Abstract

TI design TIDA-00318 is suitable for low power wearable devices and incorporates a Qi-compliant wireless power receiver (bq51003) and low current 1 cell Li-Ion linear charger (bq25100). It features an ultra-small size (5 mm x 15 mm), capable of charging currents down to 10 mA and up to 250 mA with support of termination currents as low as 1 mA. The included schematic is designed for 135 mA charge current and 8 mA termination current application.

Figure 1. Board Photo

Document History

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<th>Version</th>
<th>Date</th>
<th>Author</th>
<th>Notes</th>
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Bench Set up

- TIDA-00318 was tested on a bench setup with wireless receiver coil TDK WR222230 and a 110 mAh Li-Ion battery as shown in the Figure 1. The test equipment is as follows:
  - Oscilloscope: Tektronix DPO3034, 300 MHz
  - Passive Voltage Probes (4) : Tektronix P6139B – 500 Mhz, 8 pF, 10 MΩ, 10x
  - Current Probe: Tektronix TCP202A Current Probe
  - Power Supply: HP E3681A
  - Electronic Load: Keithley Source Meter 2420
  - Keithley Multi-meter 2000 (5)
  - Lithium-Ion batteries (various capacities / chemistries)
  - FLUKE Thermal Couple : 80TK
  - Wireless Power Transmitter: TI bq500212AEVM-550 PWR550

Figure 2. Bench Setup
Receive Coil

- A TDK WR222230 was used as the receiver coil in this experiment. The shield diameter is 22 mm and the coil outer diameter is 17 mm.

![Figure 3. Receiver Coil](image-url)
Charging Cycle Test

- The charging cycle test in this document shows five measurements: battery voltage, battery current, input voltage, input current and device temperature.

### Table 1. Measurement Conditions

<table>
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<tr>
<td>Battery voltage</td>
<td>V</td>
</tr>
<tr>
<td>Battery current</td>
<td>A</td>
</tr>
<tr>
<td>Input voltage</td>
<td>V</td>
</tr>
<tr>
<td>Input current</td>
<td>A</td>
</tr>
<tr>
<td>Device temperature</td>
<td>°C</td>
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Battery

- The battery pack using in this experiment is a 110 mAh Li-Ion battery pack.

![110 mAh Li-Ion Battery Pack](image)

**Figure 5.** 110 mAh Li-Ion Battery Pack

Temperature Measurement

- Temperature measurements were made with a FLUKE 80TK thermal couple.

![FLUKE 80TK Thermal Couple](image)

**Figure 6.** FLUKE 80TK Thermal Couple
4.2 V 250 mA Charge Cycle with 10 mA Charge Termination

Figure 7. 4.2 V 250 mA Charge Cycle with 10 mA Charge Termination

4.2 V 135 mA Charge Cycle with 20 mA Charge Termination

Figure 8. 4.2 V 135 mA Charge Cycle with 20 mA Charge Termination
4.2 V 60 mA Charge Cycle with 1 mA Charge Termination

Figure 9. 4.2 V 60 mA Charge Cycle with 1 mA Charge Termination

Figure 10. 4.2 V 60 mA Charge Cycle with 1 mA Charge Termination (2)
TIDA-00318 Operation Waveform

IBAT Load Transition from 0 mA to 100 mA

$V_{BAT} = 3.8 \text{ V}$

Figure 11. IBAT Load Transition from 0 mA to 100 mA
IBAT Load Transition from 100 mA to 0 mA
VBAT = 3.8 V

Figure 12. IBAT Load Transition from 100 mA to 0 mA
References

1. Highly Integrated Wireless Receiver Qi (WPC v1.1) Compliant Power Supply (SLUSBC8)
2. bq2510x 250-mA Single-Input, Single Cell Li-Ion Battery Chargers (SLUSBV8)
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