SMT Soldering

For the Masses

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Important Concepts:

Don’t be scared

Use good lighting

The right tools make things easier, but aren’t required to make it work

Avoid too much caffeine or sugar before starting… Really.

Always avoid bullet points when using power point no one reads them

Important Concepts:

Why you would want to use SMT parts

- Allows greater density of parts
- Easier to make your own boards (less drilling)
- Larger part selection
- Better RF and EMI/RFI performance
- Easier to make repairs
  - You can replace parts or cut and change traces without removing the board from its enclosure or mounts

ATMega324p

52.25mm x 15.5mm

Not Shown
5mm x 5mm BGA
and DQFN 44 packages

TQFP 44

12mm x 12mm

QFN 44

7mm x 7mm

Required Tools:

No matter which method you use these are cheap and save time and stress

Tweezers (Sharp point) ($2 - $5)

Liquid Flux (Needle, Pen, Brush application) ($5)

Solder Wick ($3)

Rosin Core Solder (15mil / 28awg is nice) ($50)

Soldering Iron (Temperature Control is a +) ($100)

Some sort of Magnification ($0 - $300)

Extra Tools:

These make certain types of SMT work easier / faster

- Hot Air Gun ($20-$50)
- Electric Skillet / Griddle (A lid is nice) ($20)
- Stereo **Zoom!** Microscope ($300)
- Soldering Tweezers ($175+tips)
- Solder Paste ($3 - $30)

The Easy Stuff:

These devices require nothing beyond basic soldering skills

- 1206 sized 2 pin devices or larger (MELF)
- SOIC Packages
- Large SMT power devices

The Moderate Stuff:

Magnification to check your soldering after the fact
Still nothing special

- 0603 (0805 for some people) sized devices, MiniMELF
- TQFP (square IC packages) 0.8mm pitch
- TSSOP (0.8mm)
- The Odd stuff, Switches, Connectors

The Hard Stuff:

You will want to look these parts over carefully before Applying power to your board.

- 0402 (0603 for some people) sized devices, SOT102
- TQFP (square IC packages) 0.5mm pitch
- TSSOP (0.5mm)
- QFN/DFN and other “leadless” parts

The Really Hard Stuff:

Expect to get these wrong a few times, or ruin a part

0603 LEDs

Yeah that’s it, everything else is easy by hand
Compared to those!

The Common Methods:

Just like PTH parts

Do them one pin at a time with an iron
and a very fine point. (0.5mm – 1mm)
This is slow and kind of frustrating, but sometimes
it is the only way to accomplish the task.

Drag Soldering (MiniWave)

Also done with an iron, this is very effective and
fast for devices with multiple pins.
Requires a larger sized tip, and lots of flux (2 – 3mm)

The Common Methods:

Hot Air

Really the only effective way of removing parts
And one of the easiest for putting large components back onto pads that aren't well prepped, or for placing single large components on a board with paste.

Hot Plate / Toaster Oven

Fast and easy way to first assemble a board
Not effective for making changes to a board or for rework.

Fixing the Ooops’:

