Flash Memory - 256 kB RAM
Maximum Data Rate	LTE-Cat.M: Downlink: 300 Kbps, Uplink: 375 Kbps LTE-Cat.NB-IoT: Downlink: 27.2 Kbps, Uplink: 62.5 Kbps
3GPP Standard Compliance	3GPP Release 13 compliant, Upgradable to Release 14
Output Power class	Power Class 3 (23 dBm)
Firmware Upgrade	- Firmware upgrade over USB interface - Firmware upgrade over the air (FOTA)

Supported Protocols	<ul style="list-style-type: none">- IPv4, IPv6- TCP/UDP SOCKET- HTTP/HTTPS- TLS/DTLS- LWM2M Client- MQTT
AT Commands	3GPP TS 27.007 and 3GPP TS 27.005 AT commands, as well as Würth Elektronik eiSos enhanced AT commands
Operating Voltage	<ul style="list-style-type: none">- VDD: From 2.3 V to 4.3 V- VDD_FEM: From 3.1 V to 4.3 V
Temperature Range	Operation temperature: -40 °C to +85 °C

Further details about the LTE-M / NB-IoT cellular module can be found under www.we-online.de/adrastea-i

5 Hardware description

This chapter contains a detailed description of the hardware features of the Adrastea-I FeatherWing. The design files for this hardware can be downloaded from <https://github.com/WurthElektronik/FeatherWings>.

The hardware description of the Sensor FeatherWing can be found in the Sensor FeatherWing *User manual*.

5.1 Connectors

This section explains all connectors of the Adrastea-I FeatherWing.

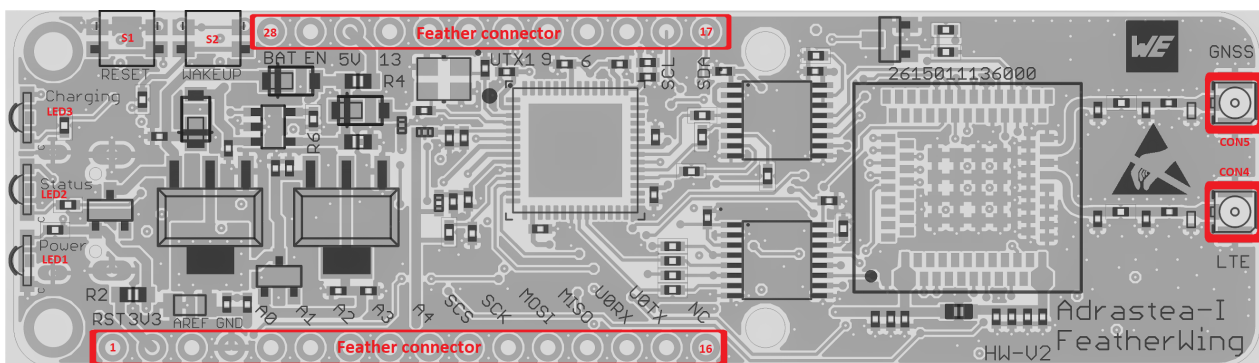


Figure 5: Connectors Top

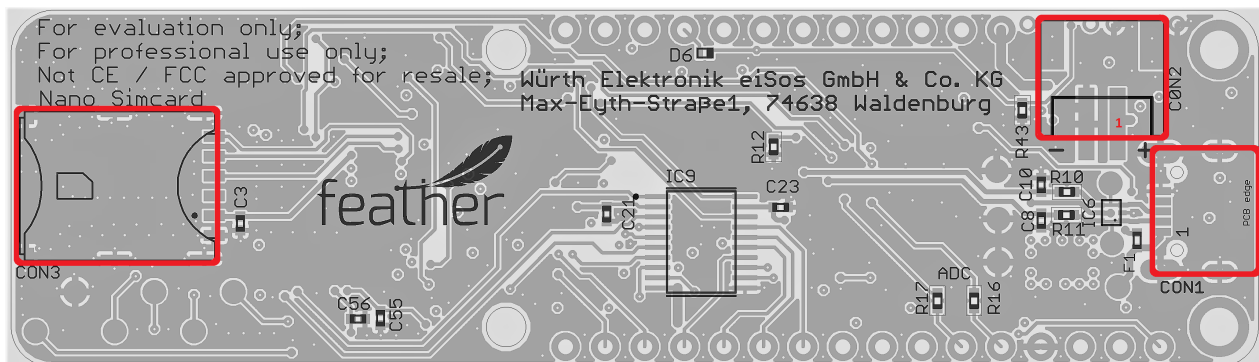


Figure 6: Connectors Bottom

Pin header	Function	WE- article number
Feather connector	Connection to feather M0 or other Featherwings	-
CON1	Micro-USB connector for host connection and VDD bus supply	629105150521
CON2	Li-Po battery connector	-
CON3	SIMcard connection	693043020611
CON4	LTE RF signal	636101111001
CON5	GNSS RF signal	636101111001

Table 5: Default assembled connectors and pin headers

5.1.1 Feather connector

This is the standard set of connectors that is used across the Feather ecosystem. The table below describes the functions of each of the 28 pins as applicable to this FeatherWing.

Pin Number	Pin name	Function
1	/RST	Reset
2	3V3	3.3 V power supply via R2
3	AREF	Not connected
4	GND	Ground
5	GPIOA0	Adrastea ADC0/GPIO1 via R16
6	GPIOA1	Adrastea ADC1/GPIO2 via R17
7	GPIOA2	Not connected
8	GPIOA3	Not connected
9	GPIOA4	Not connected
10	GPIOA5	Adrastea SPIM1_CS/GPIO40
11	GPiOSCK	Adrastea SPIM1_CLK/GPIO41
12	GPiOMOSI	Adrastea SPIM1_MOSI/GPIO38
13	GPiOMISO	Adrastea SPIM1_MISO/GPIO39
14	GPiORX	Adrastea UART0 TX pin
15	GPiOTX	Adrastea UART0 RX pin
16	N.C.	Not connected
17	GPiOSDA	Adrastea I2C0_SDA
18	GPiOSCL	Adrastea I2C0_SCL
19	GPIO5	Not connected
20	GPIO6	Adrastea WAKEUP pin
21	GPIO9	Not connected

22	GPIO10	Not connected
23	GPIO11	Not connected
24	GPIO12	Not connected
25	GPIO13	Not connected
26	USB	USB 5V power via R4
27	EN	Not connected
28	VBAT	Battery

5.1.2 CON1

Connector CON1 is a micro-USB connector that enables connection to PC via standard micro-USB cable.

CON1	Function
-	Micro-USB connector for host connection and 5 V bus power supply

Table 7: Micro-USB connector

5.1.3 CON2

Connector CON2 is a Li-Po battery connector that allows to power board via 3.7 V Lithium battery. VBAT is given by a charging IC with $I_{Charge} = 200 \text{ mA}$. I_{Charge} can be modified by changing R6 which is a 5.1 k Ω by default. A 2 k Ω resistor for example allows a current of 500 mA. In charging mode (D9 lights up) VBAT is 4.2 V.



The maximum output current of the supply source must be considered when changing R6.

CON2	Function
1	VBAT
2	GND

Table 8: Battery connector

5.1.4 CON3

Connector CON3 is a push/pull nano SIMcard holder.

CON3	Function
1	Voltage supply for SIMcard
2	SIMcard reset signal
3	SIMcard clock signal
5	SIMcard GND
6	Not connected
7	SIMcard data signal

Table 9: Nano SIMcard holder



A SIM card is not included in this kit. LTE-M/NB-IoT enabled SIM card in nano formfactor is required for cellular operation.

IoT SIM cards can be ordered from WE-DTAG Connectivity Portal
<https://iotcreators.com/wuerth/>.

5.1.5 CON4

Connector CON4 (UMRF receptacle) is used to connect the LTE antenna.

CON4	Function
Inner	RF Signal
Outer	GND

Table 10: UMRF connector for LTE



Optional: The antenna is matched with the marked components. Depending on the exact application and band of operation, experts may use the placeholder (C46, C50 and R34) for additional filtering and tuning.

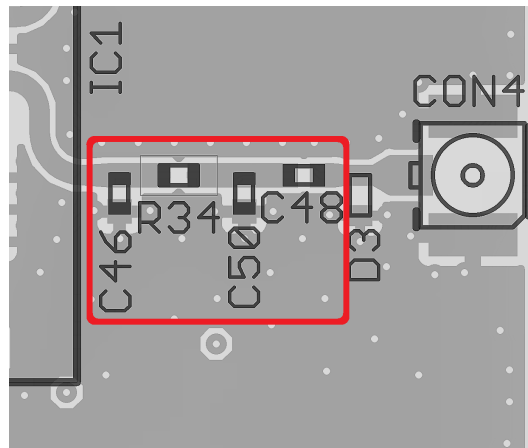


Figure 7: Matching filter for LTE transmission line

5.1.6 CON5

Connector CON5 (UMRF receptacle) is used to connect the GNSS antenna.

