

SKELE+ON TECHNOLOGIES



DATA SHEETS

SkelCap

ULTRACAPACITORS

SCK3000 and SCH3400 weldable cells,
SCL3000 and SCI3400 threaded terminal cells

DATA SHEET

SkelCap

ULTRACAPACITOR

- + Capacitance 3000 F
- + Extreme power density
- + Durable and safe aluminum casings
- + Non-Threaded terminals
- + High cycle life >1,000,000 cycles
- + RoHS & UL810A compliant



| GENERAL SPECIFICATIONS | VALUE | UNIT |
|--------------------------|-------|-------|
| Rated voltage V_R | 2.85 | V |
| Surge voltage V_S | 3.0 | V |
| Specific energy | 6.7 | Wh/kg |
| Nominal specific power | 24 | kW/kg |
| Practical specific power | 18 | kW/kg |

| TEMPERATURE AND LIFE | VALUE | UNIT |
|---|-----------|--------|
| Operating temperature range | | |
| Minimum | -40 | °C |
| Maximum | +65 | °C |
| Storage temperature range (uncharged) | | |
| Minimum | -40 | °C |
| Maximum | +50 | °C |
| Life | | |
| Lifetime at V_R and +65 °C | 1500 | Hours |
| Capacitance decrease 20% against rated value; | | |
| 1s ESR increase 100% against rated value | | |
| Storage life @ RT, uncharged | 10 | Years |
| Cyclelife @ RT, between V_R and $V_R/2$ | 1,000,000 | Cycles |

| GENERAL | VALUE | UNIT |
|----------------------------------|-------|------|
| Rated capacitance | 3000 | F |
| Total (5s) DC ESR, Rated at 150A | 0.25 | mΩ |
| DC 1s ESR, rated at 50A | 0.22 | mΩ |
| DC 10ms ESR, rated at 50A | 0.17 | mΩ |

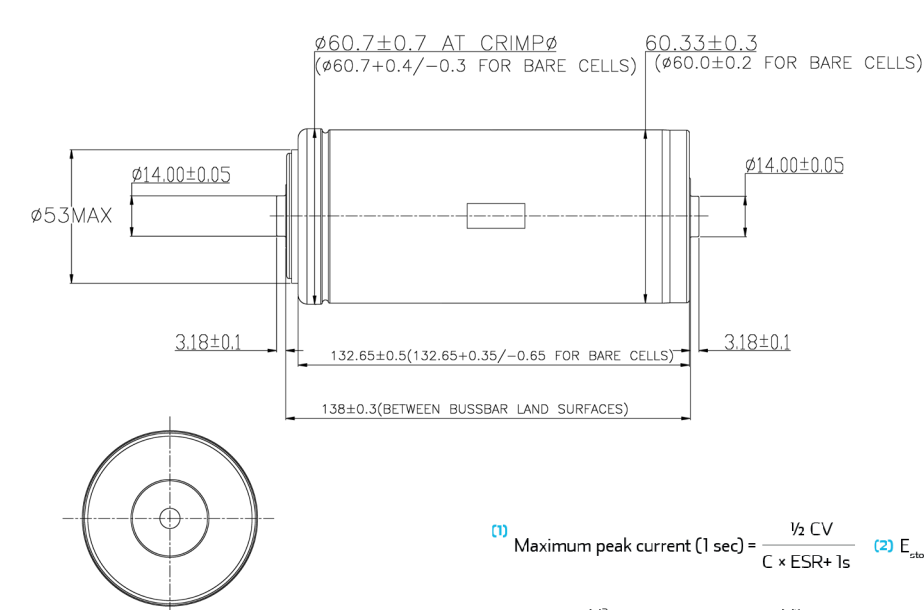
| ENERGY | VALUE | UNIT |
|------------------------------|-------|-------|
| Stored energy ² | 3.38 | Wh |
| Specific energy ³ | 6.7 | Wh/kg |
| Energy density ⁴ | 8.7 | Wh/L |

| POWER* | VALUE | UNIT |
|--|-------|-------|
| Nominal power*, calculated from 10 ms ESR (for comparison) | | |
| Specific power, matched Impedance ⁶ | 23.8 | kW/kg |
| Power density, matched Impedance ⁷ | 30.6 | kW/L |
| Practical power*, calculated from 1 s ESR (for engineering) | | |
| Power, matched impedance ⁵ | 9.2 | kW |
| Specific power, matched Impedance ⁶ | 18.4 | kW/kg |
| Power density, matched impedance ⁷ | 23.7 | kW/L |

