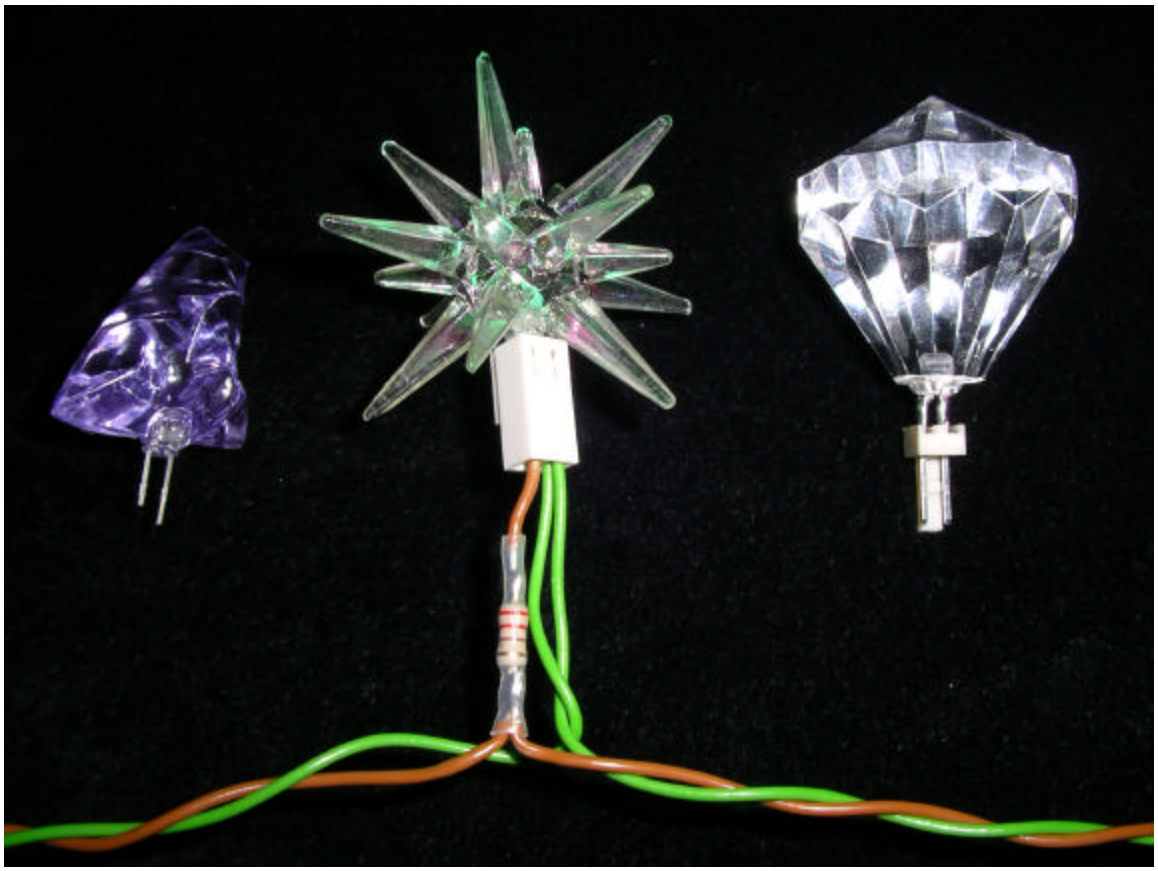
## Clive Mitchell’s Instructions to Build LED Charm Lights



Have you ever picked up a crystal or interestingly shaped piece of clear plastic and either held it up to the light or shone a torch into it to see how it looks when lit up? I have. In fact I went a step further and started collecting oddly shaped pieces of clear plastic in various colours, drilled them and glued in a suitably coloured LED (Light Emitting Diode). The results were so pleasing that I gradually amassed a large collection of artistic illuminated plastic chunks. It made sense to design a simple way of displaying them, and I duly came up with the idea of "charm lights". For those who aren't familiar with jewellery fashion trends, the charm bracelet is a gold chain that you can clip various "charms" onto. It's a way to make yourself a piece of customised jewellery that you can add to or change as you desire. Thus I decided to make the electronic version. This consists of a string of small sockets into which the LED illuminated plastic objects can be plugged to form a chain of illuminated objects like Christmas lights. (But much nicer!)

It's almost unusual to have an electronic project that doesn't require a microcontroller these days. It's even stranger when there isn't a PCB (Printed Circuit Board) to worry about. This project uses neither, which makes it very easy to build and yet still produces stunningly attractive results.

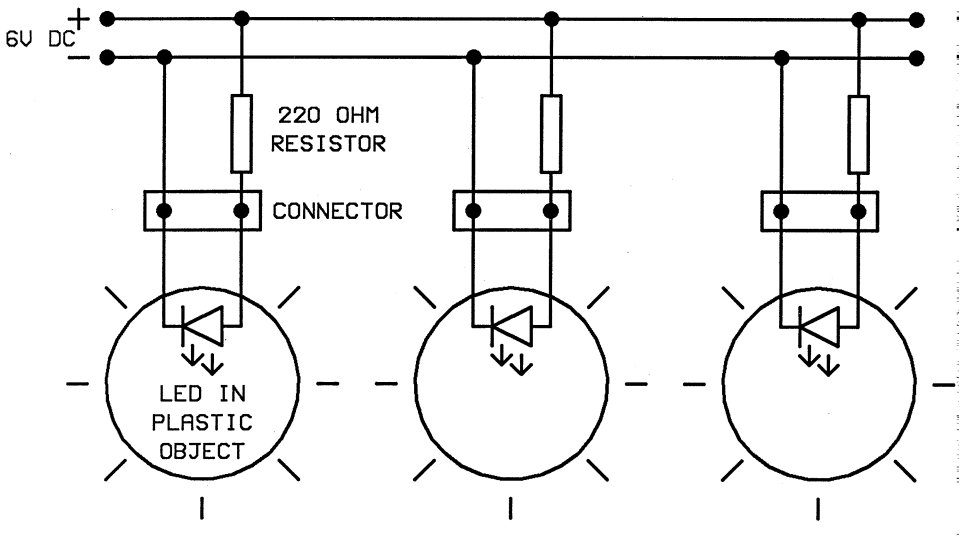
When an LED is glued into a plastic object using a suitable glue like two part epoxy resin, the layer of glue that surrounds the LEDs lens and mates it to the object causes an interesting effect where the lens disappears and the LED chip effectively becomes part of the plastic object. The result is that all the light from the LED enters the object and is bounced around inside, making the whole object light brilliantly. The choice of LED colour is important if coloured plastic objects are used, since LEDs generally emit a single wavelength of light which gives them their vivid colour.

