Newton Soldering Course

16 November 2026



Planning

Lecture

- What is soldering?
- Electronic components
- Soldering techniques
- Finding and fixing errors
- Principles of the kit

Practical

- Planning your lay-out
- Assembling your lay-out
- Soldering the components
- Testing
- Debugging
- Testing
- Etc.

What is soldering?

Breadboard

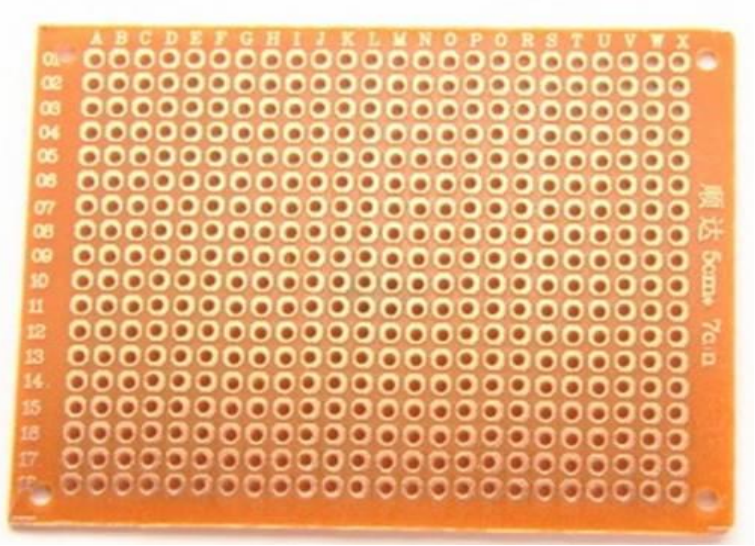
- For testing
- Temporary
- Fragile
- Not suitable for high frequencies

Soldering

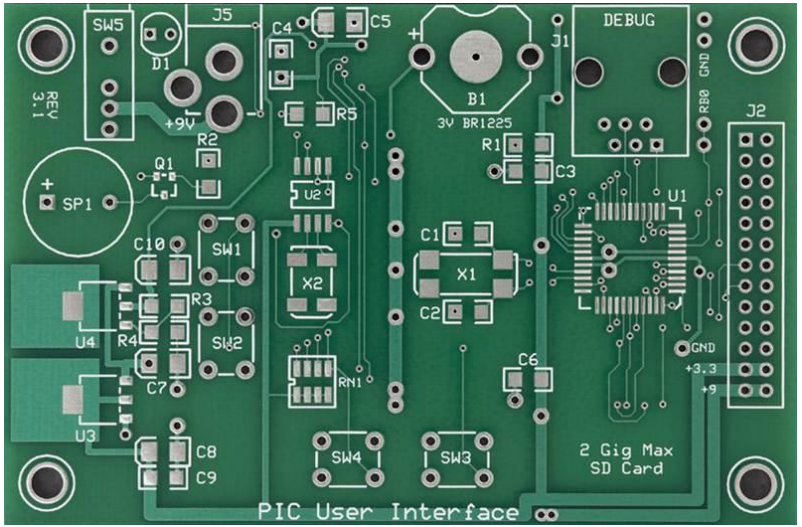
- Permanent
- Rigid and proper electrical connections
- Durable

What is soldering?

Through-hole (THT)



Surface mount (SMD)

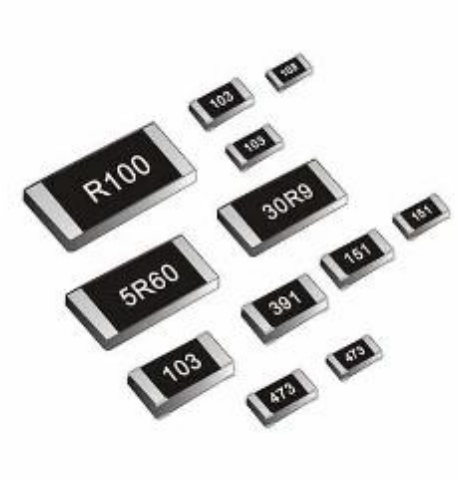


What to take into account?

