USER MANUAL

Maxwell Technologies®
Ultracapacitor Energy Storage Modules

Model: BMOD0001 P007 B02

Document 3003572

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1. Introduction

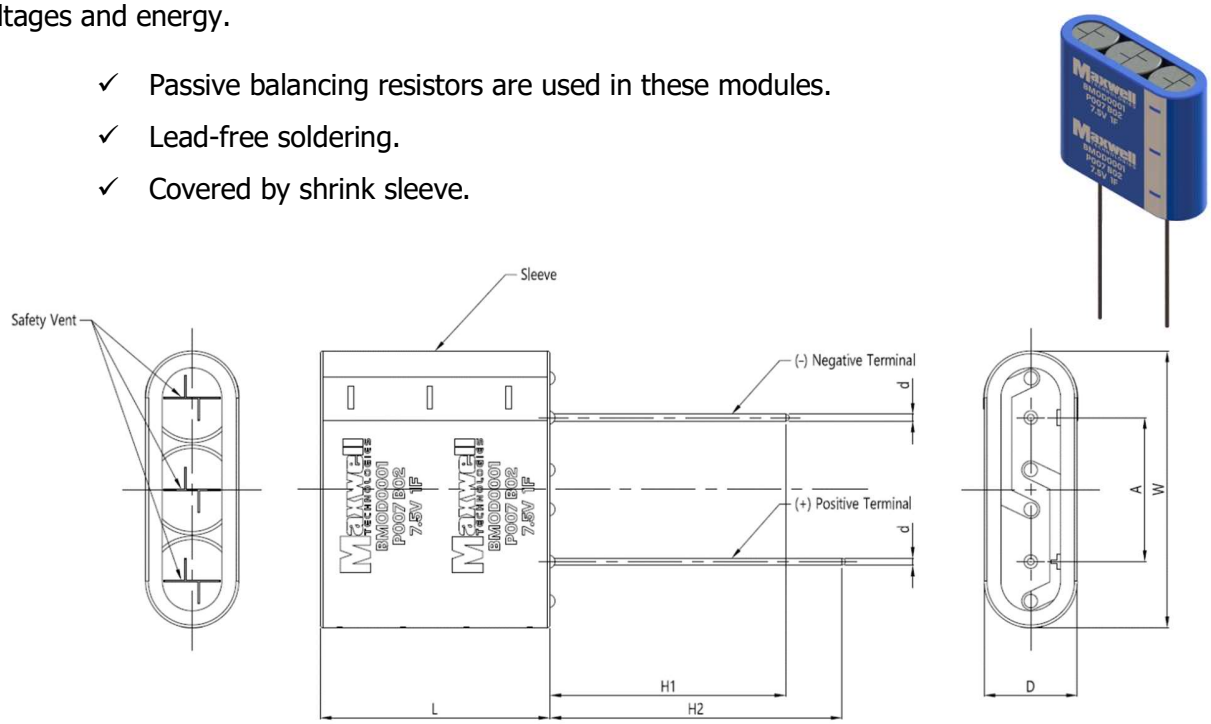
The BMOD0001 P007 B02 energy storage modules are self-contained energy storage devices comprised of three ultracapacitor cells connected in series. The 7.5 volt small cell module is available in a 1.0 Farad version and is suitable for applications that require pulse power in small form factors.

This module provides ultra-low equivalent series resistance (ESR) and long lifetime with up to 500,000 duty cycles, ensuring reliability and minimal maintenance in deployed systems. These modules are typically used in automated meter reading (AMR) applications, among various others that require compact, high performance energy storage. With three ultracapacitor cells in a series, the 7.5-volt modules achieve higher voltage in a single package and contribute to reduced integration costs.

Compliance with RoHS and REACH requirements gives customers the confidence that their choice fulfills current regulatory standards, with the added value of project cost reduction and improved time-to-market.

Multiple modules may be connected in series to obtain higher operating voltages, in parallel to provide additional energy storage, or a combination of series/parallel arrangements for higher voltages and energy.

- ✓ Passive balancing resistors are used in these modules.
- ✓ Lead-free soldering.
- ✓ Covered by shrink sleeve.



DIVISION	W (±1.0)	L (±2.0)	D (±1.0)	d (±0.05)	H1 (min.)	H2 (min.)	A (±0.5)	REMARK
DIMENSION (mm)	24.0	22.0	8.0	0.6	15.0	19.0	12.8	

Figure 1: BMOD0001 P007 B02 Mechanical Configuration

2. Unpacking and Handling

2.1. Unpacking

Inspect the shipping carton for signs of damage prior to unpacking the module. Damage to the shipping carton or module should be reported to the carrier immediately. Remove the module from the shipping carton and retain the shipping materials until the unit has been inspected and is determined to be operational.

NOTE: The original shipping materials are approved for both air and ground shipment.

The original shipping container may contain the following:

- Energy Storage Module
    - If a Maxwell business partner has repackaged the unit for shipment the quantity may be different.
- 1 x Product Information Sheet (optional)

If the unit is found to be defective or any parts are missing, contact your supplier. A Return Material Authorization (RMA) number must be issued prior to returning the unit for repair or replacement.

2.2. Handling

Maxwell ultracapacitor modules are designed to provide years of trouble-free operation. Proper handling is required to avoid damage to the module. In particular, the following handling precautions should be observed:

- Do not drop modules. Internal damage may occur that will not be visible from the module exterior.
- Protect the module from impact.

3. Characteristic

3.1. Capacitance Measurement

Capacitance is measured by the formula shown in Figure 2. The time (T_2-T_1) is the time to discharge the capacitor module from 80 % of the rated voltage to 40% of the rated voltage using a constant current load. For the BMOD0001, I_{dch} is equal to 30mA.

