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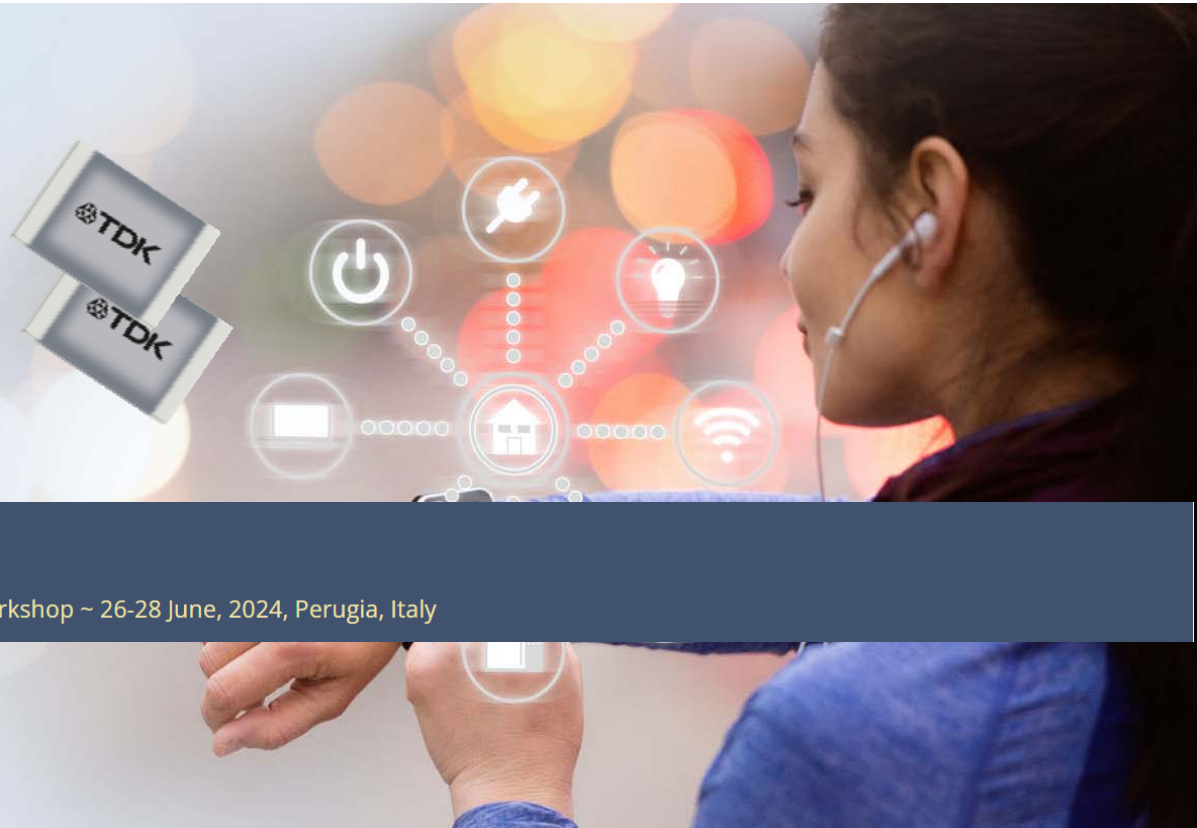
TDK

