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# HB Supercapacitors

## Cylindrical cells



### Features

- Ultra low ESR for high power density
- UL recognized

### Applications

- Electric, Gas, Water smart meters
- Controllers
- RF radio power
- Solar capture
- Storage servers
- Pulse power
- Backup power

### Description

Eaton supercapacitors are high reliability, high power, ultra-high capacitance energy storage devices utilizing electrochemical double layer capacitor (EDLC) construction combined with proprietary materials and processes. This combination of advanced technologies allows Eaton to offer a wide variety of capacitor solutions tailored to applications for backup power, pulse power and hybrid power systems. They can be applied as the sole energy storage or in combination with batteries to optimize cost, life time and run time. System requirements can range from a few microwatts to megawatts. All products feature low ESR for high power density with environmentally friendly materials for a green power solution. Eaton supercapacitors are maintenance-free with design lifetimes up to 20 years and operating temperatures down to -25 °C and up to +85 °C.



*Powering Business Worldwide*

## Ratings

|                             |                                                                   |
|-----------------------------|-------------------------------------------------------------------|
| Capacitance                 | 3.0 F to 110 F                                                    |
| Maximum working voltage     | 2.5 V                                                             |
| Surge voltage               | 2.8 V                                                             |
| Capacitance tolerance       | -10% to +30% (+20 °C)                                             |
| Operating temperature range | -25 °C to +70 °C                                                  |
| Extended temperature range  | -25 °C to +85 °C (with linear voltage derating to 2.3 V @ +85 °C) |

## Specifications

| Capacitance (F) | Part Number     | Maximum Initial ESR <sup>1</sup><br>(Ω) | Nominal Leakage Current <sup>2</sup><br>(μA) | Stored Energy <sup>3</sup><br>(mWh) | Peak Power <sup>4</sup><br>(W) | Pulse Current <sup>5</sup><br>(A) | Continuous Current <sup>6</sup><br>(A) | Typical Thermal Resistance <sup>7</sup> ,<br>Rth (°C/W) | Short Circuit Current <sup>8</sup><br>(A) |
|-----------------|-----------------|-----------------------------------------|----------------------------------------------|-------------------------------------|--------------------------------|-----------------------------------|----------------------------------------|---------------------------------------------------------|-------------------------------------------|
| 3               | HB0820-2R5305-R | 0.160                                   | 7.0                                          | 2.6                                 | 9.8                            | 1.0                               | 1.1                                    | 76                                                      | 16                                        |
| 5               | HB1020-2R5505-R | 0.100                                   | 11                                           | 4.3                                 | 16                             | 3.0                               | 1.4                                    | 73                                                      | 25                                        |
| 6               | HB0830-2R5605-R | 0.100                                   | 11                                           | 5.2                                 | 16                             | 6.0                               | 1.8                                    | 47                                                      | 25                                        |
| 10              | HB1030-2R5106-R | 0.060                                   | 20                                           | 8.7                                 | 26                             | 5.2                               | 2.5                                    | 40                                                      | 42                                        |
| 15              | HB1325-2R5156-R | 0.050                                   | 22                                           | 13                                  | 31                             | 9.3                               | 2.4                                    | 53                                                      | 50                                        |
| 25              | HB1625-2R5256-R | 0.040                                   | 28                                           | 22                                  | 39                             | 13                                | 2.8                                    | 47                                                      | 63                                        |
| 35              | HB1635-2R5356-R | 0.030                                   | 32                                           | 30                                  | 52                             | 19                                | 3.6                                    | 39                                                      | 83                                        |
| 60              | HB1840-2R5606-R | 0.025                                   | 47                                           | 52                                  | 63                             | 26                                | 4.8                                    | 26                                                      | 100                                       |
| 110             | HB1860-2R5117-R | 0.020                                   | 180                                          | 95                                  | 78                             | 24                                | 8.7                                    | 10                                                      | 125**                                     |

\*\* Repeated short circuit current will permanently damage the leads and cause an open failure.

