

TIDA-00623 Test Report

Jing Zou

BMS/WLPC

Abstract

TI design TIDA-00623 wireless power supply transmitter is an application of the bq50002 and bq500511 devices in a 5W Qi compliant configuration, with a 5-V input voltage.

Transmitter circuits are laid out in a 28mm diameter configuration which illustrates compact solution size and is smaller than the dimensions for WPC Type A11 TX Coil.

TIDA-00623 is derived from the bq50002 Evaluation Module bq50002EVM-607, both numbers may appear in documentation but refer to a single design.



Figure 1. TIDA-00623 Photo

Document History

Version	Date	Author	Notes
1.0	October 2015	Jing Zou	First release

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bq51013B EVM (bq51013BEVM-764)

The bq51013B wireless power receiver (RX) EVM (bq51013BEVM-764) was used for test with the TIDA-00623. This is a 5-W Qi compliant RX that will output 5-V at up to 1-A. The Vishay IWAS-4832FF-50 is 48-mm X 32-mm RX coil with low DC resistance (DCR) and performs well in a 5-W application. For additional information on the receiver see bq51013B product folder at TI.com.

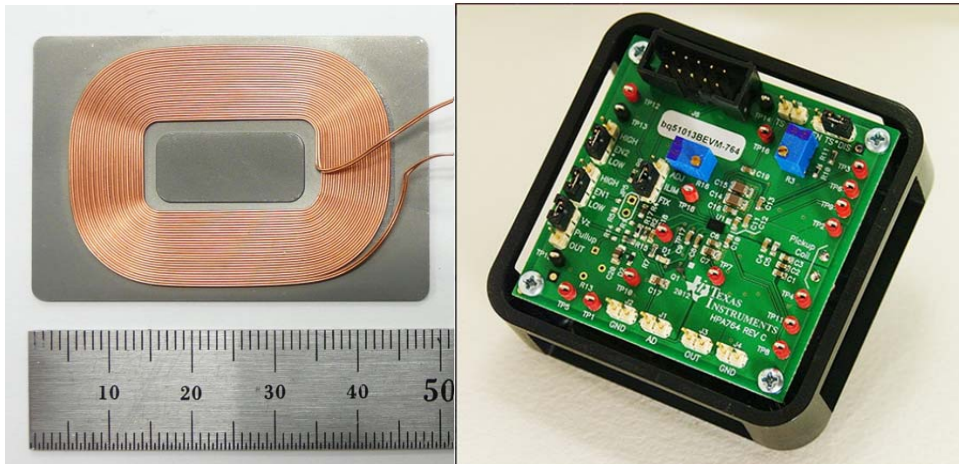


Figure 2 Test Receiver Coil and bq51013B EVM

Block Diagram

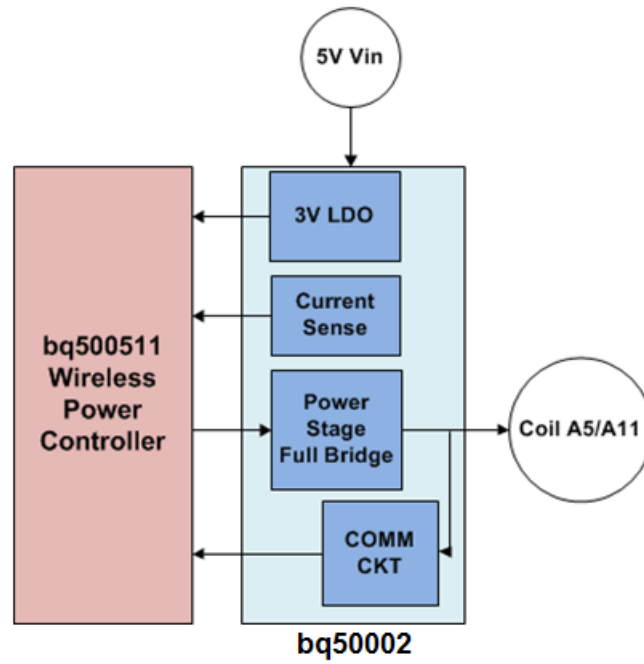


Figure 3 Block Diagram

Schematic

The TIDA-00623 schematic is shown in figure 4.

