

Wireless Power Receiver Compliant with WPC

Purpose

The RT1650 is a wireless power receiver compliant with WPC low power V1.1 standard. This document explains the function and use of the RT1650 evaluation board (EVB), and provides information to enable operation, modification of the evaluation board and circuit to suit individual requirements.

Table of Contents

Introduction.....	2
Application.....	2
Specification.....	3
RT1650 Evaluation Board.....	3
Schematic.....	4
Bill of Materials.....	5
More Information.....	7
Important Notice for Richtek Evaluation Board.....	7

Introduction

General Product Information

The RT1650 is a wireless power receiver compliant with WPC low power V1.1 standard. The RT1650 integrates a synchronous full-bridge rectifier, a low dropout regulator, and a Micro Controller Unit (MCU) for control and communication. The device receives AC power from a WPC compatible wireless transmitter and provides output power up to 7.5W, which could be used as a power supply for a charger of mobile or consumer devices.

The MCU-based controller can support bi-direction channel communication including Frequency Shift Keying (FSK) demodulation for power signal from the transmitter and Amplitude Shift Keying (ASK) modulation for power signal to the transmitter. The RT1650 provides Foreign Object Detection (FOD) function to meet the requirement after WPC LP V1.1.

The RT1650 provides a programmable dynamic rectifier voltage control function to improve power efficiency, a programmable current limit for suitable load setting, and proper protection functions such as UVLO, OVP, and OTP.

Product Feature

- **Single-Chip WPC V1.1 Compliant Power Receiver**
- **Integrated Synchronous Rectifier Switch**
- **Support Output Power up to 7.5W**
- **Rectifier Efficiency up to 96%**
- **System Efficiency up to 80%**
- **Programmable Dynamic Rectifier Voltage Control for Optimized Transient Response and Power Efficiency**
- **Embedded 32-bit ARM Cortex-M0 MCU**
- **Easy Tuning for Communication and Control Parameters**
- **Support Bi-direction Channel Communication**
 - ▶ **FSK Demodulation for Power Signal from Wireless Power Transmitter**
 - ▶ **ASK Modulation for Power Signal to Wireless Power Transmitter**
- **Support Alignment with Transmitter**
- **Over Current Limit**
- **CSP 3.0mm x 3.4mm 48B (Pitch = 0.4mm)**
- **Low Profile (0.5mm Max.)**

