TIDA-00259 Test Report

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Abstract

TI design TIDA-00259 wireless power supply transmitter is an application of the bq500212A IC in a 5W Qi compliant configuration, 5V input voltage.

Transmitter circuits are laid out in a 50mm X 50mm configuration which matches the dimensions for WPC Type A11 TX Coil.

The design is Qi certified and has been certified to WPC v1.1 standard.

TIDA-00259 is derived from the bq500212A Evaluation Module bq500212AEVM-550, both numbers may appear in documentation but refer to a single design.

Figure 1. TIDA-00259 Photo

Document History

Version	Date	Author	Notes
1.0	November 2014	Bill Johns	First release

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bq51013B EVM (bq51013BEVM-764)

The bq51013B wireless power receiver EVM (bq51013BEVM-764) was used for test with the TIDA-00259. This is a 5W Qi compliant RX that will output 5V at up to 1A out. The Vishay IWAS-4832FF-50 is 48mm X 32mm RX coil with low DCR and performs well in a 5W application. For additional information on the receiver see bq51013B product folder at TI.com.

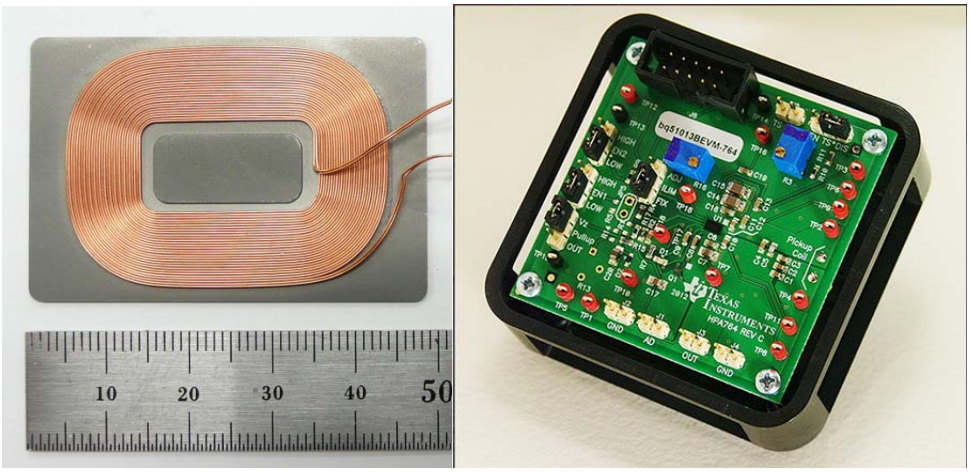

Figure 2 Test Receiver Coil and bq51013B EVM

Block Diagram

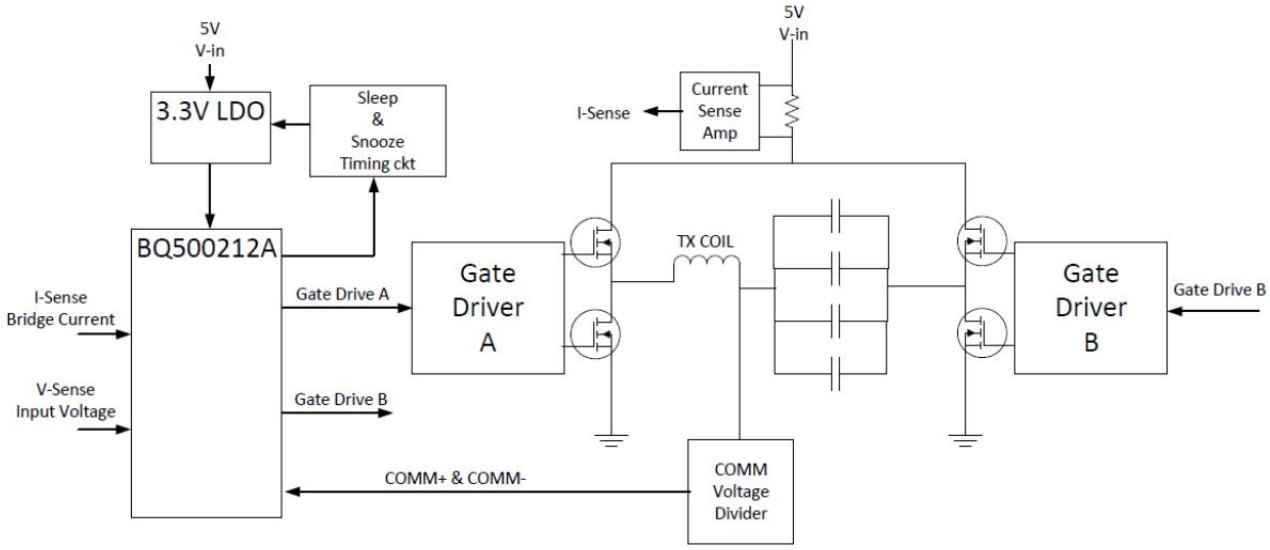

Figure 3 Block Diagram

Schematic

The TIDA-00259 power schematic shown in figure 4 and bq500212A section schematic is shown in figure 5.

