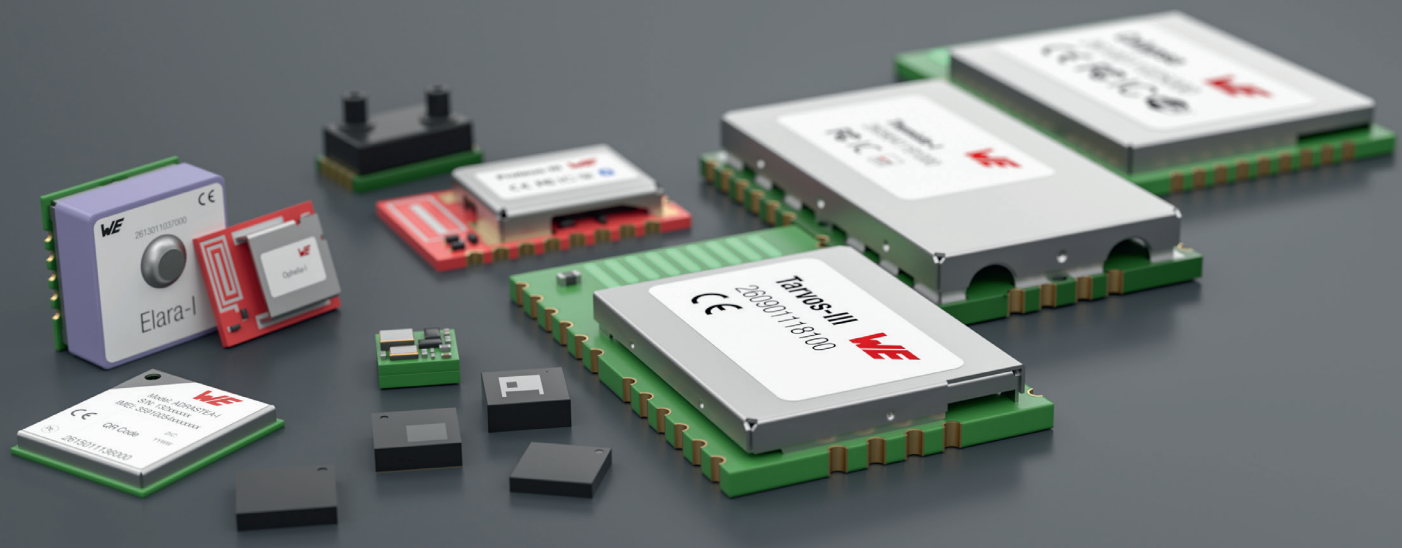

User manual

Mini EV-Board for radio modules Stephano-I / Orthosie-I

2617039025001

Version 1.0

June 2, 2025

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

****

MUST READ

Check for firmware updates

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

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

Revision history

Manual version	HW version	Notes	Date
1.0	1.0	• Initial version	June 2025

Abbreviations

Abbreviation	Name	Description
Bluetooth® LE	Bluetooth Low Energy	
BYOF	Build Your Own Firmware	Radio module without firmware, to be used to develop customized firmware
COM port	Communication port	
EV	Evaluation	
ESD	Electro Static Discharge	
FTDI	Future Technology Devices International	USB to UART converter chipset
GND	Ground	
HIGH	High signal level	
I/O	Input & Output	
LED	Light Emitting Diode	
LFCLK	Low Frequency Clock	
LFXO	Low Frequency crystal Oscillator	
LOW	Low signal level	
NFC	Near Field Communication	
PCB	Printed Circuit Board	
RF	Radio Frequency	Describes everything related to the wireless transmission
SMA	SubMiniature version A	Connector for radio signals
SWD	Serial Wire Debug	Debugging interface
THT	Through-Hole Technology	
UART	Universal Asynchronous Receiver Transmitter	Allows communicating with the module of a specific interface
USB	Universal Serial Bus	
VDD	Voltage Drain Drain	Supply voltage

Contents

1 Supported radio modules

The EV-Board described in this manual can be used to evaluate the following products:

WE order code	Description
2617011022000	BYOF radio module Orthosie-I [1]
2617011025000	WiFi and Bluetooth® LE combo module Stephano-I [2]

Table 1: Compatibility

The EV-Kit can be ordered using the following order code:

WE order code	Description
2617039025001	Mini EV-Board Stephano-I. The same mini EV board shall be used to evaluate Orthosie-I.

Table 2: Order code

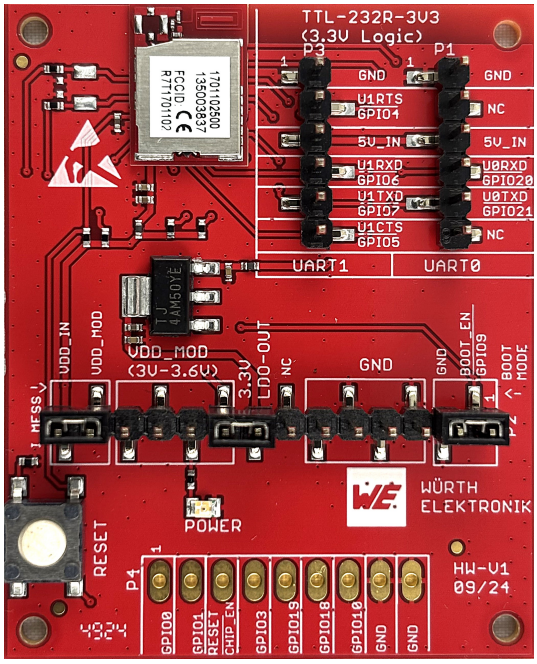

Figure 1: Stephano-I/Orthosie-I mini-EV-Board

Content 2617039025001	Quantity
Mini EV-Board Stephano-I / Orthosie-I integrated PCB antenna	1

Table 3: Content mini EV-Board

2 Functional description

The mini EV-Board is an application oriented, cost effective and minimalistic device to evaluate the supported Würth Elektronik eiSos radio modules. It offers the user the possibility to develop hardware and software for the corresponding radio module.

By default, the mini EV-Board is assembled with the minimum required headers to take the module into operation. Additional components may be required to evaluate further functionalities. These must be assembled by the user and require soldering competence.

Accessories required to test full scope of the radio module are:

- Additional assembly components listed in table 4 and soldering equipment
- TTL-232R-3V3 FTDI cable [3]

All pins are available on pads where a pin header can be soldered in. The pins that are needed for minimal pin configuration are available on already equipped headers, e.g. to connect a microcontroller or a PC and to set jumpers to choose operating modes of the radio module.

Default jumper placement of P2 pin (1-2) sets the radio module to boot mode. In this mode, the Orthosie-I module can be programmed. To evaluate the Stephano-I module, the P2 pin (1-2) shall be removed and the module needs to be reset.

2.1 Taking into operation - PC

To use the TTL-232R-3V3 FTDI cable [3], the corresponding FTDI driver package [4] must be installed on the PC following the installation guidelines [5].

The TTL-232R-3V3 FTDI cable shall be connected to the pin header P1 or P3 of the mini EV-Board, depending on the application. The UART0 is accessible through pin header P1 for flashing and debugging. The UART1 is accessible through pin header P3 for application firmware. For more details, see the corresponding radio module user manual [1, 2].

It is important that the VDD is stable and able to reliably supply the module's static and peak current consumption, as specified by the module manual. A minimum board supply current of 200 mA is necessary, so that the peak transmission current of the module is supported.

STOP

Incorrect orientation of the TTL-232R-3V3 FTDI cable may damage the radio module. For easy orientation, the pin number 1 and signals are labeled.

