

3.0V 3000F ULTRACAPACITOR CELL

BCAP3000 P300 K04/05

Maxwell's High Power and Energy Cell



Maxwell Technologies' 3.0V 3000F ultracapacitor cell is designed to support the latest trends in renewable energy, industrial electrification, and transportation. Designed from the ground up, Maxwell developed the 3.0V 3000F cell to be one of the highest energy, highest power workhorses of its ultracapacitor portfolio. Whether used alone, integrated into a module assembly, or in a hybrid configuration, Maxwell's 3.0V 3000F product will help reduce the overall cost and weight of the system while improving the customer's return on investment.

Ultracapacitors are the technology of choice for long life and high power applications because of their long operating lifetime, low maintenance requirements, and superior cold weather performance compared to batteries.

FEATURES AND BENEFITS

- Rated at 3.0V, 3000F
- High power & energy cell with ultra low ESR
- Improved overall performance to previous generation of 3.0V products
- DuraBlue™ Shock and Vibration Technology
- 1,500 hour DC life at maximum operating temperature and voltage*
- Designed for up to 1,000,000 duty cycles*
- Laser weldable or screw post terminals
- Compliant with UL, RoHS, and REACH requirements

TYPICAL APPLICATIONS

- Heavy transportation
 - Hybrid buses
 - Rail
 - Truck
 - Construction vehicles
- Heavy industrial and stationary solutions
 - Backup and UPS systems
 - STATCOM systems
- Grid, microgrid, and microturbines
- Automotive
 - VSS
 - EPAS
 - EPAB
- Liftgate & Plow
- Backup power
- X-by-wire

ORDERING INFORMATION

Model Number	Part Number	Package Quantity
BCAP3000 P300 K04/05	135961 / 135962	15

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

PRODUCT SPECIFICATIONS & CHARACTERISTICS

Values are referenced at T_A = room temperature and V_R = 3.0V rated voltage (unless otherwise noted). Min and Max values indicate product specifications. Typical results will vary and are provided for reference only. Additional terms and conditions, including the limited warranty, apply at the time of purchase. See the warranty details for applicable operating and use requirements.

Symbol	Parameter	Conditions	Min	Typical	Max	Unit
ELECTRICAL						
V_R	Rated Voltage		–	–	3.0	V
V_{SURGE}	Surge Voltage	Note 1	–	–	3.1	V
C_R	Rated Capacitance	BOL, Note 2,8	3,000	3,140	3,600	F
R_S	Equivalent Series Resistance (ESR _{DC})	BOL, Note 2,8	–	0.13	0.23	mΩ
I_{LEAK}	Leakage Current	Note 3	–	8	12	mA
I_{PEAK}	Peak Current	BOL, Note 4,8	–	–	2,600	A
I_{MAX}	Continuous Current	BOL, Note 7,8 - $\Delta T = 15^\circ\text{C}$ - $\Delta T = 40^\circ\text{C}$	– –	– –	170 280	A_{RMS}
LIFE						
t_{65C}	High Temperature Life	$V_R = 3.0V$ and $T_A = 65^\circ\text{C}$, EOL, Note 8 - Capacitance change ΔC from min C_R - Resistance change ΔR from max R_S	– – –	1,500 -20 +100	– – –	hours % %
t_{25C}	Projected Life Time	$V_R = 3.0V$ and $T_A = 25^\circ\text{C}$, EOL, Note 8 - Capacitance change ΔC from min C_R - Resistance change ΔR from max R_S	– – –	10 -20 +100	– – –	years % %
n_{CYCLE}	Projected Cycle Life	$T_A = 25^\circ\text{C}$, EOL, Note 6,8 - Capacitance change ΔC from min C_R - Resistance change ΔR from max R_S	– – –	1,000,000 -20 +100	– – –	cycles % %
t_{SHELF}	Shelf Life	Stored uncharged, $T_A \leq 25^\circ\text{C}$ and $RH \leq 50\%$ - Capacitance \geq min. BOL C_R - Resistance \leq max. BOL R_S	–	4	–	years

