

Selecting a Real Time Clock (RTC) for the GPC1 Board

The GPC1 board has pads for both DIP8 and SO8 versions of a Real Time Clock (RTC). There are basically two kinds of I2C 8 pin RTC devices, differing in the use of Pin 3. One kind uses Pin 3 as an interrupt while the other uses Pin 3 for battery or super-cap backup power. The GPC1 is designed for the latter type of RTC, which operates by automatically detecting low main power on Pin 8 and switching to backup power on Pin 3. The advantage of this type of RTC is that the device is aware of a backup power condition and can incorporate useful functions based on that knowledge. One such function is offering interrupts that can be disabled under backup power. Another is capturing the time that main power goes down and saving that time for readout when main power is restored. Some devices even have a built-in charger to charge a super-cap used for backup power, though this feature is not particularly needed with the GPC1 since a charging diode and resistor are included on the board.

Although it was a design goal of the GPC1 to use through-hole components for ease of hand assembly, the RTC is a fairly new device and is not available in the DIP8 version from most manufacturers. Philips continues to support the DIP package even in its latest RTC, the full-featured PCF8563, but unfortunately none of the Philips RTC offerings to date use Pin 3 for backup power. The venerable DS1307 is available in DIP package and has backup power on Pin 3, but it lacks many of the latest RTC features like an alarm interrupt.

Unfortunately, the DIP8 package is not an option for the ST M41T81, which is the RTC deemed most suitable at present for the GPC1 board. The M41T81 is recommended because it allows full use of the power management features of the GPC1. The GPC1 is designed to use the alarm interrupt from the RTC to turn on main power so that the board can “wake up” at designated or periodic times to perform tasks and then shut itself down, resulting in very low power usage for battery or solar powered applications. The M41T81 is attractive in that its alarm interrupt can be programmed all the way through months so that the alarm can be set for one time during the year, whereas other RTC devices only allow the alarm to be set only through hours or days. The alarm can be configured to repeat at the same time every minute, hour, day, month, or year. This alarm repeating feature is available in most RTC devices and is useful for periodic routine tasks.

Another important feature of the M41T81 is a second timer interrupt, in addition to the alarm interrupt, that can be used when main power is on to call a subroutine for periodic time readout and display from the clock. Other RTC devices have additional timers, but the M41T81 is unique in that its auxiliary timer, called the watchdog timer, is disabled during backup power conditions. This is important because when main power is shut down by the OFF key it would not be desirable to have the power turn back on one second later due to a continuing timer interrupt. Instead, power should only be turned back on by the ON key or by the alarm interrupt, if enabled.

A feature of the M41T81 which may be useful to some critical time-keeping applications is the built-in method for trimming the oscillator. On the negative side, the M41T81 does not have any user RAM as some other RTC devices do, nor does it have the super-cap charger. It is hoped that future RTC devices will incorporate all the desired features. At present, trade-offs favor the M41T81 even though some features are lacking. Careful consideration should be given to the choice of a RTC since the software driver can be quite complicated and there is little standardization between manufacturers as to programming. Future introductions by ST may offer enhanced features while retaining software compatibility. Hopefully, a future introduction by Philips will support the Pin 3 backup power convention and offer the DIP package option.