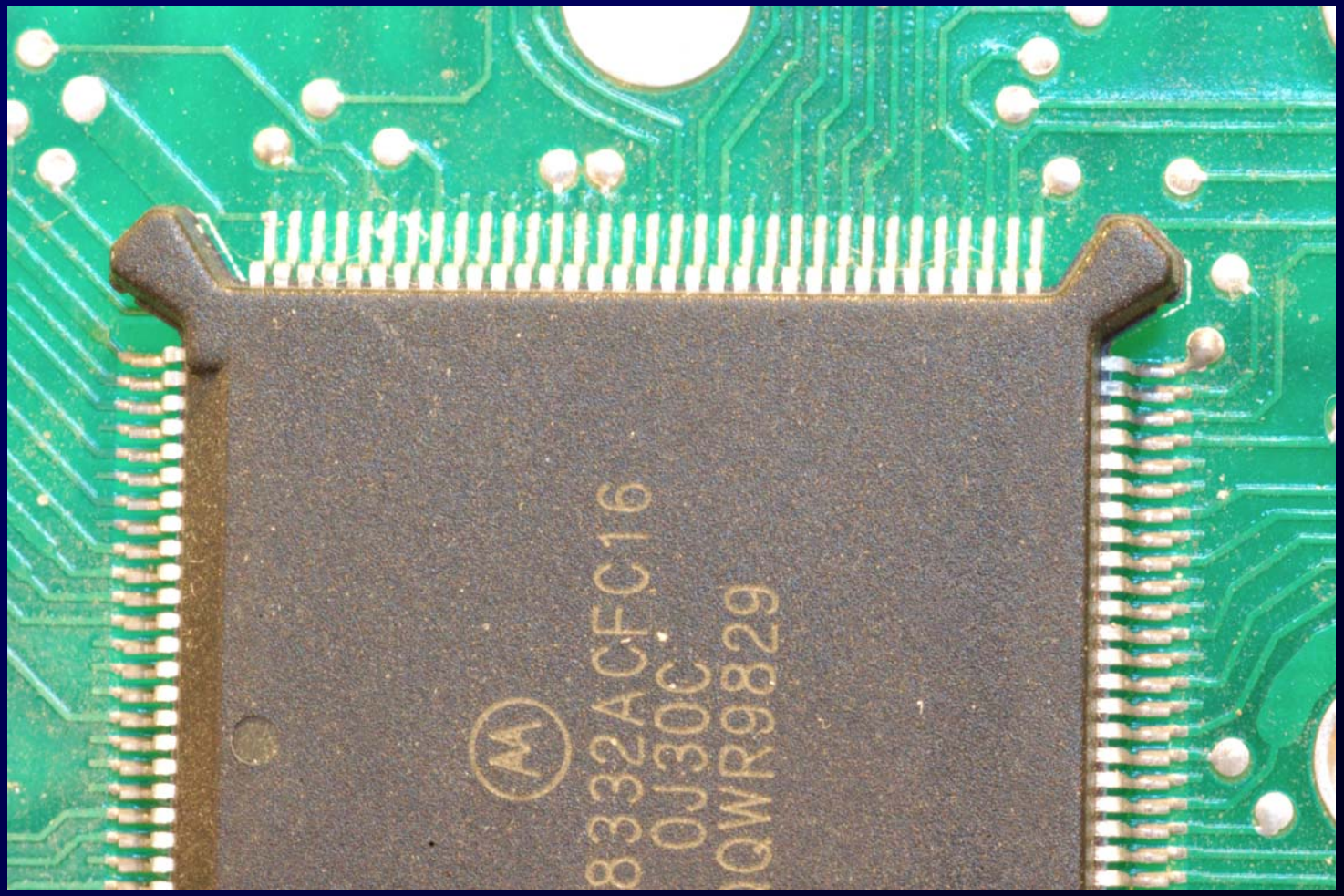
No matter how careful you are, you will make a bridge
Or need to reroute a net.

Flux and solder wick will fix most any soldering problems.

Patience will allow you to make intricate sculptures with
Fine pitch SMT parts!

Examples:

This is the first SMT part I soldered by hand!

