Keywords: efficiency, battery charger, battery mode, charge source

APPLICATION NOTE 5967

EFFICIENCY IMPROVEMENT IN BATTERY MODE - MAX1737, MAX1757, MAX1758

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Abstract: This application note presents an efficiency improvement to the MAX1737, MAX1757, and MAX1758 in battery mode when the charge source is removed.

The MAX1737, MAX1757, and MAX1758 are battery chargers for one to four cells (**Figure 1**). The devices use the body diode of the internal MOSFET to provide load current when the charge source is removed. The internal body diode voltage drop is ~700mV with 1A of load current. The maximum package dissipation of the MAX1737 is 860mW and that of the MAX1757/MAX1758 is 762mW. Relying on the body diode of the internal MOSFET when the battery provides the load current in the absence of a charger is not an acceptable solution.

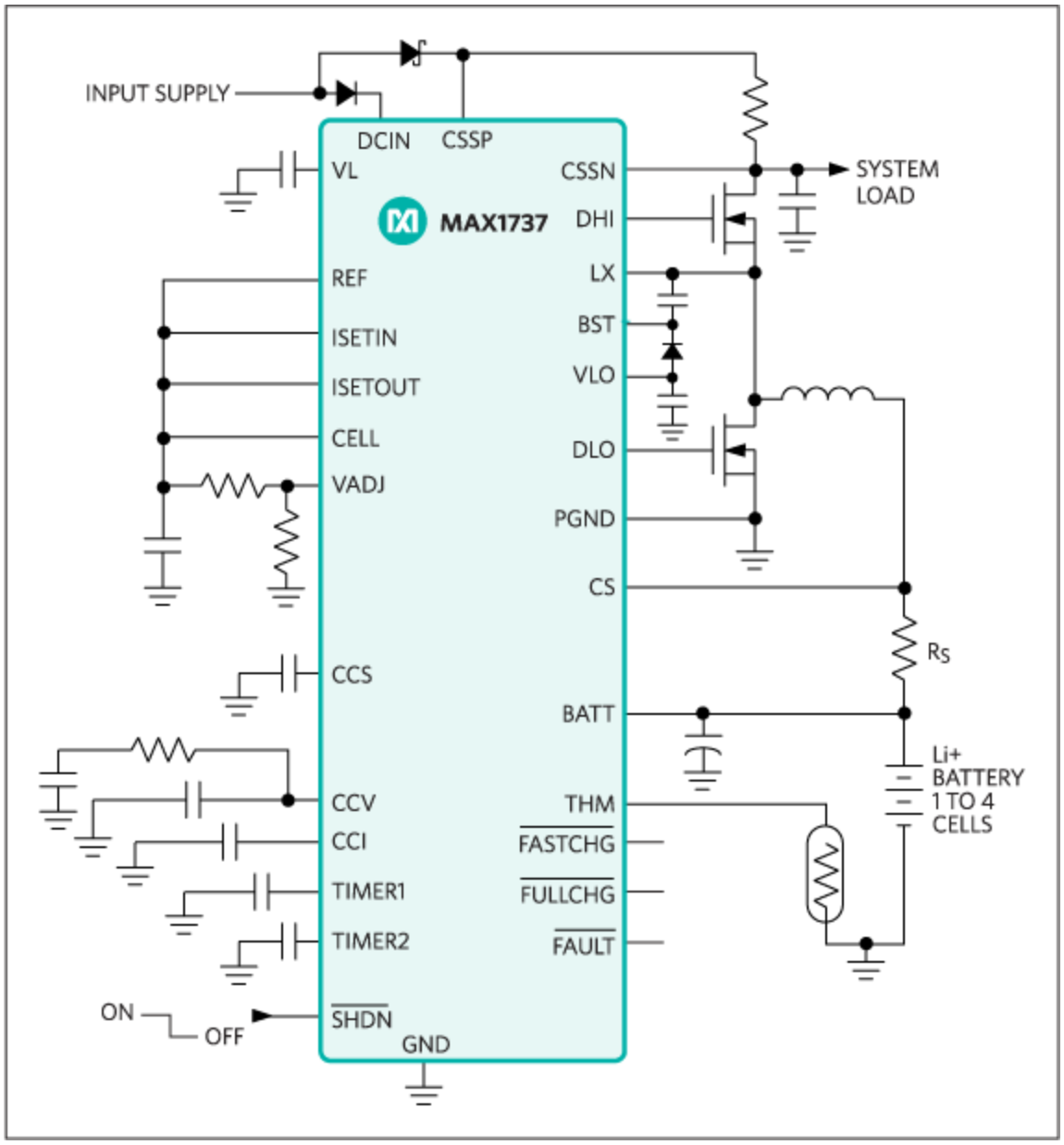

Figure 1. Typical operating circuit of MAX1737.

One way to remedy the situation is to add a Schottky diode from BATT to system load. The Schottky diode is reverse-biased when the charge supply voltage is present. When the source voltage is absent, the voltage drop from BATT to system load at 1A load current with a 1N5820 Schottky diode is ~400mV, which is close to half of when using the internal body diode. That comes to an appreciable power loss of ~400mW at 1A load on the battery which is not ideal.

A p-channel MOSFET is added as in the dash-lined diagram (**Figure 2**) in place of the aforementioned Schottky diode.

