MANUAL
200 W
DEVELOPMENT KIT

Wireless Power Transfer
Extended Medium Power Solution

Order Code 760308EMP

200 W Development Kit – Extended Medium Power Solution for Wireless Power Transfer

Transmitter Board and Receiver Board

Abstract

Infineon and Würth Elektronik eiSos (WE) offer this wireless power development kit (order code 760308EMP) to demonstrate the advantages of wireless power and to give developers the opportunity to test and integrate a wireless power solution into their application. This manual describes the setup and basic usage of this development kit.
Please note that this development kit is intended to be operated in a research and development environment under supervision of qualified technicians or engineers for test and measurement purposes. This development kit is not designed to fulfill requirements for CE compliance.

Description of Featured Products

The BSZ070N08LS5 is a logic level OptiMOS™ 5 power MOSFET for the synchronous rectification (SR) application which has the right RDS-on level for this 200 W kit in a very compact 3.3 x 3.3 mm SMD package. The IR1161L is a high speed SR control IC. The space saving SOT-23 package improves efficiency up to 2% over conventional secondary side diode rectification. Its minimum on time feature is adjustable to pair with a variety of Infineon MOSFET selections. The XMC1302, an ARM® Cortex®-M0 up to 48 MHz, is the number one choice for your high performance, smart and safe wireless charging application. The 760308102142 Wireless Power Transfer Coil has a high Q-factor for a high power transfer efficiency. The 171032401 step-down converter is easy to use, small-sized and suited for a wide range of applications. The 860160578032 are long-life electrolytic capacitors with a low ESR. For further details, please also consult the relevant product datasheets at www.infineon.com and www.we-online.com.

Key Specification

- Mains power input voltage ..... 100 – 240 V_{AC}
- Regulated input voltage ..... 24 V_{DC}
- Maximum transmitted power ..... 200 W
- Output voltage ..... 19 – 20 V
- Maximum coil distance ..... 10 mm

Features

- Plug & Play Wireless Power Development Kit
- Wireless power transfer system up to 200 W
- Complete solution consisting of TX and RX
- Flexible and modular approach for fast integration of wireless power in your product design
- Data transfer between receiver and transmitter board
- Manual and automatic output voltage control
- IoT sensor I²C interface
- Visit www.we-online.com/wirelesspower/200WKit for details

ESD

More information:
www.we-online.com/wirelesspower/200WKit

Figure 1: Wireless power transfer system with transmitter board, coils and receiver board.

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1. Introduction

This manual is valid for development kit version 1.0. It provides guidelines to quickly setup the hardware for fast and easy evaluation of the wireless charging system and the featured key components. For further details and updates about the used parts, please consult the relevant product datasheets and general information at www.we-online.com/wirelesspower/200WKit, also for downloading the latest version of this document and additional useful information such as application notes, Gerber files, schematics, bill of materials, firmware etc.

2. Hardware Description

2.1 Block diagram

The development kit consists of the following components:

- Transmitter board — Demonstration of charging pad function using MCU, discrete full bridge and TX coil
- Receiver board — Demonstration of wireless power receiver inside a mobile device using synchronous rectification and RX coil
- Power supply — Wide input range mains power supply with different adapters for international use

A block diagram of the development kit is depicted in figure 2. The transmitter design corresponds to a proprietary wireless power transfer design using an XMC1302-T038X0064 to control the wireless power transfer. The necessary 24 V_{DC} input voltage is provided with the included mains adapters.

WARNING

Before switching on the system, the enclosed load resistor must be connected to the output of the receiver, as the operation without any load could destroy the system. For further use we recommend the usage of an adjustable load (see chapter 6, step 2).