## Performance

| Parameter                                | Capacitance change<br>(% of initial value) | ESR<br>(% of maximum initial value) |
|------------------------------------------|--------------------------------------------|-------------------------------------|
| Life (1000 hours @ +70 °C @ 2.5 Vdc)     | ≤ 30%                                      | ≤ 200%                              |
| Storage (3 years, uncharged, <+35 °C)    | ≤ 5%                                       | ≤ 110%                              |
| Cycle Life <sup>9</sup> (500,000 cycles) | ≤ 30%                                      | ≤ 200%                              |

1. Capacitance and Equivalent Series Resistance (ESR) measured according to IEC62391-1 at +20 °C, with current in milliamps (mA) = 8°C\*V

2. Leakage current at 20 °C after 72 hour charge and hold

3. Energy (mWh) =  $\frac{1}{2} \cdot C \cdot V^2 \cdot 1000$   
3600

4. Peak Power (W) =  $\frac{V^2}{4 \cdot \text{ESR}}$

5. Pulse Current in Amps (A), 1 second discharge from rated voltage to half rated voltage =  $\frac{1}{2} \cdot C \cdot V$   
(1+ESR\*C)

6. Continuous current with a 15 °C temperature rise. Continuous current (A) =  $\sqrt{\frac{\Delta T}{\text{ESR} \cdot R_{th}}}$

7. Thermal resistance (Rth) cell body temperature to ambient in open air in degrees C per Watt (°C/W)

8. Short circuit current is for safety information only. Do not use as operating current.

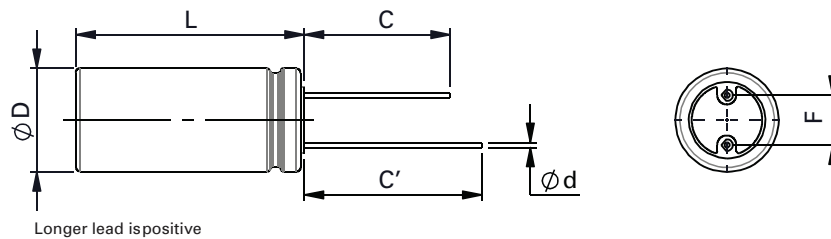
9. Cycling between rated voltage and half voltage, 3 seconds rest at +20 °C

## Safety and Certifications

|            |                                             |
|------------|---------------------------------------------|
| Regulatory | UL810a,RoHS                                 |
| Warnings   | Do not overvoltage, do not reverse polarity |
| Shipping   | UN3499, <0.3Wh, Non-hazardous goods         |

## Dimensions (mm)

| Part Number     | ØD nominal | ØD maximum | L maximum | F ±0.50 | Ød ±0.02 | C minimum | C' minimum | Typical mass (grams/pieces) |
|-----------------|------------|------------|-----------|---------|----------|-----------|------------|-----------------------------|
| HB0820-2R5305-R | 8          | 8.5        | 21        | 3.5     | 0.5      | 20        | 25         | 1.5                         |
| HB1020-2R5505-R | 10         | 10.5       | 22.3      | 5       | 0.6      | 20        | 25         | 2.4                         |
| HB0830-2R5605-R | 8          | 8.5        | 31        | 3.5     | 0.5      | 20        | 25         | 2.4                         |
| HB1030-2R5106-R | 10         | 10.5       | 31.5      | 5       | 0.6      | 20        | 25         | 3.5                         |
| HB1325-2R5156-R | 13         | 13.5       | 28.4      | 5       | 0.6      | 20        | 25         | 4.8                         |
| HB1625-2R5256-R | 16         | 16.5       | 28.4      | 7.5     | 0.8      | 20        | 25         | 8.2                         |
| HB1635-2R5356-R | 16         | 16.5       | 38        | 7.5     | 0.8      | 20        | 25         | 9.8                         |
| HB1840-2R5606-R | 18         | 18.5       | 42        | 7.5     | 0.8      | 20        | 25         | 13.8                        |
| HB1860-2R5117-R | 18         | 18.5       | 60.5      | 7.5     | 0.8      | 20        | 25         | 22                          |



