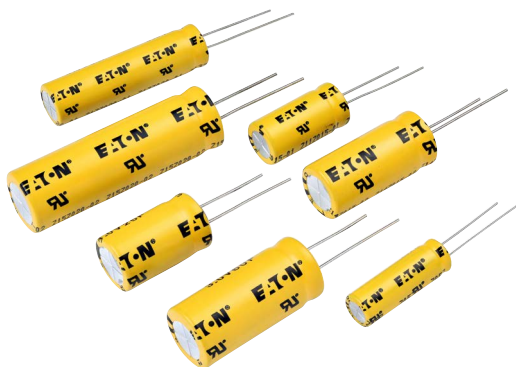


# TV Supercapacitors

## Cylindrical cells



### Description

Eaton supercapacitors are high reliability, high power, ultra-high capacitance energy storage devices utilizing electric 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 -40 °C and up to +85 °C.

### Features

- 3.0 V operating voltage for high power and high energy
- Ultra low ESR for high power density
- Large capacitance for high energy density
- UL recognized

### Applications

- Electric, Gas, Water smart meters
- RF radio pulse power
- Storage server
- Industrial backup / ride through
- Pulse power
- Solar capture

### Environmental compliance



### Agency information



\* Supercapacitor lifetimes vary based on charge voltage and temperature. See Eaton's application guidelines or contact your local Eaton sales representative for more information on lifetime estimates



Powering Business Worldwide

## Ratings<sup>10</sup>

|                             |   |
|-----------------------------|---|
| Capacitance                 | 3.3 F to 100 F  |
| Maximum working voltage     | 3.0 V   |
| Surge voltage               | 3.3 V   |
| Capacitance tolerance       | -10% to +30% (+20 °C)   |
| Operating temperature range | -40 °C to +65 °C  |
| Extended temperature range  | -40 °C to +85 °C (with linear voltage derating to 2.5 V @ +85 °C) |

## Specifications

| Capacitance (F) | Part number     | Maximum initial ESR <sup>1</sup> (Ω) | Nominal leakage current <sup>1,2</sup> (μA) | Stored energy <sup>3</sup> (mWh) | Peak power <sup>4</sup> (W) | Pulse current <sup>5</sup> (A) | Continuous current <sup>6</sup> (A) | Typical thermal resistance <sup>7</sup> Rth (°C/W) | Short circuit current <sup>8</sup> (A) |
|-----------------|-----------------|--------------------------------------|---|----------------------------------|-----------------------------|--------------------------------|-------------------------------------|--|--|
| 3.3             | TV0820-3R0335-R | 0.075                                | 15  | 3.75                             | 30                          | 3.7                            | 1.6                                 | 76   | 40                                     |
| 6               | TV1020-3R0605-R | 0.035                                | 13  | 7.5                              | 64.3                        | 7.4                            | 2.4                                 | 73   | 86                                     |
| 10              | TV1030-3R0106-R | 0.026                                | 25  | 12.5                             | 86.5                        | 12                             | 3.7                                 | 40   | 115                                    |
| 15              | TV1325-3R0156-R | 0.024                                | 35  | 18.8                             | 94                          | 17                             | 3.4                                 | 53   | 125                                    |
| 25              | TV1625-3R0256-R | 0.018                                | 60  | 31.3                             | 125                         | 26                             | 4.2                                 | 47   | 167                                    |
| 30              | TV1633-3R0306-R | 0.017                                | 70  | 37.5                             | 132                         | 30                             | 4.5                                 | 43   | 176                                    |
| 34              | TV1245-3R0346-R | 0.016                                | 75  | 42.5                             | 141                         | 33                             | 6.5                                 | 22   | 188**                                  |
| 35              | TV1635-3R0356-R | 0.015                                | 90  | 43.8                             | 150                         | 34                             | 5.1                                 | 39   | 200**                                  |
| 60              | TV1840-3R0606-R | 0.013                                | 135   | 75                               | 173                         | 51                             | 6.7                                 | 26   | 231**                                  |
| 100             | TV1860-3R0107-R | 0.011                                | 225   | 125                              | 205                         | 71                             | 11.7                                | 10   | 273**                                  |

\*\* Repeated short circuit current will permanently damage the leads.

## Performance

| Parameter  | Capacitance change (% of initial value) | ESR (% of maximum initial value) |
|--|---|----------------------------------|
| Lifetime: (1000 hours at maximum temperature and voltage)  | ≤ 30%                                   | ≤ 200%                           |
| Charge/Discharge Cycles <sup>9</sup> : (500,000 at +20 °C) | ≤ 30%                                   | ≤ 200%                           |
| Storage: (3 years, uncharged, <35 °C)                      | ≤ 5%                                    | ≤ 10%                            |

1. Capacitance, Equivalent Series Resistance (ESR) and Leakage current are measured according to IEC62391-1 with current in milliamps (mA) =  $8 \times C \times V$ .

