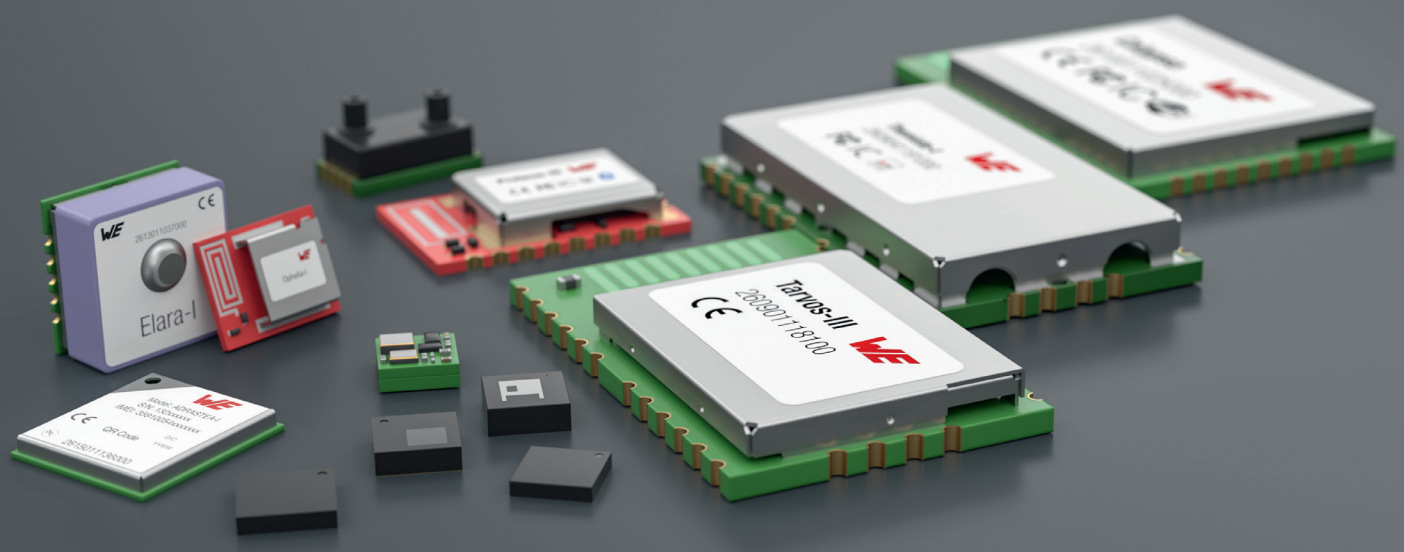

User manual

Adrastea-I FeatherWing

2615039336001

Version 1.0

February 22, 2024

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 to include in the customer system design, the possibility for a firmware update of the product.

Revision history

Manual version	HW version	Notes	Date
1.0	2.0	Initial version	February 2024

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	
HIGH	High signal level	
IDE	Integrated Development Environment	
IEC	International Electrotechnical Commission	
IEEE	Institute for Electrical and Electronic Engineers	
JTAG	Joint Test Action Group	
LED	Light Emitting Diode	
Li-Po	Lithium-Polymer	
LOW	Low signal level	
MCU	Microcontroller Unit	
PC	Personal Computer	
PCB	Printed Circuit Board	
RAM	Random Access Memory	
RTS	Request to Send	
SDK	Software Development Kit	
SIM	Subscriber Identity Module	
UMRF	Ultraminiature Radio Frequency	
USB	Universal Serial Bus	
VCC	Voltage Common Collector	Supply voltage
VDD	Voltage Drain Drain	Supply voltage

Contents

1 General description

1.1 Introduction

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.

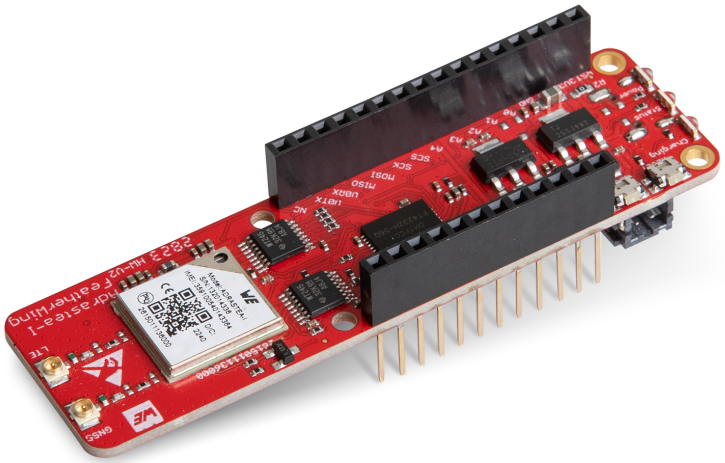

Figure 1: The WE Adrastea-I FeatherWing (2615039336001)

1.2 Block diagram

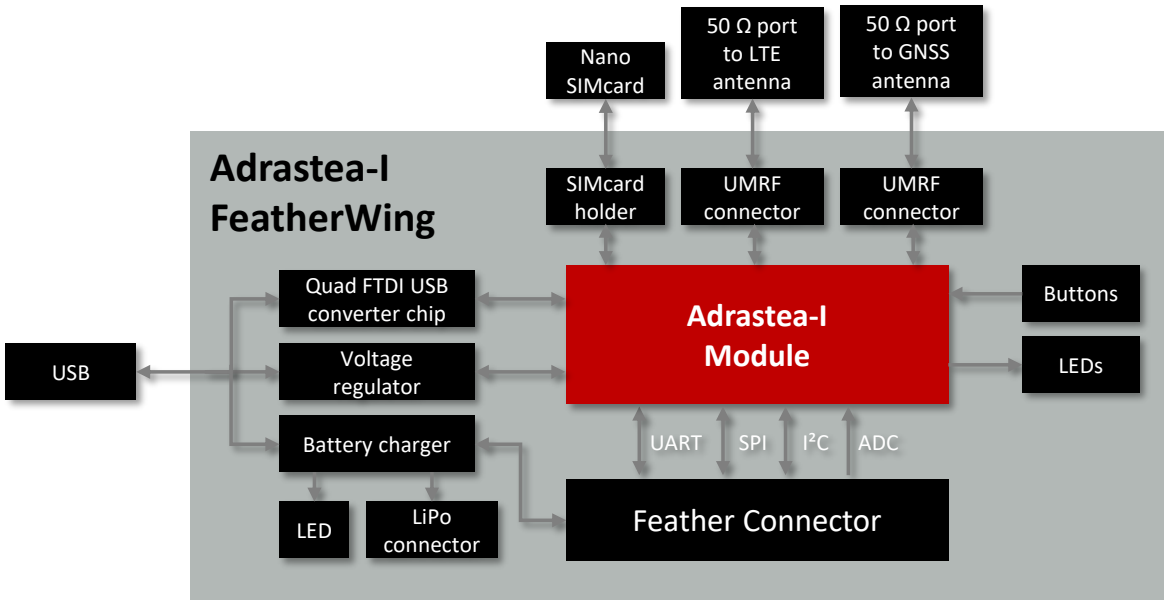

Figure 2: Block diagram - Adrastea-I FeatherWing

1.3 Contents

Description	Quantity
WE Adrastea-I FeatherWing	1
LTE dipole antenna	1
GNSS dipole antenna	1
WR-UMRF SMA Bulkhead Jack to UMRF Right Angle Plug	2
Packaging: ESD safe bag	1

Table 1: 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.