A Rechargeable Solid-state SMD Battery for the Stand-alone IoT Application

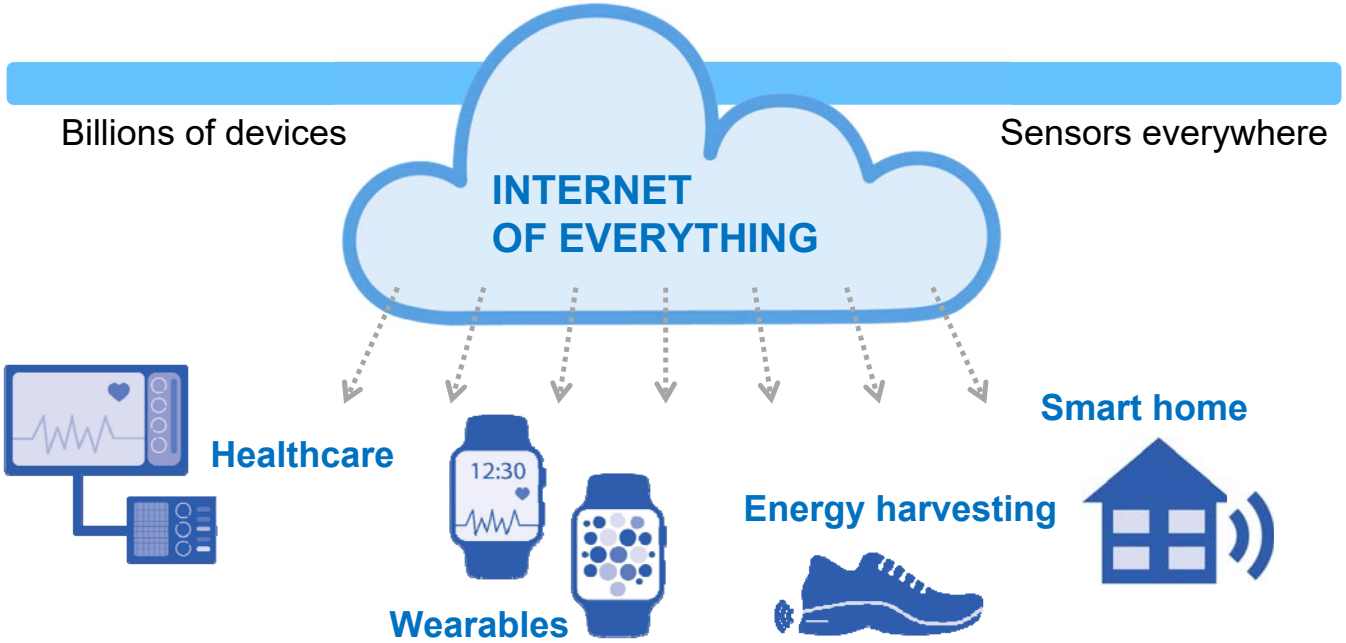


EnerHarv 2024

PSMA International Energy Harvesting Workshop ~ 26-28 June, 2024, Perugia, Italy

https://www.tdk-electronics.tdk.com/en/ceracharge

Demands for a new battery technology



New application fields driving demand for compact, safe, rechargeable energy sources

CeraCharge – the world's first solid-state, SMT-compatible Li-based battery

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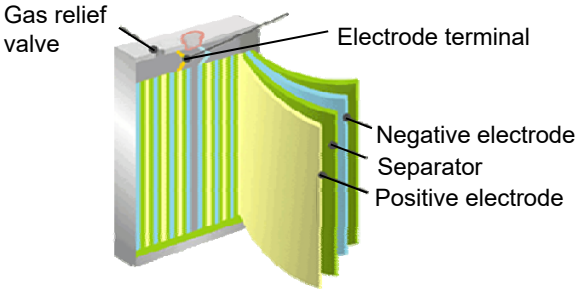
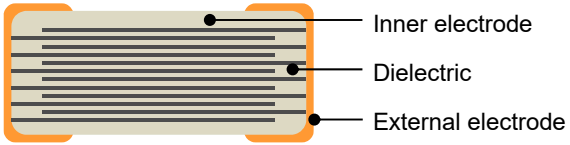
Li-ion battery



Organic electrolyte (Li-ion)

