DC/DC Converter IC for Charging Li-ion Batteries **MB39A132 / MB39A134**

Pulse-width modulation-type DC/DC converter ICs capable of independently controlling the charge voltage and current, "MB39A132 (Nch/Nch synchronous rectification)" and "MB39A134 (Pch/Di asynchronous rectification)." The DC/DC converter control block has an independent built-in AC adapter detection comparator and is capable of controlling the system voltage supply source. Enabling a wide input voltage range and low current consumption under standby mode and capable of controlling the charge voltage and current with high accuracy, it is optimal for built-in Li-ion battery chargers for Notebook PCs and so forth.

Overview

This product is a power management IC for charging Notebook PCs that utilize 2- to 4-cell Li-ion batteries. The built-in output voltage preset function enables switching of the charge voltage among 2-, 3-, and 4-cell by switching the input logic at the CELLS pin. It is also capable of setting the charge voltage per cell by switching the input logic at the ADJ3 pin.

MB39A132 can set the voltage to 4.35V, 4.2V, or 4.0V and MB39A134 to 4.2V or 4.1V. It is also possible to set it to the
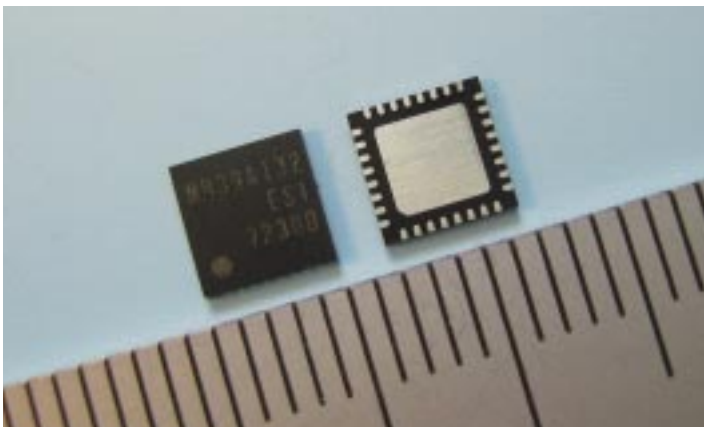
Photo 1 MB39A132 External View

Photo 2 MB39A134 External View

desired voltage using an external resistor.

This product has a built-in AC adapter detection function that operates independently from the DC/DC converter control block, which outputs a Hi-Z signal to the ACOK pin when the AC adapter voltage is lower than the specified voltage.

Like our existing charging ICs, it is capable of detecting voltage drops in the AC adapter and it dynamically controls the charge current (Dynamically Controlled Charging) for the rechargeable battery so that the voltage drop is stabilized. It is also equipped with a soft-start function to prevent the excessive charge current caused by the inrush current at power startup (MB39A132).

Product Features

- Rectification type:
  MB39A132: Nch/Nch synchronous rectification
  MB39A134: Pch/Di asynchronous rectification
- Support 2, 3, and 4 cell battery pack
- Two built-in constant current control loops
- Built-in AC adapter detection function (ACOK pin)
- Charge voltage setting accuracy:
  MB39A132: ±0.5% (Ta=+25℃ to +85℃)
  MB39A134: ±0.7% (Ta=−10℃ to +85℃)
- Built-in charge voltage control without external setting resistor
  MB39A132: (4.00V/cell, 4.20V/cell, and 4.35V/cell)
  MB39A134: (4.10V/cell and 4.20V/cell)

 ∗ *Both products can set the desired output voltage levels with external resistors.*

- Two built-in high accuracy current detection amplifiers:
  Detection accuracy: ±1mV (+INC1, +INC2=3V to VCC)
  Input offset voltage (MB39A132): +3mV (Current Amp1, Current Amp2)
  Input offset voltage (MB39A134): 0mV (Current Amp1)
  +3mV (Current Amp2)
- Built-in charging current control setting without external setting resistor (Rs=20mΩ: 2.85A)
  Adjustable charging current with external resistor
- Support for switching frequency setting using an external resistor (Frequency setting capacitor integrated)
  100kHz to 2MHz
- In standby mode (Icc=6μA,Typ.) , only AC adapter detection function is operated
- Built-in charge stop function at low VCC
- Built-in soft-start function adjustable time (MB39A132)
- Built-in independent operation function of AC adapter side current detection amplifier
- Package: MB39A132: QFN-32
  MB39A134: TSSOP-24