CON5	Function
Inner	RF Signal
Outer	GND

Table 11: UMRF connector for GNSS



Optional: The antenna is matched with the marked components. Following this reference design, it served experts for filtering and fine tuning.

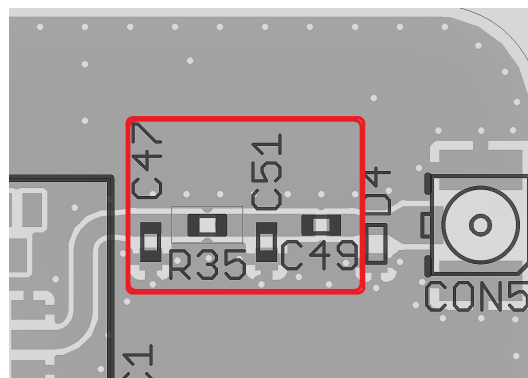


Figure 8: Matching filter for GNSS transmission line

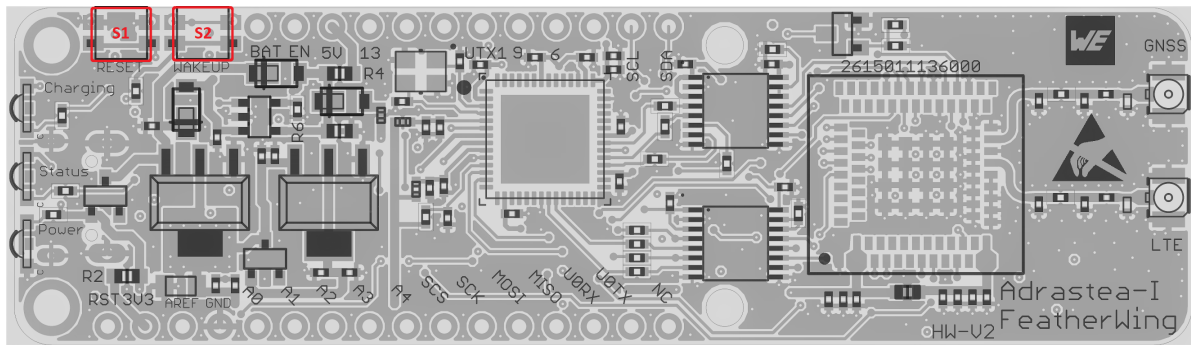


Figure 9: Buttons

5.2 Push buttons

5.2.1 S1

This push button is connected to the */RESET* pin of the Adrastea module. Pressing this button resets the module.

5.2.2 S2

This push button is connected to the *WAKEUP* pin of the Adrastea module. Pressing this button allows the module to get out from sleep mode.



After pushing the S2, the command "sleepSet disable" should be sent to indefinitely wake-up the module. If this command is not received, the module goes back to the sleep state.

If S2 is not pushed, it enables the module to get into sleep mode.

5.3 Power supply

The Adrastea-I FeatherWing is powered with 5 V by USB or the Feather 5 V pin. It can also be powered by battery via CON2. The internal voltage regulator regulates the voltage down to 3.3 V and 1.8 V to supply the remaining parts of the circuit. The 3.3 V power-rail is connected to the 3 V Feather pin. The FeatherWing can also be powered with 3.3 V via the 3 V Feather pin. In this case, battery charging is disabled.

If the FeatherWing is power sourced, the power LED (D3) lights up.



If an other Featherwing is connected and both are connected to different power supplies, R4 should be removed to avoid undesirable leakage current. If the second board also has a 3.3 V power rail, which is connected to the 3 V Feather pin, R2 should also be removed.

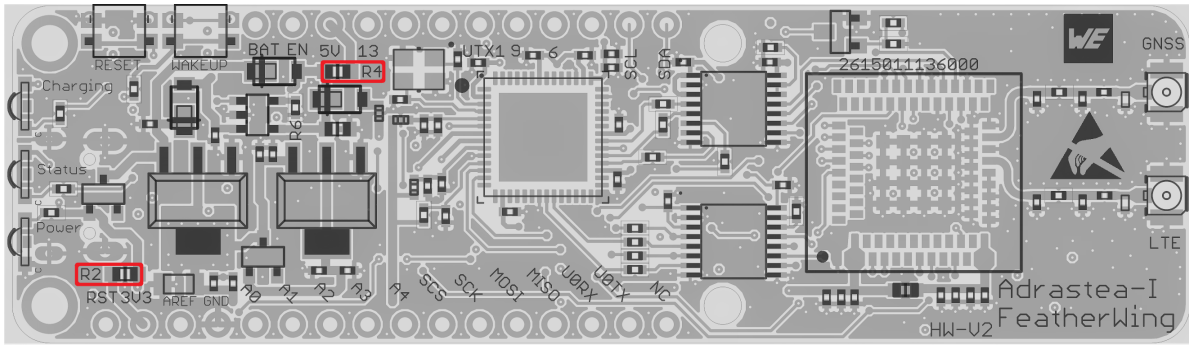


Figure 10: Resistor R2 and R4

5.4 UART/USB

The UART of the module is available on the USB jack, so that the module can be connected directly to a PC. Using the FTDI-driver, the PC will show four virtual COM-Ports. Normally, the PC assigns the COM-PORT number in ascending order, which respectively corresponds to the UART0, UART1 and UART2. The following table shows an example of possible assignment of COM-PORTs.

COM-Port number	UART	Function
COM57	UART0	Miniconsole (AT command). Only UTX and URX
COM58	UART1	Console Logs. Only UTX and URX
COM59	UART2	FW update. Full UART (inc. /CTS and /RTS)
COM60	not used	-

Table 12: COM-PORT to UART assignment example



Only UART2 is available as full UART. Flow control pins are available (/CTS and /RTS).

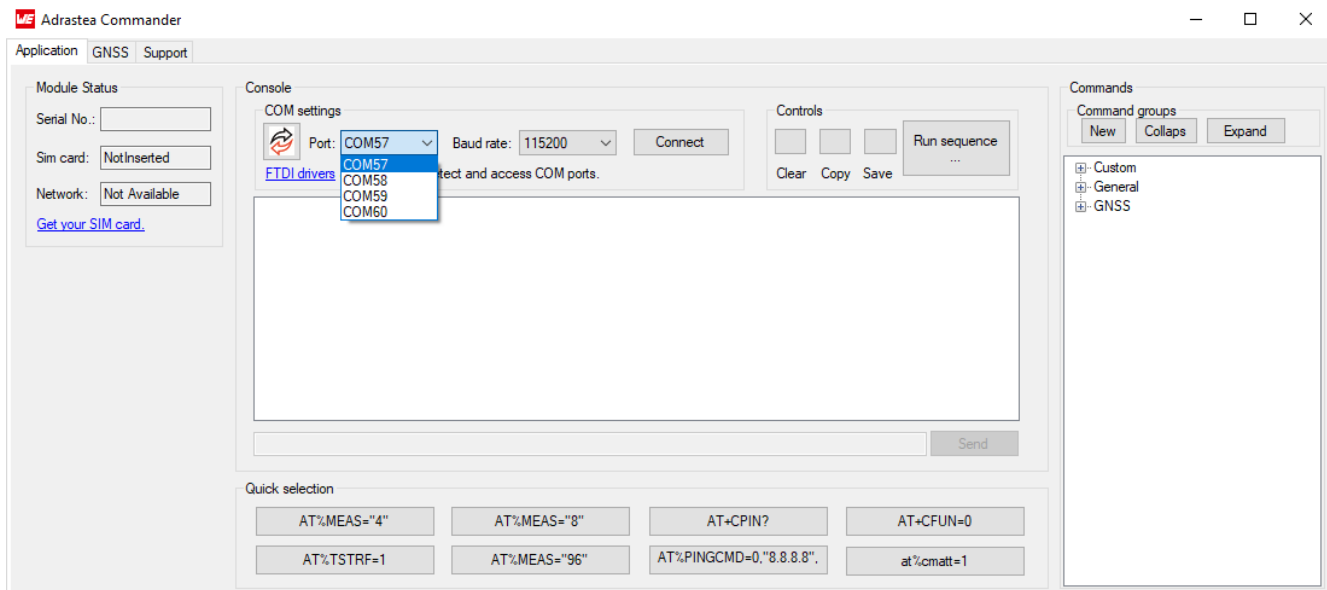


Figure 11: COM ports detected - Adrastea commander



The USB cable length must not exceed 3 meters.

