

USER MANUAL

CALYPSO FEATHERWING

2610039025001

VERSION 1.3

OCTOBER 18, 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	1.1	Initial version	November 2020
1.1	1.2	<ul style="list-style-type: none">• Change of antenna connection chapter 3.4• Change of chapter 3.2.	February 2023
1.2	1.2	New corporate design	June 2023
1.3	1.2	<ul style="list-style-type: none">• Fixed broken links.• Added chapter 7.	October 2024

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

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1 General description

1.1 Introduction

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

The Calypso FeatherWing consists of the Calypso radio module that offers WiFi 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 SNMP, 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.

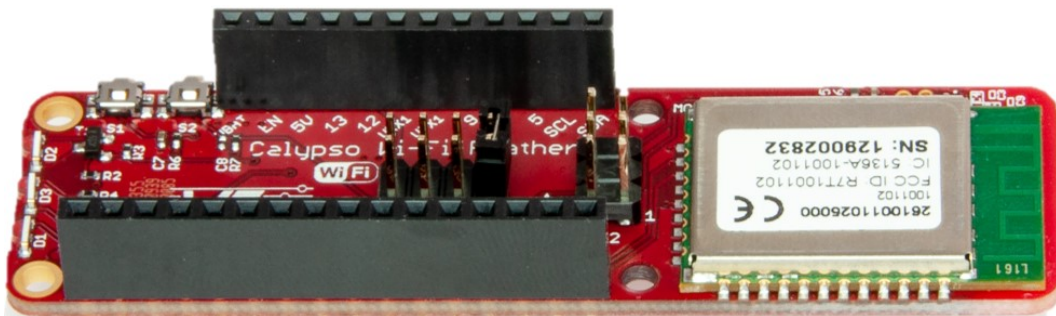


Figure 1: The WE Calypso FeatherWing (2610039025001)

1.2 Block diagram

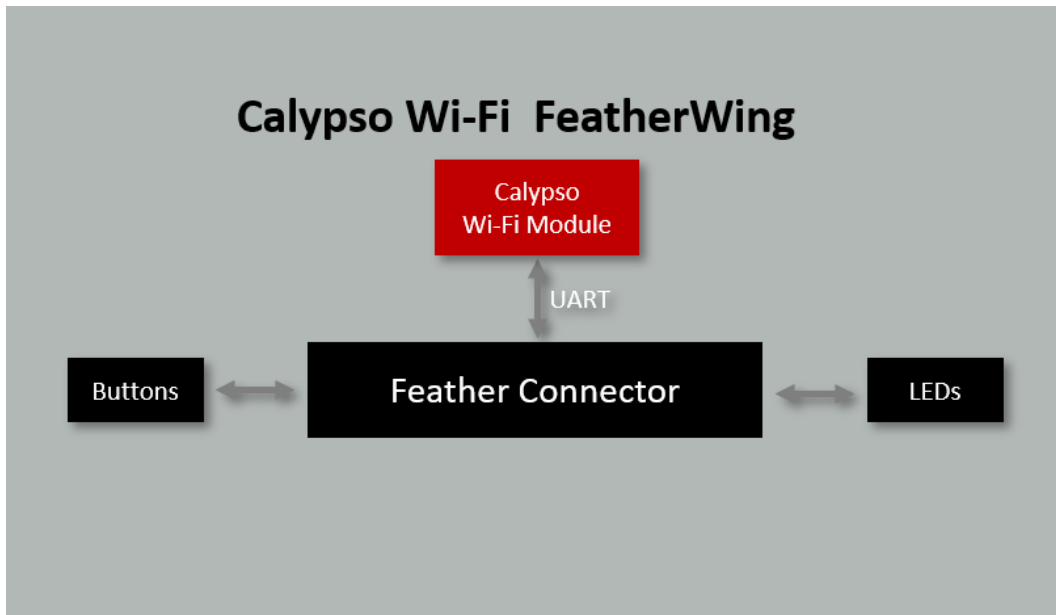


Figure 2: Block diagram - Calypso FeatherWing

1.3 Contents

Description	Quantity
WE Calypso FeatherWing	1
Packaging: ESD safe bag	1

Table 1: Contents 2610039025001

2 Functional description

The Calypso 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 WiFi 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 WiFi module (2610011025000)

The Calypso WiFi module is a compact WiFi 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 WiFi 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) WiFi 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 addressing	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 WiFi module can be found under www.we-online.de/calypso

3 Hardware description

This sections contains a detailed description of the hardware features of the Calypso FeatherWing. The design files for this hardware can be downloaded from github.com/WurthElektronik/FeatherWings/tree/main/CalypsoWiFiFeatherWing.

