

**FEATURES AND BENEFITS\***

- Up to 1,000,000 duty cycles or 10 year DC life
- High power density
- 650F to 3,000F capacitance range
- Threaded terminals or laser-weldable posts

**TYPICAL APPLICATIONS**

- Automotive subsystems
- Wind turbine pitch control
- Hybrid vehicles
- Rail
- Heavy industrial equipment
- UPS & telecom systems



**PRODUCT SPECIFICATIONS**

<b>ELECTRICAL</b>	<b>BCAP0650</b>	<b>BCAP1200</b>	<b>BCAP1500</b>	<b>BCAP2000</b>	<b>BCAP3000</b>
Rated Capacitance <sup>1</sup>	650 F	1,200 F	1,500 F	2,000 F	3,000 F
Minimum Capacitance, initial <sup>1</sup>	650 F	1,200 F	1,500 F	2,000 F	3,000 F
Maximum Capacitance, initial <sup>1</sup>	780 F	1,440 F	1,800 F	2,400 F	3,600 F
Maximum ESR <sub>DC</sub> , initial <sup>1</sup>	0.8 mΩ	0.58 mΩ	0.47 mΩ	0.35 mΩ	0.29 mΩ
Test Current for Capacitance and ESR <sub>DC</sub> <sup>1</sup>	65 A	75 A	100 A	100 A	100 A
Rated Voltage	2.70 V	2.70 V	2.70 V	2.70 V	2.70 V
Absolute Maximum Voltage <sup>2</sup>	2.85 V	2.85 V	2.85 V	2.85 V	2.85 V
Absolute Maximum Current	680 A	930 A	1150 A	1500 A	1900 A
Leakage Current at 25°C, maximum <sup>3</sup>	1.5 mA	2.7 mA	3.0 mA	4.2 mA	5.2 mA
<b>TEMPERATURE</b>					
Operating temperature (Cell case temperature)					
Minimum	-40°C	-40°C	-40°C	-40°C	-40°C
Maximum	65°C	65°C	65°C	65°C	65°C
Storage temperature (Stored uncharged)					
Minimum	-40°C	-40°C	-40°C	-40°C	-40°C
Maximum	70°C	70°C	70°C	70°C	70°C
<b>PHYSICAL</b>					
Mass, typical	160 g	260 g	280 g	360 g	510 g
Terminals	Threaded or Weldable	Threaded or Weldable	Threaded or Weldable	Threaded or Weldable	Threaded or Weldable
Maximum Terminal Torque (K04)	14 Nm	14 Nm	14 Nm	14 Nm	14 Nm
Vibration Specification	ISO 16750, Table 14	ISO 16750, Table 14	ISO 16750, Table 14	ISO 16750, Table 14	ISO 16750, Table 14
Shock Specification	SAE J2464	SAE J2464	SAE J2464	SAE J2464	SAE J2464

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

## PRODUCT SPECIFICATIONS (Cont'd)

POWER & ENERGY	BCAP0650	BCAP1200	BCAP1500	BCAP2000	BCAP3000
Usable Specific Power, $P_d^4$	6,800 W/kg	5,800 W/kg	6,600 W/kg	6,900 W/kg	5,900 W/kg
Impedance Match Specific Power, $P_{max}^5$	14,000 W/kg	12,000 W/kg	14,000 W/kg	14,000 W/kg	12,000 W/kg
Specific Energy, $E_{max}^6$	4.1 Wh/kg	4.7 Wh/kg	5.4 Wh/kg	5.6 Wh/kg	6.0 Wh/kg
Stored Energy, $E_{stored}^{7,11}$	0.66 Wh	1.22 Wh	1.52 Wh	2.03 Wh	3.04 Wh
SAFETY					
Short Circuit Current, typical (Current possible with short circuit from rated voltage. Do not use as an operating current.)	3,400 A	4,700 A	5,700 A	7,700 A	9,300 A
Certifications	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS

## TYPICAL CHARACTERISTICS

THERMAL CHARACTERISTICS					
Thermal Resistance ( $R_{ca}$ , Case to Ambient), typical <sup>8</sup>	6.5°C/W	5.3°C/W	4.5°C/W	3.8°C/W	3.2°C/W
Thermal Capacitance ( $C_{th}$ ), typical <sup>8</sup>	190 J/°C	300 J/°C	320 J/°C	410 J/°C	600 J/°C
Maximum Continuous Current ( $\Delta T = 15^\circ C$ ) <sup>8</sup>	54 A <sub>RMS</sub>	70 A <sub>RMS</sub>	84 A <sub>RMS</sub>	110 A <sub>RMS</sub>	130 A <sub>RMS</sub>
Maximum Continuous Current ( $\Delta T = 40^\circ C$ ) <sup>8</sup>	88 A <sub>RMS</sub>	110 A <sub>RMS</sub>	140 A <sub>RMS</sub>	170 A <sub>RMS</sub>	210 A <sub>RMS</sub>
LIFE					
DC Life at High Temperature <sup>1</sup> (held continuously at Rated Voltage and Maximum Operating Temperature)	1,500 hours	1,500 hours	1,500 hours	1,500 hours	1,500 hours
Capacitance Change (% decrease from minimum initial value)	20%	20%	20%	20%	20%
ESR Change (% increase from maximum initial value)	100%	100%	100%	100%	100%
Projected DC Life at 25°C <sup>1</sup> (held continuously at Rated Voltage)	10 years	10 years	10 years	10 years	10 years
Capacitance Change (% decrease from minimum initial value)	20%	20%	20%	20%	20%
ESR Change (% increase from maximum initial value)	100%	100%	100%	100%	100%
Projected Cycle Life at 25°C <sup>1,9,10</sup>	1,000,000 cycles	1,000,000 cycles	1,000,000 cycles	1,000,000 cycles	1,000,000 cycles
Capacitance Change (% decrease from minimum initial value)	20%	20%	20%	20%	20%

LIFE (Cont'd)

ESR Change (% increase from maximum initial value)	100%	100%	100%	100%	100%
Test Current	65 A	75 A	100 A	100 A	100 A
Shelf Life (Stored uncharged at 25°C)	4 years	4 years	4 years	4 years	4 years

ESR AND CAPACITANCE VS TEMPERATURE

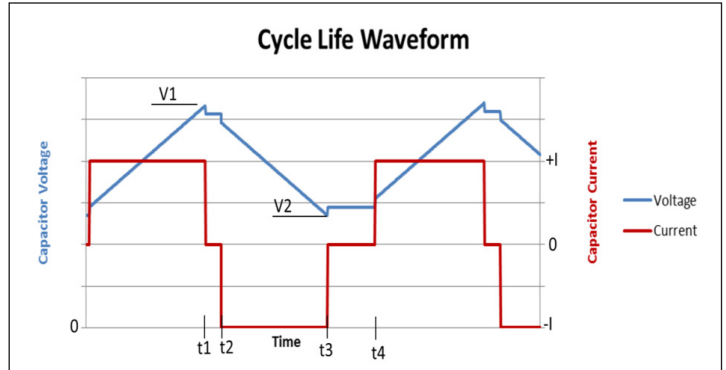


NOTES

1. Capacitance and  $ESR_{DC}$  measured at 25°C using specified test current per waveform below.
2. Absolute maximum voltage, non-repeated. Not to exceed 1 second.
3. After 72 hours at rated voltage. Initial leakage current can be higher.
4. Per IEC 62391-2,  $P_d = \frac{0.12V^2}{ESR_{DC} \times mass}$
5.  $P_{max} = \frac{V^2}{4 \times ESR_{DC} \times mass}$
6.  $E_{max} = \frac{\frac{1}{2} CV^2}{3,600 \times mass}$
7.  $E_{stored} = \frac{\frac{1}{2} CV^2}{3,600}$
8.  $\Delta T = I_{RMS}^2 \times ESR \times R_{ca}$
9. Cycle using specified test current per waveform below.
10. Cycle life varies depending upon application-specific characteristics. Actual results will vary.
11. Per United Nations material classification UN3499, all Maxwell ultracapacitors have less than 10 Wh capacity to meet the requirements of Special Provisions 361. When packaged according to the regulation, both individual ultracapacitors and modules composed of those ultracapacitors shipped by Maxwell can be transported without being treated as dangerous goods (hazardous materials).