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

2 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.

2.1 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.

2.2 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 x14.6 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.

2.2.1 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^2C 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	- IPv4, IPv6 - TPC/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	- 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

Module Key Featurestab:module_features
Further details about the LTE-M / NB-IoT cellular module can be found under
we-online.com/catalog/en/ADRASTEA

3 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*.

3.1 Connectors

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

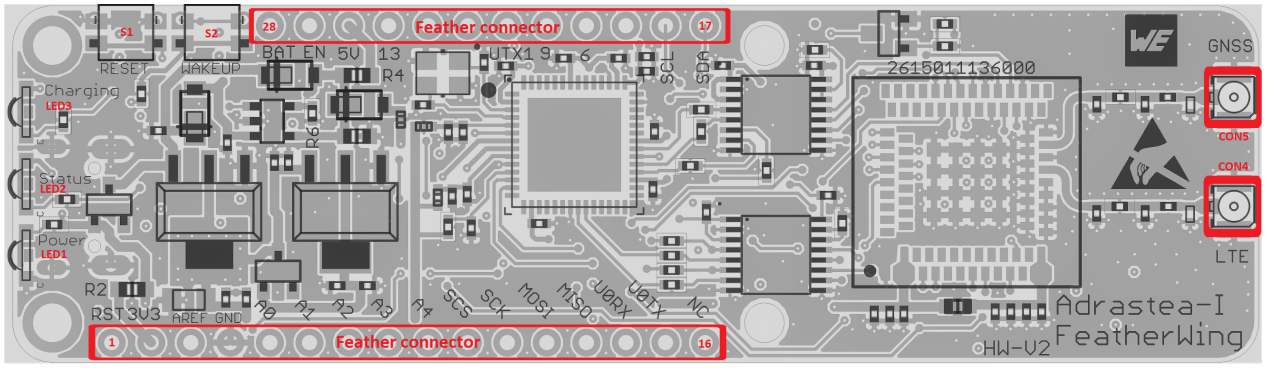

Figure 3: Connectors Top

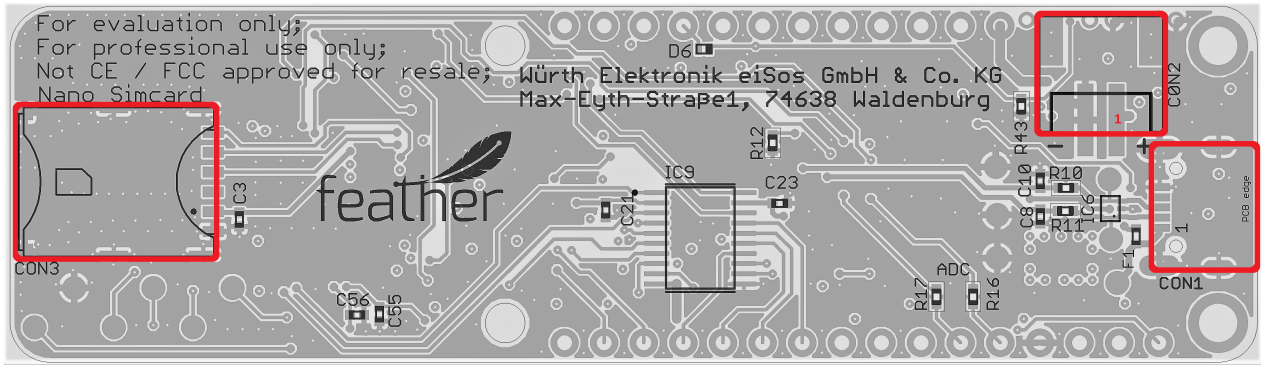

Figure 4: Connectors Bottom

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 3: Default assembled connectors and pin headers

3.1.1 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	$\overline{RST}$	$\overline{Reset}$
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

3.1.2 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 5: Micro-USB connector

3.1.3 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 mA. I_{Charge} can be modifed by changing R6 wich is a 5.1 kΩ by default. A 2 kΩ 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 6: Battery connector

3.1.4 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 7: 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/*.

3.1.5 CON4

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

CON4	Function
Inner	RF Signal
Outer	GND

Table 8: 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.

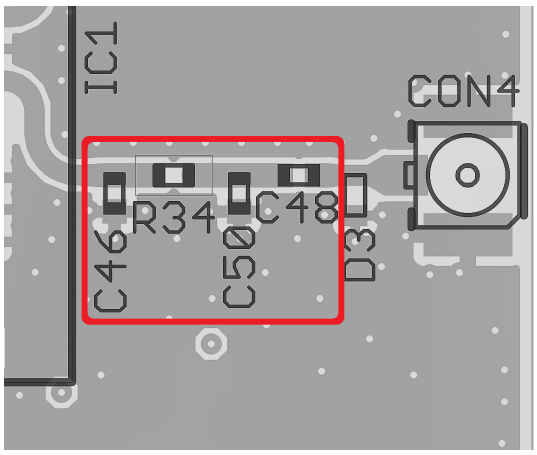

Figure 5: Matching filter for LTE transmission line

3.1.6 CON5

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

CON5	Function
Inner	RF Signal
Outer	GND

Table 9: 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.

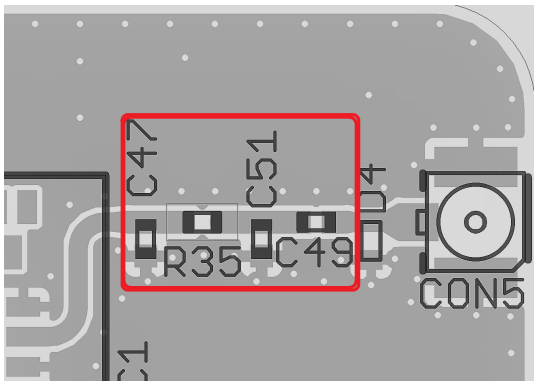

Figure 6: Matching filter for GNSS transmission line

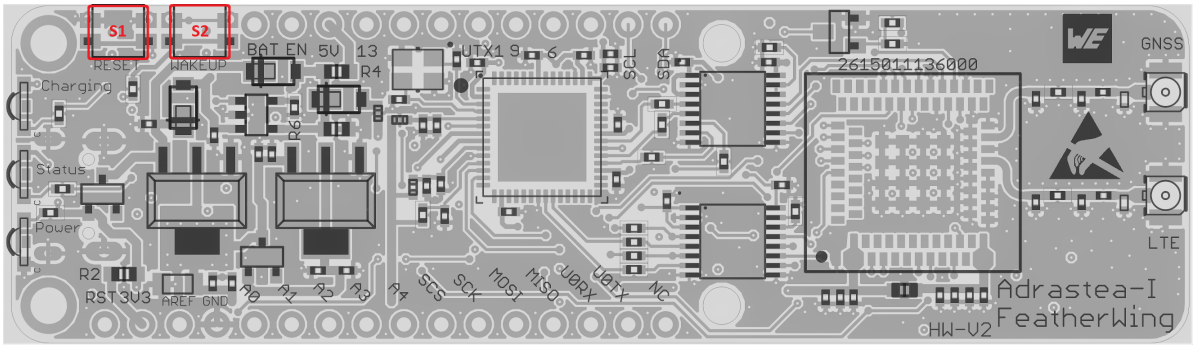

Figure 7: Buttons

3.2 Push buttons

3.2.1 S1

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

3.2.2 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.