Multilayer ceramic



High-energy Li-ion battery technology

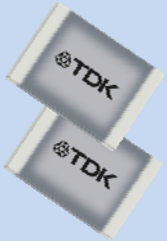
High-volume production process

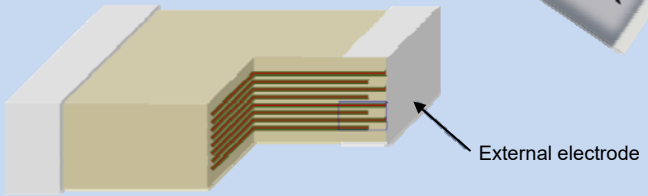
CeraCharge

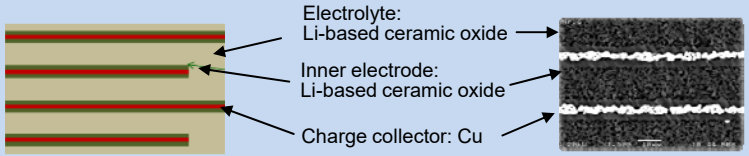
All solid state

All-ceramic multilayer battery

- High safety
- SMT-compatible
- Suitable for reflow soldering

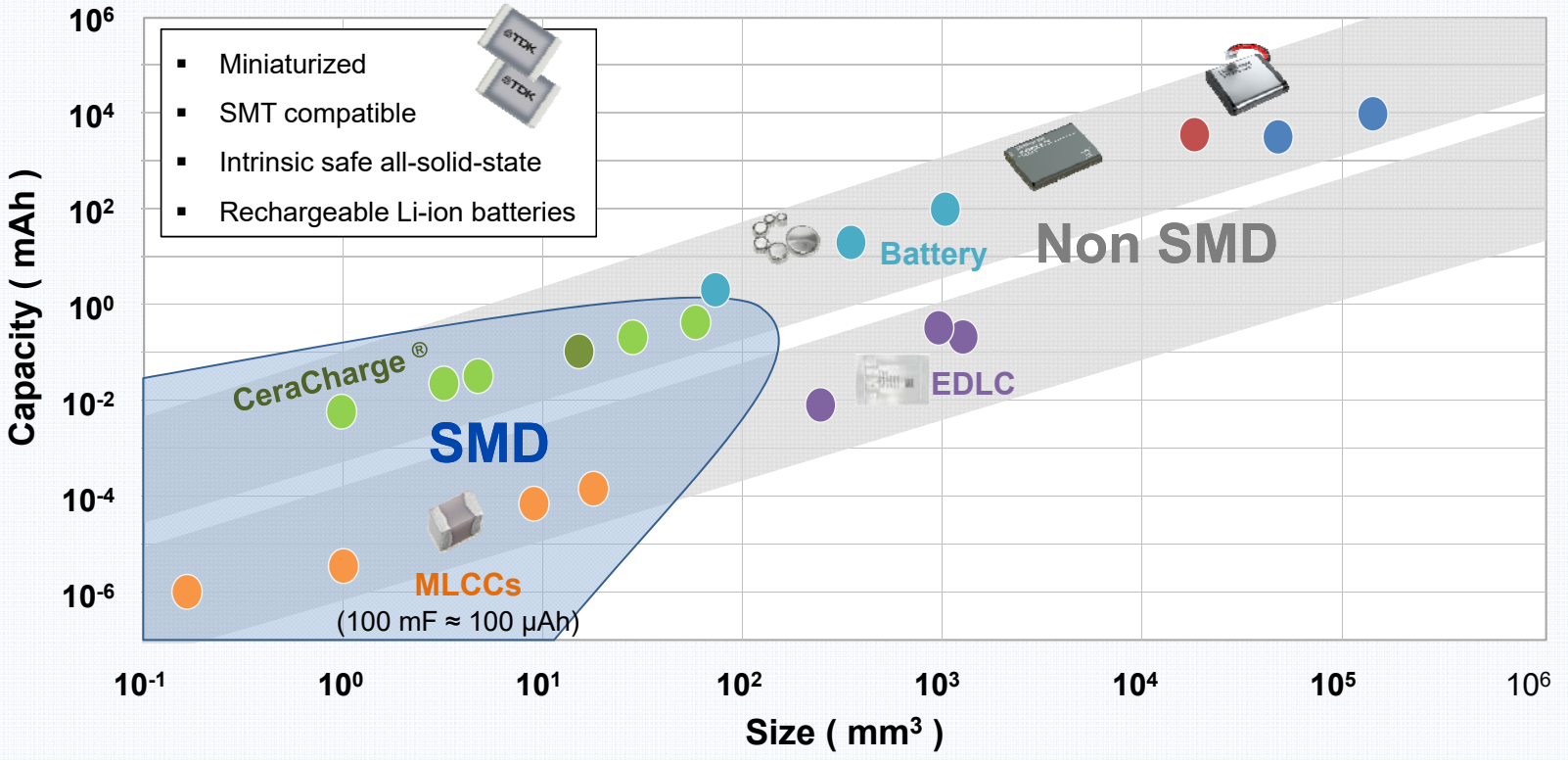






CeraCharge combines the advantages of Li-ion batteries with the safety and manufacturing benefits of ceramic multilayer components

Comparison of energy storage devices



CeraCharge® Unique features and key benefits

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CeraCharge™

- All solid-state rechargeable battery with no liquid electrolyte
- Based on a multilayer technology, similar to MLCCs, but with 1000 times the capacity of a capacitor in the same case size
- Replacement of coin cells and supercapacitors
- To increase capacity and voltage, any number of individual components can be connected in series and parallel.

Key benefits

