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# HS108 / HS208 SUPERCAPACITOR

## Datasheet Rev3.1, May 2013

This Datasheet should be read in conjunction with the CAP-XX Supercapacitors Product Guide which contains information common to our product lines.

## Electrical Specifications

The HS108 is a single cell supercapacitor. The HS208 is a dual cell supercapacitor with two HS108 cells in series, so HS208 capacitance = Capacitance of HS108/2 and HS208 ESR = 2 x HS108 ESR.

**Table 1: Absolute Maximum Ratings**

| Parameter | Name | | Conditions | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|---|
| **Terminal Voltage** | Vpeak | HS108 | | 0 | | 2.9 | V |
| | | HS208 | | | | 5.8 | |
| **Temperature** | Tmax | | | -40 | | +85 | °C |

**Table 2: Electrical Characteristics**

| Parameter | Name | | Conditions | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|---|
| **Terminal Voltage** | Vn | HS108 | | 0 | | 2.75 | V |
| | | HS208 | | 0 | | 5.5 | |
| **Capacitance** | C | HS108 | DC, 23°C | 1440 | 1800 | 2160 | mF |
| | | HS208 | | 720 | 900 | 1080 | |
| **ESR** | ESR | HS108 | DC, 23°C | 20.8 | 26 | 31.2 | mW |
| | | HS208 | | 40 | 50 | 60 | |
| **Leakage Current** | $I_L$ | | 2.75V, 23°C 120hrs | | 3 | 5 | µA |
| **RMS Current** | $I_{RMS}$ | | 23°C | | | 6 | A |
| **Peak Current**[1] | $I_P$ | | 23°C | | | 30 | A |

[1]Non repetitive current, single pulse to discharge fully charged supercapacitor.

**Table 3: Thickness**

| | | | | | |
|---|---|---|---|---|---|
| **HS108F** | **1.70mm** | No adhesive tape on underside of the supercapacitor | **HS108G** | **1.80mm** | Adhesive tape on underside, release tape removed |
| **HS208F** | **3.50mm** | | **HS208G** | **3.60mm** | |

## Definition of Terms

In its simplest form, the Equivalent Series Resistance (ESR) of a capacitor is the real part of the complex impedance. In the time domain, it can be found by applying a step discharge current to a charged cell as in Fig. 1. In this figure, the supercapacitor is pre-charged and then discharged with a current pulse, I =1A for duration 0.01 sec.

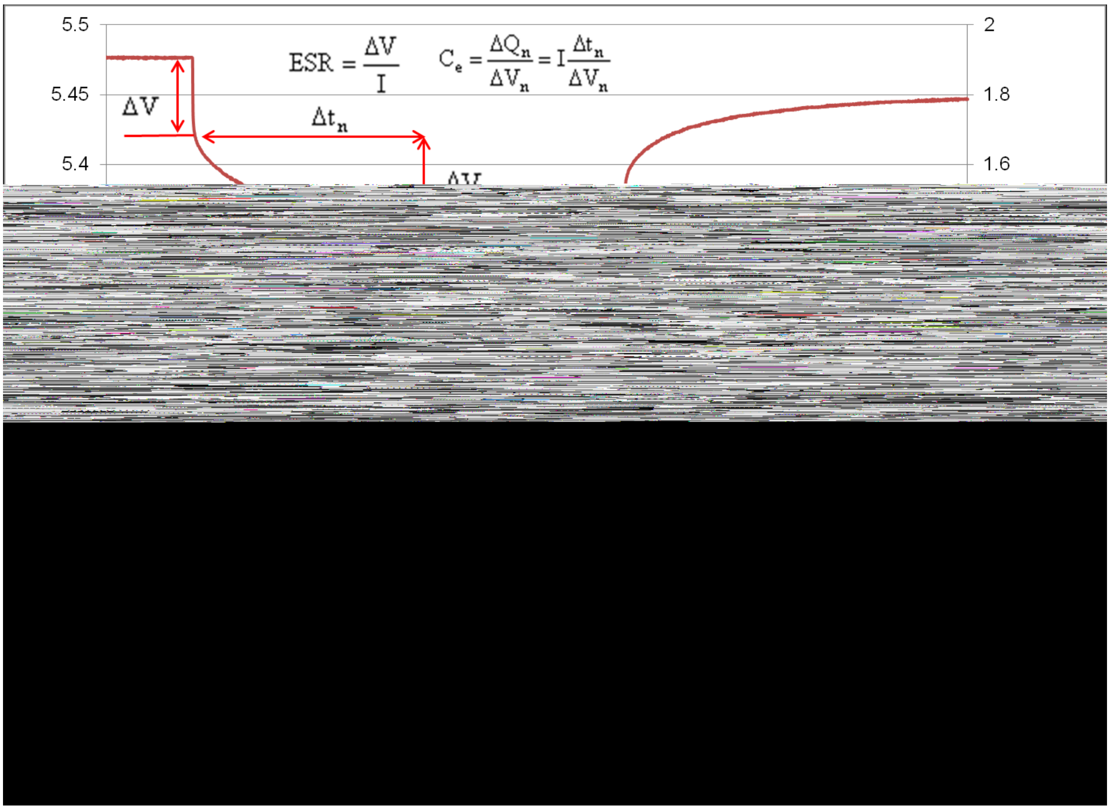


**Figure 1: Effective capacitance, instantaneous capacitance and ESR for an HS208**

The ESR is found by dividing the instantaneous voltage step (æV) by I. In this example = (5.475V-5.426V)/1.02A = 48mÝ.

The instantaneous capacitance ($C_i$) can be found by taking the inverse of the derivative of the voltage, and multiplying it by I.

The effective capacitance for a pulse of duration $Dt_n$, Ce($Dt_n$) is found by dividing the total charge removed from the capacitor (æ$Q_n$) by the voltage lost by the capacitor (æ$V_n$). For constant current Ce($Dt_n$) = I x $Dt_n$/$DV_n$. Ce increases as the pulse width increases and tends to the DC capacitance value as the pulse width becomes very long (~10 secs). After 2msecs, Fig 1 shows the voltage drop $V_{2ms}$ = (5.426 V ï 5.375V) = 51mV. Therefore Ce(2ms) = 1.02A x 2ms/51mV = 40mF. After 10ms, the voltage drop = 5.426 V ï 5.333V = 93mV. Therefore Ce(10ms) = 1.02 A x 10ms/93mV = 0.11F. The DC capacitance of an HS208 = 0.9 F. Note that æV, or IR drop, is not included because very little charge is removed from the capacitor during this time. Ce shows the time response of the capacitor and it is useful for predicting circuit behavior in pulsed applications.