| STANDARDS AND CERTIFICATIONS | | |
|------------------------------|--------------------------|--|
| Vibration Specification | ISO 16750-3 Table 12 | |
| Shock Resistance | IEC60068-2-27 Shock Test | |
| Certifications | RoHS | |
| Standards | REACH, UL810A | |

| THERMAL* | VALUE | UNIT |
|--|-------|-------|
| Thermal resistance, R _{ca} , typical | 4 | °C/W |
| Thermal capacitance, C _{th} , typical | 0.58 | kJ/°C |
| Max continuous current, ΔT = 15°C ⁸ | 131 | A |
| Max continuous current, ΔT = 40°C ⁸ | 213 | A |

| PHYSICAL PARAMETERS | VALUE | UNIT |
|---------------------|-------|------|
| Mass. Typical | 0.50 | kg |
| Volume | 0.39 | L |
| Diameter | 60 | mm |
| Length | 138 | mm |



*Power values calculated using DC 10ms ESR ≈ AC 100Hz.

- Standard markings**
- + Name of manufacturer, part number, serial number, rated voltage
 - + Rated capacitance, negative and positive terminals, warning marking
 - + Total energy in watt-hours

- Notes**
- + Testing instructions available on www.skeletontech.com
 - + All information provided on this data sheet and all subsequent ultracapacitors sales and testing are subject to Standard Terms of Service (ToS) available on www.skeletontech.com, document General Terms of Sale for Skeleton Technologies OÜ.

(1)
Maximum peak current (1 sec) =
$$\frac{\frac{1}{2} CV}{C \times \text{ESR} + 1s}$$

(2)
E_{stored} =
$$\frac{\frac{1}{2} CV^2}{3,600}$$

(3)
E_{max} =
$$\frac{\frac{1}{2} CV^2}{3,600 \times \text{mass}}$$

(4)
E_{max} =
$$\frac{\frac{1}{2} CV^2}{3,600 \times \text{volume}}$$

(5)
P_{max} =
$$\frac{V^2}{4 \times \text{ESR}}$$

(6)
P_{max} =
$$\frac{V^2}{4 \times \text{ESR} \times \text{mass}}$$

(7)
P_{max} =
$$\frac{V^2}{4 \times \text{ESR} \times \text{volume}}$$

(8)
I_{max} =
$$\sqrt{\frac{\Delta T}{\text{ESR} \times R_{\theta}}}$$

DATA SHEET

SkelCap

ULTRACAPACITOR

- + Capacitance 3400 F
- + Extreme power density
- + Durable and safe aluminum casings
- + Non-Threaded terminals
- + High cycle life >1,000,000 cycles
- + RoHS & UL810A compliant



| GENERAL SPECIFICATIONS | VALUE | UNIT |
|--------------------------|-------|-------|
| Rated voltage V_R | 3.0 | V |
| Surge voltage V_S | 3.0 | V |
| Specific energy | 8.4 | Wh/kg |
| Nominal specific power | 28 | kW/kg |
| Practical specific power | 22 | kW/kg |

| TEMPERATURE AND LIFE | VALUE | UNIT |
|---|-----------|--------|
| Operating temperature range | | |
| Minimum | -40 | °C |
| Maximum | +65 | °C |
| Storage temperature range (uncharged) | | |
| Minimum | -40 | °C |
| Maximum | +50 | °C |
| Life | | |
| Lifetime at V_R and +65 °C | 1500 | Hours |
| Capacitance decrease 25% against rated value; 1s ESR increase 100% against rated value | | |
| Storage life @ RT, uncharged | 10 | Years |
| Cyclelife @ RT, between V_R and $V_R/2$ | 1,000,000 | Cycles |

| GENERAL | VALUE | UNIT |
|----------------------------------|-------|------|
| Rated capacitance | 3400 | F |
| Total (5s) DC ESR, Rated at 150A | 0.22 | mΩ |
| DC 1s ESR, rated at 50A | 0.20 | mΩ |
| DC 10ms ESR, rated at 50A | 0.16 | mΩ |

| ENERGY | VALUE | UNIT |
|------------------------------|-------|-------|
| Stored energy ² | 4.25 | Wh |
| Specific energy ³ | 8.4 | Wh/kg |
| Energy density ⁴ | 10.9 | Wh/L |

| POWER* | VALUE | UNIT |
|--------|-------|------|
|--------|-------|------|

Nominal power*, calculated from 10 ms ESR (for comparison)

| | | |
|--|------|-------|
| Specific power, matched Impedance ⁶ | 27.7 | kW/kg |
| Power density, matched Impedance ⁷ | 36 | kW/L |

