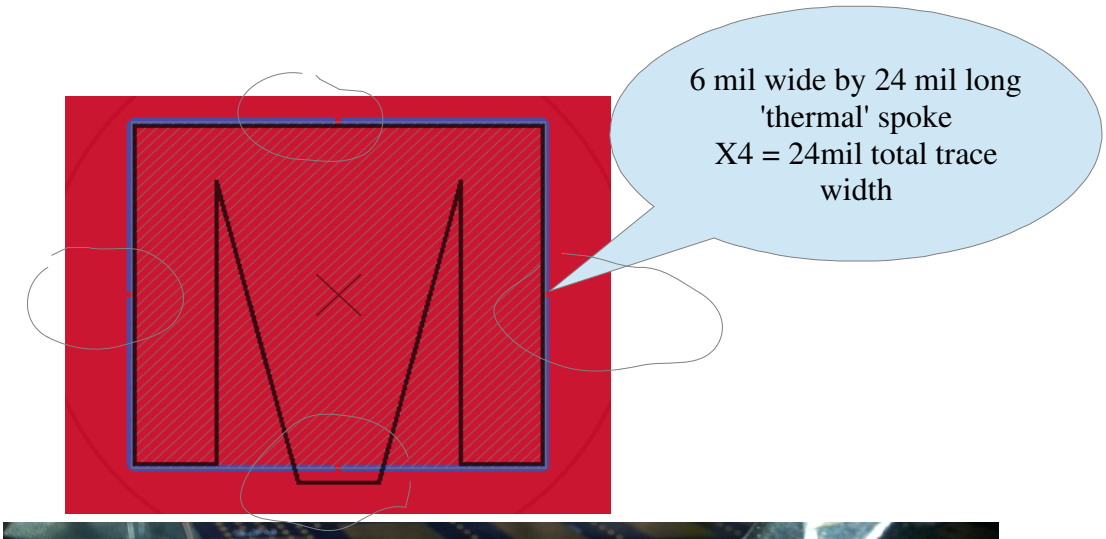

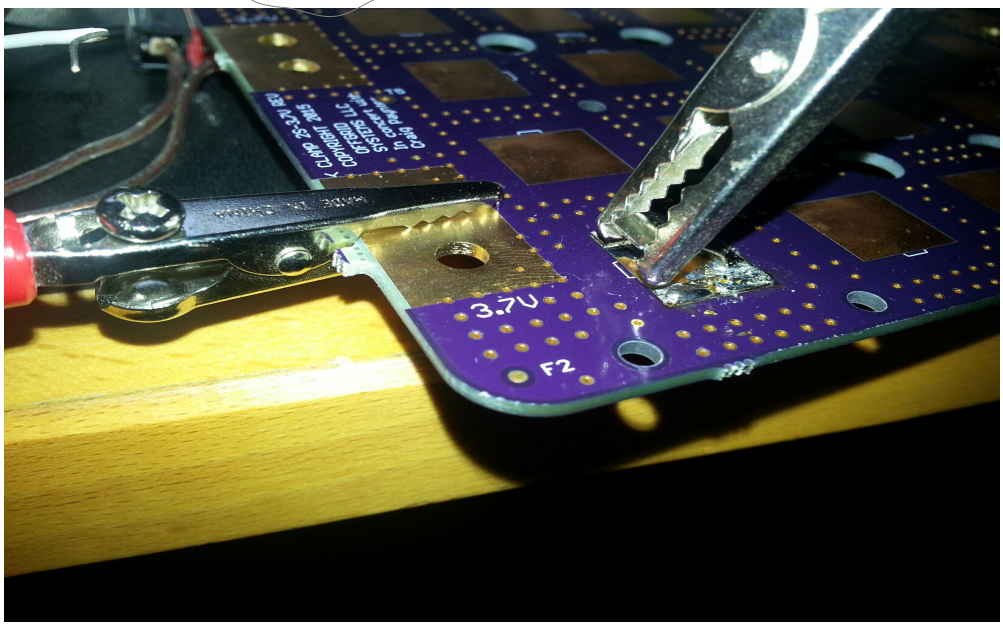

Using traces as fuses, or more specifically using thermal relief 'spokes' as fuses.

Using trace width calculator at http://www.pcbco.com.au/tracecalc.html, it was found that a 24mil wide of 1 ounce trace thickness with 20 amps will fuse at 1000C which should be high enough temp to melt copper. Boards were built with a thermal relief comprised of 4 spokes each with a width of 6 mils = 24 mils total and then tested. So the width of each spoke is 6 mils and the length is 24 mils. Here are the test results.

Power supply = Sorenson DCS-150-20
Temperature = Fluke 62 Max IR thermometer
Temp probe = Fluke 80TK with K type small thermocouple probe
Ambient temperature = 21.7C
Test currents = 8A and 20.5ADC, 50 , 60 and 80ADC (where the fuses finally blew)
Two boards were tested = Clamp board – 2S-3.7V rev-- and Clamp board – 2S – 7.4-0V rev--

Board with fuse traces = Clamp board – 2S-3.7V rev--
Board without fuse traces = Clamp board – 2S – 7.4-0V rev--
Voltage drop test done by taking voltage drop from top of cell spring contact to via just outside spring contact pad

Board with fuse trace results:
Test for 40 min at 2C (8ADC) cell rating – 5degC rise after 40 minutes

Test at 5C (20ADC) cell rating:

1. 20degC rise after 2 minutes
2. 30degC rise after 5 minutes – note spring contact area too hot to touch, significant heat coming from alligator clip attachment to spring contact. Measured 60C near fuse spokes with temp probe.
3. Noted that spring contact to board voltage drop was 46mV or 0.046/20.5=2.24 milliohm, which is 883mW total or 220mw per fuse spoke
4. Also noted that all four fuse traces were within 4degC of each other.

Test at high C rating to try and blow fuse(s)

1. Connect Dkpack as power source (7.4V) and electronic load as short circuit, and watch current on load meter. First try 40A, no blow for 2-3 seconds, allow to cool. Next 50 and 60A, still no blow, allow to cool. Test at 80A for 8 seconds and PCB traces fuses audibly 'pop' and current meter goes to 0A.
2. Picture of blown traces...(too small to see easily, must look under scope to see)

Board without fuse trace results:
Test at 20ADC with19degC rise after 5 minutes, max temperature found 45degC with temp probe. Max voltage drop of was 20mV or about 1 milliohm. Feeling around on the spring contact I believe most of the heat was generated from alligator clip attachment to top of spring contact.