

Buck-boost Converter Battery Life Time Estimation for Wireless Network Cameras

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Japanese Version: 無線ネットワーク・カメラおよびビデオ・ドアベルのバッテリー駆動時間の延長
 Chinese Version: 延长无线网络摄像头和可视门铃的蓄电池寿命

Many wireless network cameras or video doorbells are designed to operate in locations where power cables might not be accessible. Those locations include the front door, a bookshelf, a tree in the garden, or others. The goal is to mount the camera easily at any location without the need to install power cables. In this situation, a very efficient power solution needs to be used to get the maximum possible battery lifetime.

Many cameras and doorbells use a single-cell Li-Ion battery. This battery powers different points of load which require various voltage levels where buck, boost, or buck-boost converters offer best solutions. WiFi®, Bluetooth® and LED modules usually require supply voltages that are within the battery output voltage range.

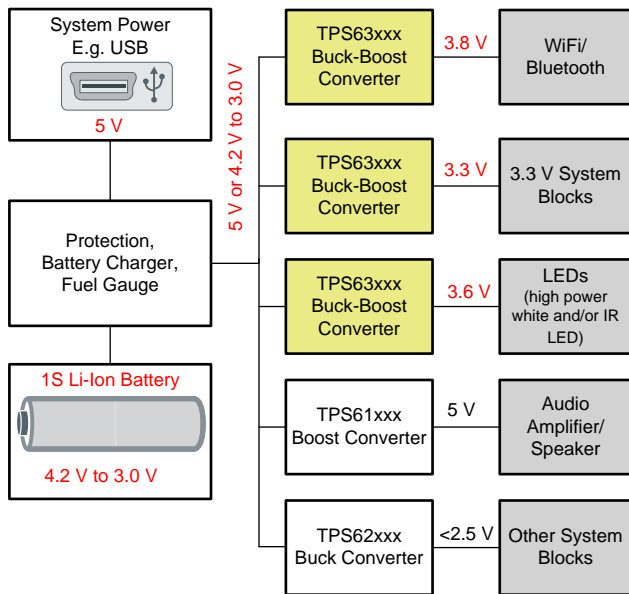


Figure 1. Wireless Network Camera or Video Doorbell System Block Diagram Example

In this case, buck-boost DC/DC converters provide stable supply voltages for these blocks over the whole battery operating range. Moreover, in the LED block, the buck-boost converter can be used as a constant current source.

A further use case of a buck-boost converter is voltage stabilization as shown in Figure 2. For example, if a high load, like the WiFi module or the camera, is enabled, the battery voltage drops due to its internal impedance. The drop can be below the targeted system voltage. A buck-boost stabilizes the output voltage in this case.

Both applications have in common that the battery lifetime is increased compared to other solutions.

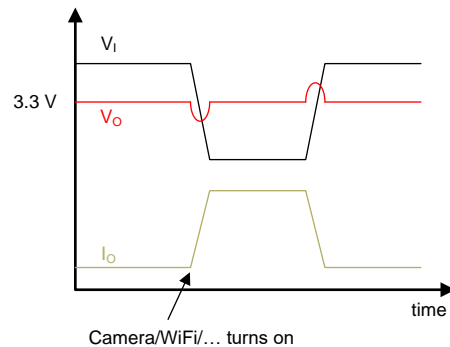
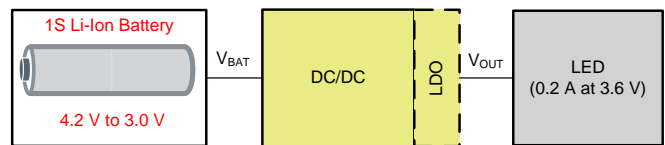


Figure 2. Buck-boost as Voltage Stabilizer

This document discusses the effects on battery lifetime of different power solutions based on a simulated LED driver example.

