CALYPSO WI-FI FEATHERWING

USER MANUAL

2610039025001

VERSION 1.1

FEBRUARY 15, 2022

Revision history

Manual version	HW version	Notes	Date
1.0	2.0	Initial version	November 2020
1.1	2.0	Updated github repository links	February 2022

Abbreviations

Abbreviation	Name	Description
CISPR	Comité International Spécial des Perturbations Radioélectriques	International Special Committee on Radio
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	
PC	Personal Computer	
PCB	Printed Circuit Board	
VCC		Supply voltage
VDD	Voltage Drain Drain	Supply voltage

Contents

1 General description

1.1 Introduction

The Würth Elektronik eiSos Calypso Wi-Fi FeatherWing is a development board that offers a secure 2.4 GHz Wi-Fi connectivity solution. It is fully compatible to the popular Adafruit Feather line of development boards and extends the Feathers with Wi-Fi connectivity.

The Calypso Wi-Fi FeatherWing consists of the Calypso radio module that offers Wi-Fi connectivity based on IEEE 802.11 b/g/n with a fully featured TCP/IP (IPv4 and IPv6) stack. With out-of-the-box support to commonly used network applications like SNTP, HTTP(S), MQTT(S) Calypso offers an easy and secure solution to any IoT application.

It has an AT-style command interface on the standard UART and hence can be connected to any of the Feather microcontroller boards. The Arduino (C/C++) drivers and examples (see chapter 4) made available makes it easy to build a prototype to kick-start the application development.
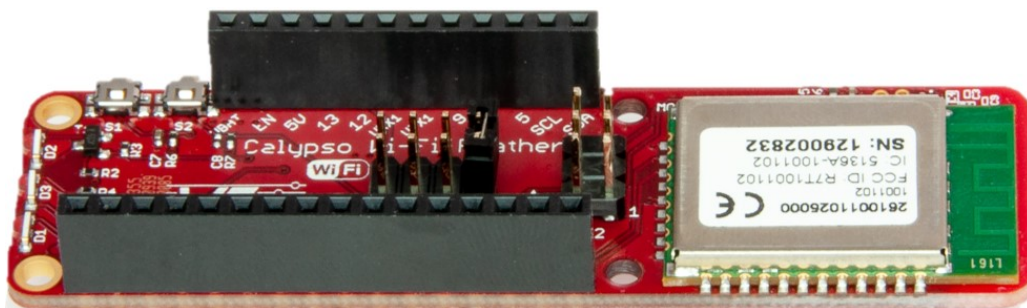

Figure 1: The WE Calypso Wi-Fi FeatherWing (2610039025001)
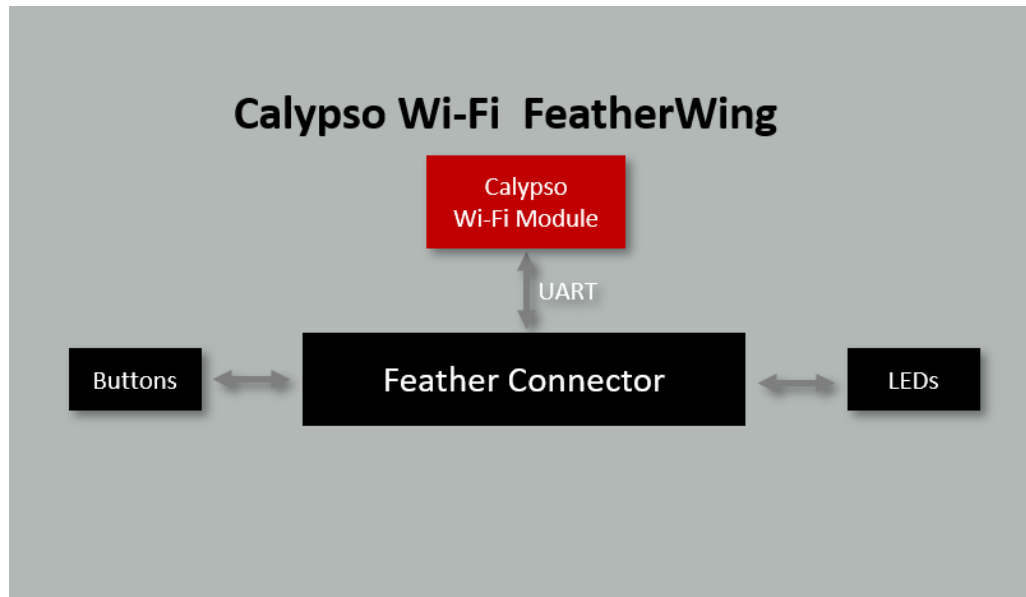
1.2 Block diagram