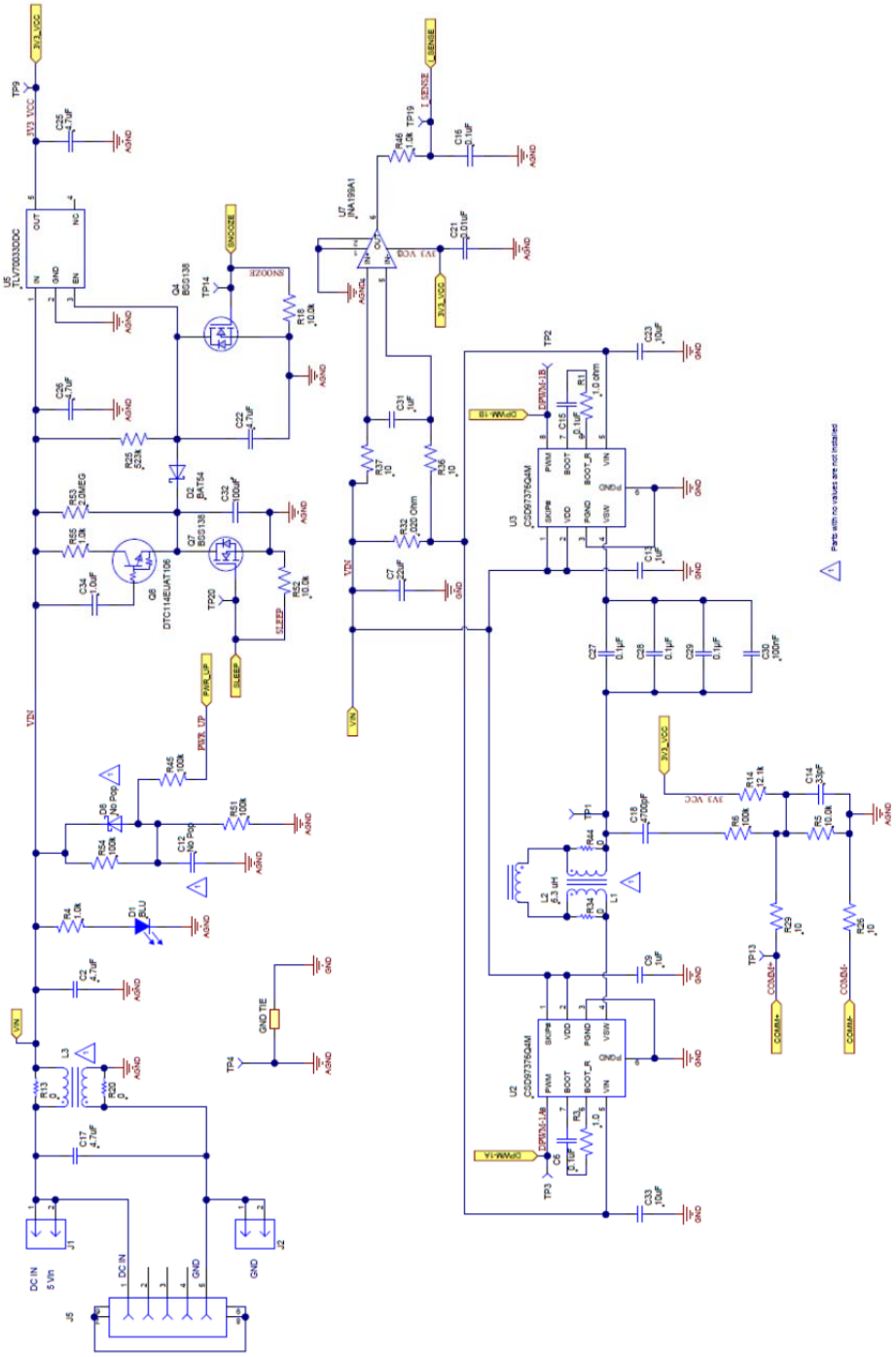

Figure 4 TIDA-00259 Schematic Power Section

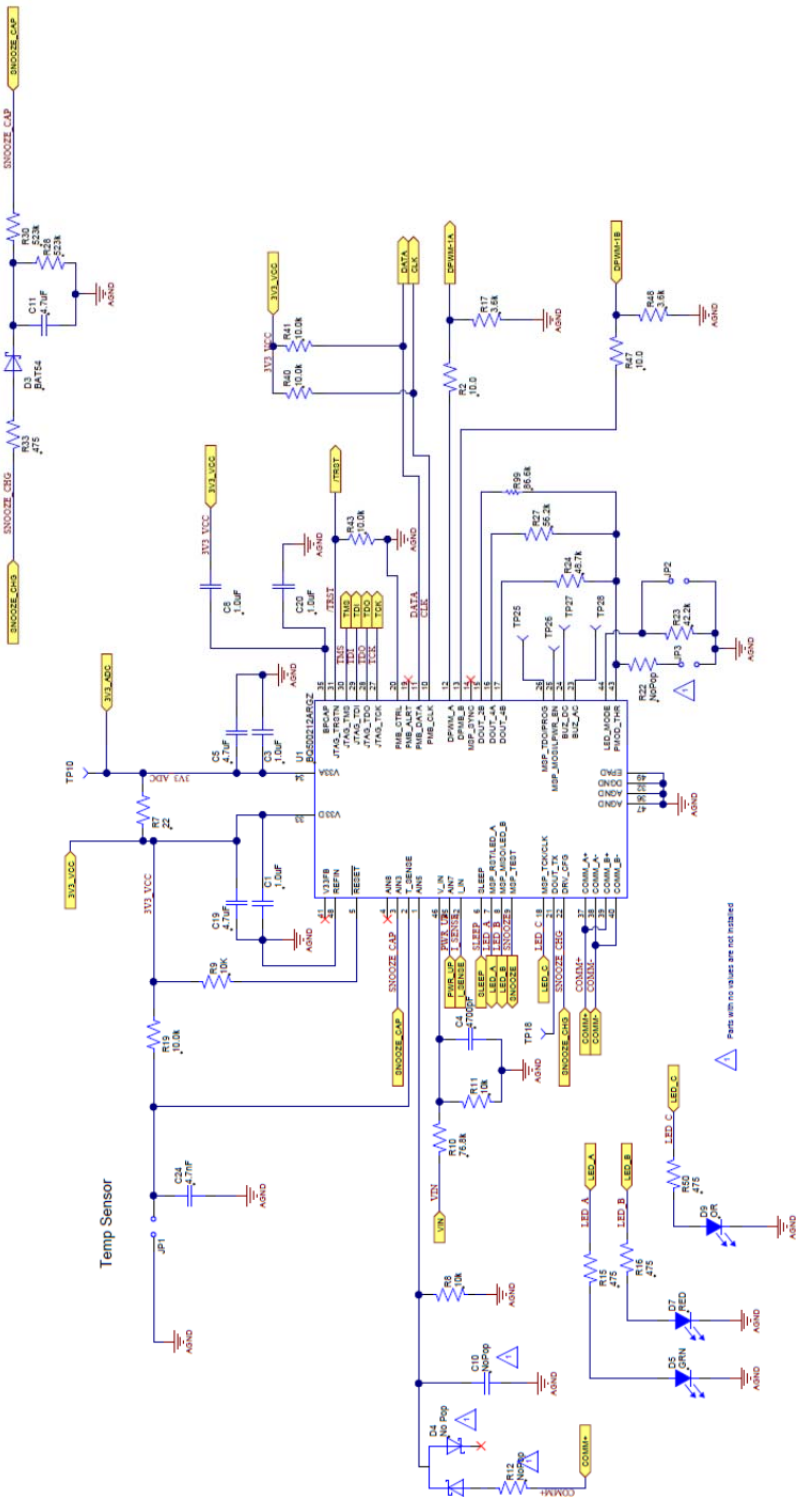

Figure 5 TIDA-00259 Schematic bq500212A Section

Configuration Options

LED_MODE – Resistor R23 (see fig 5 U1-44) controls the behavior of status LED D5, D7 and D9. The standard value is 42.2k ohms for control option 1, see data sheet for additional settings.

NTC- Connector JP1 (see fig 5 U1-2) provides the option for connecting a negative temperature coefficient (NTC) sensor for thermal protection, see data sheet for additional settings.