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	3.3 V 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	5 V	Not connected
27	EN	Not connected
28	VBAT	Not connected

3.2 Jumpers

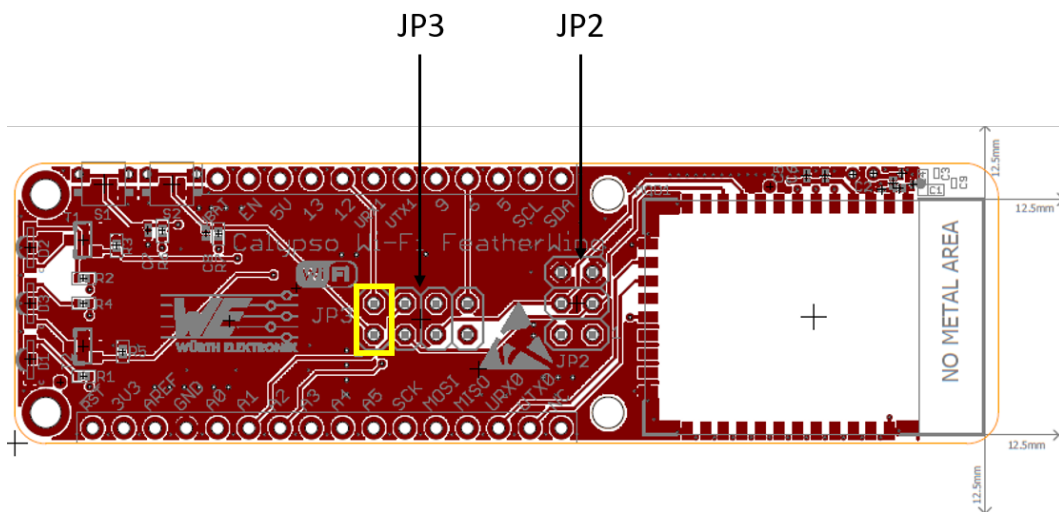


Figure 3: Jumpers and their default state

3.2.1 JP2

This jumper enables the user to start Calypso WiFi 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.

JP2	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
APP_MODE_1_module	APP_MODE_0_module	
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

APP_MODE_x means the labeling of the nets in the circuit of the EV-Board.

APP_MODE_x_module means the pin name of the module corresponding to the Calypso documentation. The numbering is not consistent.

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	Function	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 WiFi module. Pressing this button resets the module.

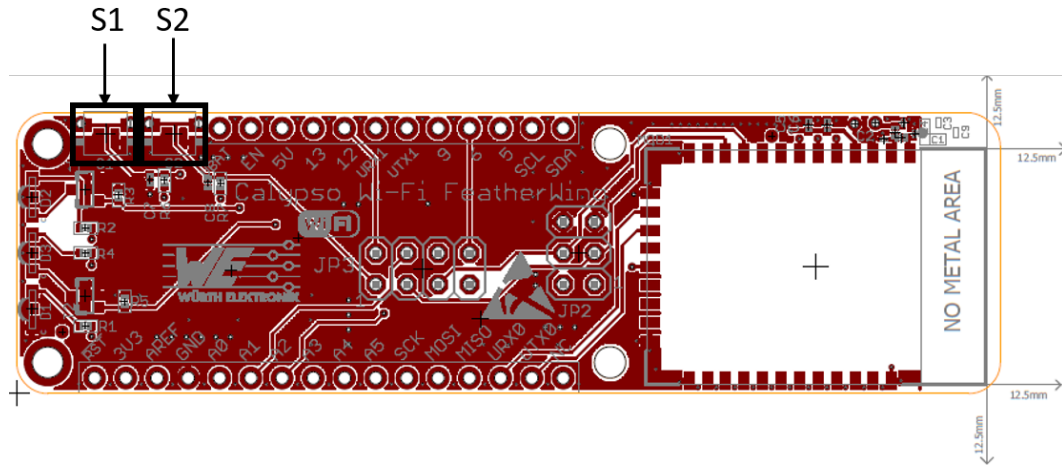


Figure 4: Push buttons

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.

