



## USER MANUAL

ADRASTEA-I FEATHERWING

2615039336001

VERSION 1.1

OCTOBER 16, 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 including the possibility of a firmware update in the customer system design.

## 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"><li>• Updated chapter Important notes</li><li>• Updated chapter Legal notice</li></ul> | October 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                           |

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# 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.

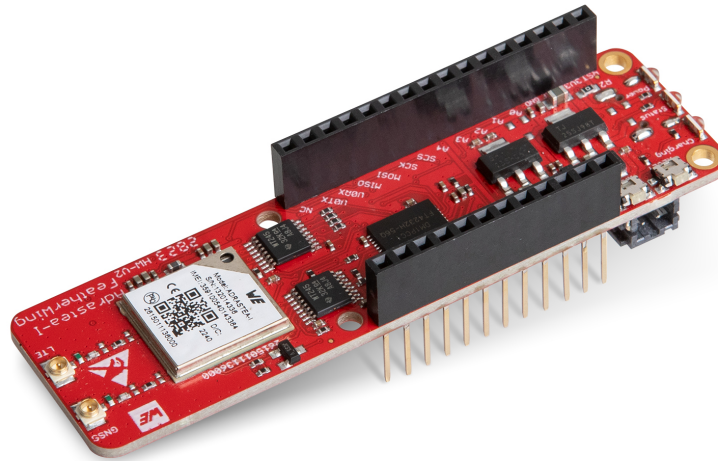


Figure 1: The WE Adrastea-I FeatherWing (2615039336001)

## 1.2 Block diagram

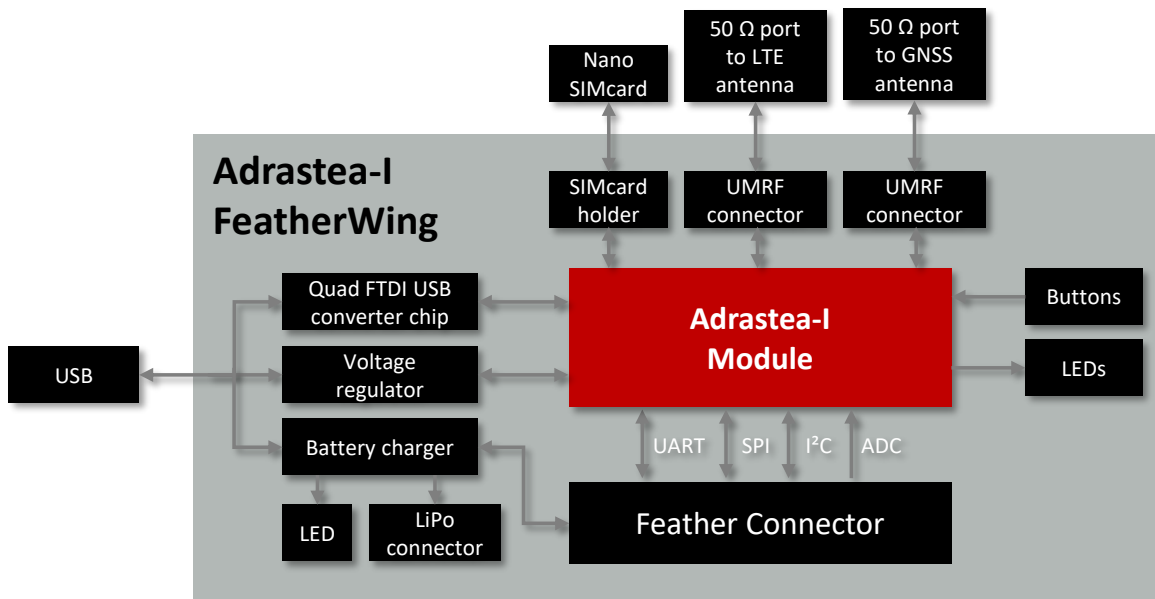


Figure 2: Block diagram - Adrastea-I FeatherWing

## 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](http://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](http://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 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.

### 2.2.1 Module Key Features

| Feature                  | Description  |
|--------------------------|--|
| Physical Dimensions      | 13.4mm x 14.6mm x 1.85mm   |
| Supported Networks       | - LTE-Cat.M<br>- LTE-Cat.NB-IoT  |
| LTE Supported Bands      | <b>LTE-Cat.M:</b> B2/B3/B4/B5/B8/B12/B20/B25/B26/B28<br><b>LTE-Cat.NB-IoT:</b> B3/B5/B8/B20/B28  |
| Module Interfaces        | - USIM<br>- UART<br>- I <sup>2</sup> C Master<br>- SPI Master<br>- GPIO<br>- ADC<br>- 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:<br>- ARM Cortex-M4<br>- 1 MB Flash Memory<br>- 256 kB RAM                         |
| Maximum Data Rate        | <b>LTE-Cat.M:</b> Downlink: 300 Kbps, Uplink: 375 Kbps<br><b>LTE-Cat.NB-IoT:</b> 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<br>- Firmware upgrade over the air (FOTA)  |

|                     |   |
|---------------------|---|
| Supported Protocols | <ul style="list-style-type: none"><li>- IPv4, IPv6</li><li>- TCP/UDP SOCKET</li><li>- HTTP/HTTPS</li><li>- TLS/DTLS</li><li>- LWM2M Client</li><li>- MQTT</li></ul> |
| 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"><li>- VDD: From 2.3 V to 4.3 V</li><li>- VDD_FEM: From 3.1 V to 4.3 V</li></ul>   |
| Temperature Range   | Operation temperature: -40 °C to +85 °C   |

Module Key Features `tab:module_features`

Further details about the LTE-M / NB-IoT cellular module can be found under

[www.we-online.de/adrastea-i](http://www.we-online.de/adrastea-i)

