

**FEATURES AND BENEFITS\***

- Up to 500,000 duty cycles or 10 year life
- Low internal resistance
- High power density
- 1F to 150F capacitance range
- -40° to 85°C operating temperature range

**TYPICAL APPLICATIONS**

- Back-up power for cache-to-flash applications
- Smart Meters
- Automotive subsystems
- Consumer and industrial electronics
- Wireless transmitters



**PRODUCT SPECIFICATIONS**

<b>ELECTRICAL</b>	<b>BCAP0001</b>	<b>BCAP0003</b>	<b>BCAP0005</b>	<b>BCAP0010 T01/T11/T12</b>
Rated Capacitance <sup>1</sup>	1 F	3.3 F	5 F	10 F
Minimum Capacitance, initial <sup>1</sup>	0.8 F	2.6 F	4.0 F	8.0 F
Maximum ESR <sub>DC</sub> , initial <sup>1</sup>	700 mΩ	290 mΩ	170 mΩ	75 mΩ
Test Current for Capacitance and ESR <sub>DC</sub> <sup>1</sup>	0.1 A	0.33 A	0.5 A	1 A
Rated Voltage (65°/85°C)	2.70 / 2.30 V	2.70 / 2.30 V	2.70 / 2.30 V	2.70 / 2.30 V
Absolute Maximum Voltage <sup>2</sup>	2.85 V	2.85 V	2.85 V	2.85 V
Absolute Maximum Current	0.8 A	1.9 A	3.2 A	7.2 A
Leakage Current at 25°C, maximum <sup>3</sup>	0.006 mA	0.012 mA	0.015 mA	0.030 mA

**TEMPERATURE**

Operating temperature range (Cell case temperature)				
Minimum	-40°C	-40°C	-40°C	-40°C
Maximum	65° / 85°C	65° / 85°C	65° / 85°C	65° / 85°C
Storage temperature range (Stored uncharged)				
Minimum	-40°C	-40°C	-40°C	-40°C
Maximum	70°C	70°C	70°C	70°C

**PHYSICAL**

Mass, typical	1.1 g	1.7 g	2.3 g	3.5 g
Terminals	Wire Leads	Wire Leads	Wire Leads	Wire Leads
Vibration	-	-	-	-
Shock	-	-	-	-

\*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)

<b>ELECTRICAL</b>	<b>BCAP0025 T01/T11</b>	<b>BCAP0050</b>	<b>BCAP0100 T01</b>	<b>BCAP0100 T07</b>	<b>BCAP0150</b>
Rated Capacitance <sup>1</sup>	25 F	50 F	100 F	100 F	150 F
Minimum Capacitance, initial <sup>1</sup>	25 F	50 F	100 F	100 F	150 F
Maximum ESR <sub>DC</sub> , initial <sup>1</sup>	42 mΩ	20 mΩ	15 mΩ	15 mΩ	14 mΩ
Test Current for Capacitance and ESR <sub>DC</sub> <sup>1</sup>	2.5 A	5 A	10 A	10 A	15 A
Rated Voltage (65°/85°C)	2.70 / 2.30 V	2.70 / 2.30 V	2.70 / 2.30 V	2.70 / 2.30 V	2.70 / 2.30 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	20 A	27 A	36 A	36 A	40 A
Leakage Current at 25°C, maximum <sup>3</sup>	0.045 mA	0.075 mA	0.260 mA	0.260 mA	0.500 mA
<b>TEMPERATURE</b>					
Operating temperature range (Cell case temperature)					
Minimum	-40°C	-40°C	-40°C	-40°C	-40°C
Maximum	65° / 85°C	65° / 85°C	65° / 85°C	65° / 85°C	65° / 85°C
Storage temperature range (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	7.5 g	13 g	23 g	22 g	32 g
Terminals	Wire Leads	Wire Leads	Wire Leads	Snap In	Snap in
Vibration	-	-	-	-	-
Shock	-	-	-	-	-