Intrinsically safe

- Cannot leak, burn, explode
- 100% Pb-free
- No special handling required for recycling

Easy to assemble

- Reflow solderable
- Embeddable
- No need to change battery
- Available in EIA case size

Robust design

- Wide operating temperature range
- Suitable for vacuum applications

Main applications:

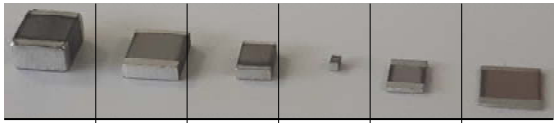
IoT devices, real-time clocks, BLE beacons, systems for energy harvesting

Specification

CeraCharge 1812*		
Nominal voltage	[V]	1.5
Operating voltage	[V_{op}]	0 to 1.6
Nominal capacity	[µAh]	100 ±20
Nominal discharge current	[µA]	20
Operating temperature	[°C]	-20 to +80
Case size	[EIA]	1812
Dimensions	[mm]	4.5 x 3.2 x 1.1

* Release for mass production since 2020

Available engineering samples



2220 2,6mm	2220 1,6mm	**1812*** **1.1mm**	0603 0,8mm	1812 0,5mm	2220 0,3mm

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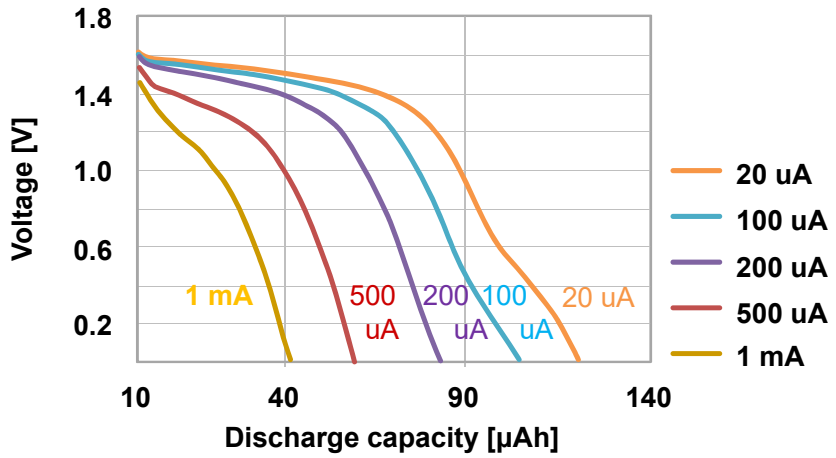
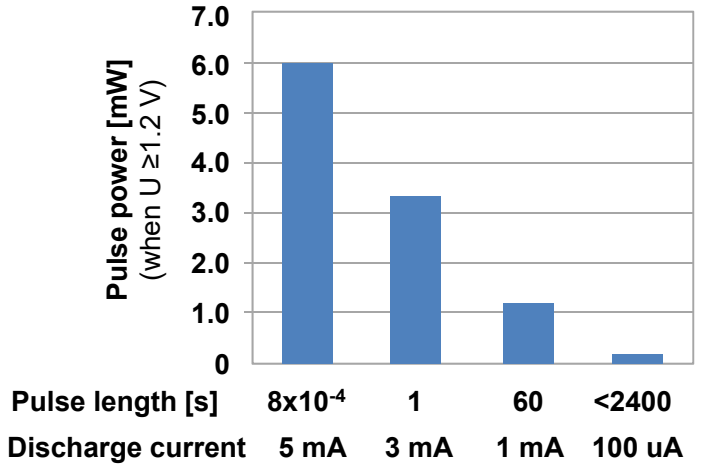
CeraCharge features fast and pulsed discharging

