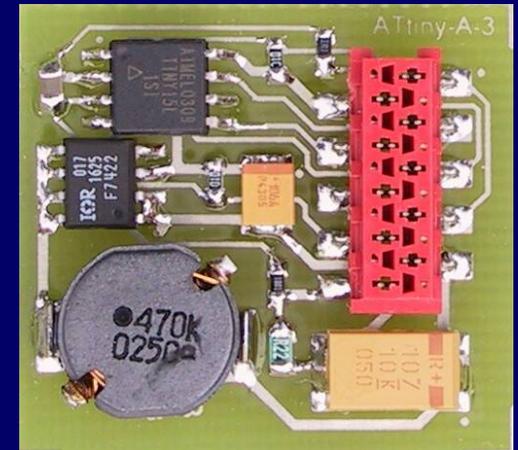# Making Surface-mount (SMT) boards at home

8 November 2003, July 2005



## Mike Cowlishaw

Speleogroup

# Overview

- ATtiny-A Caving Lamp

- Designing the board

- Making the PCB

- Population (mounting the components)

# ATtiny-A Caving Lamp

- 1-Watt LED lamp:

  Slow-fail (no sudden loss of light)
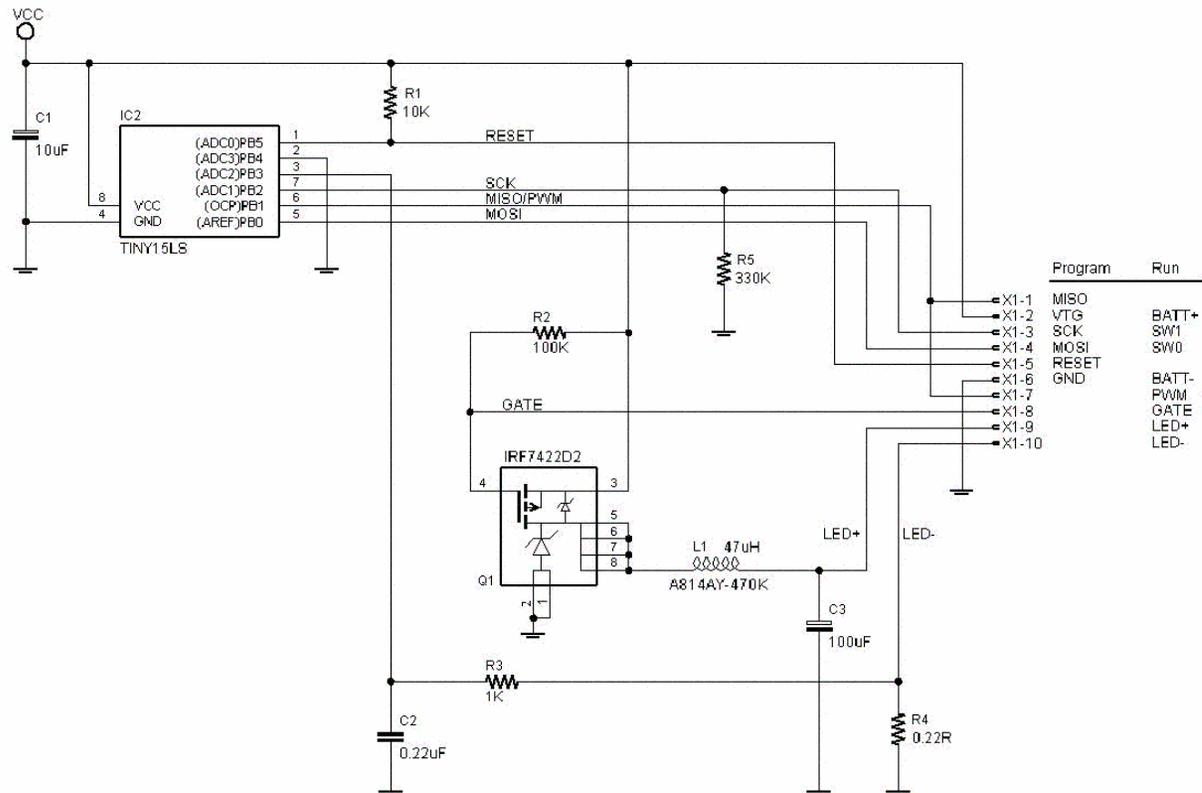
  Microprocessor is Atmel ATtiny-15L (8-pin device)