DATA / CLK / AGND – I2C (see fig 5 U1-10 & 11) interface to the bq500212A can be used with software tools to monitor device operation. Consult factory for more info.

FOD / PMOD – Protection feature that is enabled and disabled using resistor R24 & R99 (see fig 5 U1-17 & 15) for FOD and R27 (see fig 5 U1-16) for PMOD, see data sheet for additional settings.

L1 and L3 – Common Mode Choke for additional input power filter or output TX Coil
L1 – DLW5BTM101TQ2 – 6A, 9 mΩ, MuRata
L3 – DLW5BTM102TQ2 – 2.5A, 24mΩ, MuRata

Test Results

Figure 6 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 500ms rate set by the RC time constant associated with C22.

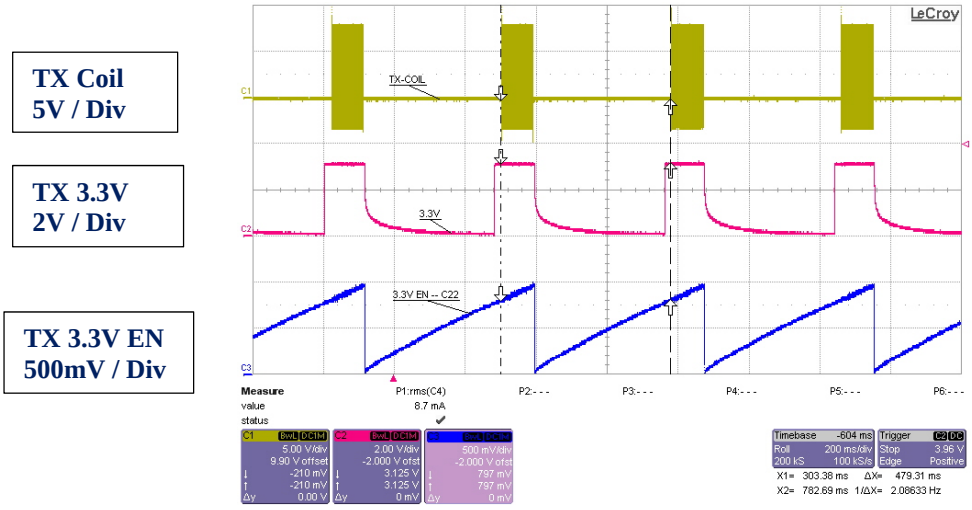

Figure 6 TX Standby Mode

Figure 7 shows a typical start up behavior for the TX and RX as the RX is placed on a TX in standby. The RX / TX can be seen transitioning from standby, note on Vrect below:

1.) Vrect increases above under voltage lockout, 2.7V and devices start operations
2.) RX sends first three packets (SS / ID / Config). Packets are decoded by TX which continues to send power.
3.) RX begins tuning TX operating point to V-RECT target voltage of 7.5V
4.) RX at target voltage and enables VOUT, 5V.