Typical discharge curves



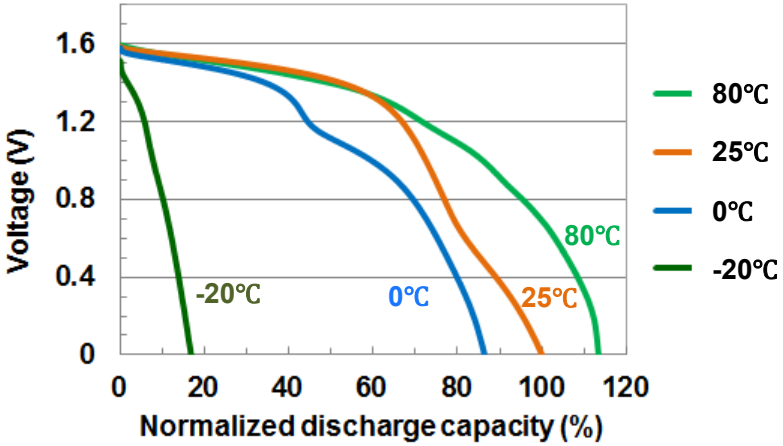
Typical pulse power characteristics



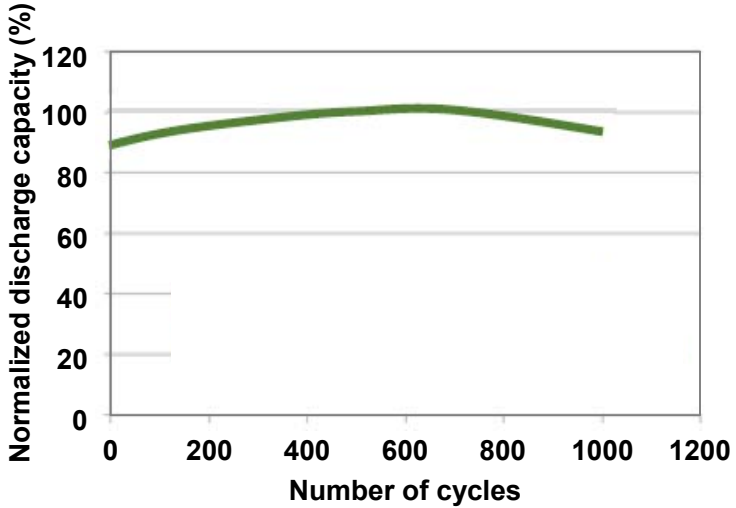
CeraCharge can support a current up to 1 mA (10 C) and pulse current 3 mA for 1 sec