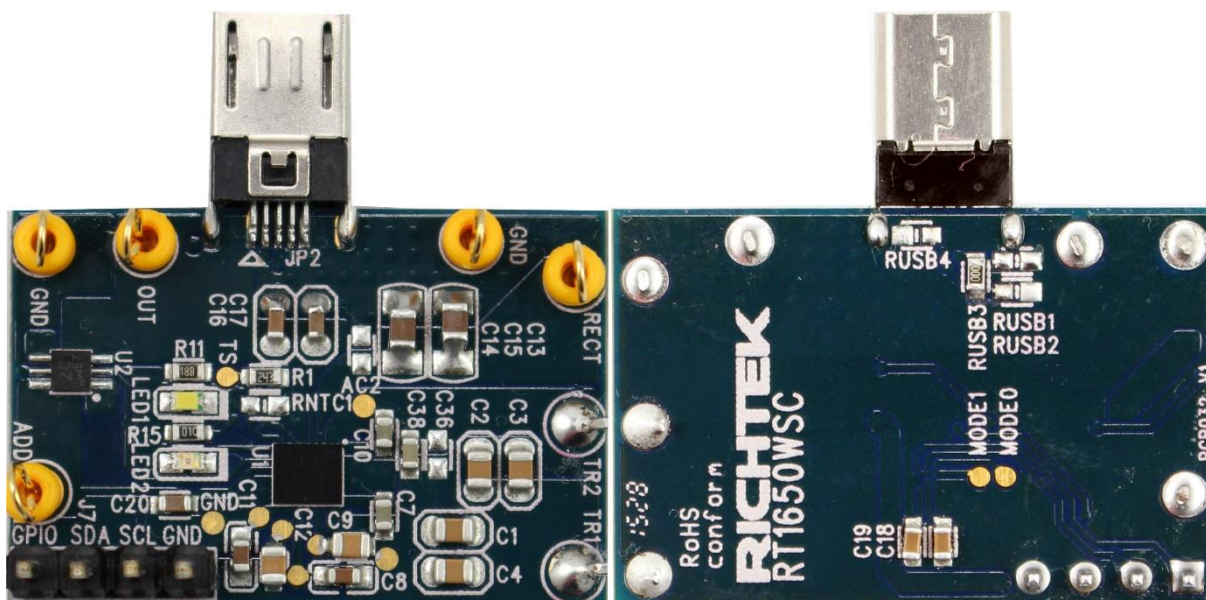
Application

- WPC Compliant Receivers
- Cell Phones & Smart Phones
- Portable Electronic Devices

Specification

Parameter	Symbol	Min	Typ	Max	Unit
Input Voltage Range	V _{RECT}	5	--	10	V
Output Voltage	V _{OUT}	--	5	--	V
Output Current	I _o	0	--	1.5	A
Current Limit	I _{LIM}	--	1.6	--	A
Operating Frequency	f _{osc}	110	--	205	kHz

RT1650 Evaluation Board



Please carefully inspect the EVB IC and external components, comparing them to the following Bill of Materials, to ensure that all components are installed and undamaged. If any components are missing or damaged during transportation, please contact the distributor or send e-mail to evb_service@richtek.com

Test Points

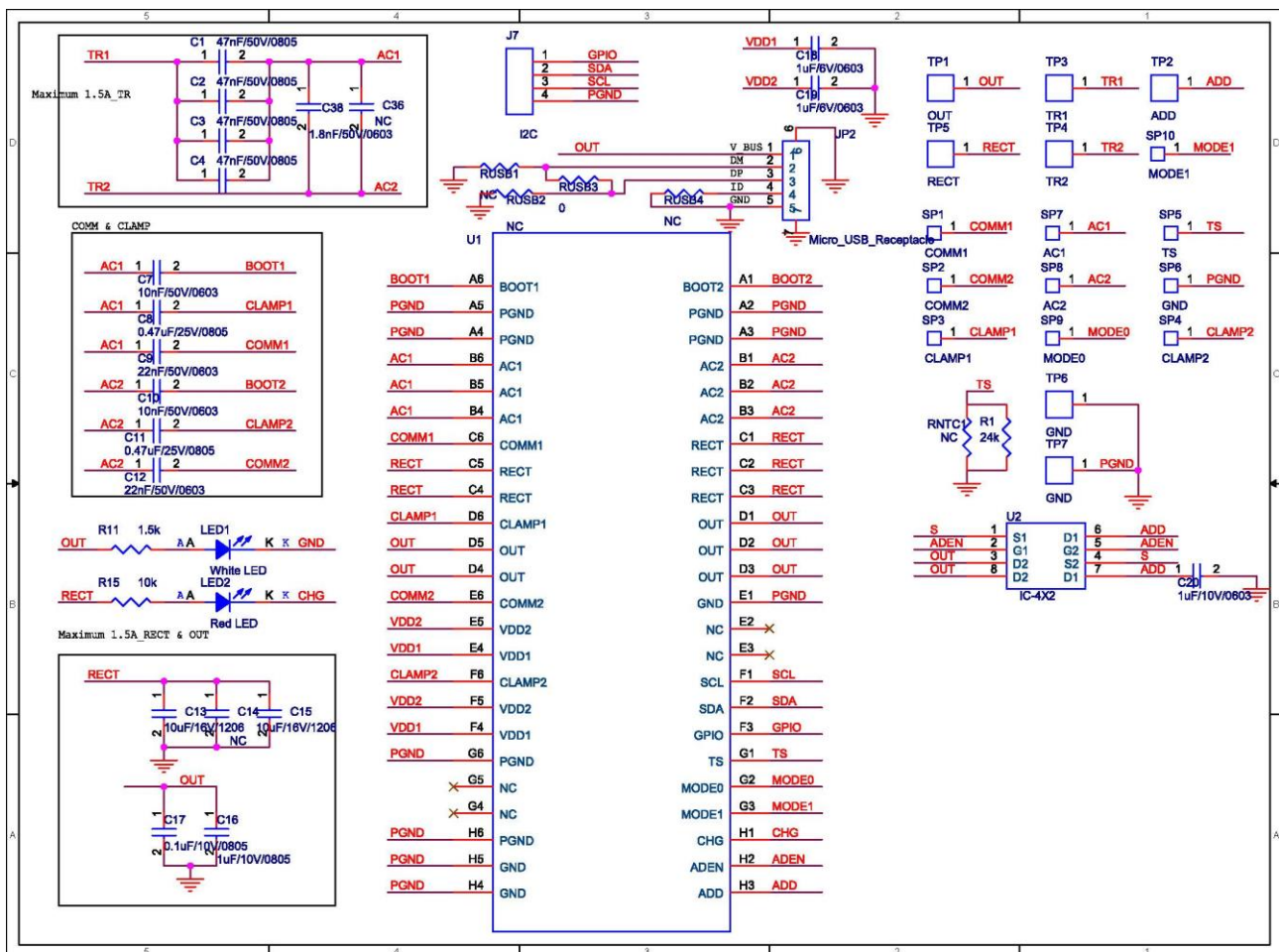
The EVB is provided with the test points and pin names listed in the table below.