See:  http://www.spelogroup.org/attinya.html

# Designing the board

- Plenty of choices

- I used CadSoft Eagle
  - full-featured  (professional output options, coupled schematic/PCB editors, auto-router, multi-layer, very programmable, *etc.*)
  - free for up to 4"x3", two-layer, 1-sheet
  - responsive support (newsgroup)

# Schematic



Atmel Tiny15L microcontrolled constant-current source for Luxeon 1W Star/O LED caving lamp/torch.
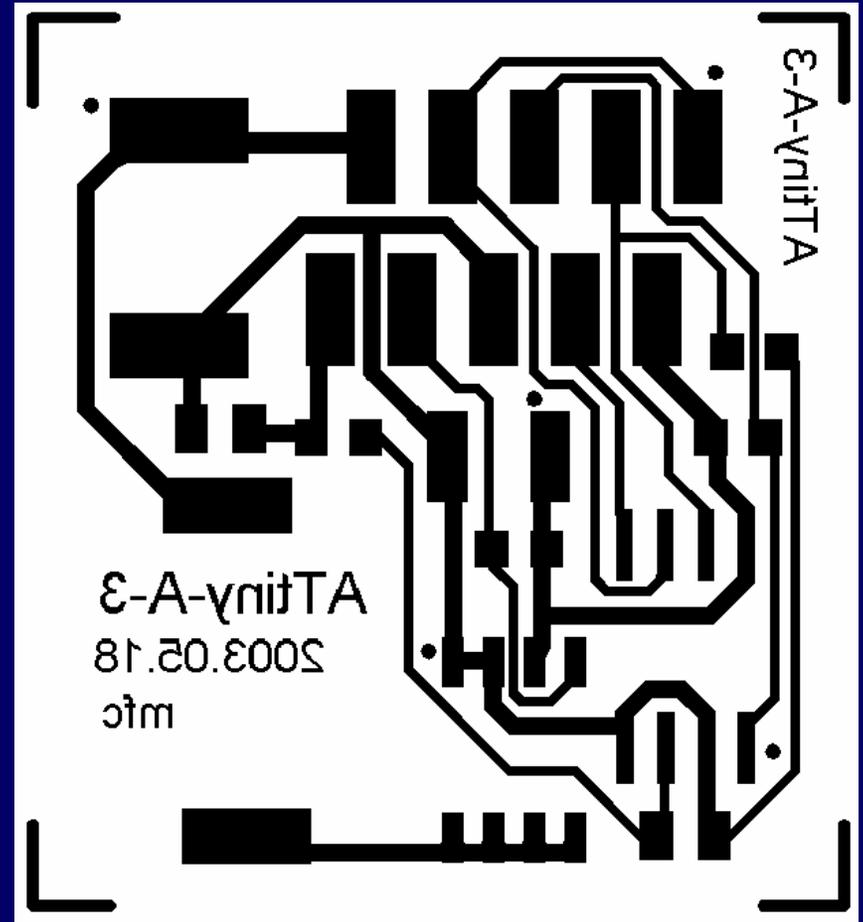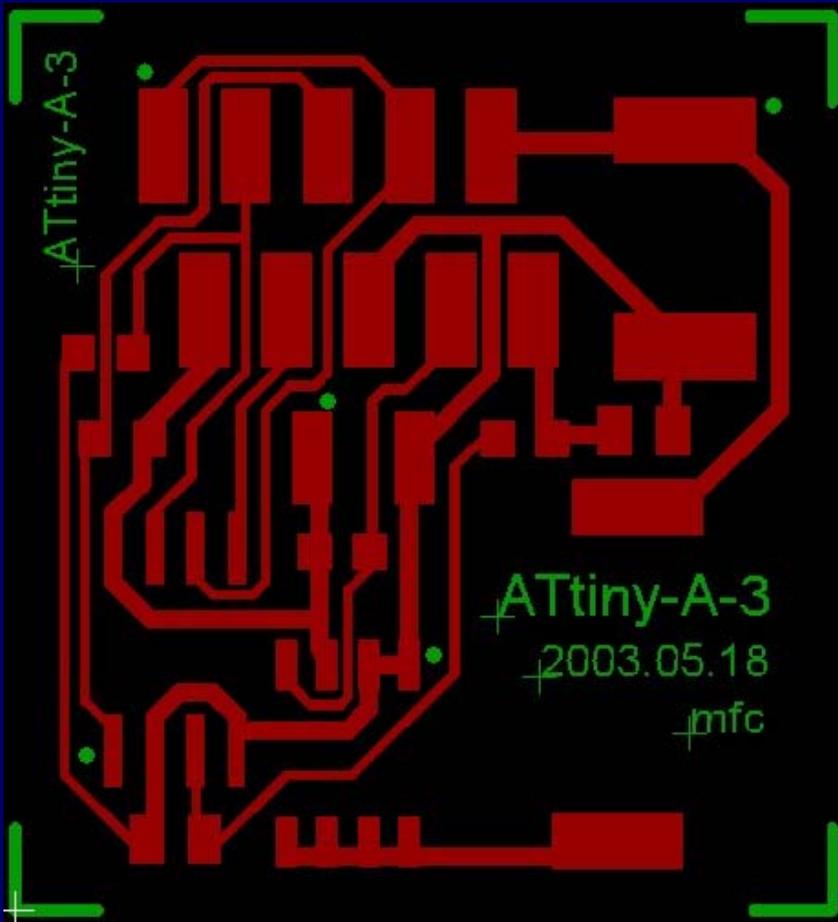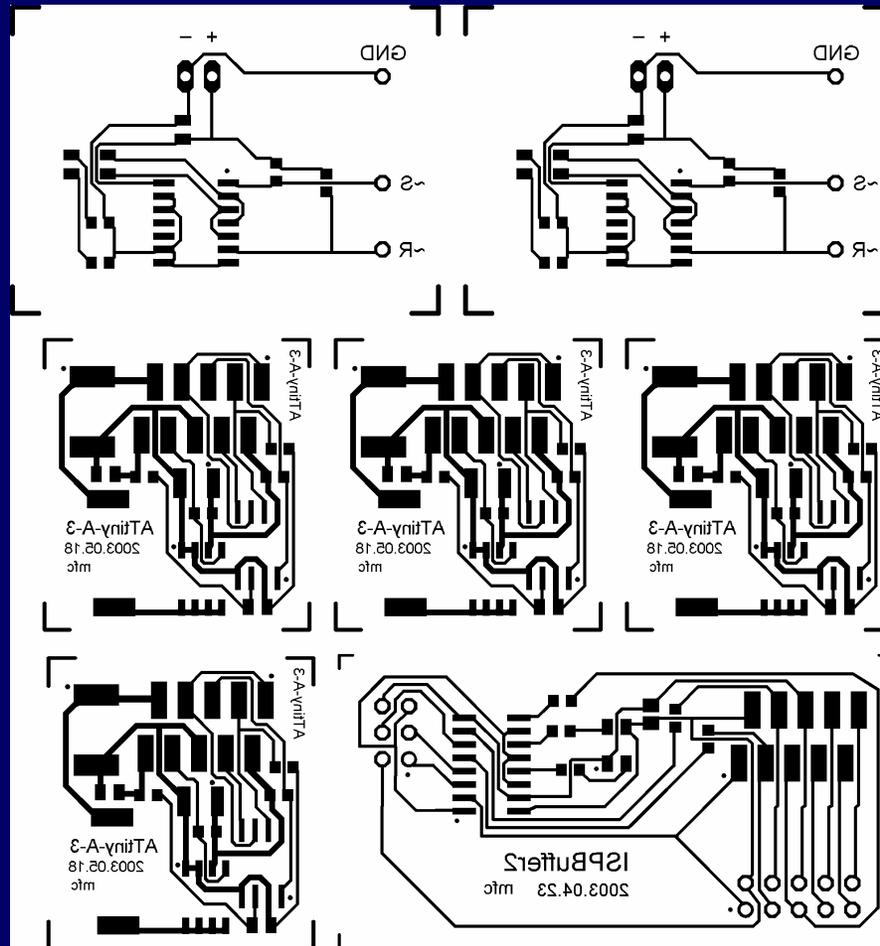
ATtiny-A-3
25/05/2003 18:16:41
Author: mfc
Sheet: 1/1

