

# SMT Soldering

Easy enough for anyone!

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<http://www.fenchurch.org>

The image features a close-up of a computer keyboard with blue keys and a black mouse, set against a dark blue background. The text "Nikola Engineering" is overlaid in white, with a stylized blue swoosh graphic behind it. The background image shows a close-up of a computer keyboard with blue keys and a black mouse, set against a dark blue background.

Nikola Engineering

<http://www.nikola.com>

# Important Concepts:

Don't be scared, otherwise known as: What's the worst that could happen?

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.

# Important Concepts:

Why you would want to use SMT parts

- Allows greater density of parts

- Easier to make your own boards (less drilling)

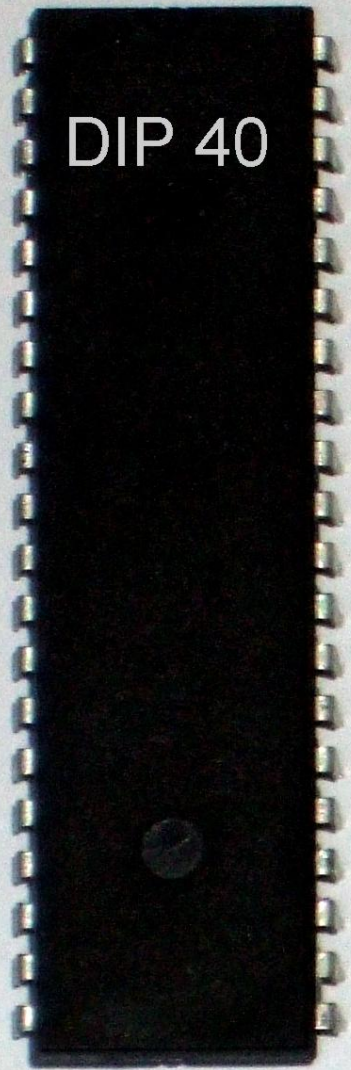
- Larger part selection

- Easier to make repairs

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

# ATMega324p

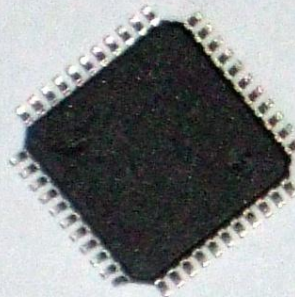
DIP 40



52.25mm x 15.5mm

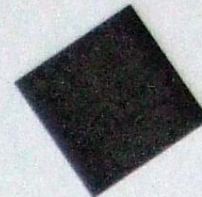
Not Shown  
5mm x 5mm BGA  
and DQFN 44 packages

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)

Hot air Rework Station (\$100 - \$300)