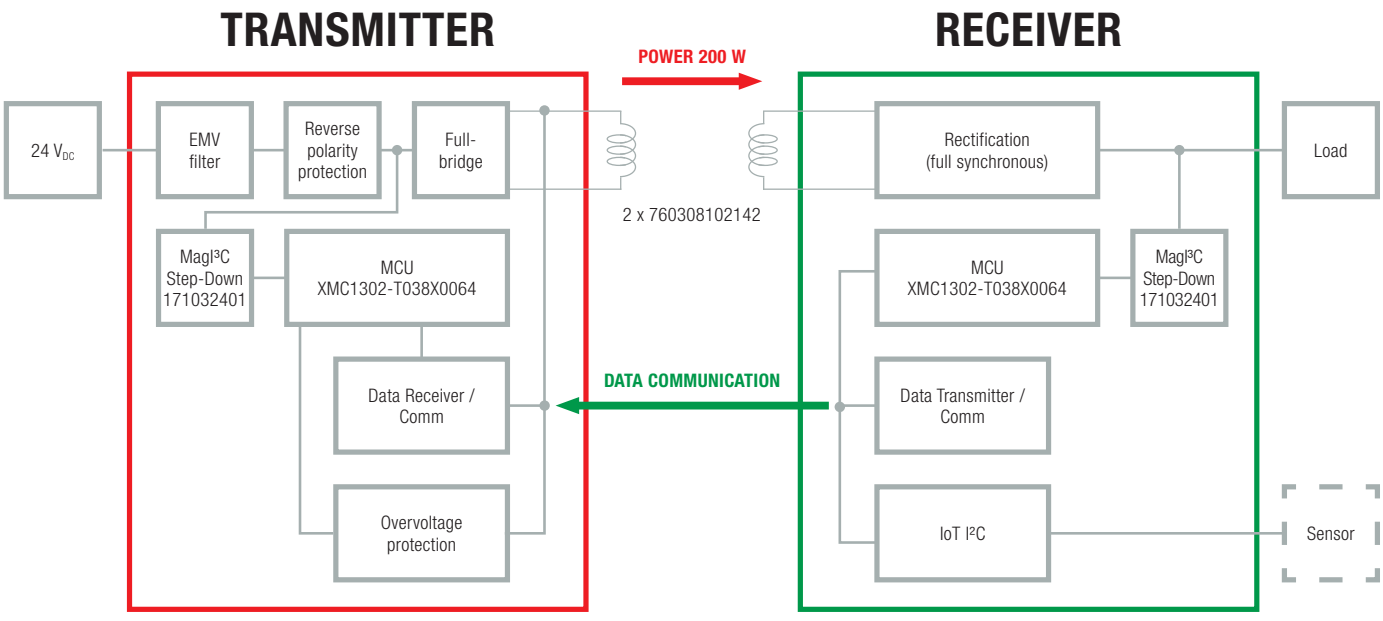

Figure 2: Development kit block diagram

The transmitter board contains the EMI-filter, reverse voltage protection, full bridge, resonant tank and the control circuit. The power transfer is fully digitally controlled by an XMC1302 series microcontroller. The control signals for the full bridge are generated by the MCU and can be controlled in automatic mode or manual mode. In manual mode the switching frequency can be changed with the encoder. This can be used to change the output voltage or for optimizing the efficiency.

The receiver board integrates all necessary functions to act as a wireless power receiver such as full synchronous rectification, modulator and a WE MagI³C Power Module. The modulator is used for data transfer. It is controlled by the MCU to send data from receiver side to transmitter side. The receiver is equipped with an I²C interface that can be used to interface to sensors. The sensor interface has its own adjustable power supply.

2.2 Key components

The purpose of the development kit is the evaluation of the key components used to realize the wireless power system. Table 1 gives an overview of the different ICs and coils. For more detailed information about these devices please refer to the individual web pages and datasheets.

2.3 Design advice

- The switching frequency has to be higher than the resonant frequency of the resonant tank, otherwise the output voltage can reach a very high level.
- The voltage in the resonant tank can be high. For this purpose the voltage rating of the resonant tank capacitors have to be considered.
- Please keep in mind that when changing the output voltage the efficiency will drop. As a consequence the temperature on some parts will rise.

2.4 Schematic, Gerber Files, Bill of Materials and Firmware

Please visit www.we-online.com/wirelesspower/200WKit for downloading the latest production data consisting of the schematics, assembly data, Gerber files, bill of materials (BOMs) and firmware files for all boards of this development kit.

For firmware development and debugging the external tool XMC Link from Infineon is required. More details can be found on www.infineon.com.

Please note that there will be no support for the firmware since it is only a basic functionality software which is meant for demo purposes only.

Manufacturer	Product Family	Part Number	Used in
Infineon	OptiMOS™ 5 Transistor	**BSZ070N08LS5**	RX board
Infineon	Synchronous Rectifier Controller	**IR1161L**	RX board
Infineon	ARM® Cortex®-M0 Microcontroller	**XMC1302-T038X0064 AB**	TX and RX board
Würth Elektronik eiSos	Wireless Power Coil	**760308102142**	TX and RX board
Würth Elektronik eiSos	MagI³C Power Module	**171032401**	TX and RX board
Würth Elektronik eiSos	WCAP-ATLL Aluminum Electrolytic Capacitor	**860160578032**	RX board

Table 1: Key components used in the development kit

3. Development kit setup and operating hints

3.1 Warnings

- This development kit must only be operated by trained professionals.
- This development kit should be operated in a well ventilated environment and, if used inside a case, the case should not be covered.
- This development kit should be placed on a stable, flat, non-conductive surface in use and should not be contacted by conductive items.