5.5 LEDs

The following table shows the function of the leds included in the board.

NAme	Designator	Function
Power led	LED1	lights on when board is power sourced
Status led	LED2	turn off when the module is in a DH0 state
Charging led	LED3	Indicates when a battery connected to the board is being charged

Table 13: LED indicators

5.6 Schematics

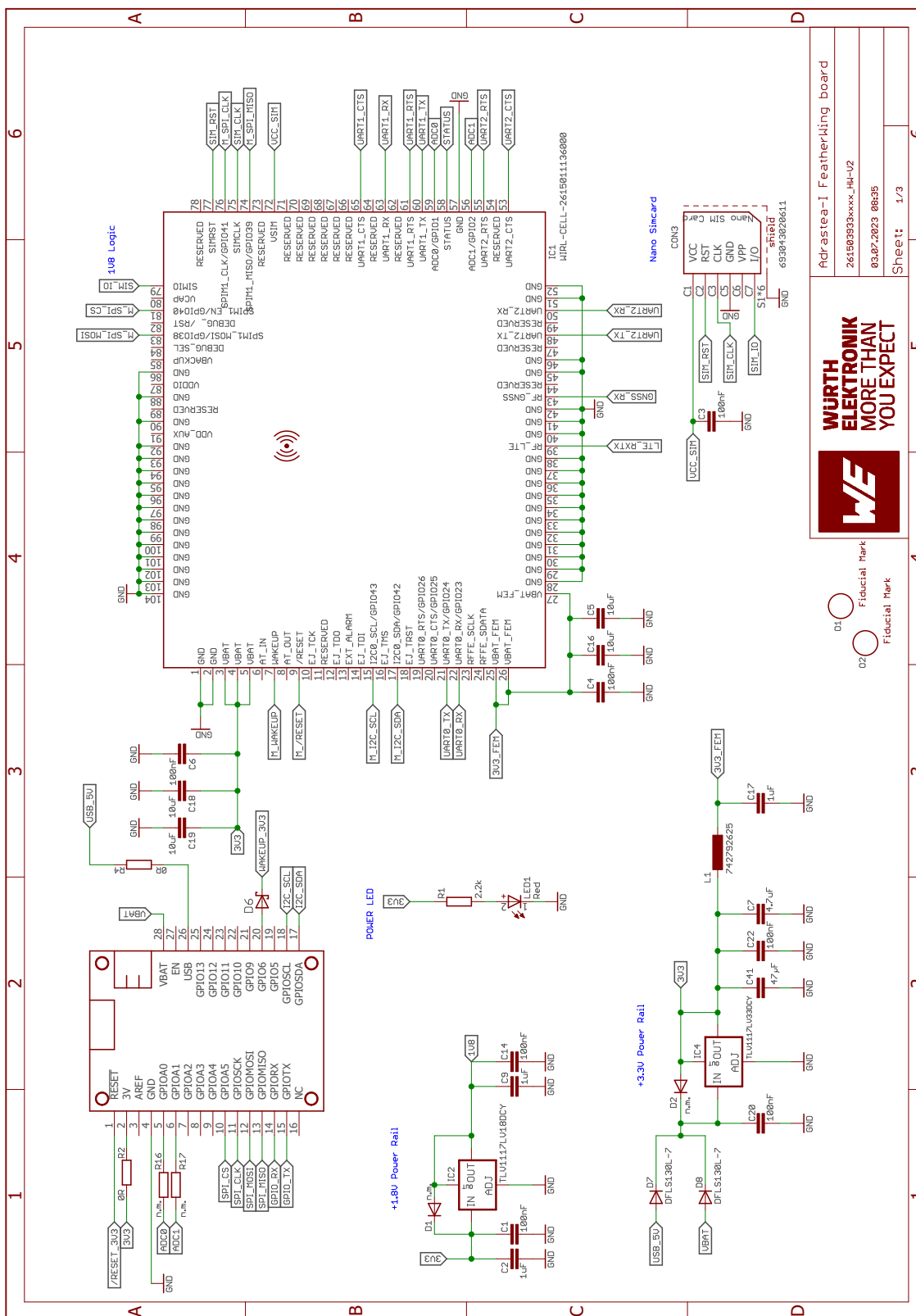


Figure 12: Schematic part 1

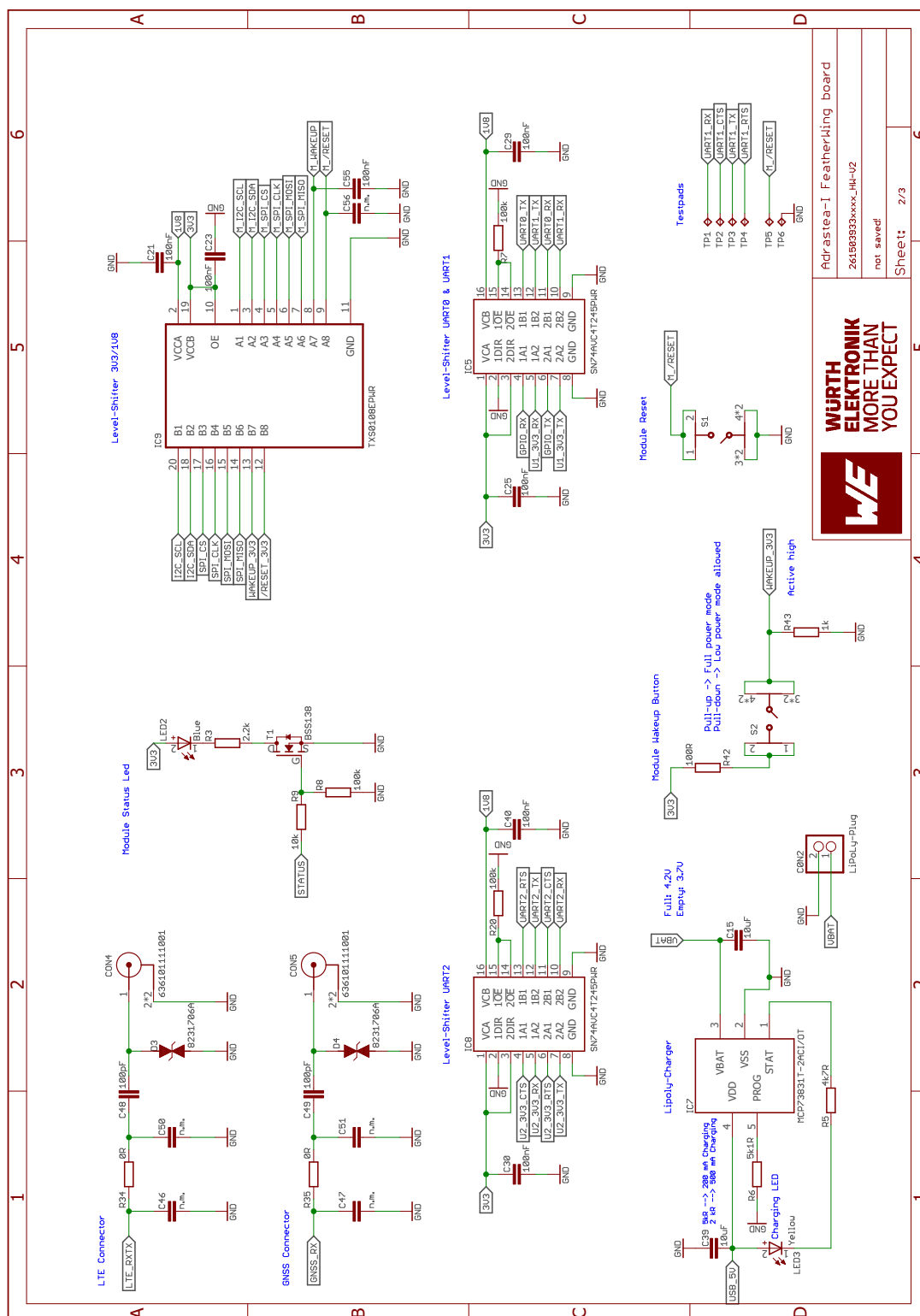


Figure 13: Schematic part 2

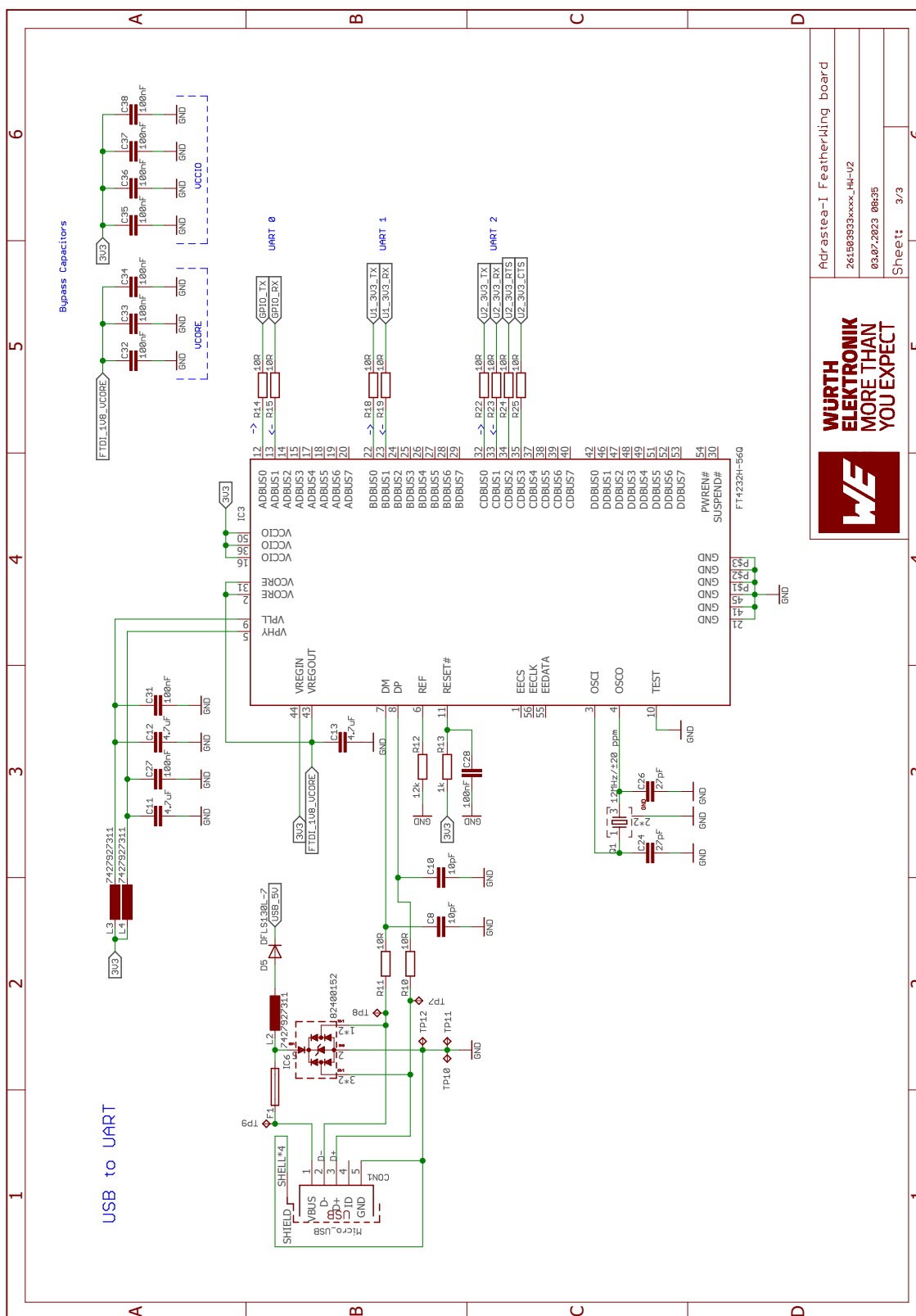


Figure 14: Schematic part 3

5.7 Layout

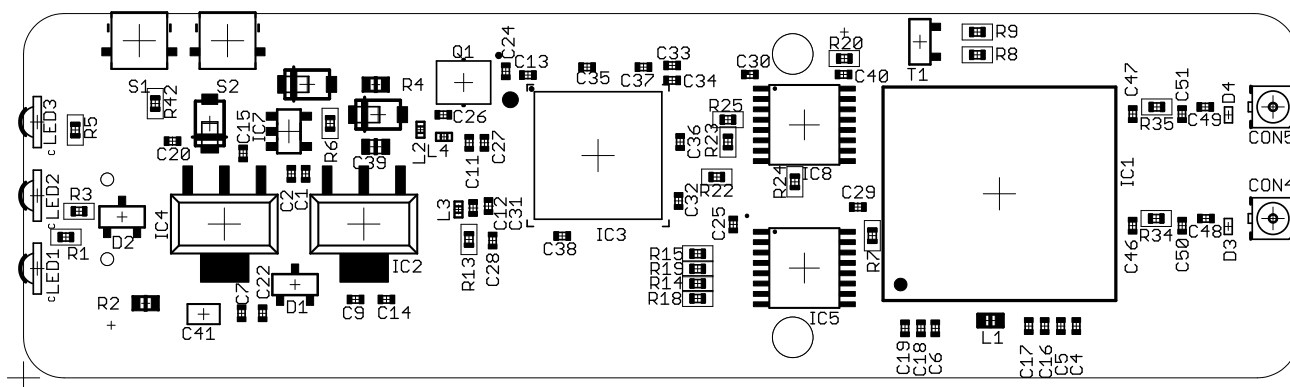


Figure 15: Assembly diagram top layer

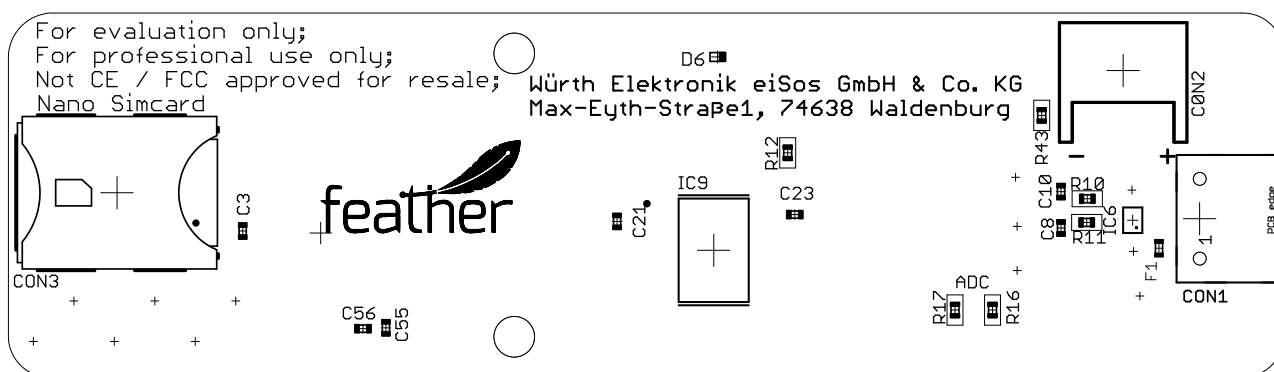


Figure 16: Assembly diagram bottom layer

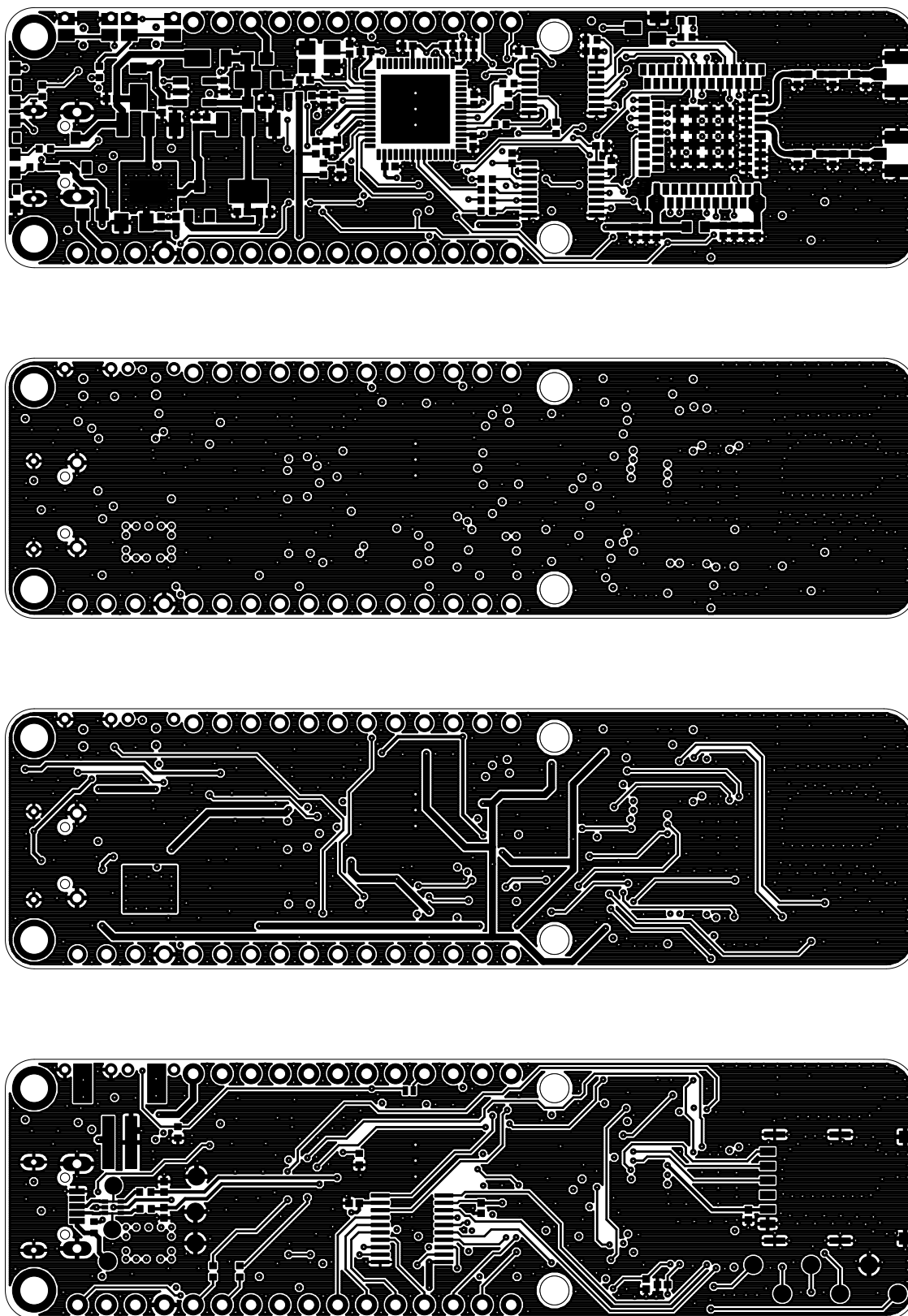


Figure 17: Top layer (upper), second layer (second), third layer (third), fourth layer (bottom)

5.8 Bill of material

Part	Value	Pack	Manufacturer	NR
C1	100nF	0402	Würth Elektronik eiSos	885012205037
C2	1µF	0402	Würth Elektronik eiSos	885012105012
C3	100nF	0402	Würth Elektronik eiSos	885012205037
C4	100nF	0402	Würth Elektronik eiSos	885012205037
C5	10µF	0402	Würth Elektronik eiSos	885012105020
C6	100nF	0402	Würth Elektronik eiSos	885012205037
C7	4,7µF	0402	Würth Elektronik eiSos	885012105008
C8	10pF	0402	Würth Elektronik eiSos	885012005055
C9	1µF	0402	Würth Elektronik eiSos	885012105012
