



# Super Capacitor Reference Design

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# Introduction

## Overview

Rechargeable batteries are commonly used to maintain a system state during power loss events. Recent changes in environmental and recycling rules limiting heavy metals and dangerous chemicals in commercial products have made conventional chemical batteries increasingly more difficult and expensive to use.

Innovations in the industry have created EDL capacitors, commonly know as “supercaps” or “ultracaps”, which can store enough energy to replace batteries in certain applications. While these capacitors cannot supply power as long as or as dense as rechargeable batteries, they do not contain certain heavy metals, can charge quicker, have a longer shelf life and higher charge/discharge cycle counts.

With these advantages, EDL capacitors have certain limiting factors. They are harder to charge, monitor and test when compared to batteries. This reference design hides this complexity allowing EDL capacitors to be easily integrated into many systems.

## Applications

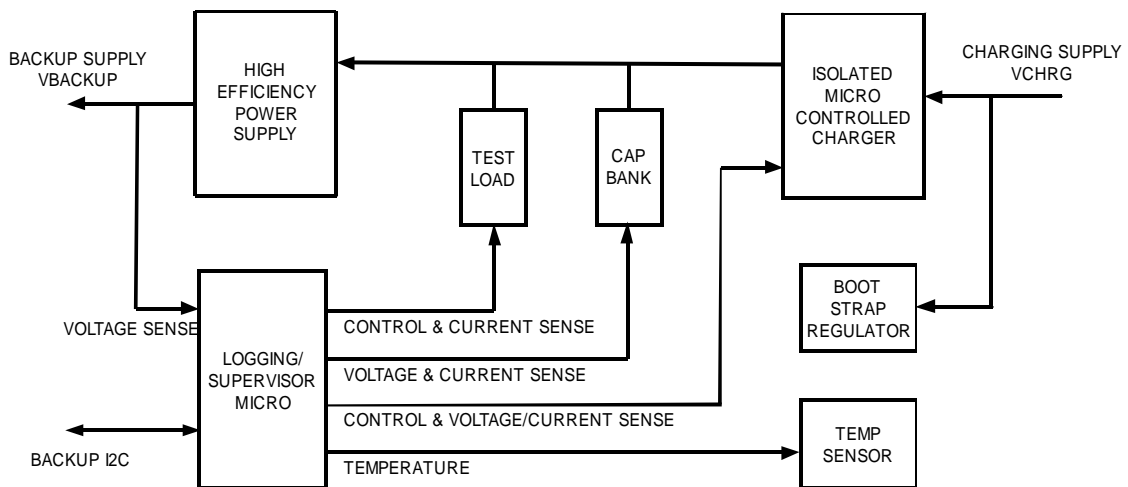
- Memory backup for RAID systems.
- Short term state hold-over power supplies.

## Features

- Uses EDL capacitors to provide short-term backup power during power loss events.
- Supports a variable number and size of EDL capacitors for different module energy ratings.
- Tests the EDL capacitors to detect weak or failed devices.
- Greater than 10 year life operating at 70°C ambient temperature.
- Innovative design outputs a constant regulated voltage from the capacitor bank.
  - Nominally 4.8V
  - Nominally 2A
  - Approximately 85% energy efficient
- High-efficiency buck/boost converter design maximizes energy efficiency.
- Supports a wide range of charge voltages with constant charge power consumption.
  - 4.5V to 12.5V
  - Limited to 1A max charge current
  - Limited to max 6 watts charging power
- Automatically isolates the charging source from the EDL capacitor to prevent feedback during power loss.
- Internal supervisory microcontroller for testing and monitoring the EDL capacitors, chargers and regulators.

- Optional temperature sensor for monitoring ambient temperature for life-time estimation.
- Optional status indication using LED's.
- I2C slave interface for configuration and status information.
- Embedded EEPROM for data logging and module serialization.
- Built-in Self Test Feature
- Configurable Alarms

## Block Diagram



## LICENSE DELIVERABLES

- Engineering Documentation
  - Description of Operation
- ORCAD Schematics
- Parts List
- Layout Guidelines
- Custom Part Selection if required
- Controller Firmware (object code)

- Customization for:
  - EDL Capacitance values
  - Number of Capacitors
  - Max allowed charge time
  - Max charge level
  - Min discharge level
  - Allowed capacitance drift
  - Temperature alarm levels



## Super Cap Module

Demo Loss of input power, and 2.7 ohm Load  
emulating Memory backup to Flash period & power

CH1: Input Voltage

CH2: Total Cap Voltage (across entire array of Caps)

CH3: VOUT from module

CH4: Voltage across one of the Caps