3.3 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.

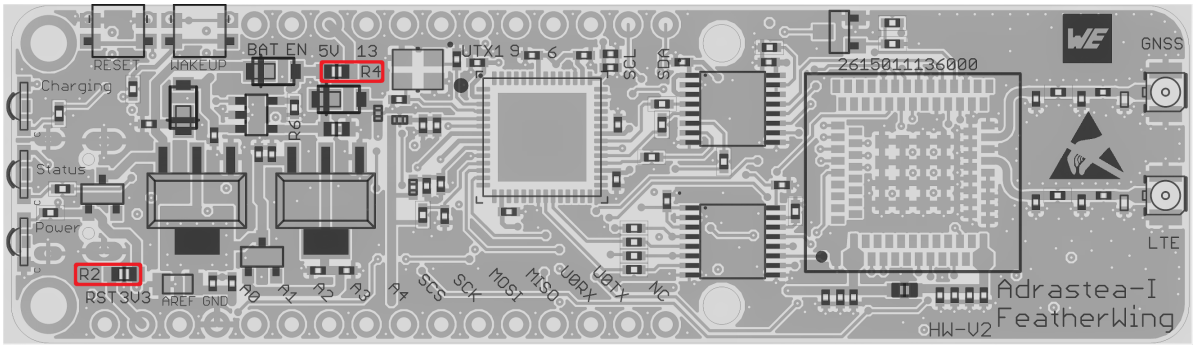

Figure 8: Resistor R2 and R4

3.4 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 assings the COM-PORT number in ascending order, which respectively corresponds to the UART0, UART1 and UART2. The following table shows an example of possible assingment 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 10: COM-PORT to UART assignment example

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

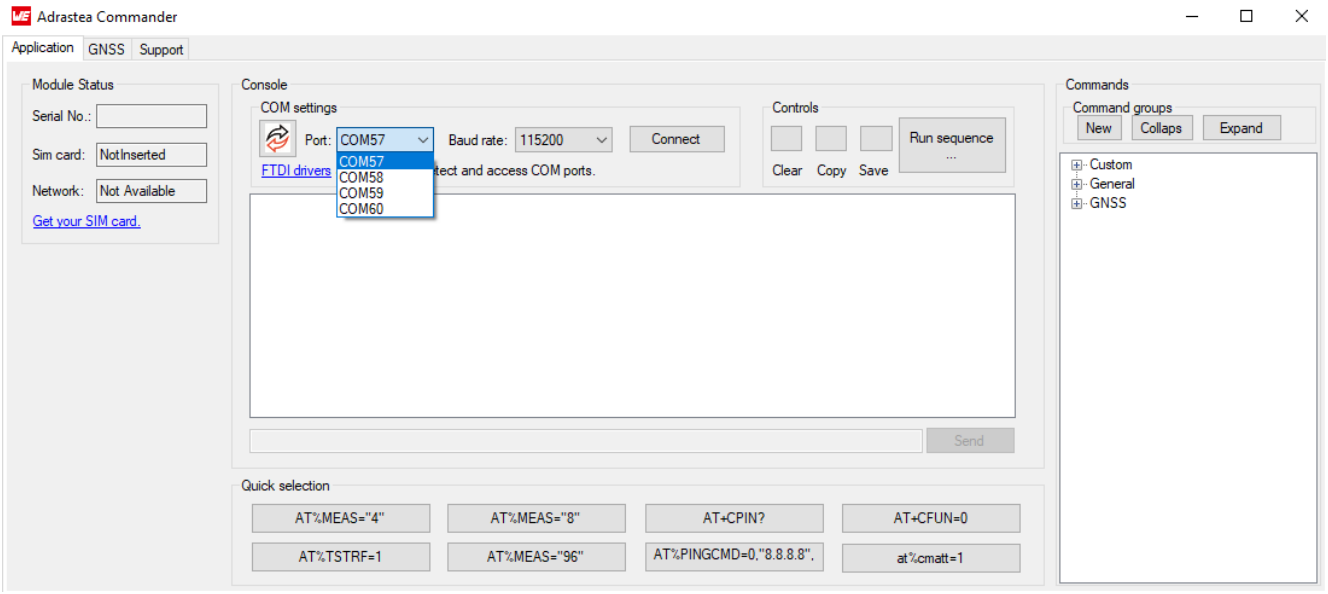

Figure 9: COM ports detected - Adrastea commander

The USB cable length must not exceed 3 meters.

