

## 2011 Chevrolet Volt – VIN 0815

### Advanced Vehicle Testing – Beginning-of-Test Battery Testing Results



#### VEHICLE DETAILS AND BATTERY SPECIFICATIONS<sup>1</sup>

##### Vehicle Details

Base Vehicle: 2011 Chevrolet Volt  
 VIN: 1G1RD6E48BU100815  
 Propulsion System: Multi-Mode PHEV (EV, Series, and Power-split)  
 Engine: DOHC I-4, 1.4 L, 63 kW @ 4800 rpm  
 Number of Electric Machines<sup>2</sup>: 2  
 Motor: 111 kW (peak), AC induction, Air Cooled  
 Generator<sup>2</sup>: 54 kW (peak), DC Permanent Magnet, Liquid Cooled  
 Peak Electric Drive and Engine Power: 112 kW

##### Battery Specifications

Manufacturer: LG Chem  
 Type: Lithium-ion  
 Number of Cells: 288  
 Nominal Cell Voltage: 3.7 V  
 Nominal System Voltage: 355.2 V  
 Rated Pack Capacity: 45 Ah  
 Rated Pack Energy: 16 kWh  
 Maximum Cell Charge Voltage<sup>3</sup>: 4.15 V  
 Minimum Cell Discharge Voltage<sup>3</sup>: 3.00 V  
 Thermal Management: Active, liquid

#### BATTERY LABORATORY TEST RESULTS SUMMARY

##### Vehicle Mileage and Testing Date

Vehicle Odometer: 8,177 mi  
 Date of Test: March 6, 2012

##### Static Capacity Test

Measured Average Capacity: 41.8 Ah  
 Measured Average Energy Capacity: 15.2 kWh

##### EVPC Test

Pulse Discharge Power @ 80% DOD<sup>4</sup>: 115.9 kW  
 Pulse Charge Power @ 20% DOD<sup>4</sup>: 55.9 kW

##### Constant-Power Discharge Test

Capacity Discharged: 41.9 Ah  
 Energy Discharged: 15.6 kWh

##### NOTES:

1. Vehicle details and battery specifications were either supplied by the manufacturer or derived from a literature review.
2. Not all electric machines (EMs) always provide traction power; one of the EMs is a traction motor while the main role of the other is to act as a generator.
3. Maximum cell charge voltage and minimum cell discharge voltage are based on similar battery chemistries from the same battery manufacturer.
4. Calculated power values based on battery charge and discharge voltage limits (see Note 3) at 80% and 20% DOD for discharge and charge power, respectively.

## Test Results Analysis

Test results for the beginning-of-testing (BOT) battery testing are provided herein. Battery test results include those from the Static Capacity Test and the Electric Vehicle Power Characterization (EVPC) Test, based on recommended test procedures from the United States Advanced Battery Consortium (USABC) at the time of testing.

### Static Capacity Test Results

Static capacity test results are summarized in the fact sheet on the previous page. The test was performed on March 6, 2012 with a vehicle odometer reading of 8,177 miles. The average measured C/3-rate capacity was 41.8 Ah compared with the manufacturer’s rated capacity of 45.0 Ah. The average measured energy capacity was 15.2 kWh.

Figure 1 is a graph of battery voltage versus energy discharged. This graph illustrates the voltage values during the constant-current discharge versus the cumulative energy discharged from the battery at a C/3 discharge rate.