# PCB layout (single-sided)

# Imposition



**(A simple Rexx program was used to concatenate .bmp images.)**

# Board-making process

- Print (UV-transparent film, *etc.*), 600 dpi
- Expose photo-resist PCB (3 minutes)
- Develop (1 minute)
- Etch (10 minutes, agitating)
- Strip photoresist mask (< 1 minute)
- Chemical tin-plate (10 minutes)
- Cut into separate PCBs (5 minutes)

**Cost: about $5 per full board, or 50 cents per mini-board**

# Seno Etch-in-bag



**Removable seal strips**
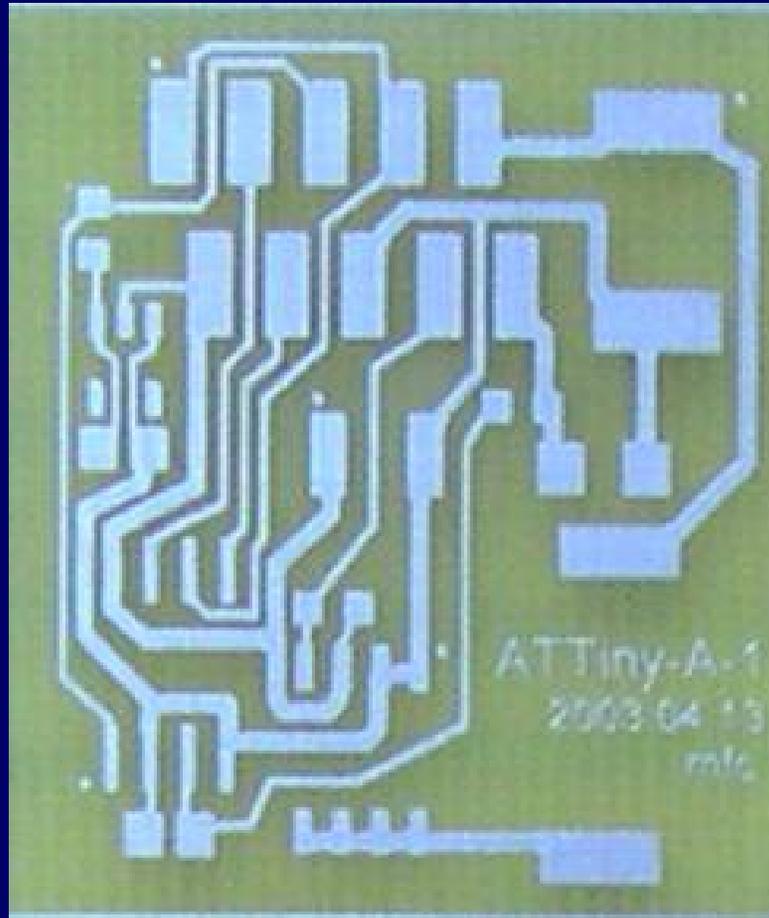
**Ferric Chloride**

**(from pellets)**

**12"**
**30cm**

# Table-mounted jigsaw



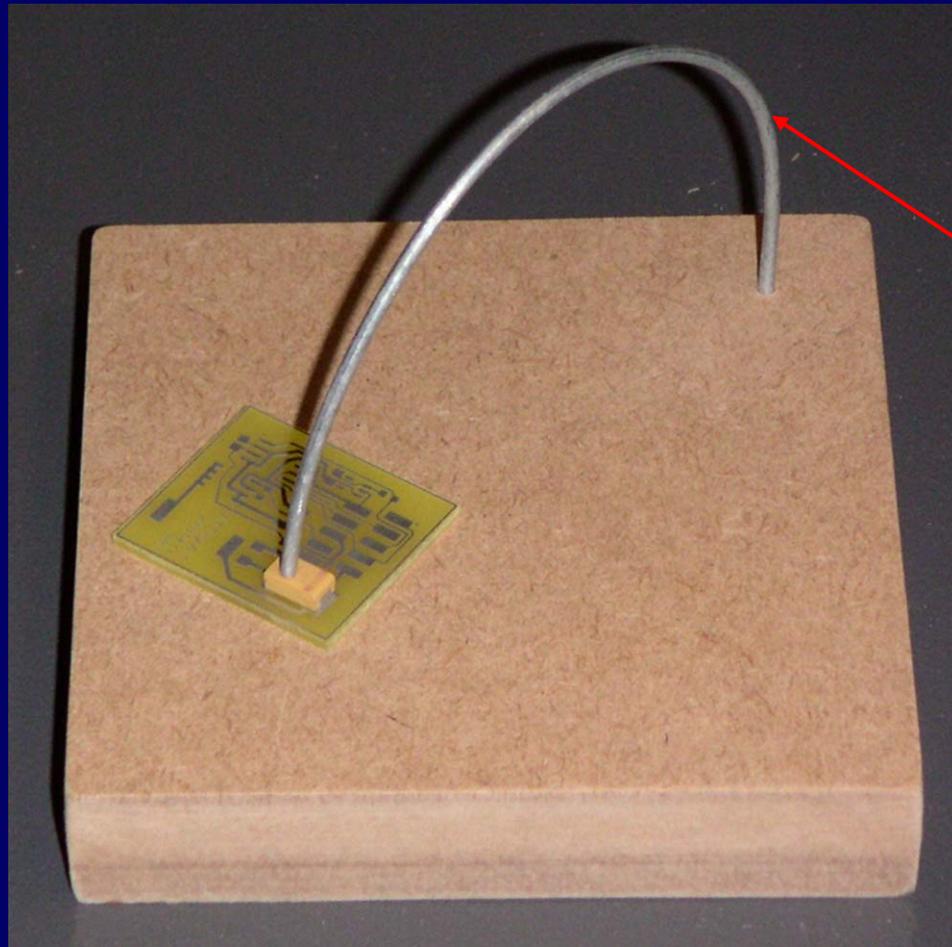**(Ceramic tile-cutter blade to cut fibreglass.)**