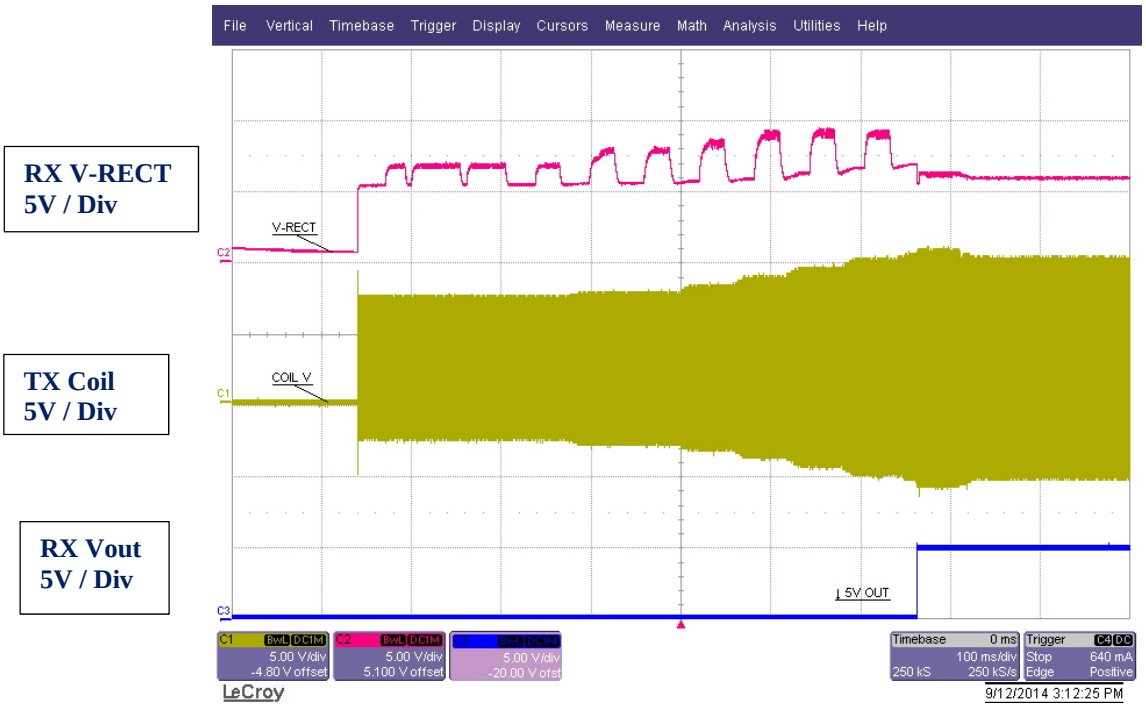

Figure 7 Start Up into 100mA load

Figure 8 shows the TX and RX behavior during Charge Complete, EPT 01. The bq51013B is configured to send EPT 01. In response TX will end power transfer and not ping for about 4 seconds.