# 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!



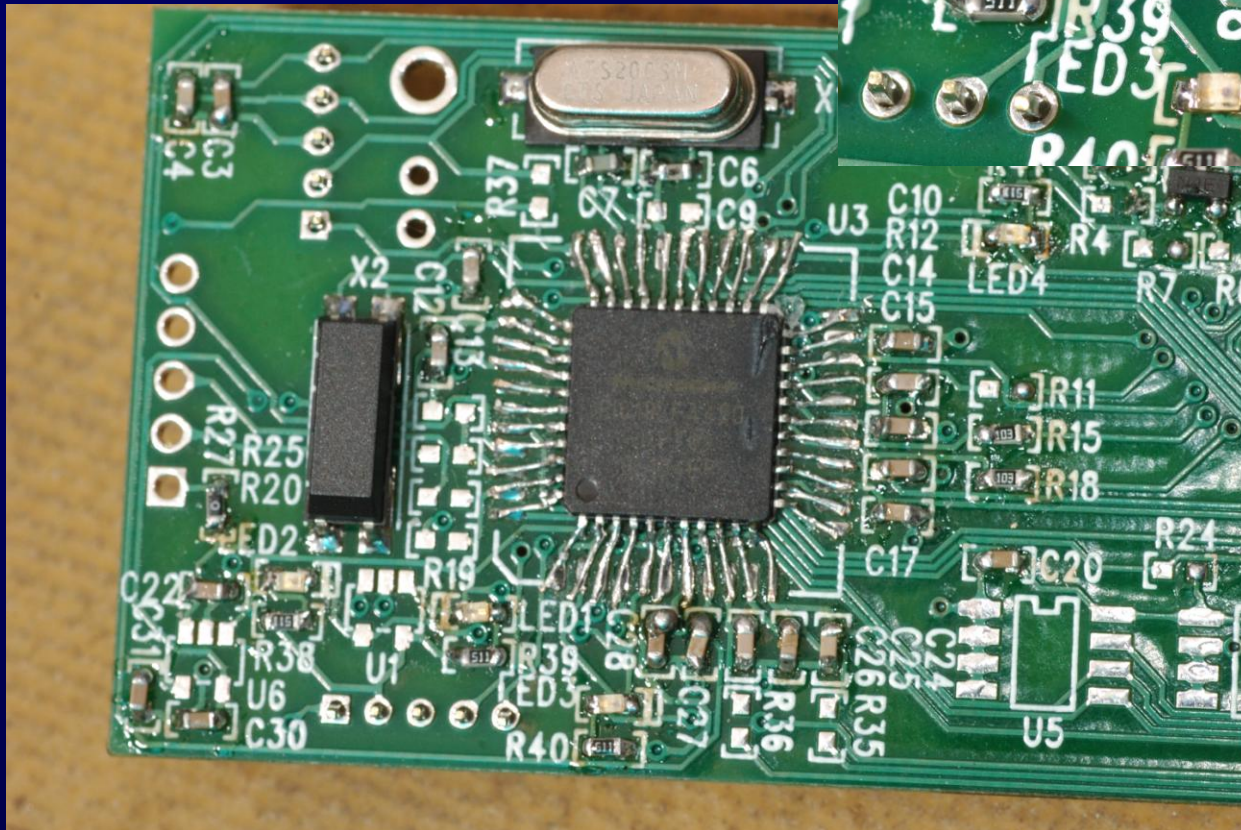
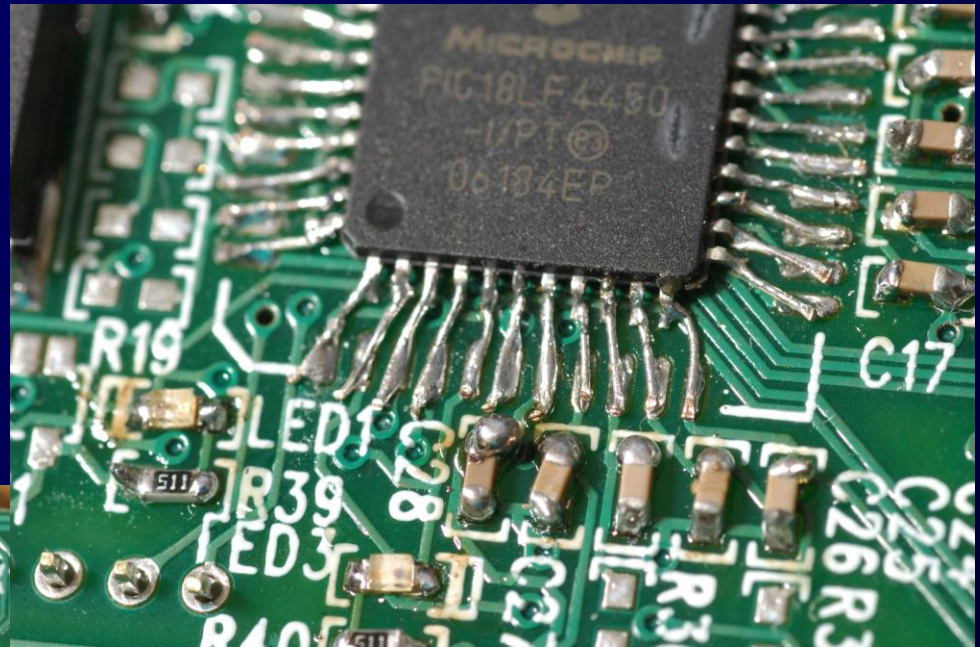
Drag Soldering (MiniWave) Brush on Flux



# Examples:

This is an easy repair!

30ga wire repair  
to extend pins



Whoops  
Wrong footprint  
TQFP 0.5mm part  
TQFP 0.8mm decal

# Going Further

## Soldering to Standards

IPC-A-610

<http://www.dynamixtechnology.com/docs/drm-SMT-d.pdf>

NASA

<https://nepp.nasa.gov/index.cfm/5511>

<http://workmanship.nasa.gov/lib/insp/2%20books/frameset.html>

## Safety

### Lead Residue

Not much of a concern, it should never get so hot to vaporize. Wash your hands

### Fumes

Flux fumes can be bad, use ventilation if working for long times.

