Backing Up Epson Toyocom Real-Time Clock Chips

A Demonstration Tool for Cymbet™ EnerChip™ Solid State Thin Film Rechargeable Batteries



Figure 1. Cymbet Demo Kit for Epson Toyocom RTC chips.

Introduction

Cymbet™ EnerChip™ solid state, thin film batteries are ideal as rechargeable backup power sources for real-time clock (RTC) chips, memories, microcontrollers and other low-power circuits where data or timing information must be retained in the absence of primary power. They come in standard integrated circuit packages and can be reflow soldered for high volume PCB assembly.

This application note describes a test/demo kit and test procedures which allows a user to evaluate Cymbet batteries as a backup for Epson Toyocom RTC chips. This system consists of the following items:

1. Cymbet Epson RTC Demo Board (upper right in *Figure 1*). Includes a Cymbet CBC050 50-µAh battery, a Cymbet CBC012 12-µAh battery, the same battery charging circuit as Cymbet's EVAL-01 board, and an Epson Toyocom RTC-8564 JE real-time clock chip.
2. CD ROM with Cymbet software.
3. Cypress Semiconductor USB-to-I^{2}C Bridge Kit, CY3240-I2USB. Includes a USB-to-I^{2}C converter board (upper left in *Figure 1*) and a USB cable. Cypress kit or equivalent to be furnished by user.

The Cymbet Epson RTC Demo Board uses the Cymbet EVAL-01 circuit to charge an on-board Cymbet battery at a constant voltage. Please see AN-1003 for details. As the battery is charging, the charging current drops until the battery is fully charged. At full charge, the current is in the sub-nanoamps. A simple but effective technique prevents the battery from discharging through the charging circuit or the power supply during primary power outages.

The Cypress USB-to-I^{2}C converter board was chosen to provide a cost effective way of programming the Epson RTC-8564 JE real time clock chip and to use the display and operating system of a notebook computer to provide a graphical user interface (GUI). The board also provides a convenient way to power the clock chip and charge the Cymbet solid state battery.

To charge the battery, operate the system with the Demo Board connected for at least 30 minutes. The battery will be charged to 80% within 30 minutes and to 100% after 45 minutes. Please see AN-1003 for details on battery charging times.

System Operation

Overview

The demo system utilizes a Microsoft Windows™ based computer with a USB interface. Upon connection, the RTC Demo Board will have its time set or read via the computer. The Board will then be disconnected from the USB-to-I^{2}C converter, and the GUI will blank the time display digits. When the Demo Board is again connected to USB-to-I^{2}C converter, the correct updated time will be shown by the GUI since the RTC module has been powered by the Cymbet battery.

Installing the Software

Open the .zip file and copy the contents into a directory on your computer. The files should include *PSoCfirstTouchUSBNetLib.dll*, *RTCDemo.exe* and *logo1.bmp*. The software will not work if installed on a network drive. To start the GUI, click on the *RTCDemo* icon. If there is a warning, go to the Microsoft website, download the .net Framework update, and install
http://www.microsoft.com/downloads/Search.aspx?displaylang=en

Running the System

Caution: to minimize the possibility of damaging the demo system, make sure power is off whenever separating or mating the Demo Board with the USB-to-I^{2}C converter. Do this by turning off the RTC power button in the GUI, or disconnect the USB connector at the personal computer or USB-to-I^{2}C converter board.

GUI Description

The graphical user interface (GUI) is shown in *Figure 2*. The GUI has fields to display hours, minutes and seconds, status of the low voltage indicator of the Epson RTC module, and status of the USB link. The GUI also provides fields to turn power on and off to the Demo Board and to set the time.

