EnerChip™ CBC012

Rechargeable Solid State Energy Storage: 12µAh, 3.8V

Features

- All Solid State Construction
- SMT Package and Process
- Lead-Free Reflow Tolerant
- Thousands of Recharge Cycles
- Low Self-Discharge
- Eco-friendly, RoHS compliant

Electrical Properties

Output voltage (nominal):	3.8V
Capacity (nominal):	12µAh
Charging source:	4.00V to 4.15V
Recharge time to 80%:	10 minutes
Charge/discharge cycles:	>5000 to 10% DOD

Physical Properties

Package size (DFN):	5 mm x 5 mm x 0.9 mm
Operating temperature:	-20°C to 70°C
Storage temperature:	-40°C to 125°C

Applications

- **Standby supply** for non-volatile SRAM, real-time clocks, controllers, supply supervisors, and other system-critical components.
- **Wireless sensors and RFID tags** and other powered, low duty cycle applications.
- **Localized power source** to keep microcontrollers and other devices alert in standby mode.
- **Power bridging** to provide backup power to system during exchange of primary batteries.
- **Embedded Energy** where bare die can be embedded into modules or co-packaged with other ICs

Pin Number(s)	Description
1	V-
2,3,4,5	NIC
6	V+
Note: NIC = No Internal Connection	

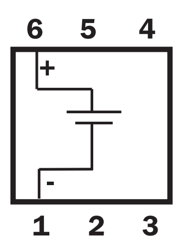
5 mm x 5 mm
DFN SMT Package

2.8 mm x 3.5 mm
Bare Die

The EnerChip™ CBC012 is a surface-mount, solid state, thin film, rechargeable energy storage device rated for 12µAh at 3.8V. It is ideal as a localized on-board power source for SRAMs, real-time clocks and microcontrollers which require standby power to retain time or data. It is also suitable for RFID tags, smart sensors, and remote applications which require a miniature, low-cost, and rugged power source. For many applications, the CBC012 is a superior alternative to button cell batteries and super-capacitors.

Because of their solid state design, EnerChip™ storage devices are able to withstand solder reflow temperatures and can be processed in high-volume manufacturing lines similar to conventional semiconductor devices. There are no harmful gases, liquids or special handling procedures, in contrast to traditional rechargeable batteries.

The CBC012 is based on a patented, all solid state, rechargeable energy cell with a nominal 3.8V output. Recharge is fast and simple, with a direct connection to a 4.1V voltage source and no current limiting components. Recharge time is 10 minutes to 80% capacity. Robust design offers thousands of charge/discharge cycles. The CBC012 is packaged in a 5 mm x 5 mm 6-pin DFN package. It is shipped in tubes, tape-and-reel, or waffle pack trays.



CBC012 Schematic Representation
Top View

Operating Characteristics

Parameter	Condition	Min	Typical	Max	Units
Discharge Cutoff Voltage	25°C	3.0[(1)]	-	-	V
Charge Voltage	25°C	4.0[(2)]	4.1	4.3	V
Pulse Discharge Current	25°C	100[(3)]	-	-	µA
Cell Resistance (25°C)	Charge cycle 2	-	2.8	4.5	kΩ
	Charge cycle 1000	-	13	20	kΩ
Self-Discharge (5-yr average; 25°C)	Non-recoverable	-	2.5	-	% per year
	Recoverable	-	1.5[(4)]	-	% per year
Operating Temperature	-	-20	25	+70	°C
Storage Temperature	-	-40	-	+125[(5)]	°C
Recharge Cycles (to 80% of rated capacity; 4.1V charge voltage) — 25°C	10% depth-of-discharge	5000	-	-	cycles
	50% depth-of discharge	1000	-	-	cycles
Recharge Cycles — 40°C	10% depth-of-discharge	2500	-	-	cycles
	50% depth-of-discharge	500	-	-	cycles
Recharge Time (to 80% of rated capacity; 4.1V charge voltage)	Charge cycle 2	-	10	22	minutes
	Charge cycle 1000	-	45	70	minutes
Capacity	50µA discharge; 25°C	12	-	-	µAh

(1) *Failure to cutoff the discharge voltage at 3.0V will result in EnerChip performance degradation.*

