

240V 3.75F ULTRACAPACITOR MODULE

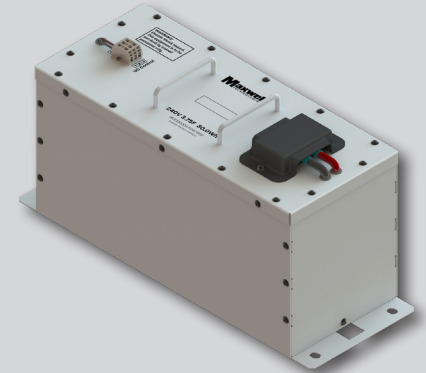
BMOD0004 P240 B02
EMHSR-0003C7-240ROC

FEATURES AND BENEFITS

- Rated voltage of 240V and capacitance of 3.75F
- High performance module with low ESR
- Designed with compact and light-weight package
- Long lifetimes with up to 500,000 duty cycles*
- Passive cell balancing

TYPICAL APPLICATIONS

- Wind turbine pitch control system
- Industrial UPS and DVR



PRODUCT SPECIFICATIONS

ELECTRICAL

Rated Voltage, V_R	240 VDC
Surge Voltage ¹	273 VDC
Rated Capacitance, C^3	3.75 F
Min. / Max. Capacitance, Initial	3.75 F / 4.5 F
Typical Capacitance, Initial ^{2,3}	3.92 F
Rated (Max.) ESR_{DC} , Initial ³	323 m Ω
Typical ESR_{DC} , Initial ^{2,3}	293 m Ω
Typical Leakage Current ⁴	26 mA
Maximum Peak Current, Non-repetitive ⁵	200 A

PHYSICAL

Nominal Mass	13.3 kg
Output Terminals	65 A terminal block
Insulation Coordination	IEC 60664-1 (Category: OV II)
Protection Degree	IEC 60529 – IP 20
Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27

POWER & ENERGY

Maximum Stored Energy, E_{max} ^{6,8}	30 Wh
Gravimetric Specific Energy ⁶	2.2 Wh/kg
Usable Specific Power ⁶	1.6 kW/kg
Impedance Match Specific Power ⁶	3.3 kW/kg

SAFETY

Certifications	RoHS, REACH, UL 810A (Cell Level)
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TYPICAL CHARACTERISTICS

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, \leq 50% RH)	4 years

UMU / MONITORING

Cell Balancing	Passive single cell balancing
Over-Voltage Monitoring	Voltage check at approx. 1/3 and 2/3 point of the rated voltage

*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.

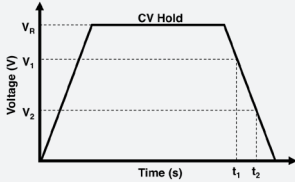
Datasheet: 240V 3.75F ULTRACAPACITOR MODULE

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

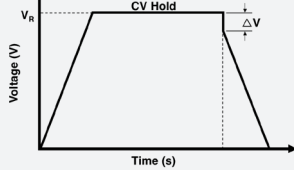
2. "Typical" values represent mean values of production sample.

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 19.2V. e.g. in case of 240V 3.75F module, 4 * 3.75 * 240 = 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 19.2V. e.g. in case of 240V 3.75F module, charge with 4 * 3.75 * 240 = 3,600 mA and discharge with 40 * 3.75 * 240 = 36,000 mA.



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



$$ESR_{DC} = \frac{\Delta V}{I}$$

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

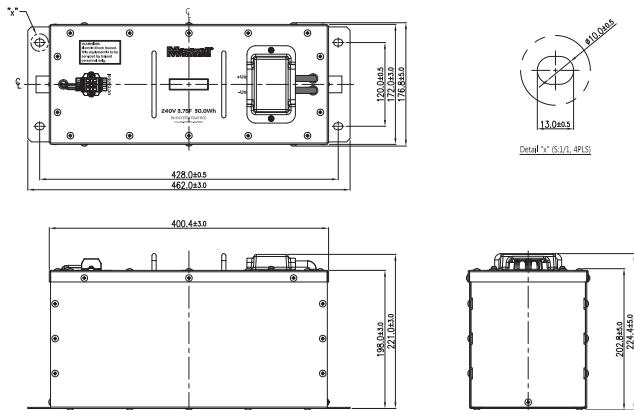
- Cycle life varies depending upon application-specific characteristics. Actual results will vary.

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

BMOD0004 P240 B02



When ordering, please reference the Maxwell Model Number below.

Maxwell Model Number: BMOD0004 P240 B02
Maxwell Part Number: 133737
Alternate Model Number: EMHSR-0003C7-240R0C

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