### 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.

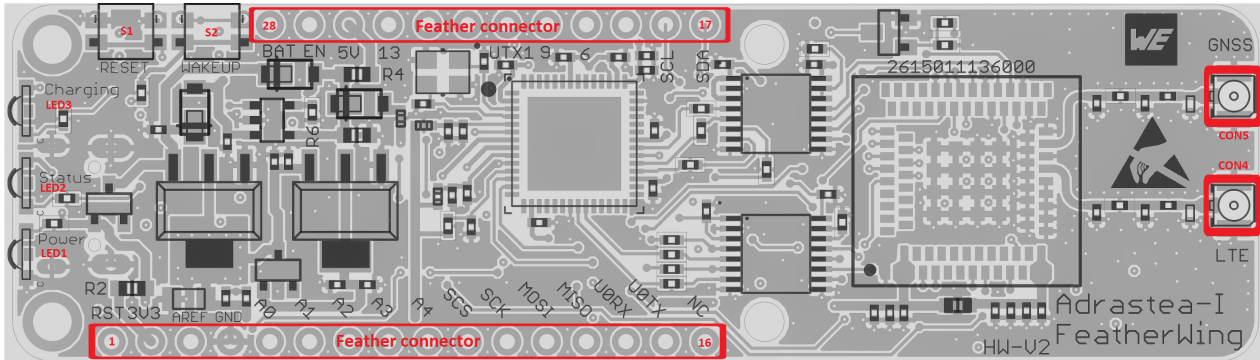


Figure 3: Connectors Top

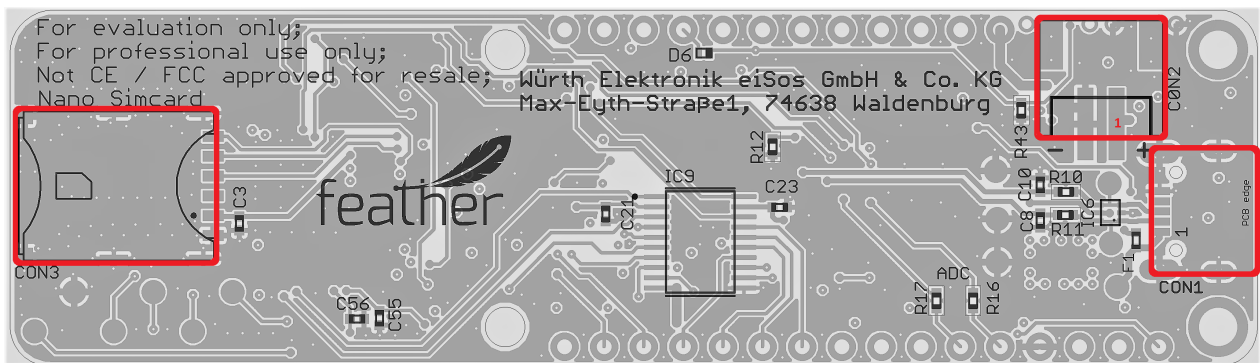


Figure 4: Connectors Bottom

| 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         | GPIOCK           | Adrastea SPIM1_CLK/GPIO41   |
| 12         | GIOMOSI          | Adrastea SPIM1_MOSI/GPIO38  |
| 13         | GIOMISO          | Adrastea SPIM1_MISO/GPIO39  |
| 14         | GIORX            | Adrastea UART0 TX pin       |
| 15         | GIOTX            | Adrastea UART0 RX pin       |
| 16         | N.C.             | Not connected               |
| 17         | GIOSDA           | Adrastea I2C0_SDA           |
| 18         | GIOSCL           | 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  $I_{Charge} = 200 \text{ mA}$ .  $I_{Charge}$  can be modified 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.

