

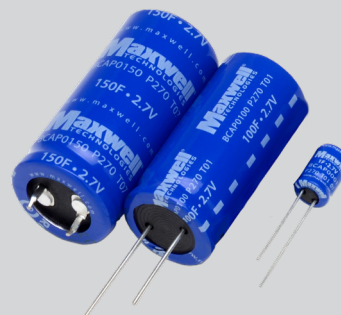
2.7V 1F, 100F, 150F ULTRACAPACITOR CELL

FEATURES AND BENEFITS*

- Up to 500,000 duty cycles or 10 year life
- Low internal resistance
- High power density
- 1F to 150F capacitance range
- -40° to 85°C operating temperature range

APPLICATIONS

- Back-up power for cache-to-flash applications
- Smart meters
- Automotive subsystems
- Consumer and industrial electronics
- Wireless transmitters



PRODUCT SPECIFICATIONS

| ELECTRICAL | BCAP0001 | BCAP0100 T01 | BCAP0150 |
|---|---------------|---------------|---------------|
| Rated Capacitance | 1 F | 100 F | 150 F |
| Minimum Capacitance, initial ³ | 0.8 F | 100 F | 150 F |
| Maximum ESR _{DC} , initial ³ | 700 mΩ | 15 mΩ | 14 mΩ |
| Test Current for Capacitance and ESR _{DC} ³ | 0.1 A | 10 A | 15 A |
| Rated Voltage (65°/85°C) | 2.70 / 2.30 V | 2.70 / 2.30 V | 2.70 / 2.30 V |
| Absolute Maximum Voltage ¹ | 2.85 V | 2.85 V | 2.85 V |
| Absolute Maximum Current ⁵ | 0.8 A | 36 A | 40 A |
| Leakage Current at 25°C, maximum ⁴ | 0.006 mA | 0.260 mA | 0.500 mA |

TEMPERATURE

Operating temperature range
(Cell case temperature)

| | | | |
|---------|------------|------------|------------|
| Minimum | -40°C | -40°C | -40°C |
| Maximum | 65° / 85°C | 65° / 85°C | 65° / 85°C |

Storage temperature range
(Stored uncharged)

| | | | |
|---------|-------|-------|-------|
| Minimum | -40°C | -40°C | -40°C |
| Maximum | 70°C | 70°C | 70°C |

PHYSICAL

| | | | |
|---------------|------------|------------|---------|
| Mass, typical | 1.1 g | 23 g | 32 g |
| Terminals | Wire Leads | Wire Leads | Snap in |
| Vibration | - | - | - |
| Shock | - | - | - |

*Results may vary. Additional terms and conditions, including the limited warranty, apply at the time of purchase. See the warranty details for applicable operating and use requirements.

PRODUCT SPECIFICATIONS

POWER & ENERGY AT 2.7V

| | BCAP0001 | BCAP0100 T01 | BCAP0150 |
|---|------------|--------------|------------|
| Usable Specific Power, P_d^6 | 1,100 W/kg | 2,500 W/kg | 2,000 W/kg |
| Impedance Match Specific Power, P_{max}^6 | 2,400 W/kg | 5,300 W/kg | 4,100 W/kg |
| Specific Energy, E_{max}^6 | 0.9 Wh/kg | 4.4 Wh/kg | 4.7 Wh/kg |
| Stored Energy, $E_{stored}^{6,9}$ | 0.001 Wh | 0.101 Wh | 0.152 Wh |

SAFETY

| | | | |
|---|--------------|--------------|--------------|
| Short Circuit Current, typical ² (Current possible with short circuit from rated voltage. Do not use as an operating current.) | 4 A | 180 A | 190 A |
| Certifications | UL810a, RoHS | UL810a, RoHS | UL810a, RoHS |

TYPICAL CHARACTERISTICS

THERMAL

| | | | |
|--|----------------------|----------------------|----------------------|
| Thermal Resistance (R_{ca} , Case to Ambient), typical ^{2,8} | 120°C/W | 22°C/W | 18°C/W |
| Thermal Capacitance (C_{th}), typical ² | 1.0 J/°C | 23 J/°C | 32 |
| Maximum Continuous Current ($\Delta T = 15^\circ C$) ^{8,10} (BOL) | 0.4 A _{RMS} | 6.7 A _{RMS} | 7.7 A _{RMS} |
| Maximum Continuous Current ($\Delta T = 40^\circ C$) ^{8,10} (BOL) | 0.7 A _{RMS} | 11 A _{RMS} | 13 A _{RMS} |