## PRODUCT SPECIFICATIONS (Cont'd)

POWER & ENERGY AT 2.7V	BCAP0001	BCAP0003	BCAP0005	BCAP0010 T01/T11/T12
Usable Specific Power, $P_d$ <sup>4</sup>	1,100 W/kg	1,800 W/kg	2,200 W/kg	3,300 W/kg
Impedance Match Specific Power, $P_{max}$ <sup>5</sup>	2,400 W/kg	3,700 W/kg	4,700 W/kg	6,900 W/kg
Specific Energy, $E_{max}$ <sup>6</sup>	0.9 Wh/kg	2.0 Wh/kg	2.2 Wh/kg	2.9 Wh/kg
Stored Energy, $E_{stored}$ <sup>7,11</sup>	0.001 Wh	0.003 Wh	0.005 Wh	0.010 Wh

## SAFETY

Short Circuit Current, typical (Current possible with short circuit from rated voltage. Do not use as an operating current.)	4 A	9 A	16 A	36 A
Certifications	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS

## TYPICAL CHARACTERISTICS

## THERMAL CHARACTERISTICS

Thermal Resistance ( $R_{ca}$ , Case to Ambient), typical <sup>8</sup>	120°C/W	76°C/W	73°C/W	43°C/W
Thermal Capacitance ( $C_{th}$ ), typical	1.0 J/°C	1.4 J/°C	2.0 J/°C	3.6 J/°C
Maximum Continuous Current ( $\Delta T = 15^\circ\text{C}$ ) <sup>8</sup>	0.4 A <sub>RMS</sub>	0.8 A <sub>RMS</sub>	1.1 A <sub>RMS</sub>	2.2 A <sub>RMS</sub>
Maximum Continuous Current ( $\Delta T = 40^\circ\text{C}$ ) <sup>8</sup>	0.7 A <sub>RMS</sub>	1.3 A <sub>RMS</sub>	1.8 A <sub>RMS</sub>	3.5 A <sub>RMS</sub>

PRODUCT SPECIFICATIONS (Cont'd)

POWER & ENERGY AT 2.7V	BCAP0025 T01/T11	BCAP0050	BCAP0100 T01	BCAP0100 T07	BCAP0150
Usable Specific Power, $P_d^4$	2,800 W/kg	3,400 W/kg	2,500 W/kg	2,700 W/kg	2,000 W/kg
Impedance Match Specific Power, $P_{max}^5$	5,800 W/kg	7,000 W/kg	5,300 W/kg	5,500 W/kg	4,100 W/kg
Specific Energy, $E_{max}^6$	3.4 Wh/kg	3.9 Wh/kg	4.4 Wh/kg	4.6 Wh/kg	4.7 Wh/kg
Stored Energy, $E_{stored}^{7,11}$	0.025 Wh	0.051 Wh	0.101 Wh	0.101 Wh	0.152 Wh

SAFETY

Short Circuit Current, typical (Current possible with short circuit from rated voltage. Do not use as an operating current.)	64 A	140 A	180 A	180 A	190 A
Certifications	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS

TYPICAL CHARACTERISTICS

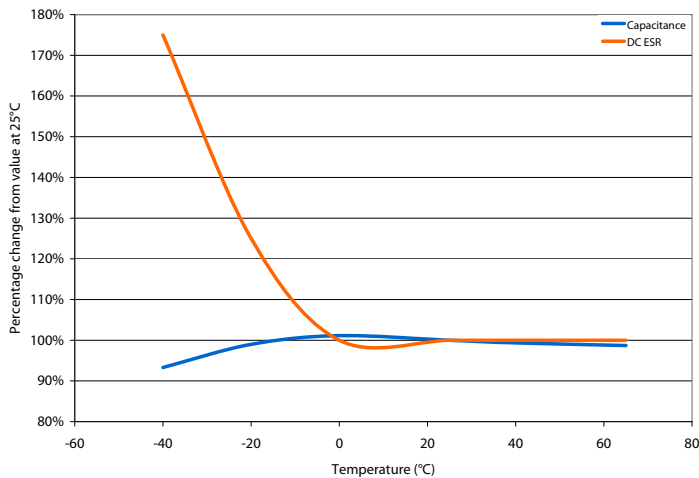
THERMAL CHARACTERISTICS

Thermal Resistance ( $R_{ca}$ , Case to Ambient), typical <sup>8</sup>	47°C/W	26°C/W	22°C/W	22°C/W	18°C/W
Thermal Capacitance ( $C_{th}$ ), typical	6.3 J/°C	13 J/°C	23 J/°C	23 J/°C	32
Maximum Continuous Current ( $\Delta T = 15^\circ C$ ) <sup>8</sup>	2.8 A <sub>RMS</sub>	5.4 A <sub>RMS</sub>	6.7 A <sub>RMS</sub>	6.7 A <sub>RMS</sub>	7.7 A <sub>RMS</sub>
Maximum Continuous Current ( $\Delta T = 40^\circ C$ ) <sup>8</sup>	4.5 A <sub>RMS</sub>	8.8 A <sub>RMS</sub>	11 A <sub>RMS</sub>	11 A <sub>RMS</sub>	13 A <sub>RMS</sub>

TYPICAL CHARACTERISTICS (Cont'd)

LIFE	BCAP0001	BCAP0003	BCAP0005	BCAP0010 T01/T11/T12
DC Life at High Temperature <sup>1</sup> (held continuously at Rated Voltage & Maximum Operating Temperature)	1,000 hours	1,000 hours	1,000 hours	1,000 hours
Capacitance Change (% decrease from minimum initial value)	30%	30%	30%	30%
ESR Change (% increase from maximum initial value)	100%	100%	100%	100%
Projected DC Life at 25°C <sup>1</sup> (at Rated Voltage & 25°C)	10 years	10 years	10 years	10 years
Capacitance Change (% decrease from minimum initial value)	30%	30%	30%	30%
ESR Change (% increase from maximum initial value)	100%	100%	100%	100%
Projected Cycle Life at 25°C <sup>1,9,10</sup>	500,000 cycles	500,000 cycles	500,000 cycles	500,000 cycles
Capacitance Change (% decrease from minimum initial value)	30%	30%	30%	30%
ESR Change (% increase from maximum initial value)	100%	100%	100%	100%
Test Current	0.1 A	0.33 A	0.5 A	1.0 A
Shelf Life (Stored uncharged at 25°C)	2 years	2 years	2 years	2 years

ESR AND CAPACITANCE VS TEMPERATURE

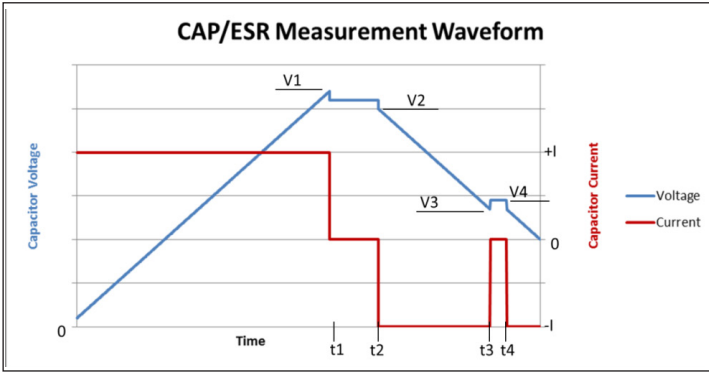


TYPICAL CHARACTERISTICS (Cont'd)