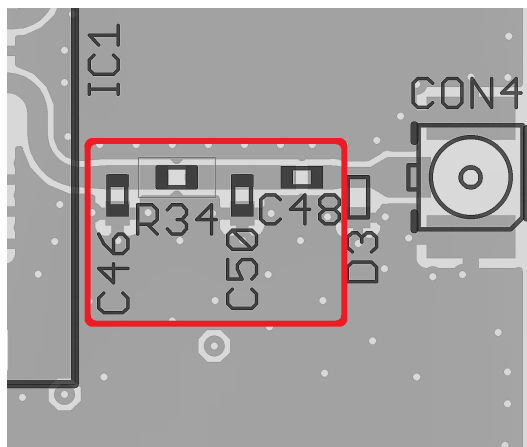


Figure 5: Matching filter for LTE transmission line

**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.

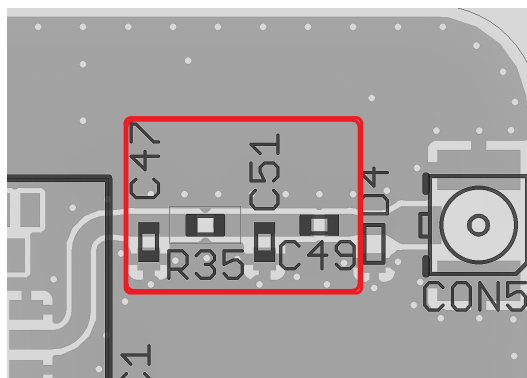


Figure 6: Matching filter for GNSS transmission line

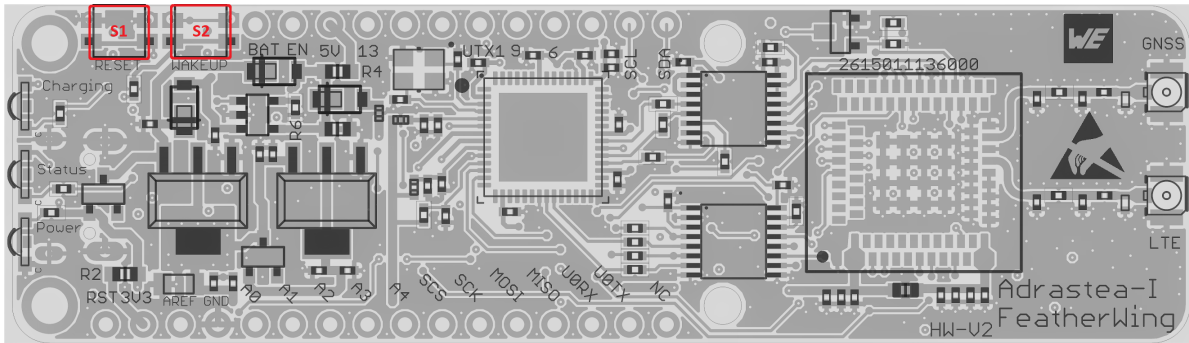


Figure 7: Buttons

## 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.



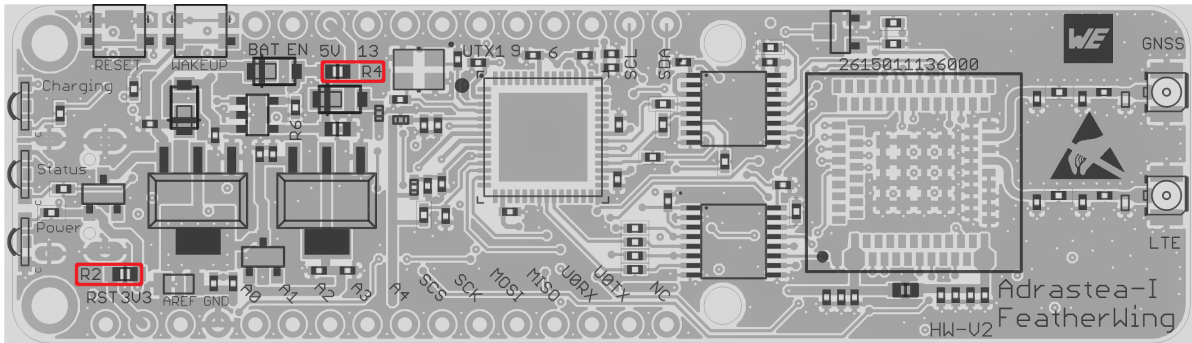


Figure 8: Resistor R2 and R4

### 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 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 10: COM-PORT to UART assignment example



