

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

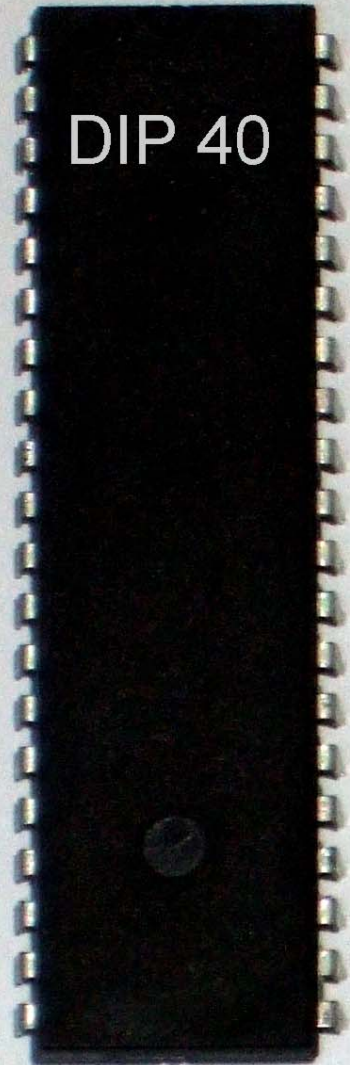
Better RF and EMI/RFI performance

Easier to make repairs

You can replace parts or cut and change traces without removing the board from its enclosure or mounts

ATMega324p

DIP 40



52.25mm x 15.5mm

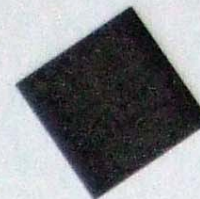
Not Shown
5mm x 5mm BGA
and DQFN 44 packages

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!

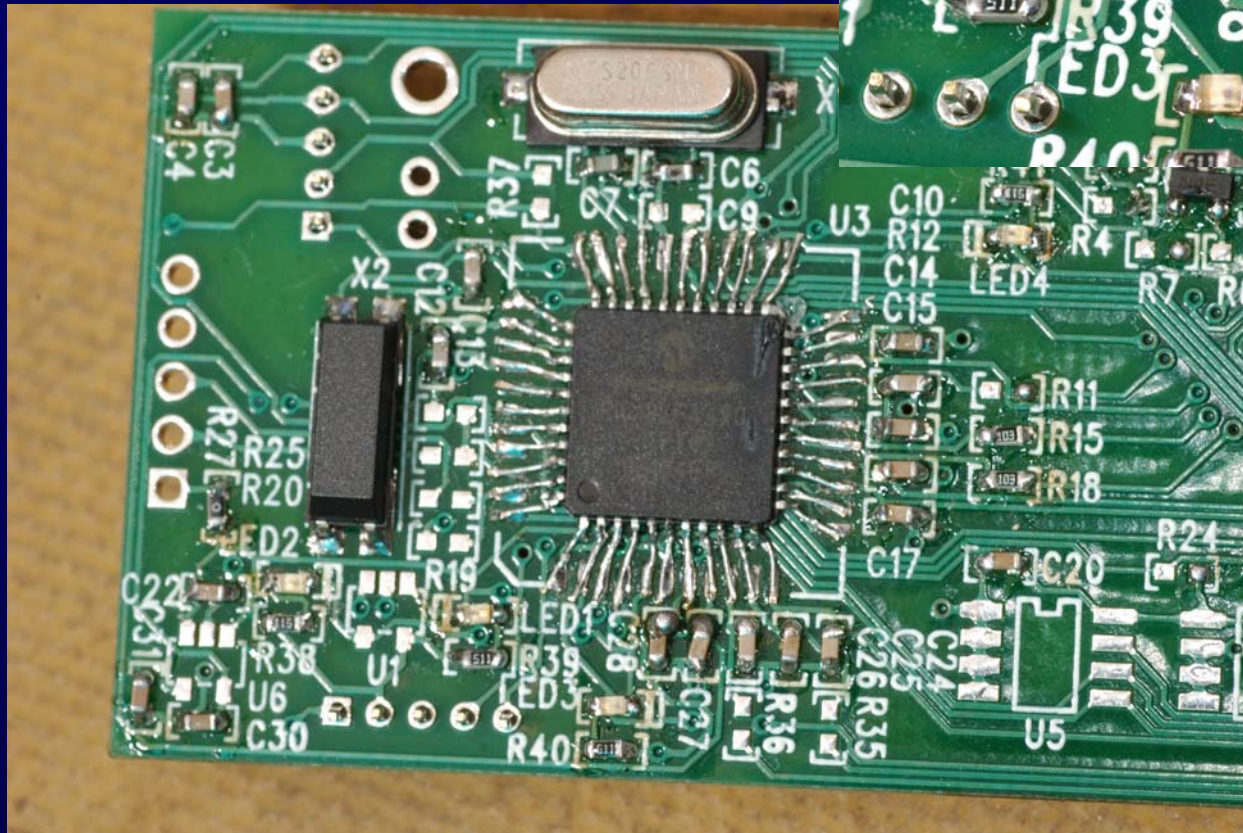
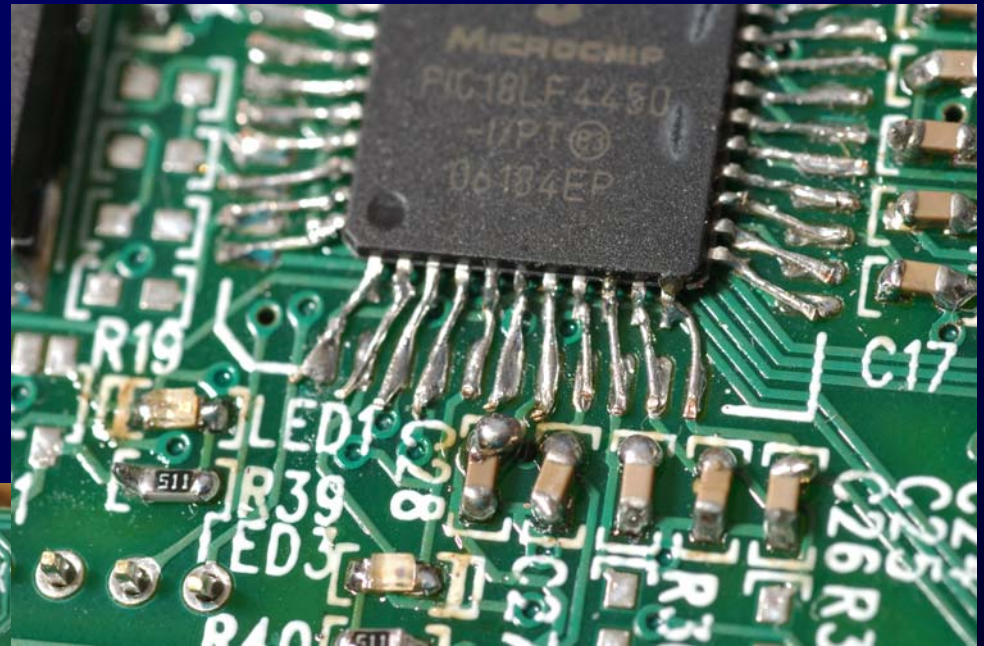