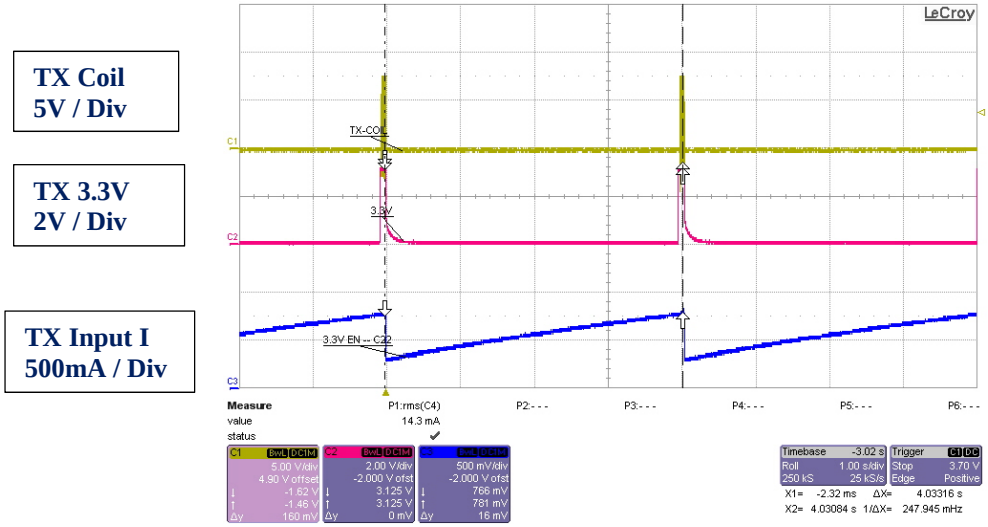

Figure 8 Charge Complete, End Power Transfer 01

Figure 9 shows the transmitter operating in power transfer mode with a load of about 5W. The coil drive signal is a 50% duty cycle signal 180 degrees out of phase. Operating freq will change with load between 110kHz and 205kHz, at this point freq is about 150kHz.

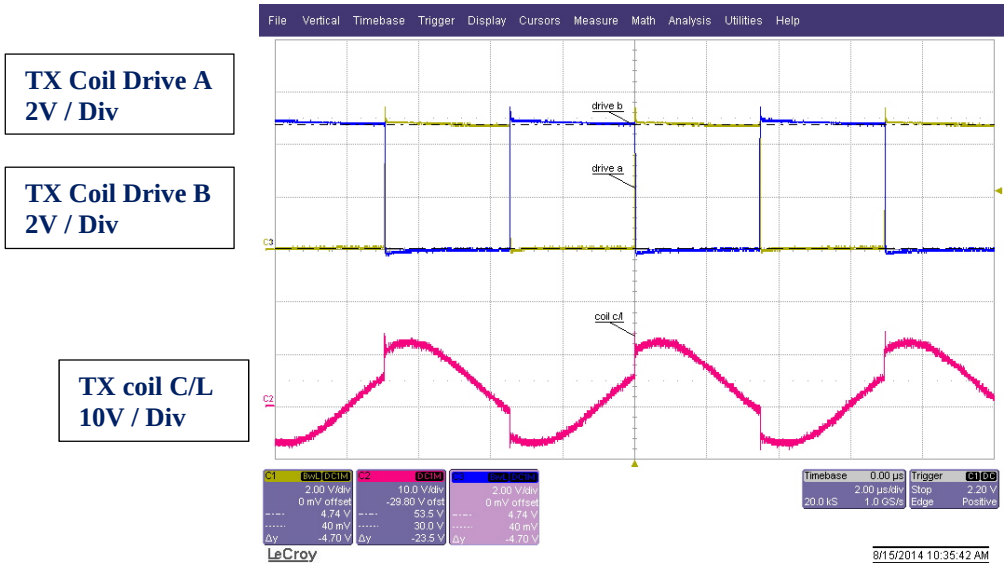

Figure 9 TX Coil Drive and C / L Tank voltage

Figure 10 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.