If a blue LED is glued into a purple object then much of the light will be lost because of the red component in the plastic. Likewise if the same blue LED is put into an object made of clear blue plastic, then the light transmission will be superb. Water clear plastic is suitable for every colour but may provide less of a visual effect than colored plastic. The surface texture of the object is important too since a more diffused or rippled surface will appear much brighter than a smooth surface. Experiment!

The light string consists of a pair of wires twisted together and terminated into a small socket at regular intervals. A resistor is included for each socket to limit the current through each LED. You can see the basic idea from the simple schematic, and the constructional details are summed up nicely in the picture that shows the way the wires are terminated into the sockets via the resistors. You'll also notice that a bit of heatshrink sleeving has been used to cover the resistor. The Molex connector shown uses little crimps that latch into the housing when inserted. You can either buy a suitable crimping tool or just solder the wires into the crimps.

The string of lights is powered by a common wall wart type of power supply which supplies six volts at an appropriate current. Each LED will require about 20mA so a 300mA supply can theoretically run 15 lights while a 500mA supply can run 25. I added a three pin connector onto each end of the light string so that it could be extended as desired, but that's optional. For simplicity and cheapness I would recommend an unregulated supply, since a slight voltage variation isn't too critical.

The connectors I used were standard 0.1" pitch Molex style connectors since these will happily allow an LED to be inserted directly. The resistor value is 220 ohm which should provide a current of about 20mA through red, orange and yellow LEDs and a bit less through blue, white, UV or super-green LEDs. The choice of LED is mainly based on intensity and since angle is not important you should note that LEDs that may appear to be quite high intensity may be cheating the value up by emitting over a very narrow angle. T1 / 3mm LEDs are a good choice since they allow the use of smaller plastic objects. Be very wary of bulk blue, white and green LEDs sold on the Internet. They are sometimes very unreliable.




To get an LED into your chosen plastic object you should carefully drill a hole of suitable diameter to allow the LED to be inserted. Don't drill it too deep as it is good if the LED tip can hit the bottom of the hole. Be sensible while drilling, since the irregular shapes may lead to the drill slipping and the risk of "blood" (I'm sure we've all been there!). A good choice of drill is a low power cordless drill with a slightly blunt drill bit so that it doesn't snatch into the plastic. Once the

plastic is drilled, mix up some two part epoxy resin glue and carefully smear a dab into the hole with a bit of wire to "wet" the internal surface. Dip the tip of the chosen LED into the resin and push it firmly into the hole so that it displaces excess glue and forms a good bond without any trapped air bubbles. Allow the glue to set with the object stood upright in a bit of modelling clay. Be patient! Let the glue set completely before disturbing the object. I tend to use 5-minute epoxy resin. Don't use the one minute stuff, since it tends to set so quickly that you end up wasting a lot. Mix small batches of the resin and only do three or four items at a time. Otherwise you'll get caught out by the speed with which the glue sets.

The LED leads should be trimmed down and this is where you can either choose to solder the LED pins to a small male connector that matches the sockets on the wiring, or for sheer simplicity just crop the leads down to about 3/8" making the positive lead (the long one) a bit longer than the negative so you can remember the polarity. Check out the picture as an example. LEDs will not light if connected the wrong way round, so observe the polarity before pushing the LED pins into the sockets.

And that's really about it. Just take a good look at the pictures to see how things are assembled then start making some lights up. If you mess up, then don't worry. Just start again. After all, the stuff is cheap.

Once you've made a set of charm lights you'll find yourself actively looking for things to make into lights. Some good suggestions are..... Clear bouncy balls, decorative plastic "ice", chandelier-like plastic crystals, keyrings and even some industrial components. As you find and make new lights, you can simply shuffle the lights about on the string to your hearts content.

You can find more assembly details at:-

http://www.emanator.demon.co.uk/bigclive/trink.htm

**Here's a list of components sourced from the Allied catalogue.**
Please be aware that I live in Scotland and the original design was based around locally available components. These seem to be the nearest equivalents, but there's no harm in checking...

| | |
|---|---|
| 928-9625 | 6V 300mA PSU |
| 928-9630 | 6V 600mA PSU |
| 863-3250 | 2-crimp connector housing |
| 863-9969 | Female crimps |
| 696-9104 | 24 AWG stranded wire (green) |
| 696-9109 | 24 AWG stranded wire (brown) |
| 796-9851 | 5-minute Quik Stik epoxy glue |
| 832-0248 | 220 ohm 1/4W resistors |
| 617-0414 | Clear 1/8th inch heatshrink tubing |
| 505-9999 | Red 3mm LED |
| 505-9715 | Orange 3mm LED |
| 505-0002 | Yellow 3mm LED |
| 505-9716 | Ultra green 3mm LED |
| 505-9720 | Blue 3mm LED |