

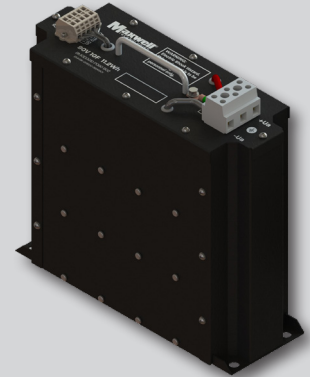
90V 10F ULTRACAPACITOR MODULE

FEATURES AND BENEFITS

- Rated voltage of 90V and capacitance of 10F
- High performance module with low ESR
- Designed for indoor cabinet environment
- Long lifetimes with up to 500,000 duty cycles*
- Integrated UMU (Ultracapacitor Management Unit) for individual cell balancing, voltage and temperature monitoring, and reverse polarity detection

TYPICAL APPLICATIONS

- Wind turbine pitch control system
- Industrial UPS and DVR



PRODUCT SPECIFICATIONS & CHARACTERISTICS

BMOD0010 P090 B02 | BMOD0010 P090 C02
EMHSR-0010C0-090R0C1 | EMHSR-0010C0-090R0C2

ELECTRICAL

Rated Voltage, V_R	90 VDC
Surge Voltage ¹	102 VDC
Rated Capacitance, C^3	10 F
Min. / Max. Capacitance, Initial	10F / 12F
Typical Capacitance, Initial ^{2,3}	10.4 F
Rated (Max.) ESR_{DC} , Initial ³	121 m Ω
Typical ESR_{DC} , Initial ^{2,3}	110 m Ω
Typical Leakage Current ⁴	26 mA
Maximum Peak Current, Non-repetitive ⁵	200 A

PHYSICAL

Nominal Mass	6.3 kg
Output Terminals	10mm ² Ferrules-type terminal block
Insulation Coordination	IEC 60664-1 (Category: OV II)
Protection Degree	IEC 60529 – IP 30
Vibration	SAE J2380
Shock	SAE J2464

POWER & ENERGY

Maximum Stored Energy, E_{max} ^{6,8}	11.2 Wh
Gravimetric Specific Energy ⁶	1.7 Wh/kg
Usable Specific Power ⁶	1.2 kW/kg
Impedance Match Specific Power ⁶	2.6 kW/kg

TEMPERATURE

Operating Temperature Range	-40°C to +65°C
Storage Temperature Range (Stored without charge)	-40°C to +70°C

LIFE*

Projected DC Life at Room Temperature (At rated voltage and 25°C, EOL ⁹)	10 years
DC Life at High Temperature (At rated voltage and 65°C, EOL ⁹)	1,500 hours
Projected Cycle Life at Room Temperature ⁷ (Constant current charge-discharge from V_R to $1/2V_R$ at 25°C, EOL ⁹)	500,000 cycles
Shelf Life (Stored uncharged at 25°C)	4 years

UMU / MONITORING

Cell Balancing	Passive single cell balancing
Over-voltage Monitoring	High and low logic signal (B02: 5V / C02: 24V)
Over-temperature Monitoring	High and low logic signal (B02: 5V / C02: 24V)
Reverse Polarity Monitoring	High and low logic signal (B02: 5V / C02: 24V)
Signal Output	5-pin connector

SAFETY

Certifications	RoHS REACH, UL 810A (Cell Level)
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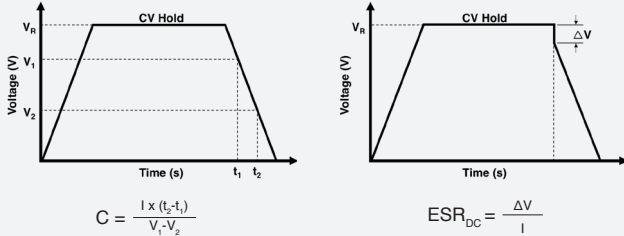
*Results may vary. Additional terms and conditions, including the limited warranty, apply at the time of purchase. See the warranty details for applicable operating and use requirements.

