

**Programmable Switching Li+ Battery Charger with USB/AC Input, CurrentPath™ Manager, TurboCharge™ Mode\*, Low Battery Recovery\*, AICL\* and USB On-The-Go Support**
**FEATURES & APPLICATIONS**

- Automatic Input Current Limit for universal USB/AC/DC adapter compatibility\*
- Optional automatic power source detection per latest USB charging specification 1.0
- USB input with programmable input current limiting (USB2.0 compliant)
- Up to 750mA charging output from 500mA USB port or 1500mA from AC adapter using proprietary “TurboCharge™ Mode”
- Input/output CurrentPath™ control allows system operation with deeply discharged/missing battery – no start-up delay
- “Low Battery Recovery” mode for >500mA startup from 100mA USB port with deeply discharged cells – no start-up delay
- USB On-the-Go (OTG) power support (up to 500mA @ +5V)
- Reverse current blocking prevents battery discharge
- High-efficiency step-down regulator with 3MHz switching
- +4.35 to +6.2V input voltage range
- +18V input tolerance (non-operating)
- High-accuracy float voltage regulation: 1.0%
- Digital programming of all major parameters via I<sup>2</sup>C interface
  - Pre-charge voltage, float voltage
  - Input/pre-charge/fast charge/term. current
  - Battery temperature limits, safety timers
- Comprehensive protection features
  - Status/fault indicator
  - Battery/IC thermal protection
  - Short circuit/UV/OV protection
  - Charge termination safety timers
  - Software watchdog timers
- Tiny CSP-30 package

**Applications**

- Portable Media Players
- Smartphones/PDA's
- Digital camcorders/still cameras
- Handheld GPS

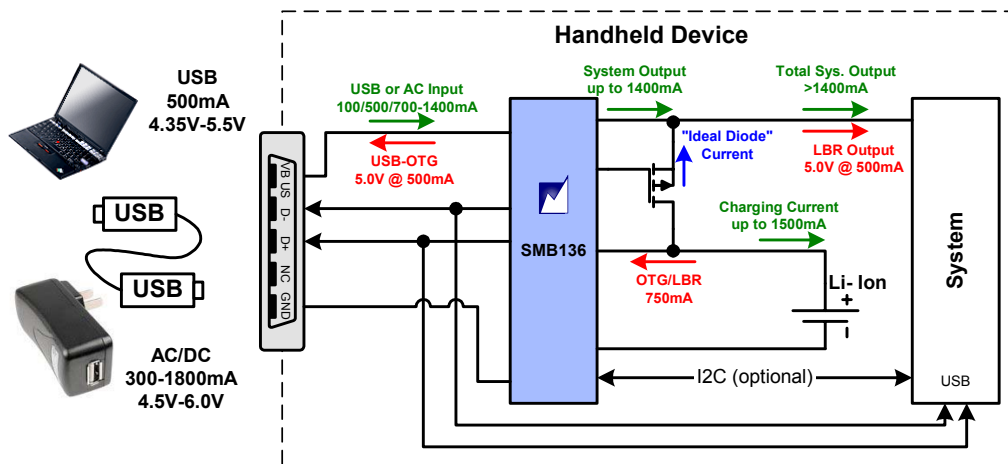
**SYSTEM APPLICATION**
**INTRODUCTION**

The SMB136 is a programmable single-cell lithium-ion/lithium-polymer battery charger designed for a variety of portable applications. The device provides a simple and efficient way to charge high-capacity Li-Ion batteries via a USB or AC power source. Unlike conventional charging devices, the SMB136's high-efficiency switch-mode operation eliminates the low charge current and thermal problems of conventional linear solutions. Also the switching architecture in conjunction with programmability enables dramatically faster charging – TurboCharge™ mode - from current limited in puts such as USB.

The SMB136 works seamlessly in conjunction with a USB controller. Also the SMB136 can manage two outputs independently: battery charging and system power. This allows immediate system operation even under missing/deeply discharged battery conditions. In the case of a low battery and insufficient/missing input supply the SMB136 can run its switching regulator in reverse to support “Low Battery Recovery” mode (+4.17V @ 500mA) or USB “On the Go” power (+5.0V @ 500mA).

Charge control includes input current limit (supporting USB2.0), trickle charge, pre-charge, constant current/constant voltage, float voltage and termination/safety settings that are fully programmable via a serial I<sup>2</sup>C/SMBus and stored in non-volatile memory making the device truly a flexible solution. Fast charge current level can be set via I<sup>2</sup>C (limited by the input current settings). An Enable (EN) pin is also provided for suspending charging and/or sleep mode. Built-in reverse-current blocking prevents inadvertent cell discharge.

The SMB136 also offers a wide variety of features that protect the battery pack as well as the charger and input circuitry: over-current, under/over-voltage, safety timers and thermal protection. Accurate 1.0% battery float voltage control ensures complete charging and improves battery capacity utilization. Status can be monitored via the serial port for charge state and fault conditions. In addition, the STAT output can be used to signal charge status. Operating voltage is specified from +4.35V to +6.2V with +18V non-operating input tolerance. The SMB136 is available in an ultra-compact CSP-30 package and is rated over the -30C to +85C temperature range.


**Figure 1 – Using the SMB136 to charge a single cell Li+ battery from USB or AC Adapter power sources**

\*Patent Pending