Figure 2: Block diagram - Calypso Wi-Fi FeatherWing

1.3 Contents

Description	Quantity
WE Calypso Wi-Fi FeatherWing	1
Packaging: ESD safe bag	1

Table 1: Contents 2610039025001

2 Functional description

The Calypso Wi-Fi 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 Calypso Wi-Fi 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 Calypso Wi-Fi module (2610011025000)

The Calypso Wi-Fi module is a compact Wi-Fi radio module based on IEEE 802.11 b/g/n with a fully featured TCP/IP stack. The edge castellated connections, smart antenna configuration and an easy-to-use AT-style command interface enable easy integration of the Calypso into any embedded application.

The module supports IPv4 as well as IPv6 and implements several commonly used network applications like SNTP, DHPv4, DHCPv6, mDNS, HTTP(S), MQTT(Secure) out-of the box. Advanced security features like up to 6 simultaneous secure sockets, secure boot, secure storage and secure OTA update provide a good basis for a secure end product.

Whether a serial cable replacement or low power IoT application with cloud connectivity, the Calypso Wi-Fi module offers a robust and standard compliant wireless connectivity solution for low-power and low-medium throughput applications.

Key features

In this section, the features of the Calypso module are summarized in the form of a table. Calypso offers the user to configure and exploit its rich features through an easy-to-use command interface over UART.

Feature	Description
Radio standards	IEEE 802.11 b/g/n station IEEE 802.11 b/g Access point (for provisioning only) Wi-Fi Direct client and group owner
Channels	1-13
Security	WEP, WPA/WPA2PSK, WPA2 Enterprise (802.1x)
Provisioning	In AP mode using the on-board HTTPS server
Network layer	IPv4, IPv6
IP addresssing	Static, LLA, DHCPv4, DHCPv6 with DAD
Transport layer	TCP, UDP SSLv3.0/TLSv1.0/TLSv1.1/TLSv1.2 Up to 15 simultaneous sockets of which 6 can be secure.
Network applications	MQTT(Secure) client HTTP(S) client SNTP client HTTP(S) server mDNS, DNS-SD DHCP server Ping
Update	Secure FOTA update with fall back mechanism
Security	Secure key storage Trusted root-certificate catalog Encrypted file system Secure OTA Software tamper detection Cloning protection
Power management	802.11 power save power modes Lower power sleep mode with timed or pin wake-up

Table 2: Key features

Further details about Calypso Wi-Fi module can be found under
we-online.com/catalog/en/CALYPSO

3 Hardware description

This sections contains a detailed description of the hardware features of the Calypso Wi-Fi FeatherWing. The design files for this hardware can be downloaded from *github.com/WurthElektronik/FeatherWings*.

3.1 Connectors

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	$\overline{RST}$	Not connected
2	3V3	3.3V power supply
3	AREF	Not connected
4	GND	Ground
5	A0	Not connected
6	A1	(Optional) Calypso APP_MODE_0 pin via JP3
7	A2	(Optional) Calypso APP_MODE_1 pin via JP3
8	A3	Not connected
9	A4	Not connected
10	A5	Not connected
11	SCK	Not connected
12	MOSI	Not connected
13	MISO	Not connected
14	U0RX	Calypso UTXD pin
15	U0TX	Calypso URXD Pin
16	NC	Not connected