CeraCharge features wide temperature and long cycle operating

Temperature characteristics



Cycle characteristics

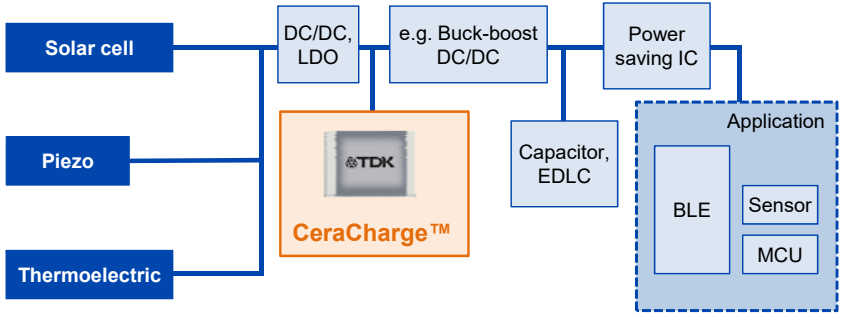


CeraCharge is able to work from -20°C to 80°C and up to 1000 cycles without any significant capacity loss

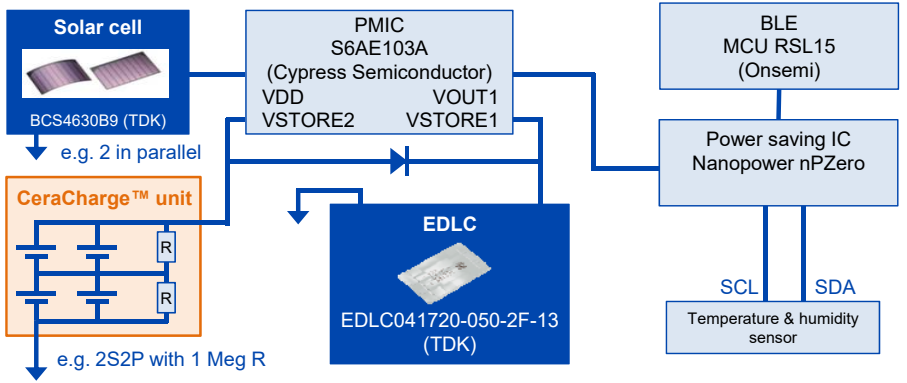
CeraCharge® as battery in stand alone beacons

- **Beacon:** Stand alone systems that collect and broadcast data using for that, **harvested energy**
- **CeraCharge®** is the ideal storage media to support the modern IC technology (MPUs, sensors)
  Those ICs are extremely **low energy demanding** and require **long operation lifetime**
- Smart home, medical and **Industry 4.0** are driving the demand on Beacon systems

Topology



Circuit example



Application note
Teaser
Development kit

Smart energy solution for standalone beacons

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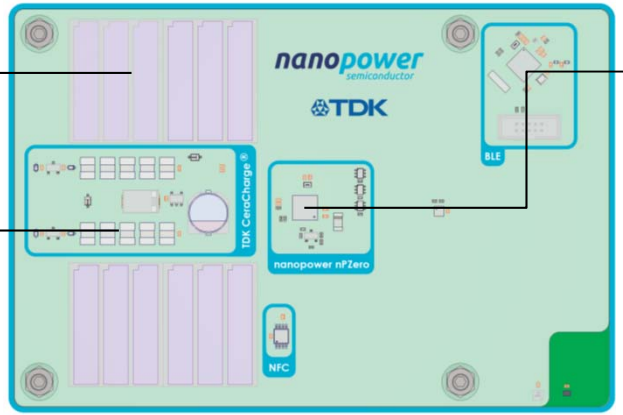
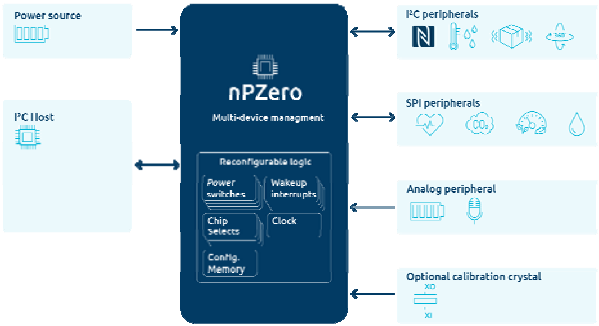
Film solar cell

