Case Study Background

One of Cymbet's Industrial Process Controls customers is designing a new embedded systems–based control system for a manufacturing assembly line and needs power holdover for MCU and RTC data retention. The Industrial controller is using a Texas Instruments MSP430x22x4 microcontroller with an on-board supply supervisor capability. This MSP430 MCU has ultralow power Standby Mode of 700 nanoamps and Off Mode RAM Retention of 100 nanoamps. This MCU also has a very low power LF Oscillator and an ultrafast wake-up from Standby Mode in less than 1 microsecond. They are using the 38 pin DA package. The data sheet for this MSP430 can be found at *www.ti.com/lit/ds/symlink/msp430f2274.pdf*.

Figure 1: Industrial Controller Embedded System requiring Time Retention

Project Design Requirements

The Industrial Process Control embedded system design team requirements were:

1. Need to provide power back-up for an MSP430 microcontroller in the event of a main power failure
2. Need to back-up the MCU RAM memory for 10 days
3. Need to back-up the MCU in Standby Mode (VLO) for 7 days
4. Need to back up the MCU Real-time clock operation for 3 days
5. Battery must be rechargeable
6. Battery must have less than 2% self discharge per year,
7. Must never have to change the battery
8. Control system product with integrated battery must be able to be shipped via air
9. Battery must be RoHS and WEEE compliant
10. Must have a small device footprint
11. Must use surface mount technology and reflow solder for assembly.

Design Solution

The Industrial Process Controls design team implemented the **EnerChip™ CC CBC3150** solid state battery with integrated power management to meet their design requirements for power back-up of the real time clock function in the MCU.

Many systems utilizing microcontrollers and/or real time clock chips require non-volatile date retention and/or real-time clock operation in the event of main power interruption. Normally, this is accomplished with the use of a supply supervisory circuit coupled with a backup power source such as a coin cell or supercapacitor. When main power is interrupted - as during line power outages or when the main battery is removed for recharging or replacement - the backup power source provides enough energy to maintain the data in the embedded SRAM or keep the internal real-time clock operational. Many MCUs have an internal supply supervisor circuit that can be used to control the switchover function from main power to auxiliary power. When the supply voltage threshold level is reached during power droop or complete power loss, the MCU can be programmed to generate an internal interrupt that places the MCU into a low power state for maximum run time from the backup power source.

The EnerChip CC is a surface mount device that co-packages a rechargeable solid state battery with integrated battery management. The EnerChip CC performs the charge control, discharge control, threshold voltage detection, and supply supervisory functions all in one low profile package. It operates over the range of 2.5V to 5.5V.

Using the EnerChip CC to provide power back-up to the Microcontroller is a very simple circuit as is shown in the following schematic diagram example:

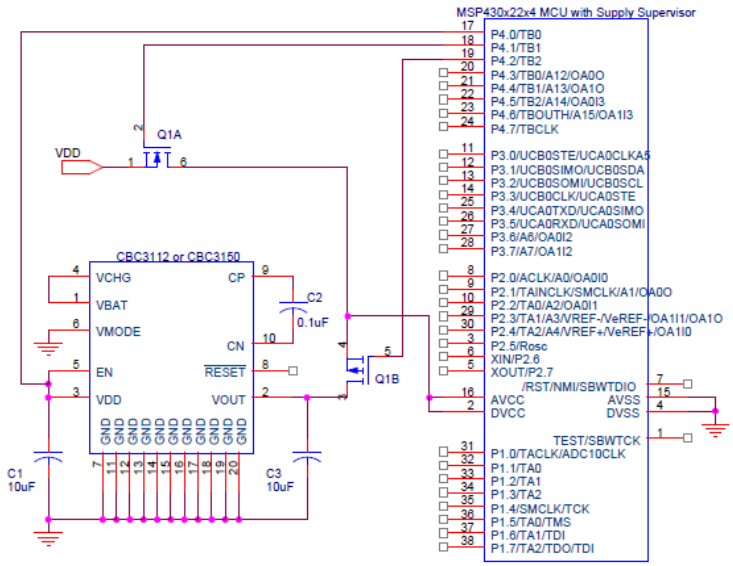


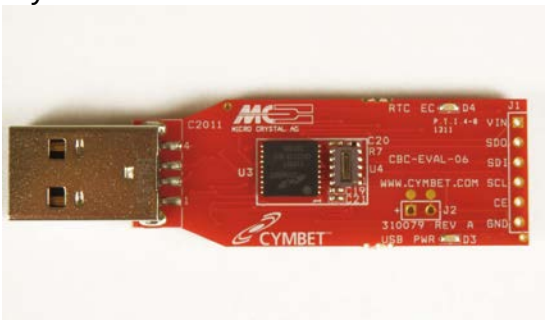
Figure2: Microcontroller RTC power backup example using EnerChip CC CBC3150

Technical design information for applications such as the Industrial Process Controls embedded system can be found in the following Cymbet.com Design Center website pages:

- Application Notes for Power Backup of several different Microcontrollers are at http://www.cymbet.com/design-center/microcontroller-back-up.php
  - TI MSP430
  - Freescale HC
  - Atmel PicoPower AVR
  - Microchip PIC
  - ST Micro ST62
  - EM Microelectronics EM
- Application Notes for Real Time Clocks are at http://www.cymbet.com/design-center/rtc-backup.php
  - TI BQ32000
  - Epson RX-8564
  - Dallas-Maxim DS1340
  - Dallas-Maxim DS1390
  - Micro Crystal RV-2123
  - Microchip MDP79410
  - NXP PCF8523

Evaluating Cymbet EnerChip Solutions for Your Next Project

This Case Study demonstrates how the design team in this industrial process controls company used EnerChip Solid State Batteries to improve the capabilities and competitiveness of their new assembly system. You can use EnerChip devices to reduce costs and improve the functionality of your products as well. Cymbet provides a set of evaluation kits that can be utilized to accelerate new product development schedules. For Power Back-up designs an ideal evaluation kit is the EnerChip CC RTC Power Back-up CBC-EVAL-06 kit. This easy to use USB based stick as shown in Figure 3, has a Micro Crystal RV-2123 Real Time Clock chip and an EnerChip CC CBC3112 solid state battery.



For additional information call Cymbet Applications Engineering at +1-763-633-1780 or use the Support form on Cymbet.com.