LIFE*

| | | | |
|--|----------------|----------------|----------------|
| DC Life at High Temperature ^{3,10} (held continuously at Rated Voltage & Maximum Operating Temperature) | 1,000 hours | 1,000 hours | 1,000 hours |
| Capacitance Change (% decrease from minimum initial value) | 30% | 30% | 30% |
| ESR Change (% increase from maximum initial value) | 100% | 100% | 100% |
| Projected DC Life at 25°C ^{3,10} (at Rated Voltage & 25°C) | 10 years | 10 years | 10 years |
| Capacitance Change (% decrease from minimum initial value) | 30% | 30% | 30% |
| ESR Change (% increase from maximum initial value) | 100% | 100% | 100% |
| Projected Cycle Life at 25°C ^{3,7,10} | 500,000 cycles | 500,000 cycles | 500,000 cycles |
| Capacitance Change (% decrease from minimum initial value) | 30% | 30% | 30% |
| ESR Change (% increase from maximum initial value) | 100% | 100% | 100% |
| Test Current | 0.1 A | 10 A | 15 A |
| Shelf Life (Stored uncharged at 25°C, <50% RH) | 2 years | 2 years | 2 years |

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Datasheet: 2.7V 1F, 100F, 150F ULTRACAPACITOR CELL

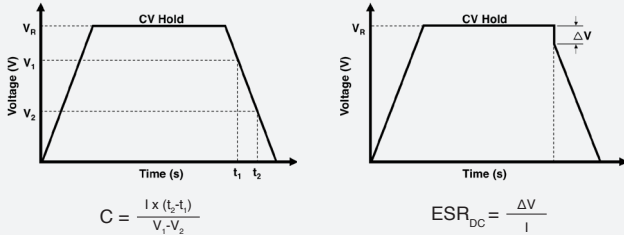
1. Surge Voltage
Absolute maximum voltage, non-repetitive. Duration not to exceed 1 second.

2. "Typical" values represent mean values of production sample.

3. Rated Capacitance & ESR_{DC} (measure method)

- Capacitance: Constant current charge (per datasheet) to V_R, 5 min hold at V_R, constant current discharge 10 mA/F to 0.1V.

- ESR_{DC}: Constant current charge (per datasheet) to V_R, 5 min hold at V_R, constant current discharge (40 * C * V_R[mA]) to 0.1 V.



where C is the capacitance (F);

I is the absolute value of the discharge current (A);

V_R is the rated voltage (V);

V₁ is the measurement start voltage, 0.8xV_R (V);

V₂ is the measurement end voltage, 0.4xV_R (V);

t₁ is the time from start of discharge to reach V₁ (s);

t₂ is the time from start of discharge to reach V₂ (s);

ESR_{DC} is the DC-ESR (Ω);

ΔV is the voltage drop during first 10ms of discharge (V).

Typical ESR_{DC}, Initial, 5 sec tested per Maxwell Application Note, "Test Procedures for Capacitance, ESR, Leakage Current and Self-Discharge Characterizations of Ultracapacitors" available at www.maxwell.com.

4. Maximum Leakage Current

- Current measured after 72 hrs at rated voltage and 25°C. Initial leakage current can be higher.
- If applicable, module leakage current is the sum of cell and balancing circuit leakage currents.

5. Maximum Peak Current

- Current needed to discharge cell/module from rated voltage to half-rated voltage in 1 second.

$$I = \frac{\frac{1}{2}V_R}{\Delta t / C + ESR_{DC}}$$

where Δt is the discharge time (sec); Δt = 1 sec in this case.

- The stated maximum peak current should not be used in normal operation and is only provided as a reference value.

6. Energy & Power (Based on IEC 62391-2)

- Maximum Stored Energy, E_{max} (Wh) = $\frac{\frac{1}{2}CV_R^2}{3,600}$

- Gravimetric Specific Energy (Wh/kg) = $\frac{E_{max}}{mass}$

- Usable Specific Power (W/kg) = $\frac{0.12V_R^2}{ESR_{DC} \times mass}$

- Impedance Match Specific Power (W/kg) = $\frac{0.25V_R^2}{ESR_{DC} \times mass}$

- Presented Power and Energy values are calculated based on Rated Capacitance & Rated (Max.) ESR_{DC}, Initial values.