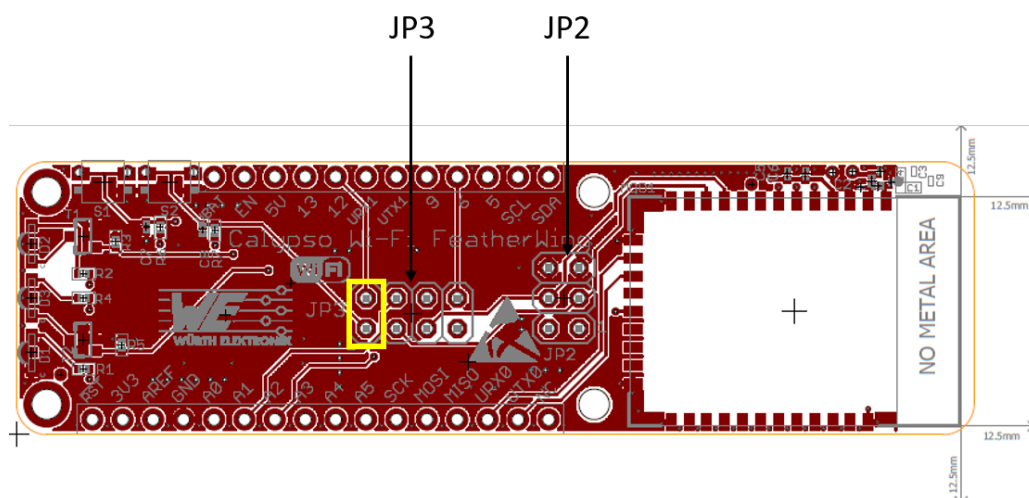| Pin Number	Pin name	Function
17	SDA	Not connected
18	SCL	Not connected
19	5	Not connected
20	6	(Optional) Calypso WAKE_UP pin via JP3
21	9	Not connected
22	U1TX	Not connected
23	U1RX	Not connected
24	12	(Optional) Switch S2 via JP3
25	13	Not connected
26	5V	Not connected
27	EN	Not connected
28	VBAT	Not connected

3.2 Jumpers

Figure 3: Jumpers and their default state

3.2.1 JP2

This jumper enables the user to start Calypso Wi-Fi module in different modes through the APP_MODE_0 and APP_MODE_1 pins. Table 4 briefly describes the different application modes of Calypso. Please refer to Section 5.2 of the Calypso user manual for further details. For normal operation in the standard AT-command mode, these jumpers do not need as the lines are pulled down internally.

JP1	Function	Jumper set (default)
1,3	APP_MODE_0 to HIGH	No
3,5	APP_MODE_0 to LOW	No
2,4	APP_MODE_1 to HIGH	No
4,6	APP_MODE_1 to LOW	No

Table 3: Jumper JP2

APP_MODE_0	APP_MODE_1	Mode
0	0	AT command normal mode
0	1	FOTA mode
1	0	Provisioning mode
1	1	AT command terminal mode

Table 4: Calypso Application modes

3.2.2 JP3

This jumper allows the connection of Calypso's pins APP_MODE_0, APP_MODE_1, WAKE_UP pins to the host microcontroller. Additionally, it allows the general purpose switch S2 to be connected to GPIO 6.

JP3	Funtion	Jumper set (default)
1,2	S2 to GPIO12	Yes
3,4	APP_MODE_0 to GPIOA1	No
5,6	APP_MODE_1 to GPIOA2	No
7,8	WAKE_UP to GPIO6	No

Table 5: Jumper JP3

3.3 Push buttons

3.3.1 S1

This push button is connected to the /RESET pin of the Calypso Wi-Fi module. Pressing this button resets the module.

