PowerRESPONDER® Cap and ESR Specification Measurement

The capacitance (Cap) and resistance (ESR) values can be measured by cycling a PR device with a constant current from the rated (upper) voltage *Vmax = Ur = 4 V* to some lower value, typically to *Vmin = 2.5V* (*Vr* – rated voltage). Nominal current ranges from 1 to 10 Amps.

The test equipment shall be capable of constant current charging, constant current discharging, and continuous measuring the current and voltage values. The test equipment shall be able to set and measure the current and voltage values with the accuracy of ± 1 % or better. The d.c. voltage recorder shall be capable of conducting measurements and recording with a 1 mV resolution and sampling interval from 10 to 100 ms.

Test sequence: All tests are performed with nominal Current and at room temperature 25C

1. CC Charge to 4V
2. CV for 20min at 4V
3. Rest 30 seconds
4. CC Discharge to 2.5V
5. Rest 30 seconds
6. CC Charge to 4V.
7. CV for 20 min at 4V
8. Rest 30 seconds
9. CC Discharge to 2.5V
10. Rest 30 seconds
11. CC Charge to 3.8V
12. CV for 8 minutes

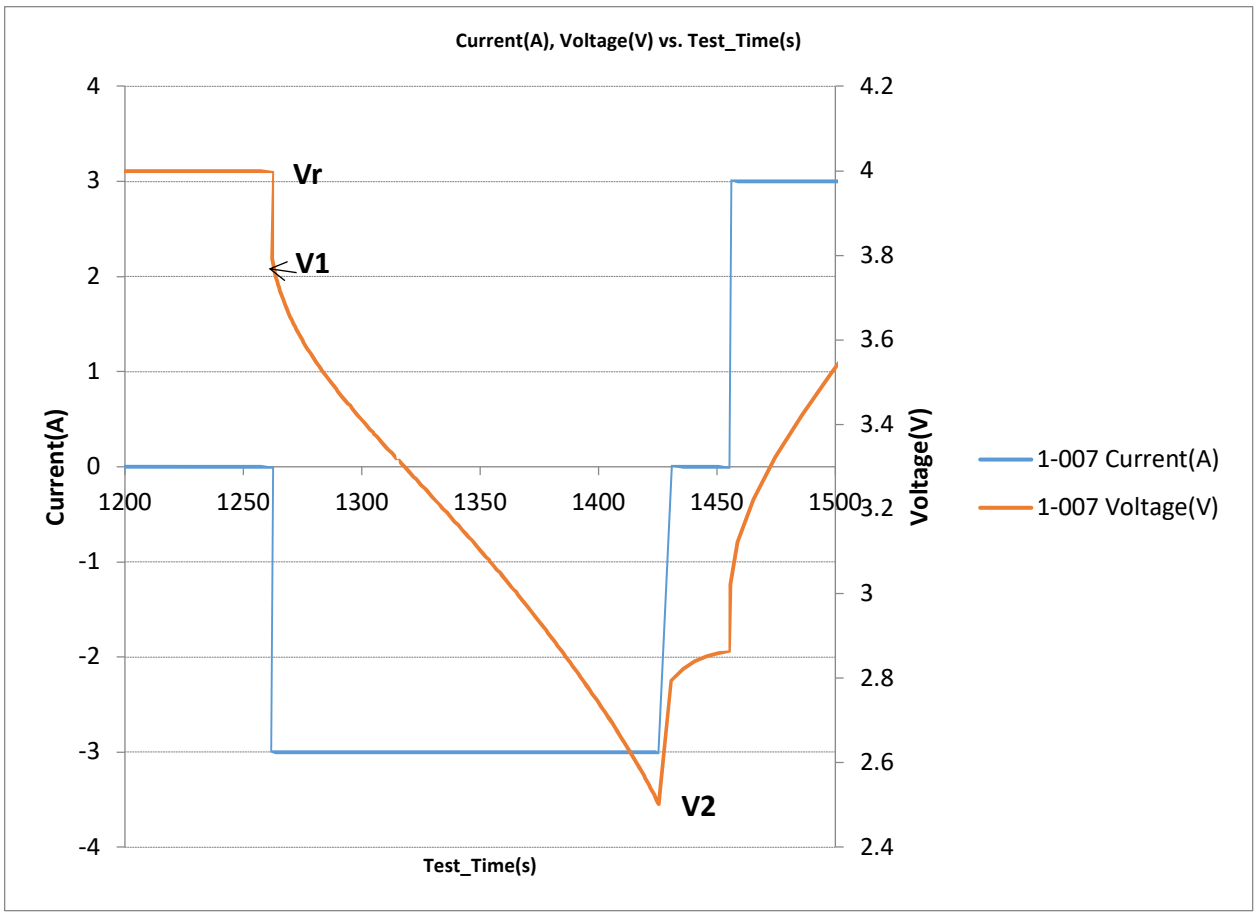
END

Data processing and parameter calculation (calculated from second discharge).

Capacitance (C). PR charge/discharge curves are not expected to be linear, therefore Capacitance should be calculated by the energy conversion capacitance method (refer to Figure below), where:

$$C = \frac{2E}{V1^2 - V2^2}$$

C is the capacitance (in F);
E is the energy (in J taken by equipment) delivered at discharging from the voltage *V1 (after the drop V1=Vr-I*ESR)* to the voltage *V2* (2.5V). *Refer to the figure below.*



Internal resistance (ESR). The internal resistance can be presented as Equivalent Series Resistance (ESR) or as Equivalent Distributed Resistance (EDR) in Ohms or mOhms. We are using ESR value for our Specs recorded in mOhms.

ESR is calculated from the value of voltage drop (see Figure above):

$$ESR\ (m\Omega) = dV/\ I$$

Where dV (in milliVolts) is the difference between the rated Voltage Vr, which is 4.0V and V1, the voltage at discharge after the initial ESR drop. I is the nominal current.