3.5 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 11: LED indicators

3.6 Schematics

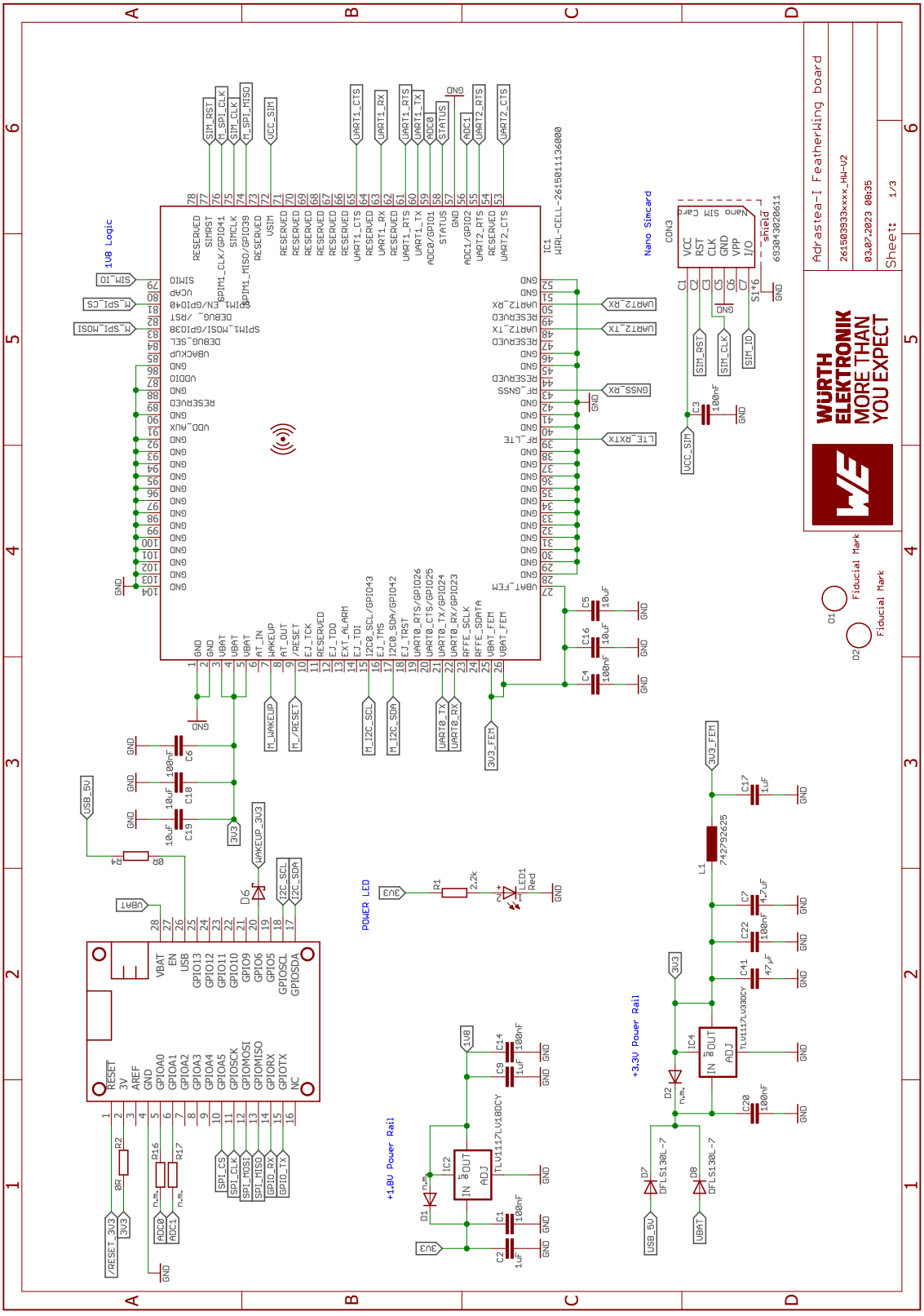

Figure 10: Schematic part 1

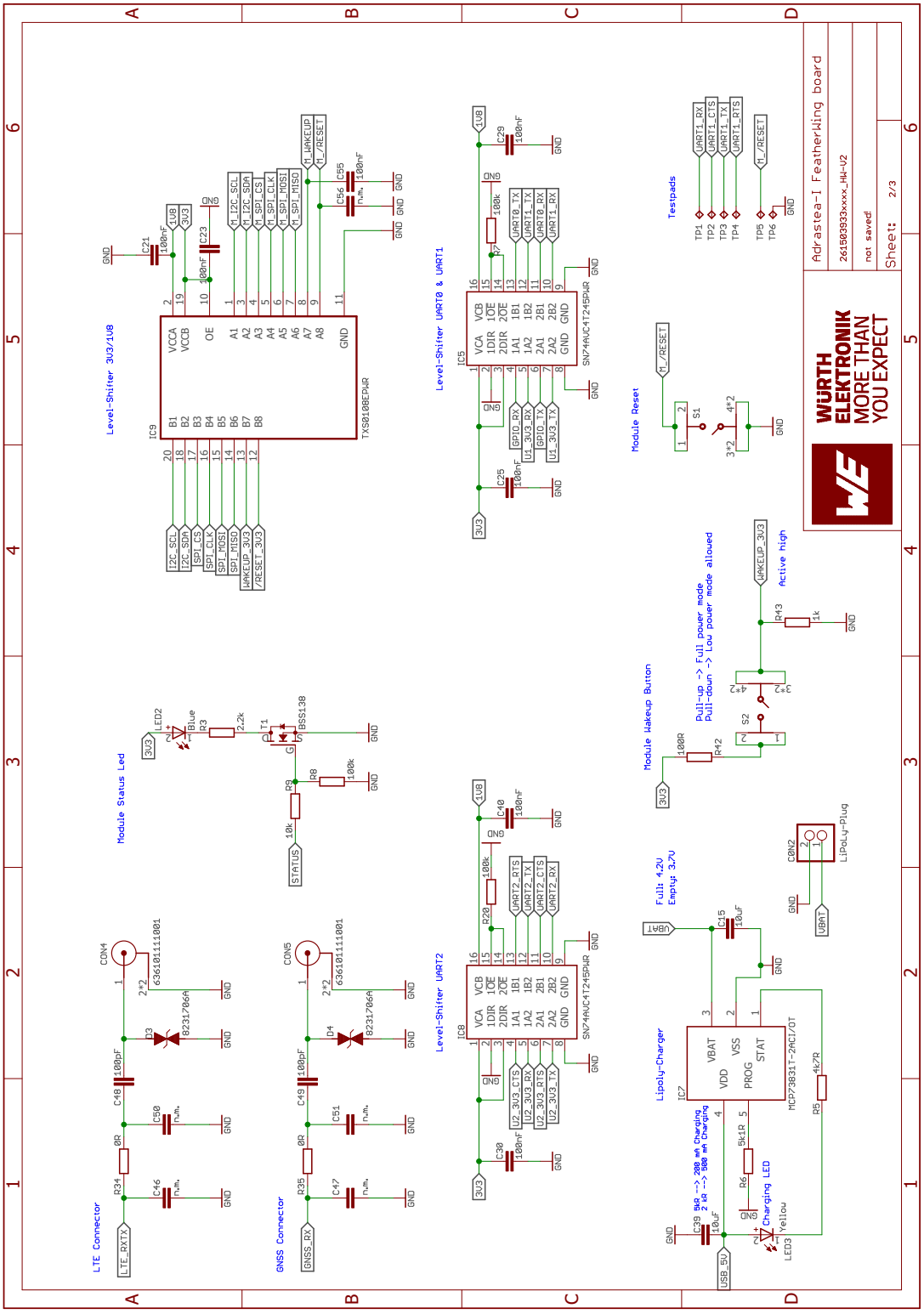

Figure 11: Schematic part 2

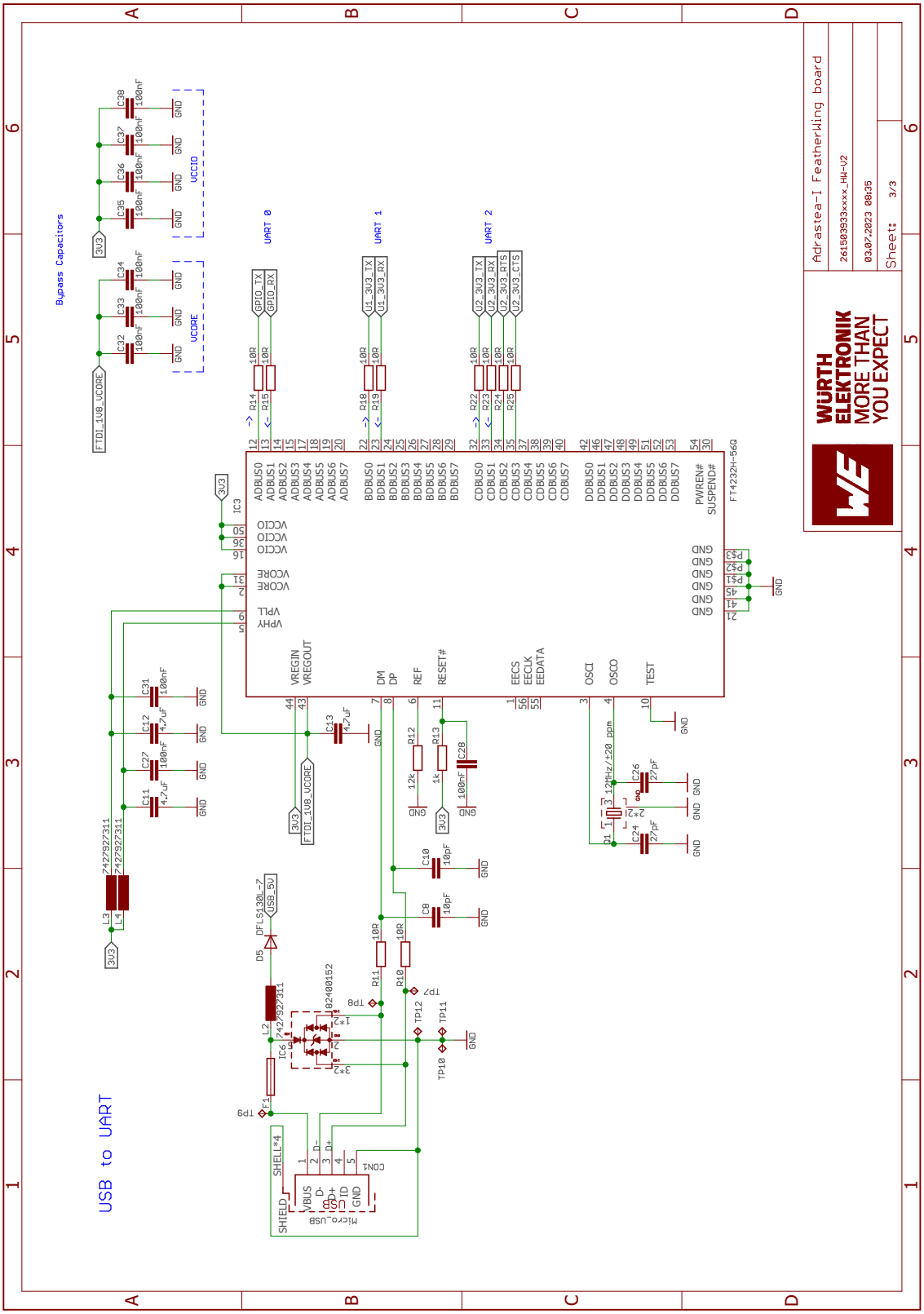

Figure 12: Schematic part 3

3.7 Layout

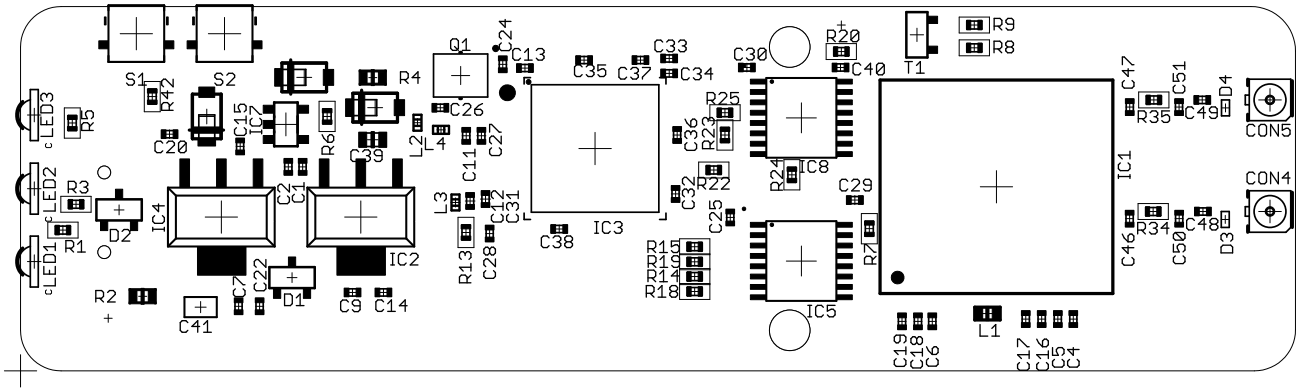

Figure 13: Assembly diagram top layer

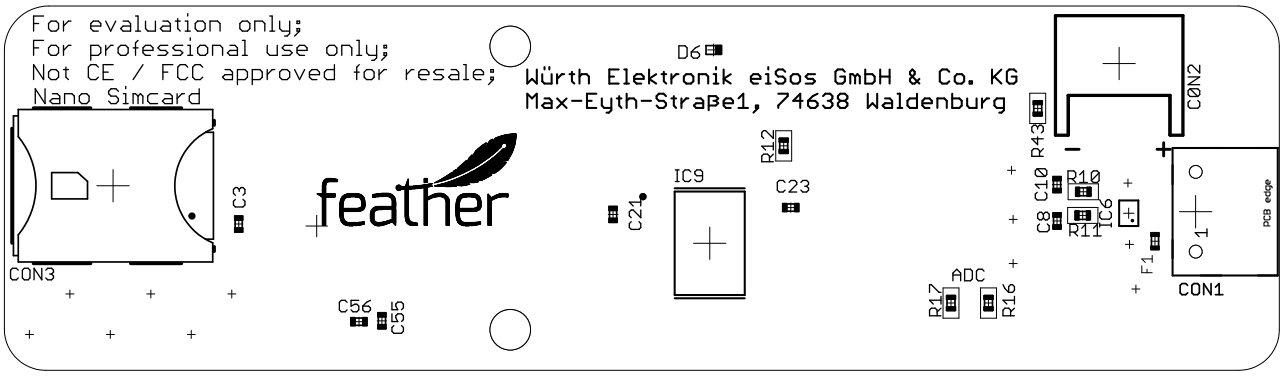

Figure 14: Assembly diagram bottom layer

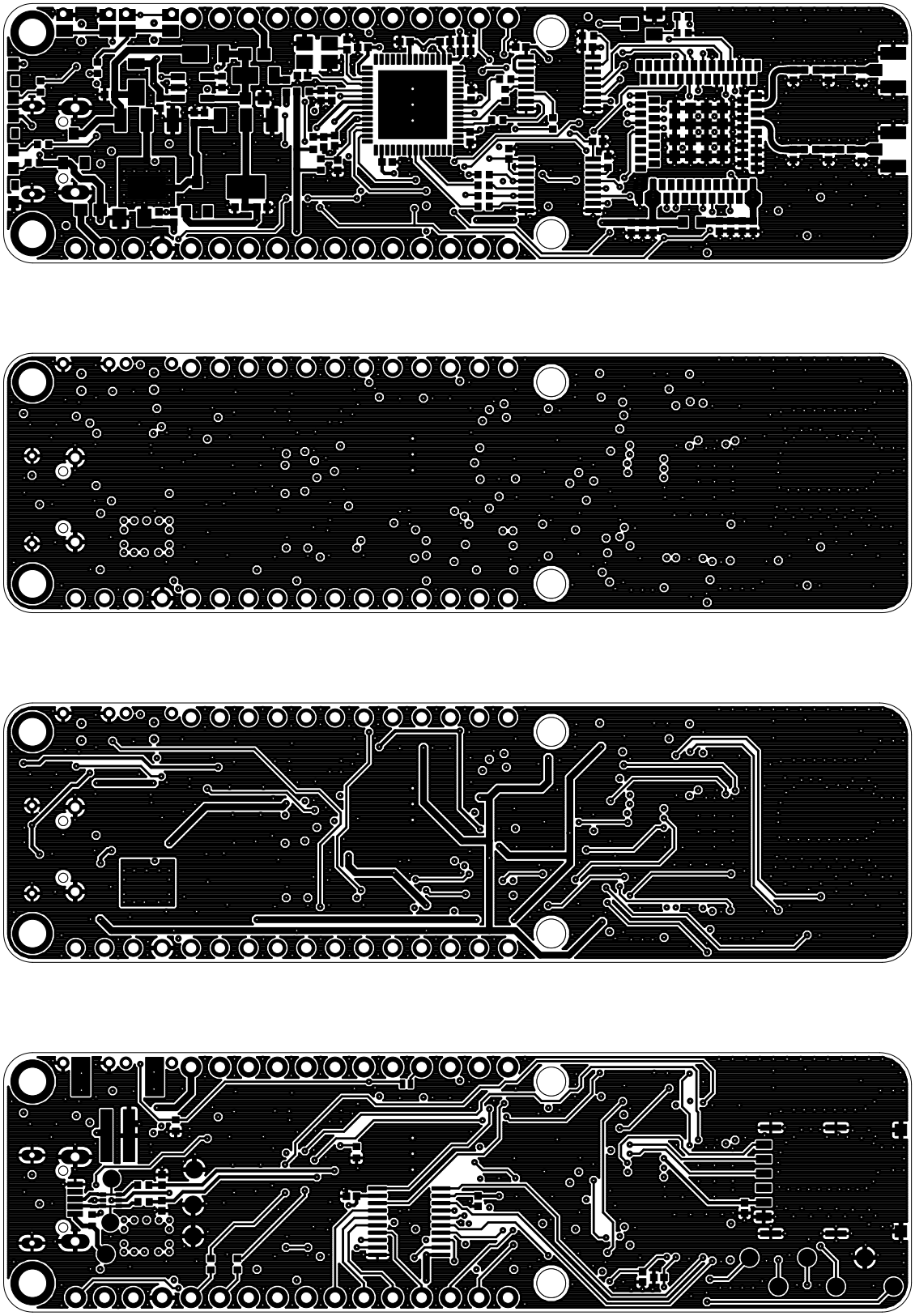

Figure 15: Top layer (upper), second layer (second), third layer (third), fourth layer (bottom)

3.8 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 12: 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 13: 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 kΩ	0402	Yageo	RC0402FR-072K2L