3.3.2 S2

S2 is a general purpose push button which is connected to GPIO 6 when a jumper is set between pins 1 and 2 of JP3. This switch can be used to trigger a specific action like switching the Calypso into provisioning mode.
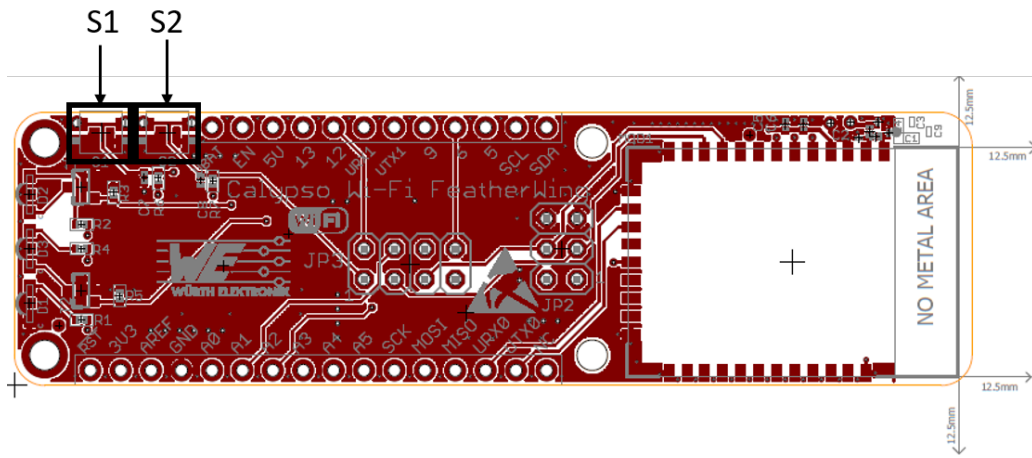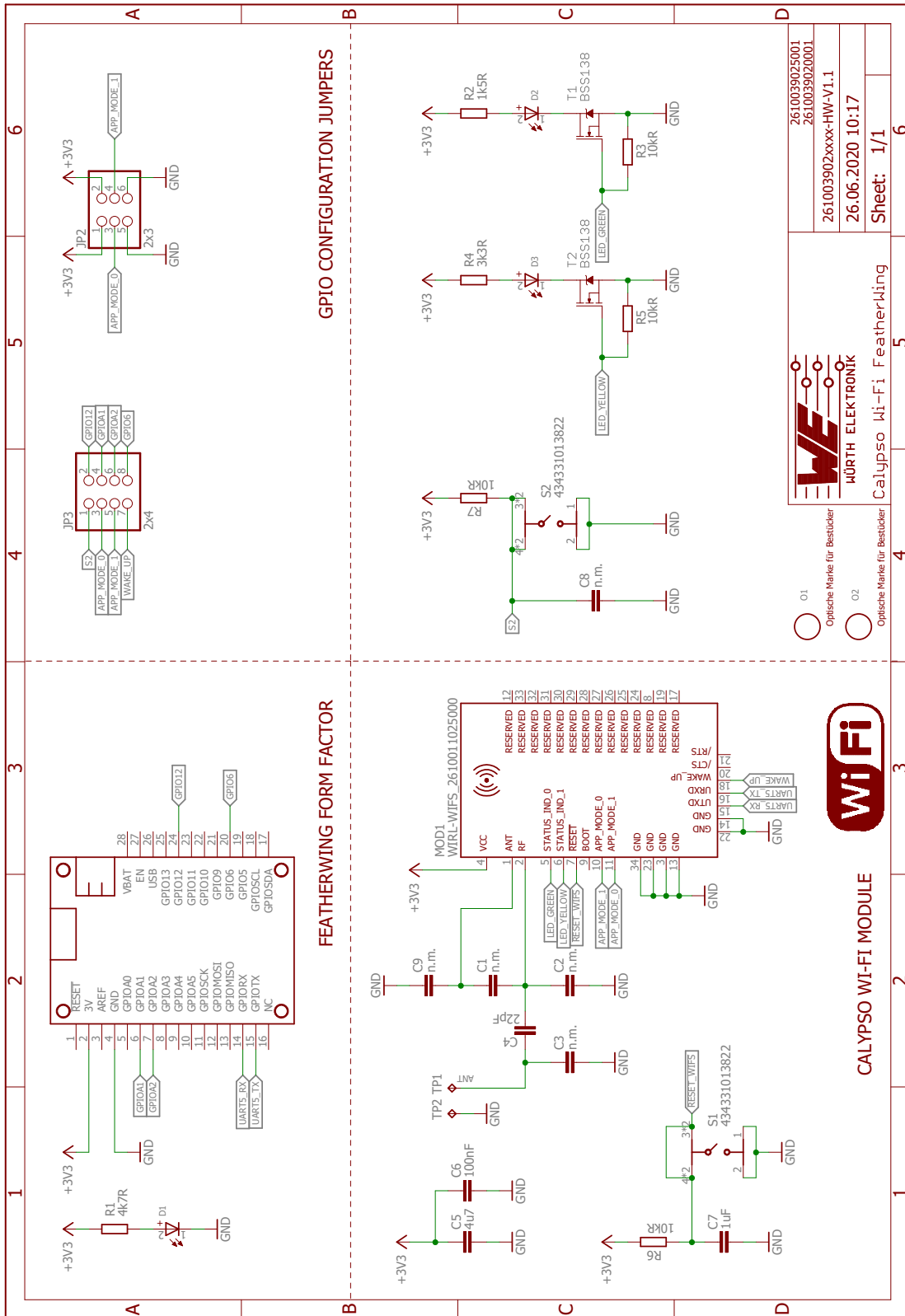
Figure 4: Push buttons