The example chosen is a high power white or infra-red LED that consumes 200 mA at 3.6-V forward voltage. The system is supplied by a Li-Ion battery with 2.5-Ah capacity. The battery has a nominal operating voltage of 3 V to 4.2 V. A DC/DC converter is used to regulate the battery voltage to the required forward voltage.

Figure 3 shows the simulation bench.



Buck Converter: 95% efficiency
 Boost with bypass (+ LDO): 95% efficiency
 Buck-boost converter: 93% efficiency

Figure 3. Simulation Bench

Figure 4 shows the discharge profile of the battery and the operating regions of different DC/DC converters.

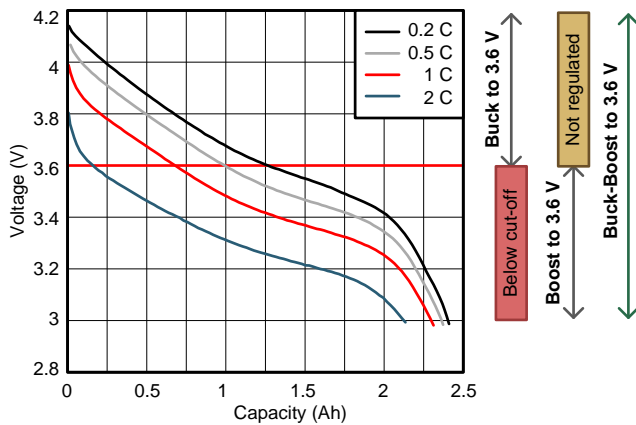


Figure 4. Li-Ion Battery Discharge Profile and Operating Regions of DC/DC Converter

This simulation compares three DC/DC converters. A buck-boost with 93% efficiency, a buck converter with 95% efficiency, and a boost with bypass with 95% efficiency. The boost with bypass is followed by an LDO to regulate the output voltage to 3.6 V. The LDO voltage drop is 20 mV.

The simulation of the three converters in the given operating point shows that the battery lifetime varies significantly between the three solutions. The system with the buck converter runs less than 8h. With the boost with bypass and LDO the battery lasts 11.1h. The buck-boost converter provides the longest battery lifetime with 11.5 h.

Figure 5 shows the battery lifetime of the different converters over output voltage with a 200-mA constant current load. The figure shows that the buck-boost provides the best results in battery lifetime, when the needed output voltage is within the battery operating range.

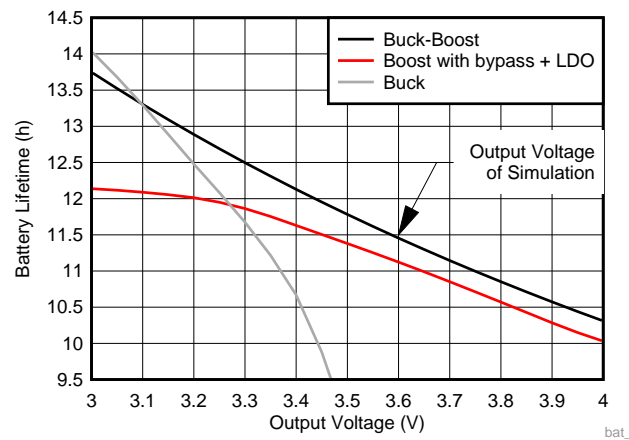


Figure 5. Battery Lifetime With a Constant Current Load Over Output Voltages

Table 1 lists the best-fitting buck-boost converters for this application.

Table 1. Recommended Buck-Boost Converters

| | |
|--------------------------|---|
| TPS63050 | Excellent efficiency |
| TPS63036 | Smallest chip size |
| TPS63802 | High output current, small solution size and improved light load efficiency |
| TPS63070 | Higher V_I and V_O range and dynamic voltage scaling feature. See SLVAE62 |

1 References

- [Different Methods to Drive LEDs Using TPS63xxx Buck-Boost Converters Application Report \(SLVA419\)](#)
- [TPS63030 Single LED Driver Evaluation Module User's Guide \(SLVU391\)](#)

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