- All peripherals used with the development kit should comply with relevant standards for the country of use and be marked accordingly to ensure that safety and performance requirements are met.
- All cables or connectors used must offer adequate insulation and operation in order that the requirements of the relevant performance and safety are met.
- The connection of incompatible devices to the development kit can cause serious damage to the unit.

WARNING

The AC voltage in the resonant tank may reach voltage up to 250 Vpp under certain conditions. Therefore, it is covered by acryl glass to ensure human safety. Nevertheless take care not to touch the PCB by bare hand and use the required level of isolation when probing test points on the PCB.

3.2 Instructions for safe use

- Do not expose the development kit to water, moisture or place on a conductive surface whilst in operation
- Take care whilst handling to avoid mechanical or electrical damage to the printed circuit board and components
- Avoid handling the printed circuit board while it is powered. Only handle by the edges to minimize the risk of electrostatic discharge damage
- Do not short any outputs to each other, to the supply or to GND
- Do no operate the development kit outside its specified ratings
- Take care to monitor the PCB and IC temperatures in particular when operating with high power loads and do not exceed the absolute maximum ratings of all components

3.3 Power supply

Apply one of the included mains plugs (North America / Japan, Great Britain, Central Europe) to the power supply connector and connect the AC plug to mains. Connect the DC plug of the mains adapter to J4 of the transmitter board. In case another power supply is used please make sure to comply with the electrical characteristics as the provided mains adapter (see table 2). Take care not to reverse polarize the applied voltage.

Parameter	Specification
Input voltage	100 – 240 V_{AC}, 50/60 Hz, 2.5 A_{MAX}
Output voltage	24 V_{DC}
Output Current rating	6.25 A