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

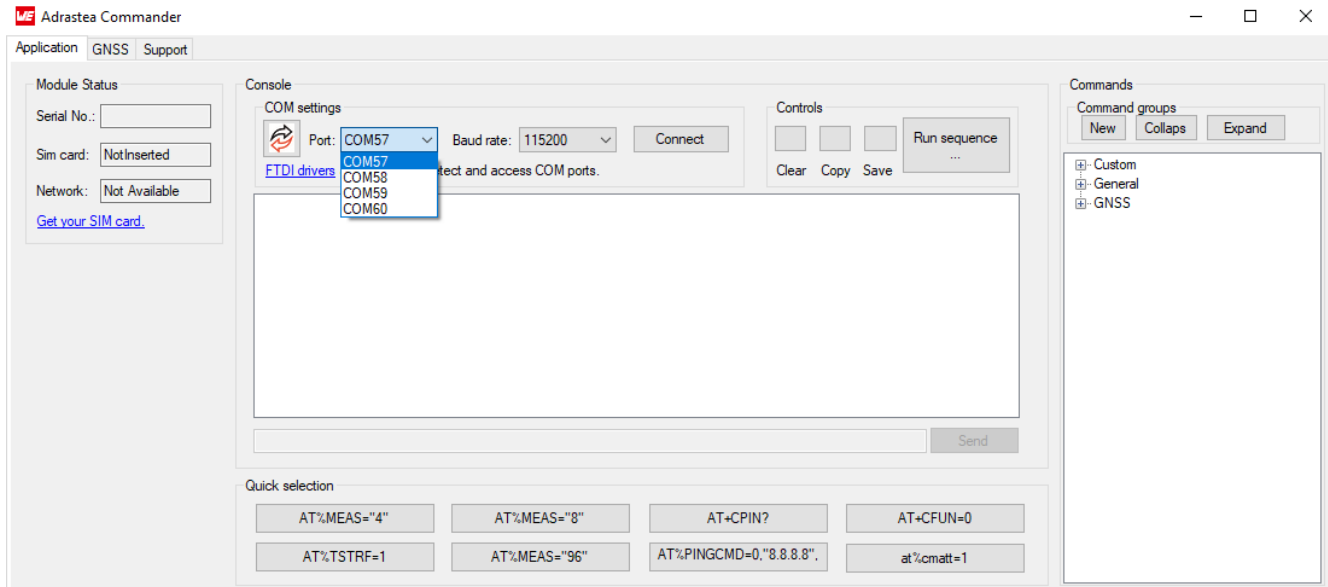


Figure 9: COM ports detected - Adrastea commander



