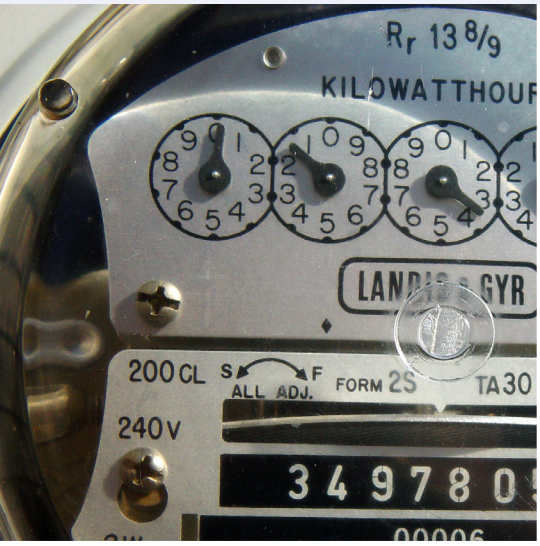
DATASHEET HC SERIES ULTRACAPACITORS

FEATURES AND BENEFITS

- High power performance
- Low RC time constant
- Over 500,000 duty cycles
- Proprietary material science and packaging technology

TYPICAL APPLICATIONS

- Automotive subsystems
- Smart Meter
- Back-up power for SSD and NV-DIMM
- Consumer electronics
- Wireless transmissions



Maxwell TECHNOLOGIES
Enabling Energy's Future™

PRODUCT SPECIFICATIONS

ELECTRICAL	BCAP0001	BCAP0003	BCAP0 005	BCAP0010 T01/T11/T12
Rated Capacitance[1]	1 F	3.3 F	5 F	10 F
Minimum Capacitance, initial[1]	0.8 F	2.6 F	4.0 F	8.0 F
Maximum ESR $_{DC,}$ initial[1]	700 mΩ	290 mΩ	170 mΩ	75 mΩ
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[11]	2.85 V	2.85 V	2.85 V	2.85 V
Maximum Continuous Current ($\Delta T = 15^{o}C$)[2]	0.4 A_{RMS}	0.8 A_{RMS}	1.1 A_{RMS}	2.2 A_{RMS}
Maximum Continuous Current ($\Delta T = 40^{o}C$)[2]	0.7 A_{RMS}	1.3 A_{RMS}	1.8 A_{RMS}	3.5 A_{RMS}
Maximum Peak Current (65˚/85˚C), 1 second (non repetitive) [3]	0.8 / 0.7 A	2.3 / 1.9 A	3.6 / 3.1 A	8 / 7 A
Leakage Current, maximum[4]	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	-	-	-	-