The next step is to connect the mini EV-Board to the PC using the TTL-232R-3V3 FTDI cable. In that way, a COM port can be detected and installed on the PC. In the device manager, the

COM port name of the TTL-232R-3V3 FTDI cable can be found. A COM port shall appear for example: "COM12" in Windows systems or "/dev/ttyUSB0" in Linux systems.

The WE UART Terminal PC tool [6] or any other serial terminal program (like hterm [7] for Windows) has to be run and the corresponding COM port has to be opened using the default settings of the mounted radio module.

After the module is powered through the TTL-232R-3V3 FTDI cable or an alternative power supply, the reset button should be pressed to ensure the correct functionality of the module.

The detailed module specific quick start instructions can be found in the corresponding radio module user manuals [1, 2].

2.2 Taking into operation - Host controller

To take the mini EV-Board into operation using a host controller, an external power supply shall be connected to the mini EV-Board. The power supply option 3, 4 or 5 from table 12 shall be used. It is important that the VDD is stable and able to reliably supply the module's static and peak current consumption, as specified by the module manual. A minimum board supply current of 200 mA is necessary, so that the peak transmission current of the module is supported.

The next step is to connect the communication lines of the module to the host controller. The headers P1, P2, P3 and P4 can be used to connect the module pins and host.

The detailed module specific quick start instructions can be found in the corresponding radio module user manuals [1, 2].

3 Development board

3.1 Block diagram

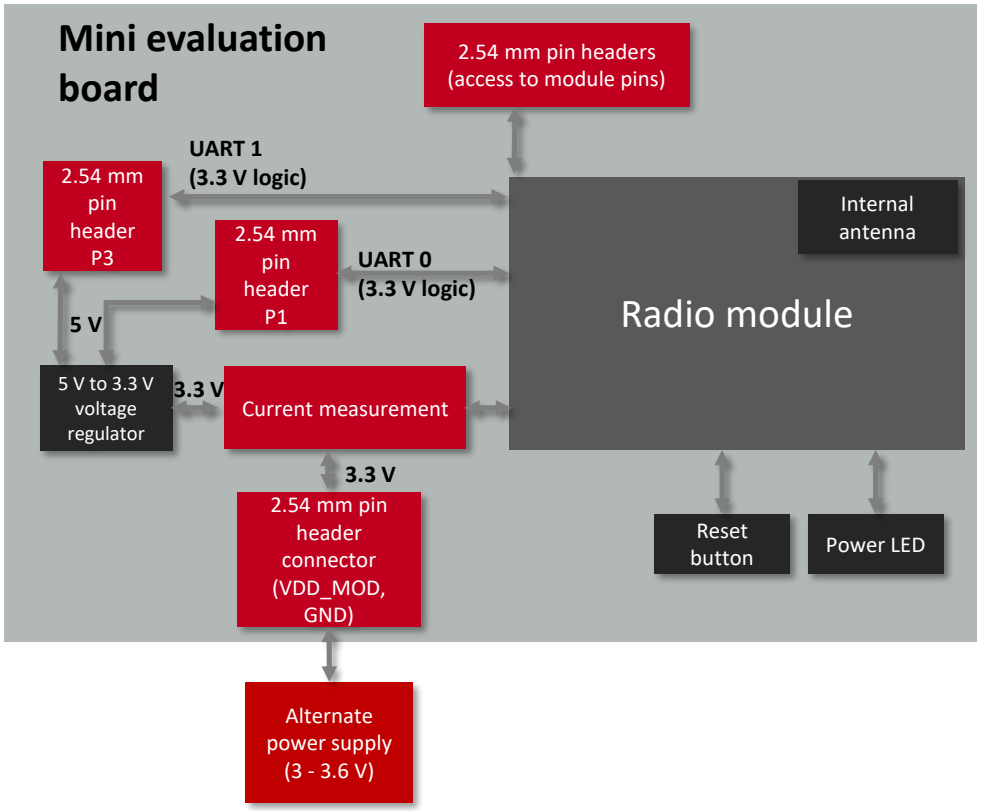

Figure 2: Block diagram

3.2 Additional assembly

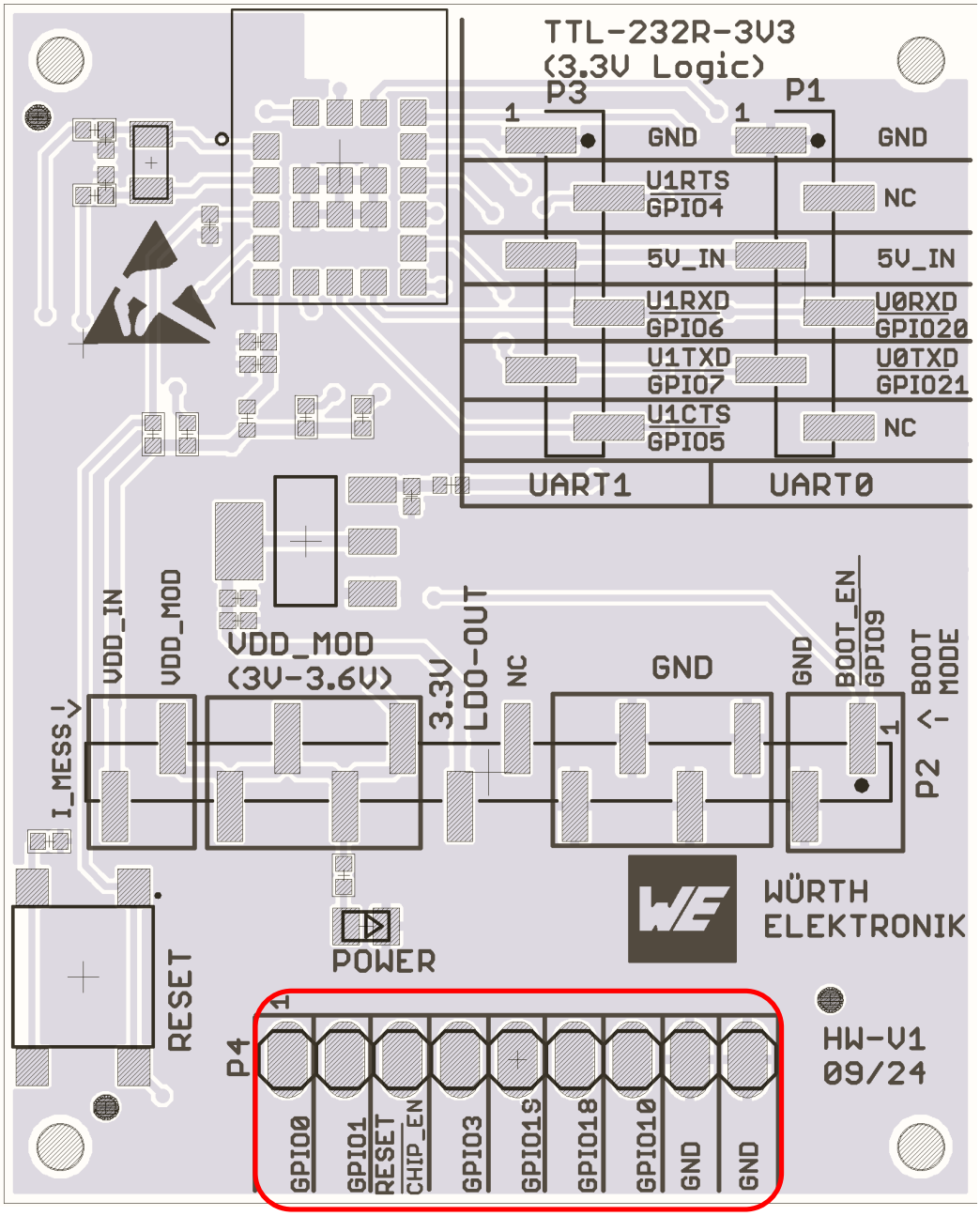

Figure 3: Additional assembly

Table 4 shows the additional assembly component for the mini EV-Board.