# 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

Mouser 533-0186

Solder Wick

Digikey 473-1061-ND

Tweezers

Digikey EROP3CSA-ND

# Lets Do some soldering:

Tools I am using

Hot Air Gun

Home Depot, Frys

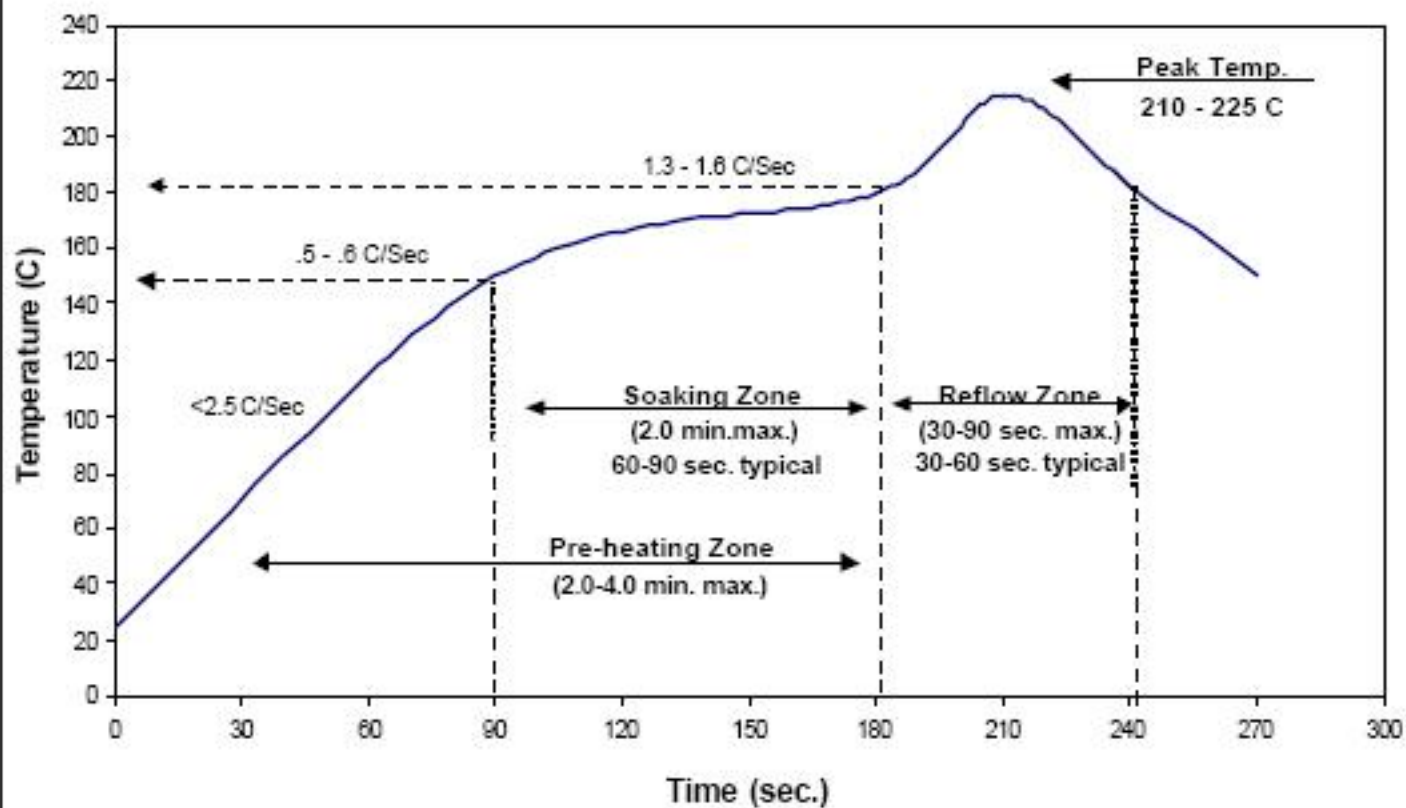
Bulk Paste

eBay, DealExtreme

Scotch Tape + X-Acto

## Kester Reflow Profile

Alloy: Sn63Pb37 or Sn62Pb36Ag02





# 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](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/](http://curiousinventor.com/guides/Surface_Mount_Soldering/)

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>