

Supercapacitor technical guide

Capacitance

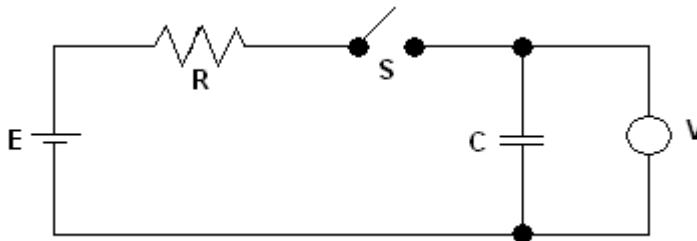
Charge method

Test condition

Capacitor voltage less than .05V

Ambient temperature 25°C

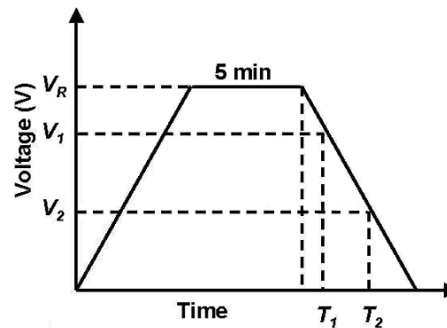
T₁= time to reach 63.2% of the applied voltage.



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

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



Where C= capacitance in Farads
I = discharge current
V= rated voltage
V₁= 80% or rated voltage
V₂= 40% of rated voltage
T₁= starting time of test
T₂= time to reach V₂

ESR_{AC}

Measured using 4-probe impedance analyzer under the following conditions

Condition: Potentiostat mode

AC amplitude: 5mV

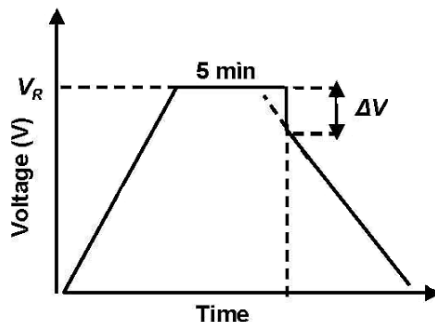
Frequency: 1 kHz, +/-100 Hz

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

$$I_{max} = \frac{1/2 V_r}{t/C + R_d} \quad \text{or} \quad Cx dv/dt = Cx(0.5V_r/1) = 0.5x Cx V_r$$

Where t= discharge time (1 second)

C= capacitance in farads

R_d= ESR_{DC}

V_r= rated voltage

Maximum stored energy

$$E_{max} = \frac{1}{2} CV^2 \text{ (Joules or watt –seconds)}$$

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

Gravimetric Specific energy

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

Specific Power

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

Short Circuit Current

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