

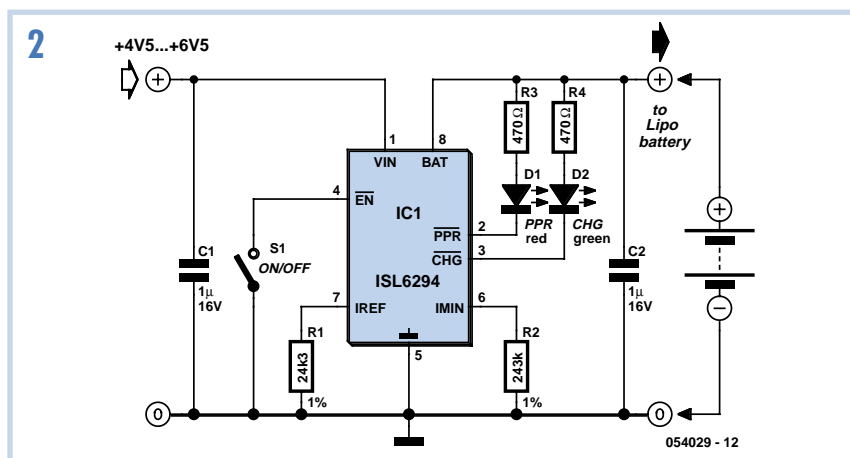
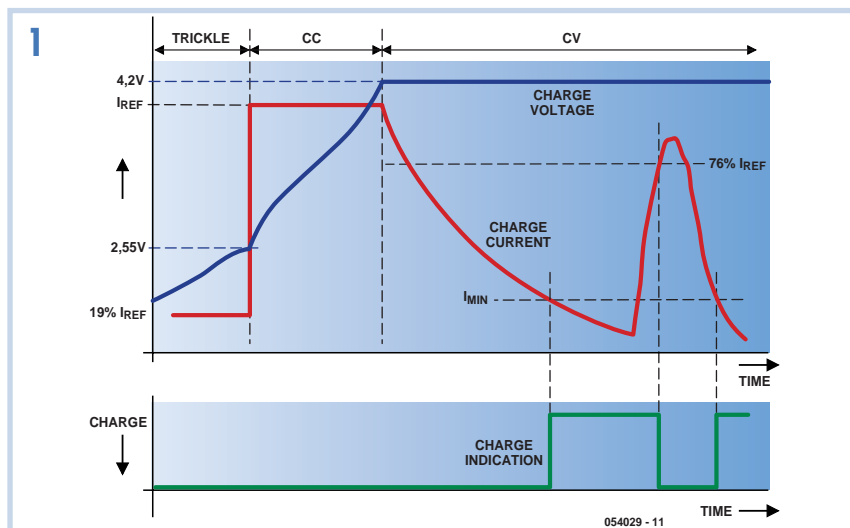
# Low-cost LiPo Charger

The charging of Lithium-Polymer (LiPo) cells takes place very differently to that of the well known NiCd and NiMH cells. This aspect has previously been covered in *Elektor Electronics*. And this isn't the first LiPo charger that we've published, but it is undoubtedly the smallest!

Chip manufacturer Intersil has designed a LiPo charger IC that requires a minimum of external components. Since the IC itself is also extremely small (2x3 mm), the complete charger can be kept very small as well. This lets us design a charger that can easily be built into various pieces of equipment, especially when we use SMDs for all external components.

For those of you who don't know how a LiPo cell should be charged, we'll give a short explanation. When the cell voltage is very low (<2.5 V), it should be charged using a small current (see **Figure 1**). This current is typically less than 0.1 C (where C is the nominal battery capacity). When the voltage has risen sufficiently, but is still below 4.2 V, the cell is charged with a constant current. Most LiPo manufacturers specify a current of 1 C for this stage. The voltage across the cell may not exceed 4.2 V, so the charger has to keep an eye on this as well. At this constant voltage the current through the cell will slowly reduce while the charge in the cell increases. At the point when the cell voltage is 4.2 V and the charging current has dropped to 0.1 C, the cell is about 80-90% charged, depending on the manufacturer. Most chargers decide at this point that the cell is fully charged and switch to trickle charging the cell.

Our charger works in exactly the same way. There are two parameters that can be adjusted in this charger, which are the normal charging current and the trickle charge that flows when the cell is 'full'. In the circuit of **Figure 2** resistor R1 sets the charging current to about 500 mA, and



resistor R2 sets the trickle charge current to about 45 mA.

R3, R4, D1 and D2 are optional in this design and provide the user with status information. D1 shows when the charging process is busy and D2 indicates that the correct input voltage is present.

If you want to use different maximum and minimum charge currents you should use the following formulae for R1 and R2:

$$R1 = 12 \times 10^3 / I_{ref}$$

$$R2 = 11 \times 10^3 / I_{min}$$

Keep in mind that the accuracy of the current source at 500 mA is about 10%; this drops to about 30% at 50 mA. You should therefore be conservative in your choice of charging current so that you keep below the manufacturer's maximum recommended charging current.