3.4 Schematics

Figure 5: Schematics
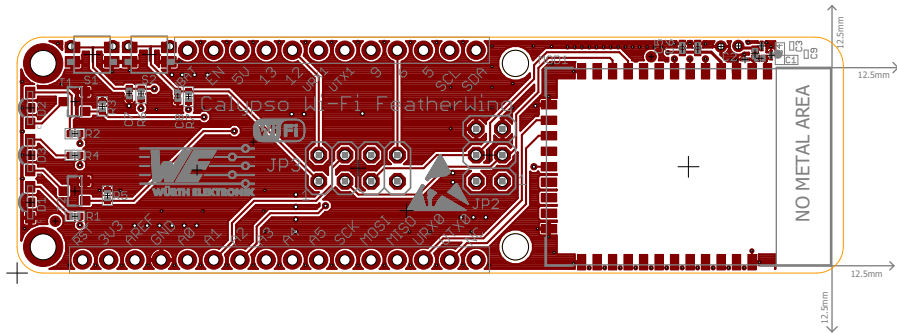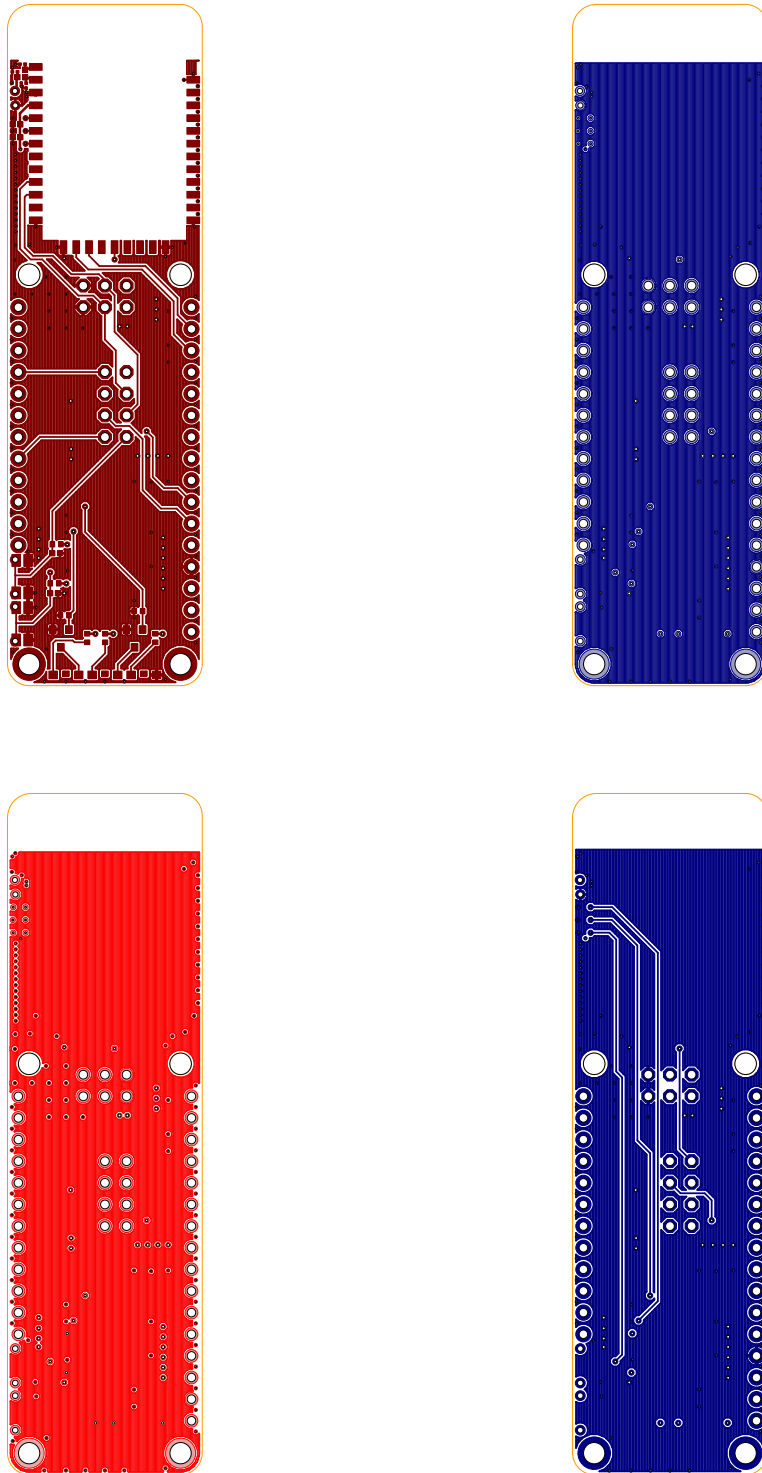
3.5 Layout

Figure 6: Assembly diagram

Figure 7: Top, bottom and internal layers

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.

