Application Report
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bq20z70, bq20z75, bq20z90, and bq20z95 Voltage, Current, and Temperature Measurement Accuracy

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ABSTRACT

This document describes the accuracy capabilities of the bq20z70, bq20z75, bq20z90, and bq20z95 solutions. All data shown in this document was gathered empirically.

1 Voltage Measurement Accuracy

For voltage measurement accuracy testing, a bq20z90EVM evaluation module and a calibrated Hewlett-Packard 3457A Multimeter provided the data described in this section. A Hewlett-Packard 6624A dc power supply simulated the four-cell voltages. The data spanned a 2.3-V to 4.4-V voltage range at 300-mV increments and a –20°C to 80°C temperature range at 10°C increments. Equipment calibration occurred at 16 V (4 V per cell) at room temperature.

Note: The tests described in this section used a four-cell configuration. Table 1 and Figure 1 indicate the voltage error of the entire battery pack. Obtain individual cell voltage errors by dividing the error by 4. A three-cell battery pack has a lower pack voltage error.

Table 1. Voltage Error Results

Temperature	–20°C	–10°C	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C
Min Error (mV)	15.0	11.0	4.6	2.0	0.5	0.5	0.9	3.7	10.0	16.0	23.0
Avg Error (mV)	19.7	11.8	5.5	2.4	2.0	1.5	2.3	5.7	12.3	20.3	30.9
Max Error (mV)	22.6	12.5	6.4	3.3	3.4	2.4	3.4	6.5	13.9	23.9	37.7

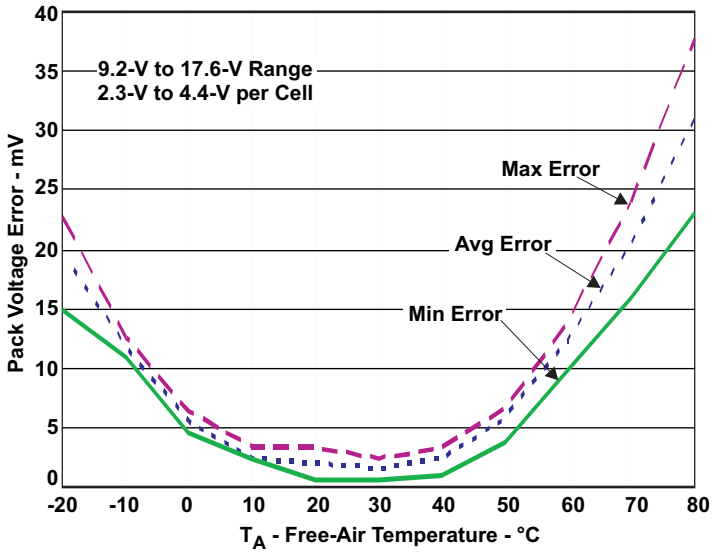

Figure 1. Pack Voltage Error vs Temperature

2 Current Measurement Accuracy

For the current measurement accuracy testing, a bq20z90EVM and a calibrated Keithley 2430-C SourceMeter provided the tabulated data in this section. The Keithley 2430-C SourceMeter also provided the current supply. A 10-mΩ sense resistor was used. A Hewlett-Packard 3457A Multimeter measured the voltage across the sense resistor. By dividing this voltage by the current, an actual resistance was calculated. This resistance was compared to the resistance determined from a calibrated value. The calibrated value was determined to be 2 A at room temperature. This method eliminates the temperature drift of the sense resistor as an error source. Data was gathered across a 3-A to 2-mA current range, halving the current at each step. Data was taken over a –20°C to 80°C temperature range at 20°C increments.

Depending on the amount of current, the error can be specified either as a percentage error or as an offset, but not both. Error at lower currents is specified as an offset, whereas error at higher currents is specified as a percentage of total current, thus the error plus offset column shown in Table 2.

Table 2. Current Error Results

Temperature (°C)	Error (%) + Offset (µV)
–20	±0.20% + 5 µV
0	±0.10% + 6 µV
20	±0.05% + 6 µV
40	±0.10% + 19 µV
60	±0.10% + 20 µV
80	±0.40% + 21 µV

3 Temperature Measurement Accuracy

For the temperature measurement accuracy testing, a bq20z90EVM and a calibrated Omega HH42 Digital Thermometer provided the data in this section . The thermometer gauge uses a Semitec 103AT-2 thermistor for temperature measurement. The gathered data spanned a –20°C to 80°C temperature range at 10°C increments. Calibration occurred at room temperature.

The error from 0°C to 80°C is <±1°C. From –20°C to 0°C, the error is <±3°C.

Calibrated Thermometer Temperature (°C)	Gauge Reported Temperature (°C)	Difference (°C)
–20.00	–17.35	–2.65
–10.00	–8.85	–1.15
0.00	0.75	–0.75
10.00	10.65	–0.65
20.00	20.35	–0.35
30.00	30.05	–0.05
40.00	39.65	0.35
50.00	49.75	0.25
60.00	60.05	–0.05
70.00	70.35	–0.35
80.00	79.65	0.35

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