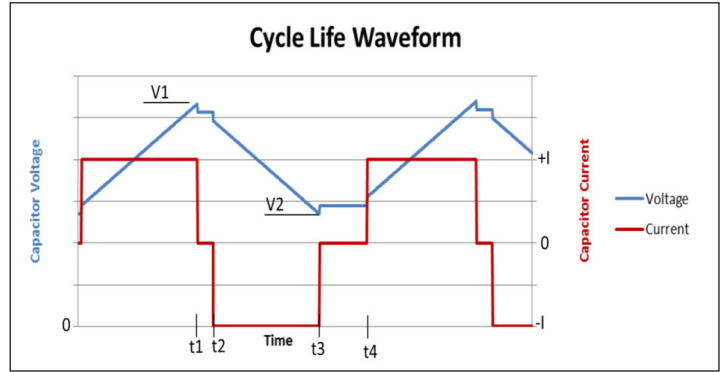
LIFE	BCAP0025 T01/ T11	BCAP0050	BCAP0100 T01	BCAP0100 T07	BCAP0150
DC Life at High Temperature <sup>1</sup> (at Rated Voltage & Maximum Operating Temperature)	1,000 hours	1,000 hours	1,000 hours	1,000 hours	1,000 hours
Capacitance Change (% decrease from minimum initial value)	30%	30%	30%	30%	30%
ESR Change (% increase from maximum initial value)	100%	100%	100%	100%	100%
Projected DC Life at 25°C <sup>1</sup> (at Rated Voltage & 25°C)	10 years	10 years	10 years	10 years	10 years
Capacitance Change (% decrease from minimum initial value)	30%	30%	30%	30%	30%
ESR Change (% increase from maximum initial value)	100%	100%	100%	100%	100%
Projected Cycle Life at 25°C <sup>1,9,10</sup>	500,000 cycles	500,000 cycles	500,000 cycles	500,000 cycles	500,000 cycles
Capacitance Change (% decrease from minimum initial value)	30%	30%	30%	30%	30%
ESR Change (% increase from maximum initial value)	100%	100%	100%	100%	100%
Test Current	2.5 A	5 A	10 A	10 A	15 A
Shelf Life (Stored uncharged at 25°C)	2 years	2 years	2 years	2 years	2 years

NOTES

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



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



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

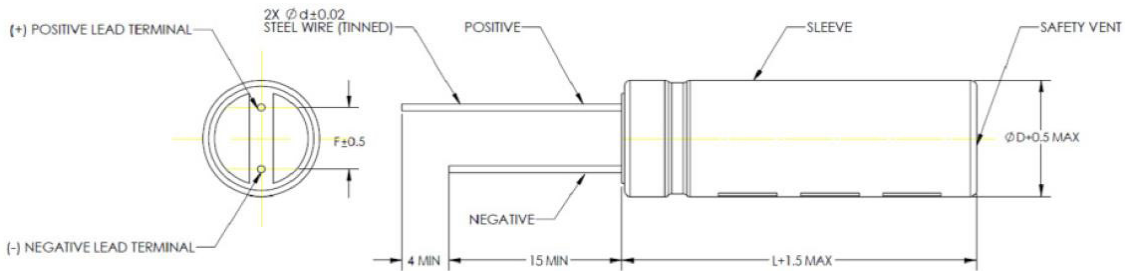
### MOUNTING RECOMMENDATIONS

Please refer to the user manual for installation recommendations.