- 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 *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 8 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 dowloads 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 FeatherWings.
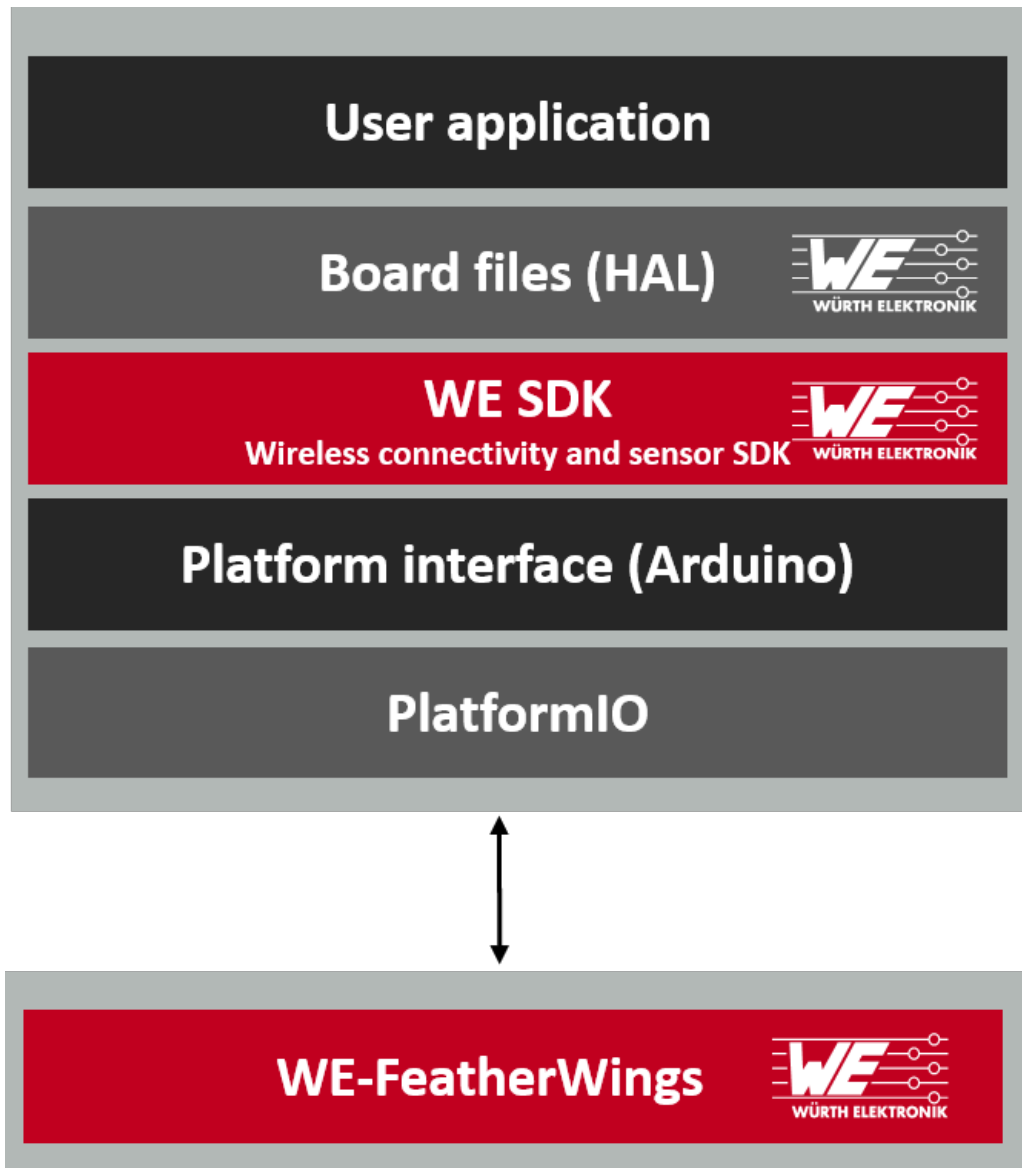
Figure 8: Software architecture