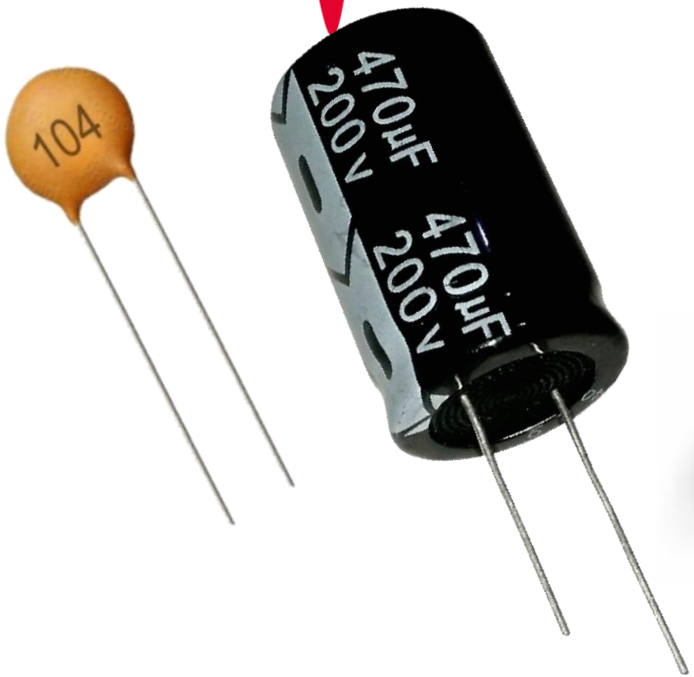
Electronic Components

Resistors



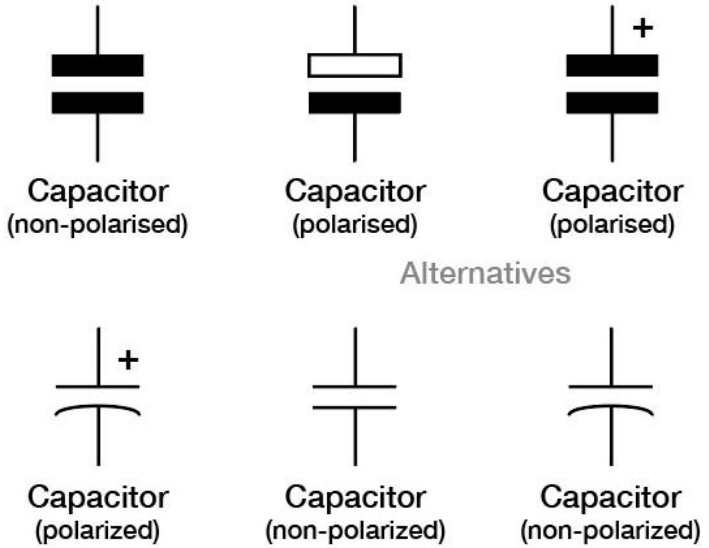


Capacitors


104
470uF
200V
470uF
200V


100
6V




Capacitor
(non-polarised)
Capacitor
(polarised)
Capacitor
(polarised)
Alternatives
Capacitor
(polarized)
Capacitor
(non-polarized)
Capacitor
(non-polarized)

Polarized Components

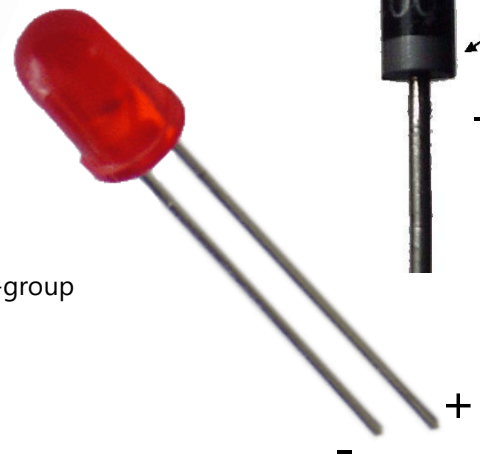
Only possible to connect in 1 direction

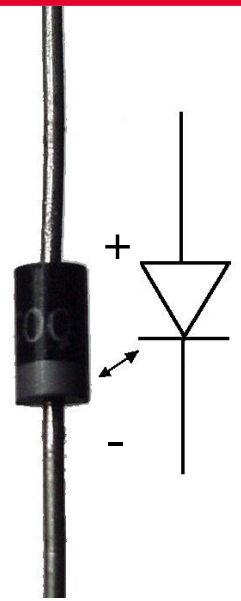
- Long side usually '+'
- White stripe usually '-'