(2) *Charging at 4.0V will charge the cell to approximately 70% of its rated capacity.*

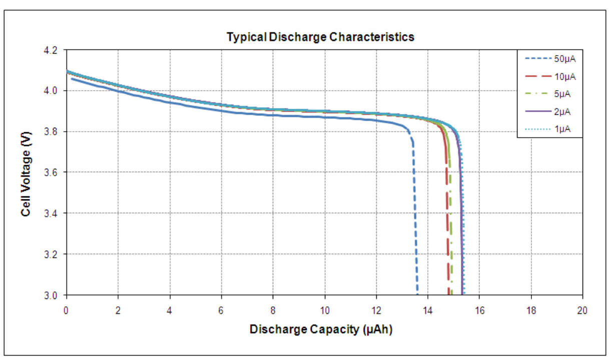
(3) *Typical pulse duration = 20 milliseconds.*

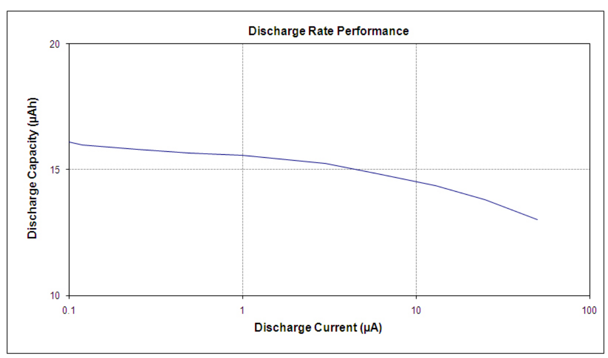
(4) *First month recoverable self-discharge is 4% average.*

(5) *Storage temperature is for uncharged EnerChip.*

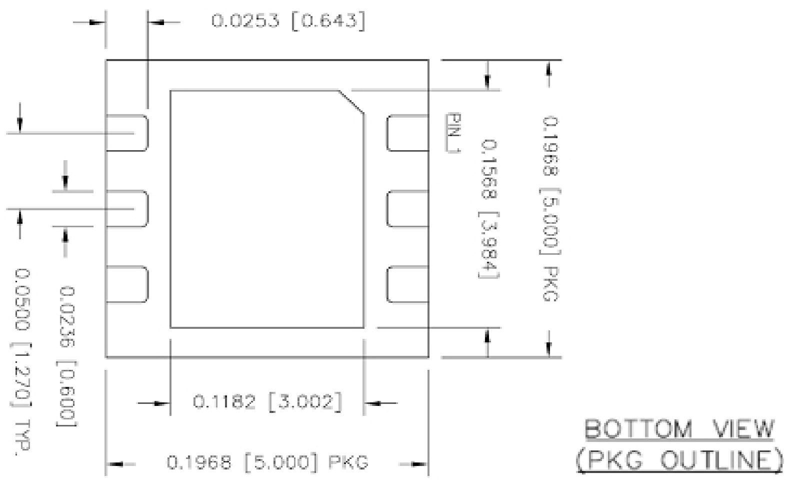
Note: All specifications contained within this document are subject to change without notice

EnerChip Discharge Characteristics





Package Dimensions - 6-pin DFN (package code D5)



Pin Number(s)	Description
1	V-
2,3,4,5	NIC
6	V+
Note: NIC = No Internal Connection	

Notes:
1. All linear dimensions are in millimeters.
2. Drawing is subject to change without notice.

Printed Circuit Board (PCB) Layout Guidelines and Recommendations

Electrical resistance of solder flux residue on PCBs can be low enough to partially or fully discharge the backup energy cell and in some cases can be comparable to the load typically imposed on the cell when delivering power to an integrated circuit in low power mode. Therefore, solder flux must be thoroughly washed from the board following soldering.

The PCB layout can make this problem worse if the cell's positive and negative terminals are routed near each other and under the package, where it is difficult to wash the flux residue away. An undesirable example is shown in Figure 1. The negative connection on the EnerChip is routed from the negative pad to a via placed under the package near the positive pad. In this scenario, solder flux residue can wick from the positive solder pad, covering both the positive pad and the via. This results in a high resistance current path between the EnerChip terminals. This current path will make the cell appear to be defective or make the application circuit appear to be drawing too much current.