## Part numbering system

| HB               | 1860                | -2R5        | 11                         | 7                                              | -R               |
|------------------|---------------------|-------------|----------------------------|------------------------------------------------|------------------|
| Family Code      | Size reference (mm) |             | Voltage (V)<br>R = decimal | Capacitance (µF)<br>Value                      | Multiplier       |
| HB = Family Code | Diameter = 18       | Length = 60 | 2R5 = 2.5 V                | Example 117 = 11 x 10 <sup>7</sup> µF or 110 F |                  |
|                  |                     |             |                            |                                                | Standard product |

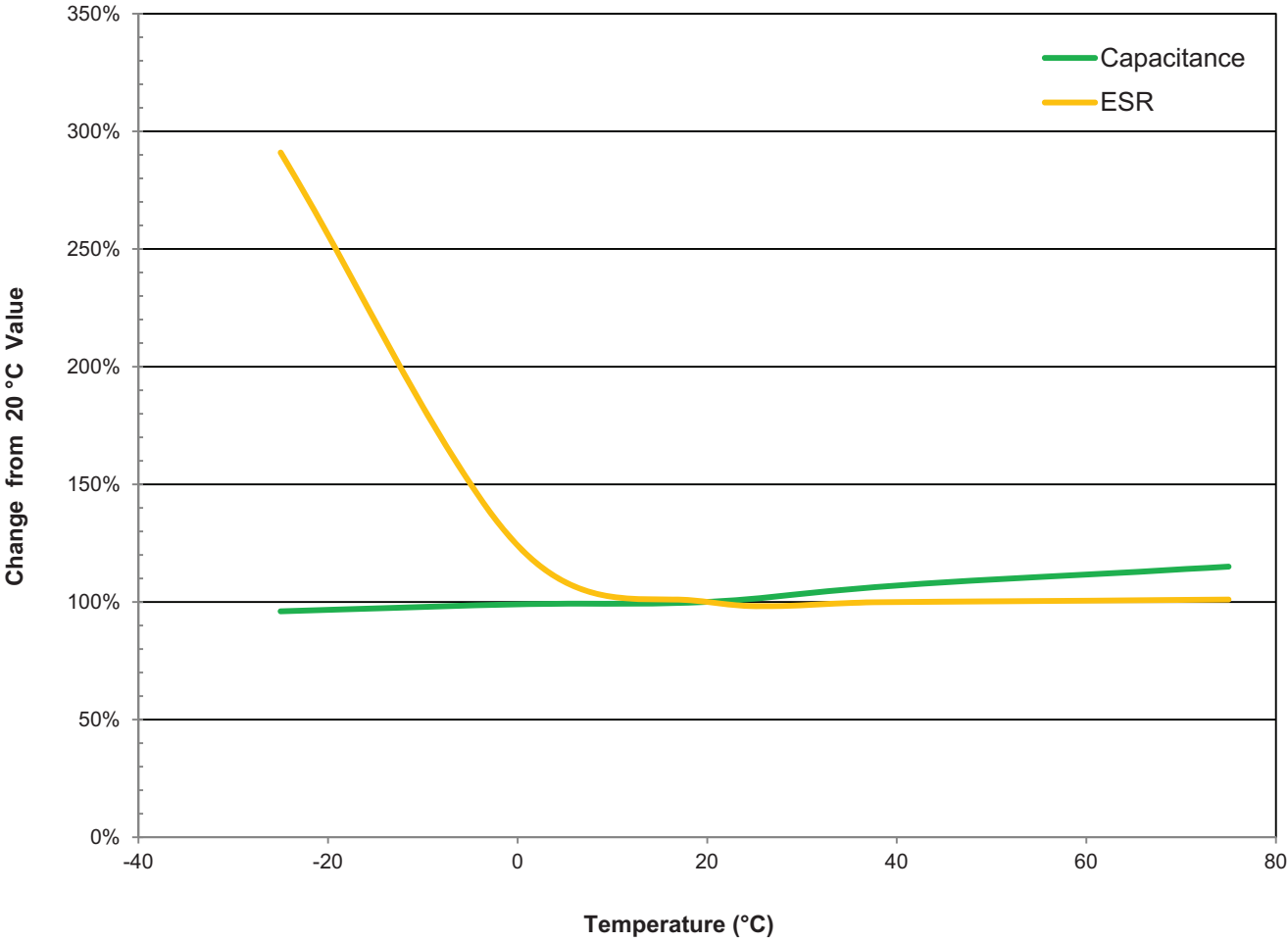
## Packaging information

- Standard packaging: Bulk, 100 units per bag (8 mm - 13 mm diameter)
- 16 mm - 18 mm diameter products: Bulk package quantity varies by size.