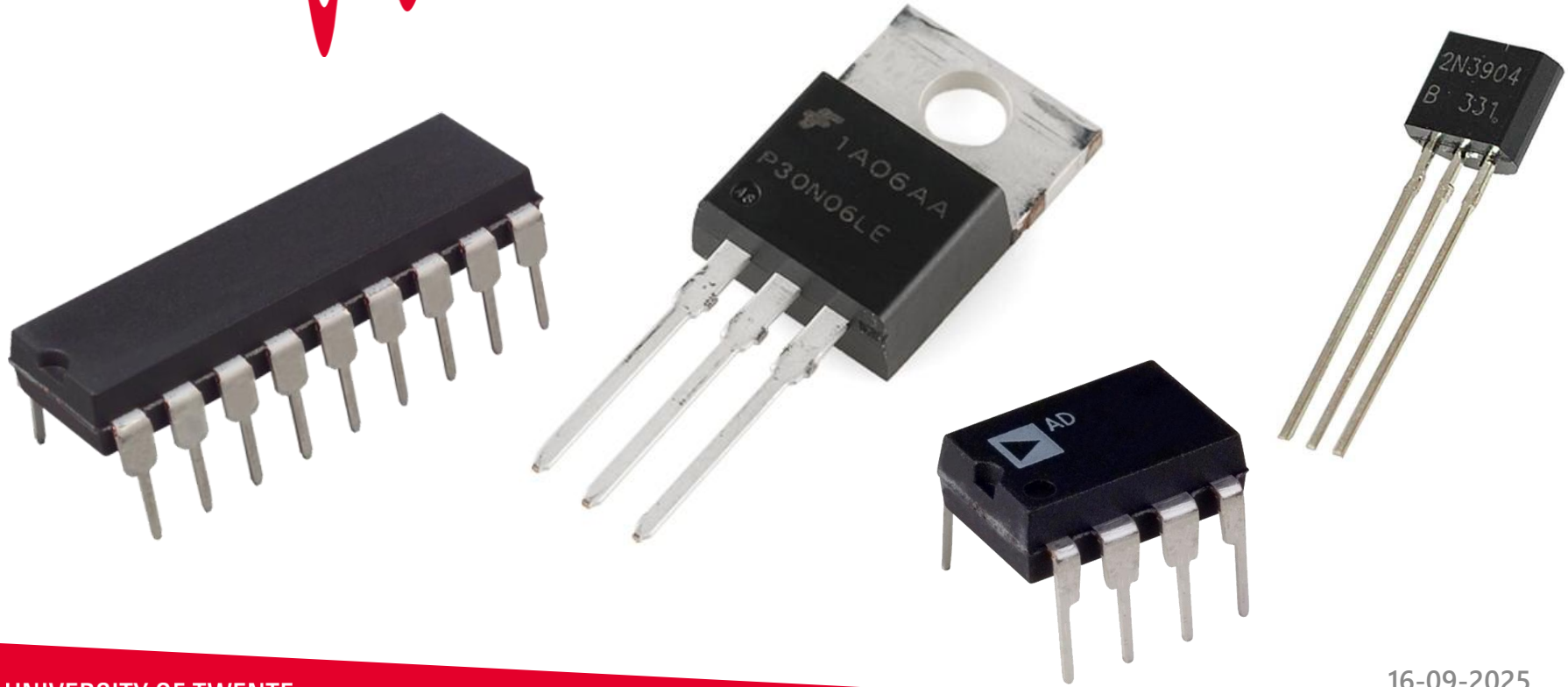


*Not sponsored
** Not affiliated to Duracell do-group





Help it has more pins!?



Help it has more pins!?

- **Orientation**
  - Almost always a indent
  - Dot on the silkscreen



Reading Datasheets

What can you find?

- Maximum ratings
- Common applications
- Electrical characteristics
- Pin layout(!)

FAIRCHILD SEMICONDUCTOR™

MJE3055T

MJE3055T

General Purpose and Switching Applications

- DC Current Gain Specified to I_C =10A
- High Current Gain-Bandwidth Product : f_T = 2MHz (Min.)



TO-220

1.Base 2.Collector 3.Emitter

NPN Silicon Transistor

Absolute Maximum Ratings T_C=25°C unless otherwise noted

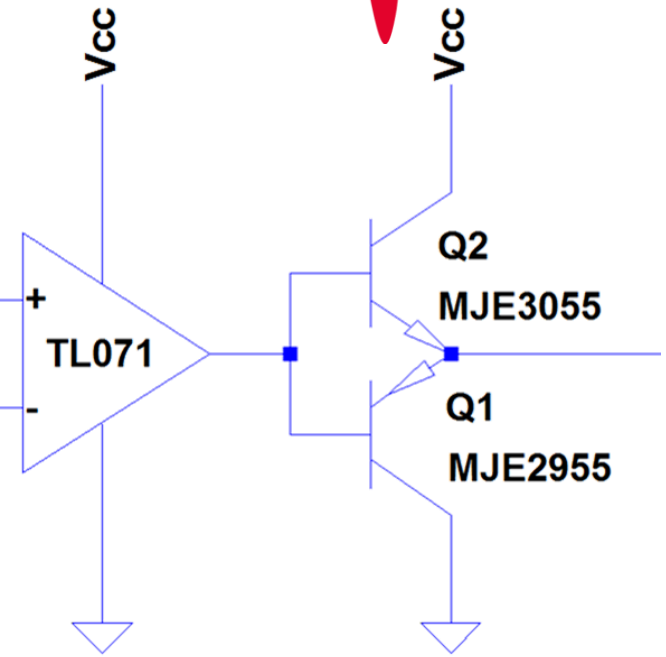
Symbol	Parameter	Value	Units
V_{CBO}	Collector -Base Voltage	70	V
V_{CEO}	Collector-Emitter Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current	10	A
I_B	Base Current	6	A
P_C	Collector Dissipation (T_C=25°C)	75	W
P_C	Collector Dissipation (T_a=25°C)	0.6	W
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	- 55 ~ 150	°C