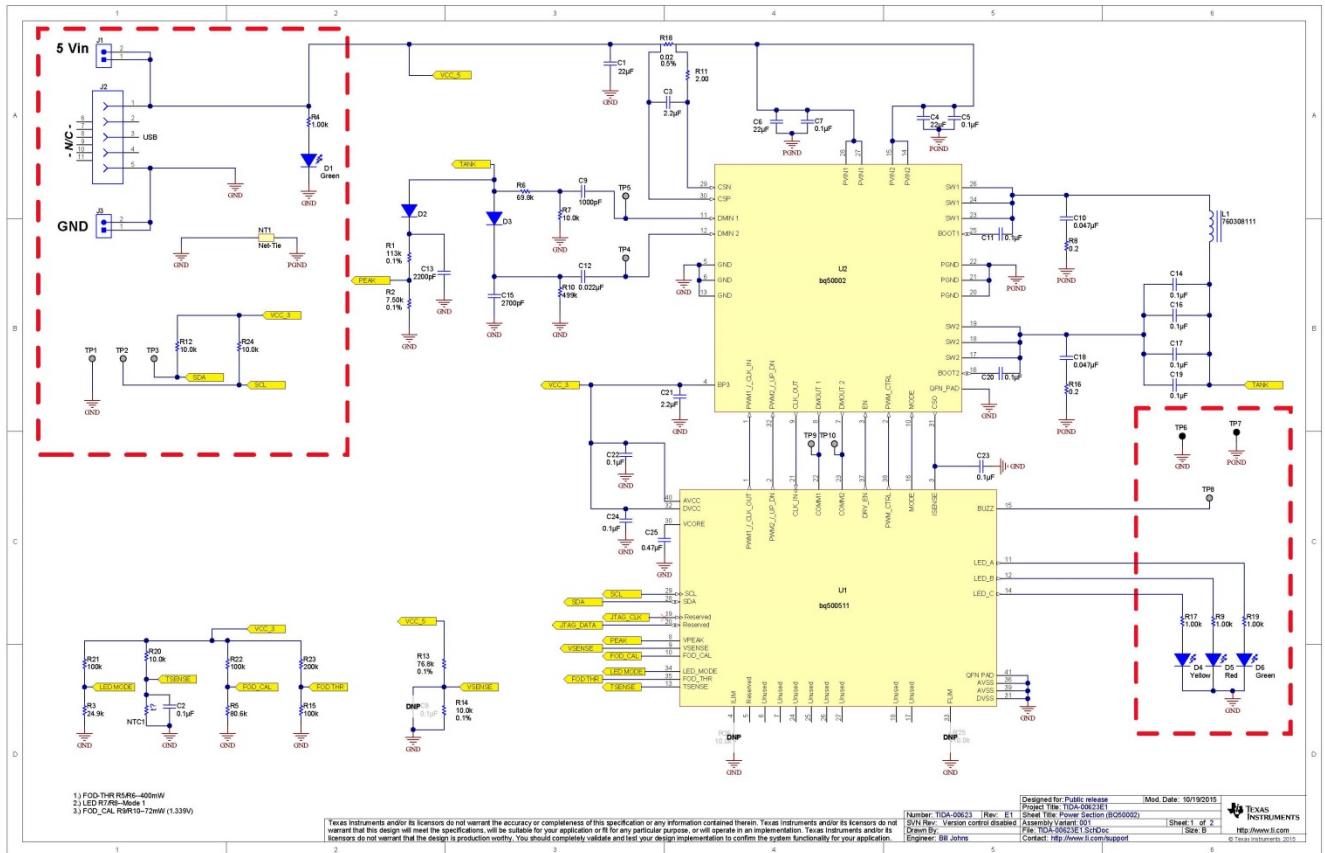


Figure 4 TIDA-00623 Schematic

Configuration Options

LED_MODE – Resistor R3 (see Figure 4 U1 pin 34) controls the behavior of status LEDs D4, D5 and D6. The standard value is 24.9 k Ω for control option 1 (see the bq500511 data sheet for additional settings).

NTC – Resistor NTC1 (see Figure 4 U1 pin 13) provides the option for connecting a negative temperature coefficient (NTC) sensor for thermal protection (see the bq500511 data sheet for additional settings).

