

Capacitor Backup

Backing the FM31xxx RTC and Event Counters



Overview

Using a capacitor to backup a real-time clock in the absence of system power is often preferable to a battery. A capacitor backup is practical with the FM31xxx family since nonvolatile data does not depend on the backup source as it does with battery backed RAM. When using a capacitor backup source, the capacitor must be charged. The highest charged voltage yields the longest backup time period after power fails. This application note illustrates three simple methods of charging the capacitor.

Trickle Charger

The FM31xxx Processor Companion family includes a built-in trickle charger designed to supply a backup capacitor while V_{DD} is applied. It requires no external components except for the back-up capacitor itself. When enabled the trickle charger sources approximately $15 \mu A$ until the VBAK pin reaches V_{DD} or the maximum allowed voltage of 3.75V. This is sufficient to fully charge a 0.1F SuperCap in a few hours. Trickle charging maximizes the charge voltage in a 3V system and provides the simplest method to comply with the VBAK max specification in a 5V system. As explained in the datasheet, the trickle charger is enabled by setting the VBC bit in the FM31xxx processor companion.

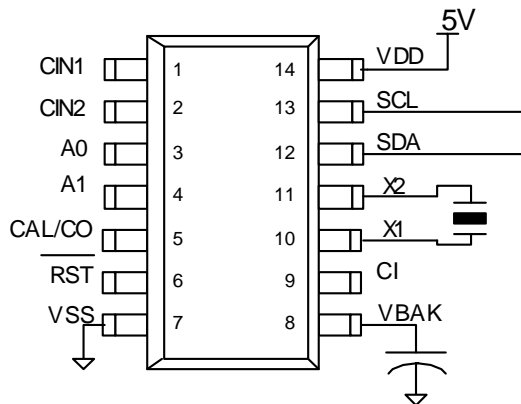


Figure 1. Trickle Charger Configuration

3V Systems

In systems that operate from a 3V supply, the VBAK capacitor can be charged by a Schottky diode and current limiting resistor. This solution requires additional external components as compared with the trickle charger but offers a faster charge time. In this case, the user can select virtually any charging time

by selecting an appropriate current limiting resistor. The charge time is approximately $5*RC$.

The blocking diode prevents current from flowing out of the capacitor into the system when V_{DD} drops below the capacitor voltage on power down. Using a Schottky diode minimizes the forward voltage drop to approximately 0.3V. Since the capacitor only charges to $V_{DD} - 0.3V$, this solution offers slightly less backup time than the trickle charger. An example circuit showing a diode charger is illustrated below.

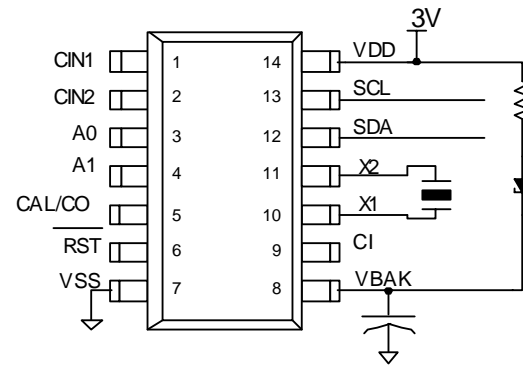


Figure 2. Diode Charger Configuration

5V Operation Systems

If the trickle charger is not used, then 5V operation systems must use an alternative to the diode charger. A simple diode, even an ordinary silicon diode would charge the capacitor to a voltage that exceeds the VBAK (max.) specification of 3.75V. There are a variety of circuits that can be used, but the most dependable is shown below. This circuit puts the largest voltage on the capacitor that does not violate the VBAK (max) specification regardless of charging current.

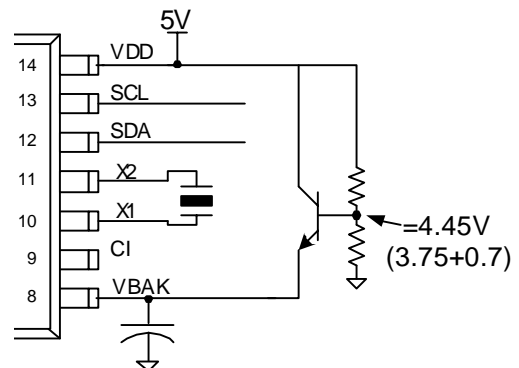


Figure 3. Transistor Driven Charger

Ramtron International Corporation

1850 Ramtron Drive, Colorado Springs, CO 80921

(800) 545-FRAM, (719) 481-7000

www.ramtron.com