To avoid this situation, make sure positive and negative traces are routed outside of the package footprint, as shown in Figure 2, to ensure that flux residue will not cause a discharge path between the positive and negative pads.

Similarly, a leakage current path can exist from the package lead solder pads to the exposed die pad on the underside of the package as well as any solder pad on the PCB that would be connected to that exposed die pad during the reflow solder process. Therefore, it is strongly recommended that the PCB layout not include a solder pad in the region where the exposed die pad of the package will land. It is sufficient to place PCB solder pads only where the package leads will be. That region of the PCB where the exposed die pad will land must not have any solder pads, traces, or vias.

When placing a silk screen on the PCB around the perimeter of the package, place the silk screen outside of the package and all metal pads. Failure to observe this precaution can result in package cracking during solder reflow due to the silk screen material interfering with the solder solidification process during cooling.

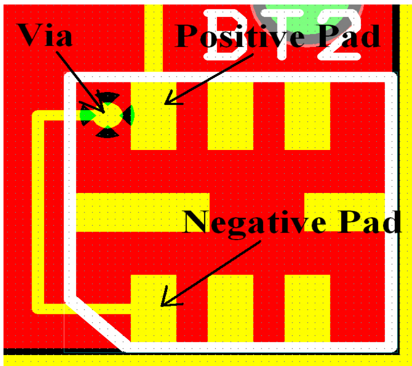


Figure 1: Improper PCB traces resulting in an undesirable parasitic leakage path.

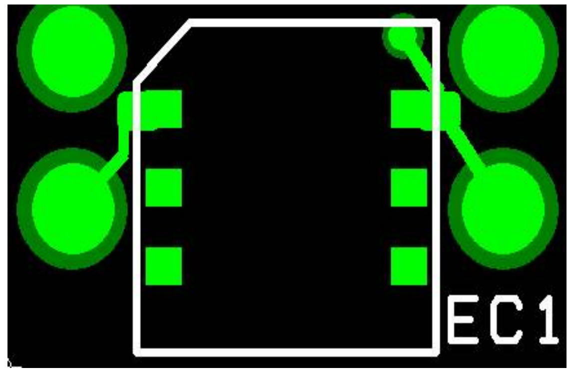


Figure 2: Proper PCB traces, precluding the formation of a parasitic leakage path.

For the CBC012-D5C the PCB layout of Figure 3 is recommended. Note that there should <u>not</u> be a center pad on the PCB that could contact the exposed die pad on the D5C package. Again, this is to reduce the possible number and severity of leakage paths between the EnerChip terminals.

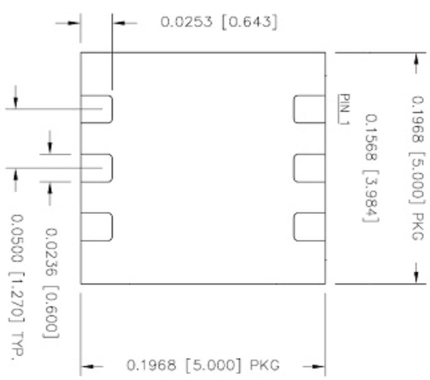


Figure 3: Recommended PCB layout to accommodate CBC012 package

Soldering, Rework, and Electrical Test

Refer to the Cymbet User Manual for soldering, rework, and replacement of the EnerChip on printed circuit boards, and for instructions on in-circuit electrical testing of the EnerChip.

Ordering Information

EnerChip Part Number	Description	Notes
CBC012-D5C	12µAh EnerChip in 6-pin M8 DFN, tube	Package for new designs
CBC012-D5C-TR	12µAh EnerChip in 6-pin M8 DFN, Tape/Reel	Package for new designs
CBC012-D5C-WP	12µAh EnerChip in 6-pin M8 DFN, Waffle Pack	Package for new designs
CBC012-BDC-WP	12µAh EnerChip Bare Die, Waffle Pack	Contact Cymbet
CBC012-BUC-WP	12µAh EnerChip Bumped Bare Die, Waffle Pack	Contact Cymbet

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