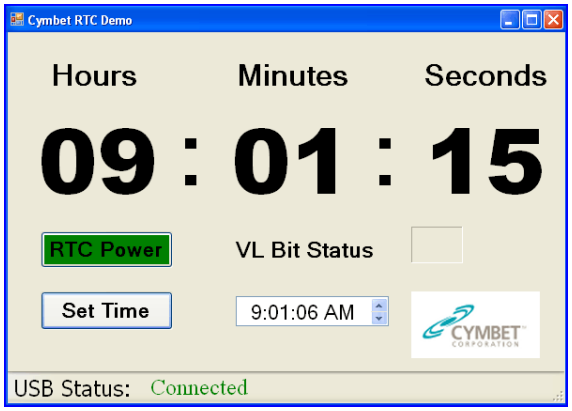


Figure 2. Graphical User Interface (GUI).

Normal operation

1) Connect shunt jumper J3 to the two pins on the bottom of the Cymbet Epson RTC demo board. This jumper enables the Cymbet cell to provide backup power to the Epson RTC-8564 JE real time clock module.

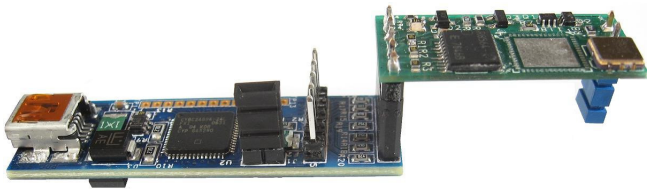


Figure 3. Connection of Cypress and Cymbet boards.

2) Connect the Cypress USB-to-I^{2}C converter to the Cymbet Demo Board as shown in *Figure 3.*

3) Connect the USB cable between the PC and USB-to-I^{2}C converter board.

4) Power up the computer if not already done and open the GUI by clicking on the *RTCdemo* icon.

5) Verify that USB status is connected. Set RTC power to on. Set appropriate time if needed. Note: when the GUI is first run it will pick up the system time and put it into the set time field at the bottom of the GUI. If it will be a more than a few minutes before the time will be set into the Epson RTC-8564 JE real time clock module it may be faster to restart the GUI instead of using the up and down arrows to set the time in the set time field.

6) Turn off RTC Power and separate the Cymbet Demo Board from the USB-to-I^{2}C converter board.

7) Verify that RTC power is off, as indicated by the GUI, then connect the Demo Board to the USB-to-I^{2}C converter.

8) Turn on the RTC Power button in the GUI and note that the correct indicated time is still being displayed.

9) If the EnerChip cell is depleted, the VL indicator (voltage low) will be displayed in the GUI. In this case, then the operation of the Epson RTC module is in an unknown state and indications are not valid. To clear the VL indicator, set a new time. The VL indicator can be forced to activate by pulling the BAT ENB shunt jumper J3 (see *Figure 3*) from the backside of the Demo Board and then turning off the RTC Power button.

Performance

The Epson RTC-8564 JE real time clock module has a typical current draw of 310 nA at 4V. As shown in *Figure 4*, it will run continuously 42 hours when powered by a 12 µAh Cymbet thin film battery and for 7 days when powered by 50 µAh battery.

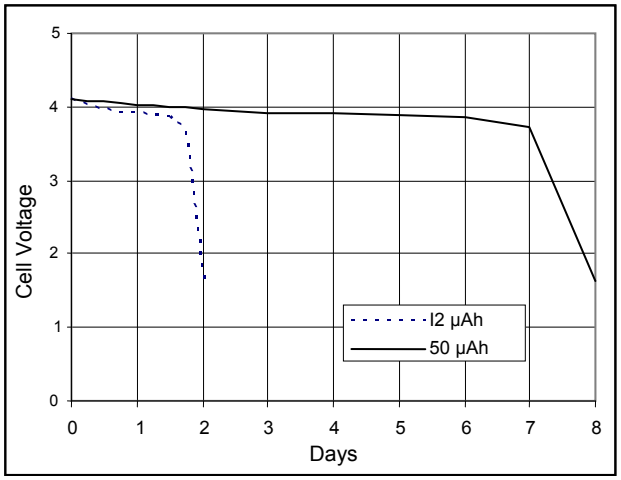


Figure 4. Battery voltage applied to RTC.