Placeholder	Function	Pins	WE Article Number
P4	Module GPIO access pins	1X9	*61300911121*

Table 4: Additional assembly component

Holes with 2 mm diameter on all the four corners are available for spacer or standoff connections.

3.3 Connectors and ports

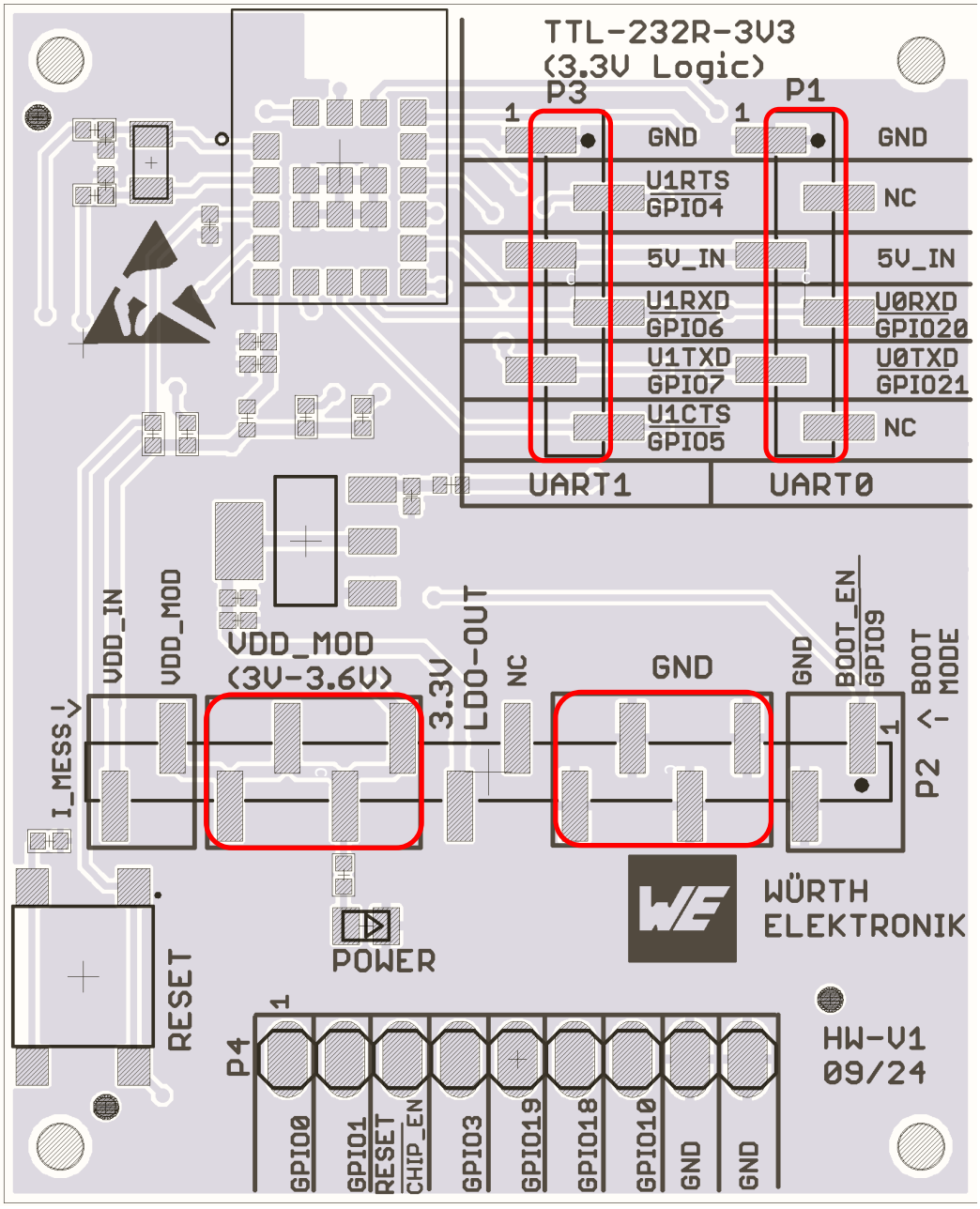

Figure 4: Connectors and ports

3.3.1 P1, P3: Module communication access pins / TTL-232R-3V3 FTDI cable connector

P1	ESP32-C3FH4	Board connection	Stephano-I
1	GND	GND	GND
2	-	NC	NC
3	-	5 V (Board power supply)	-
4	GPIO20	Module pin 15	U0RXD
5	GPIO21	Module pin 14	U0TXD
6	-	NC	NC

Table 5: Pin header P1

P3	ESP32-C3FH4	Board connection	Stephano-I
1	GND	GND	GND
2	GPIO4	Module pin 6	U1RTS
3	-	5 V (Board power supply)	-
4	GPIO6	Module pin 8	U1RXD
5	GPIO7	Module pin 10	U1TXD
6	GPIO5	Module pin 7	U1CTS

Table 6: Pin header P3

Do not connect the TTL-232R-3V3 cable on pin header P1 and P3 at the same time.

3.3.2 P2: Power supply / Current Measurement

P2	Board connection	Function
1	GPIO9	BOOT_EN
2	GND	GND
3	GND	GND
4	GND	GND
5	GND	GND
6	GND	GND
7	NC	NC
8	On-board LDO Output	3.3 V Output
9	VDD_MOD	Connector for external power supply (3 V - 3.6 V)
10	VDD_MOD	Connector for external power supply (3 V - 3.6 V)
11	VDD_MOD	Connector for external power supply (3 V - 3.6 V)
12	VDD_MOD	Connector for external power supply (3 V - 3.6 V)
13	VDD_MOD	Connector for external power supply (3 V - 3.6 V)
14	VDD_IN	Module power supply (VDD)

Table 7: Pin header P2

All the information related to the power supply is described in chapter 3.6.1.

3.3.3 P4: Module GPIO access pins

P4	ESP32-C3FH4	Board connection	Stephano-I
1	GPIO0	Module pin 1	XTAL_P
2	GPIO1	Module pin 2	XTAL_N
3	CHIP_EN	Module pin 3	RESET
4	GPIO3	Module pin 4	GPIO3
5	GPIO19	Module pin 16	USBD+
6	GPIO18	Module pin 12	USBD-
7	GPIO10	Module pin 13	GPIO10
8	GND	GND	GND
9	GND	GND	GND