R2	0 Ω	0603	Yageo	RC0603JR-070RL
R3	2.2 kΩ	0402	Yageo	RC0402FR-072K2L
R4	0 Ω	0603	Yageo	RC0603JR-070RL
R5	4.7 kΩ	0402	Yageo	RC0402FR-074K7L
R6	5.1 kΩ	0402	Yageo	RC0402FR-075K1L
R7	100 kΩ	0402	Yageo	RC0402FR-07100KL
R8	100 kΩ	0402	Yageo	RC0402FR-07100KL
R9	10 kΩ	0402	Yageo	RC0402FR-0710KL
R10	10 Ω	0402	Yageo	RC0402FR-0710RL
R11	10 Ω	0402	Yageo	RC0402FR-0710RL
R12	12 kΩ	0402	Yageo	RC0402FR-0712KL
R13	1 kΩ	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 kΩ	0402	Yageo	RC0402FR-07100KL
R22	10 Ω	0402	Yageo	RC0402FR-0710RL
R23	10 Ω	0402	Yageo	RC0402FR-0710RL

Table 14: 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	1kΩ	0402	Yageo	RC0402FR-071KL
S1	434331013822	SMT	Würth Elektronik eiSos	*434331013822*
S2	434331013822	SMT	Würth Elektronik eiSos	*434331013822*
T1	BSS138	SOT-23	onsemi	BSS138