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Symbol	Parameter	Conditions	Min	Typical	Max	Unit
POWER & ENERGY						
P_d	Usable Specific Power	BOL, Note 5,8	10.2	18.1	–	kW/kg
P_{MAX}	Impedance Match Specific Power	BOL, Note 5,8	21.3	37.6	–	kW/kg
E_d	Gravimetric Specific Energy	BOL, Note 5,8	8.2	8.5	–	Wh/kg
E_{MAX}	Stored Energy	BOL, Note 5,8,9	3.8	3.9	–	Wh
TEMPERATURE & THERMAL						
T_A	Operating Temperature	Cell case temperature	-40	25	65	°C
T_{STG}	Storage Temperature	Stored uncharged @ RH \leq 50%	-40	–	70	°C
R_{th}	Thermal Resistance	Case to ambient, Note 7	–	2.3	–	°C/W
C_{th}	Thermal Capacitance		–	430	–	J/°C
PHYSICAL						
m	Mass		–	460	–	g
–	Recommended Torque on Threaded connector (K04)	M12 Thread	10	12	14	Nm
–	Recommended Welding on Jove Terminal (K05)	Negative: 1100-F aluminum Positive: 1070-F aluminum Refer to Maxwell K2 Cell Family Welding Guidelines (maxwell.com)	–	–	–	–
–	Vibration		ISO 16750-3 (Table 12)			–
–	Shock		IEC 60068-2-27			–
SAFETY						
–	Certifications		UL810A, RoHS, REACH			

NOTES

1. Surge Voltage

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

2. Rated Capacitance and ESR_{DC}

- > Measured at 25°C per document number 1013823 available at www.maxwell.com.

3. Leakage Current

- > Current measured after 72 hours of constant voltage hold at V_R and 25°C. Initial leakage current can be higher.
- > If applicable, module leakage current is the sum of cell leakage current and bypass current created by balancing circuit.

4. Peak Current

- > Current needed to discharge cell or module from V_R to 1/2V_R in 1 second.

$$I_{PEAK} = \frac{\frac{1}{2}V_R}{\Delta t / C_R + R_S}$$

where I_{PEAK} is the maximum peak current (A);
 V_R is the rated voltage (V);
 Δt is the discharge time (sec); Δt = 1 sec in this case;
 C_R is the rated BOL capacitance (F);
 R_S is the maximum BOL ESR_{DC} (Ω).

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

5. Energy & Power (Based on IEC 62576)

- > Usable Specific Power, P_d (W/kg) = $\frac{0.12V_R^2}{R_S \times m}$
- > Impedance Match Specific Power, P_{MAX} (W/kg) = $\frac{0.25V_R^2}{R_S \times m}$
- > Gravimetric Specific Energy, E_d (Wh/kg) = $\frac{E_{MAX}}{m}$
- > Maximum Stored Energy, E_{MAX} (Wh) = $\frac{\frac{1}{2}C_R \times V_R^2}{3600}$

where V_R is the rated voltage (V);
 R_S is the BOL ESR_{DC} (Ω);
 m is the typical mass (kg);
 C_R is the BOL capacitance (F).

6. Projected Cycle Life

- > Constant current charge-discharge cycle from V_R to 1/2V_R at 25°C.
- > Cycle life is dependent upon application-specific characteristics. Actual results will vary.

7. Continuous Current & Thermal Resistance

- > Maximum current which can be used continuously within the allowed temperature range.

$$I_{MAX} = \sqrt{\frac{\Delta T}{R_{th} \times R_S}}$$

where I_{MAX} is the maximum continuous current (A);
 ΔT is the change in temperature (°C);
 R_{th} is the thermal resistance (°C/W);
 R_S is the maximum BOL ESR_{DC} (Ω).

8. BOL & EOL Conditions

- > BOL (Beginning of Life): Rated/Initial product performance
- > EOL (End of Life)
 - Capacitance: 80% of min. BOL rating (0.8 x min. C_R)
 - ESR_{DC}: 200% of max. BOL rating (2 x max. R_S)

9. Transportation Regulation Regarding Stored Energy

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

DETAILED PRODUCT DESCRIPTION

Introduction

The BCAP3000 P300 K04/K05 energy storage cell is a high power and energy design in the Maxwell driven industry-standard 60mm cylindrical form factor. The 3.0V 3000F cell design uses Maxwell's proprietary DuraBlue® Advanced technology to provide maximum level of resistance against shock and vibration.

Technology Overview

Ultracapacitor, also known as supercapacitor or electric double layer capacitor (EDLC), delivers energy at relatively high rates (beyond those accessible with batteries). Ultracapacitors store charge electrostatically (non-Faradaic) by reversible adsorption of the electrolyte onto electrochemically stable high surface area carbon electrodes. Charge separation occurs on polarization at the electrode/electrolyte interface, producing a double layer. This mechanism is highly reversible, allowing the ultracapacitor to be charged and discharged hundreds of thousands to even millions of times.