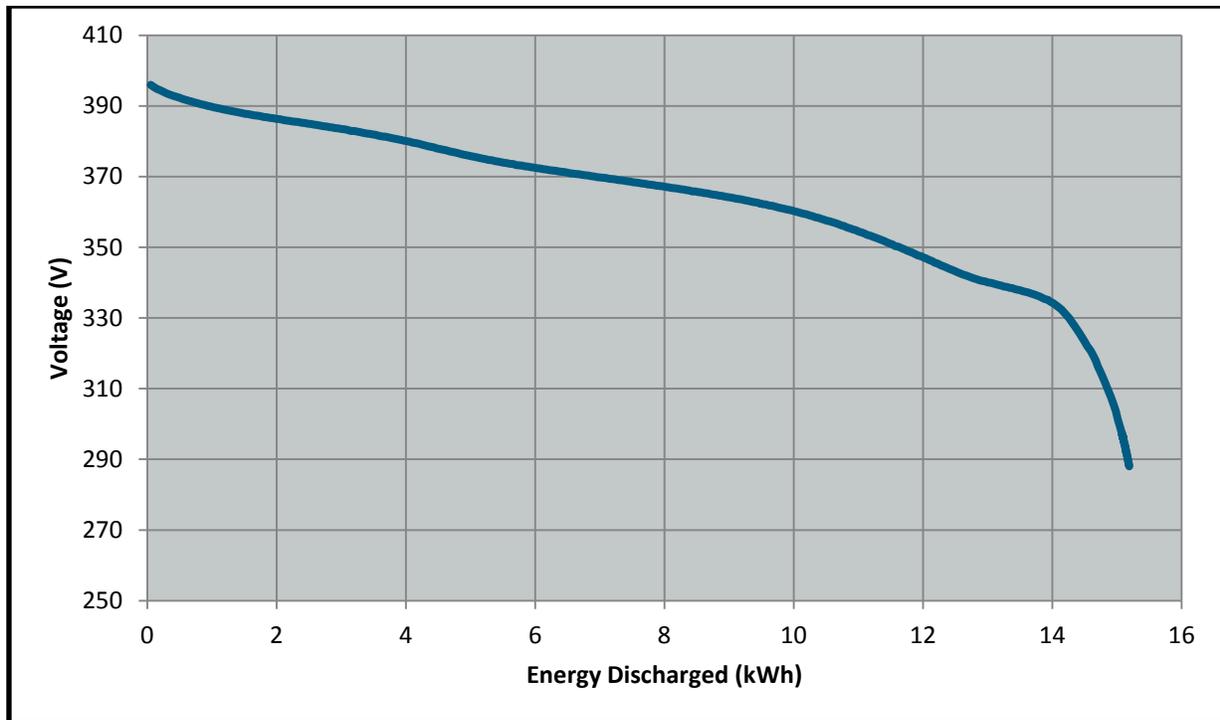


Figure 1: Voltage vs. Energy Discharged

### EVPC Test Results

EVPC test results are summarized in the fact sheet on the first page. The peak pulse discharge power is 115.9 kW at 80% depth of discharge (DOD). The peak pulse charge power is 55.9 kW at 20% DOD. The maximum and minimum cell voltages used for this analysis were 4.15 V and 3.00 V, respectively.

Figures 2 and 3 illustrate the battery's charge and discharge pulse resistance graphs which show internal resistance at various DOD. Each curve represents the resistance at the end of the specified pulse interval.

Figures 4 and 5 illustrate the battery's charge and discharge pulse power graphs which show the useable power at various DOD. Each curve represents the pulse power at the end of the specified pulse interval at the cell voltage limits.

These tests were performed for DOE's Advanced Vehicle Testing Activity (AVTA). The AVTA, part of DOE's Vehicle Technology Program, is conducted by the Idaho National Laboratory and Electric Transportation Engineering Corporation dba ECOTality North America.