Practical power*, calculated from 1 s ESR (for engineering)

| | | |
|--|------|-------|
| Power, matched impedance ⁵ | 11.3 | kW |
| Specific power, matched Impedance ⁶ | 22.2 | kW/kg |
| Power density, matched impedance ⁷ | 28.8 | kW/L |

| STANDARDS AND CERTIFICATIONS |
|------------------------------|
|------------------------------|

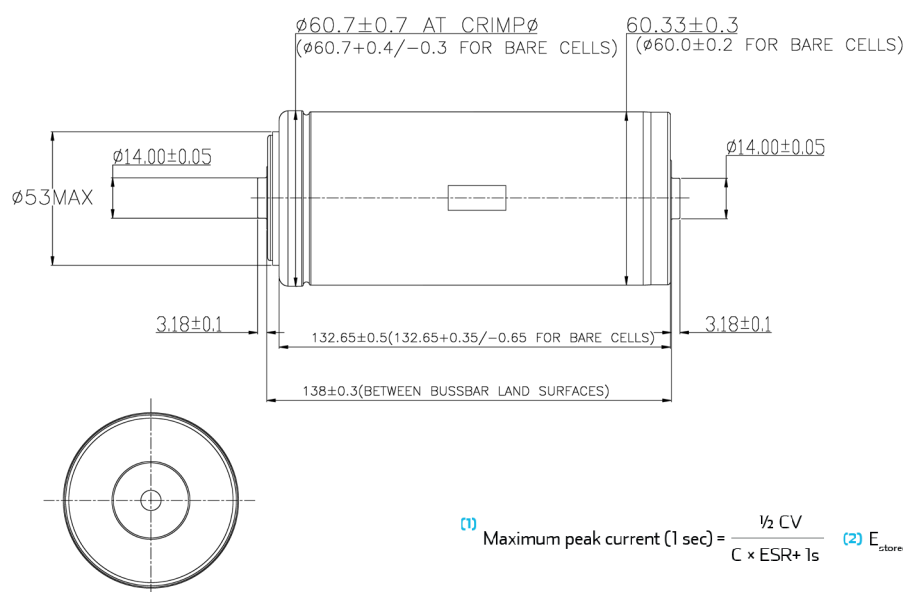
| | |
|-------------------------|--------------------------|
| Vibration Specification | ISO 16750-3 Table 12 |
| Shock Resistance | IEC60068-2-27 Shock Test |
| Certifications | RoHS |
| Standards | REACH, UL810A |

| THERMAL* | VALUE | UNIT |
|----------|-------|------|
|----------|-------|------|

| | | |
|--|------|-------|
| Thermal resistance, R_{ca} , typical | 3.35 | °C/W |
| Thermal capacitance, C_{th} , typical | 0.6 | kJ/°C |
| Max continuous current, $\Delta T = 15^{\circ}\text{C}$ ⁸ | 150 | A |
| Max continuous current, $\Delta T = 40^{\circ}\text{C}$ ⁸ | 244 | A |

| PHYSICAL PARAMETERS | VALUE | UNIT |
|---------------------|-------|------|
|---------------------|-------|------|

| | | |
|---------------|------|----|
| Mass. Typical | 0.51 | kg |
| Volume | 0.39 | L |
| Diameter | 60 | mm |
| Length | 138 | mm |



*Power values calculated using DC 10ms ESR ≈ AC 100Hz.