Table 8: Pin header P4

3.4 Jumpers

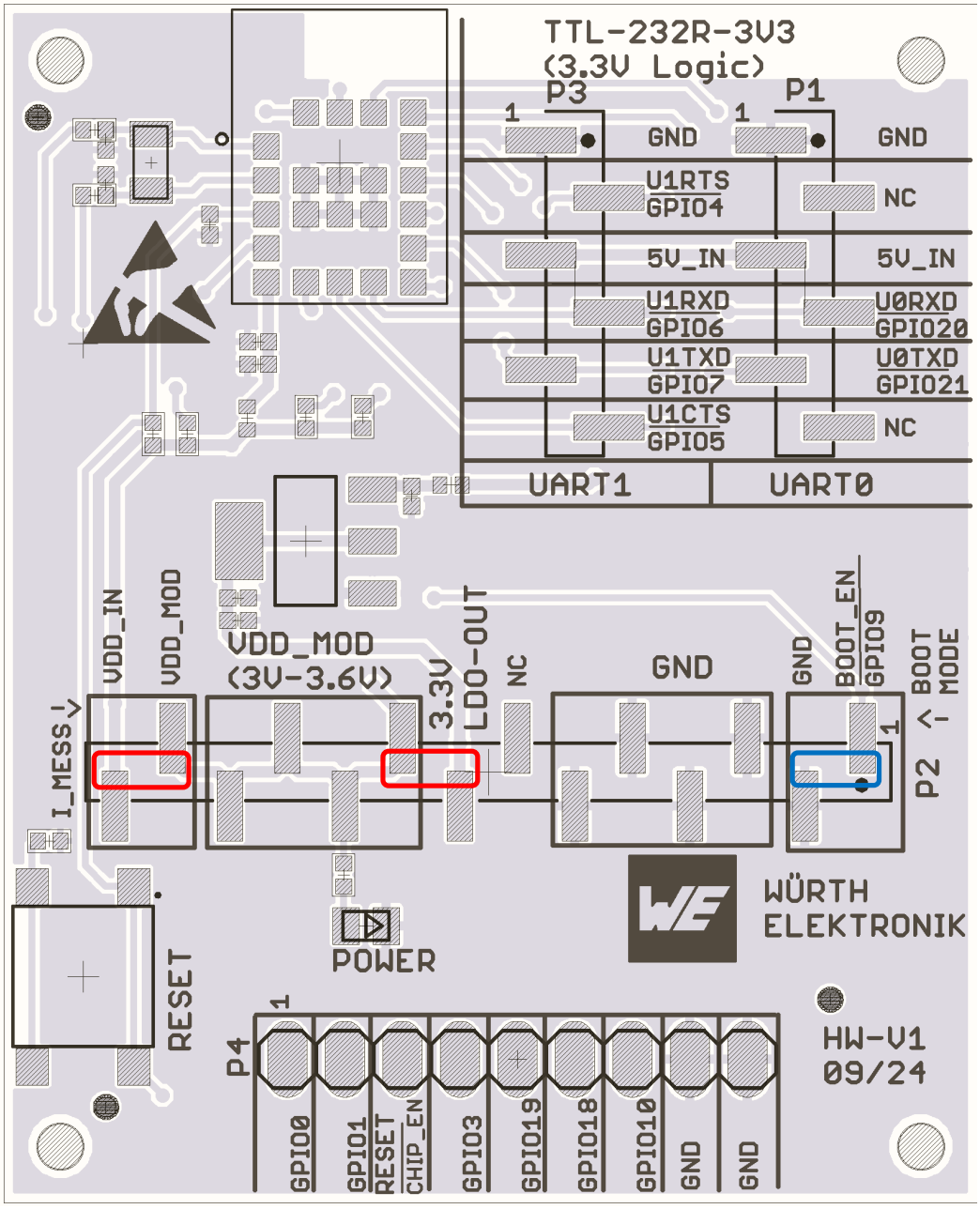

Figure 5: Jumpers

Pins	Function	Default state
P2 Pin (1-2)	Boot	Set
P2 Pin (8-9)	Internal LDO power supplied	Set
P2 Pin (13-14)	Current measurement	Set

Table 9: Jumpers

If the on board LDO is not used, the pin header P2 pin (8-9) jumper shall not be set.

3.4.1 Current measurement

By default, a jumper is set on pin (13-14) of pin header P2. For current measurement, the jumper can be removed and a current meter can be connected instead.

P2	Function
13	VDD_MOD
14	VDD_IN

Table 10: Pin header P2

3.4.2 Boot mode

By default, P2 pin (1-2) jumper is set. If P2 pin (1-2) jumper is set during power up and reset button is pressed, the module starts in boot mode to be ready for firmware flash/update. For application start-up, the jumper shall not be set during power up.

P2	Board connection	Stephano-I
1	GPIO9	BOOT
2	GND	GND

Table 11: Pin header P2

3.5 Reset button

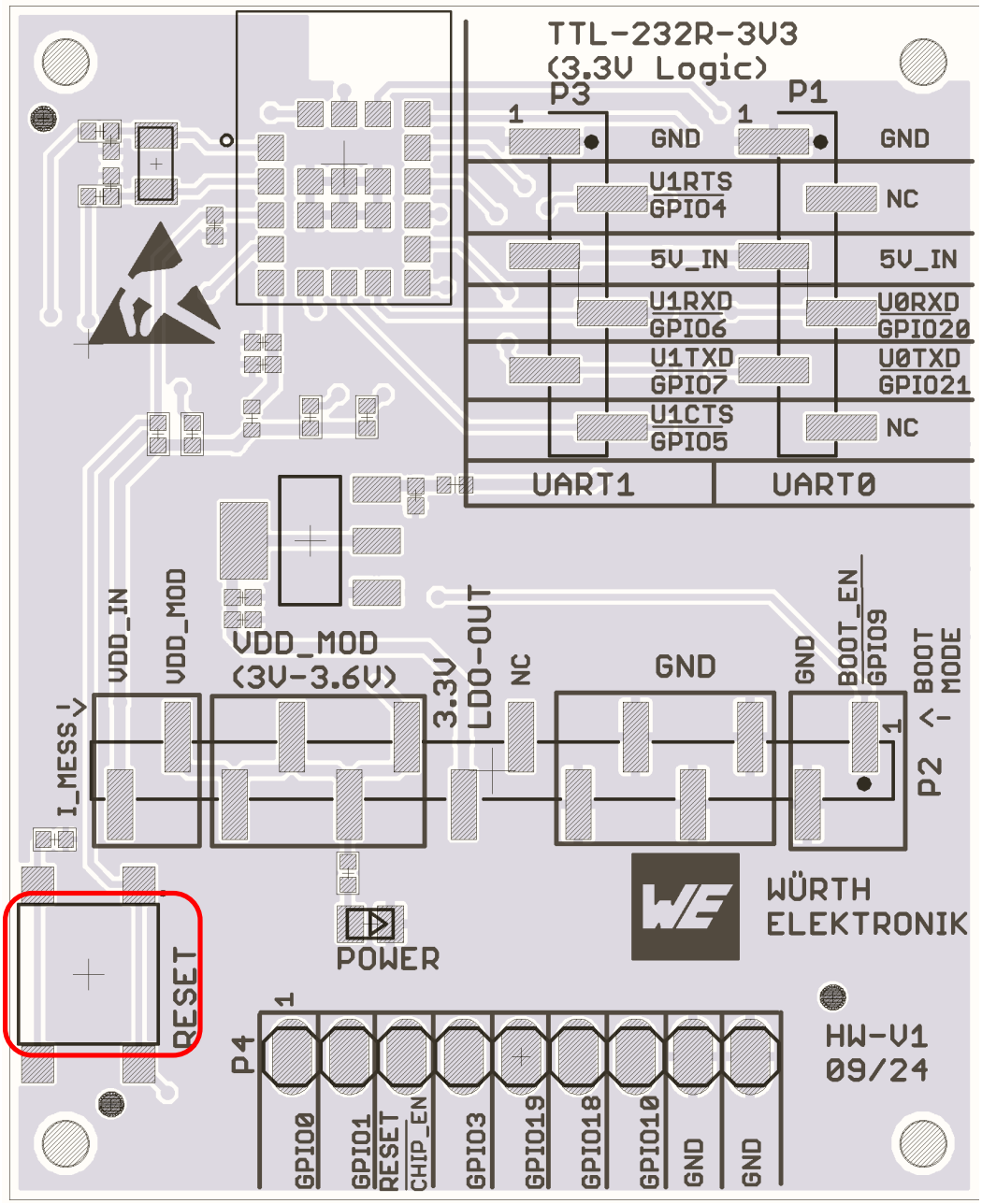

Figure 6: Buttons

On mini EV-Board level, the active low reset input is configured with a pull-up resistor. The module provides a */RESET* pin that is connected to this button, so that the module can be restarted properly. Refer to the module specific manual for detailed information [1, 2].