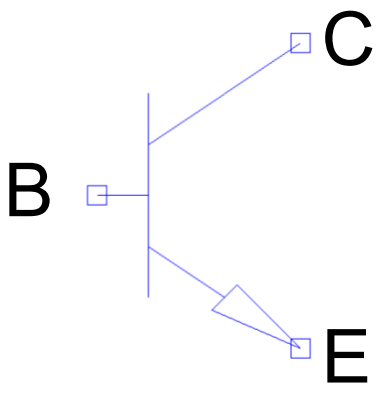
Electrical Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Max.	Units
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 200mA, I_B = 0	60		V
I_{CEO}	Collector Cut-off Current	V_{CE} = 30V, I_B = 0		700	μA
I_{CEX1} I_{CEX2}	Collector Cut-off Current	V_{CE} = 70V, V_{BE}(off) = -1.5V V_{CE} = 70V, V_{BE}(off) = -1.5V @ T_C = 150°C		1 5	mA mA
I_{EBO}	Emitter Cut-off Current	V_{EB} = 5V, I_C = 0		5	mA
h_{FE}	*DC Current Gain	V_{CE} = 4V, I_C = 4A V_{CE} = 4V, I_C = 10A	20 5	100	
V_{CE}(sat)	*Collector-Emitter Saturation Voltage	I_C = 4A, I_B = 0.4A I_C = 10A, I_B = 3.3A		1.1 8	V V
V_{BE} (on)	*Base-Emitter On Voltage	V_{CE} = 4V, I_C = 4A		1.8	V
f_T	Current Gain Bandwidth Product	V_{CE} = 10V, I_C = 500mA	2		MHz

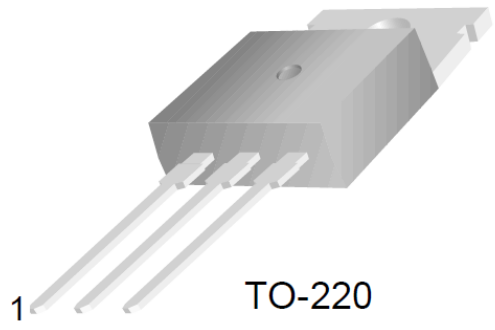
* Pulse test: PW≤300μs, duty cycle≤2% Pulse

Transistor



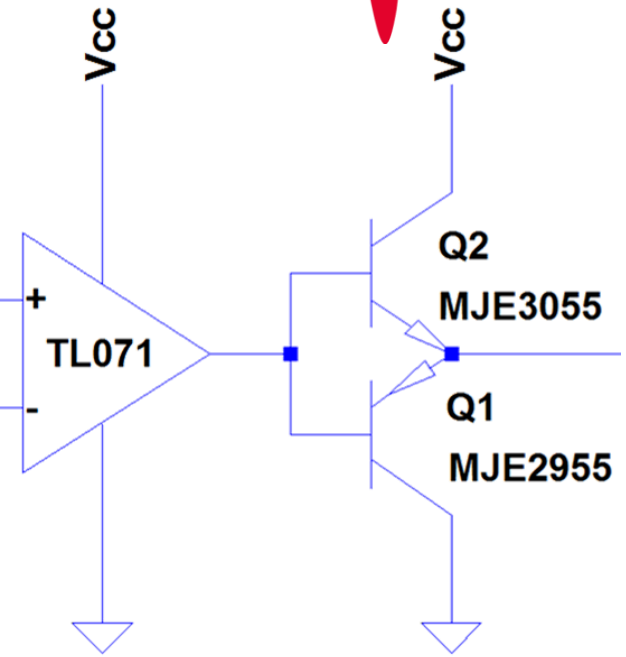


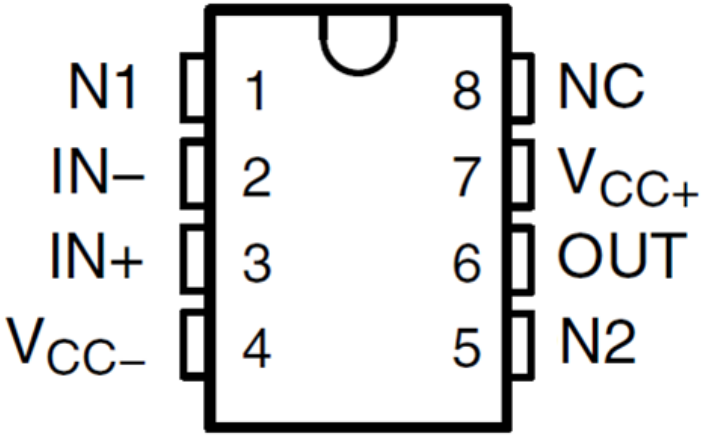
Heat sink might be connected to one of the pins!

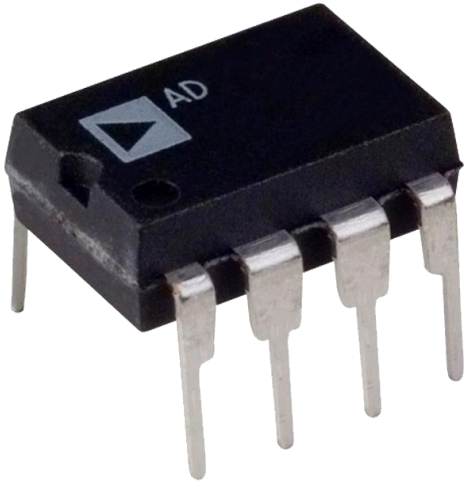


1.Base 2.Collector 3.Emitter

Op-Amp


Vcc
Vcc
+
-
TL071
Q2
MJE3055
Q1
MJE2955


N1
1
IN–
2
IN+
3
VCC–
4
8
NC
7
VCC+
6
OUT
5
N2


AD

IC Sockets

What are they used for?