C10	10pF	0402	Würth Elektronik eiSos	885012005055
C11	4,7µF	0402	Würth Elektronik eiSos	885012105008
C12	4,7µF	0402	Würth Elektronik eiSos	885012105008
C13	4,7µF	0402	Würth Elektronik eiSos	885012105008
C14	100nF	0402	Würth Elektronik eiSos	885012205037
C15	10µF	0402	Würth Elektronik eiSos	885012105020
C16	10µF	0402	Würth Elektronik eiSos	885012105020
C17	1µF	0402	Würth Elektronik eiSos	885012105012
C18	10µF	0402	Würth Elektronik eiSos	885012105020
C19	10µF	0402	Würth Elektronik eiSos	885012105020
C20	100nF	0402	Würth Elektronik eiSos	885012205037
C21	100nF	0402	Würth Elektronik eiSos	885012205037
C22	100nF	0402	Würth Elektronik eiSos	885012205037
C23	100nF	0402	Würth Elektronik eiSos	885012205037
C24	27pF	SMT	Samsung	CL05C270JB5NNNC
C25	100nF	0402	Würth Elektronik eiSos	885012205037
C26	27pF	SMT	Samsung	CL05C270JB5NNNC
C27	100nF	0402	Würth Elektronik eiSos	885012205037
C28	100nF	0402	Würth Elektronik eiSos	885012205037
C29	100nF	0402	Würth Elektronik eiSos	885012205037
C30	100nF	0402	Würth Elektronik eiSos	885012205037
C31	100nF	0402	Würth Elektronik eiSos	885012205037
C32	100nF	0402	Würth Elektronik eiSos	885012205037

Table 14: Bill of materials part 1

Part	Value	Pack	Manufacturer	NR
C33	100nF	0402	Würth Elektronik eiSos	885012205037
C34	100nF	0402	Würth Elektronik eiSos	885012205037
C35	100nF	0402	Würth Elektronik eiSos	885012205037
C36	100nF	0402	Würth Elektronik eiSos	885012205037