DATA / CLK / AGND – I²C (see Figure 4 U1 pins 29 & 28) interface to the bq500511 can be used with software tools to monitor device operation. Consult factory for more information.

FOD – Protection feature that is enabled and disabled using resistor R15 (see Figure 4 U1 pin 35) for FOD_THR and R5 (see Figure 4 U1 pin 10) for FOD_CAL (see the bq500511 data sheet for additional settings).

Test Results

Figure 5 shows the TX and RX behavior during standby with no RX on the charging pad. The TX will ping the charging pad at about a 400ms rate set by the bq500511, and send a digital ping once every 12 analog pings.



Figure 5 TX Standby Mode

Figure 6 shows a typical start up behavior for the TX and RX as the RX is placed on a TX in standby. The RX and TX can be seen transitioning from standby, note on V_{RECT} below:

- 1.) V_{RECT} increases above under voltage lockout (2.7V) and the devices start operations
- 2.) The RX first sends three packets (SS / ID / Configuration) as defined by the WPC Specification. Packets are decoded by the TX which continues to send power.
- 3.) The RX begins tuning the TX operating point to V_{RECT} target voltage of 7.5 V
- 4.) The RX at target voltage and enables V_{OUT} of 5 V.

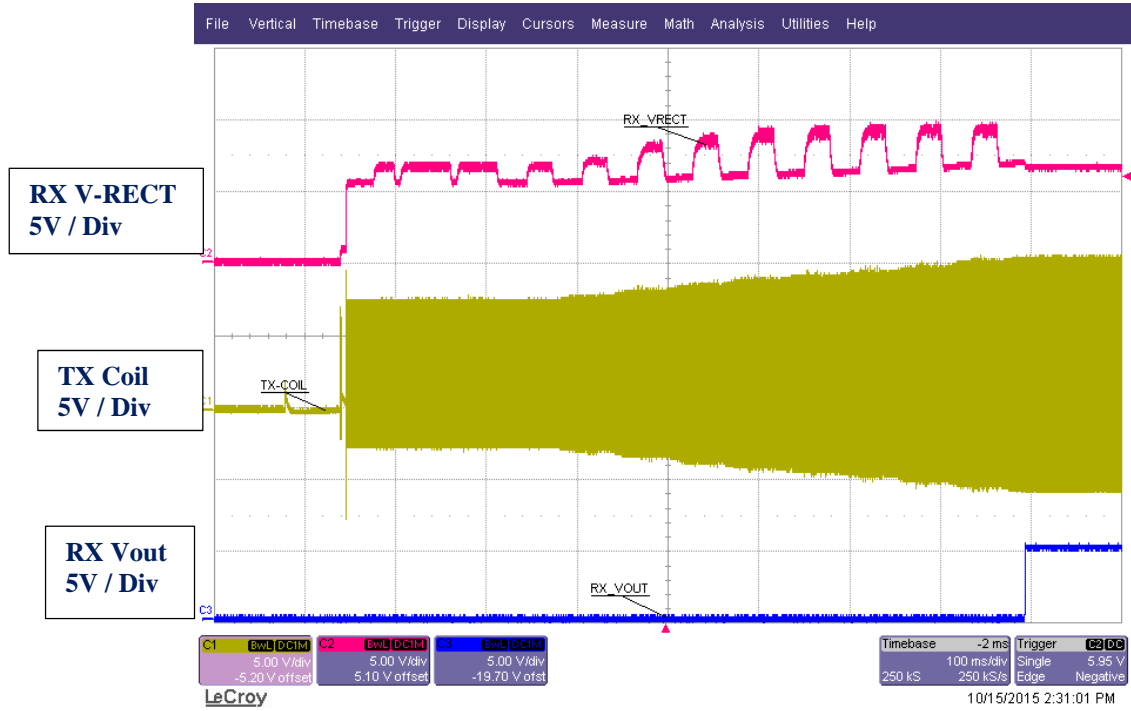


Figure 6 Start Up into 100mA load

Figure 7 shows the TX and RX behavior during Charge Complete (EPT 01). The bq51013B is configured to send EPT 01. In response, the TX will end power transfer and not ping for about 4 seconds.