3.6 Function blocks

3.6.1 Power supply

The mini EV-Board can be powered either by TTL-232R-3V3 cable or by an external power supply. Table 12 lists the connection for different power supply options.

No	Power supply	Supply @	Multimeter or jumper	Jumper
1	TTL-232R-3V3 cable	P1	P2 Pin 13-14	P2 Pin 8-9 set
2	TTL-232R-3V3 cable	P3	P2 Pin 13-14	P2 Pin 8-9 set
3	External supply	P1 dedicated pins Pin 3: 5 V, Pin 1: GND	P2 Pin 13-14	P2 pin 8-9 set
4	External supply	P3 dedicated pins Pin 3: 5 V, Pin 1: GND	P2 Pin 13-14	P2 pin 8-9 set
5	External supply	P2 dedicated pins Pin 3, 4, 5 or 6: GND Pin 9, 10, 11 or 12: 3 V - 3.6 V	P2 Pin 13-14	P2 pin 8-9 not set

Table 12: Power supply option

3.6.1.1 Pin header P1 or P3, power supply through TTL-232R-3V3

The mini EV-Board can be powered by TTL-232R-3V3 cable through P1 or P3 connector. TTL-232R-3V3 cable powers the board with 5 V supply. The integrated voltage regulator regulates the connected 5 V down to 3.3 V and supplies the remaining parts of the circuit. For current measurement, the device is connected to header P2, pin 13 to pin 14.

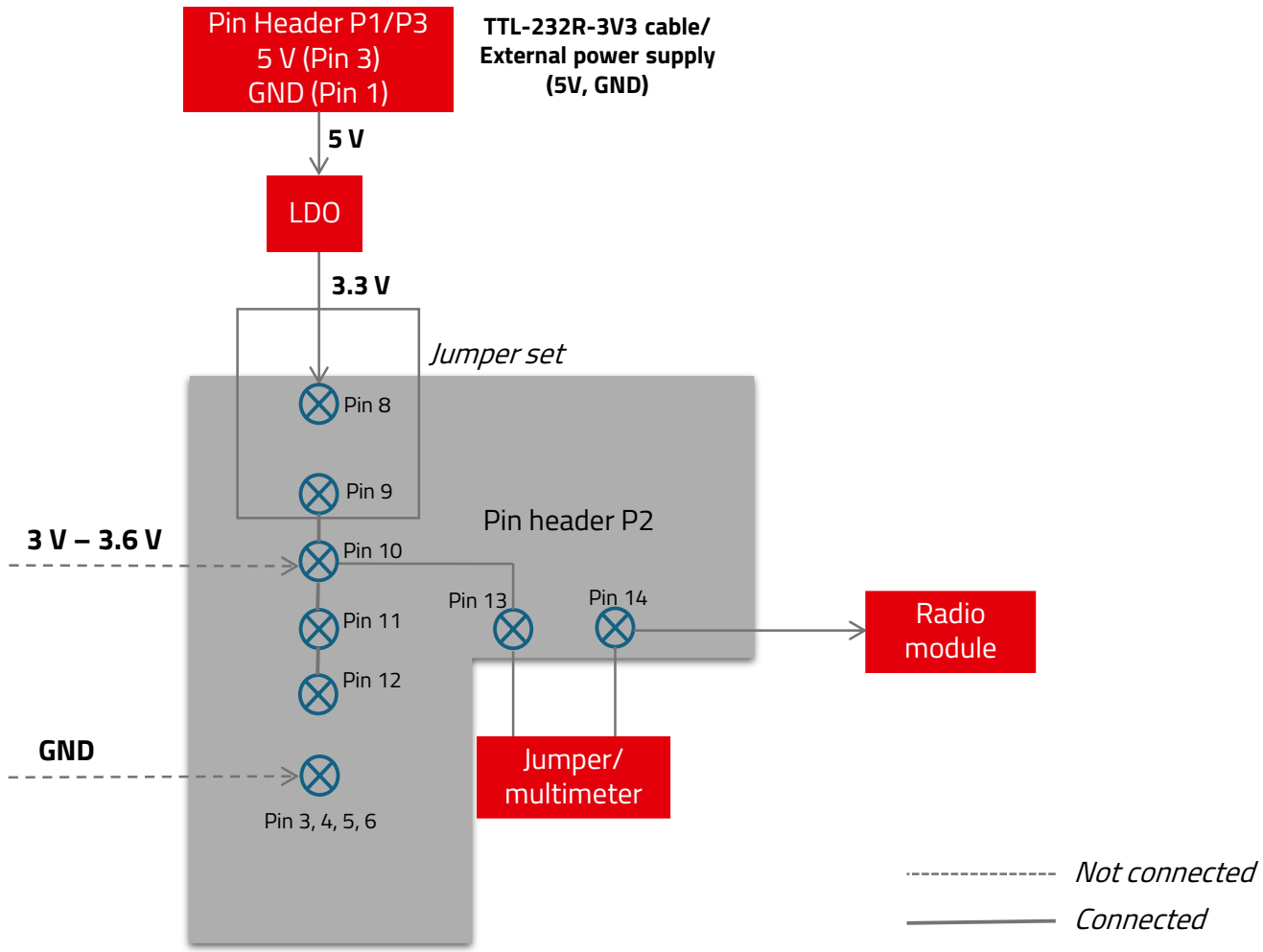

Figure 7: Block diagram of power supply through TTL-232R-3V3 cable

STOP

Do not connect the TTL-232R-3V3 cable on pin header P1 and P3 at the same time.

3.6.1.2 Pin header P1 or P3, power supply through dedicated pins

The mini EV-Board can be powered by an external power supply through connector P1 or P3, pin 3 and pin 1. The integrated voltage regulator, regulates the connected 5 V down to 3.3 V and supplies the remaining parts of the circuit. For current measurement, the device is connected to header P2, pin 13 to pin 14.

3.6.1.3 Pin header P2, power supply through dedicated pins

The mini EV-Board can be powered by an external power supply through connector P2, pin 9, 10, 11, 12 (*VDD_MOD 3 V - 3.6 V*) and pin 3, 4, 5, 6 (*GND*).

