

bq33100 Supercapacitor Manager, TI Design

The bq33100 supercapacitor manager was tested for (1) voltage accuracy, (2) current accuracy, (3) capacitance measurement accuracy, (4) ESR measurement accuracy, and (5) cell balancing accuracy using recently calibrated DMM, electronic load, and oscilloscope.

1. Voltage Measurement Accuracy

The device was first calibrated at nominal supercapacitor voltages, and then the capacitors were severely discharged in order to check the measurement accuracy near the midpoint.

Error following calibration.

Node	Reported mV	Actual mV	Error mV
Cell 1	2167	2166	1
Cell 1 + 2	4334	4333	1
Cell 1 + 2 + 3	6502	6501	1
Cell 1 + 2 + 3 + 4	8669	8668	1
Cell 1 + 2 + 3 + 4 + 5	10836	10835	1

Accuracy at lower voltage

Node	Reported mV	Actual mV	Error mV
Cell 1	1148	1157	-9
Cell 1 + 2	2258	2258	0
Cell 1 + 2 + 3	3421	3421	0
Cell 1 + 2 + 3 + 4	4544	4546	-2
Cell 1 + 2 + 3 + 4 + 5	5693	5692	1

2. Current Measurement Accuracy

The device was calibrated at 1000 mA, and then checked at 500 mA.

Calibrated Report	Linearity Report	Error
1000 mA	500 mA	0 mA

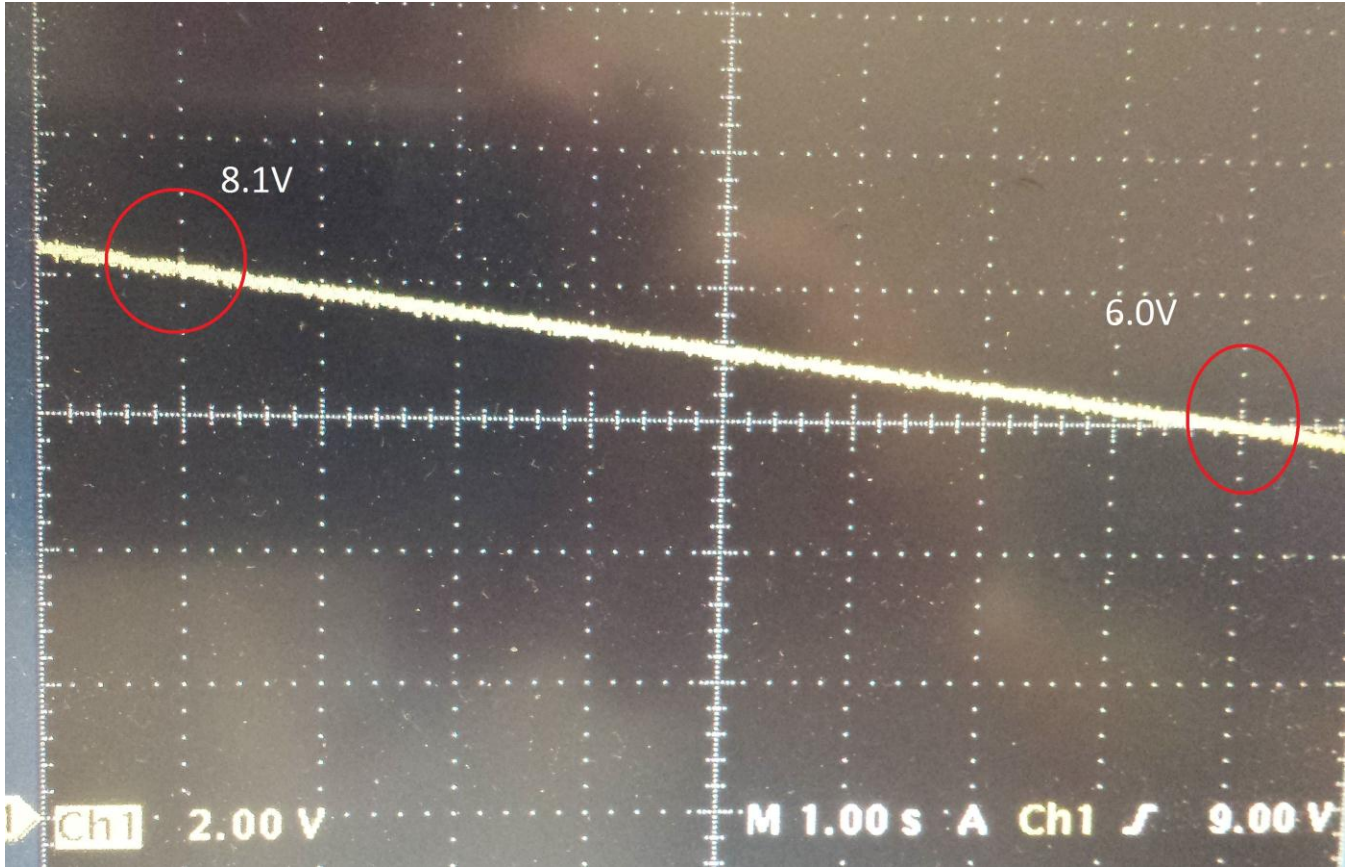
3. Capacitance Measurement Accuracy

Capacitance measurement of the device is compared to a manual check with a recently calibrated oscilloscope using a calibrated 1.0 Ampere electronic load.