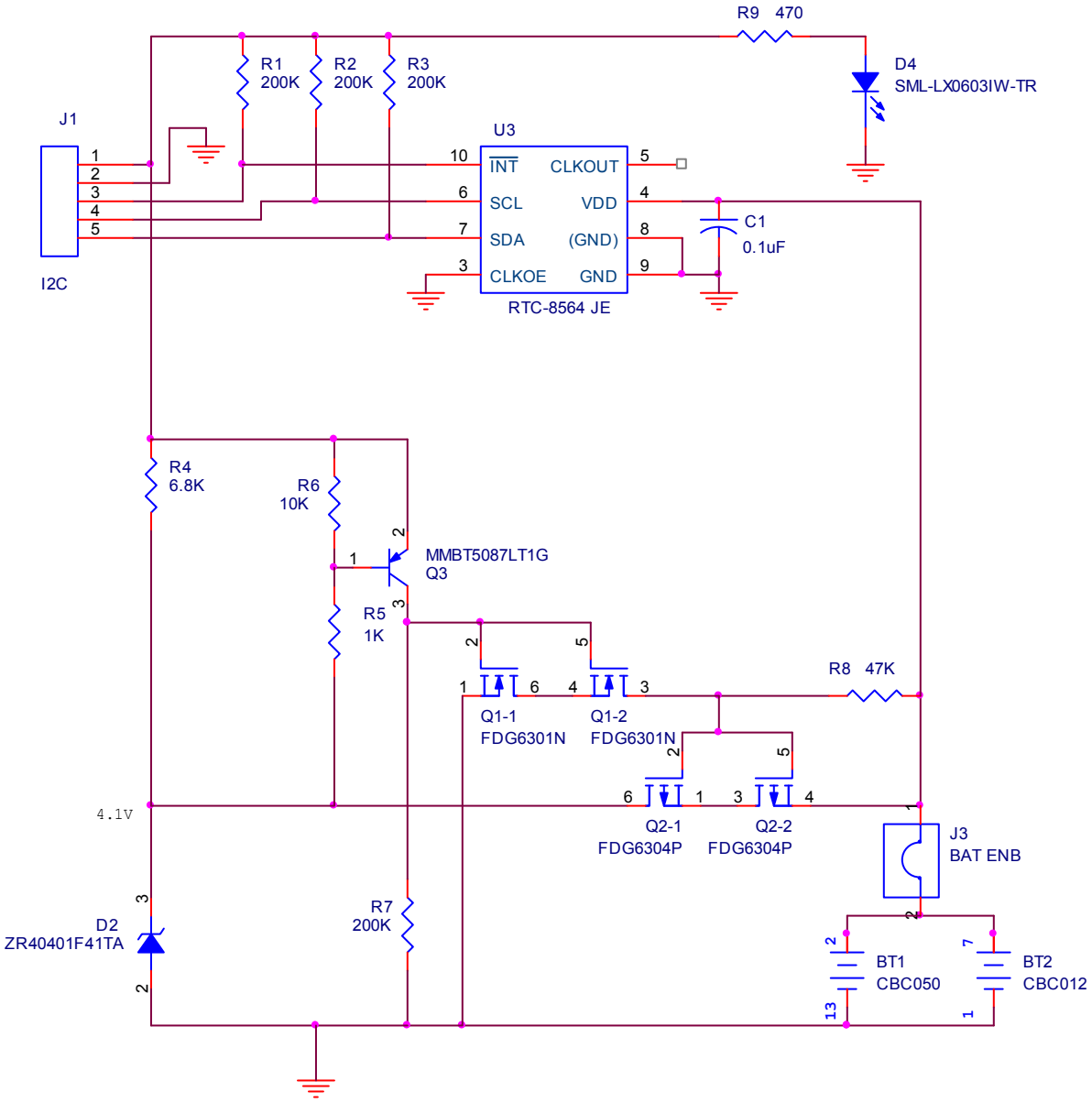


Figure 3. Schematic, Cymbet Epson RTC Demo Board.

Note: Cypress is a Registered Trademark of Cypress Corporation. All other referenced terms or product names are the property of their respective owners.