- Easy to replace components
- Prevents overheating during soldering



Do’s and don’ts

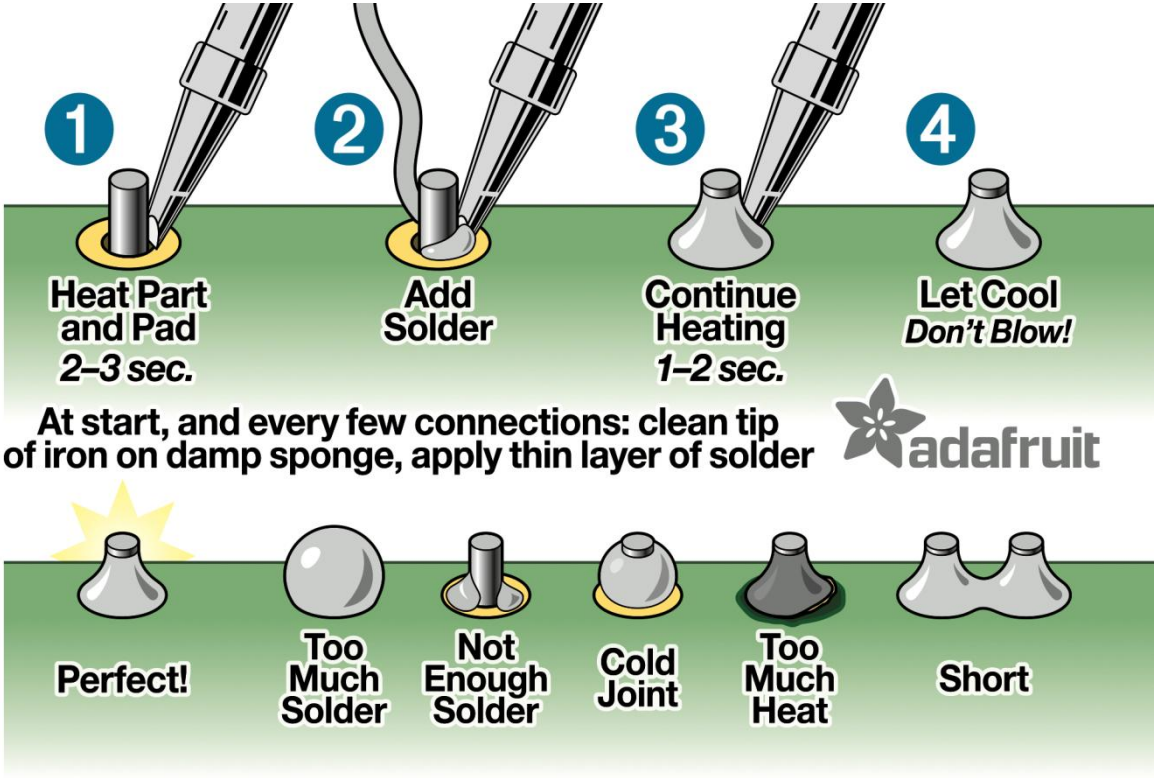
Soldering techniques

Sorts of tin

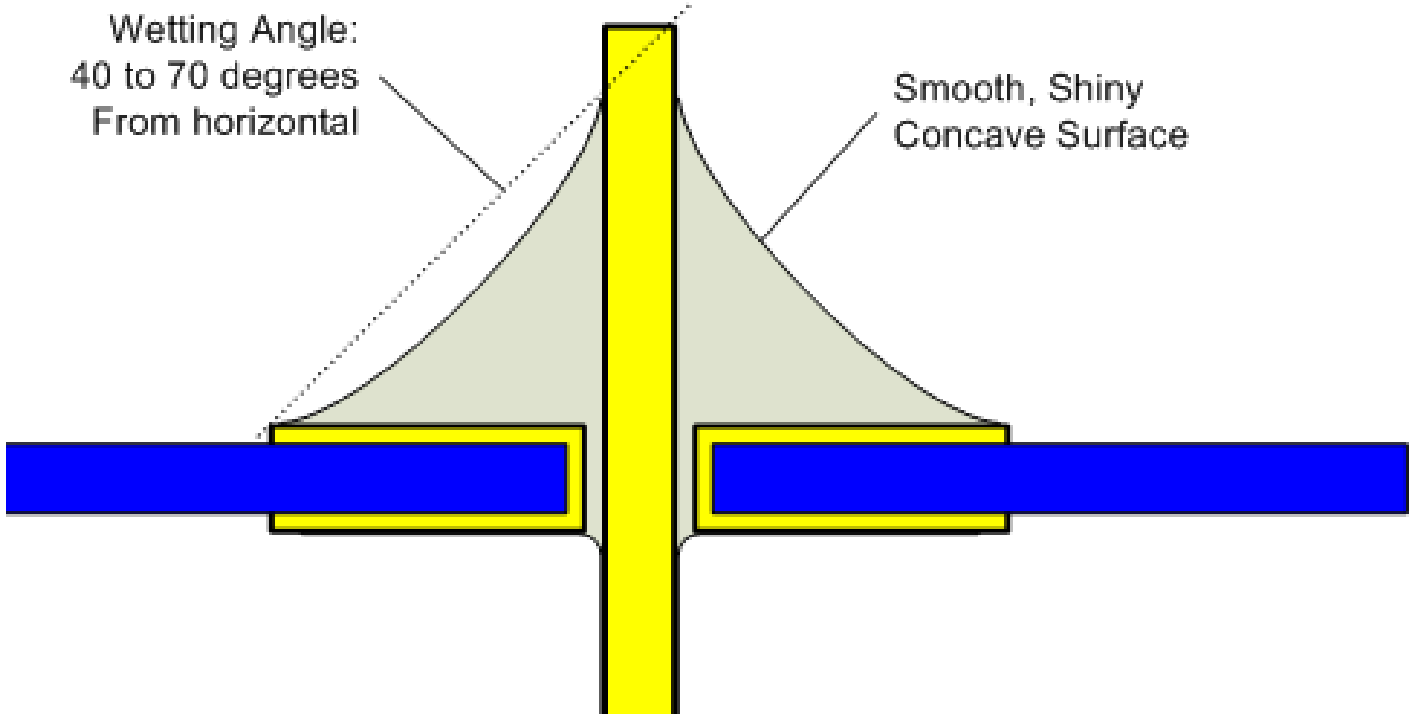
- Unleaded solder ~330°C
  - Has an expiration date
  - Uses flux core
- Leaded solder ~230°C
  - Lower melting point
  - Toxic fumes
  - Easier to solder
  - Uses flux core
- Flux
  - ‘Repairs’ oxidized metals