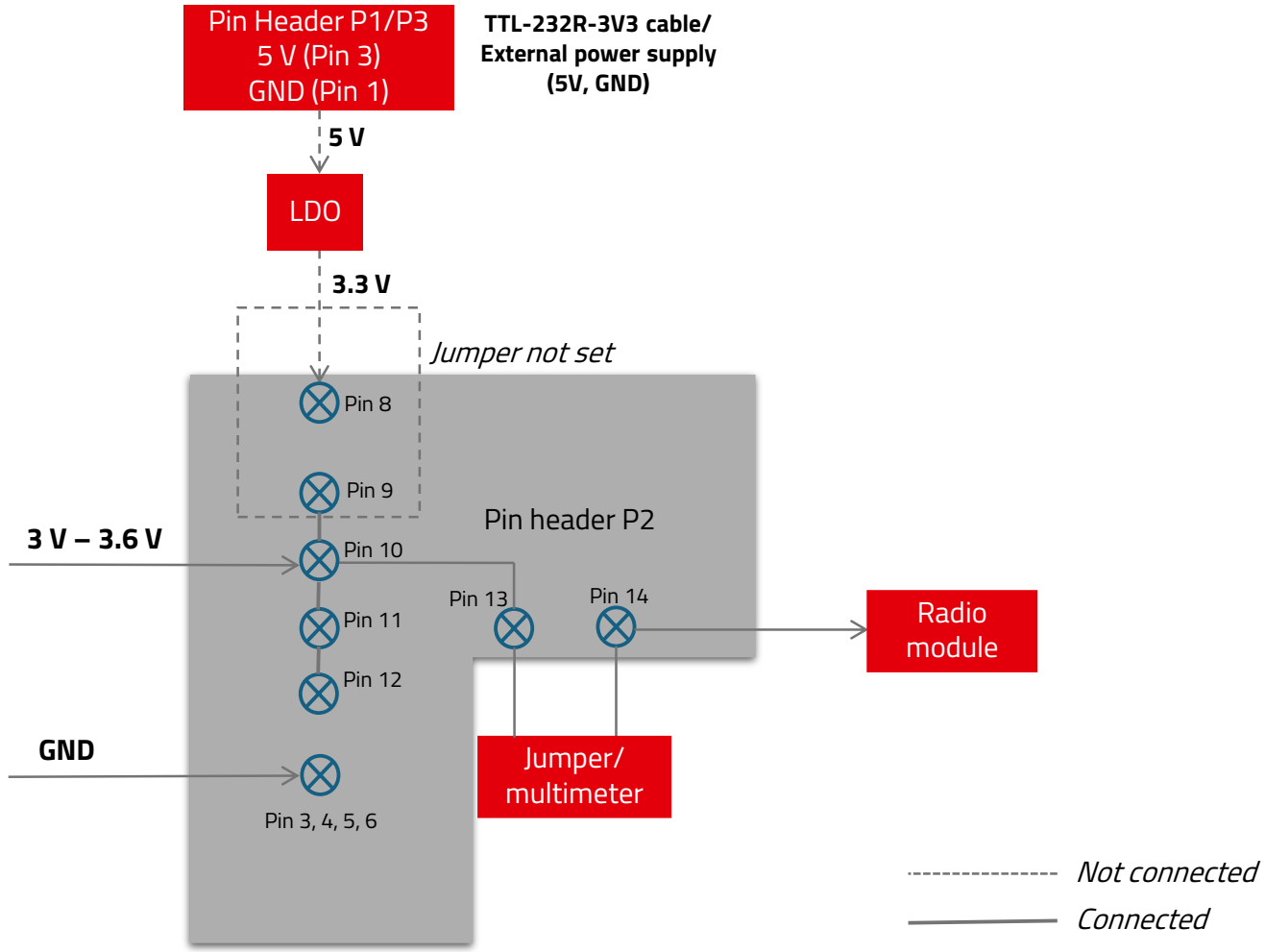

Figure 8: Block diagram of power supply through dedicated pins

If external power supply option through pin header P2, (option 5 from table 12) is used, the jumper on pin 8-9 of pin header P2 is not set.

3.6.2 UART0 / USB

The TTL-232R-3V3 cable, which contains a FTDI USB to UART converter chipset, is used for USB/UART connection between PC and mini EV-Board. The IO level of the TTL-232R-3V3 cable is 3.3 V. Using the FTDI-driver, the PC will show a virtual COM-Port, which can be used to communicate with the module. For Orthosie-I, UART0 is accessible through pin header P1 for flashing and debugging.

3.6.3 UART1 / USB

The TTL-232R-3V3 cable, which contains a FTDI USB to UART converter chipset, is used for USB/UART connection between PC and mini EV-Board. The IO level of the TTL-232R-3V3 cable is 3.3 V. Using the FTDI-driver, the PC will show a virtual COM-Port, which can be used to communicate with the module. For Stephano-I, UART1 is accessible through pin header P3 for application firmware.

STOP

Do not connect the TTL-232R-3V3 cable on pin header P1 and P3 at the same time.

3.6.4 Supported UART baudrates

In order to establish a stable UART communication between the FTDI USB to UART converter and the radio module's chipset, the difference between the baud rates of each entity must not exceed the respective immunity level. Both devices use an internal clock to generate the configured UART baud rate. Due to the fixed clock frequency, only specific baud rates can be run without frequency error.
To figure out which baud rates of the radio module can be evaluated using the FTDI USB to UART converter (FT232R or FT231X), it is important to know the real baud rate B with its introduced error. To get them, the FTDI's clock of 3000 kHz must be divided by the respective prescaler P:

$$B = \frac{3000}{P} \text{ [kBaud]}$$

The supported prescalers P can be chosen as:

$$P \in \{1, 1.5\} \text{ or } P = 2 + (N \cdot 0.125) \text{ with } N \in \{0, 1, 2, 3, 4, \ldots\}$$

When a baud rate is configured in the FTDI USB to UART converter, the prescaler is chosen that meets the closest baud rate. In that case, the real baud rate differs from the configured one, introducing a UART clock error, which may lead to UART communication issues.

Example: In case the desired baud rate $B_{desired} = 1250$ kBaud, the desired prescaler is $P_{desired} = \frac{3000}{1250} = 2.4$. The closest prescaler P is determined by $P = 2 + (N \cdot 0.125) = 2.375$ with $N = 3$. This results in a real baud rate $B = \frac{3000}{2.375} = 1263$ kBaud, which introduces an error of $\frac{B - B_{desired}}{B_{desired}} = 1.04$ % with respect to the desired baud rate.

Desired baud rate [kBaud]	Closest prescaler P	Real baud rate B [kBaud]	Error [%]
3000	1	3000	0
2500	1.5	2000	-20
2000	1.5	2000	0
1500	2	1500	0
1250	2.375	1263	1.04
1411.764706	2.125	1411.764706	0
⋮	⋮	⋮	⋮
1000	3	1000	0
921.6	3.25	923.0769231	0.16
⋮	⋮	⋮	⋮
230.4	13	230.7692308	0.16
⋮	⋮	⋮	⋮
115.2	26	115.3846154	0.15
⋮	⋮	⋮	⋮
38.4	78.125	38.4	0
⋮	⋮	⋮	⋮
19.2	156.25	19.2	0
⋮	⋮	⋮	⋮
9.6	312.5	9.6	0
⋮	⋮	⋮	⋮

Table 13: Example baud rates

3.6.5 UART direct

If a microcontroller is to be connected to the module, use the pin header P1 or P3 connector. The UART of the host can be directly connected to P1 or P3. Beware of IO level compatibility. The host must obey the values stated in the module's manual. Especially the IO level restrictions must be implemented by a host system (i.e. using a level shifter to use the allowed IO levels).

3.6.6 Programming interface

The radio modules can be programmed using the UART0 interface, which is available on pin header P1 of the mini EV-Board. TTL-232R-3V3 cable shall be used to connect the mini EV-Board to the PC. Correct orientation of the TTL-232R-3V3 cable connector shall be taken care of.

