MICREL
The Infinite Bandwidth Company™

MIC79050

Simple Li-Ion Battery Charger Guarantees ±0.75% Battery Voltage Accuracy

The rechargable Lithium-Ion (Li-Ion) battery is becoming the battery chemistry of choice in portable consumer electronics due to its small size and high energy density. The competitive nature of the consumer electronics industry is driving a need for simple, low-cost charging solutions.

Micrel's MIC79050 is a simple, single-cell Li-Ion battery charger IC. Its low external component count makes it not only the simplest, but also a very low-cost solution—only a single external capacitor is needed!

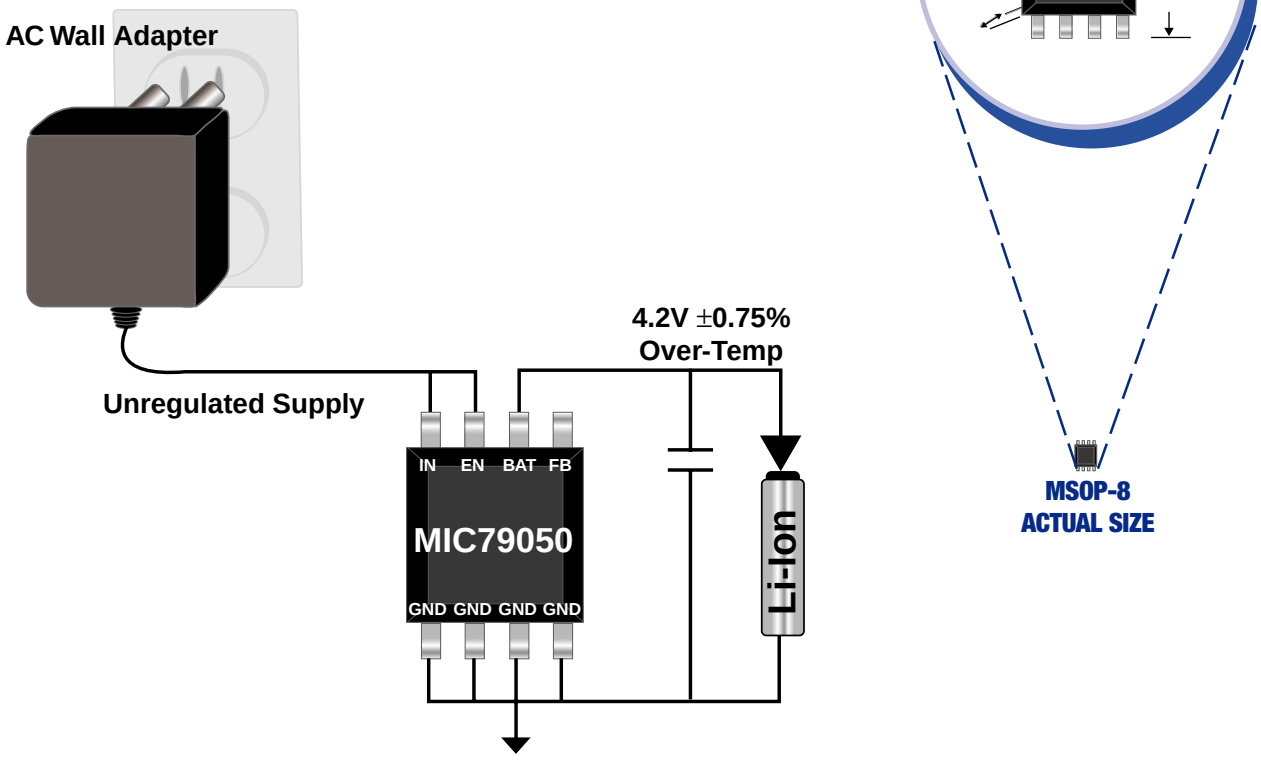
The MIC79050 includes an on-chip pass transistor for high precision charging. This allows the battery to charge to its full potential, allowing the longest possible run time.