C37	100nF	0402	Würth Elektronik eiSos	885012205037
C38	100nF	0402	Würth Elektronik eiSos	885012205037
C39	10µF	0603	Würth Elektronik eiSos	885012106031
C40	100nF	0402	Würth Elektronik eiSos	885012205037
C41	47µF	0805	Würth Elektronik eiSos	885012107006
C46	n.m.	0402	n.m.	n.m.
C47	n.m.	0402	n.m.	n.m.
C48	100pF	0402	Würth Elektronik eiSos	885012005061
C49	100pF	0402	Würth Elektronik eiSos	885012005061
C50	n.m.	0402	n.m.	n.m.
C51	n.m.	0402	n.m.	n.m.
C55	100nF	0402	Würth Elektronik eiSos	885012205037
C56	n.m.	0402	n.m.	n.m.
D1	n.m.	n.m.	n.m.	n.m.
D2	n.m.	n.m.	n.m.	n.m.
D3	8231706A	0402	Würth Elektronik eiSos	8231706A
D4	8231706A	0402	Würth Elektronik eiSos	8231706A
D5	DFLS130L-7	SOT123	Diodes inc.	DFLS130L-7
D6	BAT54	SMT	Diodes inc.	BAT54LP-7
D7	DFLS130L-7	SOT123	Diodes inc.	DFLS130L-7
D8	DFLS130L-7	SOT123	Diodes inc.	DFLS130L-7
IC1	WIRL-CELL	SMT	Würth Elektronik eiSos	2615011136000
IC2	TLV1117LV18DCY	SOT223-4	Texas Instruments	TLV1117LV18DCY
IC3	FT4232H-56Q	VQFN-56	FTDI	FT4232H-56Q
IC4	TLV1117LV33	SOT223-4	Texas Instruments	TLV1117LV33DCY
IC5	SN74AVC4T245	TSSOP16	Texas Instruments	SN74AVC4T245PWR
IC6	82400152	SOT563	Würth Elektronik eiSos	82400152
IC7	MCP73831T	SOT23-5	Microchip	MCP73831T-2ACI/OT
IC8	SN74AVC4T245	TSSOP16	Texas Instruments	SN74AVC4T245PWR
IC9	TXS0108EPWR	TSSOP-20	Texas Instruments	TXS0108EPWR
CON1	Micro USB	SMT	Würth Elektronik eiSos	629105150521
CON2	LiPoly-Plug	SMT	Adafruit	1769

