Maxwell TECHNOLOGIES | An UP Company

DATASHEET

2.7V 325F ULTRACAPACITOR CELL

BCAP0325 P270 S19

High Power Energy Solution in Compact Form Factor

Maxwell Technologies' 2.7V 325F Ultracapacitor cell enhances Maxwell's full featured lineup of energy storage solutions designed to support the latest trends in automotive applications, small UPS systems, consumer and industrial electronics, and medical equipment. The 2.7V 325F ultracapacitor cell is designed for performance and system optimization in a long life, small form factor. Whether used alone, integrated into a module assembly, or in a hybrid configuration, Maxwell's ultracapacitor 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

- High power cell with low ESR, suitable for automotive applications
- Designed for up to 1 million duty cycles*
- Small 33mm diameter enabling compact system designs
- Integrated 4-pin terminals for easy PCB mounting
- UL, RoHS and REACH compliant
- AEC-Q200 qualified

TYPICAL APPLICATIONS

- Automotive-Peak Power Assist Subsystems, Back-Up Power Applications
- UPS Systems
- Consumer and Industrial Electronics
- Emergency Lighting

ORDERING INFORMATION

Model Number	Part Number	Packaging Quantity(MOQ)
BCAP0325 P270 S19	135968	110

*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 = room temperature and V = 2.7V 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		—	—	2.7	V
V_{SURGE}	Surge Voltage	Note 1	—	—	2.85	V
C_R	Rated Capacitance	BOL, Note 2, 8	325	345	390	F
R_S	Equivalent Series Resistance (ESR_{DC})	BOL, Note 2, 8	—	1.6	1.9	mΩ
I_{LEAK}	Leakage Current	BOL, Note 3, 8	—	0.45	0.70	mA
I_{PEAK}	Peak Current	BOL, Note 4, 8	—	—	270	A
I_{MAX}	Continuous Current	BOL, Note 4, 8 -ΔT = 15˚C -ΔT = 40˚C	— —	— —	30 49	A_{RMS}
LIFE						
t_{65C}	High Temperature Life	V_R = 2.7V and T_A=65˚C, EOL, Note 8 - Capacitance change ΔC from Min C_R - Resistance change ΔR from Max R_S	— — —	3,000 -20 +100	— — —	hours % %
t_{85C}	De-rated Voltage & Higher Temperature Life	V_R = 2.3V and T_A=85˚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 = 2.7V and T_A=25˚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˚C, EOL, Note 6,8 - Capacitance change ΔC from Min C_R - Resistance change ΔR from Max R_S - Test Current: 32.5A	— — —	1,000,000 -20 +100	— — —	cycles % %
t_{SHELF}	Shelf Life	Stored uncharged, T_A=25˚C and RH ≤ 50%	—	4	—	years

Maxwell TECHNOLOGIES
Enabling Energy's Future™

PRODUCT SPECIFICATIONS & CHARACTERISTICS

Values are referenced at T = room temperature and V = 2.7V 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.

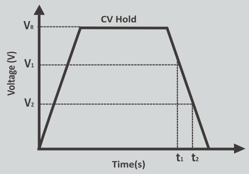
Symbol	Parameter	Conditions	Min	Typical	Max	Unit
POWER & ENERGY						
P_d	Usable Specific Power	BOL, Note 5, 8	7.1	8.4	—	kW/Kg
P_{MAX}	Impedance Match Specific Power	BOL, Note 5, 8	14.8	17.5	—	kW/Kg
E_d	Gravimetric Specific Energy	BOL, Note 5, 8	5.1	5.4	—	Wh/Kg
E_{MAX}	Stored Energy	BOL, Note 5, 8, 9	0.33	0.35	—	Wh
TEMPERATURE						
T_A	Operating Temperature	Cell case temperature	-40	25	65	℃
R_{th}	Thermal Resistance	Case to ambient, Note 7	—	8.8	—	℃/W
C_{th}	Thermal Capacitance		—	76	—	J/℃
PHYSICAL						
m	Mass		—	65	—	g
—	Vibration - Sine Wave		IEC 60068-2-6			—
—	Shock		IEC 60068-2-27			—
SAFETY						
—	Certifications		UL810A, RoHS, REACH			