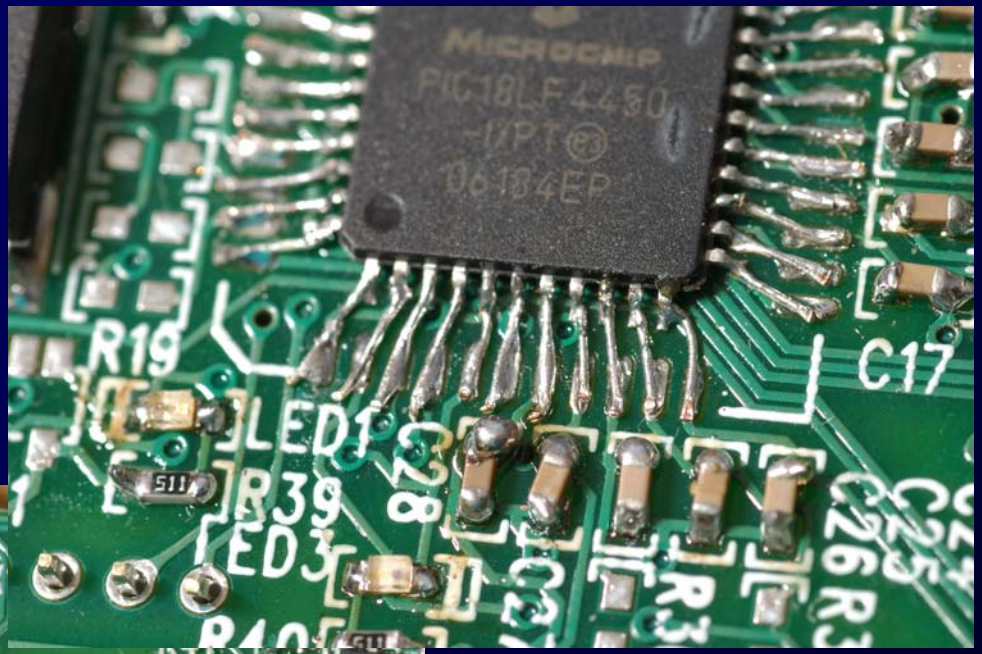


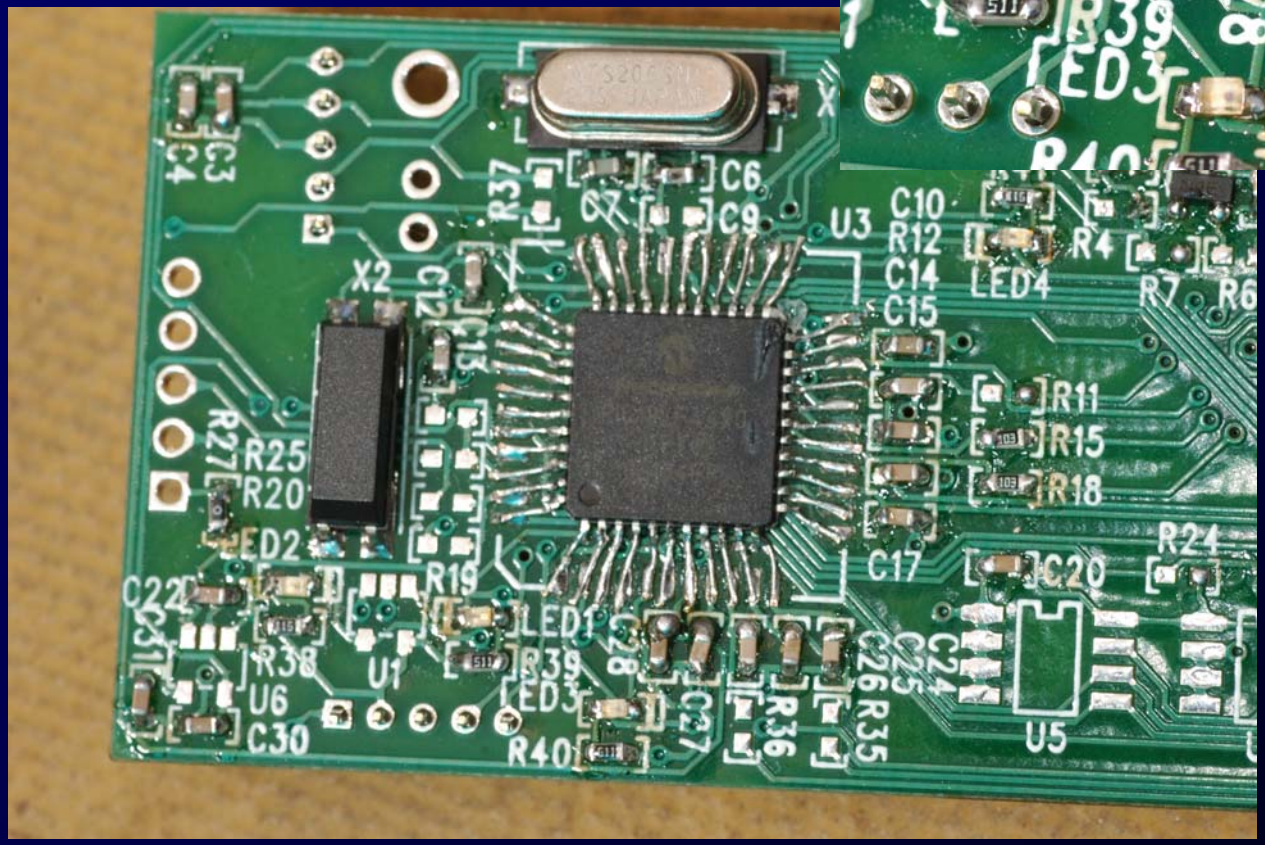
Drag Soldering (MiniWave) Brush on Flux

Examples:

This is an easy repair!

30ga wire repair
to extend pins





Whoops
Wrong footprint
TQFP 0.5mm part
TQFP 0.8mm decal

Lets Do some soldering:

Tools I am using

- Hakko Soldering Iron 0.5mm and 3mm hoof tips
  - Frys, eBay
- 15mil and 25mil Solder
  - Digikey KE1110-ND
- RMA Flux
  - Digikey KE1803-ND
- Solder Wick
  - Digikey 473-1061-ND
- Tweezers
  - Digikey EROP3CSA-ND
  - DealExtreme.com

Lets Do some soldering:

Tools I am using

- Hot Plate
  - Wal*Mart

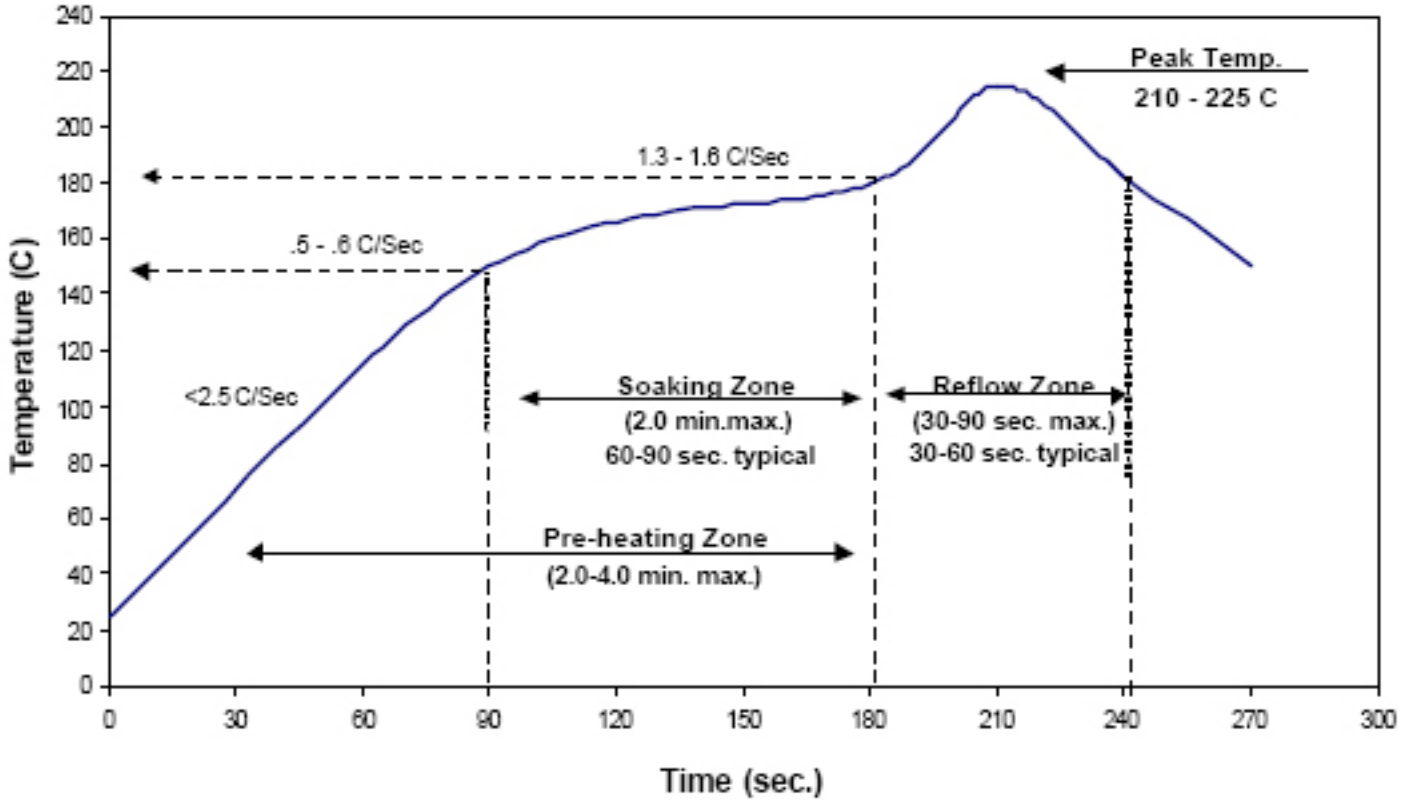
- Needle Paste
  - Zephtronics
  - http://www.zeph.com/zephpaste.htm

Lets Do some soldering:

Tools I am using

- Hot Air Gun
  - Home Depot, Frys
- Bulk Paste
  - eBay, DealExtreme
- Paste Mask
  - Advanced Circuits
  - Pololu http://www.smtstencil.com
  - ($25 - $250)
- Scotch Tape + X-Acto

Kester Reflow Profile
Alloy: Sn63Pb37 or Sn62Pb36Ag02



Lets Do some soldering:

Repairs

Replace a TQFP with Hot Air and flow new part down.

Lift a pad and run a new trace.

Where to Go for more information:

Seattle Robotics Monday Night Chat

Seattle Robotics Mailing List

Encoder Articles
http://www.seattlerobotics.org/encoder/200006/oven_art.htm

YouTube
Search for SMT Soldering some great Drag Soldering examples

Another great guide!
http://curiousinventor.com/guides/Surface_Mount_Soldering/101

Screaming Circuits
http://blog.screamingcircuits.com/
PCB Layout tips

Where to buy stuff:

Digikey
http://www.digikey.com
Paste, Flux, Solder, Tweezers

DealExtreme
http://www.dealextreme.com
Tweezers, Paste

Zephtronics
Paste
http://www.zeph.com/zephpaste.htm

PCB Pool
http://www.pcb-pool.com

eBay
http://www.ebay.com
Microscopes, Paste
http://stores.shop.ebay.com/Precision-World

Home Depot, Frys
Heat Gun

Circuit Specialists (Nearly Everything)
http://circuitspecialists.com/

Advanced Cirucits
http://www.4pcb.com

Pololu
http://www.smtstencil.com