ELECTRICAL	BCAP0025 T01/T11	BCAP0050	BCAP0100 T01	BCAP0100 T07	BCAP0150
Rated Capacitance[1]	25 F	50 F	100 F	100 F	150 F
Minimum Capacitance, initial[1]	25 F	50 F	100 F	100 F	150 F
Maximum ESR $_{DC,}$ initial[1]	42 mΩ	20 mΩ	15 mΩ	15 mΩ	14 mΩ
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[11]	2.85 V	2.85 V	2.85 V	2.85 V	2.85 V
Maximum Continuous Current ($\Delta T = 15^{o}C$)[2]	2.8 A_{RMS}	5.4 A_{RMS}	6.7 A_{RMS}	6.7 A_{RMS}	7.7 A_{RMS}
Maximum Continuous Current ($\Delta T = 40^{o}C$)[2]	4.5 A_{RMS}	8.8 A_{RMS}	11 A_{RMS}	11 A_{RMS}	13 A_{RMS}
Maximum Peak Current (65˚/85˚C), 1 second (non repetitive)[3]	16 / 14 A	34 / 29 A	54 / 46 A	54 / 46 A	65 / 56 A
Leakage Current, maximum [4]	0.045 mA	0.075 mA	0.260 mA	0.260 mA	0.500 mA
TEMPERATURE					
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
PHYSICAL					
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	BCAP0001	BCAP0003	BCAP0005	BCAP0010 T01/T11/T12
Usable Specific Power, P_d (65°/85°C)[5]	1,100 / 820 W/kg	1,800 / 1,300 W/kg	2,200 / 1,600 W/kg	3,300 / 2,400 W/kg
Impedance Match Specific Power, P_{max} (65°/85°C)[6]	2,400 / 1,700 W/kg	3,700 / 2,700 W/kg	4,700 / 3,400 W/kg	6,900 / 5,000 W/kg
Specific Energy, E_{max} (65°/85°C)[7]	0.9 / 0.7 Wh/kg	2.0 / 1.4 Wh/kg	2.2 / 1.6 Wh/kg	2.9 / 2.1 Wh/kg
Stored Energy (65°/85°C)[8]	0.001 / 0.001 Wh	0.003 / 0.002 Wh	0.005 / 0.004 Wh	0.010 / 0.007 Wh
LIFE				
High Temperature[1] (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%
Room Temperature[1] (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%
Cycle Life[1,9]	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	0.3 A	0.5 A	1.0 A
Shelf Life[1,10] (Stored uncharged up to a maximum storage temperature)	2 years	2 years	2 years	2 years
SAFETY				
Short Circuit Current, typical (65°/85°C) (Current possible with short circuit from rated voltage. Do not use as an operating current.)	4 / 3 A	9 / 8 A	16 / 14 A	36 / 31 A
Certifications	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS

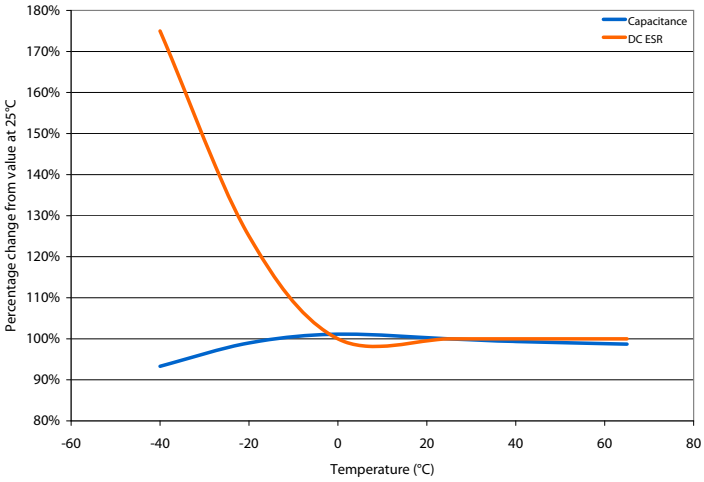
POWER & ENERGY	BCAP0025 T01/T11	BCAP0050	BCAP0100 T01	BCAP0100 T07	BCAP0150
Usable Specific Power, P_d (65˚/85˚C)[5]	2,800 / 2,000 W/kg	3,400 / 2,400 W/kg	2,500 / 1,800 W/kg	2,700 / 1,900 W/kg	2,000 / 1,400 W/kg
Impedance Match Specific Power, P_{max} (65˚/85˚C)[6]	5,800 / 4,200 W/kg	7,000 / 5,100 W/kg	5,300 / 3,800 W/kg	5,500 / 4,000 W/kg	4,100 / 3,000 W/kg
Specific Energy, E_{max} (65˚/85˚C)[7]	3.4 / 2.4 Wh/kg	3.9 / 2.8 Wh/kg	4.4 / 3.2 Wh/kg	4.6 / 3.3 Wh/kg	4.7 / 3.4 Wh/kg
Stored Energy (65˚/85˚C)[8]	0.025 / 0.018 Wh	0.051 / 0.037 Wh	0.101 / 0.073 Wh	0.101 / 0.073 Wh	0.152 / 0.110 Wh
LIFE					
High Temperature[1] (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%
Room Temperature[1] (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%
Cycle Life[1,9]	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[1,10] (Stored uncharged up to a maximum storage temperature)	2 years	2 years	2 years	2 years	2 years
SAFETY					
Short Circuit Current, typical (65˚/85˚C) (Current possible with short circuit from rated voltage. Do not use as an operating current.)	64 / 55 A	140 / 120 A	180 / 150 A	180 / 150 A	190 / 160 A
Certifications	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS	UL810a, RoHS