Table 15: Bill of materials part 4

4 Software description

Würth Elektronik eiSos provides a Software Development Kit (SDK) with examples to support all the WE FeatherWings. Here are the salient features of the WE FeatherWing SDK.

This setup 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. However the same result can be achieved using the Adrastea's inteegrated Application MCU Cortex M4.

- 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*.

4.1 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 16 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.
- **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.

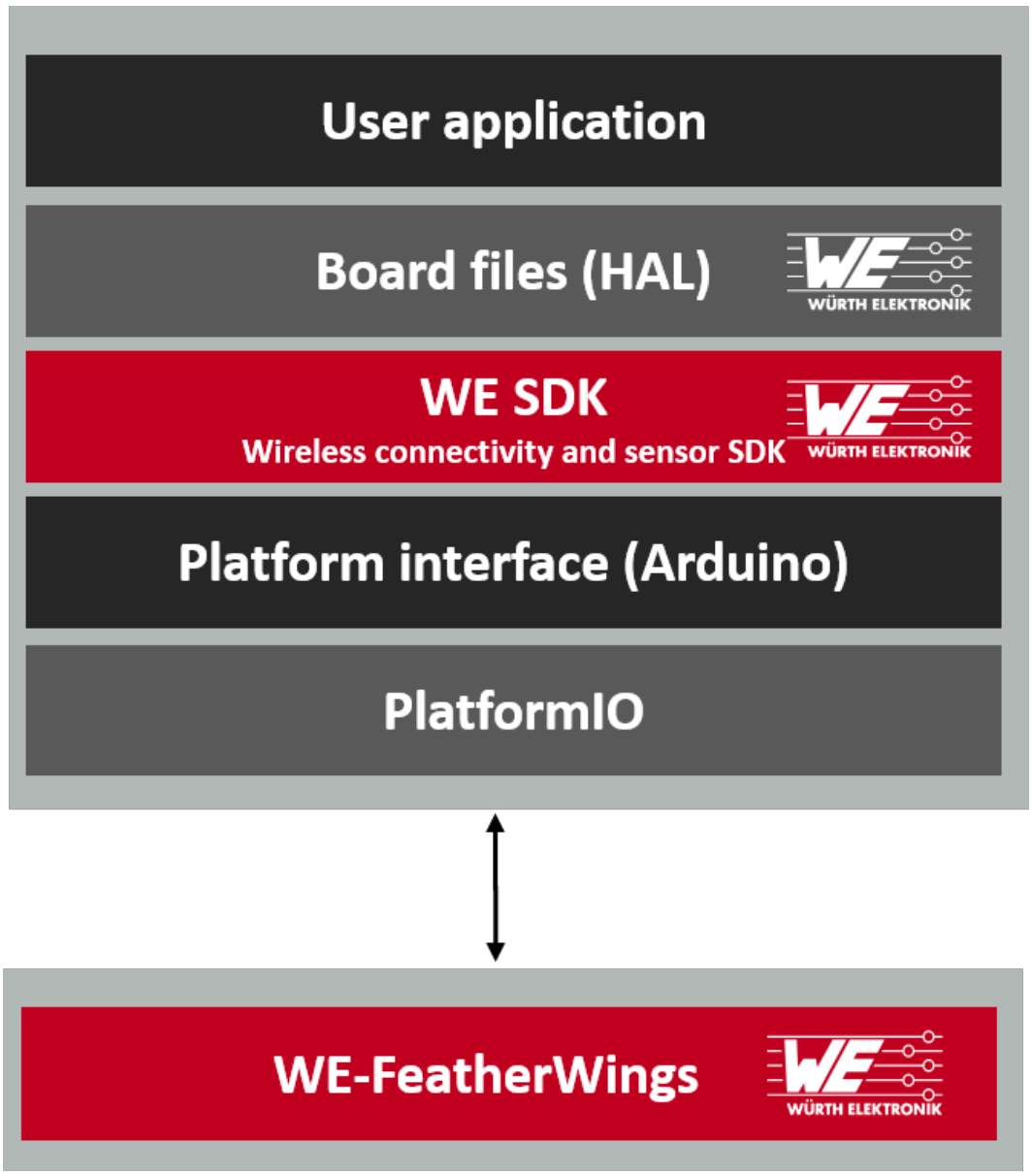

Figure 16: Software architecture

4.2 Installing the tools

4.2.1 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.