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

3. Stored Energy (mWh) =  $\frac{0.5 \times C \times V^2}{3600} \times 1000$

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

5. Pulse current for 1 second from full rate voltage to half voltage.(A) =  $\frac{0.5 \times V \times C}{(1 + \text{ESR} \times C)}$

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

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 second rest at +20 °C.

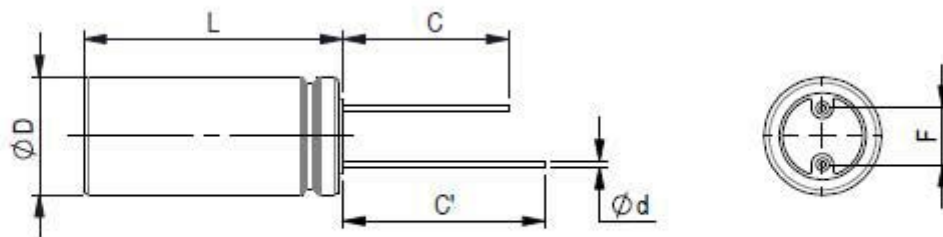
10. Testing and verification of product under end application conditions is recommended

## Safety and certifications

|                     |  |
|---------------------|--|
| Regulatory          | UL810a, RoHS, REACH  |
| Shock and vibration | MIL-STD 202G   |
| Warnings            | Do not overvoltage, do not reverse polarity                |
| Shipping            | No restrictions, per UN3499 with all cells <0.3 watt-hours |

## Dimensions (mm) and mass (g)

| Part number     | ØD maximum | L maximum | F ±0.5 | Ød ±0.02 | C minimum | C' minimum | Mass (typical) |
|-----------------|------------|-----------|--------|----------|-----------|------------|----------------|
| TV0820-3R0335-R | 8.5        | 21        | 3.5    | 0.5      | 20        | 25         | 1.4            |
| TV1020-3R0605-R | 10.5       | 22.3      | 5      | 0.6      | 20        | 25         | 2.3            |
| TV1030-3R0106-R | 10.5       | 31.5      | 5      | 0.6      | 20        | 25         | 3.2            |
| TV1325-3R0156-R | 13.5       | 28.4      | 5      | 0.6      | 20        | 25         | 4.5            |
| TV1625-3R0256-R | 16.5       | 28.9      | 7.5    | 0.8      | 20        | 25         | 7.3            |
| TV1633-3R0306-R | 16.5       | 33        | 7.5    | 0.8      | 20        | 25         | 8.3            |
| TV1245-3R0346-R | 12.9       | 49        | 5      | 0.6      | 20        | 25         | 8              |
| TV1635-3R0356-R | 16.5       | 38        | 7.5    | 0.8      | 20        | 25         | 9.3            |
| TV1840-3R0606-R | 18.5       | 42        | 7.5    | 0.8      | 20        | 25         | 13             |
| TV1860-3R0107-R | 18.5       | 60.5      | 7.5    | 0.8      | 20        | 25         | 20             |



Longer lead is positive

## Part numbering system

| TV               | 1860                |             | -3R0                       | 60  | 6          | -R               |
|------------------|---------------------|-------------|----------------------------|---|------------|------------------|
| Family code      | Size reference (mm) |             | Voltage (V)<br>R = decimal | Capacitance (μF)<br>value                     | Multiplier | Standard product |
| TV = Family code | Diameter = 18       | Length = 60 | 3R0 = 3.0 V                | Example 606= 60 x 10 <sup>6</sup> μF o r 60 F |            |                  |