How to do it correctly



Correct Joint

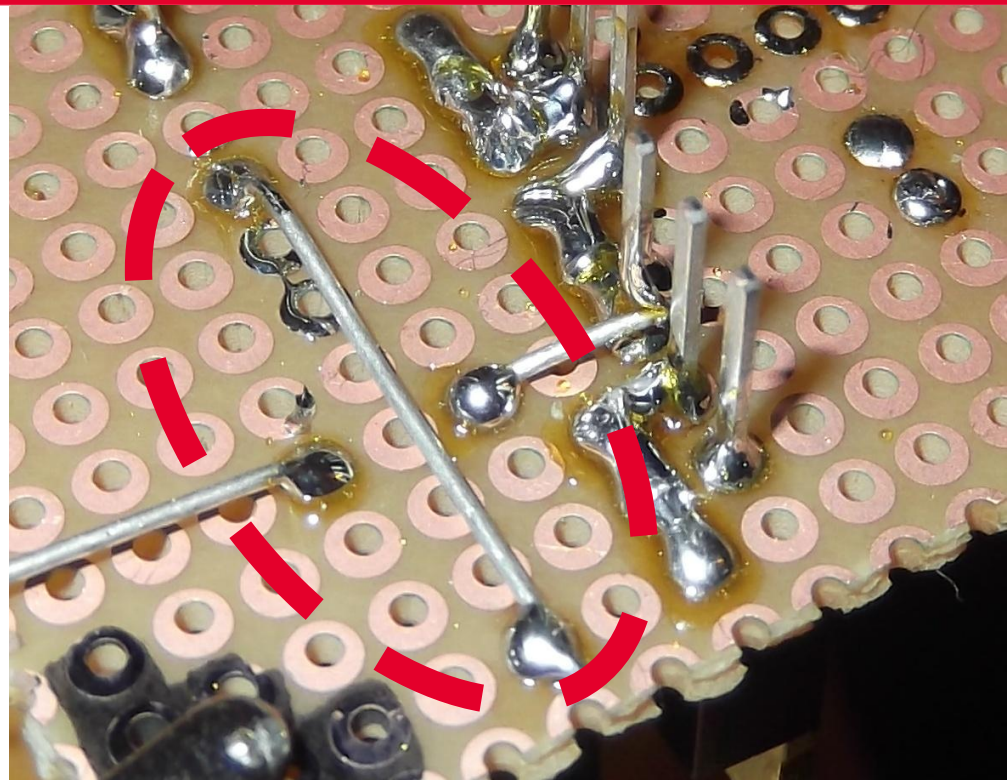


For THT

Connections

Using Component Legs

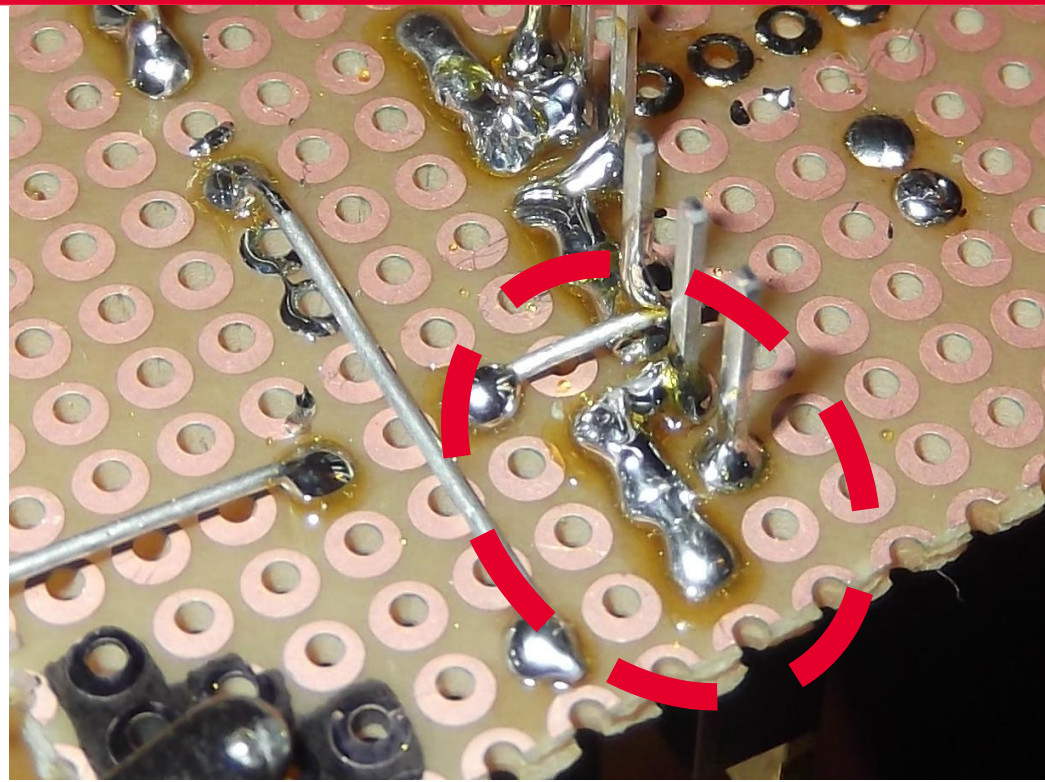
- Saves effort and solder
