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APPLICATION NOTE 4188

Calibrating the Current Offset Bias (COB) Register for the DS278x Family of Fuel Gauges

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Abstract: The DS278x family of stand-alone fuel gauges provides an accurate estimation of the remaining capacity available in rechargeable lithium-ion or lithium-polymer batteries. These fuel gauges contain a current offset bias (COB) register that can be utilized by the designer to eliminate the inherent offset introduced by the IC's current ADC. Improper calibration of this register, however, can decrease the accuracy of the current measurements, especially at low currents. This application note describes a step-by-step approach for properly calibrating the DS278x within the fully assembled battery pack in order to determine the correct value that should be placed into the COB register.

Introduction

The DS278x family of stand-alone fuel gauges—which includes the [DS2781](#), [DS2784](#), and [DS2788](#)—provides an accurate estimation of the remaining capacity that is available in rechargeable lithium-ion or lithium-polymer batteries. The accuracy of the fuel gauge is determined by the cell characteristics and application parameters that are stored in EEPROM, as well as the the accuracy of the current readings.

Each device contains a current offset bias (COB) register that allows the designer to eliminate inherent offset introduced by the IC's current ADC. The advantages of high-accuracy fuel gauging can be completely negated by the improper calibration of the device. This application note provides an example of how to properly calibrate the COB register of a DS278x.

Description

The current ADC of the DS278x family is extremely sensitive. It is capable of measuring a voltage drop of only 1.5625µV across the sense resistor. This kind of accuracy can only be achieved by calibrating the current measurement after the cell pack is assembled. COB is an offset value that is added to the current that is measured by the DS278x family of devices and, then, accumulated into the accumulated current register (ACR), as shown in Equation 1.

$$\text{Reported Current (mA)} = \text{Measured Current (mA)} + \text{Current Offset Bias (mA)} \quad (\text{Eq. 1})$$

Figure 1 illustrates the COB register format. COB is an 8-bit, two's complement value stored in 1 byte of the parameter EEPROM memory block. The COB register value can be adjusted from -199.68µV to +198.12µV in steps of 1.5625µV.

simple.

For example, if reading the current register reveals a current of +4.6875 μ V (+3 LSbs), then simply write -4.6875 μ V (-3 LSbs) to the COB register.

5. Write and copy the new COB value

The value that was determined in Step 4 should then be written to the COB register (Address 0x7Bh) in two's complement format and copied to EEPROM. The COB value for this example is -3 LSbs, so the two's complement value is 0xFDh.

Write the new value to the COB register 1 byte
Perform EEPROM copy on Block 1

6. Verify accuracy

With the new value in the COB register, Steps 2 and 3 may be repeated to verify the accuracy of the calibration.

Conclusion

The COB register value can be programmed by the customer to improve current-measurement accuracy after module or pack manufacture. The current offset calibration allows the DS278x family of stand-alone fuel gauges to be as accurate as possible. The DS278x devices also contain a current gain register (RSGAIN) that can be used to improve the accuracy of the current readings, as described in application note 4114, "[Calibrating RSGAIN for the DS278x Family of Fuel Gauges](#)." It is important to calibrate the COB of the current register before calibrating the RSGAIN.

Related Parts

DS2781	1-Cell or 2-Cell Stand-Alone Fuel Gauge IC	Free Samples
DS2784	1-Cell Stand-Alone Fuel Gauge IC with Li+ Protector and SHA-1 Authentication	Free Samples
DS2788	Stand-Alone Fuel-Gauge IC with LED Display Drivers	Free Samples

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