3.4 Schematics

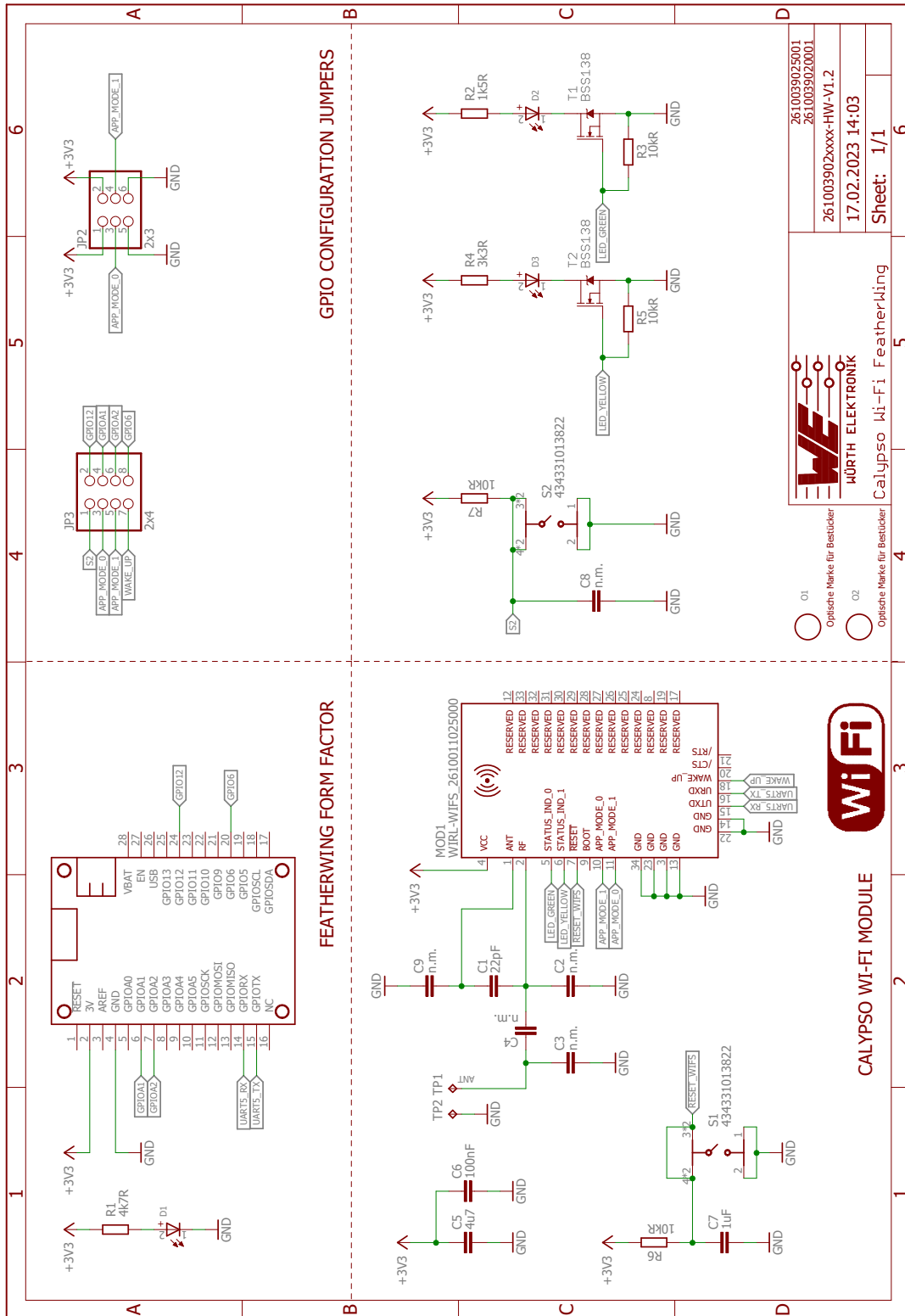


Figure 5: Schematics

3.5 Layout

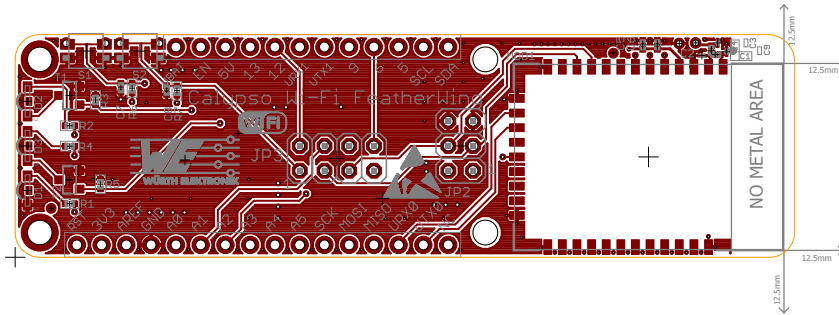


Figure 6: Assembly diagram

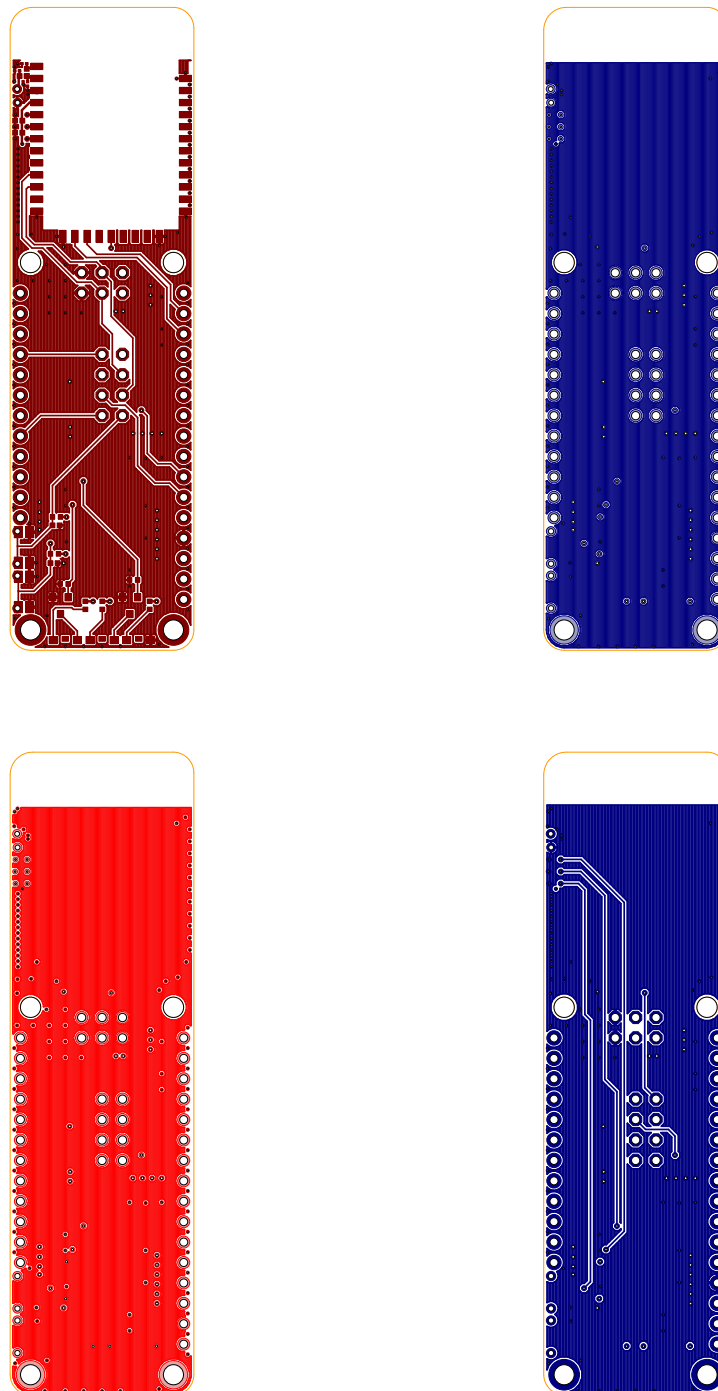


Figure 7: Top, bottom and internal layers

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 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 FeatherWings.