Standard markings

- + Name of manufacturer, part number, serial number, rated voltage
- + Rated capacitance, negative and positive terminals, warning marking
- + Total energy in watt-hours

Notes

- + Testing instructions available on www.skeleto-tech.com
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$$\begin{aligned}
 (1) \text{ Maximum peak current (1 sec)} &= \frac{\frac{1}{2} CV}{C \times \text{ESR} + 1s} & (2) E_{\text{stored}} &= \frac{\frac{1}{2} CV^2}{3,600} & (3) E_{\text{max}} &= \frac{\frac{1}{2} CV^2}{3,600 \times \text{mass}} & (4) E_{\text{max}} &= \frac{\frac{1}{2} CV^2}{3,600 \times \text{volume}} \\
 (5) P_{\text{max}} &= \frac{V^2}{4 \times \text{ESR}} & (6) P_{\text{max}} &= \frac{V^2}{4 \times \text{ESR} \times \text{mass}} & (7) P_{\text{max}} &= \frac{V^2}{4 \times \text{ESR} \times \text{volume}} & (8) I_{\text{max}} &= \sqrt{\frac{\Delta T}{\text{ESR} \times R_{th}}}
 \end{aligned}$$

DATA SHEET

SkelCap

ULTRACAPACITOR

- + Capacitance 3000 F
- + Extreme power density
- + Durable and safe aluminum casings
- + Threaded terminals
- + High cycle life >1,000,000 cycles
- + RoHS & UL810A compliant



| GENERAL SPECIFICATIONS | VALUE | UNIT |
|--------------------------|-------|-------|
| Rated voltage V_R | 2.85 | V |
| Surge voltage V_S | 3.0 | V |
| Specific energy | 6.4 | Wh/kg |
| Nominal specific power | 21 | kW/kg |
| Practical specific power | 17 | kW/kg |

| TEMPERATURE AND LIFE | VALUE | UNIT |
|---|-----------|--------|
| Operating temperature range | | |
| Minimum | -40 | °C |
| Maximum | +65 | °C |
| Storage temperature range (uncharged) | | |
| Minimum | -40 | °C |
| Maximum | +50 | °C |
| Life | | |
| Lifetime at V_R and +65 °C | 1500 | Hours |
| Capacitance decrease 20% against rated value; | | |
| 1s ESR increase 100% against rated value | | |
| Storage life @ RT, uncharged | 10 | Years |
| Cyclelife @ RT, between V_R and $V_R/2$ | 1,000,000 | Cycles |

| GENERAL | VALUE | UNIT |
|----------------------------------|-------|------|
| Rated capacitance | 3000 | F |
| Total (5s) DC ESR, Rated at 150A | 0.26 | mΩ |
| DC 1s ESR, rated at 50A | 0.23 | mΩ |
| DC 10ms ESR, rated at 50A | 0.18 | mΩ |

| ENERGY | VALUE | UNIT |
|------------------------------|-------|-------|
| Stored energy ² | 3.38 | Wh |
| Specific energy ³ | 6.4 | Wh/kg |
| Energy density ⁴ | 8.7 | Wh/L |

| POWER* | VALUE | UNIT |
|--------|-------|------|
|--------|-------|------|

Nominal power*, calculated from 10 ms ESR (for comparison)

| | | |
|--|------|-------|
| Specific power, matched Impedance ⁵ | 21.3 | kW/kg |
| Power density, matched Impedance ⁷ | 28.9 | kW/L |

Practical power*, calculated from 1 s ESR (for engineering)

| | | |
|--|------|-------|
| Power, matched impedance ⁵ | 8.8 | kW |
| Specific power, matched Impedance ⁶ | 16.7 | kW/kg |
| Power density, matched impedance ⁷ | 22.6 | kW/L |