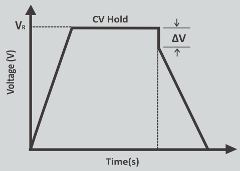
Maxwell TECHNOLOGIES
Enabling Energy's Future™

NOTES

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

2. **Rated Capacitance & ESR_{DC} (Measurement method)**
- Capacitance: Constant current charge (10mA/F) to V_R, 5 minutes hold at V_R, constant current discharge (10mA/F) to 0.1V.
- ESR_{DC}: Constant current charge (10mA/F) to V_R, 5 minutes hold at V_R, constant current discharge (40*C*V_R[mA]) to 0.1V.





$$C_R = \frac{I \times (t_2 - t_1)}{V_1 - V_2}$$

$$Rs = \frac{\Delta V}{I}$$

Where C_R is the capacitance (F);
I is the absolute value of the discharge current (A);
V_R is the rated voltage (V);
V_1 is the measurement starting voltage, 0.8 x V_R (V);
V_2 is the measurement end voltage, 0.4 x V_R (V);
t_1 is the time from discharge start to reach V_1 (s)
t_2 is the time from discharge start to reach V_2 (s);
R_S is the DC equivalent series resistance (Ω);
ΔV is the voltage drop during first 10ms of discharge (V).

3. **Leakage Current (Measurement Method)**
- 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.

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

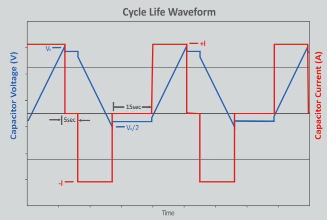
Where I_{PEAK} is the maximum peak current (A);
V_R is the rated voltage (V)
Δt is the discharge time (sec);Δt = 1 in this case;
C_R is the rated BOL capacitance (F);
R_S is the maximum BOL ESR_{DC} (Ω)

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

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) = $\frac{E_{MAX}}{m}$
- Stored Energy, E_{MAX} (Wh) = $\frac{½C_R \times V_R^2}{3,600}$

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

6. **Projected Cycle Life**
- Constant current charge-discharge cycle from V_R to ½V_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 continous current (A);
ΔT is the change in temperature (℃);
R_{th} is the typical thermal resistance (℃/W);
R_S is the maximum BOL ESR_{DC} (Ω);

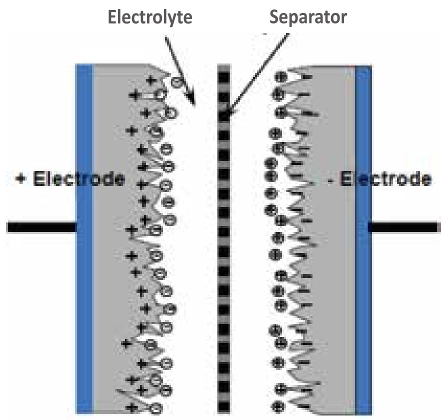
8. **BOL & EOL Conditions**
- BOL (Beginning of Life): Rated / Initial product performance
- EOL (End of Life):
  - Capacitance: 80% of min. BOL rating (0.8 x min. C_R)
  - ESR_{DC}: 200% of max. BOL rating (2 x max. R_S)

9. **Transportation Regulation**
- 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 BCAP0325 P270 S19 energy storage cell is a robust ultracapacitor solution in a cylindrical style can with integrated 4-pin terminals.