Drag Soldering (MiniWave) Brush on Flux

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 ER0P3CSA-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, Fry's

Bulk Paste

eBay, DealExtreme

Paste Mask

Advanced Circuits

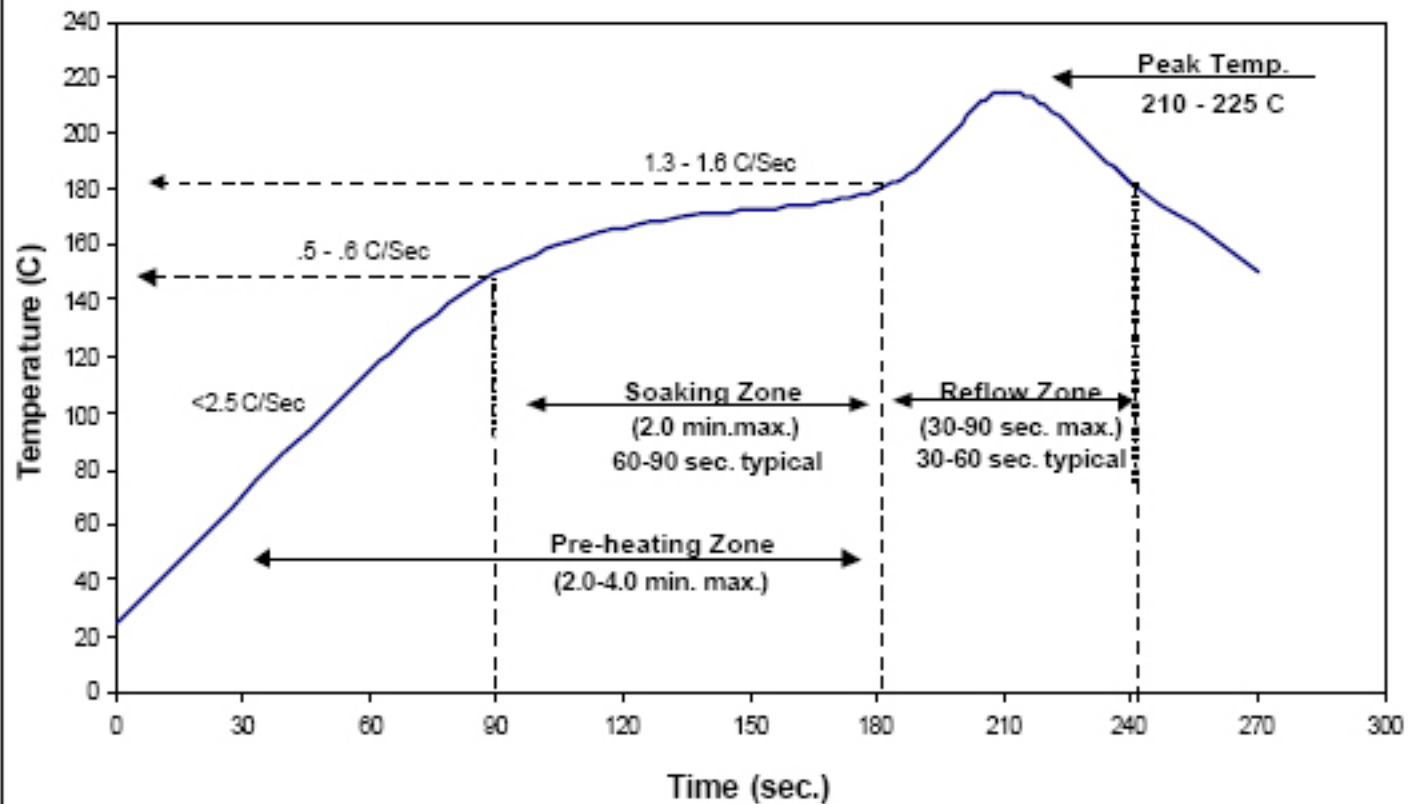
Pololu <http://www.smtstencil.com>

(\$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.dealxtreme.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>