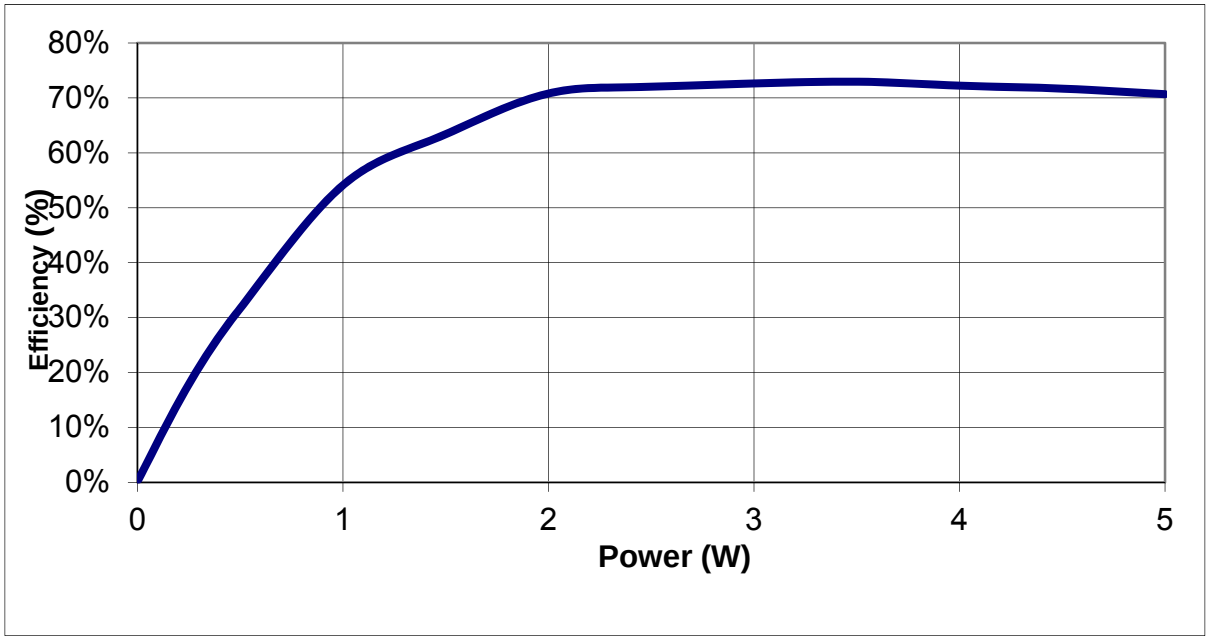

Figure 10 TIDA-00259 Efficiency with bq51013B

Thermal Measurements

The following figure shows a thermal image of the TIDA-00259 operating with the bq51013B EVM RX at 950mA output load.

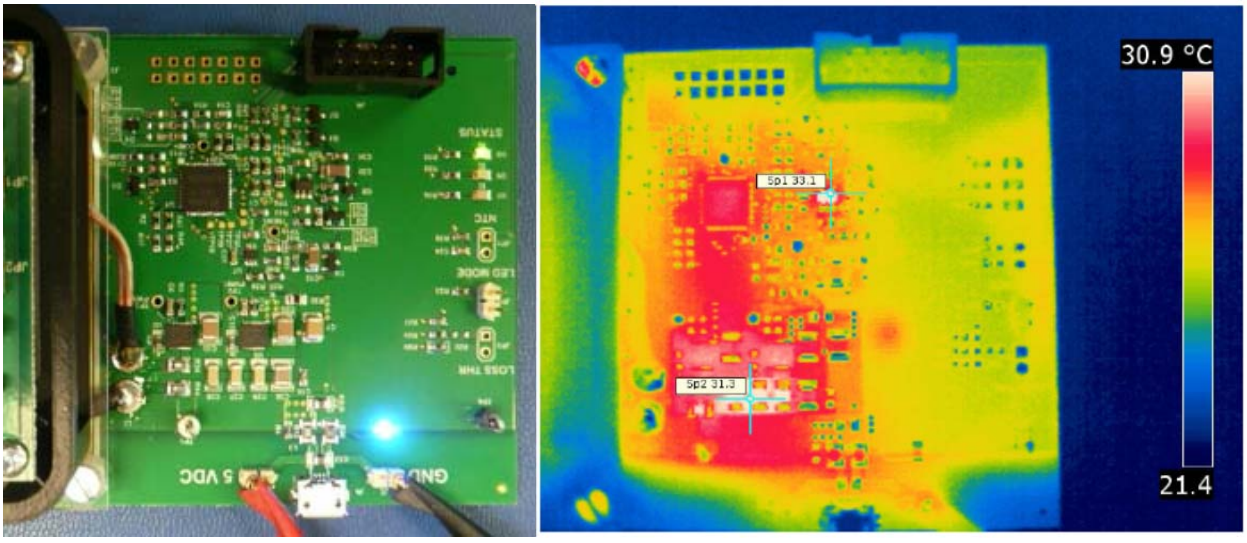

Figure 9 TIDA-00259, RX output current 950mA

References

1. Data Sheet bq500212A Wireless Power Controller for WPC (SLUSBD6C)

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