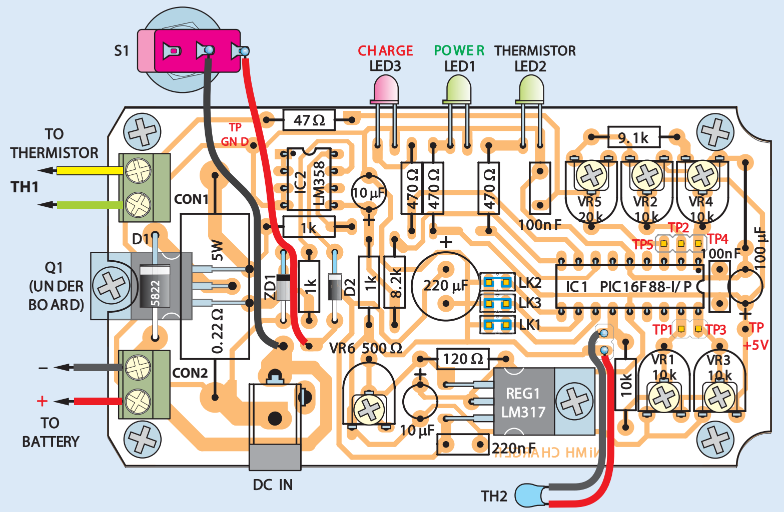

Fig.3: full-size component overlay – compare this with the photograph of our prototype at right. If the 220µF capacitor you have is higher than 14mm, it will have to be laid over to fit within the case.

Outputs RB1 and RB2 of IC1 drive the Thermistor and Charge LEDs respectively via 470Ω resistors.

Constant current source

Op amp IC2 and MOSFET Q1 are connected to provide a controlled current source to charge the battery (connected via CON2). Op amp IC2 compares the voltage across the 0.22Ω 5W resistor (at pin 6) with the DC voltage derived from the RB3 output of IC1 (at IC2 pin 5).

The output from RB3 is a 5V 500Hz pulse-width-modulated signal, which is fed to a divider and filter network comprising 8.2kΩ and 1kΩ resistors and a 10µF capacitor. The filter network smooths the pulse output to give a DC voltage.

It is this smoothed DC voltage which effectively sets the current level provided by MOSFET Q1 to the battery.

Diode D1 is included to prevent the battery from discharging via the intrinsic reverse diode inside MOSFET Q1, when the power is off. D1 is a 3A Schottky diode, specified because it has less than half the forward voltage of a normal power diode. Typically, it has about 380mV across it (at 2.5A) compared with a standard diode which has 0.84V across it at 2.5A. The lower voltage drop also means less power loss in the diode; 0.95W at 2.5A compared to 2.1W in a standard diode.

Power for the circuit is taken from a DC plugpack supply via diode D2. This diode provides reverse polarity protection for the following capacitor and regulator REG1.

An LM317T is used to provide a regulated 5V supply to IC1 and the trimpots. This was chosen in preference to a standard 5V regulator because it can be adjusted to supply a precise 5V, using trimpot VR6, to make the settings of VR1 to VR5 more accurate.

Voltage requirements

To fully charge a battery you will require up to 1.8V per cell from your plugpack, even though the nominal terminal voltage shown on the battery pack is 1.2V per cell. Hence, to charge a 6V battery which has five cells, you will need a DC input voltage of 9V (5 × 1.8V). Similarly, an 18V battery will have 15 cells and you will need 27V (15 × 1.8V) to charge it fully.

However, while the voltage requirement for charging one, two or three cells is less than 7V, in practice you need more than 7V at the input to ensure that the LM317T regulator operates correctly, ie, remains in regulation.

You can operate the charger in a car, in which case the input voltage will be around 12V with the engine stopped and up to 14.4V with the engine running. With 12V in, you can charge up to six cells (ie, a 7.2V battery). With 14.4V (ie, engine running), you can charge up to eight cells (ie, a 9.6V battery).

Note also that using a supply voltage that is significantly higher than required to charge the cells will cause the charger to heat up more than necessary. For example, at 2.5A and with 10V higher than the battery voltage, there is going to be 25W dissipated in the charger. The heatsink will certainly become hot and the charger will shut down when it reaches 50°C. So you may have to reduce charge current if the supply voltage is high compared to the battery voltage.

Charge current

Maximum charging current is limited by the mAh capacity of the cell or battery (as can be seen in Table 1) and the rating of the DC plugpack or power supply. So, if you charge at 2.5A, the power supply or plugpack must be able to deliver this current.

Note that most 'transformer' type plugpacks cannot supply this amount of current, while some 'electronic' plugpacks (ie, those with a switch-mode supply) may be able to.

Software

The software files will be available via the EPE Library site, access via **www.epemag.com**. Pre-programmed PICs will also be available from Magenta Electronics – see their advert in this issue for contact details.

Construction

The Fast NiMH Charger is constructed using a 98mm × 53mm PC board, code 720. This board is available from the *EPE PCB Service*. The printed circuit board component layout and wiring is shown in Fig.3.

It is housed in a diecast box measuring 111mm × 60mm × 30mm. A fan heatsink (that's fan-shaped, not a heatsink with a fan) measuring 55 × 105 × 25.5mm mounts on the case to ensure that the charger runs reasonably cool.

Begin construction by checking the PC board for any defects, such as shorted tracks and breaks in the copper. Check also that the hole sizes are correct. Holes for the DC socket and the 2-way screw terminals will need to be larger than the 0.9mm holes required for the other components.

Also check that the corners have been shaped to clear the internal corner posts of the box and that the 6mm diameter access semicircle for Q1's screw has been cut from the edge of the PC board – see Fig.3.

Insert the resistors first. Use the resistor colour code table as a guide to each value, or use a digital multimeter