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

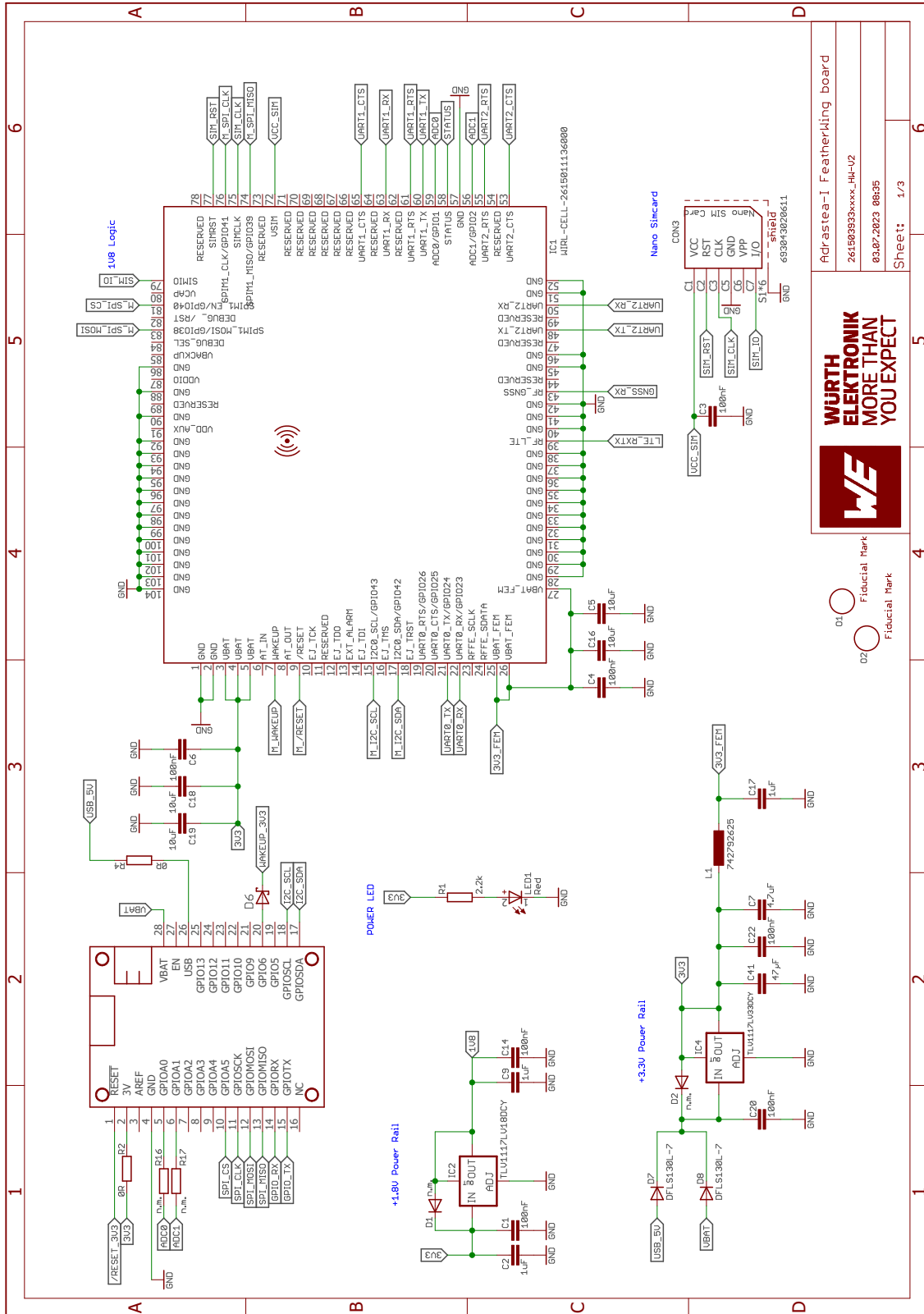
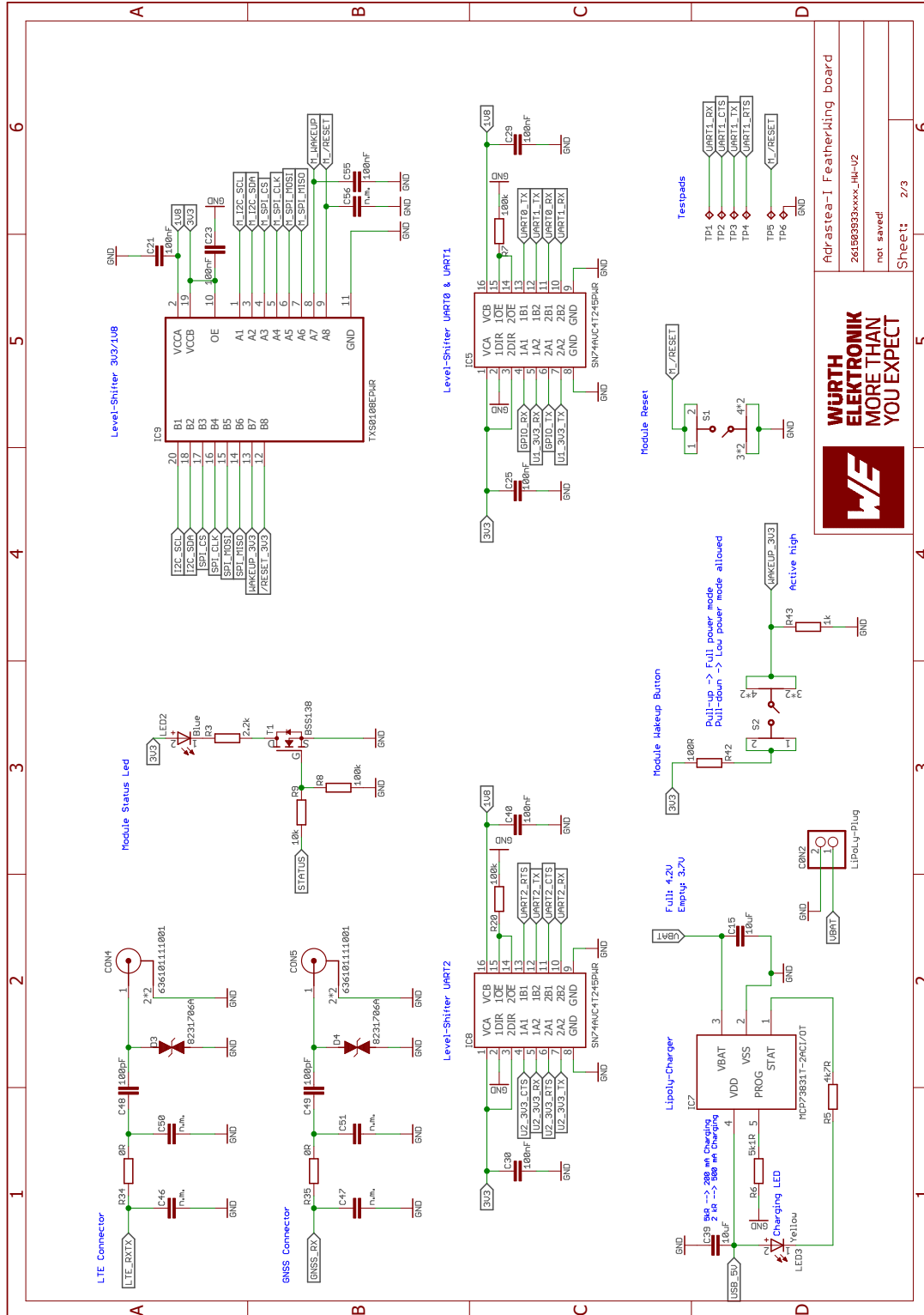
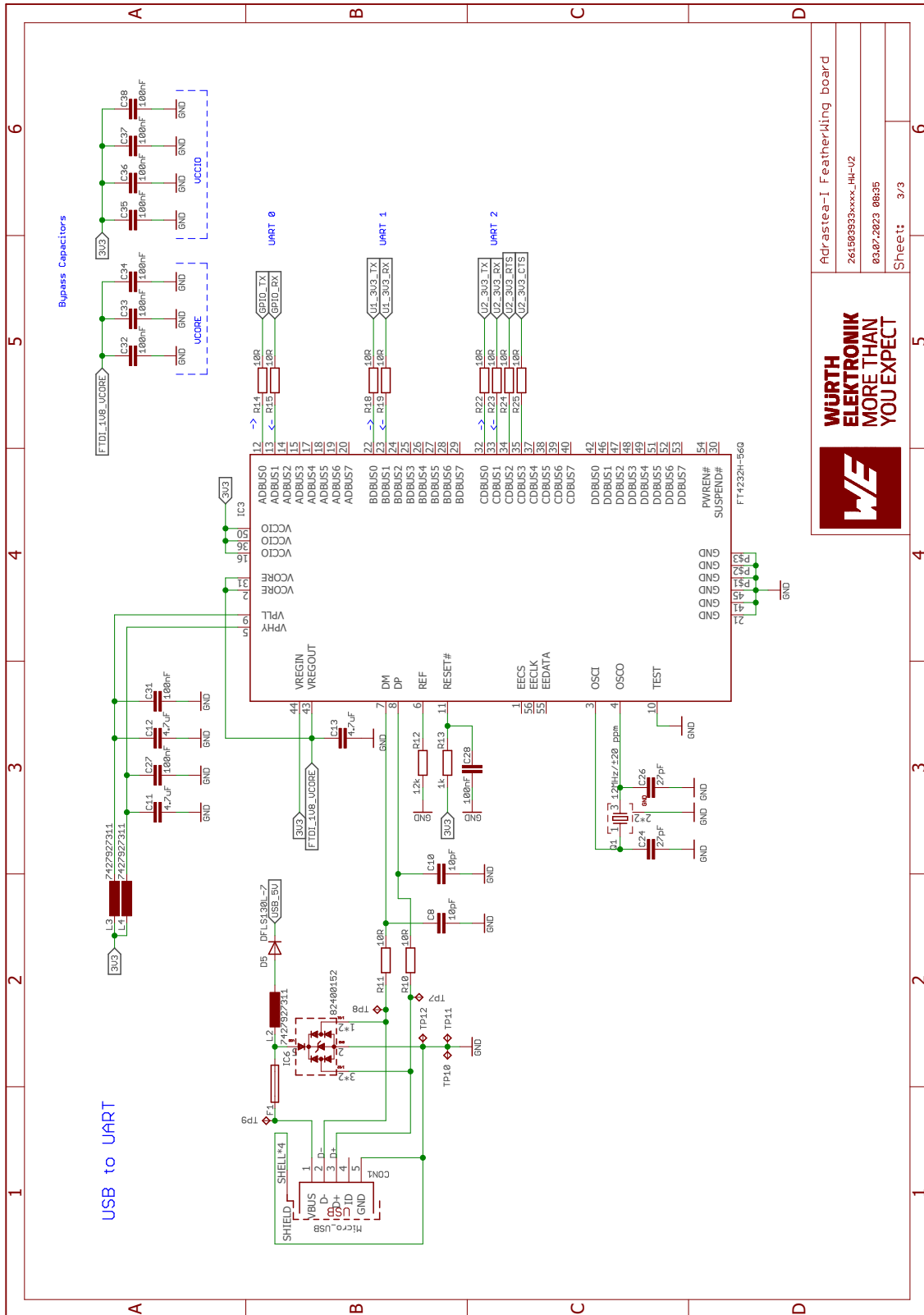