| STANDARDS AND CERTIFICATIONS |
|------------------------------|
|------------------------------|

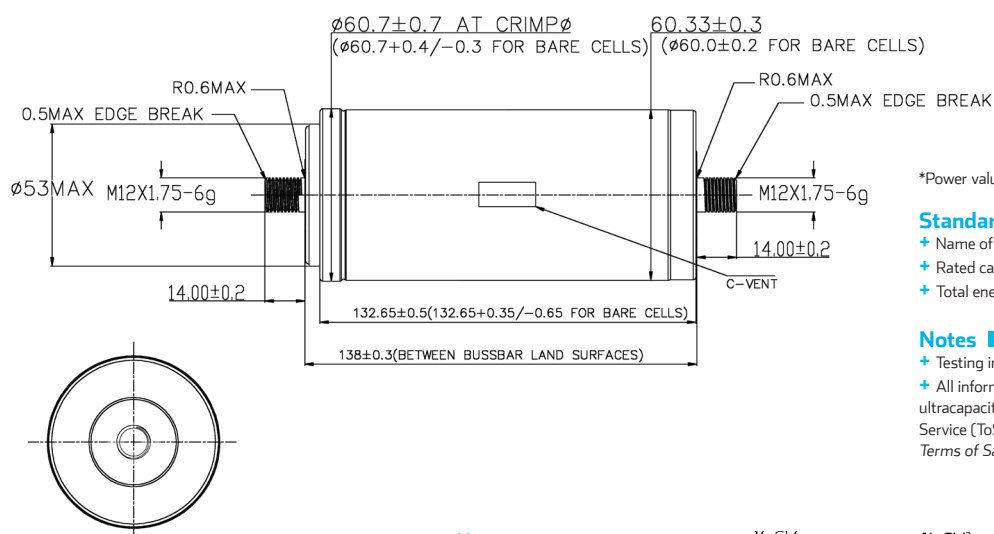
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| Vibration Specification | ISO 16750-3 Table 12 |
| Shock Resistance | IEC60068-2-27 Shock Test |
| Certifications | RoHS |
| Standards | REACH, UL810A |

| THERMAL* | VALUE | UNIT |
|----------|-------|------|
|----------|-------|------|

| | | |
|--|------|-------|
| Thermal resistance, R_{ca} , typical | 4.1 | °C/W |
| Thermal capacitance, C_{th} , typical | 0.58 | kJ/°C |
| Max continuous current, $\Delta T = 15^{\circ}\text{C}$ ⁸ | 126 | A |
| Max continuous current, $\Delta T = 40^{\circ}\text{C}$ ⁸ | 206 | A |

| PHYSICAL PARAMETERS | VALUE | UNIT |
|---------------------|-------|------|
|---------------------|-------|------|

| | | |
|---------------|------|----|
| Mass. Typical | 0.53 | kg |
| Volume | 0.39 | L |
| Diameter | 60 | mm |
| Length | 138 | mm |



*Power values calculated using DC 10ms ESR \approx AC 100Hz.

Standard markings

- + Name of manufacturer, part number, serial number, rated voltage
- + Rated capacitance, negative and positive terminals, warning marking
- + Total energy in watt-hours

Notes

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 (5) P_{\text{max}} &= \frac{V^2}{4 \times \text{ESR}} & (6) P_{\text{max}} &= \frac{V^2}{4 \times \text{ESR} \times \text{mass}} & (7) P_{\text{max}} &= \frac{V^2}{4 \times \text{ESR} \times \text{volume}} & (8) I_{\text{max}} &= \sqrt{\frac{\Delta T}{\text{ESR} \times R_{th}}}
 \end{aligned}$$

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ULTRACAPACITOR

- + Capacitance 3400 F
- + Extreme power density
- + Durable and safe aluminum casings
- + Threaded terminals
- + High cycle life >1,000,000 cycles
- + RoHS & UL810A compliant



| GENERAL SPECIFICATIONS | VALUE | UNIT |
|--------------------------|-------|-------|
| Rated voltage V_R | 2.85 | V |
| Surge voltage V_S | 3.0 | V |
| Specific energy | 7.1 | Wh/kg |
| Nominal specific power | 22 | kW/kg |
| Practical specific power | 18 | kW/kg |

| TEMPERATURE AND LIFE | VALUE | UNIT |
|---|-----------|--------|
| Operating temperature range | | |
| Minimum | -40 | °C |
| Maximum | +65 | °C |
| Storage temperature range (uncharged) | | |
| Minimum | -40 | °C |
| Maximum | +50 | °C |
| Life | | |
| Lifetime at V_R and +65 °C | 1500 | Hours |
| Capacitance decrease 20% against rated value; 1s ESR increase 100% against rated value | | |
| Storage life @ RT, uncharged | 10 | Years |
| Cyclelife @ RT, between V_R and $V_R/2$ | 1,000,000 | Cycles |

| GENERAL | VALUE | UNIT |
|----------------------------------|-------|------|
| Rated capacitance | 3400 | F |
| Total (5s) DC ESR, Rated at 150A | 0.23 | mΩ |
| DC 1s ESR, rated at 50A | 0.21 | mΩ |
| DC 10ms ESR, rated at 50A | 0.17 | mΩ |

| ENERGY | VALUE | UNIT |
|------------------------------|-------|-------|
| Stored energy ² | 3.84 | Wh |
| Specific energy ³ | 7.1 | Wh/kg |
| Energy density ⁴ | 9.8 | Wh/L |

| POWER* | VALUE | UNIT |
|--------|-------|------|
|--------|-------|------|

Nominal power*, calculated from 10 ms ESR (for comparison)

| | | |
|--|------|-------|
| Specific power, matched Impedance ⁵ | 22.1 | kW/kg |
| Power density, matched Impedance ⁷ | 30.6 | kW/L |