Table 2: Mains adapter specification

Figure 3: Included power supply with 3 different mains adapter plugs

4. Transmitter board

Parameter	Specification
Input voltage	24 V_{DC}
Input current	Max. 10 A

Table 3: Transmitter module specification

5. Receiver board

Parameter	Specification
Output voltage	Max. 24 V_{DC}
Output current	Max. 10 A

Table 4: Receiver module specification

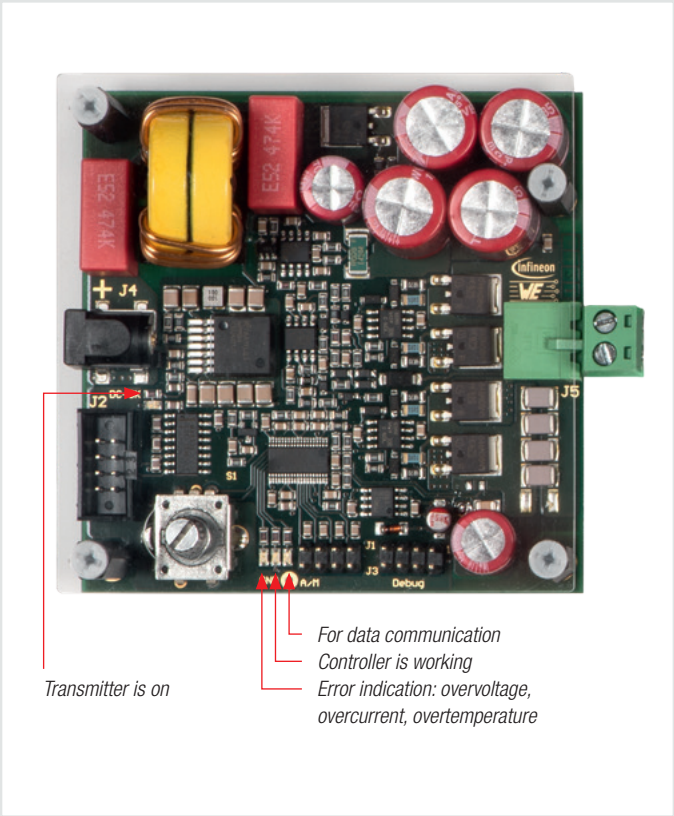

Figure 4: Transmitter board with status LEDs

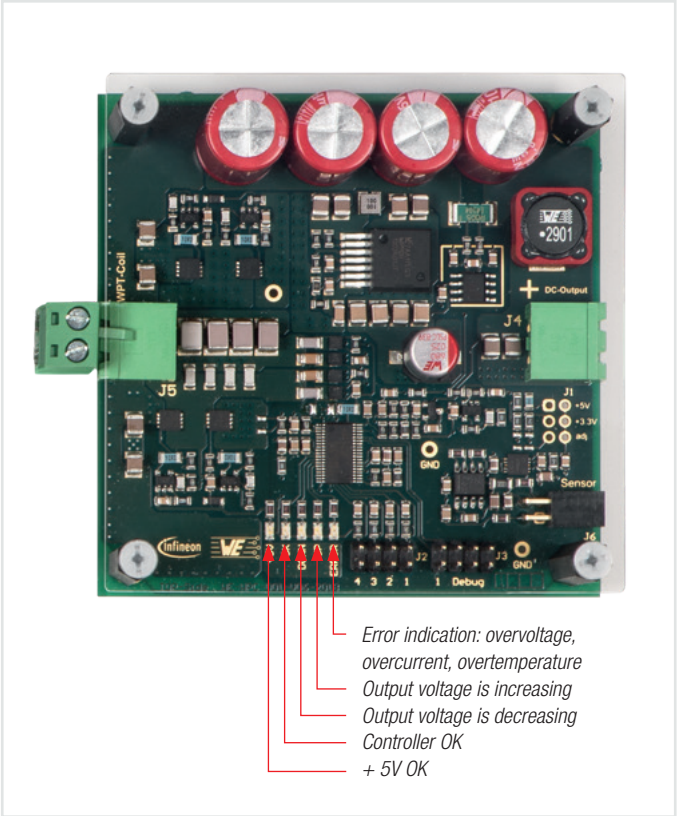

Figure 5: Receiver board with status LEDs

On the transmitter board the error indication (red LED on) shows a fault condition and the energy transfer stops.

On the receiver board the error indication (red LED on) warns of a fault condition, but the energy transfer continues.

6. Step by step installation guide for 200 W development kit

Step 1: Install software tools

Install DAVE™

DAVE™ is a free and powerful Eclipse-based development platform for XMC™ software development.

DAVE™ includes GCC compiler from GNU, DAVE™ code engine for automatic code generation and GDB debugger from GNU. DAVE™ offers pre-defined and tested SW components -DAVE™ APPs- and XMC™ Lib-Low Level Drivers (LLDs) – that accelerate the application software creation.

To install DAVE™ follow these steps:

- Download and execute the latest version of DAVE™ installation file from www.Infineon.com/DAVE
- Follow the installation guidelines that are included in the download package

Note:

Both transmitter and receiver boards are pre-flashed with the firmware. Please visit our webpage www.we-online.com/wirelesspower/200WKit to download the latest firmware version.

Step 2: Power up setup

Make sure a load is connected to J4 on the receiver board and is adjusted to 0.1 - 1 A before switching on the power supply unit. Connect the transmitter coil to J5 on the transmitter board and the receiver coil to J5 on the receiver board (see figure 6).

Additionally a display board can be connected to the RS232 interface (J2) of the transmitter board and a sensor with I²C interface to J6 of the receiver board.

Step 3: Automatic and manual operation mode

By default, in automatic mode, the development kit automatically adjusts the frequency in the range of 110 – 150 kHz to deliver an output voltage of 19 – 20 V. In manual mode the switching frequency can be adjusted between 100 kHz to 205 kHz referring to a coil distance of 6 mm. This function can be used to optimize the system performance or to test different wireless power coils. For this, a jumper has to be added on position A/M on J1 (see figure 7). Please make sure that the output voltage does not exceed 40 V at the receiver output when turning the incremental encoder (S1) in manual mode. A higher output voltage could lead to a destruction of the receiver board.