Figures 1 and **3** present the conversion efficiencies of MB39A132 and MB39A134, and **Figures 2** and **4** present the drooping characteristics of each. **Figures 5** to **8** present the transient waveforms under load step response when the battery is inserted or removed. **Figures 9** and **10** present the block diagrams of MB39A132 and MB39A134.
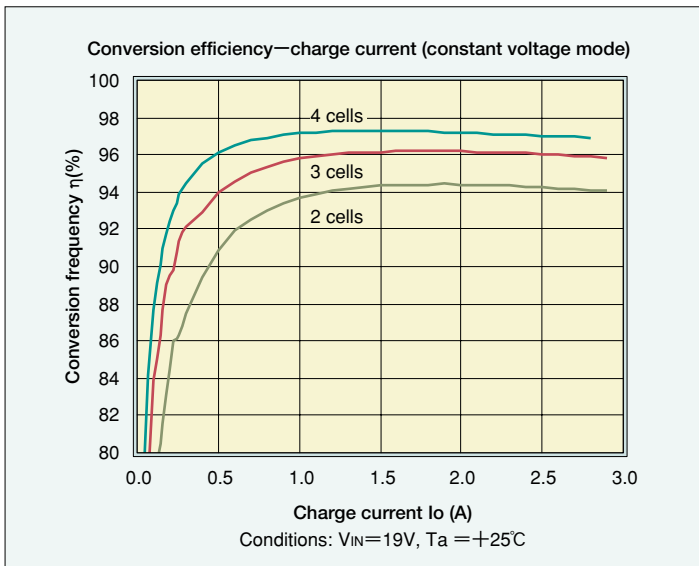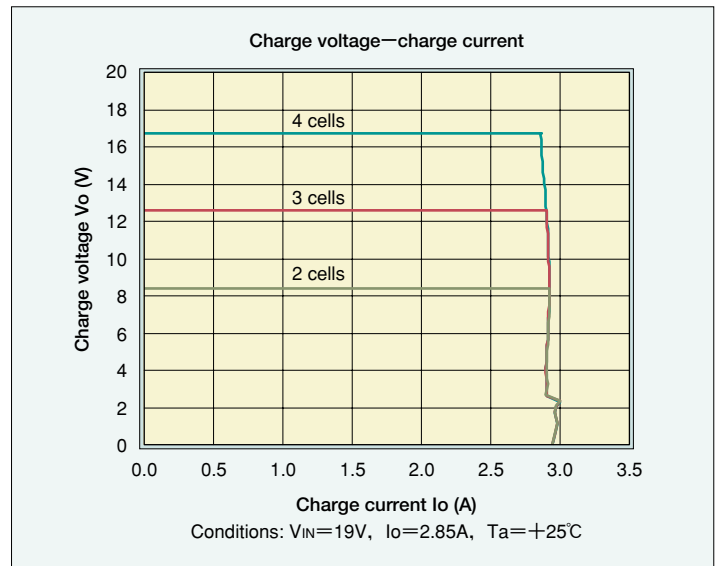
Figure 1 Conversion Efficiency of MB39A132

Conversion efficiency—charge current (constant voltage mode)

Conditions: V$_{IN}$=19V, Ta ＝+25℃

Figure 2 Drooping Characteristic of MB39A132

Charge voltage—charge current

Conditions: V$_{IN}$=19V, Io=2.85A, Ta=+25℃

Description of Functions

■ AC adapter voltage detection circuit

The AC adapter voltage detection block (AC Comp.) detects that the voltage at the ACIN pin has dropped below the voltage setting and switches the ACOK pin in the AC adapter voltage detection block to Hi-Z. The power is supplied from the VCC pin or the VIN pin with higher voltage. This function operates regardless of the input level at the CTL pin.

■ Clock generation block

The oscillation frequency can be set at 100kHz to 2MHz by connecting a resistor to the RT pin.

■ Over temperature protection circuit (OTP function)

When the junction temperature reaches 150℃, the OUT1 pin and OUT2 pin are set to level "L" and voltage output is stopped. Voltage output is resumed with the soft-start function when the junction temperature drops to 125℃. This function prevents the IC from heating.
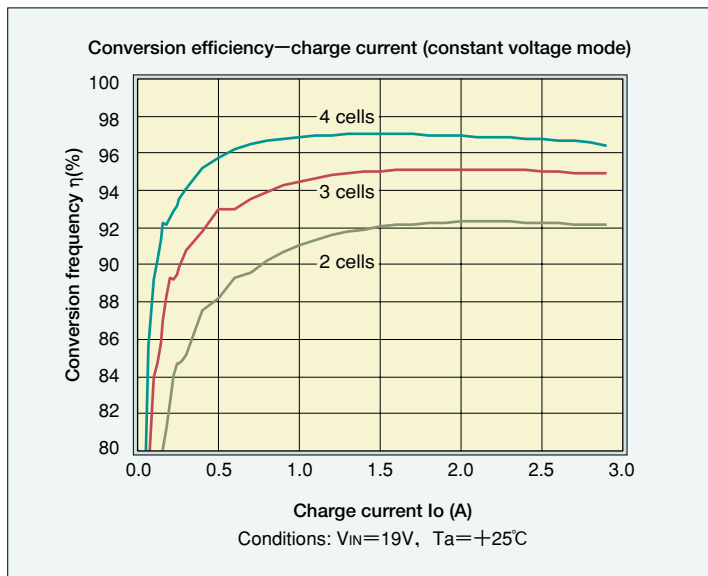
Figure 3 Conversion Efficiency of MB39A134