Figure 7 Charge Complete, End Power Transfer 01

Figure 8 shows the transmitter operating in power transfer mode with a load of about 5-W. The coil drive signal is a 50% duty cycle signal 180 degrees out of phase. Operating frequency will change with load between 110 kHz and 205 kHz, at this point frequency is about 150 kHz.

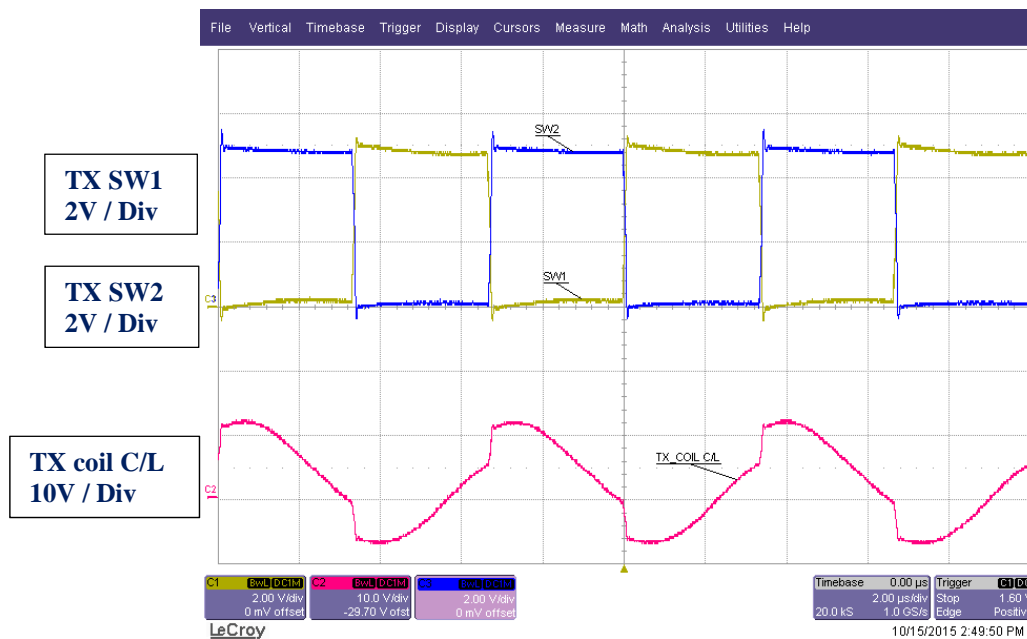


Figure 8 TX Coil Drive and C / L Tank voltage

Figure 9 shows the efficiency across the power range with the bq51013B. This is the total DC to DC system efficiency including the transmitter, coils and receiver.

