Alternative Configurations for the CircuitShell GPC1 Board

Although the proposed assembly method and specified parts will result in a powerful general purpose controller, users may want to customize the GPC1 board for their specific application by substituting, re-arranging, adding, or leaving off parts. The following paragraphs suggest some alternative configurations for the GPC1.

If not needed in a particular application, the LCD display and many support components can be eliminated, freeing a large area on the back of the board for a daughter board. The daughter board can plug into connectors J3 (or J4) and J5 to gain access to most of the microcontroller pins. If the battery clips are installed on the front of the board instead of the back, the daughter board could be made even larger, also gaining access to connector J6. Without the display, a black CircuitShell cover can replace the clear cover since the power-on LED can optionally be mounted on the front side of the board instead of the back. The switches may no longer be needed so their pads can be solder-filled and taped over. Even the power ON and OFF switches are optional since reset and programming can be remotely controlled by inserting breaks in serial communications to the board.

There may be some applications where ultra-low power consumption is a requirement. Power consumption is already greatly reduced by the use of the RTC alarm to turn power on briefly to accomplish periodic tasks. Even further efficiency may be realized by eliminating the 10ma current used by the power-on LED. This 10 ma current is also the base current of the main power switching transistor Q1, and is regulated at this fairly high level by U8 to insure saturation even at emitter-collector currents up to 500ma. Although a rugged bi-polar transistor was chosen for Q1 because of the potential for static and over-voltage conditions at the power input, it should be possible to substitute a low on-resistance P-channel MOSFET, eliminating the need for the 10ma drain. The pull-up resistor R2 is still needed in any case, but LED1, U8, and R1 can be eliminated and jumpered out. If the indicator LED is needed, the MOSFET would still provide some power reduction if R1 and U8 are programmed for a 1ma current and a high-efficiency low current LED is used.

Although a Cadmium Sulfide photo-resistor works very well for the light sensor LS1 as an automatic back-light control for the LCD display, Cadmium is a toxic heavy metal and its use in electronics may be restricted. A photo-transistor will also work, but unless a visible-light-only version is used, sensitivity to IR may cause erratic operation. Whatever light sensor is used, some experimentation with R11 may be required to achieve the desired interaction between ambient light and back-light. Pin 24 of the microcontroller is connected to bypass the light sensor and force the back-light off when configured as an output and set low. As R11 increases in resistance more hysteresis will be observed in the back-light switching point. The reason for this is that the microcontroller pin will source current at a threshold point to assist the 0 to 1 transition.

At present, the PCF8951 type multi-channel A/D converter is only available with 8 bit resolution. There are higher resolution single channel I2C A/D converters that could be added in the prototype area, along with a multiplexer. Some 8051 type microcontrollers have higher resolution A/D units built-in, but it was felt that the ROM boot-loader and PCA of the P89C66X devices were more important features. There may be 8051 offerings from other manufacturers that are pin-compatible with the GPC1 board but this possibility has not been thoroughly explored.