

## 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

| ELECTRICAL                                                      | BCAP0650             | BCAP1200             | BCAP1500             | BCAP2000             | BCAP3000             |
|-----------------------------------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| 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               |
| TEMPERATURE                                                     |                      |                      |                      |                      |                      |
| Operating temperature<br>(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<br>(Stored uncharged)                       |                      |                      |                      |                      |                      |
| Minimum                                                         | -40°C                | -40°C                | -40°C                | -40°C                | -40°C                |
| Maximum                                                         | 70°C                 | 70°C                 | 70°C                 | 70°C                 | 70°C                 |
| PHYSICAL                                                        |                      |                      |                      |                      |                      |
| 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<br>(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 |

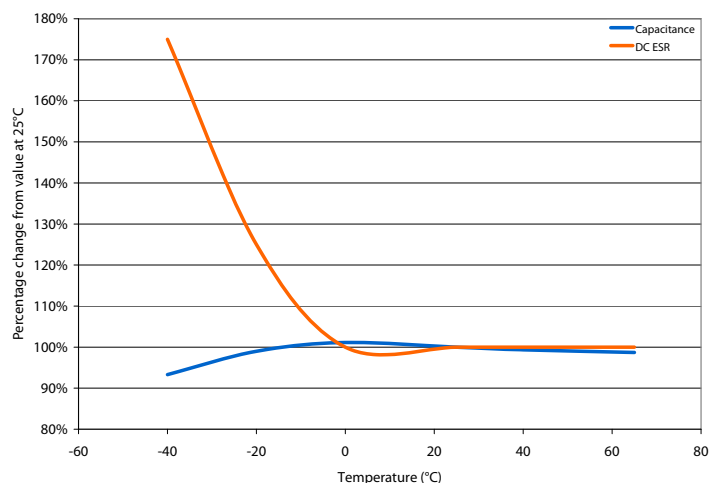
## TYPICAL CHARACTERISTICS

| 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<br>( $\Delta T = 15^\circ C$ ) <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<br>( $\Delta T = 40^\circ C$ ) <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><br>(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<br>(% decrease from minimum initial value)                                                      | 20%                 | 20%                  | 20%                  | 20%                  | 20%                  |
| ESR Change<br>(% increase from maximum initial value)                                                              | 100%                | 100%                 | 100%                 | 100%                 | 100%                 |
| Projected DC Life at 25°C <sup>1</sup><br>(held continuously at Rated Voltage)                                     | 10 years            | 10 years             | 10 years             | 10 years             | 10 years             |
| Capacitance Change<br>(% decrease from minimum initial value)                                                      | 20%                 | 20%                  | 20%                  | 20%                  | 20%                  |
| ESR Change<br>(% 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<br>(% decrease from minimum initial value)                                                      | 20%                 | 20%                  | 20%                  | 20%                  | 20%                  |

## LIFE (Cont'd)

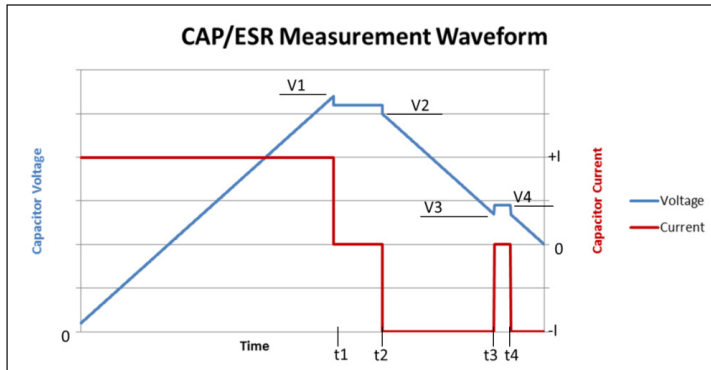
|                                                       |         |         |         |         |         |
|-------------------------------------------------------|---------|---------|---------|---------|---------|
| ESR Change<br>(% increase from maximum initial value) | 100%    | 100%    | 100%  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

## ESR AND CAPACITANCE VS TEMPERATURE

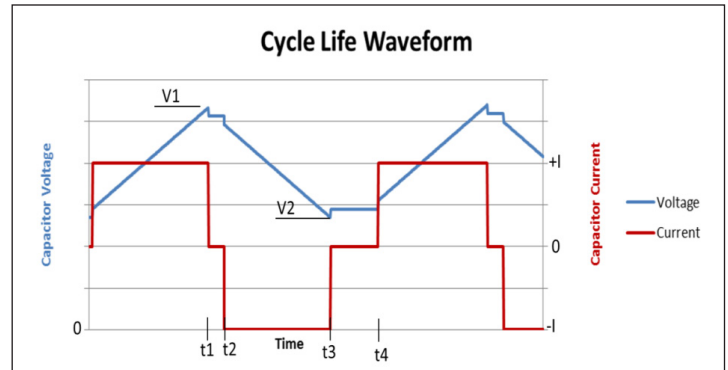


## NOTES

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,  $P_d = \frac{0.12V^2}{ESR_{DC} \times \text{mass}}$
5.  $P_{max} = \frac{V^2}{4 \times ESR_{DC} \times \text{mass}}$
6.  $E_{max} = \frac{\frac{1}{2} CV^2}{3,600 \times \text{mass}}$
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).



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



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

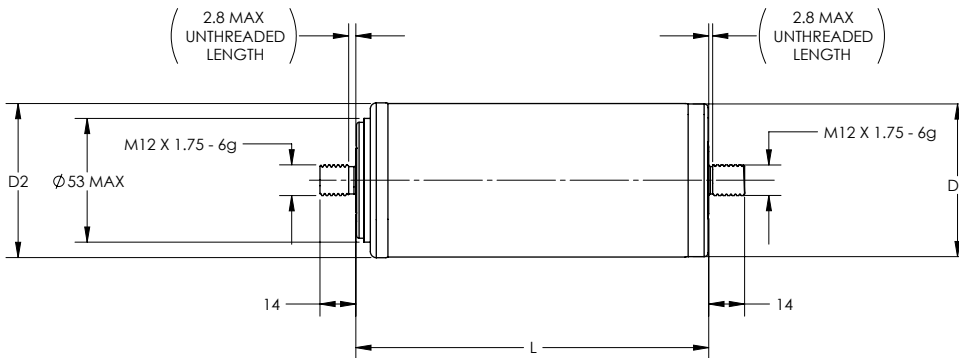
## MOUNTING RECOMMENDATIONS

Do not reverse polarity. Please refer to document number 1016419, available at [maxwell.com](http://maxwell.com) for welding recommendations.

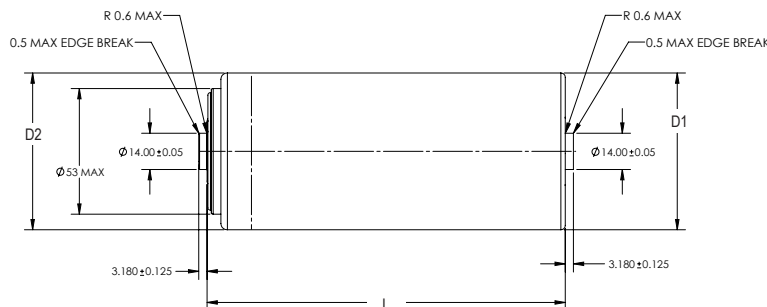
## MARKINGS

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.



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