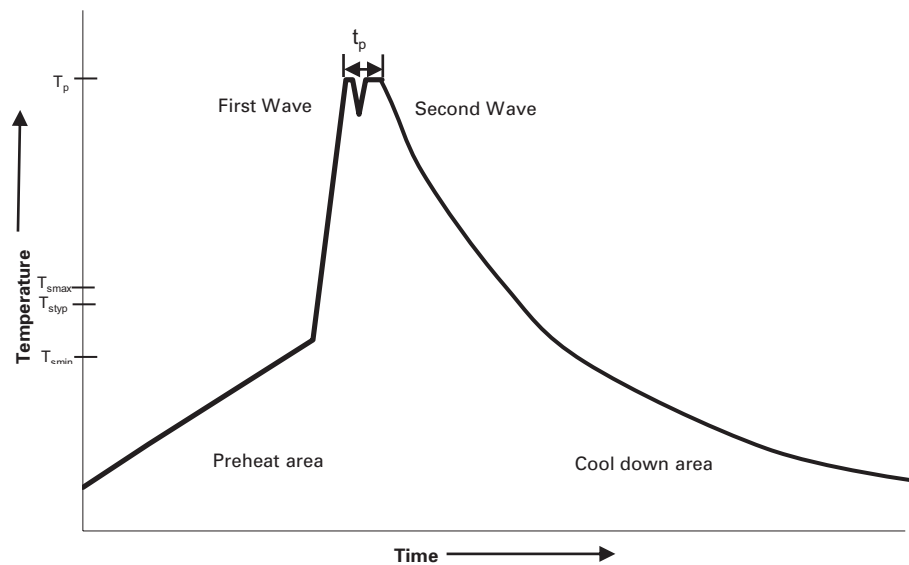
## Part marking

- Manufacturer
- Capacitance (F)
- Nominal working voltage (V)
- Family code (or part number)
- Polarity

Temperature vs. Capacitance and ESR



## Wave solder profile



| Profile Feature                     | Standard SnPb Solder                      | Lead (Pb) Free Solder                     |
|-------------------------------------|-------------------------------------------|-------------------------------------------|
| Preheat and soak                    |                                           |                                           |
| • Temperature max. ( $T_{smax}$ )   | 100 °C                                    | 100 °C                                    |
| • Time max.                         | 60 seconds                                | 60 seconds                                |
| $\Delta$ preheat to max Temperature | 160 °C max.                               | 160 °C max.                               |
| Peak temperature ( $T_p$ )*         | 220 °C – 260 °C                           | 250 °C – 260 °C                           |
| Time at peak temperature ( $t_p$ )  | 10 seconds max<br>5 seconds max each wave | 10 seconds max<br>5 seconds max each wave |
| Ramp-down rate                      | ~ 2 K/s min<br>~3.5 K/s typ<br>~5 K/s max | ~ 2 K/s min<br>~3.5 K/s typ<br>~5 K/s max |
| Time 25 °C to 25 °C                 | 4 minutes                                 | 4 minutes                                 |

## Manual solder

+350 °C, 4-5 seconds. (by soldering iron), generally manual, hand soldering is not recommended.

## Reflow soldering

Do not use reflow soldering using infrared or convection oven heating methods.

## Cleaning/Washing

Avoid cleaning of circuit boards, however if the circuit board must be cleaned use static or ultrasonic immersion in a standard circuit board cleaning fluid for no more than 5 minutes and a maximum temperature of +60 °C. Afterwards thoroughly rinse and dry the circuit boards. In general, treat supercapacitors in the same manner you would an aluminum electrolytic capacitor.

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