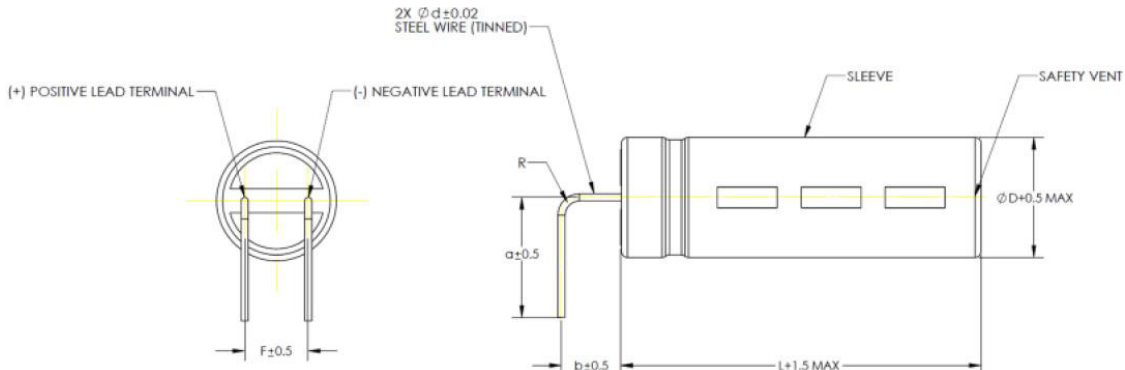
### MARKINGS

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

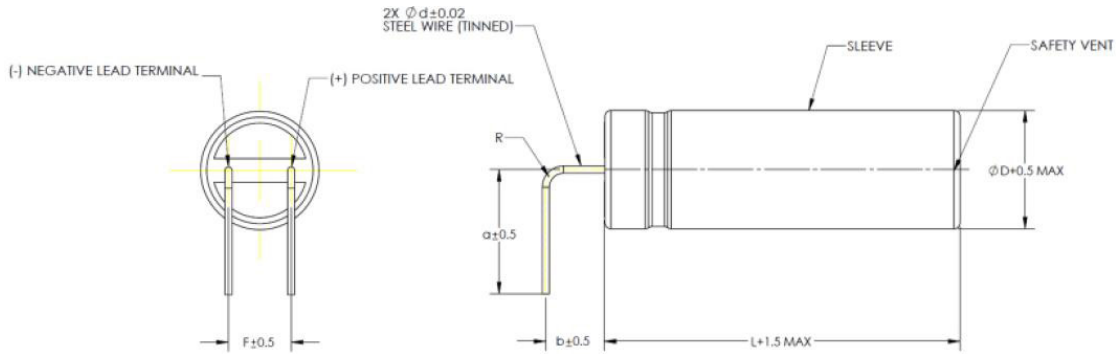
### BCAP0001, 3, 5, 10, 25, 50, 100 (T01)



### BCAP0010, 25 (T11)



BCAP0010 (T12)

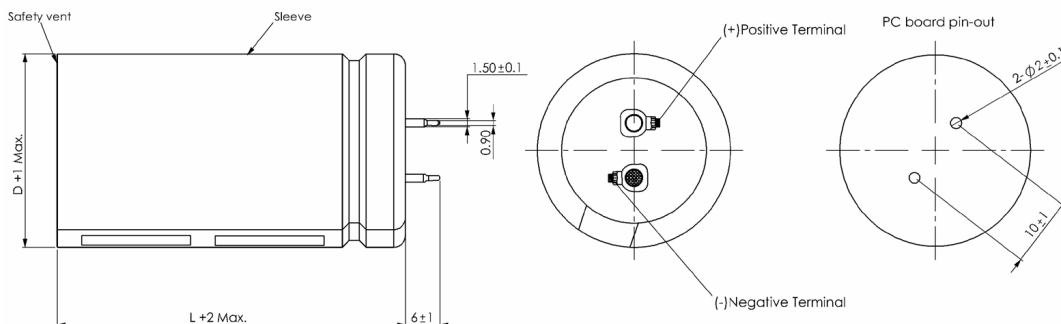


Product dimensions are for reference only unless otherwise identified. Product dimensions and specifications may change without notice. Please contact Maxwell Technologies directly for any technical specifications critical to application.

Part Description	Dimensions (mm)							Package Quantity
	L	D	d	F	R	a	b	
BCAP0001 P270 T01	12	8	0.6	3.8	-	-	-	4,000
BCAP0003 P270 T01	20	10	0.6	5	-	-	-	4,000
BCAP0005 P270 T01	20	10	0.6	5	-	-	-	4,000
BCAP0010 P270 T01	30	10	0.6	5	-	-	-	3,000
BCAP0010 P270 T11	30	10	0.6	5	1.5	10.5	5	1,600
BCAP0010 P270 T12	30	10	0.6	5	1.5	10.5	5	1,600
BCAP0025 P270 T01	26	16	0.8	7.5	-	-	-	1,300
BCAP0025 P270 T11	26	16	0.8	7.5	2	11.6	8.4	975
BCAP0050 P270 T01	40	18	0.8	7.5	-	-	-	800
BCAP0100 P270 T01	45	22	1	9.5	-	-	-	400



BCAP0100, 150 (T07)



Part Description	Dimensions (mm)				Package Quantity
	L	D	d	F	
BCAP0100 P270 T07	45	22	-	-	400
BCAP0150 P270 T07	50	25	-	-	400

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 foreign counterparts: 6525924, 6643119, 7295423, 7342770, 7352558, 7384433, 7492571, 7508651, 7791860, 7791861, 7883553, 7935155, 8072734, 8279580, and patents pending.



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