7. Cycle Life Test Profile

Cycle life varies depending upon application-specific characteristics. Actual results will vary.

8. Temperature Rise at Constant Current

- ΔT = I_{RMS}² x ESR_{DC} x R_{th}

where ΔT: Temperature rise over ambient (°C)

I_{RMS}: Maximum continuous or RMS current (A)

R_{th}: Thermal resistance, cell to ambient (°C/W)

ESR_{DC}: Rated (Max.) ESR_{DC} (Ω).

(Note: Design should consider EOL ESR_{DC} for application temperature rise evaluation.)

9. Per United Nations material classification UN3499, all Maxwell ultracapacitors have less than 10 Wh capacity to meet the requirements of Special Provisions 361. Both individual ultracapacitors and modules composed of those ultracapacitors shipped by Maxwell can be transported without being treated as dangerous goods (hazardous materials) under transportation regulations.

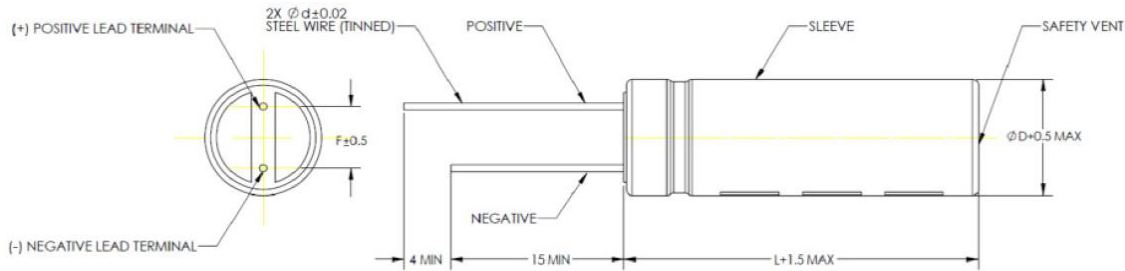
10. BOL: Beginning of Life, rated initial product performance

EOL: End of Life criteria.

- Capacitance: 80% of min. BOL rating

- ESR_{DC}: 2x max. BOL rating

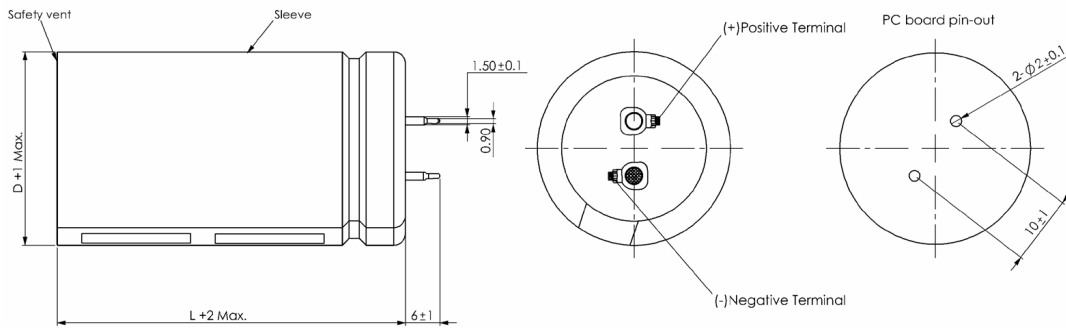
BCAP0001,100 (T01)



Product dimensions are for reference only unless otherwise identified. Product dimensions and specifications may change without notice. Please contact Maxwell Technologies directly for any technical specifications critical to application.

| Part Description | Dimensions (mm) | | | | | | | Package Quantity |
|-------------------|-----------------|----|-----|-----|---|---|---|------------------|
| | L | D | d | F | R | a | b | |
| BCAP0001 P270 T01 | 12 | 8 | 0.6 | 3.8 | - | - | - | 4,000 |
| BCAP0100 P270 T01 | 45 | 22 | 1 | 9.5 | - | - | - | 400 |

BCAP0150 (T07)



| Part Description | Dimensions (mm) | | | | Package Quantity |
|-------------------|-----------------|----|---|---|------------------|
| | L | D | d | F | |
| BCAP0150 P270 T07 | 50 | 25 | - | - | 400 |

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