3.7 Schematic - Stephano-I, Orthosie-I

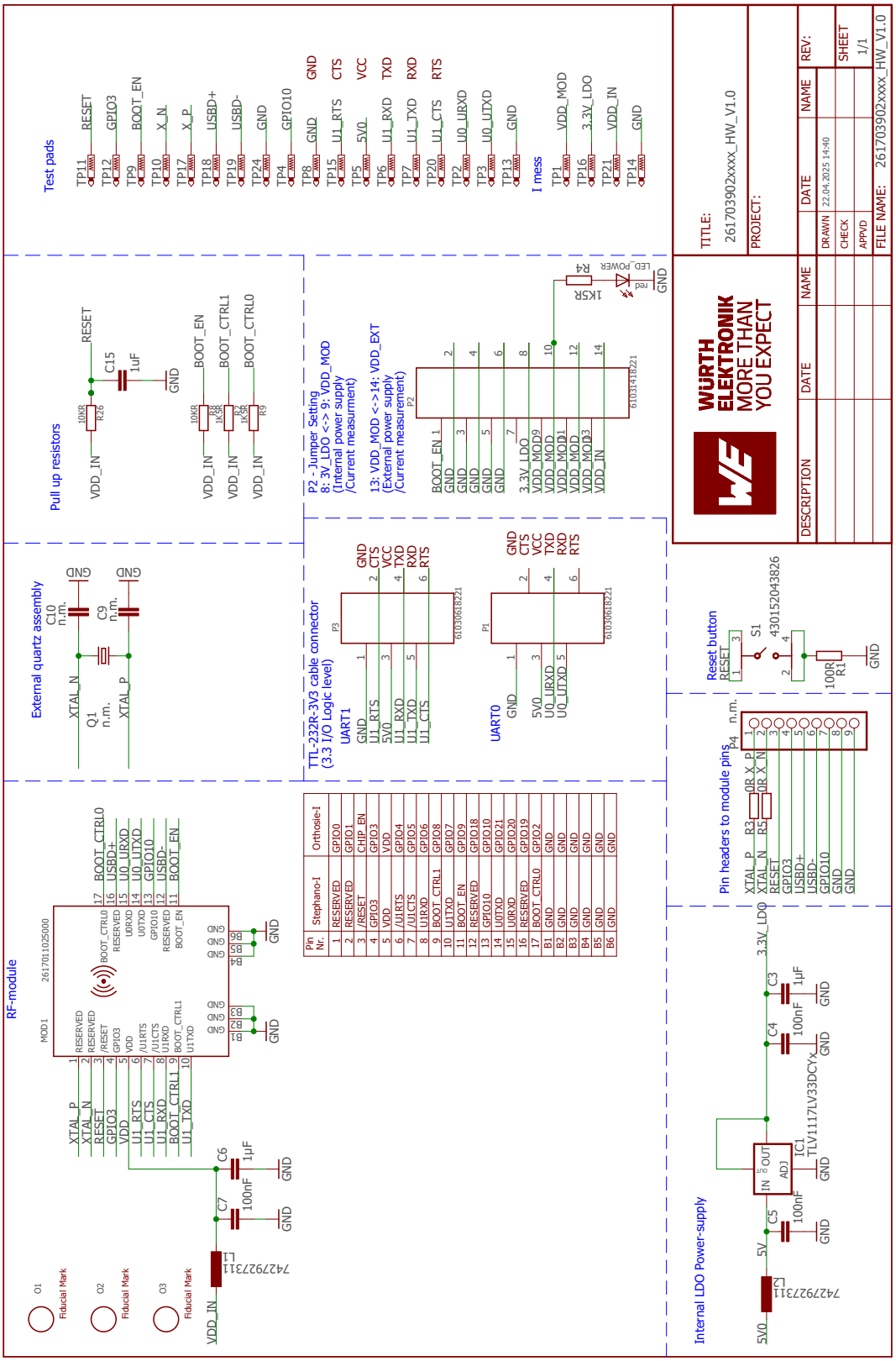

Figure 9: Schematic sheet

3.8 Layout

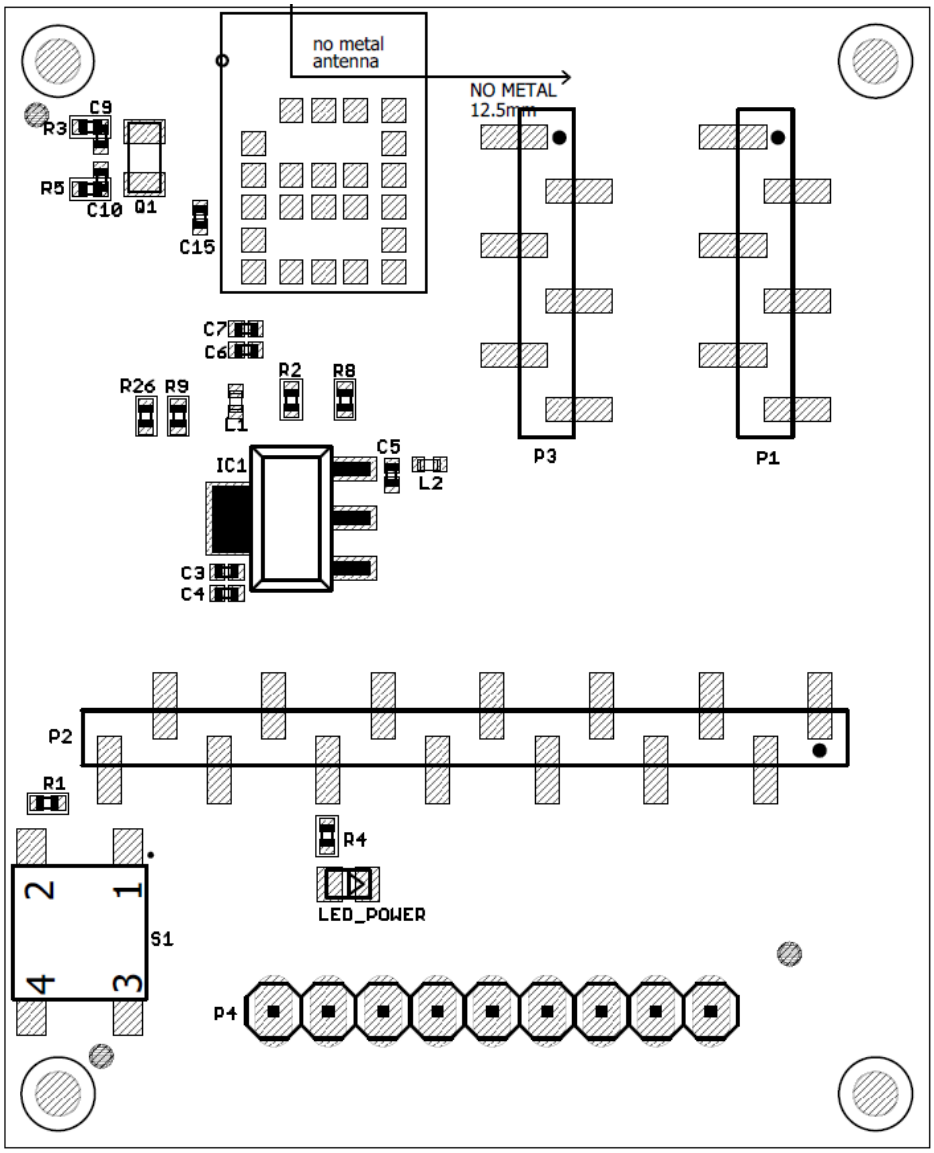

Figure 10: Assembly diagram

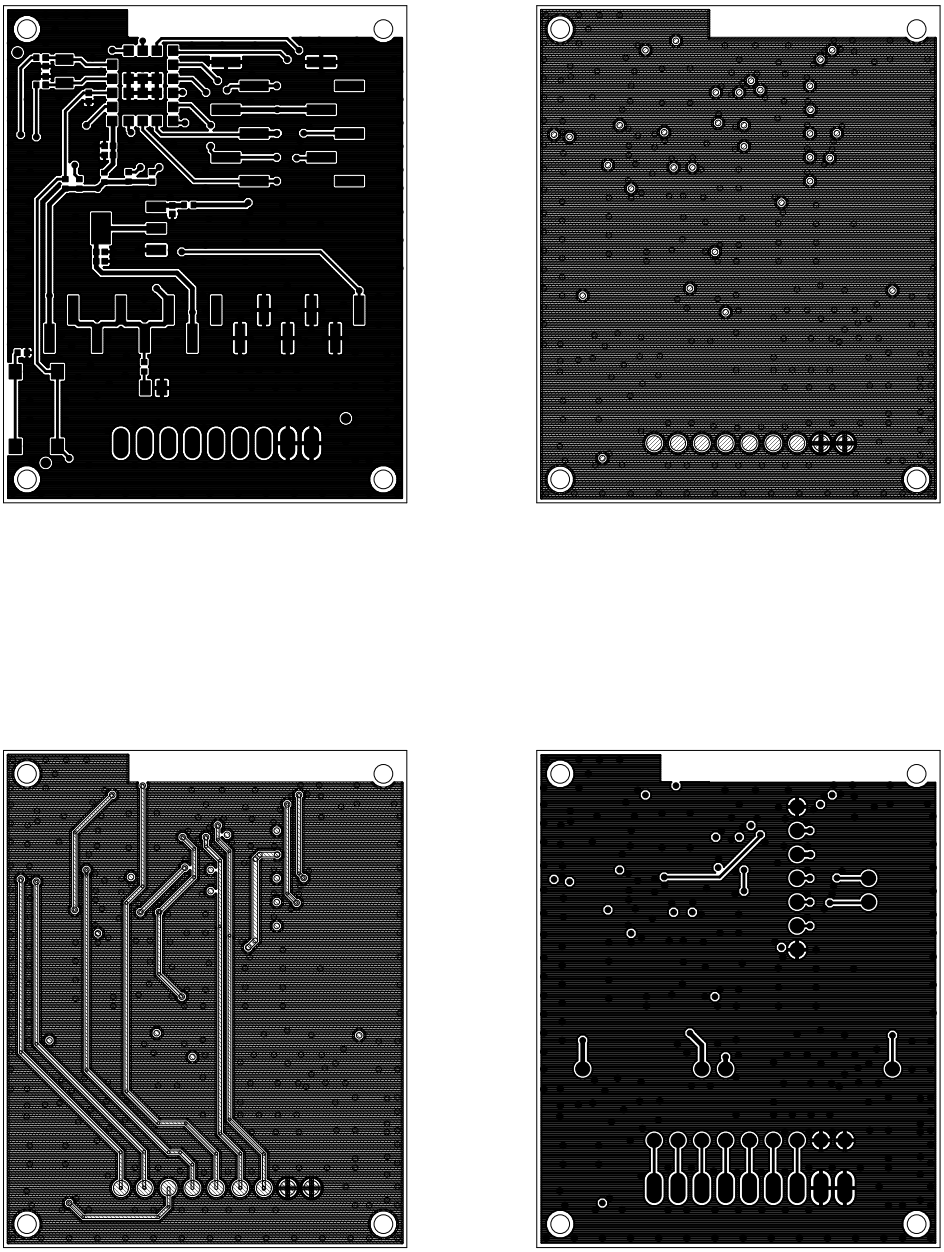

Figure 11: Top, bottom & internal layers

3.9 Bill of materials

Part	Value	Package	HEIGHT	MANUFACTURER	NR
C3	1µF	C0402_IPC	0.5mm	Würth Elektronik	885012105012
C4	100nF	C0402_IPC	0.5mm	Würth Elektronik	885012205037
C5	100nF	C0402_IPC	0.5mm	Würth Elektronik	885012205037
C6	1µF	C0402_IPC	0.5mm	Würth Elektronik	885012105012
C7	100nF	C0402_IPC	0.5mm	Würth Elektronik	885012205037
C9	n.m.	C0402_IPC	0.5mm		
C10	n.m.	C0402_IPC	0.5mm		
C15	1uF	C0402_IPC	0.5mm	Würth Elektronik	885012105012
IC1	TLV1117LV33DCYx	SOT223-4	1.8mm	TI	TLV1117LV33DCYR
L1	7427927311	L0402_WE_FERRIT	0.5mm	Würth Elektronik	7427927311
L2	7427927311	L0402_WE_FERRIT	0.5mm	Würth Elektronik	7427927311
LED_POWER	red	C0805_IPC	0.75mm	Würth Elektronik	150080RS75000
MOD1	2617011025000	WE-FP-7	2.0mm	Würth Elektronik	2617011025000
P1	61030618221	61030618221	9.9mm	Würth Elektronik	61030618221
P2	61031418221	61031418221	9.9mm	Würth Elektronik	61031418221
P3	61030618221	61030618221	9.9mm	Würth Elektronik	61030618221
P4	n.m.	1X09			
Q1	n.m.	CC7V-T1A			
R1	100R	R0402_IPC	0.35mm	Yageo	RC0402FR-07100RL
R2	1K5R	R0402_IPC	0.35mm	Yageo	RC0402FR-071K5L
R3	0R	R0402_IPC	0.35mm	Yageo	RC0402FR-070RL
R4	1K5R	R0402_IPC	0.35mm	Yageo	RC0402FR-071K5L
R5	0R	R0402_IPC	0.35mm	Yageo	RC0402FR-070RL
R8	10KR	R0402_IPC	0.35mm	Yageo	RC0402FR-0710KL
R9	1K5R	R0402_IPC	0.35mm	Yageo	RC0402FR-071K5L
R26	10KR	R0402_IPC	0.35mm	Yageo	RC0402FR-0710KL