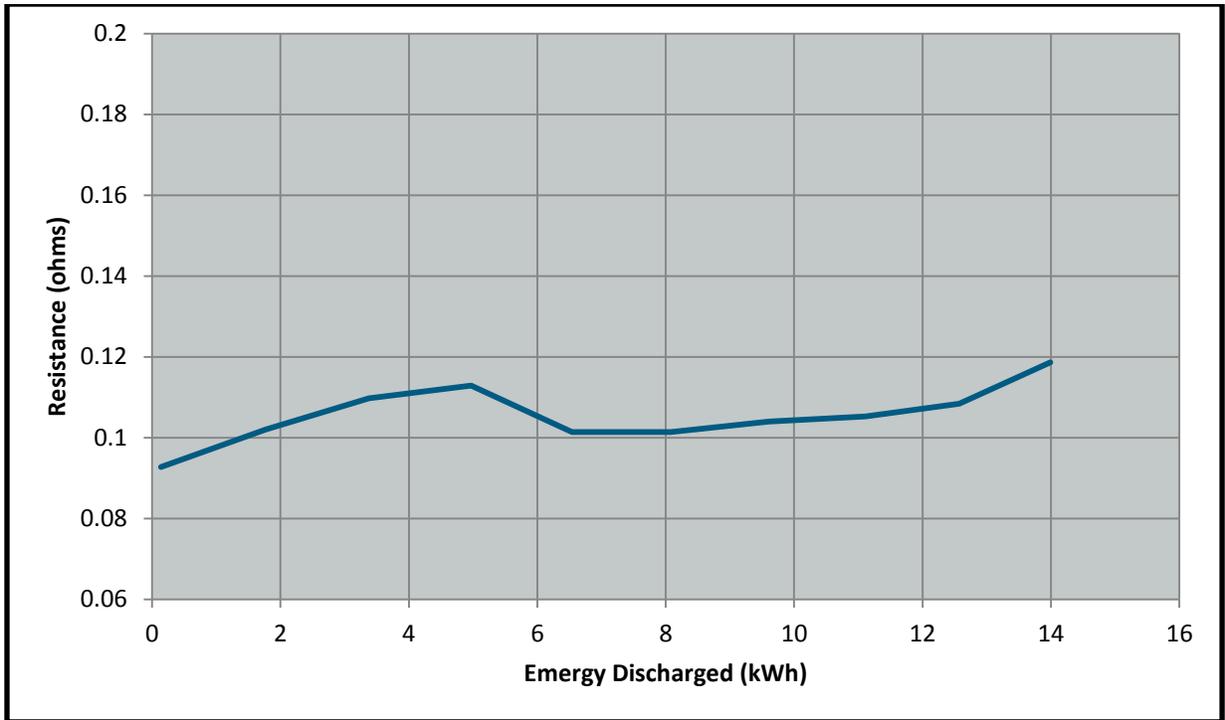


Figure 2: Charge Pulse Resistance vs. Energy Discharged

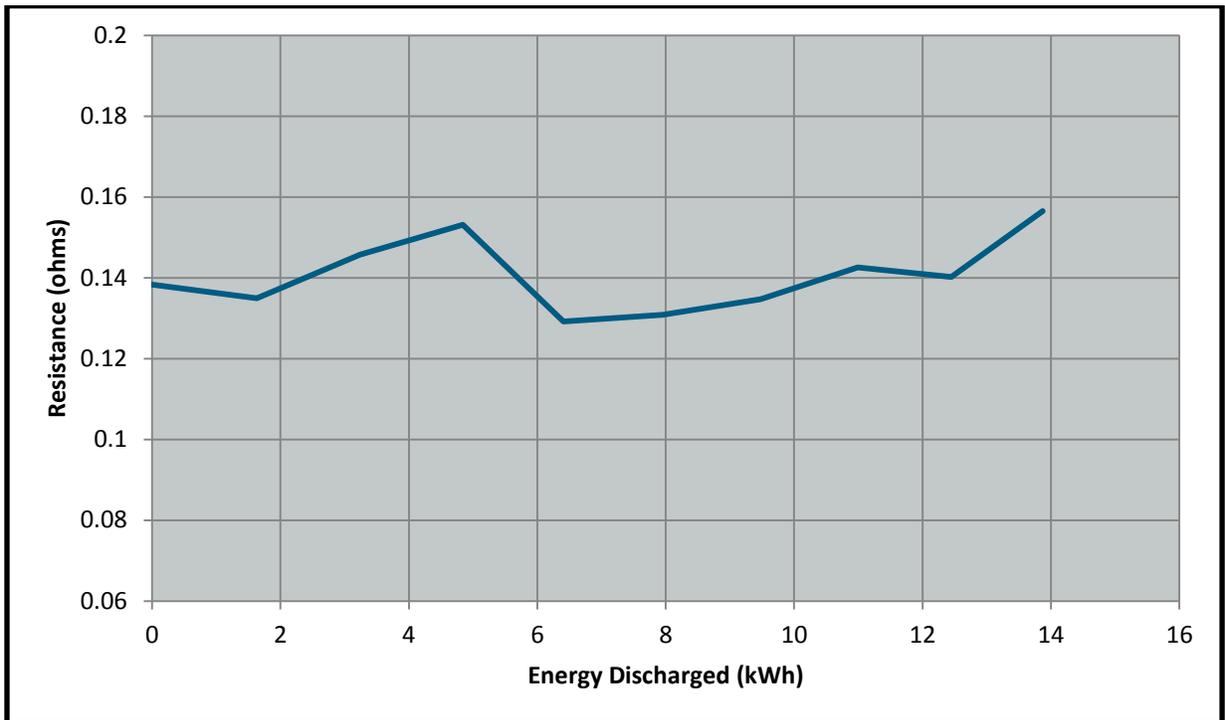


Figure 3: Discharge Pulse Resistance vs. Energy Discharged