Figure 10: Schematic part 1



Adrastea-I Featherking board  
 261503933xxxxx\_HH-U2  
 not saved  
 Sheet: 2/3

Figure 11: Schematic part 2



Adrastea-I FeatherWing board  
 261503933xxxx-HH-U2  
 03.07.2023 08:35  
 Sheet: 3/3



Figure 12: Schematic part 3

### 3.7 Layout

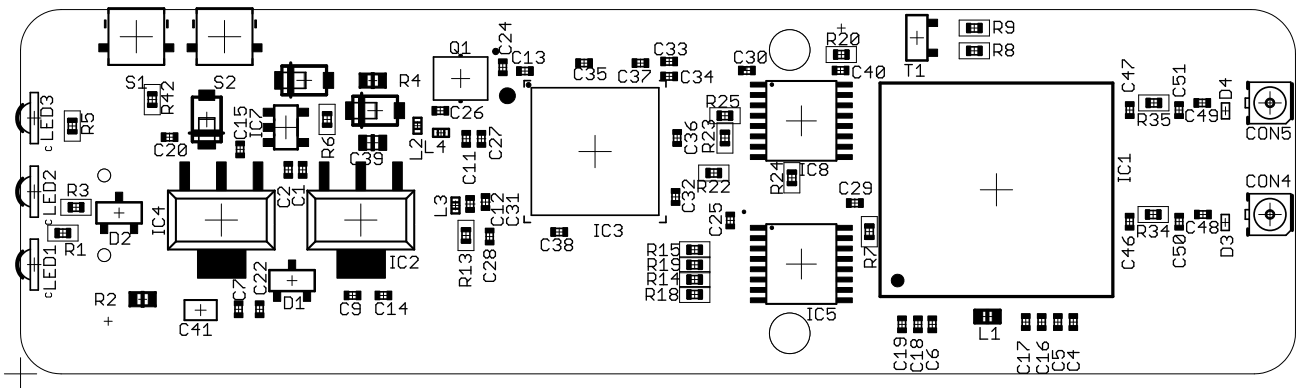


Figure 13: Assembly diagram top layer

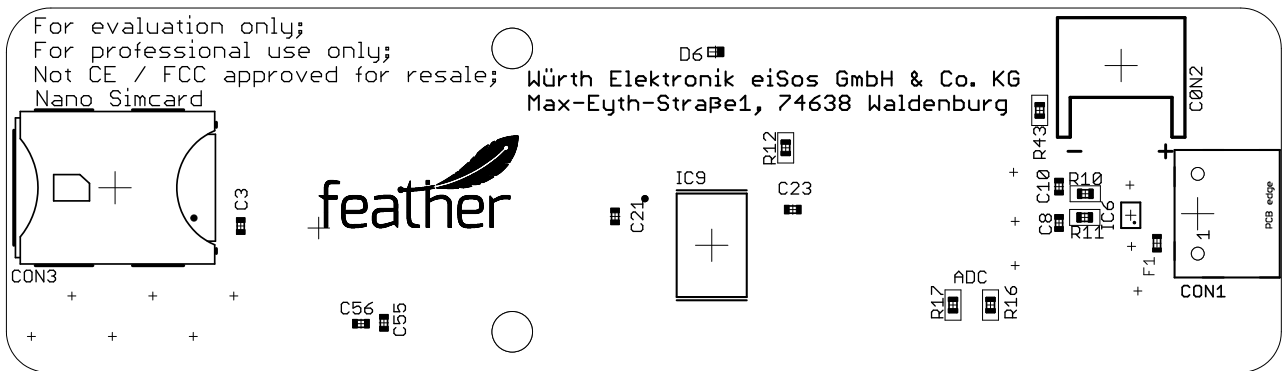


Figure 14: Assembly diagram bottom layer

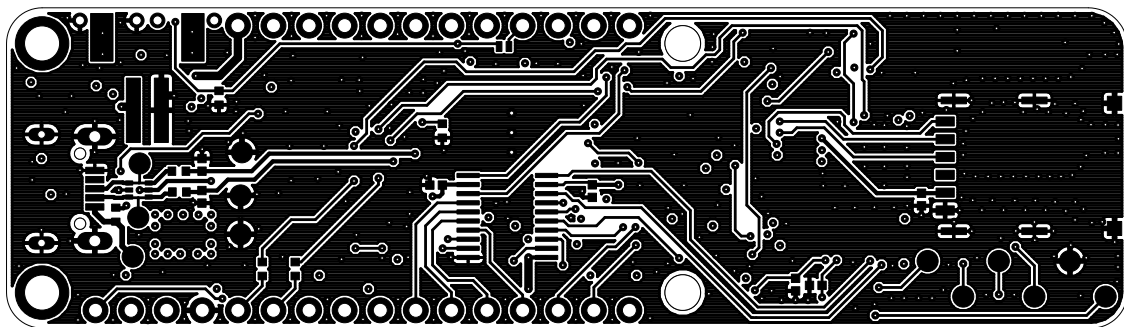
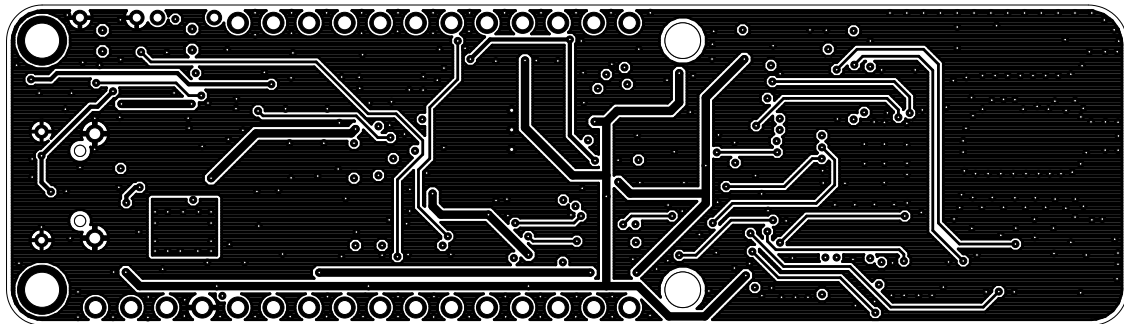
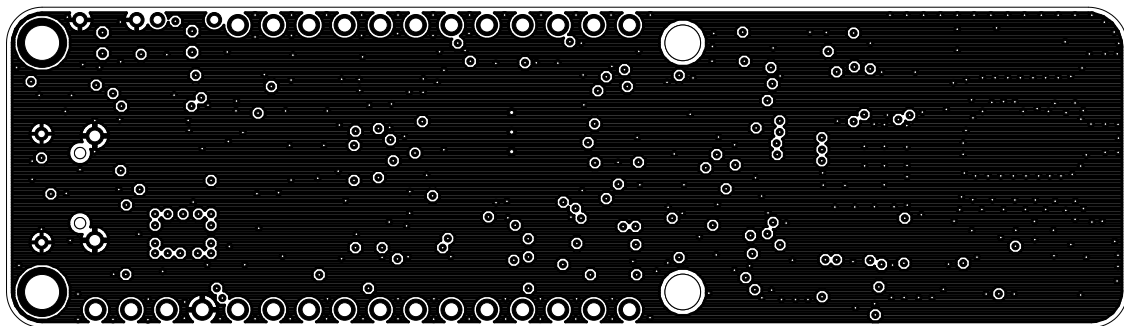
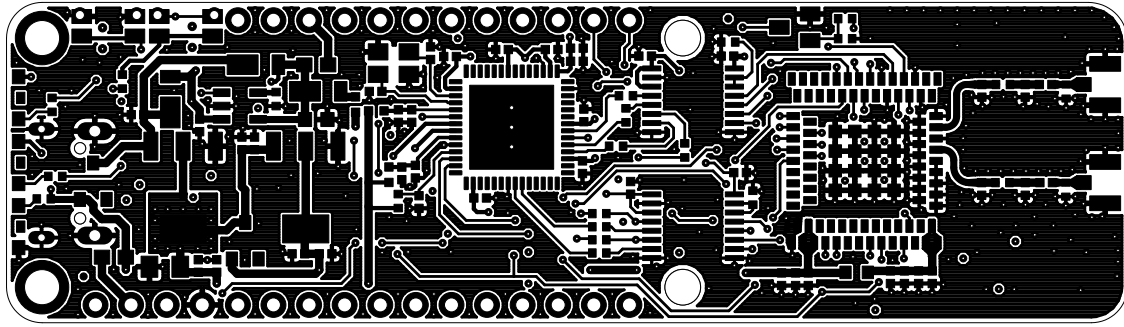


