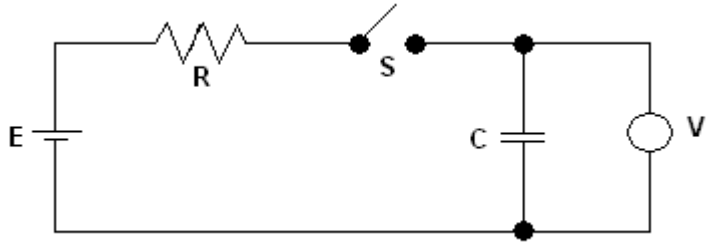
Supercapacitor technical guide

Capacitance

Charge method

Test condition

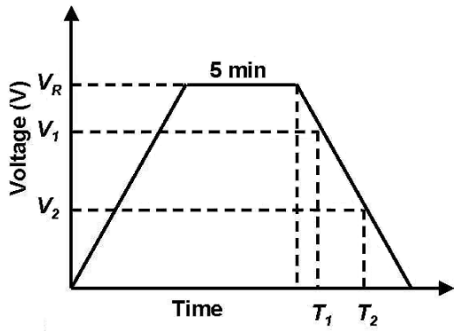
Capacitor voltage less than .05V
Ambient temperature 25°C
T_1= time to reach 63.2% of the applied voltage.



Discharge method

1. Constant current charging 10mA/F to rated voltage.
2. Constant voltage applied for 5 minutes.
3. Constant current discharge at 10mA/F down to 0.1V

$$C = \frac{I*(T_2-T_1)}{V_1-V_2}$$



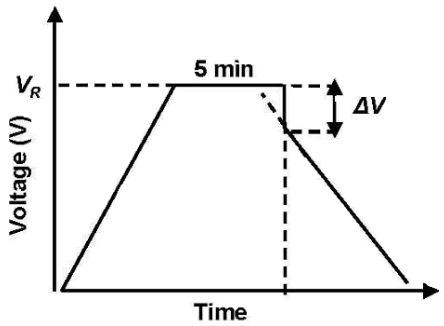
Where C= capacitance in Farads
I = discharge current
V= rated voltage
V_1= 80% or rated voltage
V_2= 40% of rated voltage
T_1= starting time of test
T_2= time to reach V_2

ESR_{AC}

Measured using 4-probe impedance analyzer under the following conditions
Condition: Potentiostat mode
AC amplitude: 5mV
Frequency: 1 kHz, +/-100 Hz

ESR_{DC}

Constant current charging to rated voltage
Hold part at rated voltage for 5 minutes
Constant current discharge to 0.1V



Where R_d is the ESR_{DC} in Ohms
ΔV is the voltage drop after 10mS
I= discharge current

Leakage current

Charge capacitor to rated voltage at 25°C thru a 1k Ohm resistor
Leakage current is measured after specified amount of time for the part being tested.

Maximum current

Current needed for a 1 second discharge from the rated voltage to ½ rated voltage

$$Imax = \frac{1/2V_r}{t/C + R_d} \quad \text{or} \quad Cxdv/dt = Cx(0.5V_r/1) = 0.5xCxV_r$$

Where t= discharge time (1 second)
C= capacitance in farads
$R_d = ESR_{DC}$
Vr= rated voltage

Maximum stored energy

$E_{max} = ½\ CV^2$ (Joules or watt –seconds)

or $E_{max} = \frac{1/2\ CV^2}{3600}$ (Wh)

Gravimetric Specific energy

$$(Wh/kg) = \frac{E_{max}}{\text{Weight (kilograms)}}$$

Specific Power

$V^2 / (4 * ESR_{DC} * \text{Weight or volume})$

Short Circuit Current

$I_{sc} = V_r / ESR_{dc}$