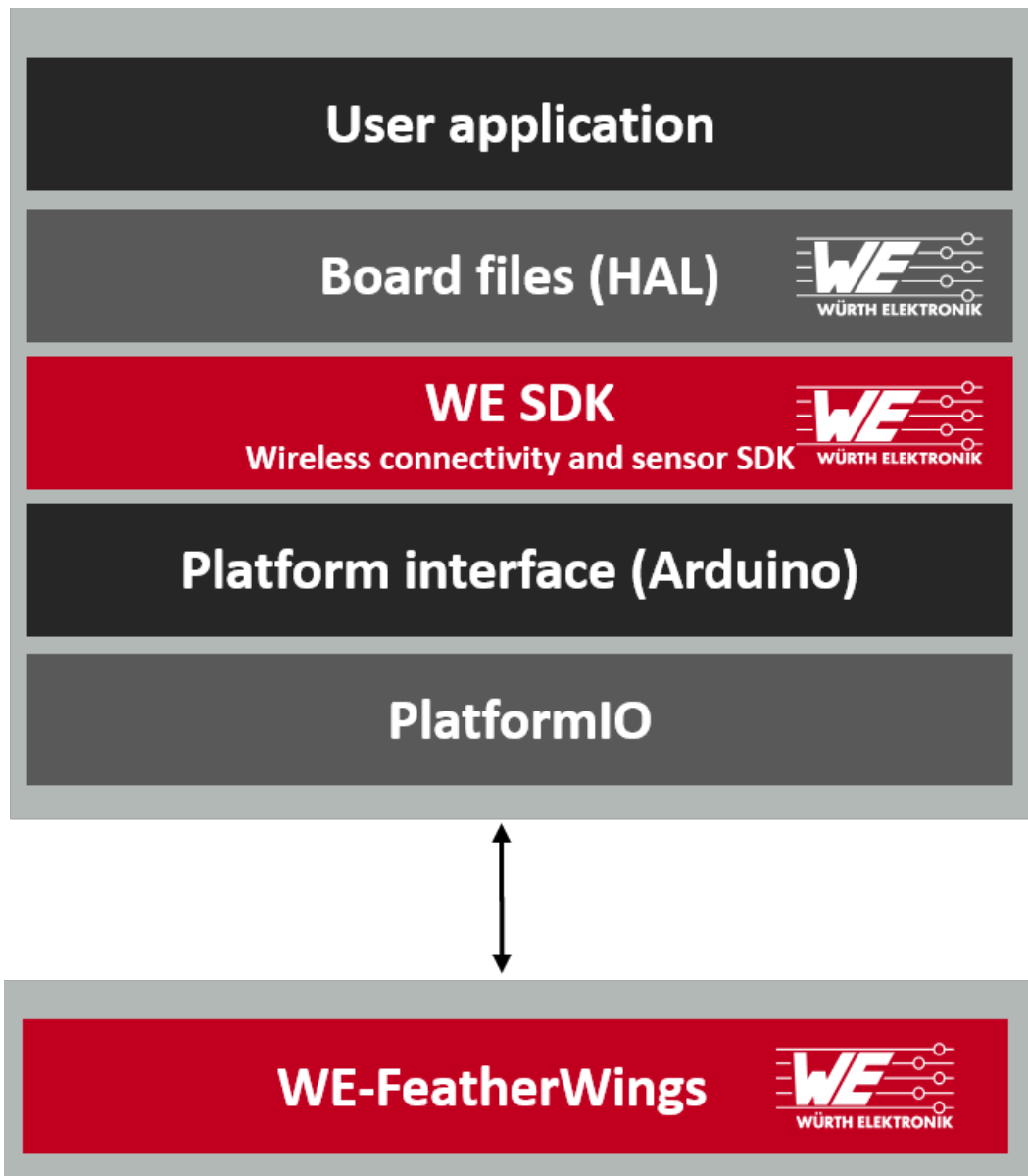


Figure 8: Software architecture

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).

