# Product specification

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Change Description</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>V00</td>
<td>26. Nov. 2014</td>
<td>Product specification</td>
<td>S.W Son</td>
</tr>
<tr>
<td>V01</td>
<td>01. Oct. 2018</td>
<td>Add comments</td>
<td>H.J Yu</td>
</tr>
</tbody>
</table>

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# Product specification

## Specification

### 1. Primary specification

<table>
<thead>
<tr>
<th>Part number</th>
<th>Capacitance (F)</th>
<th>Resistance DC (mΩ)</th>
<th>Leakage Current (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSUM 0380R8L 0002F EA HOR</td>
<td>2.5</td>
<td>650</td>
<td>&lt; 12</td>
</tr>
</tbody>
</table>

### 2. Power & Energy

<table>
<thead>
<tr>
<th>Part number</th>
<th>Usable Specific Power, $P_d$ (W/kg)</th>
<th>Impedance Match Specific Power, $P_{max}$ (W/kg)</th>
<th>Energy Density (Wh/kg)</th>
<th>Stored Energy (Wh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSUM 0380R8L 0002F EA HOR</td>
<td>1,400</td>
<td>3,000</td>
<td>2.7</td>
<td>50.4</td>
</tr>
</tbody>
</table>

### 3. Standard & Reliability

- **Rated Voltage**: 380.8V
- **Max. Voltage²**: 408V
- **Maximum Series Voltage**: 408V
- **Capacitance Tolerance**: -0% / +20%
- **Resistance Tolerance**: < Spec. Value
- **Operating temperature range**: -40 ~ 65 °C
- **Storage temperature range**: -40 ~ 70 °C

#### Endurance

After 1500 hours application of Rated voltage DC at 65 °C, the capacitor shall meet the following limits.
- Capacitance change: Within 20% of initially specified value
- Internal resistance change: Within 100% of initially specified value

#### Shelf life

After 1500 hours storage at +65 °C without load shall meet specification of endurance.

#### Life Time (25°C)

After 10 years at rated voltage and +25 °C
- Capacitance change: Within 20% of initially specified value
- Internal resistance change: Within 100% of initially specified value

#### Cycle Life (25°C)

After 1,000,000 cycles between rated voltage to half rated voltage at +25 °C
- Capacitance change: Within 20% of initially specified value
- Internal resistance change: Within 100% of initially specified value

### 4. Monitoring

<table>
<thead>
<tr>
<th>Part number</th>
<th>Temperature sensor</th>
<th>Temperature &amp; Voltage interface</th>
<th>Connector</th>
<th>Cell voltage monitoring</th>
<th>Balancing</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSUM 0380R8L 0002F EA HOR</td>
<td>PTC</td>
<td>Alarm</td>
<td>AMP178803-3</td>
<td>Over voltage alarm</td>
<td>Passive</td>
</tr>
</tbody>
</table>

*Remarks

1) Current for 1sec discharge from the rated voltage to the half of it in constant current discharge, do not use as an operating current.
2) Non repeated, not to exceed 1sec.
Product specification

■ Safety & Physical Protection

<table>
<thead>
<tr>
<th>Isolation voltage (DC)</th>
<th>Power Terminals</th>
<th>Recommended Torque - Terminal</th>
<th>Environmental Protection</th>
<th>Shock &amp; vibration Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5KV</td>
<td>M6</td>
<td>5N.m</td>
<td>-</td>
<td>IEC 60068-2-6</td>
</tr>
</tbody>
</table>

*Remarks
3) This value is for a test with limited conditions and may be different under actual conditions.

■ Geometric properties

<table>
<thead>
<tr>
<th>Part number</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSUM 0380R8L 0002F EA HOR</td>
<td>693±2</td>
<td>228±1</td>
<td>163±1</td>
<td>18.4±0.5</td>
</tr>
</tbody>
</table>

Dimension in mm (not to scale)
How to calculate specification value

1. The Measurement Methods

1-1 Capacitance

Apply rated voltage and charge for 5min after the constant current / constant voltage power supply has achieved the rated voltage. After a charge for 5min has finished, discharge with 10mA/F to 0.1V.

Measure the time t1 to t2 where the voltage between capacitor terminals at the time of discharge reduces from V1 to V2 as shown figure and calculate the capacitance value by the following formula:

1) Constant current charge with 10mA/F to VR
2) Constant voltage charge at VR for 5min
3) Constant current discharge with 10mA/F to 0.1V

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

1-2 Resistance

The DC resistance of a capacitor shall be calculated by the following formula;

\[ R_{DC} = \frac{\Delta V}{I_{DC}} \]

Where

- \( R_{DC} \) is the DC internal resistance (Ω);
- \( V \) is the effective value of AC voltage (V);
- \( \Delta V \) is the drop voltage for 10ms (V);
- \( I_{DC} \) is the discharge current (A);
1-3 Leakage current & Self discharge

The leakage current shall be measured using the direct voltage appropriate to the test temperature (25 °C) for 72hrs. Self discharge voltage shall be measured after charging up for 12hrs, disconnect the capacitor terminals from the voltage source. The capacitor shall be kept under standard condition for 100hrs.

1-4 Maximum current

Current for 1sec discharge from the rated voltage to the half of it in constant current discharge,

\[ I_{\text{Max}} = \frac{V_R - 0.5*V_R}{\Delta t / C + R_{\text{DC}}} \]

Where
- \( I_{\text{Max}} \) is the Maximum current (A);
- \( \Delta t \) is the discharge time (sec), 1 sec in this case;
- \( C \) is the capacitance (F);
- \( R_{\text{DC}} \) is the DC resistance (Ω);
- \( V_R \) is the rated voltage (V).

1-5 Maximum stored energy \( (E_{\text{MAX}}) \)

\[ E_{\text{MAX}} \text{ (Wh)} = \frac{\frac{1}{2} CV_R^2}{3600} \]

2. The Standard Atmospheric Condition for Measurement

All test and measurements shall be made under standard atmospheric conditions for testing. Before the measurements are made, the capacitor shall be stored at the measuring temperature for a time sufficient to allow the entire capacitor to reach this temperature. The period as prescribed for recovery at the end of a test is a normally sufficient for this purpose.

Temperature : 15~35 °C  
Relative humidity : 25~75%  
Air Pressure : 86~106 kPa