Table 15: Bill of materials part 2

Part	Value	Pack	Manufacturer	NR
CON3	Nano SIMcard	SMT	Würth Elektronik eiSos	693043020611
CON4	UMRF	SMT	Würth Elektronik eiSos	636101111001
CON5	UMRF	SMT	Würth Elektronik eiSos	636101111001
L1	742792625	0603	Würth Elektronik eiSos	742792625
L2	7427927311	0402	Würth Elektronik eiSos	7427927311
L3	7427927311	0402	Würth Elektronik eiSos	7427927311
L4	7427927311	0402	Würth Elektronik eiSos	7427927311
LED1	Red	1204	Würth Elektronik eiSos	155124RS73200
LED2	Blue	1204	Würth Elektronik eiSos	155124BS73200
LED3	Yellow	1204	Würth Elektronik eiSos	155124YS73200
MS1	header:1 x 12 & 1 x 16	THT	Adafruit	2830
Q1	12 MHz	CFPX-180	Würth Elektronik eiSos	830070868
R1	2.2 k Ω	0402	Yageo	RC0402FR-072K2L
R2	0 Ω	0603	Yageo	RC0603JR-070RL
R3	2.2 k Ω	0402	Yageo	RC0402FR-072K2L
R4	0 Ω	0603	Yageo	RC0603JR-070RL
R5	4.7 k Ω	0402	Yageo	RC0402FR-074K7L
R6	5.1 k Ω	0402	Yageo	RC0402FR-075K1L
R7	100 k Ω	0402	Yageo	RC0402FR-07100KL
R8	100 k Ω	0402	Yageo	RC0402FR-07100KL
R9	10 k Ω	0402	Yageo	RC0402FR-0710KL
R10	10 Ω	0402	Yageo	RC0402FR-0710RL
R11	10 Ω	0402	Yageo	RC0402FR-0710RL
R12	12 k Ω	0402	Yageo	RC0402FR-0712KL
R13	1 k Ω	0402	Yageo	RC0402FR-071KL
R14	10 Ω	0402	Yageo	RC0402FR-0710RL
R15	10 Ω	0402	Yageo	RC0402FR-0710RL
R16	n.m.	0402	n.m.	n.m.
R17	n.m.	0402	n.m.	n.m.
R18	10 Ω	0402	Yageo	RC0402FR-0710RL
R19	10 Ω	0402	Yageo	RC0402FR-0710RL
R20	100 k Ω	0402	Yageo	RC0402FR-07100KL
R22	10 Ω	0402	Yageo	RC0402FR-0710RL
R23	10 Ω	0402	Yageo	RC0402FR-0710RL

Table 16: Bill of materials part 3

Part	Value	Pack	Manufacturer	NR
R24	10 Ω	0402	Yageo	RC0402FR-0710RL
R25	10 Ω	0402	Yageo	RC0402FR-0710RL
R34	0 Ω	0402	Yageo	RC0402FR-070RL
R35	0 Ω	0402	Yageo	RC0402FR-070RL
R42	100 Ω	0402	Yageo	RC0402FR-07100RL
R43	1k Ω	0402	Yageo	RC0402FR-071KL
S1	434331013822	SMT	Würth Elektronik eiSos	<i>434331013822</i>
S2	434331013822	SMT	Würth Elektronik eiSos	<i>434331013822</i>
T1	BSS138	SOT-23	onsemi	BSS138

Table 17: Bill of materials part 4

6 Software description

Würth Elektronik eiSos provides a Software Development Kit (SDK) with examples to support all the WE FeatherWings.

6.1 Adrastea SDK

This SDK contains the source code and examples for the integrated Cortex M4 application MCU on the Adrastea-I Cellular module. It guides you the process of installing the tool chain, the IDE and provides the example source code for developing embedded applications on the Adrastea-I platform.

The SDK can be accessed on Github at <https://github.com/WurthElektronik/Adrastea-SDK>.

6.2 WE FeatherWing SDK

This SDK uses "M0 Feather" as host and "Adrastea-I Module" as client. This does not require writing a Firmware for the Adrastea's integrated Cortex M4 application MCU.

- The SDK is open-source and well documented.
- It uses popular open-source tool chain including an IDE.
- The examples are written in Arduino-styled C/C++ for quick prototyping.
- The core components of the SDK are written in pure C to enable easy porting to any microcontroller platform.
- Development platform independent (Windows, Linux or MAC).
- Modular structure of the software stack makes it easy to integrate into any project.

The SDK can be accessed on Github at <https://github.com/WurthElektronik/FeatherWings>.

6.2.1 Software architecture

The WE FeatherWing SDK is built up in a modular way using a set of open-source tools to enable complete flexibility for the user.

The figure 18 shows the architecture of the WE FeatherWing SDK.

- **PlatformIO:** is a cross-platform, cross-architecture, multiple framework professional tool for embedded software development. It provides the tool chain necessary for the software development including building, debugging, code-upload and many more. PlatformIO works well on all the modern operating systems and supports a host of development boards including the Feathers from Adafruit. Further details about PlatformIO can be found under platformio.org
- **Platform interface:** This layer provides abstraction to the peripheral drivers for the platform being used. Currently, this SDK implements an abstraction to the Arduino peripheral drivers for the Feather M0 express platform.

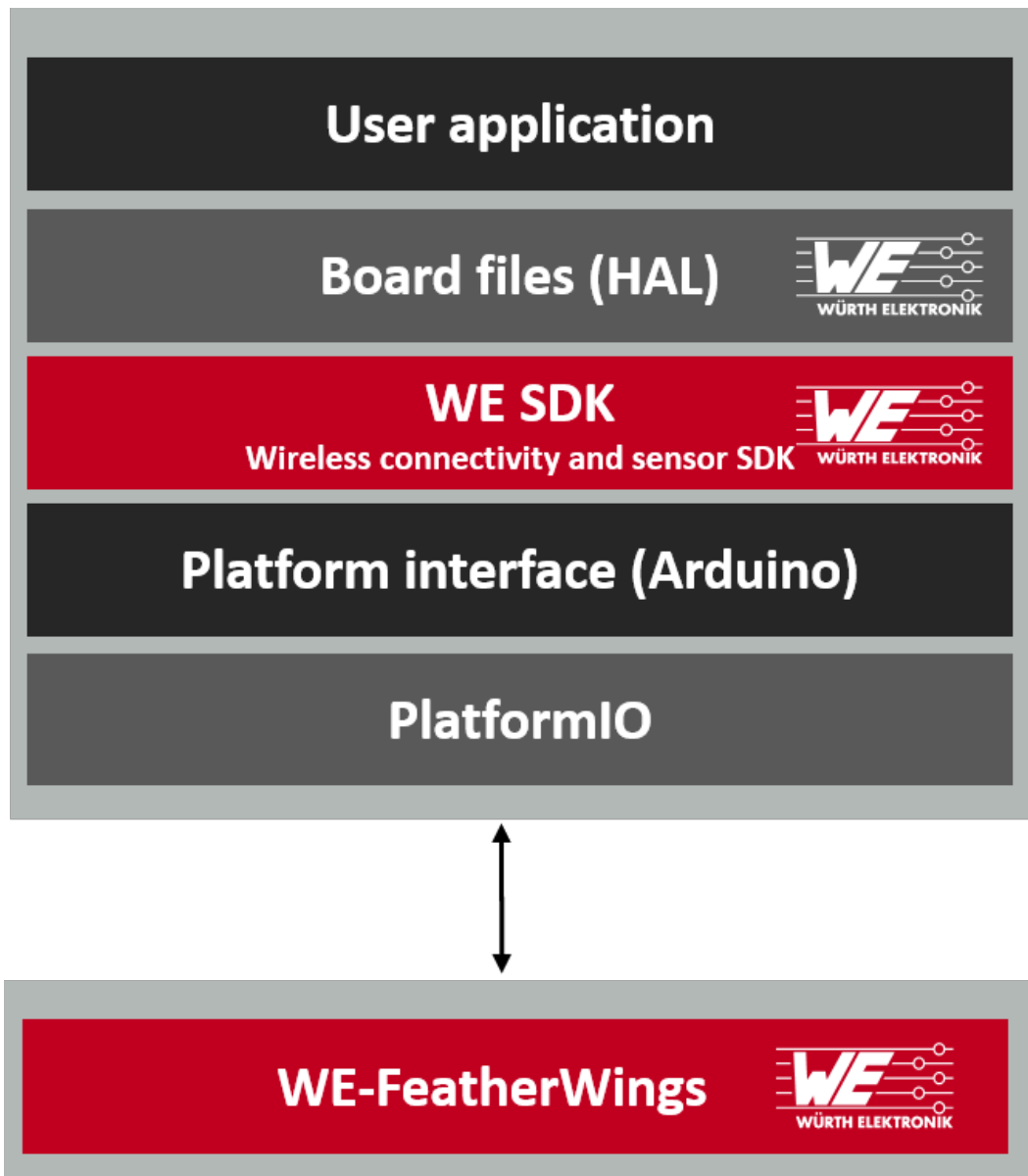


Figure 18: Software architecture

- **WE SDK:** This is a layer of platform-independent pure C drivers for sensors and wireless connectivity modules from Würth Elektronik eiSos. These drivers implement all the necessary functions to utilize full feature set of the sensors and wireless connectivity modules. More details on the SDK and downloads under, we-online.com/wcs-software.
- **Board files:** This layer provides abstraction at a board level and provides functions to configure and control individual FeatherWings from WE.
- **User application:** The SDK currently implements a quick start example for each of the FeatherWing.