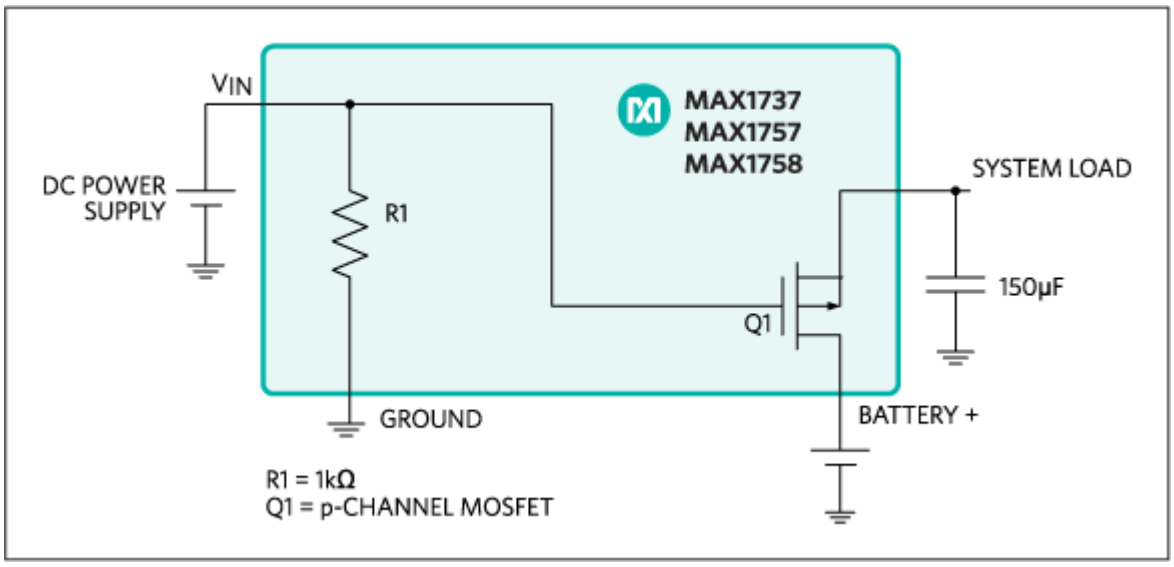

Figure 2. Adding a p-MOSFET to improve efficiency.

R1 ensures the gate of Q1 to be pulled low when the charge voltage is removed to turn on Q1 promptly. The voltage drop from BATT to system load at 1A load current with a NDT452AP MOSFET is ~60mV. The waste of battery power is ~60mW at 1A load. The transition time of the voltage at system load from the charger source to the battery is ~400µs with a voltage droop to ~400mV below that of the battery for 100µs when delivering 1A of load current. **Figure 3** shows the transition from a charge source of 14V to a battery voltage of 12V.

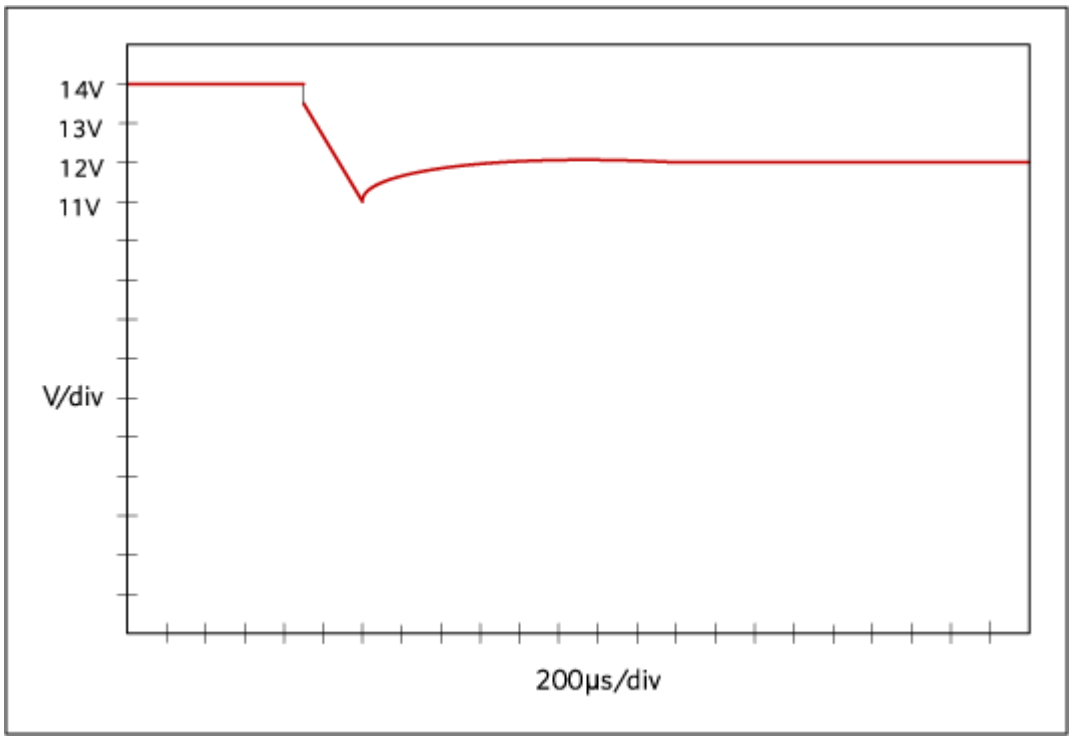

Figure 3. Switching time from DC source to battery.

Related Parts		
MAX1737	Stand-Alone Switch-Mode Lithium-Ion Battery-Charger Controller	Free Samples
MAX1757	Stand-Alone, Switch-Mode Li+ Battery Charger with Internal 14V Switch	Free Samples
MAX1758	Stand-Alone, Switch-Mode Li+ Battery Charger with Internal 28V Switch	Free Samples

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