Practical power*, calculated from 1 s ESR (for engineering)

| | | |
|--|------|-------|
| Power, matched impedance ⁵ | 9.7 | kW |
| Specific power, matched Impedance ⁶ | 17.9 | kW/kg |
| Power density, matched impedance ⁷ | 24.8 | kW/L |

| STANDARDS AND CERTIFICATIONS |
|------------------------------|
|------------------------------|

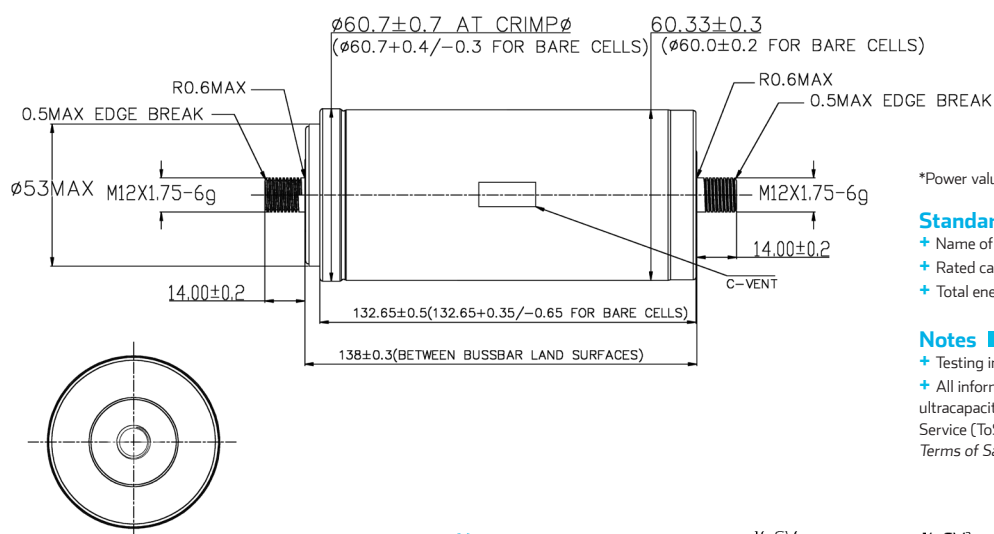
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| Certifications | RoHS |
| Standards | REACH, UL810A |

| THERMAL* | VALUE | UNIT |
|----------|-------|------|
|----------|-------|------|

| | | |
|--|------|-------|
| Thermal resistance, R_{ca} , typical | 3.35 | °C/W |
| Thermal capacitance, C_{th} , typical | 0.6 | kJ/°C |
| Max continuous current, $\Delta T = 15^{\circ}\text{C}$ ⁸ | 143 | A |
| Max continuous current, $\Delta T = 40^{\circ}\text{C}$ ⁸ | 233 | A |

| PHYSICAL PARAMETERS | VALUE | UNIT |
|---------------------|-------|------|
|---------------------|-------|------|

| | | |
|---------------|------|----|
| Mass. Typical | 0.54 | kg |
| Volume | 0.39 | L |
| Diameter | 60 | mm |
| Length | 138 | mm |



*Power values calculated using DC 10ms ESR \approx AC 100Hz.

Standard markings

- + Name of manufacturer, part number, serial number, rated voltage
- + Rated capacitance, negative and positive terminals, warning marking
- + Total energy in watt-hours

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 (5) P_{\text{max}} &= \frac{V^2}{4 \times \text{ESR}} & (6) P_{\text{max}} &= \frac{V^2}{4 \times \text{ESR} \times \text{mass}} & (7) P_{\text{max}} &= \frac{V^2}{4 \times \text{ESR} \times \text{volume}} & (8) I_{\text{max}} &= \sqrt{\frac{\Delta T}{\text{ESR} \times R_{th}}}
 \end{aligned}$$