6.2.2 IDE

Although platformIO provides a versatile command line interface for development, the SDK provides quick start projects for the Visual Studio Code. This popular IDE makes for better code organization as well as code editing. Visual Studio Code is available on all modern operating systems. Support for extensions, built-in Git and a versatile code editor make it a well rounded tool for embedded software development. Please refer to code.visualstudio.com for more details on Visual Studio Code.

6.2.3 Installation steps

- Install Visual Studio Code on the platform of your choice following the instructions under code.visualstudio.com/docs
- Follow the instructions under platformio.org/install/ide?install=vscode to install PlatformIO IDE extension.

6.2.4 Hardware setup

The quick start examples in the SDK are written to be run on *Adafruit's Feather M0 express*. The hardware setup is as simple as stacking up the FeatherWing on top of the M0 Feather and powering up the board.

6.2.5 Running the quick start example

- Clone or download the WE FeatherWing SDK from Github.
<https://github.com/WurthElektronik/FeatherWings>
- Open the workspace of interest with the filename <FeatherWing>.code-workspace in Visual Studio code.
- Build and upload the code from the PlatformIO tab as shown in the Figure 19.
- After successful upload, click on Monitor to view the debug logs in the serial terminal (see Figure 19).



Make sure that PlatformIO has installed all dependencies properly. Manual actions for installing required plugins and drivers, when behind a firewall or proxy may be required. Local admin rights to do so may also be required.

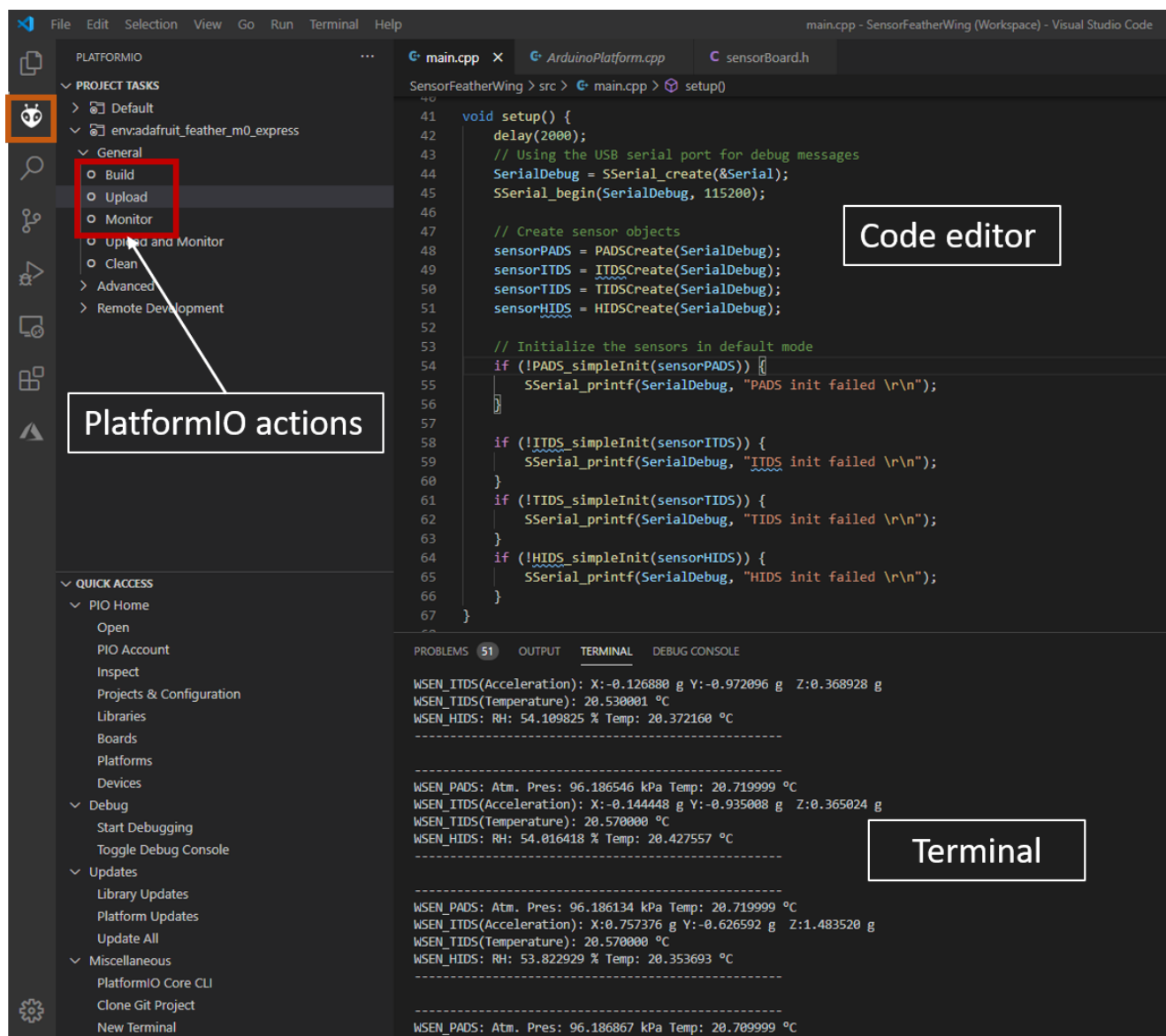


Figure 19: Running the quick start example

7 Regulatory compliance information

Pursuant to Article 1 (2.) of the EU directive 2014/53/EU, Article 1 (2.) the directive does not apply to equipment listed in Annex I (4.): custom-built EV-Kits destined for professionals to be used solely at research and development facilities for such purposes.

7.1 Exemption clause

Relevant regulation requirements are subject to change. Würth Elektronik eiSos does not guarantee the accuracy of the before mentioned information. Directives, technical standards, procedural descriptions and the like may be interpreted differently by the national authorities. Equally, the national laws and restrictions may vary with the country. In case of doubt or uncertainty, we recommend that you consult with the authorities or official certification organizations of the relevant countries. Würth Elektronik eiSos is exempt from any responsibilities or liabilities related to regulatory compliance.

Notwithstanding the above, Würth Elektronik eiSos eiSos makes no representations and warranties of any kind related to their accuracy, correctness, completeness and/or usability for customer applications. No responsibility is assumed for inaccuracies or incompleteness.

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General customer responsibility

Some goods within the product range of Würth Elektronik eiSos GmbH & Co. KG contain statements regarding general suitability for certain application areas. These statements about suitability are based on our knowledge and experience of typical requirements concerning the areas, serve as general guidance and cannot be estimated as binding statements about the suitability for a customer application. The responsibility for the applicability and use in a particular customer design is always solely within the authority of the customer. Due to this fact, it is up to the customer to evaluate, where appropriate to investigate and to decide whether the device with the specific product characteristics described in the product specification is valid and suitable for the respective customer application or not. Accordingly, the customer is cautioned to verify that the documentation is current before placing orders.

Customer responsibility related to specific, in particular safety-relevant applications

It has to be clearly pointed out that the possibility of a malfunction of electronic components or failure before the end of the usual lifetime cannot be completely eliminated in the current state of the art, even if the products are operated within the range of the specifications. The same statement is valid for all software source code and firmware parts contained in or used with or for products in the wireless connectivity and sensor product range of Würth Elektronik eiSos GmbH & Co. KG. In certain customer applications requiring a high level of safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health, it must be ensured by most advanced technological aid of suitable design of the customer application that no injury or damage is caused to third parties in the event of malfunction or failure of an electronic component.

Best care and attention

Any product-specific data sheets, manuals, application notes, PCNs, warnings and cautions must be strictly observed in the most recent versions and matching to the products revisions. These documents can be downloaded from the product specific sections on the wireless connectivity and sensors homepage.

Customer support for product specifications

Some products within the product range may contain substances, which are subject to restrictions in certain jurisdictions in order to serve specific technical requirements. Necessary information is available on request. In this case, the Business Development Engineer (BDM) or the internal sales person in charge should be contacted who will be happy to support in this matter.

Product improvements

Due to constant product improvement, product specifications may change from time to time. As a standard reporting procedure of the Product Change Notification (PCN) according to the JEDEC-Standard, we inform about major changes. In case of further queries regarding the PCN, the Business Development Engineer (BDM), the internal sales person or the technical support team in charge should be contacted. The basic responsibility of the customer as per section 8 and 8 remains unaffected.

All software like "wireless connectivity SDK", "Sensor SDK" or other source codes as well as all PC software tools are not subject to the Product Change Notification information process.