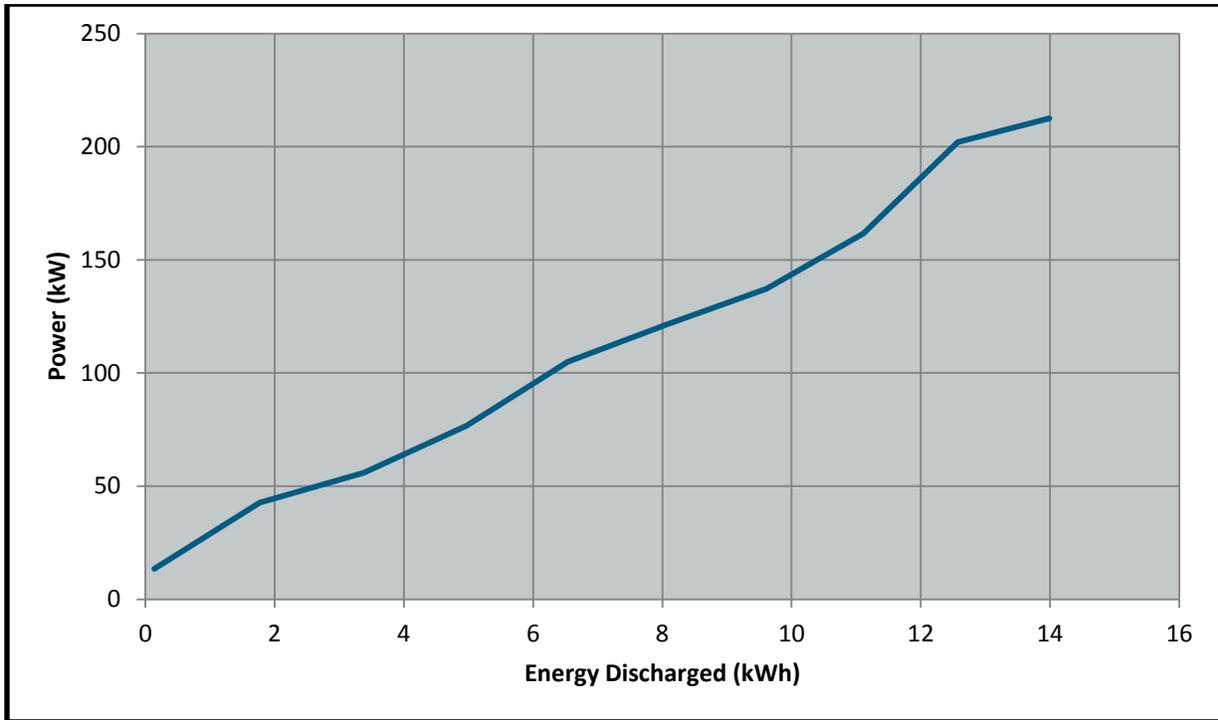


Figure 4: Charge Pulse Power vs. Energy Discharged

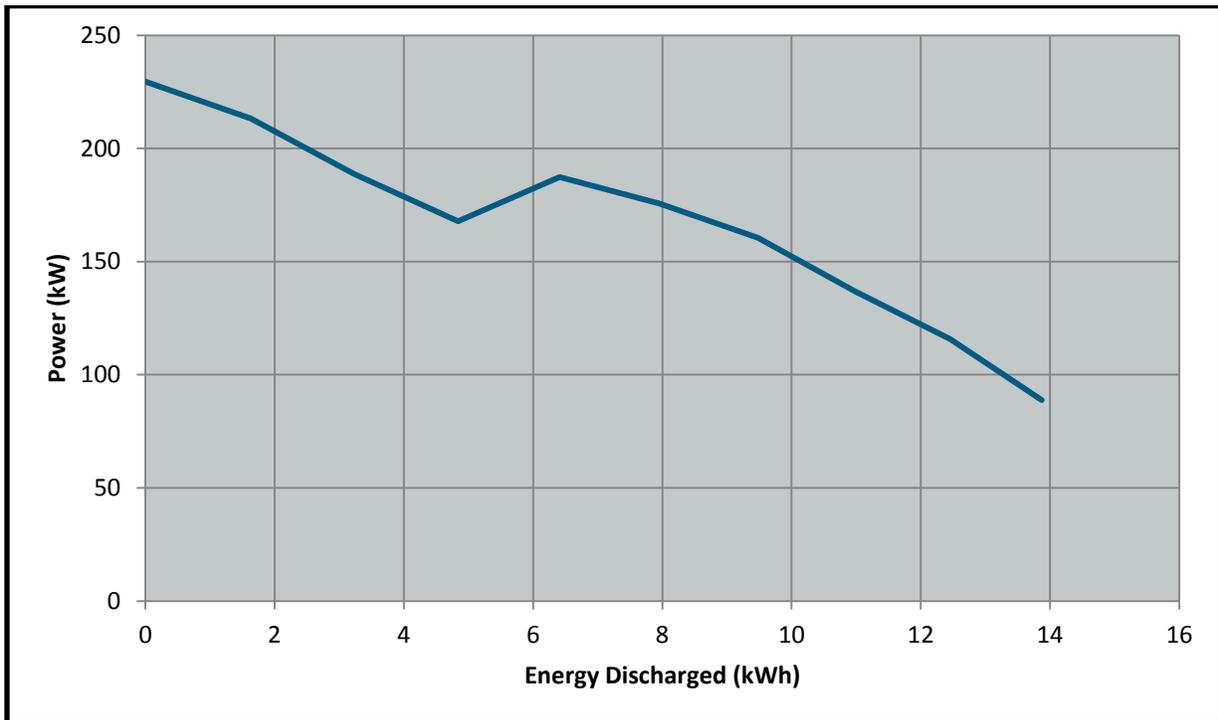


Figure 5: Discharge Pulse Power vs. Energy Discharged