4.2.2 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.

4.3 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.

4.4 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 17.
- After successful upload, click on Monitor to view the debug logs in the serial terminal (see Figure 17).

Make sure that Plattform IO 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.

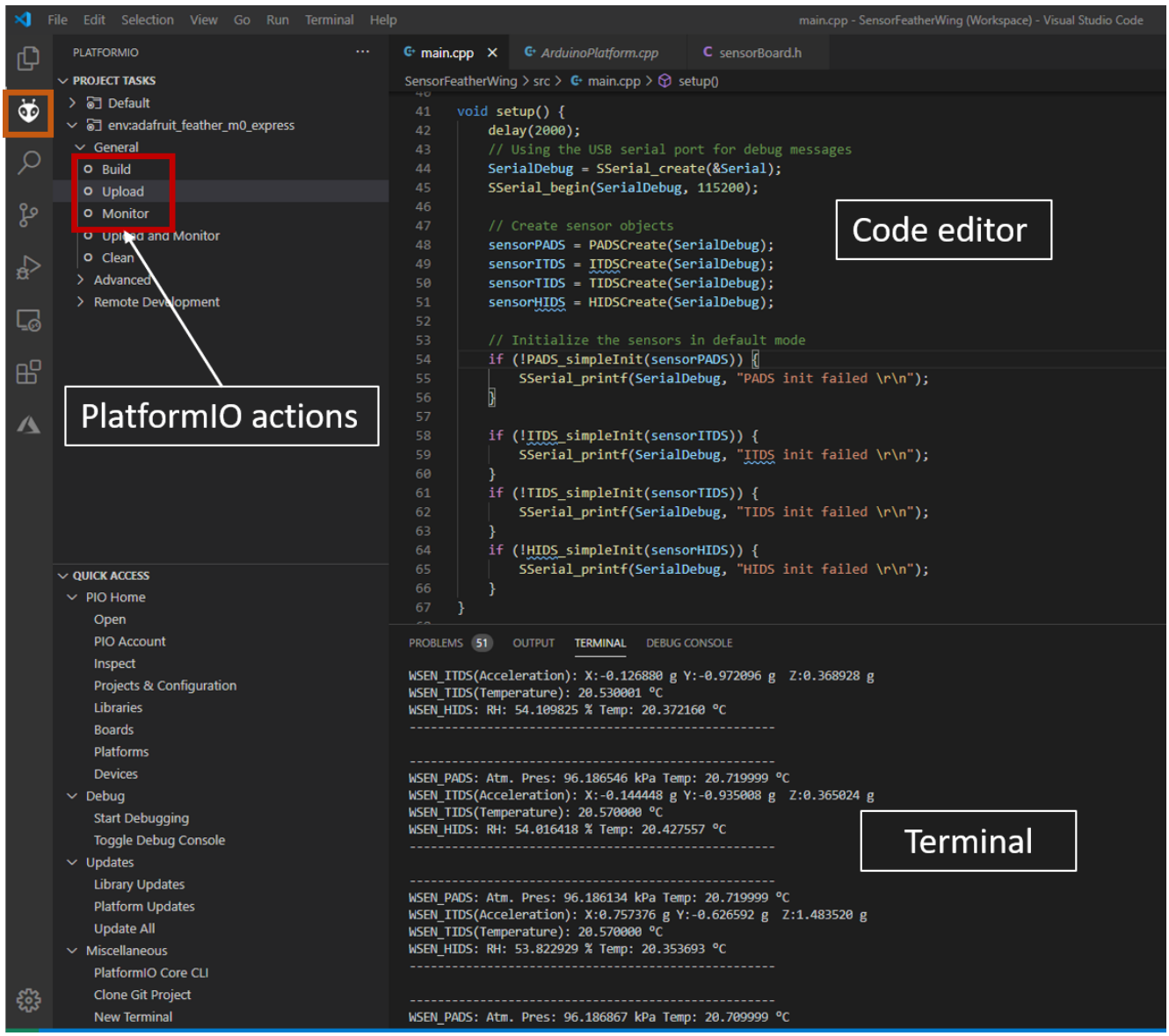

Figure 17: Running the quick start example

5 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 evaluation kits destined for professionals to be used solely at research and development facilities for such purposes.

Nevertheless this evaluation board has been tested to satisfy general EMC requirements. Following standards have been applied:

- IEC 61000-4-3
- IEC 61000-4-4
- IEC 61000-4-6
- CISPR 16-2-1
- CISPR 16-2-3

5.1 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 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.

6 Important notes

The following conditions apply to all goods within the wireless connectivity product range of Würth Elektronik eiSos GmbH & Co. KG:

6.1 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.

6.2 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.

6.3 Best care and attention

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

6.4 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 field sales engineer or the internal sales person in charge should be contacted who will be happy to support in this matter.

6.5 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 field sales engineer, the internal sales person or the technical support team in charge should be contacted. The basic responsibility of the customer as per section 6.1 and 6.2 remains unaffected. All wireless connectivity module driver software ¨wireless connectivity SDK¨ and it's source codes as well as all PC software tools are not subject to the Product Change Notification information process.

6.6 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 field sales engineer 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.

6.7 Property rights

All the rights for contractual products produced by Würth Elektronik eiSos GmbH & Co. KG on the basis of ideas, development contracts as well as models or templates that are subject to copyright, patent or commercial protection supplied to the customer will remain with Würth Elektronik eiSos GmbH & Co. KG. Würth Elektronik eiSos GmbH & Co. KG does not warrant or represent that any license, either expressed or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, application, or process in which Würth Elektronik eiSos GmbH & Co. KG components or services are used.

6.8 General terms and conditions

Unless otherwise agreed in individual contracts, all orders are subject to the current version of the "General Terms and Conditions of Würth Elektronik eiSos Group", last version available at *www.we-online.com*.

7 Legal notice

7.1 Exclusion of liability

Würth Elektronik eiSos GmbH & Co. KG considers the information in this document to be correct at the time of publication. However, Würth Elektronik eiSos GmbH & Co. KG reserves the right to modify the information such as technical specifications or functions of its products or discontinue the production of these products or the support of one of these products without any written announcement or notification to customers. The customer must make sure that the information used corresponds to the latest published information. Würth Elektronik eiSos GmbH & Co. KG does not assume any liability for the use of its products. Würth Elektronik eiSos GmbH & Co. KG does not grant licenses for its patent rights or for any other of its intellectual property rights or third-party rights.

Notwithstanding anything above, Würth Elektronik eiSos GmbH & Co. KG makes no representations and/or warranties of any kind for the provided information related to their accuracy, correctness, completeness, usage of the products and/or usability for customer applications. Information published by Würth Elektronik eiSos GmbH & Co. KG regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof.