Test point/ Pin name	Signal	Comment (expected waveforms or voltage levels on test points)
TR1, TR2	Input voltage	Power input. Connect with standard Qi Rx coil to receive AC power input.
RECT	Rectifier output	The rectifier output. Connect 20 μ F capacitor to GND to reduce the voltage ripple.
GND	Ground	Ground.
OUT	LDO output	LDO support the 5V/1A output power.
ADD	Adapter input	Adapter 5V input. This voltage connect to the OUT directly.

Power-up & Measurement Procedure

1. Connect input pin (TR1, TR2) with Qi standard coil.
2. Put the Rx coil on the WPC compatible Tx and let the cooper face to the Tx coil.
3. Waite few seconds for the communication and power up. The LED1(White LED) is for the vout ready and LED2 (Red LED) is for the vrect ready.
4. Customer can increase the loading to 1A from OUT pin slowly.

Schematic

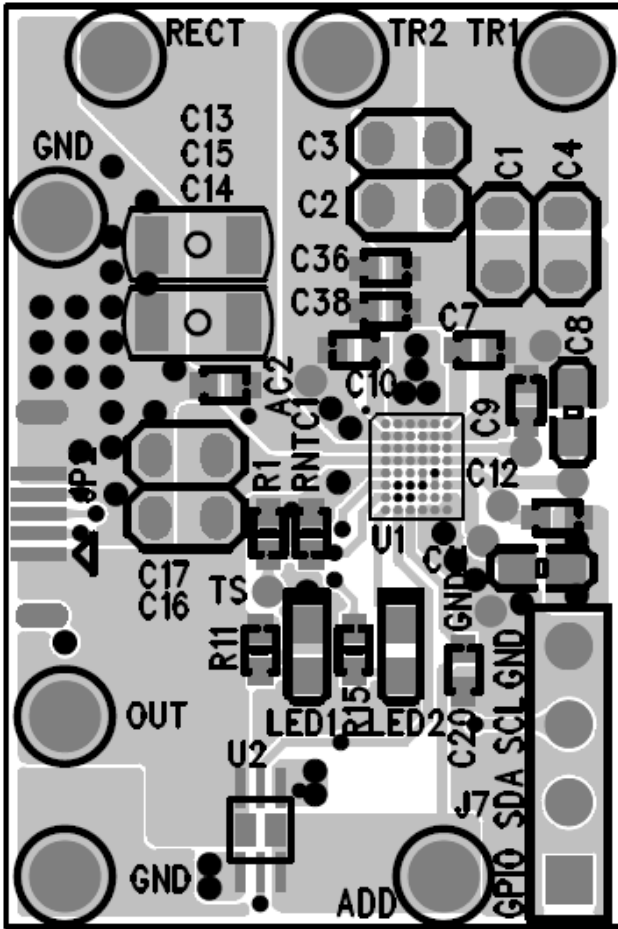


Bill of Materials

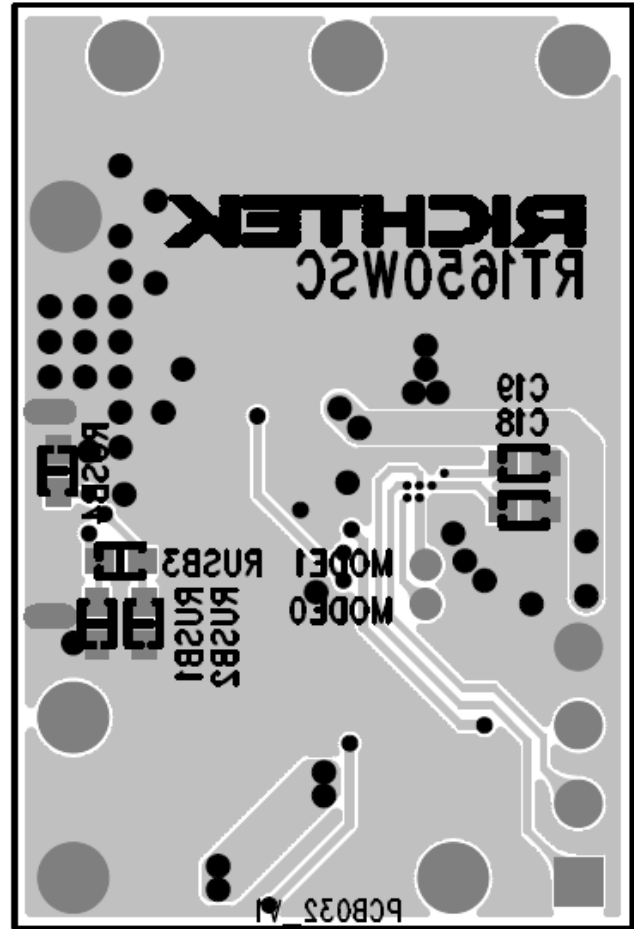
Reference	Qty	Part number	Description	Package	Manufacture
U4	1	RT1650	RT1650	WL-CSP-48B 3x3.4 (BSC)	RICHTEK
U3	1	PMDPB80XP	dual P-channel MOSFET		NXP
U6	1	C22TCH-05XT-1XBLX	Micro-USB Connector		Cherng Weel
C1, C2, C3, C4	5	0603B473K500	47nF/50V/X7R	0603	WALSIN
C7, C10	2	0603B103K500	10nF/50V/X7R	0603	WALSIN
C8, C11	2	C1608X7R1H474KT	0.47µF/50V/X7R	0603	TDK