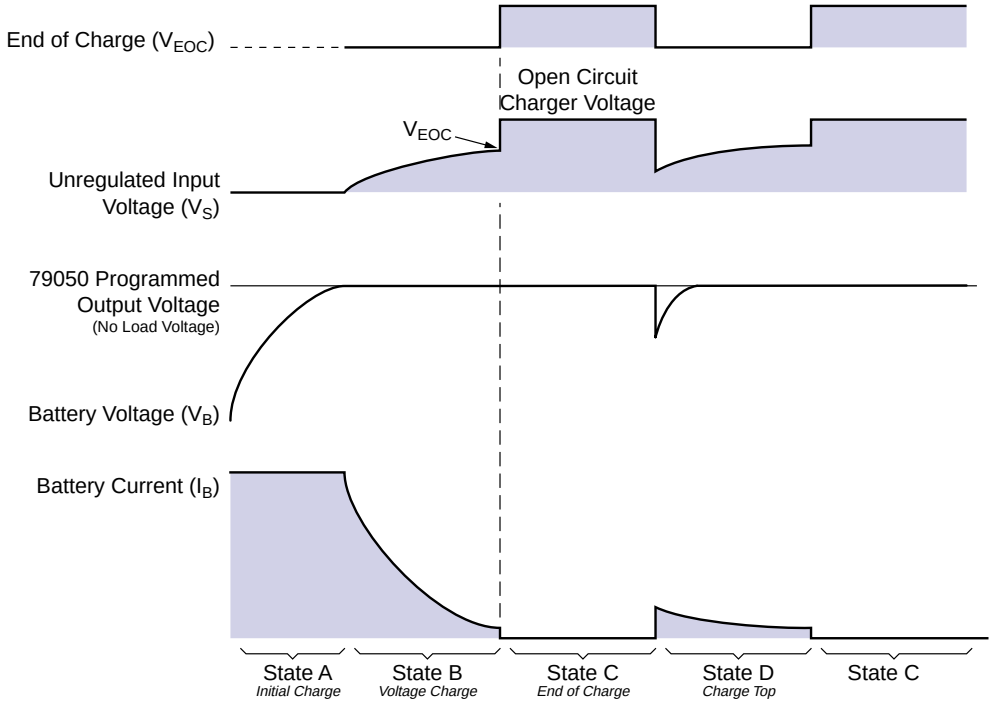
It is also equipped with protection circuitry. In the event the input to the charger is disconnected, the MIC79050 provides reverse current and reverse battery protection. It also comes with current limit and thermal shutdown protection.

All the features of the MIC79050 are packed into the tiny power MSOP-8 package. Available in the –40°C to +125°C temperature range, the MIC79050 also comes in power SO-8 and SOT-223 packages.

Key Features

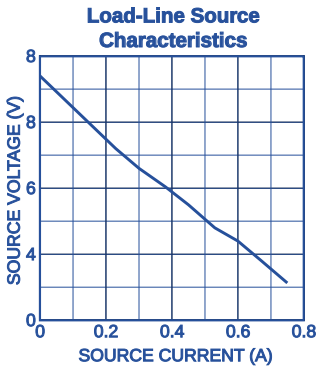
- Simple, linear charger: only needs 1 output capacitor!
- High accuracy charge voltage: ±0.75% over charging temperature range
- Ultra-low dropout: 380mV @ 500mA
- "Zero" off-mode current
- Minimal reverse leakage
- Wide input voltage range: up to 16V
- Enable function available
- Pulse charging capability
- Thermal shutdown and current limit protection
- Small power MSOP-8, SO-8 and SOT-223 packages

