Using the bq2589x ADC to Estimate Battery Temperature

PWR/BMS/HPC

ABSTRACT

This application note explains how to use the bq2589x IC's integrated analog-to-digital converter (ADC) to estimate battery temperature.

Description

The bq2589x has an integrated ADC which provides the following instantaneous measurements after an I2C write request:

- Battery voltage
- SYS voltage
- VBUS voltage
- Charge current
- TS Percentage (that is, V(TS)/V(REGN))

The TS percentage, instead of TS voltage, is provided because the TS voltage is pulled up to the linear regulator voltage, REGN, which has a finite tolerance and will track the VBUS voltage if VBUS droops below V(REGN). Using the TS% instead of absolute TS pin voltage eliminates errors due to V(REGN) variation. Figure 1 shows the TS pullup configuration.

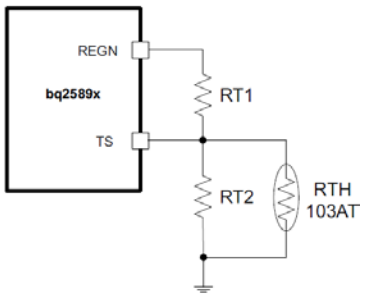

Figure 1. TS Pullup Configuration

Computation

Solving the standard resistor divider equation for V(TS)/V(REGN) = TS% gives the following equation:

$$RTH = \frac{RT1}{\frac{1}{TS\%} - 1 - \frac{RT1}{RT2}} \quad (1)$$

Where:

RTH is the resistance of the thermistor.

RT1 is the top resistor of the pullup divider.

RT2 is the bottom resistor of the pullup divider.

Once RTH is known, equation 2 can be used to compute an estimate of the battery's temperature:

$$T = \frac{\beta}{ln\left(\frac{RTH}{R_0 e^{\frac{-\beta}{T_0}}}\right)} \quad (2)$$

Where:

β is the thermistor's Beta.

R_0 is thermistor's resistance at temperature T_0.

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