Ultracapacitor Construction

An ultracapacitor is constructed with symmetric carbon positive and negative electrodes separated by an insulating ion-permeable separator and packaged into a container filled with organic electrolyte (salt/solvent) designed to provide maximum ionic conductivity and electrode wetting. It is the combination of high surface-area activated carbon electrodes (typically > 1500m²/g) with extremely small charge separation (Angstroms) that results in high capacitance.

Ultracapacitor Energy = $\frac{1}{2} CV^2$

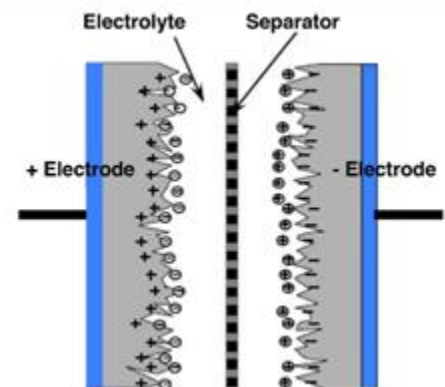
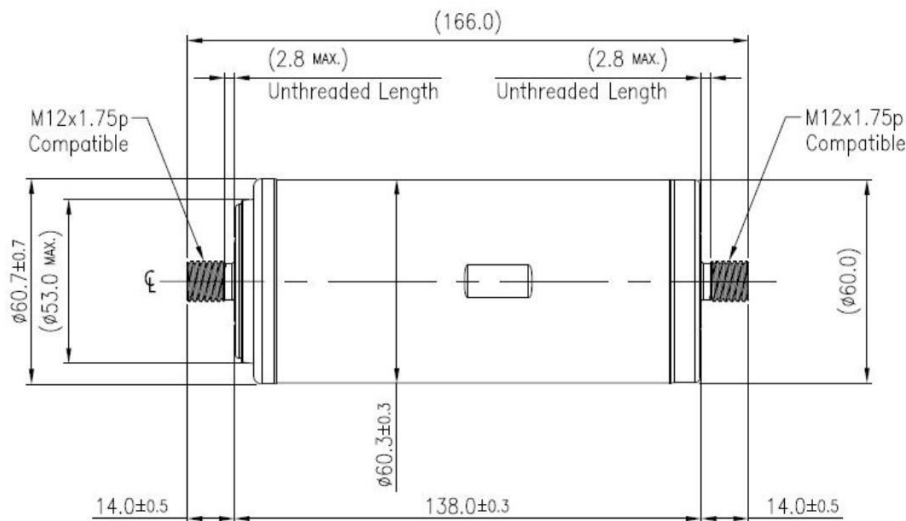


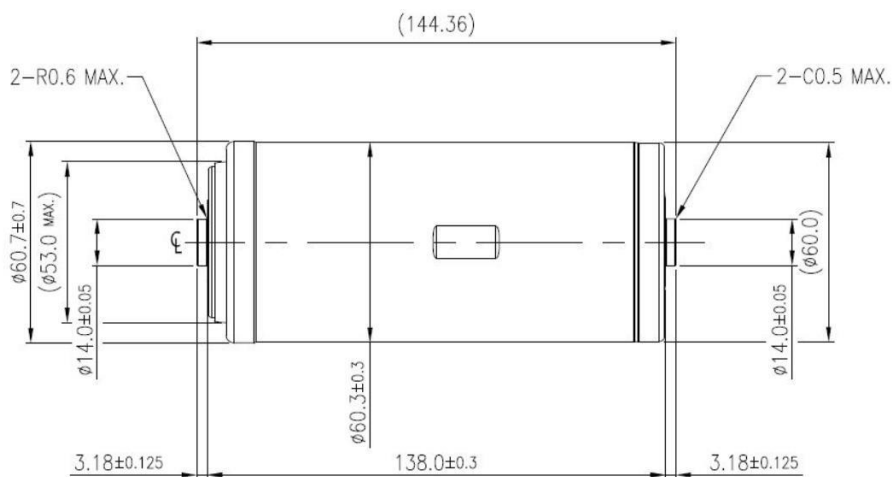
Figure 1: Ultracapacitor Structure Diagram

MECHANICAL DRAWINGS

BCAP3000 P300 K04



BCAP3000 P3000 K05



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