Product life cycle

Due to technical progress and economical evaluation, we also reserve the right to discontinue production and delivery of products. As a standard reporting procedure of the Product Termination Notification (PTN) according to the JEDEC-Standard we will inform at an early stage about inevitable product discontinuance. According to this, we cannot ensure that all products within our product range will always be available. Therefore, it needs to be verified with the Business Development Engineer (BDM) or the internal sales person in charge about the current product availability expectancy before or when the product for application design-in disposal is considered. The approach named above does not apply in the case of individual agreements deviating from the foregoing for customer-specific products. The approach named above does not apply in the case of EV-Boards. EV-Boards may be changed without any notification.

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Würth Elektronik eiSos GmbH & Co. KG provide you as a user with technical data (including data sheets), design resources (including reference designs), recommendations for use or other design recommendations, web tools, safety information and other information in the form of evaluation-boards, -kits or -modules (hereinafter jointly referred to as "EVB") in accordance with the terms and conditions contained here. The EVB is provided in the "as is" state. WE disclaims all express and implied warranties, in particular those concerning the suitability for a certain purpose, the absence of defects or non-violation of third-party rights. The EVB is intended for experienced developers to develop

User manual Adrastea-I FeatherWing Kit

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General warnings

Do not touch the EVB when it is live, and allow charged components, such as capacitors, to discharge completely before handling the EVB. Depending on the individual application, high voltages can occur on the EVB and some components can reach temperatures above 50 °C. Even after disconnecting the EVB from the power source, these conditions remain for a significant time. Please ensure that the appropriate safety precautions are taken when installing and operating this EVB, as one of the following may occur if you handle or use this EVB without observing the relevant safety precautions: - Death - Serious injury - Electric shock - Electric burns - Severe heat burns -

When using the EVB, you undertake to read the instructions for use in full together with the relevant information supplied and/or available on the homepage www.we-online.de/wcs-manuals before putting this EVB into operation. The following points have to be observed in particular:

- Do not touch the EVB while it is live.
- The EVB must be fully assembled and all devices to be tested must be connected before voltage is applied to the EVB.
- The EVB should never be left unattended during operation.
- Capacitors must be completely discharged. The capacitors must be actively discharged using a suitable resistor.

Protection against static electricity

Use the unpackaged product only in ESD protected areas. Wear the ESD personal protective equipment prescribed for these areas. Ground all conductive components, including personnel, as prescribed in ESD protected areas. Ensure that the product is only used by trained personnel.

Purpose and use

The EVB is not a finished product and is not intended for general use by the consumer. The EVB is intended exclusively for use in the evaluation of WE components in the lab or in development environments by highly qualified technicians or engineers, familiar with the risks involved in handling electrical or mechanical components, systems and subsystems. The use of the EVB is your full and independent responsibility. The EVB is expressly not intended to be installed in a terminal device or to be part of a terminal device in whole or in part. WE reserves the right, at its own discretion, to make corrections, improvements, adjustments or other changes to the EVB or to discontinue the EVB. The EVB is not intended for use in devices and applications for which a higher safety and reliability standard is prescribed. It is also not approved for use in safety-relevant applications or where personal injury or fatal consequences must be expected in the event of failure.

Operation of the EVB

The EVB may only be operated within the specifications and environmental parameters recommended by WE, as described in the instructions for use. Exceeding the specified parameters (including, but not limited to, input and output voltage, current, power, and ambient conditions) may result in damage to property. If you have questions about these electrical parameters, please contact WE at (regulatory-compliance@we-online.com) prior to connecting peripheral electronics (including the input voltage and intended loads). Any load outside a certain power range may lead to negative consequences, including, but not limited to, unintended or inaccurate evaluations or possibly permanent damage to the EVB or the electronics connected to it. Please ensure that the appropriate safety precautions are taken when working with the EVB, as serious injuries, including severe or even fatal injuries from electric shock or electric burns, may occur if you do not follow the appropriate safety precautions. Under no circumstances should the EVB be touched while live. When the EVB is connected to a power source, some of its components are electrically charged and/or have temperatures above 50 °C. This condition also applies for a short time after disconnecting from the supply voltage until the capacitors are completely discharged and hot components have cooled down. These components include connectors, linear regulators, switching transistors, heat sinks, resistors, diodes, inductors and other components, which can be identified from the documentation in the instructions for use. As with all electronic lab work, only qualified persons with knowledge of electronic performance evaluation, measurement and diagnostic tools, should use the EVB.

Hazards and warnings

Before putting the EVB into operation, please read the instructions for use and especially the various hazards and warnings described therein. The instructions for use contain important safety information on voltages and temperatures. You take full responsibility and liability for the proper and safe handling of the EVB. You agree to comply with all safety requirements, rules and regulations related to the use of the EVB. You also take full responsibility for: (1) establishing safeguards to ensure that the use of the EVB does not cause damage to property, personal injury or death, even if the EVB does not function as described, intended or expected, (2) the test setup in which the EVB is integrated, all safety requirements, rules and regulations and also that no damage to property, personal injury or other hazardous situation occurs even if the EVB fails, and (3) ensuring the safety of all activities performed by you or your employees when using the EVB. In particular, this means that the technical rules VDE [German Electrical Engineering, Electronic and Information Technology Association] 0105-100 and BGI [German trade association information] 891 (or corresponding applicable safety regulations outside Germany) for the operation of electrical test setups must be observed, the test area is protected against unauthorized access or accidental touching, current limitations, and emergency stop mechanisms are functional and test setups are never operated unattended. If you have any questions about the safe use of the EVB, please contact WE at regulatory-compliance@we-online.com for more information.

Your responsibility with regard to the applicable laws

- You are responsible for being sufficiently informed about and complying with all international, national, state and local applicable laws, rules and regulations that apply to the handling or use of the EVB by you or your employees.
- The EVB generates, uses and radiates radio frequency energy, but has not been tested for conformity with the limits applicable to the product category, which are applicable according to the European Union regulations for protection against radio frequency interference. Operation of the EVB may cause interference with radio communication. In this case, the costs incurred for necessary measures to remedy the interference are to be borne by the user.

As the EVB is not a finished product, it may not comply with applicable regulatory, safety or certification standards that are normally as-

sociated with other products, such as Directive 2011/65/EC of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of hazardous substances and Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). You take full responsibility for compliance with such standards that apply to the EVB. You also take responsibility for the proper disposal of the components and materials of the EVB.

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WE ensures that the EVB meets the specifications given in the instructions for use (within the deviations stated therein) for a period of 12 months from the date of purchase and functions in accordance with the instructions for use. On the basis of the underlying statutory provisions, WE shall rectify defects or offer free replacement of the EVB to which damage occurs that is evidently attributable to a defect for which WE is responsible and is at fault. A warranty claim is subject to the user having complied with the statutory duties of inspection and notification of defects and that the EVB has been received by WE no later than ten (10) days after expiry of the warranty period. This warranty is not transferable to others. This warranty does not apply to defects or impairments in performance resulting from incorrect use, use contrary to WE's instructions, improper installation, improper operation or misuse. WE accepts no liability whatsoever for the failure of equipment or other items not manufactured by or for WE, including, but not limited to, equipment or items to which the EVB is attached or for which the EVB is used. WE DOES NOT GRANT ANY WARRANTIES OR ASSURANCES WHATSOEVER, EXPRESS OR IMPLIED, WITH RESPECT TO THE EVB, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MARKETABILITY OR SUITABILITY FOR A PARTICULAR PURPOSE.

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Firmware update(s)

You have the opportunity to request the current and actual firmware for a bought wireless connectivity product within the time of warranty. However, Würth Elektronik eiSos has no obligation to update a modules firmware in their production facilities, but can offer this as a service on request. The upload of firmware updates falls within your responsibility, e.g. via ACC or another software for firmware updates. Firmware updates will not be communicated automatically. It is within your responsibility to check the current version of a firmware in the latest version of the product manual on our website. The revision table in the product manual provides all necessary information about firmware updates. There is no right to be provided with binary files, so called "firmware images", those could be flashed through JTAG, SWD, Spi-Bi-Wire, SPI or similar interfaces.

Disclaimer of warranty

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Miscellaneous

Würth Elektronik eiSos reserves the right at any time to change these terms at its own discretion. It is your responsibility to check at Würth Elektronik eiSos homepage for any updates. Your continued usage of the products will be deemed as the acceptance of the change.

We recommend you to be updated about the status of new firmware and software, which is available on our website or in our data sheet and manual, and to implement new software in your device where appropriate.

By ordering a product, you accept these license terms in all terms.

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