TYPICAL CHARACTERISTICS

THERMAL CHARACTERISTICS	BCAP0001	BCAP0003	BCAP0005	BCAP0010 T01/T11/T12
Thermal Resistance (Rth, Case to Ambient), typical[2]	120°C/W	76°C/W	73°C/W	43°C/W
Thermal Capacitance (C_{th}), typical [2]	1.0 J/°C	1.4 J/°C	2.0 J/°C	3.6 J/°C

THERMAL CHARACTERISTICS	BCAP0025 T01/T11	BCAP0050	BCAP0100 T01	BCAP0100 T07	BCAP0150
Thermal Resistance (Rth, Case to Ambient), typical[2]	47°C/W	26°C/W	22°C/W	22°C/W	18°C/W
Thermal Capacitance (C_{th}), typical [2]	6.3 J/°C	13 J/°C	23 J/°C	23 J/°C	32 J/°C

ESR AND CAPACITANCE VS TEMPERATURE



NOTES

1. Capacitance and ESR_{DC} measured at 25°C per Document Number 1007239 available at www.maxwell.com.
2. Per Maxwell Document 1007239 available at www.maxwell.com.
3. Maximum Peak current (1 sec) = $\frac{½\ CV}{C \times ESR_{DC} + 1}$
4. After 72 hours at 25°C and rated voltage. Initial leakage current can be higher.
5. Per IEC 62391-2, $P_d = \frac{0.12V^2}{ESR_{DC} \times mass}$
6. $P_{max} = \frac{V^2}{4 \times ESR_{DC} \times mass}$
7. $E_{max} = \frac{½\ CV^2}{3{,}600 \times mass}$
8. $E_{stored} = \frac{½\ CV^2}{3{,}600}$
9. Cycle per Document Number 1007239 available at www.maxwell.com.
10. No more than 10% decrease in capacitance from minimum initial capacitance or 50% increase in ESR from maximum initial ESR.
11. Absolute maximum voltage non repeated, not to exceed 1 second.

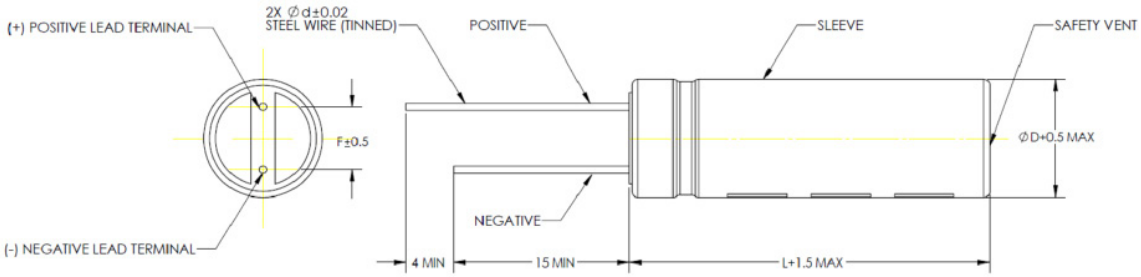
MOUNTING RECOMMENDATIONS

Do not reverse polarity. Please refer to document number 1014595, available at maxwell.com for soldering recommendations.