$V1 = V_{rated}$      $t2 - t1 = 15 \text{ seconds}$      $\text{Capacitance} = I \times (t3 - t2) / (V2 - V3)$   
 $V3 = 0.5 \times V_{rated}$      $t4 - t3 = 5 \text{ seconds}$      $\text{ESR} = (V4 - V3) / I$



$V1 = V_{rated}$      $t2 - t1 = 5 \text{ seconds (I=0)}$   
 $V2 = 0.5 \times V_{rated}$      $t4 - t3 = 15 \text{ seconds (I=0)}$

### MOUNTING RECOMMENDATIONS

Do not reverse polarity. Please refer to document number 1016419, available at maxwell.com for welding recommendations.

### MARKINGS

Products are marked with the following information: Rated capacitance, rated voltage, product number, name of manufacturer, positive terminal, warning marking, serial number.

### BCAPxxxx P270 K04



### BCAPxxxx P270 K05



Part Description	Dimensions (mm)			Package Quantity
	L (±0.3mm)	D1 (±0.2mm)	D2 (±0.7mm)	
BCAP0650 P270 K04/05	51.5	60.4	60.7	30
BCAP1200 P270 K04/05	74	60.4	60.7	30
BCAP1500 P270 K04/05	85	60.4	60.7	30
BCAP2000 P270 K04/05	102	60.4	60.7	15
BCAP3000 P270 K04/05	138	60.4	60.7	15

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. All products featured on this datasheet are covered by the following U.S. patents and their respective counterparts: 6643119, 7295423, 7342770, 7352558, 7384433, 7440258, 7492571, 7508651, 7580243, 7791860, 7791861, 7859826, 7883553, 7935155, 8072734, 8098481, 8279580, and patents pending.



**Maxwell Technologies, Inc.**  
**Global Headquarters**  
 3888 Calle Fortunada  
 San Diego, CA 92123  
 USA  
 Tel: +1 858 503 3300  
 Fax: +1 858 503 3301



**Maxwell Technologies SA**  
 Route de Montena 65  
 CH-1728 Rossens  
 Switzerland  
 Tel: +41 (0)26 411 85 00  
 Fax: +41 (0)26 411 85 05



**Maxwell Technologies, GmbH**  
 Leopoldstrasse 244  
 80807 München  
 Germany  
 Tel: +49 (0)89 / 4161403 0  
 Fax: +49 (0)89 / 4161403 99



**Maxwell Technologies  
 Shanghai Trading Co. Ltd.**  
 Unit A2,C 12th Floor  
 Huarun Times Square  
 500 Zhangyang Road,  
 Pudong New Area  
 Shanghai 200122,  
 P.R. China  
 Phone: +86 21 3852 4000  
 Fax: +86 21 3852 4099



**Maxwell Technologies Korea Co., Ltd.**  
 Room 1524, D-Cube City  
 Office Tower, 15F #662  
 Gyeongin-Ro, Guro-Gu,  
 Seoul, 152-706  
 South Korea  
 Phone: +82 10 4518 9829

MAXWELL TECHNOLOGIES, MAXWELL, MAXWELL CERTIFIED INTEGRATOR, ENABLING ENERGY'S FUTURE, BOOSTCAP, C CELL, D CELL and their respective designs and/or logos are either trademarks or registered trademarks of Maxwell Technologies, Inc. and may not be copied, imitated or used, in whole or in part, without the prior written permission from Maxwell Technologies, Inc. All contents copyright © 2013 Maxwell Technologies, Inc. All rights reserved. No portion of these materials may be reproduced in any form, or by any means, without prior written permission from Maxwell Technologies, Inc.