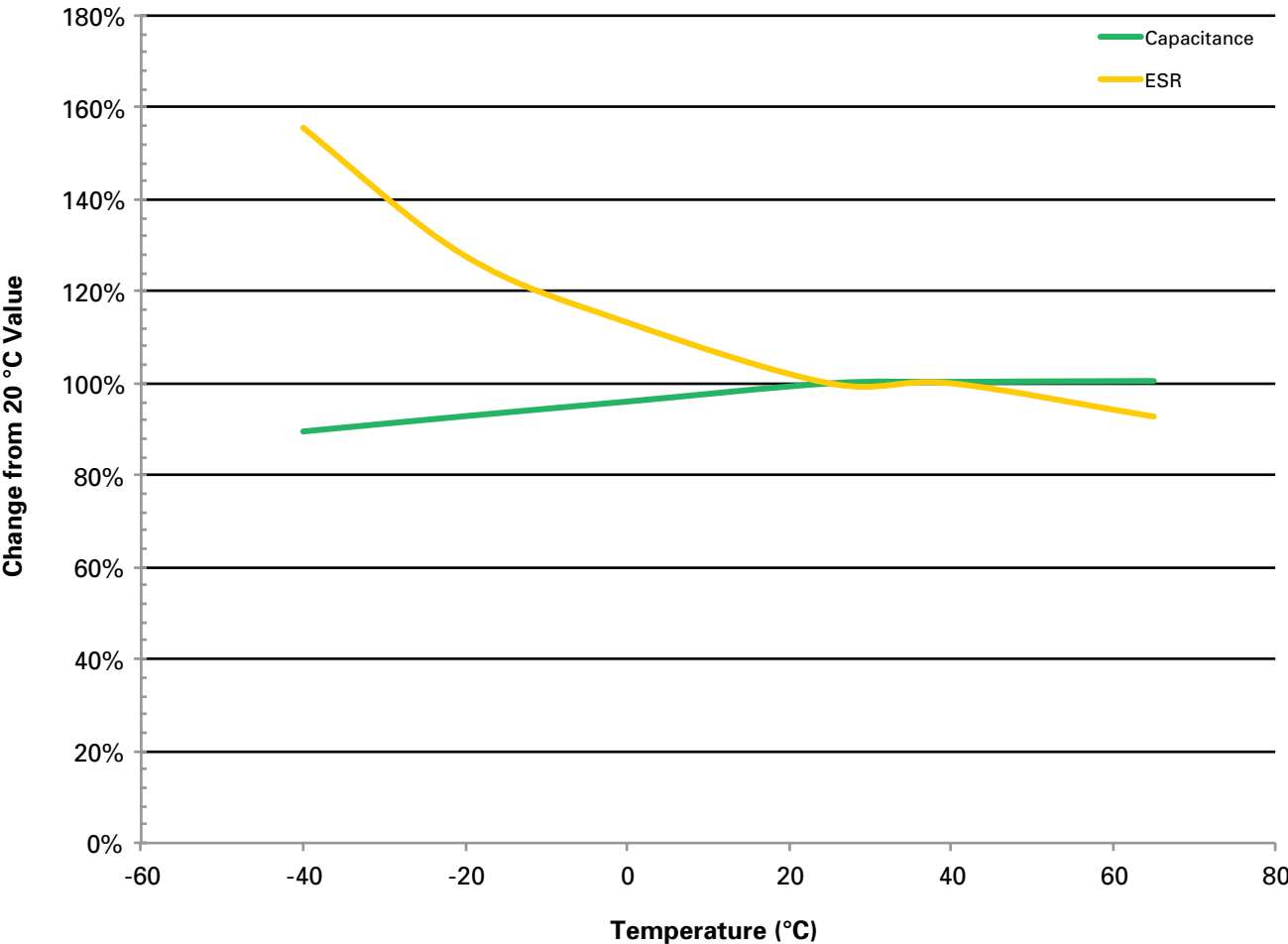
## Packaging information

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

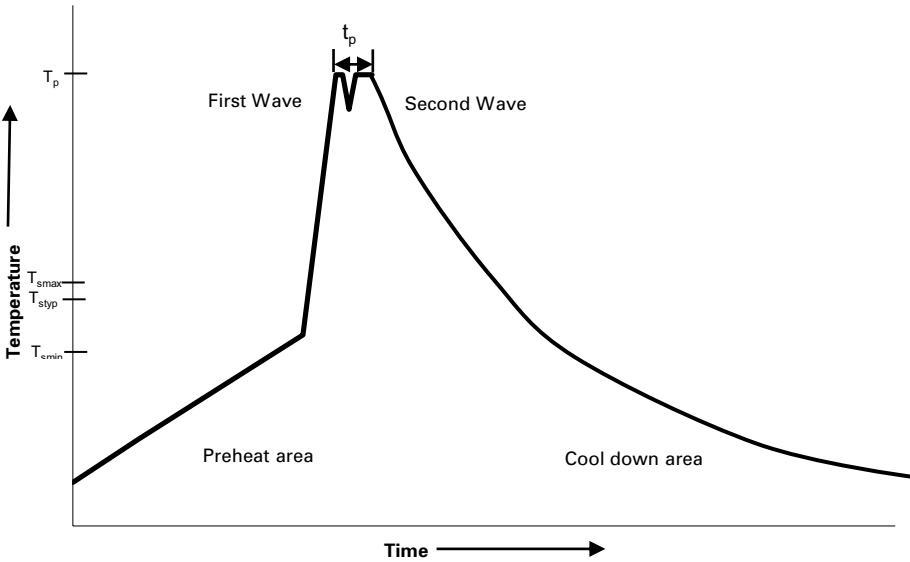
## Part marking

- Eaton logo
- Capacitance value (F)
- Maximum operating voltage (V)
- TV Supercapacitors
- Polarity mark
- UL recognition Ru symbol
- date code ywwwydd-nn
  - y=year code for cell build (z=2016)
  - www=work week for cell build
  - y=year code for electrode (z=2016)
  - ddd=serial day of year for electrode build
  - nn=number of lot in the day

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.

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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