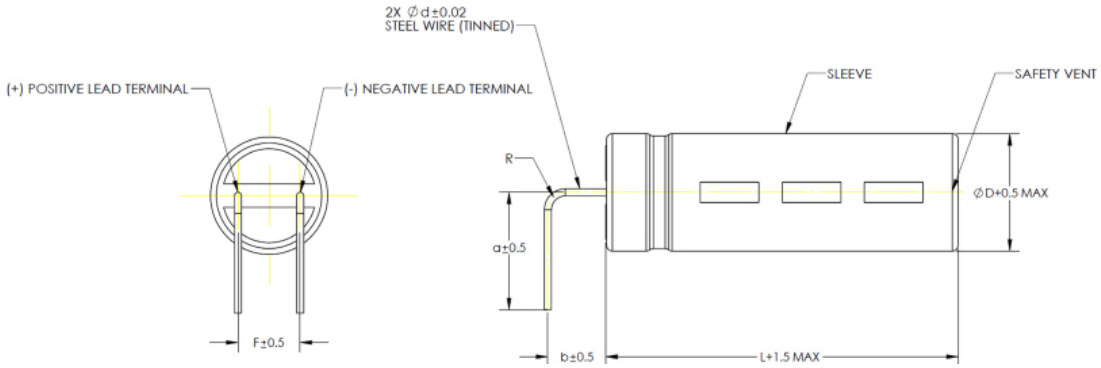
MARKINGS

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

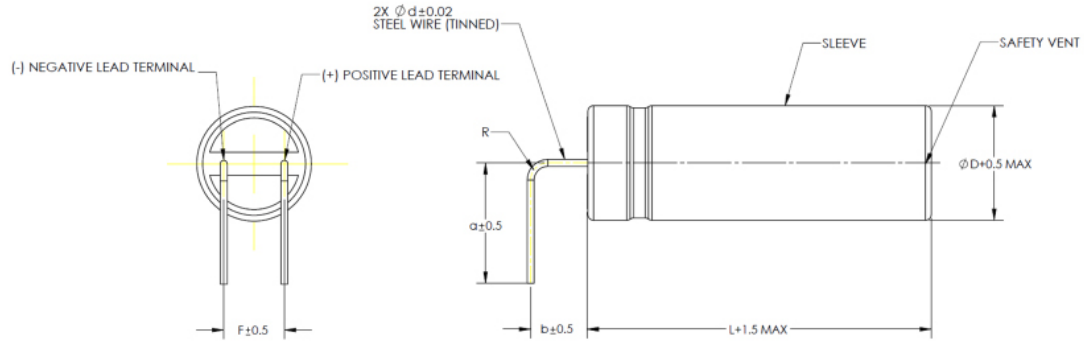
BCAP0001, 3, 5,10,25,50,100 (T01)



BCAP0010, 25 (T11)

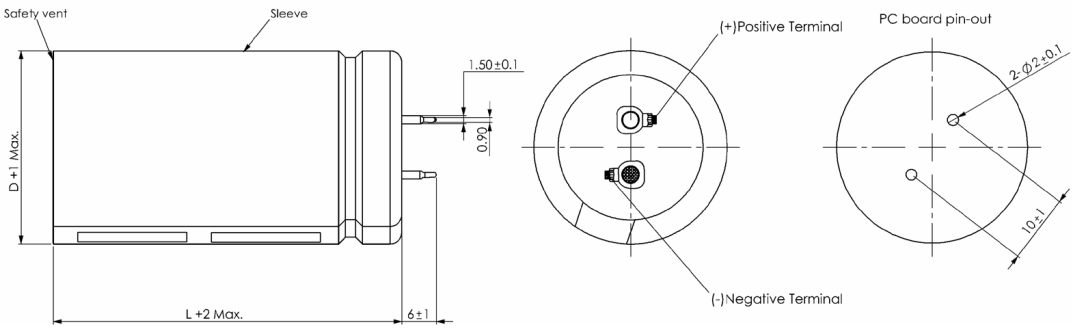


BCAP0010 (T12)



Part Description	Dimensions (mm) L	D	d	F	R	a	b	Package Quantity
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	11.5	5.46	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) L	D	d	F	Package Quantity
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. Patent information can be found at www.maxwell.com.

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