Maxwell Technologies’ 3V 25F ultracapacitor cell is part of Maxwell’s latest full-featured 3.0V product platform designed to provide energy storage in support of the latest trends in renewable energy, smart grid, and IoT. Designed from the ground up, Maxwell developed the 3V small cell products to be high energy, high power solutions that also incorporate the XP™ technology offering enhanced performance under adverse environmental conditions. Whether used alone, integrated into a module assembly, or in a hybrid configuration, Maxwell’s 3V products will help reduce the overall cost and size of the system while improving return on investments for the customer.

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

**FEATURES AND BENEFITS**

- Enhanced performance under adverse environmental conditions
- Updated Bill of Materials compared to earlier 2.7V XP products resulting in improved performance at higher voltage
- Long lifetimes with up to 1,000,000 duty cycles*
- Straight and Bent Lead versions available
- Compliant with UL, RoHS and REACH requirements

**TYPICAL APPLICATIONS**

- Actuators
- Emergency Lighting
- Telematics / IoT
- Automotive
- Security Equipment
- Backup and UPS Systems
- Advanced Metering

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Part Number</th>
<th>Package Quantity (MOQ)</th>
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<tbody>
<tr>
<td>BCAP0025 P300 X11</td>
<td>135001</td>
<td>1,500</td>
</tr>
<tr>
<td>BCAP0025 P300 X12</td>
<td>135002</td>
<td>1,150</td>
</tr>
</tbody>
</table>

*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 & CHARACTERISTICS

Values are referenced at $T_A = \text{room temperature}$ and $V_R = 3.0\text{V}$ 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.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_R$</td>
<td>Rated Voltage</td>
<td>–</td>
<td>–</td>
<td>3.0</td>
<td>V</td>
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<tr>
<td>$V_{\text{SURGE}}$</td>
<td>Surge Voltage</td>
<td>Note 1</td>
<td>–</td>
<td>–</td>
<td>3.15</td>
<td>V</td>
</tr>
<tr>
<td>$C_R$</td>
<td>Rated Capacitance</td>
<td>BOL, Note 2,8</td>
<td>22.5</td>
<td>25.0</td>
<td>30.0</td>
<td>F</td>
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<tr>
<td>$R_S$</td>
<td>Equivalent Series Resistance (ESR$_{\text{DC}}$)</td>
<td>BOL, Note 2,8</td>
<td>–</td>
<td>17</td>
<td>25</td>
<td>mΩ</td>
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<tr>
<td>$I_{\text{LEAK}}$</td>
<td>Leakage Current</td>
<td>Note 3,8</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>µA</td>
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<tr>
<td>$I_{\text{PEAK}}$</td>
<td>Peak Current</td>
<td>BOL, Note 4,8</td>
<td>–</td>
<td>–</td>
<td>23</td>
<td>A</td>
</tr>
<tr>
<td>$I_{\text{MAX}}$</td>
<td>Continuous Current</td>
<td>BOL, Note 7,8</td>
<td>–</td>
<td>–</td>
<td>4.1</td>
<td>$A_{\text{RMS}}$</td>
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</tbody>
</table>

### LIFE

- **High Temperature Life** ($T_R = 3\text{V}$ and $T_A = 65\text{°C}$, EOL, Note 8)
  - Capacitance change $\Delta C$ from min $C_R$
  - Resistance change $\Delta R$ from max $R_S$
  - Duration: $2,000$ hours

- **De-rated Voltage & Higher Temperature Life** ($V_R = 2.7\text{V}$ and $T_A = 85\text{°C}$, EOL, Note 8)
  - Capacitance change $\Delta C$ from min $C_R$
  - Resistance change $\Delta R$ from max $R_S$
  - Duration: $1,500$ hours

- **Projected Life Time** ($V_R = 3\text{V}$ and $T_A = 25\text{°C}$, EOL, Note 8)
  - Capacitance change $\Delta C$ from min $C_R$
  - Resistance change $\Delta R$ from max $R_S$
  - Duration: $10$ hours

- **Projected Cycle Life** ($T_A = 25\text{°C}$, EOL, Note 6,8)
  - Capacitance change $\Delta C$ from min $C_R$
  - Resistance change $\Delta R$ from max $R_S$
  - Duration: $1,000,000$ cycles

- **Biased Humidity Life** ($V_R = 3\text{V}$, $T_A = 60\text{°C}$, and $\text{RH} = 90\%$)
  - Duration: $4,000$ hours

- **Shelf Life**
  - Stored uncharged, $T_A = 25\text{°C}$ and $\text{RH} \leq 50\%$
  - Duration: $4$ years
Datasheet: 3.0V 25F ULTRACAPACITOR CELL

**PRODUCT SPECIFICATIONS & CHARACTERISTICS**

Values are referenced at $T_A = \text{room temperature}$ and $V_R = 3.0\text{V}$ 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.