7.2 Suitability in customer applications

The customer bears the responsibility for compliance of systems or units, in which Würth Elektronik eiSos GmbH & Co. KG products are integrated, with applicable legal regulations. Customer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of Würth Elektronik eiSos GmbH & Co. KG components in its applications, notwithstanding any applications-related in-formation or support that may be provided by Würth Elektronik eiSos GmbH & Co. KG. Customer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences lessen the likelihood of failures that might cause harm and take appropriate remedial actions. The customer will fully indemnify Würth Elektronik eiSos GmbH & Co. KG and its representatives against any damages arising out of the use of any Würth Elektronik eiSos GmbH & Co. KG components in safety-critical applications.

7.3 Trademarks

AMBER wireless is a registered trademark of Würth Elektronik eiSos GmbH & Co. KG. All other trademarks, registered trademarks, and product names are the exclusive property of the respective owners.

7.4 Usage restriction

Würth Elektronik eiSos GmbH & Co. KG products have been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment

where a higher safety standard and reliability standard is especially required or where a failure of the product is reasonably expected to cause severe personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover, Würth Elektronik eiSos GmbH & Co. KG products are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation (automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network etc. Würth Elektronik eiSos GmbH & Co. KG must be informed about the intent of such usage before the design-in stage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component, which is used in electrical circuits that require high safety and reliability function or performance. By using Würth Elektronik eiSos GmbH & Co. KG products, the customer agrees to these terms and conditions.

8 License terms

These License terms will take effect upon the purchase and usage of the Würth Elektronik eiSos GmbH & Co. KG wireless connectivity products. You hereby agree that these license terms are applicable to the product and the incorporated software, firmware and source codes (collectively, "Software") made available by Würth Elektronik eiSos in any form, including but not limited to binary, executable or source code form.
The software included in any Würth Elektronik eiSos wireless connectivity product is purchased to you on the condition that you accept the terms and conditions of these license terms. You agree to comply with all provisions under these license terms.

8.1 Limited license

Würth Elektronik eiSos hereby grants you a limited, non-exclusive, non-transferable and royalty-free license to use the software and under the conditions that will be set forth in these license terms. You are free to use the provided software only in connection with one of the products from Würth Elektronik eiSos to the extent described in these license terms. You are entitled to change or alter the source code for the sole purpose of creating an application embedding the Würth Elektronik eiSos wireless connectivity product. The transfer of the source code to third parties is allowed to the sole extent that the source code is used by such third parties in connection with our product or another hardware provided by Würth Elektronik eiSos under strict adherence of these license terms. Würth Elektronik eiSos will not assume any liability for the usage of the incorporated software and the source code. You are not entitled to transfer the source code in any form to third parties without prior written consent of Würth Elektronik eiSos.
You are not allowed to reproduce, translate, reverse engineer, decompile, disassemble or create derivative works of the incorporated software and the source code in whole or in part. No more extensive rights to use and exploit the products are granted to you.

8.2 Usage and obligations

The responsibility for the applicability and use of the Würth Elektronik eiSos wireless connectivity product with the incorporated firmware in a particular customer design is always solely within the authority of the customer. Due to this fact, it is up to you to evaluate and investigate, where appropriate, and to decide whether the device with the specific product characteristics described in the product specification is valid and suitable for your respective application or not.
You are responsible for using the Würth Elektronik eiSos wireless connectivity product with the incorporated firmware in compliance with all applicable product liability and product safety laws. You acknowledge to minimize the risk of loss and harm to individuals and bear the risk for failure leading to personal injury or death due to your usage of the product.
Würth Elektronik eiSos' products with the incorporated firmware are not authorized for use in safety-critical applications, or where a failure of the product is reasonably expected to cause severe personal injury or death. Moreover, Würth Elektronik eiSos' products with the incorporated firmware are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation (automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network etc. You

shall inform Würth Elektronik eiSos about the intent of such usage before design-in stage. In certain customer applications requiring a very high level of safety and in which the malfunction or failure of an electronic component could endanger human life or health, you must ensure to have all necessary expertise in the safety and regulatory ramifications of your applications. You acknowledge and agree that you are solely responsible for all legal, regulatory and safety-related requirements concerning your products and any use of Würth Elektronik eiSos' products with the incorporated firmware in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by Würth Elektronik eiSos. YOU SHALL INDEMNIFY WÜRTH ELEKTRONIK EISOS AGAINST ANY DAMAGES ARISING OUT OF THE USE OF WÜRTH ELEKTRONIK EISOS' PRODUCTS WITH THE INCORPORATED FIRMWARE IN SUCH SAFETY-CRITICAL APPLICATIONS.

8.3 Ownership

The incorporated firmware created by Würth Elektronik eiSos is and will remain the exclusive property of Würth Elektronik eiSos.

8.4 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.

8.5 Disclaimer of warranty

THE FIRMWARE IS PROVIDED "AS IS". YOU ACKNOWLEDGE THAT WÜRTH ELEKTRONIK EISOS MAKES NO REPRESENTATIONS AND WARRANTIES OF ANY KIND RELATED TO, BUT NOT LIMITED TO THE NON-INFRINGEMENT OF THIRD PARTIES' INTELLECTUAL PROPERTY RIGHTS OR THE MERCHANTABILITY OR FITNESS FOR YOUR INTENDED PURPOSE OR USAGE. WÜRTH ELEKTRONIK EISOS DOES NOT WARRANT OR REPRESENT THAT ANY LICENSE, EITHER EXPRESS OR IMPLIED, IS GRANTED UNDER ANY PATENT RIGHT, COPYRIGHT, MASK WORK RIGHT, OR OTHER INTELLECTUAL PROPERTY RIGHT RELATING TO ANY COMBINATION, MACHINE, OR PROCESS IN WHICH THE WÜRTH ELEKTRONIK EISOS' PRODUCT WITH THE INCORPORATED FIRMWARE IS USED. INFORMATION PUBLISHED BY WÜRTH ELEKTRONIK EISOS REGARDING THIRD-PARTY PRODUCTS OR SERVICES DOES NOT CONSTITUTE A LICENSE FROM WÜRTH ELEKTRONIK EISOS TO USE SUCH PRODUCTS OR SERVICES OR A WARRANTY OR ENDORSEMENT THEREOF.

8.6 Limitation of liability

Any liability not expressly provided by Würth Elektronik eiSos shall be disclaimed.
You agree to hold us harmless from any third-party claims related to your usage of the Würth Elektronik eiSos' products with the incorporated firmware, software and source code. Würth Elektronik eiSos disclaims any liability for any alteration, development created by you or your customers as well as for any combination with other products.

8.7 Applicable law and jurisdiction

Applicable law to these license terms shall be the laws of the Federal Republic of Germany. Any dispute, claim or controversy arising out of or relating to these license terms shall be resolved and finally settled by the court competent for the location of Würth Elektronik eiSos registered office.

8.8 Severability clause

If a provision of these license terms is or becomes invalid, unenforceable or null and void, this shall not affect the remaining provisions of the terms. The parties shall replace any such provisions with new valid provisions that most closely approximate the purpose of the terms.

8.9 Miscellaneous

Würth Elektronik eiSos reserves the right at any time to change this 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.

List of Figures

List of Tables

Contact
Würth Elektronik eiSos GmbH & Co. KG
Division Wireless Connectivity & Sensors

Max-Eyth-Straße 1
74638 Waldenburg
Germany

Tel.: +49 651 99355-0
Fax.: +49 651 99355-69
www.we-online.com/wireless-connectivity