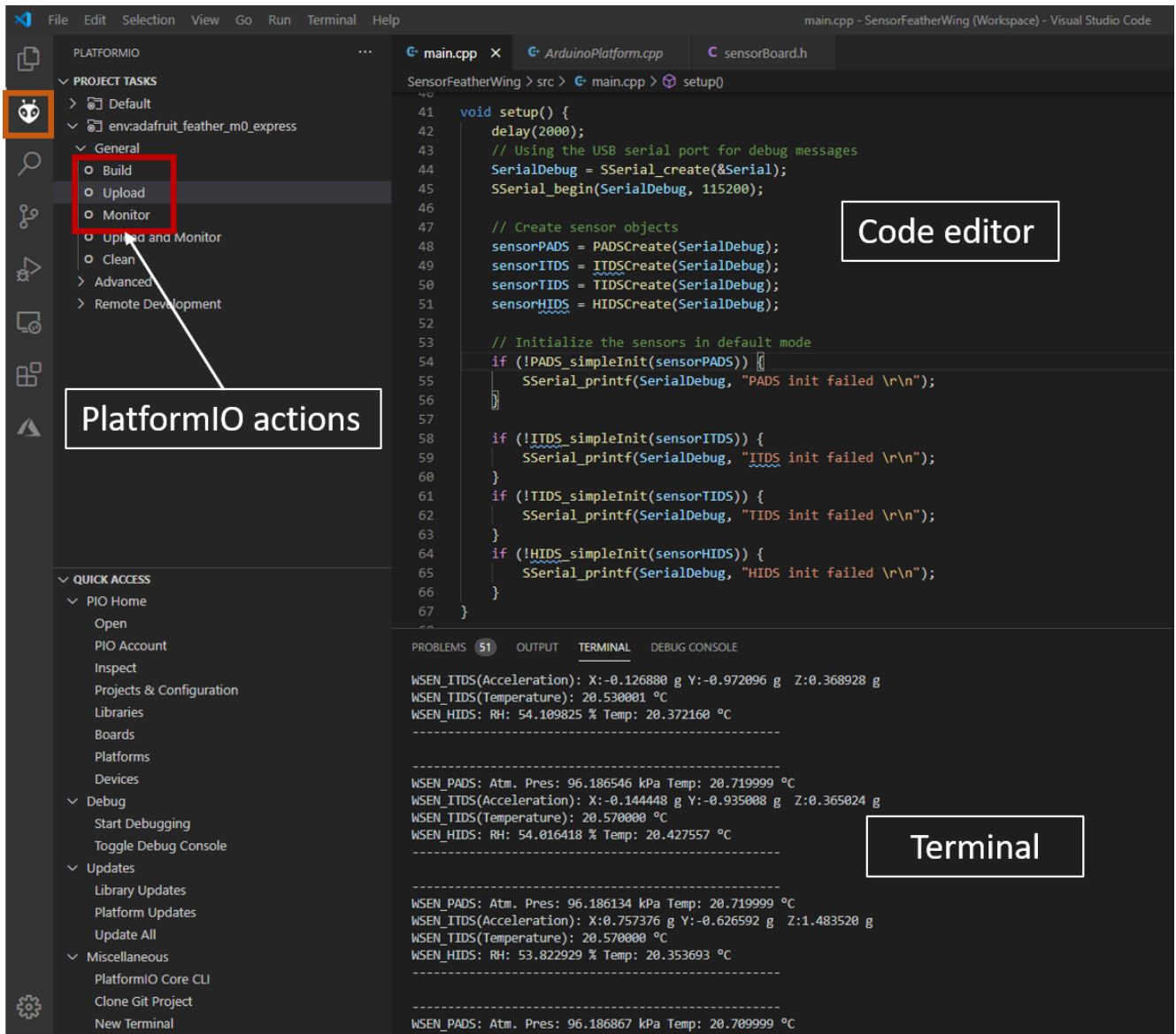


Figure 9: Running the quick start example

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 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

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 and sensors product range of Würth Elektronik eiSos GmbH & Co. KG:

General customer responsibility

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

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

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

Best care and attention

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

Customer support for product specifications

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

Product improvements

Due to constant product improvement, product specifications may change from time to time. As a standard reporting procedure of the Product Change Notification (PCN) according to the JEDEC-Standard, we inform about major changes. In case of further queries regarding the PCN, the Business Development Engineer (BDM), the internal sales person or the technical support team in charge should be contacted. The basic responsibility of the customer as per section 6 and 6 remains unaffected.

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

Product life cycle

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

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.

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 Terms of Use for Würth Elektronik eiSos GmbH & Co. KG EV-Boards, evaluation kits and evaluation modules

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

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their application with WE components. As a user, you are solely responsible for: (1) selection of the appropriate WE components for the application, (2) design, validation and testing the application, and (3) assurance that the application meets the applicable standards and all other safety requirements and other applicable requirements. WE may change the EVB without prior notice. WE grants you permission to use the EVB only for developing an application suitable for using WE components. Any other duplication, representation or transfer of the EVB is expressly prohibited. WE does not grant any licenses for the use of the intellectual property rights from WE or third parties. WE is fully indemnified from all claims, damages, costs, losses and liabilities arising from the misuse of this EVB. The WE components are provided in accordance with WE's conditions of sale or other applicable conditions available either at <https://katalog.we-online.com> or in conjunction with such WE components. WE's provision of the EVB does not constitute an extended warranty in relation to the WE components.

General warnings

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

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

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

Protection against static electricity

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

Purpose and use

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

Operation of the EVB

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

Hazards and warnings

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

Your responsibility with regard to the applicable laws

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

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

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

Exclusion of further rights and rights of use for intellectual property of EVB

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User manual Calypso FeatherWing

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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

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