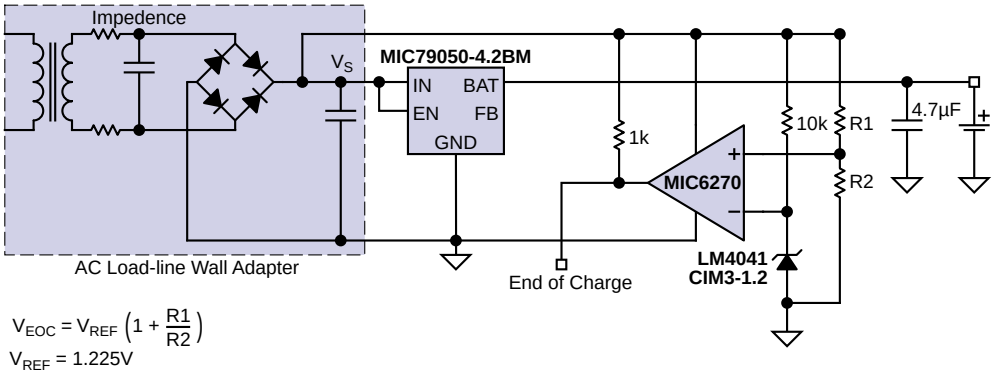




The Charging Cycle

1. State A: Initial charge. Here the battery's charging current is limited by the wall adapter's natural impedance. The battery voltage approaches 4.2V (V_{EOC}).
2. State B: Constant voltage charge. Here the battery voltage is at 4.2V ± 0.75% and the current is decaying in the battery. When the battery has reached approximately 1/10th of its 1C rating, the battery is considered to have reached full charge. Because of the natural characteristic impedance of the cheap wall adapters, as the battery voltage decreases so the input voltage increases. The MIC6270 and the LM4041 are configured as a simple voltage monitor, indicating when the input voltage has reached such a level so the current in the battery is low, indicating full charge.
3. State C: End of charge cycle. When the input voltage, V_S reaches $V_{EOC,}$ an end of charge signal is indicated.
4. State D: Top up charge. As soon as enough current is drawn out of the input source, which pulls the voltage lower than the V_{EOC}, the end of charge flag will be pulled low and charging will initiate.



