CeraCharge®

World’s first rechargeable solid-state SMT battery

TDK Electronics AG
Piezo & Protection Devices Business Group
Multilayer Technology
Munich, Germany
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Demand for a new battery technology

Billions of devices

Sensors everywhere

INTERNET OF EVERYTHING

Healthcare

Wearables

Energy harvesting

Smart home

New application fields drive the demand for compact, safe, rechargeable energy sources
CeraCharge®: World’s first solid-state SMT-compatible Li-ion battery

CeraCharge® combines the advantages of Li-ion batteries with the safety and manufacturing benefits of ceramic multilayer components.

CeraCharge®: All-ceramic multilayer battery
- High safety
- SMT-compatible
- Suitable for reflow soldering

High-energy Li-ion battery technology

Li-ion battery
- Gas relief valve
- Electrode terminal
- Negative electrode
- Separator
- Positive electrode
- Organic electrolyte (Li-ion)

Multilayer ceramic
- Inner electrode
- Dielectric
- External electrode

All solid-state
- Electrolyte: Li-based ceramic oxide
- Inner electrode: Li-based ceramic oxide
- Charge collector: Cu
- External electrode

High-volume production process
Comparison of energy storage devices

- **CeraCharge®**
- World’s first rechargeable solid-state SMT battery

### Comparison Table

<table>
<thead>
<tr>
<th>Device</th>
<th>Capacity [mAh]</th>
<th>Volume [mm³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td>10⁶</td>
<td>10⁶</td>
</tr>
<tr>
<td>Non SMT</td>
<td>10⁴</td>
<td>10⁵</td>
</tr>
<tr>
<td>SMT</td>
<td>10²</td>
<td>10³</td>
</tr>
<tr>
<td>MLCCs</td>
<td>10⁻²</td>
<td>10⁻⁴</td>
</tr>
<tr>
<td>CeraCharge®</td>
<td>10⁻⁶</td>
<td>10⁻⁶</td>
</tr>
<tr>
<td>EDLC</td>
<td>10⁻⁶</td>
<td>10⁻⁶</td>
</tr>
</tbody>
</table>

(100 mF = 100 μAh)
Unique features

All-ceramic structure
- Cannot leak
- Cannot burn
- Cannot explode

SMT-compatible
- World’s smallest
- Safe
- Rechargeable
- Easy to assemble
- Reflow solderable
- Embeddable
- No need to change battery
- Available in EIA case sizes

Robust design
- Wide temperature range
- Suitable for vacuum applications
**Key figures**

**Size 1812**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>[V] 1.5</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>[V\textsubscript{op}] 0 to 1.6</td>
</tr>
<tr>
<td>Nominal capacity</td>
<td>[µAh] 100</td>
</tr>
<tr>
<td>Nominal discharge current</td>
<td>[µA] 20</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>[°C] –20 to +80</td>
</tr>
<tr>
<td>Case size</td>
<td>[EIA] 1812</td>
</tr>
<tr>
<td>Dimensions</td>
<td>[mm] 4.4 x 3.0 x 1.1</td>
</tr>
<tr>
<td>Weight</td>
<td>[g] 0.04</td>
</tr>
</tbody>
</table>

**CeraCharge® offers 1000 times the capacity of a capacitor in the same case size**
Main applications

**Real-time clock**
Backup battery
- MCU
- LCD
- RTC
- CeraCharge®

**Internet of Things: Beacon**
Energy storage (battery)
- Solar cell
- PMIC (CV output)
- BLE module
- MCU
- Sensor
- CeraCharge®

**Energy harvesting**
Energy storage
- Energy harvesting unit
- EN threshold control
- Capacitor
- RF module
- MCU
- Sensor
- CeraCharge®

**Wearables**
Sub-battery for voltage and current smoothing
- Energy source
- PMIC (CV output)
- BLE module
- MCU
- Sensor
- Li battery (main battery)
- CeraCharge®