<table>
<thead>
<tr>
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<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_d$</td>
<td>Usable Specific Power</td>
<td>BOL, Note 5,8</td>
<td>–</td>
<td>9.6</td>
<td>–</td>
<td>kW/kg</td>
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<tr>
<td>$P_{MAX}$</td>
<td>Impedance Match Specific Power</td>
<td>BOL, Note 5,8</td>
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<td>20.1</td>
<td>–</td>
<td>kW/kg</td>
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<tr>
<td>$E_d$</td>
<td>Gravimetric Specific Energy</td>
<td>BOL, Note 5,8</td>
<td>–</td>
<td>4.7</td>
<td>–</td>
<td>Wh/kg</td>
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<tr>
<td>$E_{MAX}$</td>
<td>Stored Energy</td>
<td>BOL, Note 5,8,9</td>
<td>–</td>
<td>31.3</td>
<td>–</td>
<td>mWh</td>
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**TEMPERATURE**

<table>
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<tr>
<th>Symbol</th>
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<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>$T_A$</td>
<td>Operating Temperature</td>
<td>Cell case temperature</td>
<td>-40</td>
<td>25</td>
<td>65</td>
<td>°C</td>
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<tr>
<td>$R_{th}$</td>
<td>Thermal Resistance</td>
<td>Case to ambient, Note 7</td>
<td>–</td>
<td>35</td>
<td>–</td>
<td>°C/W</td>
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<tr>
<td>$C_{th}$</td>
<td>Thermal Capacitance</td>
<td>–</td>
<td>7.6</td>
<td>–</td>
<td>J/°C</td>
<td></td>
</tr>
</tbody>
</table>

**PHYSICAL**

| m | Mass | – | 6.6 | – | g |
| – | Vibration – Sine Wave | IEC 60068-2-6 | – |
| – | Shock | IEC 60068-2-27 | – |

**SAFETY**

| – | Certifications | UL810A, RoHS, REACH |
**NOTES**

1. Surge Voltage
   Absolute maximum voltage, non-repetitive. The duration must not exceed 1 second.

2. Rated Capacitance & ESR<sub>BOL</sub> (Measurement Method)
   - Capacitance: Constant current charge (10mA/F) to \( V_n \), 5 min hold at \( V_n \), constant current discharge (10mA/F) to 0.1V.
   - ESR<sub>BOL</sub>: Constant current charge (10mA/F) to \( V_n \), 5 min hold at \( V_n \), constant current discharge (40 * \( C_n \) * \( V_n \) [mA]) to 0.1V.

3. Leakage Current (Measurement Method)
   - Current measured after 72 hours of constant voltage hold at \( V_n \) 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 \( V_n \) to 1/2\( V_n \) in 1 second.
   \[
   I_{\text{PEAK}} = \frac{\Delta V}{\Delta t / C_n}
   \]
   where \( I_{\text{PEAK}} \) is the maximum peak current (A); \( \Delta V \) is the voltage drop during first 10ms of discharge (V); \( \Delta t \) is the discharge time (sec); \( \Delta t = 1 \) sec in this case; \( C_n \) is the rated capacitance (F); \( V_n \) is the rated voltage (V).
   - The stated peak current should not be used in normal operation and is provided as a reference value only.

**DETAILED PRODUCT DESCRIPTION**

**Introduction**
The BCAP0025 P300 X11 / X12 energy storage cell is a robust ultracapacitor solution in a leaded cylindrical style can. The 3.0V 25F cell design uses Maxwell’s proprietary XP™ high heat and humidity environmental technology to provide maximum life under adverse conditions.

**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 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 maximize ionic conductivity and electrode wetting. It is the combination of high surface-area activated carbon electrodes (typically >1500m<sup>2</sup>/g) with extremely small charge separation (Angstroms) that results in high capacitance.

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maxwell.com
MECHANICAL DRAWINGS

Datasheet: 3.0V 25F ULTRACAPACITOR CELL

BCAP0025 P300 X11

BCAP0025 P300 X12

<table>
<thead>
<tr>
<th>DIMENSION (Tolerance)</th>
<th>L (±1.0)</th>
<th>D (+0.5)</th>
<th>d (±0.05)</th>
<th>A (±0.5)</th>
<th>H1 (min)</th>
<th>H2 (min)</th>
<th>R (min)</th>
<th>a (±0.5)</th>
<th>b (±0.5)</th>
<th>UNIT</th>
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<tbody>
<tr>
<td>BCAP0025 P300 X11</td>
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<td>16.0</td>
<td>0.80</td>
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<td>15.0</td>
<td>19.0</td>
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<td>mm</td>
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<tr>
<td>BCAP0025 P300 X12</td>
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<td>16.0</td>
<td>0.80</td>
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<td>2.0</td>
<td>11.6</td>
<td>8.4</td>
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