Technology Overview
An ultracapacitor, also known as a supercapacitor or an 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.*



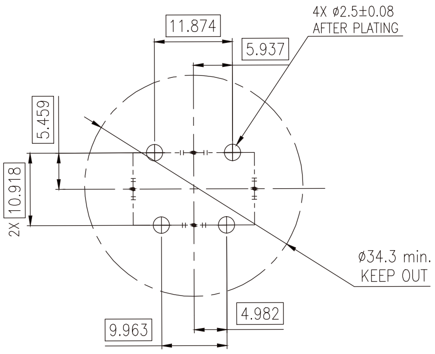
Ultracapacitor Construction
An ultracapacitor is constructed with symmetric carbon positive and negative electrodes separated by an insulating ion-permeable separator and packaged into a container filled with organic electrolyte (salt/solvent) designed to maximize ionic conductivity and electrode wetting.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

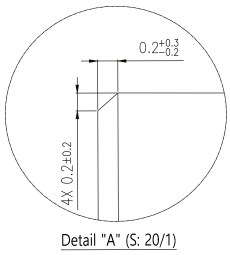
*Results may vary. Additional terms and conditions, including the limited warranty, apply at the time of purchase. See the warranty details for applicable operating and use requirements.

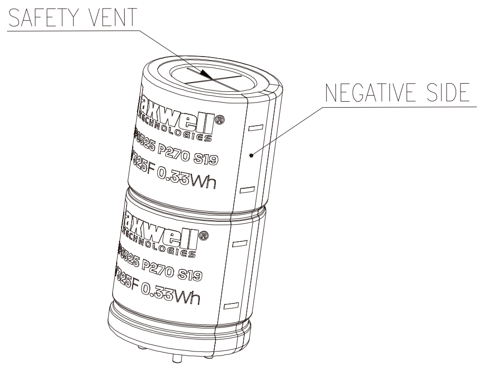
Maxwell TECHNOLOGIES
Enabling Energy's Future™

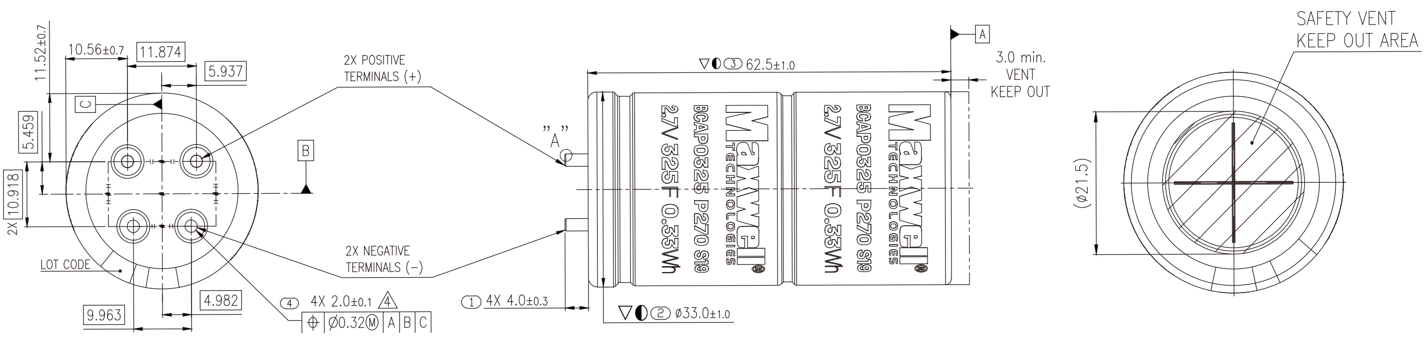
MECHANICAL DRAWINGS

BCAP0325 P270 S19









Dimension (Tolerance)	L (±1.0)	D (±1.0)	H (±0.3)	UNIT
BCAP0325 P270 S19	62.5	33.0	4.0	mm

Products and related processes may be covered by one or more U.S. or international patents and pending applications. Product dimensions are for reference only unless otherwise identified. Maxwell Technologies reserves the right to make changes without further notice to any products herein.
“Typical” parameters which may be provided in Maxwell Technologies datasheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including “Typicals” must be validated for each customer application by customer’s technical experts. Please contact Maxwell Technologies directly for any technical specifications critical to application.

Maxwell Technologies Korea Co., Ltd.
17, Dongtangiheung-ro
681 Beon-gil, Giheung-gu,
Yongin-si, Gyeonggi-do
17102
Republic of Korea
Tel: +82 31 289 0700
Fax: +82 31 286 6767

Enabling Energy’s Future™