- Amorphous silicon film solar cell
- Light Weight (< 0.1g)
- Thin Thickness (< 0.2mm)
- Mechanical Flexibility, bendable
- Customizable shape and size



nPZero power-saving IC

- A new architecture and new method to dramatically reduce the power consumption



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Demo-show at the booth.
More details on web, by scanning

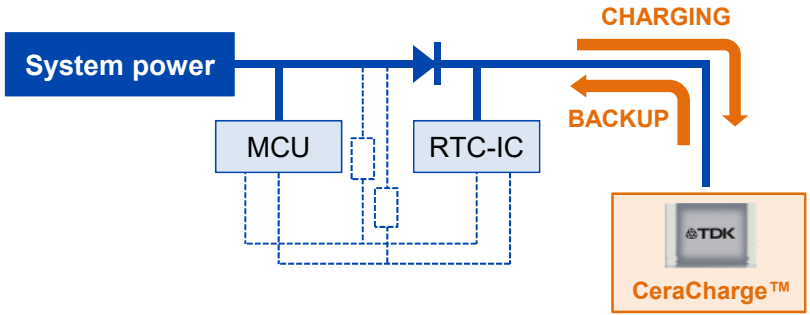
CeraCharge® as backup battery for real time clock (RTC)

- RTCs have to continue counting the time during **energy interruption** and for that need a back up source of energy
- **CeraCharge®** is the ideal back up energy solution for RTCs, offering many opportunities of process/product optimizations to designers

Charging circuit suggestion

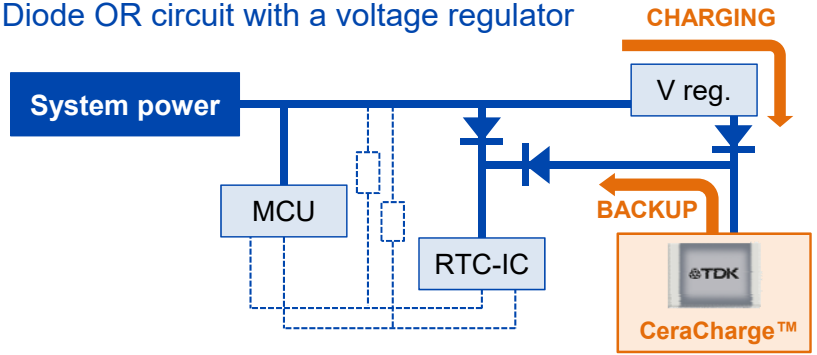
1. Power line voltage is compatible with CeraCharge specifications

Connected to a power line in parallel with RTC-IC



2. Power line voltage is higher than CeraCharge specifications

Diode OR circuit with a voltage regulator



Reference design: RV-3032-C7

https://www.microcrystal.com/en/products/real-time-clock-rtc-modules/rv-3032-c7

- Low power consumption
- Temperature compensated
- Plug and play for CeraCharge

Application note
Teaser
Development kit

Miniaturization / high temperature applications

NEW TYPE OF RECHARGEBLE BATTERY
In CookPerfect Wireless, we use new unique battery technology.
The battery is more sustainable than what is typically used in other cooking thermometers. This thermometer uses **ceramic batteries** as opposed to lithium batteries.
The docking station has a rechargeable battery, which can be recharged by a USB cable.

CeraCharge is used in

- Thin tube of ~4mm in diameter;
- Measure 5 temperature sensors;
- Broad-casting with BLE;
- For more than 12h;

Demo-show at the booth.
More details on web:
https://cookperfect.com/collections/cooking-thermometers/products/cookperfect-wireless

https://www.tdk-electronics.tdk.com/en/ceracharge