Datasheet: 90V 10F ULTRACAPACITOR MODULE

1. Surge Voltage
Absolute maximum voltage, non-repetitive. Duration not to exceed 1 second.

2. "Typical" values represent mean values of production sample.

3. Rated Capacitance & ESR_{DC} (measure method)
 • Capacitance: Constant current charge with (4 * C * V_R[mA]) to V_R, 5 min hold at V_R, constant current discharge with (4 * C * V_R[mA]) to 7.2V. e.g. in case of 90V 10F module, 4 * 10 * 90 = 3,600 mA.
 • ESR_{DC}: Constant current charge with (4 * C * V_R[mA]) to V_R, 5 min hold at V_R, constant current discharge with (40 * C * V_R[mA]) to 7.2V. e.g. in case of 90V 10F module, charge with 4 * 10 * 90 = 3,600 mA and discharge with 40 * 10 * 90 = 36,000 mA.



where C is the capacitance (F);
 I is the absolute value of the discharge current (A);
 V_R is the rated voltage (V);
 V₁ is the measurement start voltage, 0.8xV_R (V);
 V₂ is the measurement end voltage, 0.4xV_R (V);
 t₁ is the time from start of discharge to reach V₁ (s);
 t₂ is the time from start of discharge to reach V₂ (s);
 ESR_{DC} is the DC-ESR (Ω);
 ΔV is the voltage drop during first 10ms of discharge (V).

4. Typical Leakage Current
 • Current measured after 72 hrs at rated voltage and 25°C. Initial leakage current can be higher.
 • If applicable, module leakage current is the sum of cell and balancing circuit leakage currents.

5. Maximum Peak Current
 • Current needed to discharge cell/module from rated voltage to half-rated voltage in 1 second.

$$I = \frac{\frac{1}{2}V_R}{\Delta t / C + ESR_{DC}}$$

where Δt is the discharge time (sec); Δt = 1 sec in this case.

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

6. Energy & Power (Based on IEC 62391-2)

• Maximum Stored Energy, E_{max}(Wh) = $\frac{\frac{1}{2}CV_R^2}{3,600}$

• Gravimetric Specific Energy (Wh/kg) = $\frac{E_{max}}{mass}$

• Usable Specific Power (W/kg) = $\frac{0.12V_R^2}{ESR_{DC} \times mass}$

• Impedance Match Specific Power (W/kg) = $\frac{0.25V_R^2}{ESR_{DC} \times mass}$

• Presented Power and Energy values are calculated based on Rated Capacitance & Rated (Max.) ESR_{DC}, Initial values.

7. Cycle Life Test Profile

Cycle life varies depending upon application-specific characteristics. Actual results will vary.

8. 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.

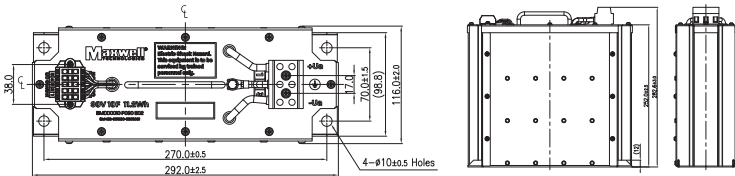
9. BOL: Beginning of Life, rated initial product performance

EOL: End of Life criteria.

• Capacitance: 80% of min. BOL rating

• ESR_{DC}: 2x max. BOL rating

BMOD0010 P090 B02/C02



Part Description	Dimensions (mm)		
	Length (±2.5)	Width (±2.0)	Height (±3.0)
BMOD0010 P090 B02/C02	292.0	116.0	282.6

When ordering, please reference the Maxwell Model Number below.

Maxwell Model Number:	Maxwell Part Number:	Alternate Model Number:
BMOD0010 P090 B02	133734	EMHSR-0010C0-090R0C1
BMOD0010 P090 C02	134003	EMHSR-0010C0-090R0C2

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