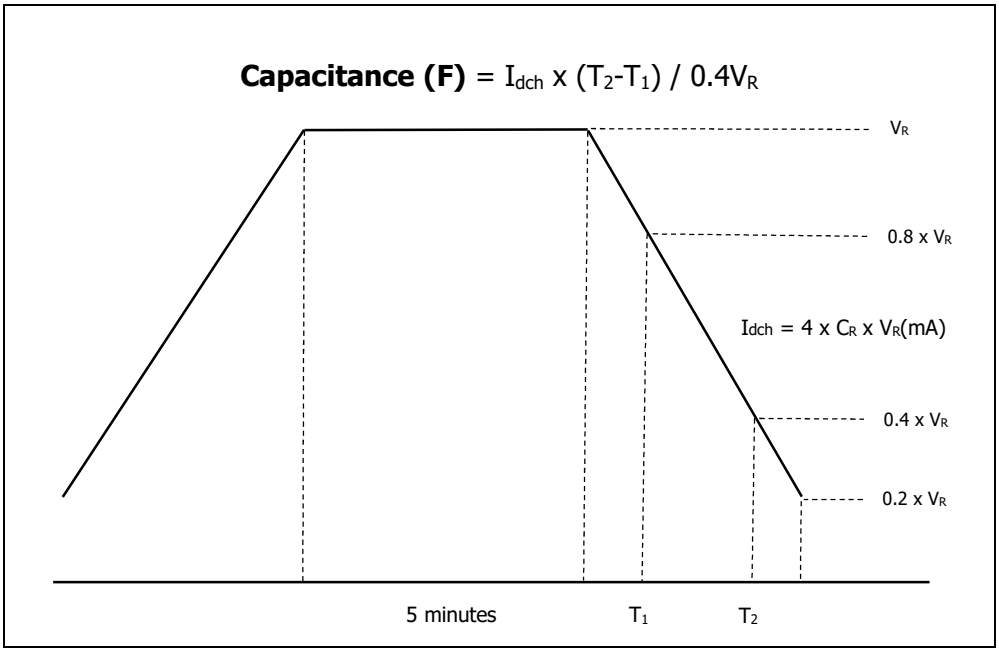


Figure 2: Capacitance Measurement

3.2. Internal Resistance (ESR) Measurement

Internal resistance of 7.5V/1F module are measured using an impedance analyzer. The parameters used are as follows:

Voltage at measurement: Less than 0.4V
Amplitude: 5mV
Frequency: 1kHz

3.3. Thermal Performance

The modules generate small amounts of heat during use. As with most electronic components, reduced operating temperature will extend the service life. In most applications, natural air convection is adequate for cooling; when operated at the rated module current. The majority of module heat rejection occurs from the flat top and bottom cover plates. Increasing airflow over these two module surfaces will further improve module heat rejection and reduce operating temperature.

The thermal resistance, R_{TH}, of the units has been experimentally determined assuming free convection at ambient temperature (~ 25 °C). The R_{TH} value provided on the datasheet is useful for determining the operating limits for the units.

Using the R_{TH} value, a module temperature rise can be determined based upon any current and duty cycle. The temperature rise can be expressed by the following equation.

$$\Delta T = I^2 R_{ESR} R_{TH} d_f$$

where:

I = RMS current (amps)

R_{ESR} = equivalent series resistance, R_{DC} (ohms)

R_{TH} = thermal resistance (°C/W)

d_f = duty cycle fraction

The ΔT value calculated above, added to the ambient temperature, must remain below the specified maximum operating temperature for the module (for maximum operating temperature, refer to the module datasheet). If supplemental cooling methods are employed, it may be possible to operate at higher currents or duty cycles than if cooling by natural air convection only.

Thermal capacitance is a parameter that is useful in calculating or estimating how fast the module will reach its stable temperature state under given I_{RMS}. This value can be estimated by the following equation.

$$t = 5 C_{TH} R_{TH}$$

where:

t = time (sec)

C_{TH} = thermal capacitance, (J/°C)

R_{TH} = thermal resistance (°C/W)

4. Operation

The module should only be operated within the specified voltage and temperature ratings specified on the datasheet. Designers should determine whether current limiting is necessary based on the current ratings of attached components. Observe polarity indicated on module. Do not reverse polarity.

5. Safety

- Do not operate unit above the specified voltage.
- Do not operate unit above the specified temperature rating.
- Do not touch terminals with conductors while charged. Serious burns, shock, or arcing may occur.
- Prior to installation on or removal from the system, it is mandatory to ensure the module is discharged.
- Wear safety glasses when handling the module.

Prior to removal from the system, cable removal, or any other handling, ensure that the energy storage module is completely discharged in a safe manner. The stored energy and the voltage levels may be dangerous if mishandling occurs. Maintenance should only be conducted by trained personnel on discharged modules.

6. Operation and Storage Conditions

6.1 The discharged module can be stored in the original package in a dry place. Discharge used modules prior to storage or shipment. Shorting of the terminals is strongly recommended to maintain a short circuit after having discharged the module.

6.2 Maxwell recommends that the module compartment is vented to the exterior and has an ambient temperature control system that regulates compartment temperature to below 40°C and relative humidity below 90% for extended module life.

6.3 Maxwell's specification for maximum operating cell temperature is 65°C. Cell temperature should ideally be maintained at or below 25°C to maximize product lifetime.

6.4 This product is recommended to be used at altitudes below 4,000 m.

7. Disposal

Do not dispose of module in trash. Dispose of according to local regulations.

8. Specification

Refer to datasheets at our website, www.maxwell.com, for specifications of each product.

9. Revision History

Rev No.	Contents	Date
0	Initial version created.	2023.12.14

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