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.
  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 9

- After successful upload, click on Monitor to view the debug logs in the serial terminal (See Figure 9).
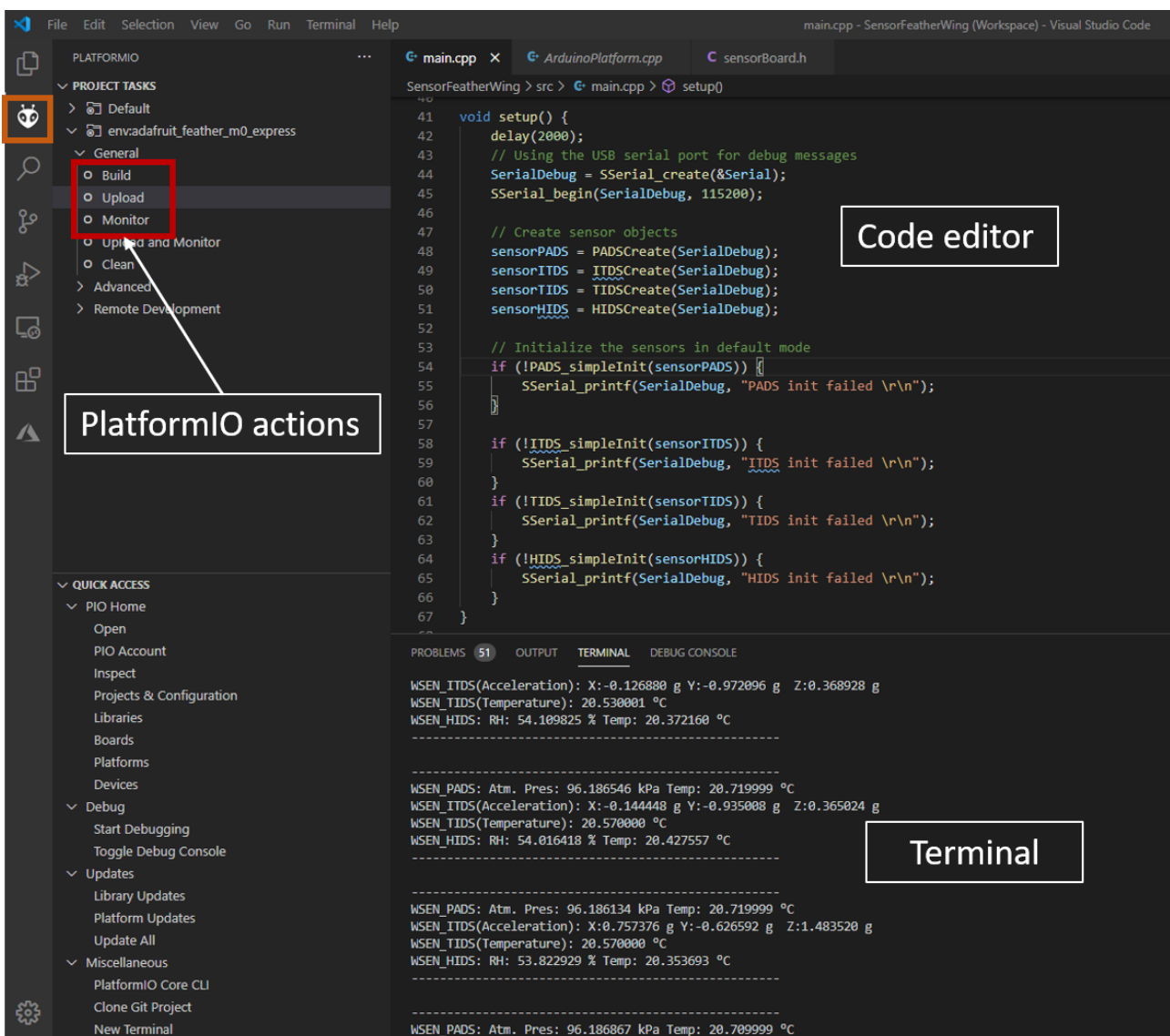

Figure 9: Running the quick start example

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

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If a provision of this 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 wireless connectivity product, you accept this license terms in all terms.

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