C9, C12	2	0603B223K500	22nF/50V/X7R	0603	WALSIN
C13, C15	2	GRM31CR71E106KA12L	10µF/25V/X7R	1206	muRata
C14, C17	1	C1608X7R1H104KT000N	0.1µF/25V/X7R	0603	TDK
C16	1	C2012X7R1E105KT	1µF/25V/X7R	0805	TDK
C18, C19	2	C1608X5R1E105KT000E	1µF/25V/X5R	0603	TDK
C36	1	0603N101J500	100pF/50V/NPO	0603	WALSIN
C38	1	0603B182K500	1.8nF/50V/X7R	0603	WALSIN
LED1	1	LNL-190UW-4H	LED		LighTop
LED2	1	LNL-191SUR	LED		LighTop
RNTC1	1		NC	0603	
RUSB1, RUSB2	2		NC	0603	
RUSB3	1	0R	0Ω	0603	
R14	1	24K	24kΩ	0603	
R15	1	10K	10kΩ	0603	
R11	1	1K5	1.5kΩ	0603	
Coil	1	WR483245-15F5-G	12.9µH		TDK

Enable thermal management : RNTC = NCP15WF104F03RC, R14 = 33k

EVB Layout



Top Layer



Bottom Layer

Operating Guideline

1. Connect receiver coil to TR1 and TR2 pins respectively.
2. Connect positive end and negative end of load to OUT and GND pins respectively.
3. Power on transmitter and place the receiver coil on the surface of transmitter interface.
4. When the receiver output is turned on, the LED will be turned on as an indicator

More Information

For more information, please find the related datasheet or application notes from Richtek website <http://www.richtek.com>.

Important Notice for Richtek Evaluation Board

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