Conversion efficiency—charge current (constant voltage mode)

Conditions: V_{IN}=19V, Ta=+25℃

Figure 4 Drooping Characteristic of MB39A134

Charge voltage—charge current

Conditions: V_{IN}=19V, Io=2.85A, Ta=+25℃
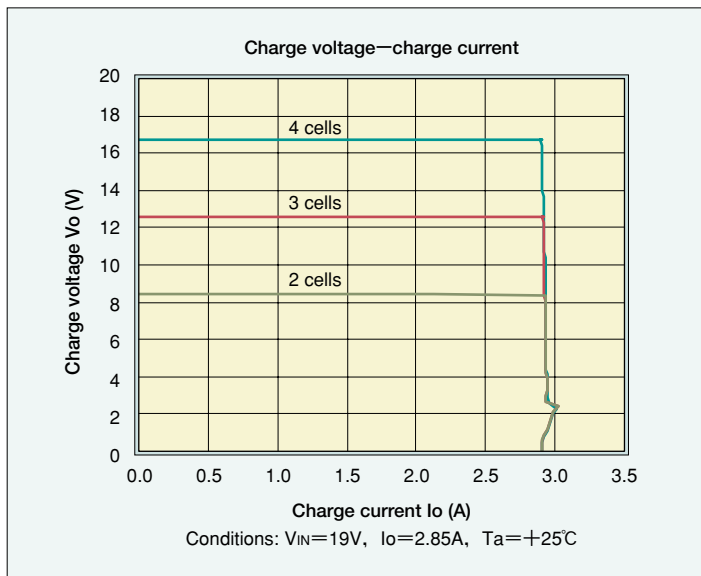
Figure 5 Transient Waveforms under Load Step Response in MB39A132 (Constant Current Mode), Battery insertion

Conditions: V_{IN}=19V, Io=2.85A, Ta=+25℃
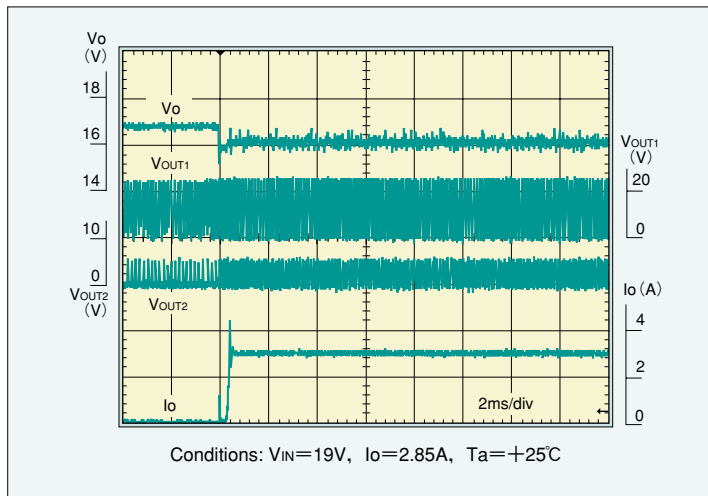
Figure 6 Transient Waveforms under Load Step Response in MB39A132 (Constant Current Mode), Battery removal

