## **Designing a Battery Charger**

Vicor's BatMod current source module enables designers to easily build a compact, lightweight battery charging system with commonly available parts. The BatMod module provides programmable controlled current and voltage outputs and is ideal for applications involving standard input and output voltages. Because the BatMod allows the output voltage and the charge current to be set independently, the system design is greatly simplified.

## **Basic Battery Charger**

Figure 1 shows a basic charging circuit with a BatMod module for the follow-ing system requirements:

- Battery voltage 12V
- Float voltage 13.8V
- Charge current Adjustable 0–14.4A

Setting the float voltage: Since the open circuit output of a 12V BatMod module (VI-2X1-CU-BM) is 15V, a trimming resistor (R3) is necessary to set a float voltage of 13.8V. To determine the value of R3, follow these steps:

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• Solve for V<sub>TRIM</sub>:

\left(\frac{V_{FLOAT}}{V_{NOM}}\right)V_{REF} = V_{TRIM}

\left(\frac{13.8V}{15V}\right)2.5V = 2.3V
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• Solve for V_{R5}:

V_{REF} - V_{TRIM} = V_{R5}

2.5V - 2.3V = 0.2V
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• Solve for I<sub>R5</sub>:  

$$I_{R5} = \frac{V_{R5}}{R5} = \frac{0.2V}{10K\Omega} = 20\mu A$$
• Solve for R3:  

$$\frac{V_{TRIM}}{I_{R5}} = R3$$

$$\frac{2.3V}{20\mu A} = 115K\Omega$$

A 13.8 volt output requires a  $115K\Omega$  resistor.

Setting the charge current: The charge current can be programmed from 0 to maximum (14.4A) by applying 1 to 5 volts to the  $I_{TRIM}$  pin. To determine the voltage required to produce a particular charge current, 10A for example, use the following formula:

$$4 \left( \frac{\text{Desired Charge Current}}{\text{Maximum Output Current}} \right) + 1 = \text{V}_{\text{TTRIM}}$$

$$4\left(\frac{10A}{14.4A}\right) + 1 = 3.78V$$

To set the input to  $I_{TRIM}$  to 3.78V, adjust the potentiometer (R2) accordingly.

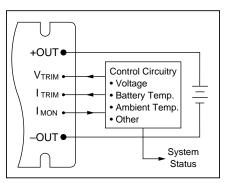
The Figure 1 configuration will charge the battery at a maximum of 10A with a 13.8V float voltage. Other charge rates and float voltages may be similarly calculated. If a fixed charge current is desired, the potentiometer can be replaced with two fixed resistors. In applications requiring tight control over the charging current, D1 can be replaced with a precision reference.

## **Advanced Battery Charger**

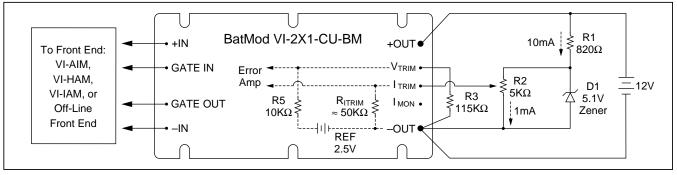
Many new battery technologies require sophisticated charging and monitoring systems to preserve their high performance and to extend their life. The BatMod serves as an ideal building block for constructing an advanced battery management system, which typically incorporates a microprocessor-based control circuit that is easily adapted for a variety of battery chemistries and monitoring functions. (See Figure 2.)

To maintain the optimum charge on the battery, the control circuit independently adjusts the float voltage and charge current in response to conditions during the charge: the

(continued)



*Figure 2—The BatMod in an advanced battery charging system.* 



*Figure 1*—*A basic charging circuit using a BatMod current source module.* 



## **Battery Charger**

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battery's voltage, current, temperature and pressure, and other pertinent parameters. It can also relay battery status information such as capacity, charge and discharge history, and cause of failure.

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With its wide range of outputs, the BatMod offers designers a simple, cost-effective solution to battery charging for all major battery types.

For details, contact Vicor (phone 800-735-6200, fax 508-475-6715) or your local Vicor representative.