

Benefits of Rechargeable Batteries in Real-time Location System Trackers



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Real-time location systems (RTLS) enhance the lives of consumers and businesses by making everyday routines smarter through accurate, location tracking technology such as GPS and *Bluetooth*® Low Energy. RTLS trackers eliminate the stress of losing belongings such as luggage or pets using long-distance GPS tracking. RTLS trackers also enhance businesses with *Bluetooth*® Low Energy beacons to monitor customer traffic, employee patterns and the location of equipment, which can help identify process bottlenecks and improve customer experience. These applications are just the beginning for RTLS trackers, and designing RTLS with rechargeable batteries can help you get the most out of the systems.

In this article, I will highlight the benefits of rechargeable batteries in RTLSs and explain how TI chargers solve design challenges associated with implementing rechargeable batteries in RTLSs.

The benefits of rechargeable RTLS

Rechargeable RTLS designs are useful in large-scale applications with devices that do not have access to a direct power supply. The area design advantages of RTLSs such as:

- Eliminating the need to buy and replace hundreds of primary cell batteries.
- The freedom to place devices anywhere with no need for a direct power source.
- The ability to maximize possible device locations by creating smaller designs through the implementation of compact charger integrated circuits (ICs).

In addition to large-scale applications, rechargeable RTLS is advantageous in consumer electronics, such as personal item tracking devices and smart dog collars. With rechargeable RTLS, customers can:

- Fully charge a battery in five hours.
- Never worry about losing their keys, wallets or pets because the batteries in the RTLS are dead.

[Figure 1](#) highlights different applications of rechargeable RTLSs.



Monitoring patients and staff in hospitals



Keeping track of personal items



Monitoring foot traffic in airports



Finding pets

Figure 1. Rechargeable RTLS applications

Rechargeable RTLS design challenges

Indoor and outdoor RTLS devices are usually designed to be aesthetic and small for portability, and designing your system with power integrated battery chargers helps achieve those two design requirements. Chargers with power integration include power rails on the device, such as an LDO, load switch and low power buck converters, which provide the correct voltages for other components in the circuit. Incorporating power rails into the charger reduces the overall number of components and helps you achieve small, aesthetic designs.

Due to the need for small, portable devices, the batteries in RTLS devices are on the smaller side because of the size constraints, and the devices also need to be designed to maximize the capacity of the battery. Chargers with easily customizable charge currents and accurate termination currents help maximize the lifetime of the battery. The I²C interface allows you to easily set the charge current to a small value that will charge the battery quickly without damaging it which increases the number of times the battery can be recharged. Accurate termination currents help prevent higher termination currents that cause a reduction in the length of each charge and unused battery capacity.

Finally, it requires effort and labor costs to collect and recharge RTLS devices, especially for large-scale applications, so designing your device with efficient power consumption is critical. Choosing a charger with very low quiescent current minimizes power consumption and increases battery time. In addition, chargers with load switches can cut off power to blocks that are not being used which also reduces power consumption.

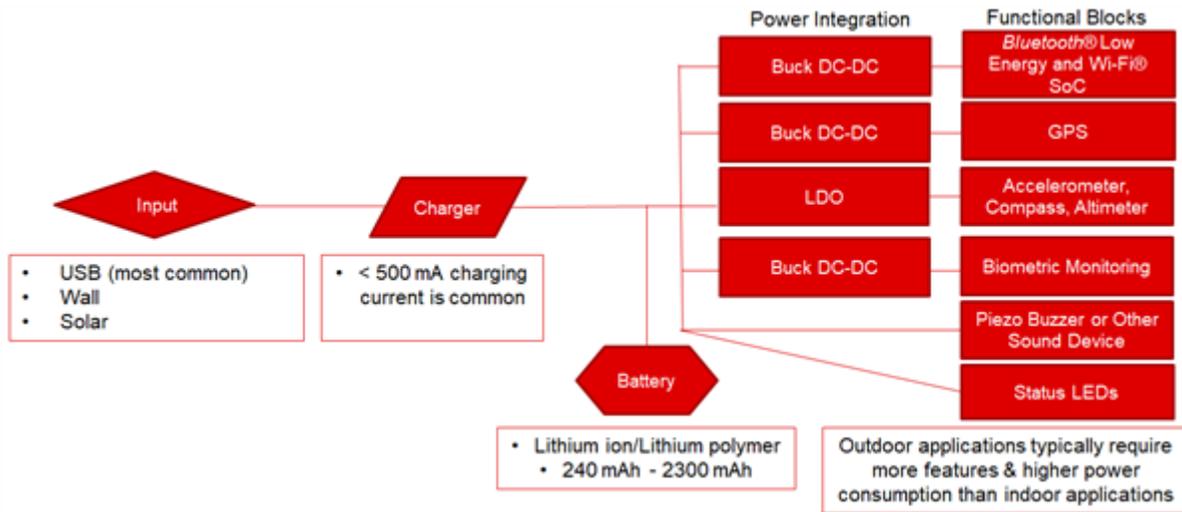


Figure 2. Rechargeable RTLS block diagram for pet trackers

TI chargers for rechargeable RTLS devices

TI's [BQ24040](#) and [BQ21061](#) are two linear chargers that can help address common design challenges. The BQ24040 satisfies charging requirements for simpler RTLS devices. It is 4mm² and its 1µA standby current helps extend battery life leading to more uptime. This device is useful for RTLS applications in which people rarely interact with the device, such as *Bluetooth*® Low Energy beacons. The BQ21061 is useful in RTLS devices such as smart dog collars. The I²C interface enables easy configuration of charging properties, while the LDO adds an extra power rail to minimize space. The power path feature provides a ship-mode option.

The [BQ25619](#) is a switching charger that would also be useful in rechargeable RTLS applications. In general, switching chargers are more efficient than linear chargers in terms of power loss; they also have higher charging currents and wider input voltage and current ranges. A switching charger, like the BQ25619, is a good fit for rechargeable RTLS applications that need bigger rechargeable batteries and fast power consumption. The BQ25619 has a flexible 20-mA to 1.5-A charging current range and quick charge capabilities, along with I²C for charging customization and a standby current of 10 µA to preserve battery life. [Table 1](#) compares all three chargers.

Table 1. Comparing the BQ24040, BQ21061 and BQ25619 battery chargers

Feature	BQ24040	BQ21061	BQ25619
Standby current	1 µA	470 nA	9 µA
Ship mode	No	Yes	Yes
Charge current range	100 mA - 1 A	1.25 mA - 500 mA	20 mA - 1.5 A
Standalone or I ² C	Standalone	I ² C	I ² C
Size	2.00 mm x 2.00 mm	2.00 mm x 1.60 mm	4.0 mm x 4.0 mm
Power path	No	Yes	Yes
LDO	No	Yes	No

In addition to the previously mentioned applications, herd tracking is a growing opportunity for RTLSs that requires a large-scale solution for animal tracking. By placing RTLS devices similar to the dog collars on farm animals such as cows, farmers are able to monitor the health and location of every animal in a herd to make smarter, more informed decisions. Designers for this application are implementing highly integrated chargers with long battery life, such as the BQ25155, in order to efficiently collect biometric data. As the need for RTLS continues to grow, design engineers are turning to highly integrated battery chargers to keep up with more demanding device requirements.

Additional resources

- Read these technical articles:

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- [“How to choose the right linear charger for your application.”](#)
 - [“Revolutionizing RTLS with Bluetooth low energy technology.”](#)
 - Read the application report, [“BQ21061 Two Layer Small Form Factor Design for Cost Optimized PCBs.”](#)
 - Search for the right [TI battery charger IC](#) for your next design.

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