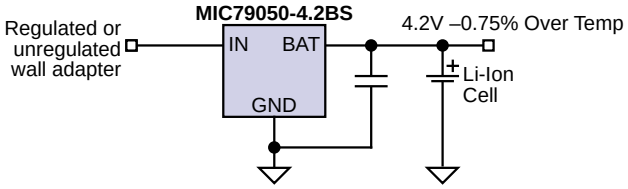


$$V_{EOC} = V_{REF}\left(1 + \frac{R1}{R2}\right)$$

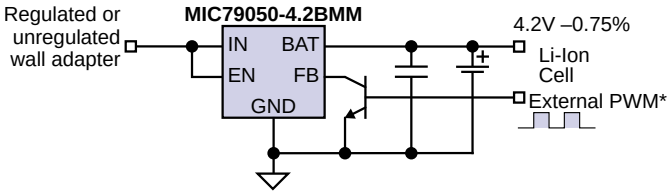
V_{REF} = 1.225V

Load-Line Charger with End-of-Charge Termination

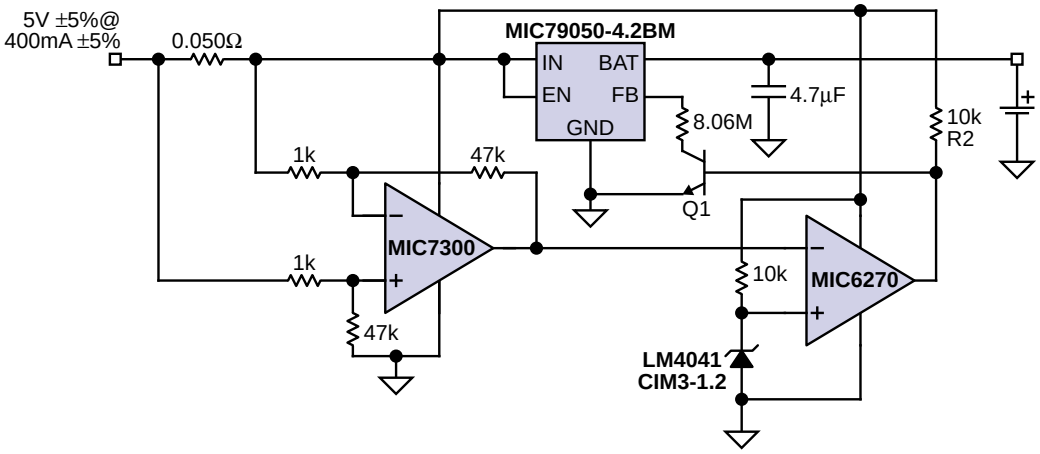
Application Circuits



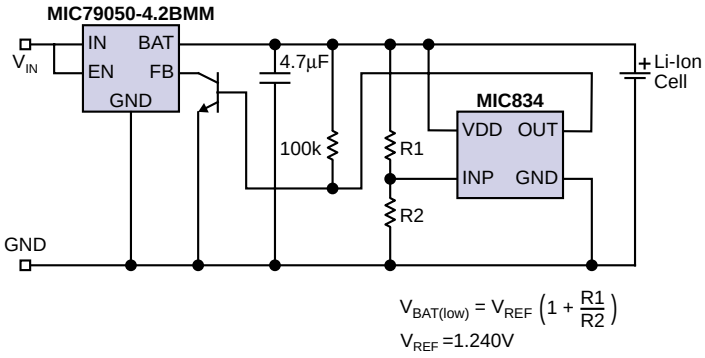
Simplest Battery Charging Solution



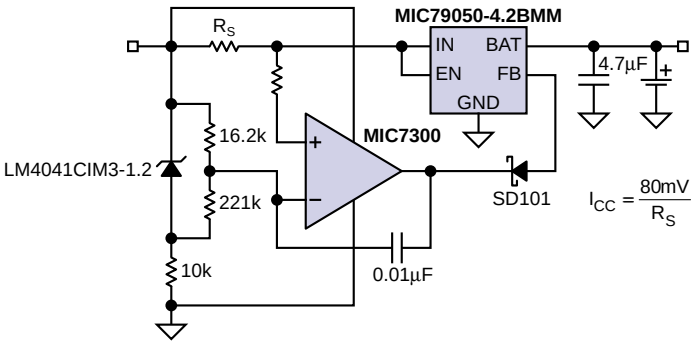
Simplest Battery Charging Solution with Pulse Charging



Protected Constant-Current Charger

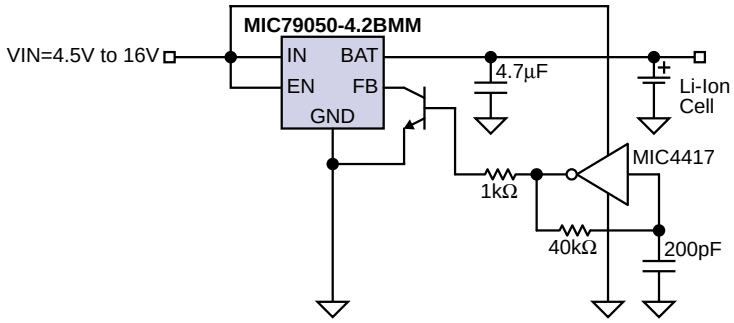


Pulse Charging for Top-Off Voltage

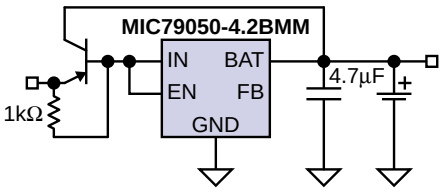


Constant-Current, Constant-Voltge Charger

Application Circuits (cont'd)



PWM-Based Pulse Charging



High Current Charging

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