- Use the components to make a bridge



Connections

Using Solder Bridges

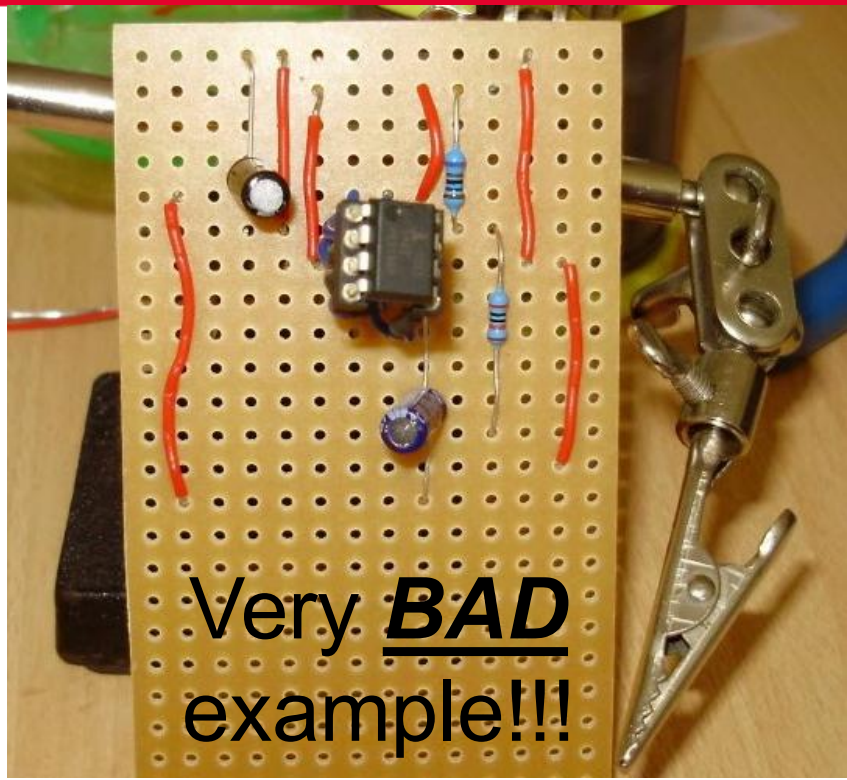
- Connects nearby components
- Use tin to make the connection