Figure 15: Top layer (upper), second layer (second), third layer (third), fourth layer (bottom)

### 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                | CL05C270JB5NANC |
| C25  | 100nF | 0402 | Würth Elektronik eiSos | 885012205037    |
| C26  | 27pF  | SMT  | Samsung                | CL05C270JB5NANC |
| 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 &<br>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 $\Omega$  | 0402   | Yageo                  | RC0402FR-0710RL     |
| R25  | 10 $\Omega$  | 0402   | Yageo                  | RC0402FR-0710RL     |
| R34  | 0 $\Omega$   | 0402   | Yageo                  | RC0402FR-070RL      |
| R35  | 0 $\Omega$   | 0402   | Yageo                  | RC0402FR-070RL      |
| R42  | 100 $\Omega$ | 0402   | Yageo                  | RC0402FR-07100RL    |
| R43  | 1k $\Omega$  | 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 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 integrated 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](http://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](http://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.

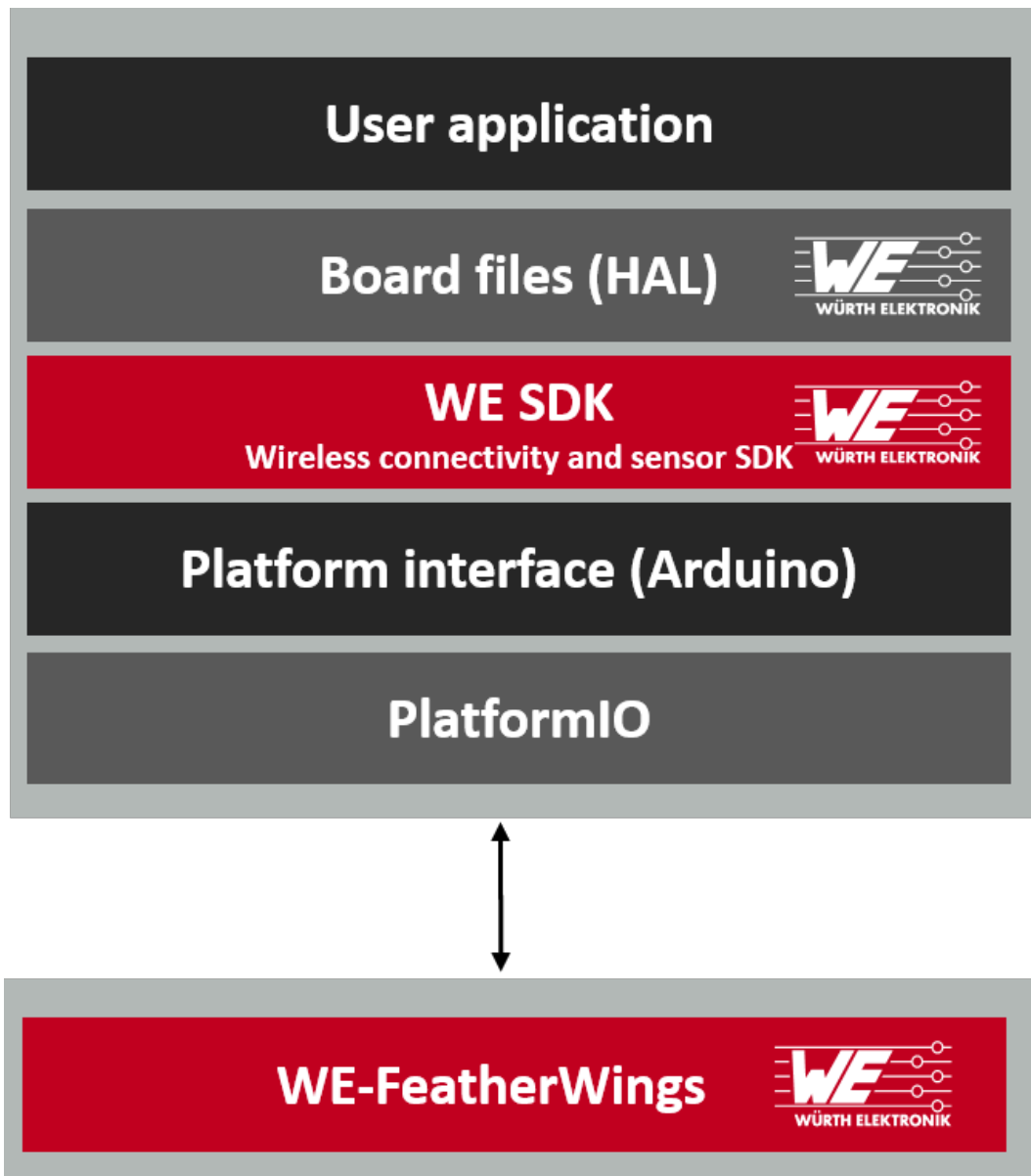


Figure 16: Software architecture

## 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](https://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](https://code.visualstudio.com/docs)
- Follow the instructions under [platformio.org/install/ide?install=vscode](https://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 Platform 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.

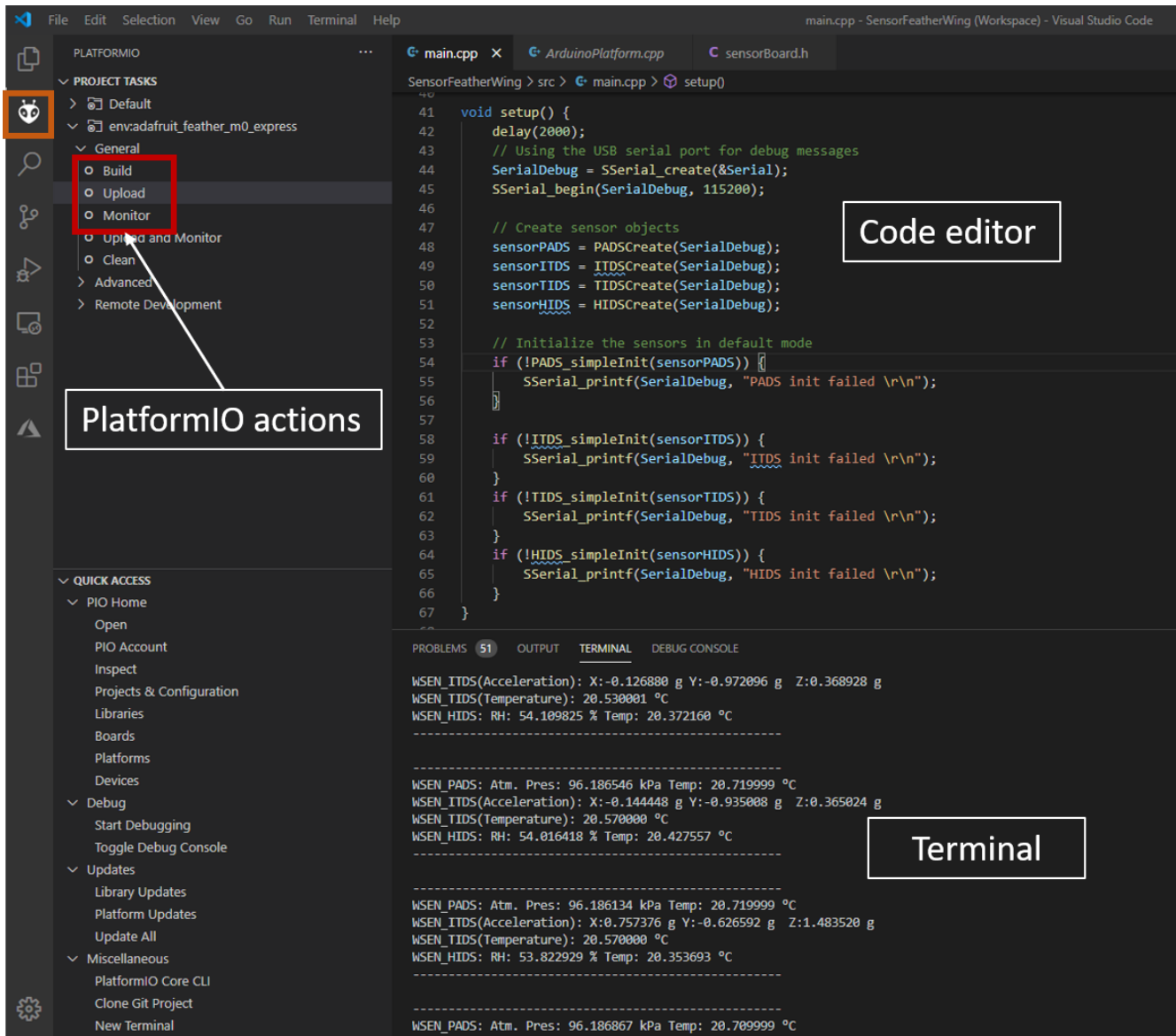


Figure 17: Running the quick start example

## 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 EV-Kits destined for professionals to be used solely at research and development facilities for such purposes.

Nevertheless this EV-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

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