Conditions: V_{IN}=19V, Io=2.85A, Ta=+25℃
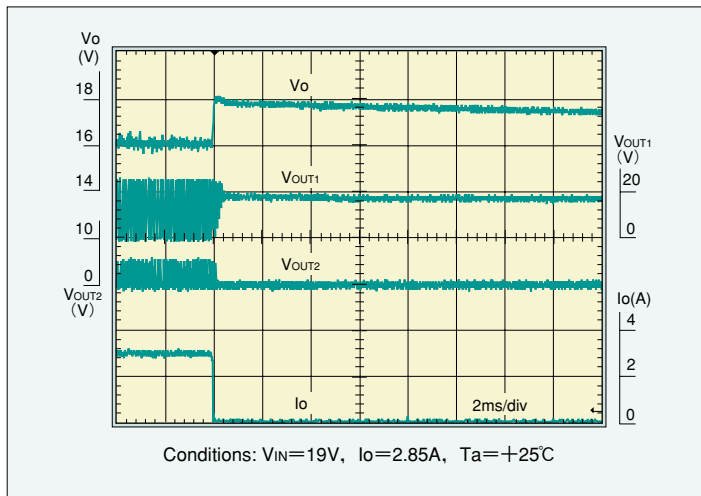
Figure 7 Transient Waveforms under Load Step Response in MB39A134
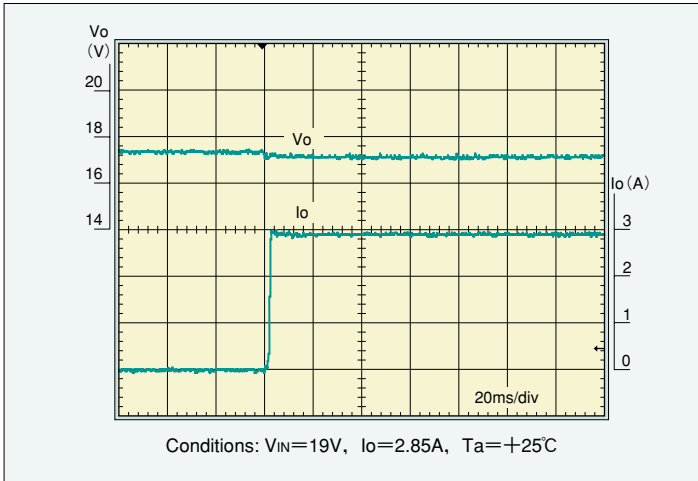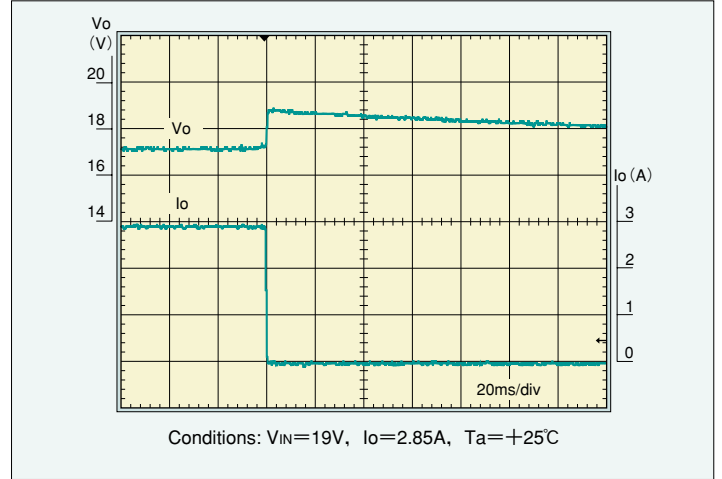(Constant Current Mode), Battery insertion

Conditions: V_{IN}=19V, Io=2.85A, Ta=+25℃

Figure 8 Transient Waveforms under Load Step Response in MB39A134
(Constant Current Mode), Battery removal

Conditions: V_{IN}=19V, Io=2.85A, Ta=+25℃

Applications

- Built-in chargers for Notebook PCs, etc.
- Handy terminals, etc.

Evaluation Board/Package

   Photos 3 and **4** present the evaluation boards for MB39A132 and MB39A134. The package sizes of these products are listed as follows:

- MB39A132: QFN-32
  5.0mm×5.0mm×0.85mm (0.5mm lead pitch)
- MB39A134: TSSOP-24
  4.4mm×6.5mm×1.1mm (0.5mm lead pitch)

Photo 3 MB39A132 Evaluation Board
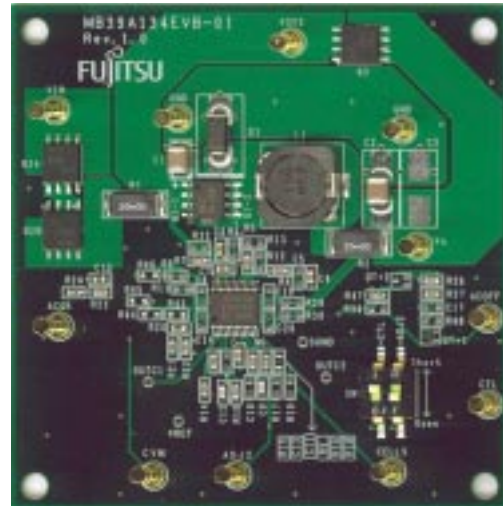

Photo 4 MB39A134 Evaluation Board

Figure 9 MB39A132 Block Diagram

Figure 10 MB39A134 Block Diagram