Capacitance measured by the bq33100 is 4.1 F

Name	Value	Unit	Log	Scan
ESR	210	mohm	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Relative State of Charge	100	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Health	100	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitance	4.1	F	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Capacitance measured on the oscilloscope is $8 \text{ Seconds} * 1.0 \text{ Ampere} / 1.9 \text{ V} = 4.2 \text{ F}$



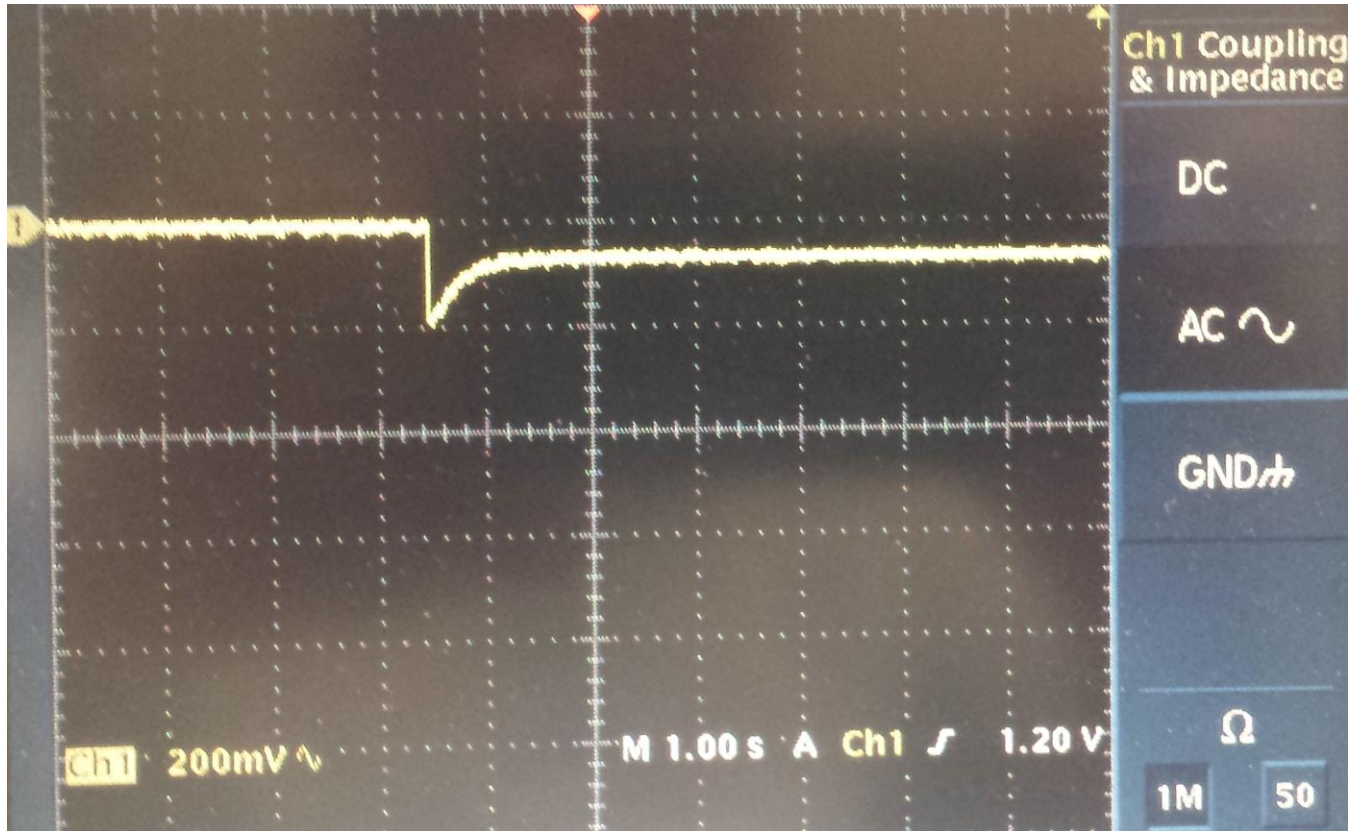
4. ESR Measurement Accuracy

ESR measurement of the device is compared to a manual check with a recently calibrated oscilloscope and calibrated 1.0 Ampere electronic load.

ESR measured by the bq33100 is 210 milliOhms

Name	Value	Unit	Log	Scan
ESR	210	mohm	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Relative State of Charge	100	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Health	100	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitance	4.1	F	<input type="checkbox"/>	<input checked="" type="checkbox"/>

ESR measured on the oscilloscope is $200 \text{ mV} / 1 \text{ Ampere} = 200 \text{ milliOhms}$



5. Cell Balancing Accuracy

Cell balancing accuracy was tested by observing unbalanced cells during initial charge and comparing those readings to cell voltage measurements 5 minutes following the initial charge.

Initially we see a significant imbalance totaling 45 mV between the 5 capacitor cells

Name	Value	Unit	Log	Scan
Charging Current	500	mA	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Charging Voltage	10500	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitor Voltage 5	2133	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitor Voltage 4	2142	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Name	Value	Unit	Log	Scan
Capacitor Voltage 3	2098	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitor Voltage 2	2115	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitor Voltage 1	2097	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Operation Status	0904	hex	<input type="checkbox"/>	<input checked="" type="checkbox"/>

After 5 minutes of balancing by the bq33100, the cell voltages are all within 1 mV

Name	Value	Unit	Log	Scan
Charging Current	500	mA	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Charging Voltage	10500	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitor Voltage 5	2115	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitor Voltage 4	2115	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Name	Value	Unit	Log	Scan
Capacitor Voltage 3	2115	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitor Voltage 2	2114	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Capacitor Voltage 1	2115	mV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Operation Status	1804	hex	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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