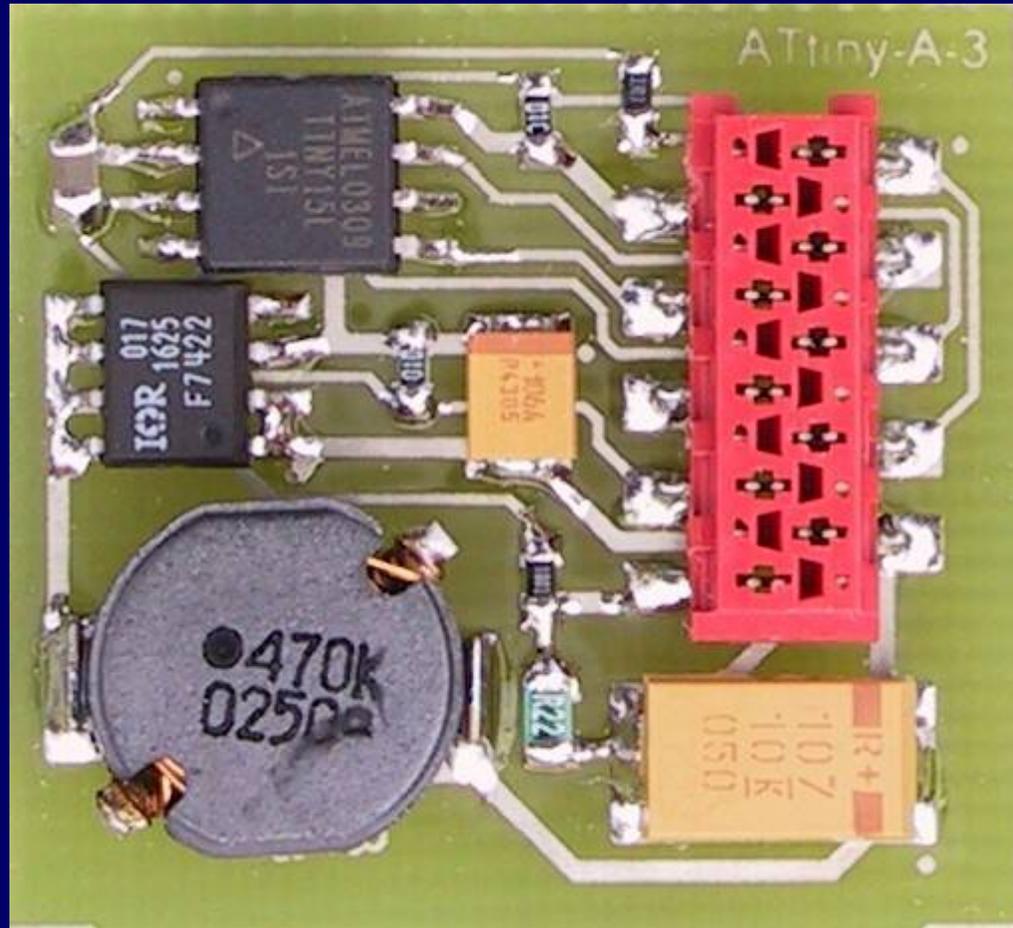# Finished PCB

# Soldering

- Need to hold four things in one place
  - Small PCB  (*e.g.,* 1" x 1")
  - SMT component, as small as 0.06" x 0.03"
    [1.5mm x 0.75mm]
  - solder  (Electronic Silver Solder)
  - soldering iron  (needle tip)

- I don't have four hands, so…

# … the SMT 'secret weapon'



Coat-hanger wire

# Completed board

# Finished board in use