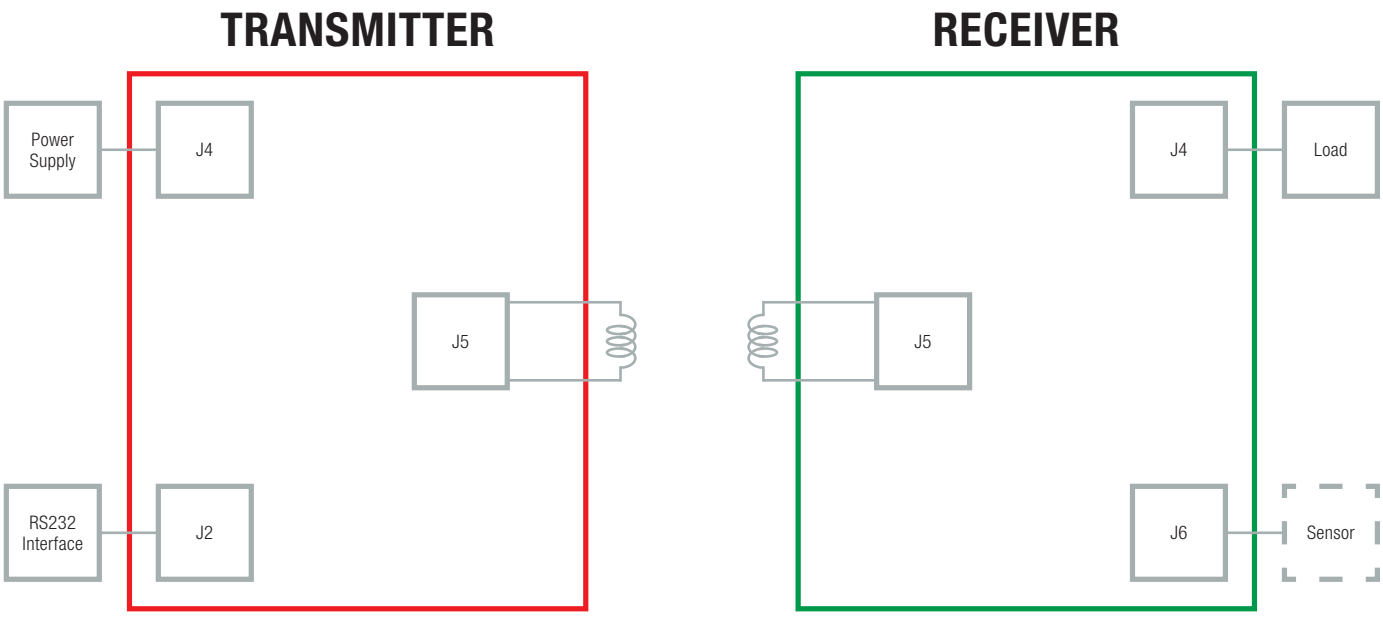

Figure 6: Block diagram for initial setup

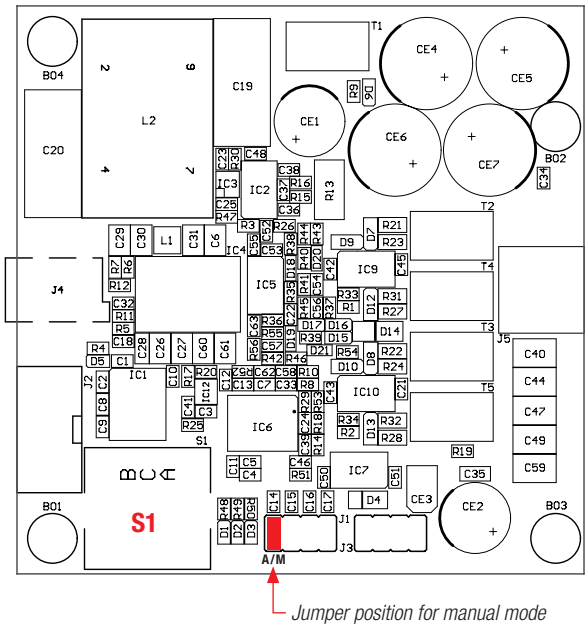

Figure 7: Jumper setting for manual or automatic mode

Step 4: Apply power

When the setup is finished, input power can applied. The DC-OK LED on the transmitter is on. Now the system is in standby mode. To start/stop the wireless power transfer press S1 (see figure 7).

7. Customer Support

If any further technical supports required when operating with the development kit please visit our FAQ site www.we-online.com/200wfaq or contact Würth Elektronik eiSos with your questions.
wirelesspower@we-online.com

Additional Terms, warnings, restrictions and disclaimers of the Infineon and Würth Elektronik eiSos Wireless Power Development Kit (later defined as DEVELOPMENT KIT)

Infineon and Würth Elektronik eiSos (later defined as WE) provide the enclosed DEVELOPMENT KIT under the following conditions:
The user has to bear all responsibility and liability for the proper and safe handling with regard to this DEVELOPMENT KIT. The user shall indemnify Infineon and WE from all claims arising from the handling or utilization of the DEVELOPMENT KIT. In the case this DEVELOPMENT KIT does not comply with the specifications indicated in the Manual, the DEVELOPMENT KIT may be returned within 30 days from the date of delivery for a full reimbursement of the purchase price.

THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY INFINEON AND WE TO THE USER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Please read the Manual carefully prior to handling the DEVELOPMENT KIT. This Manual contains essential safety information regarding temperatures and voltages.

No license is granted under any patent right or other intellectual property rights of Infineon or WE covering or relating to any machine, process and procedure, or combination in which such the DEVELOPMENT KIT or services might be or are used. Our arrangement with the user is not exclusive as Infineon and WE are currently working with a large number of customers for DEVELOPMENT KITs. Infineon and WE bear no liability for applications assistance, customer product design, software performance, or infringement of patents or services described in the Manual.

Code of federal regulations

As noted in the DEVELOPMENT KIT Manual, this DEVELOPMENT KIT and/or accompanying hardware may or may not be subject to and compliant with the Code of Federal Regulations, Title 47, Part 15.
For DEVELOPMENT KITs annotated to comply with the Code of Federal Regulations, Title 47, Part 15. Operation is subject to the following two conditions: (1) This DEVELOPMENT KIT may not cause harmful interference, and (2) this DEVELOPMENT KIT must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This DEVELOPMENT KIT as a Class A digital apparatus complies with Canadian ICES-003. Changes or modifications not expressly approved by the party responsible for compliance could void the users' authority to operate the equipment. For DEVELOPMENT KITs annotated as not subject to or compliant with the Code of Federal Regulations, Title 47, Part 15. This DEVELOPMENT KIT is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY and is not considered by Infineon and WE to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to the Code of Federal Regulations, Title 47, Part 15, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at its own expense will be required to take whatever measures may be required to correct this interference.

For Feasibility Evaluation Only, in Laboratory/Development Environments.
The DEVELOPMENT KIT is not a complete product. It is intended exclusively for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts. Those experts mandatory have to be familiar with the dangers and application risks in connection with handling electrical mechanical components, systems and subsystems. It should not be used as an end product or as a part of an end product.
Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

a) You have unique awareness of the Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which affects your products and which refers to your use (and/or the use of your employees, affiliates, contractors or designees) of the DEVELOPMENT KIT for evaluation, testing and other purposes.

b) You are unlimited and exclusive responsible for the safety of your DEVELOPMENT KIT and for the compliance with all relevant laws and other applicable regulatory requirements. Further you have to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the DEVELOPMENT KIT. You are also responsible to ensure that any interfaces (electronic and/or mechanical) between the DEVELOPMENT KIT and any human body are designed with suitable isolation and means to safely limit the accessible leakage currents to minimize the risk of electrical shock hazard.

c) Since the DEVELOPMENT KIT is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar completed products. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You have to use reasonable safeguards to ensure that your use of the DEVELOPMENT KIT will not result in any property damage, injury or death, even if the DEVELOPMENT KIT should fail to perform as specified or expected.

Certain Instructions. It is important to handle this DEVELOPMENT KIT within Infineons's and WE's recommended specifications and environmental considerations as described in the Manual. Surpassing the specified DEVELOPMENT KIT classifications (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these classifications please contact a WE external sales representative before connecting interface electronics including input power and intended loads. Any loads applied beyond the specified output range may result in unintended and/or inexact operation and/or possible lasting damage to the DEVELOPMENT KIT and/or interface electronics. Please consult the DEVELOPMENT KIT Manual prior to connecting any load to the DEVELOPMENT KIT output. If there is uncertainty regarding the load specification, please contact an Infineon or WE external sales representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified by using the DEVELOPMENT KIT schematic published in the DEVELOPMENT KIT Manual. Please be aware that the devices of the DEVELOPMENT KIT may be very warm in case of placing the measurement test setup close to the DEVELOPMENT KIT during normal procedure. Please ensure that only qualified personnel educated in electronic measurement and diagnostics usually found in development environments should use these DEVELOPMENT KITs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold Infineon, WE, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, „Claims") arising out of or in connection with any use of the DEVELOPMENT KIT that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the DEVELOPMENT KIT fails to perform as specified or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the Infineon or WE product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, you have to specifically notify Infineon or WE of such intent and enter into a separate Assurance and Indemnity Agreement.

More information or support on
www.we-online.com/wirelesspower/200WKit
wirelesspower@we-online.com

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