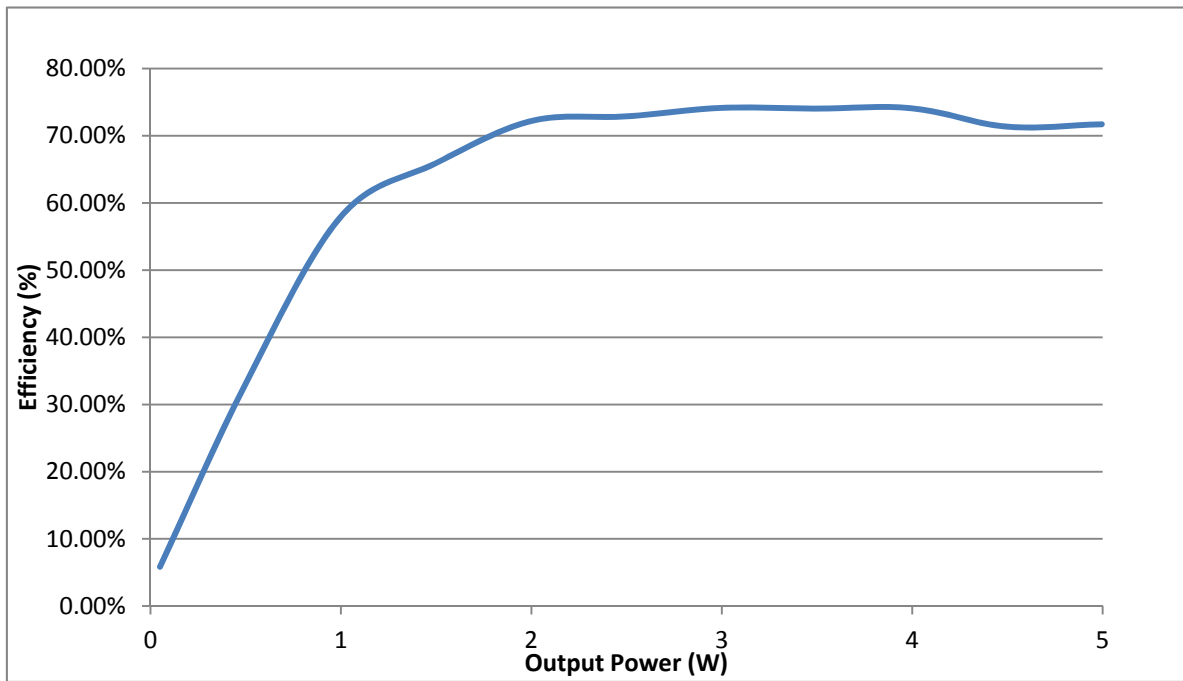


Figure 9 TIDA-00623 Efficiency with the bq51013B EVM

Thermal Measurements

The Figure 10 shows a thermal image of the TIDA-00623 operating with the bq51013B EVM RX at 950-mA output load.

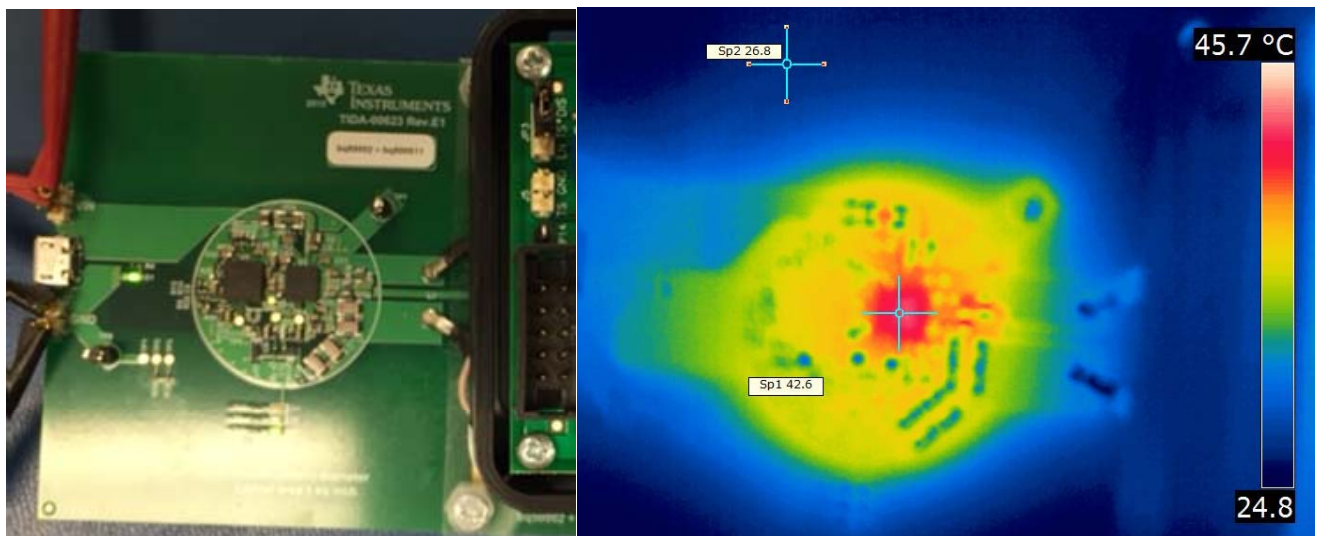


Figure 10 TIDA-00623 Thermal Image with the RX output current at 950 mA

References

1. Data Sheet bq500511 Wireless Power Controller for WPC (SLUSCD3A)
2. Data Sheet bq50002 Low-Cost 5-V Wireless Power Transmitter Analog Front End for WPC 1.2 A11 Transmitters (SLUSBW1)

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