S1	430152043826	430152043826	4.3mm	Würth Elektronik	430152043826

4 Regulatory compliance information

4.1 European Conformity

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 designed for professionals to be used solely at research and development facilities for such purposes.

4.2 FCC

Pursuant to §2.803 (c) of Title 47 Chapter I Subchapter A Part 2 Subpart I, the EV-Kit falls under the FCC exception. Therefore it is marked as "For evaluation only; not FCC approved for resale".

4.3 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.

5 References

[1] Würth Elektronik. Orthosie-I user manual. https://www.we-online.de/katalog/de/manual/2617011022000.

[2] Würth Elektronik. Stephano-I user manual. https://www.we-online.de/katalog/de/manual/2617011025000.

[3] TTL-232R-3V3 FTDI cable. https://www.ftdichip.com/Support/Documents/DataSheets/Cables/DS_TTL-232R_CABLES.pdf.

[4] FTDI virtual COM port driver. https://ftdichip.com/drivers/vcp-drivers/.

[5] FTDI driver installation guidelines. https://www.ftdichip.com/Support/Documents/InstallGuides.htm.

[6] Würth Elektronik. WE UART Terminal PC tool (Smart Commander). https://www.we-online.de/wcs-software.

[7] hterm. Terminal program. https://www.der-hammer.info/pages/terminal.html.

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.

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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.
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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.

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