Connections

Using Wire Bridges

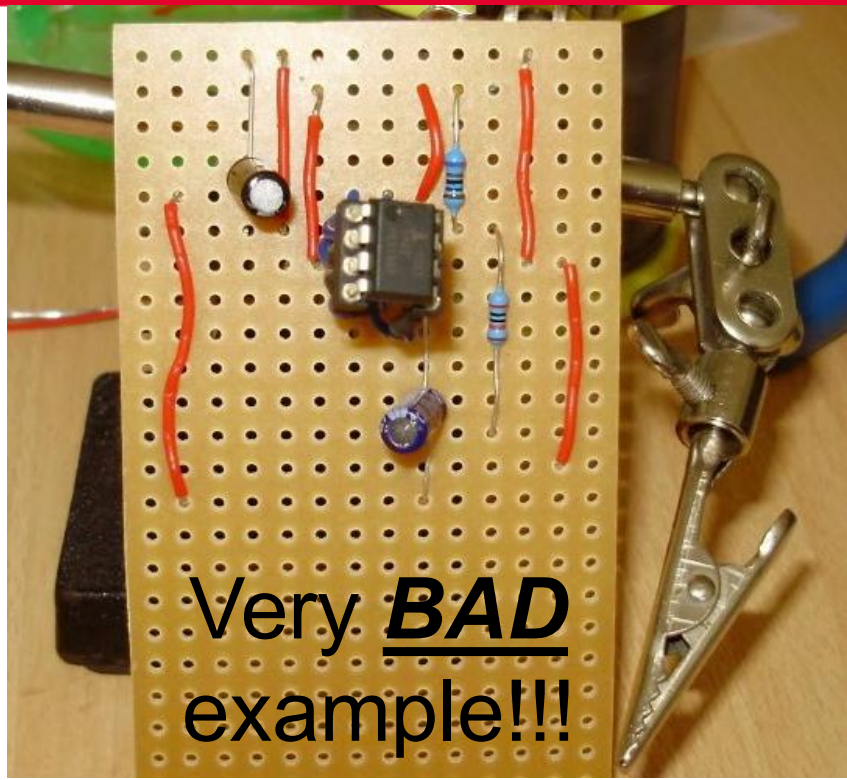
- Covers large distances
- Makes circuit chaotic
- Try to avoid these!



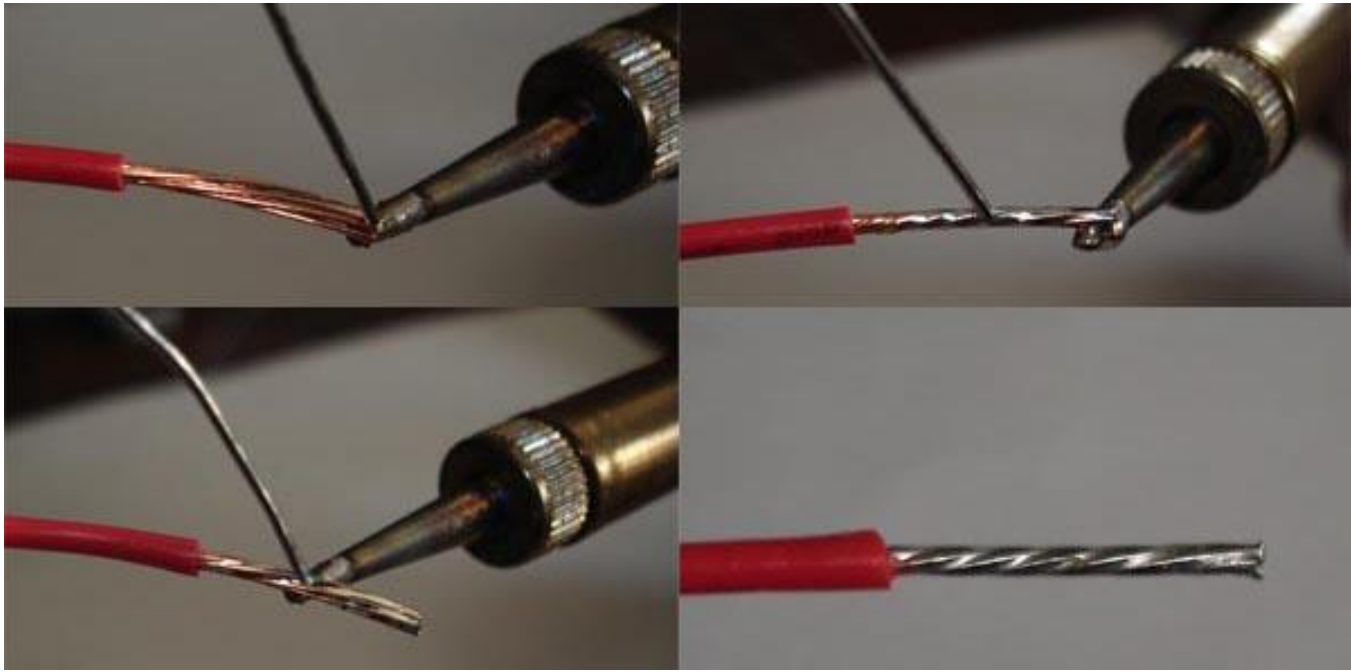
Fitting Components

Keep it tidy!

- Make sure components are flush with the PCB
- Avoid using wires
- Do not connect the IC until after soldering



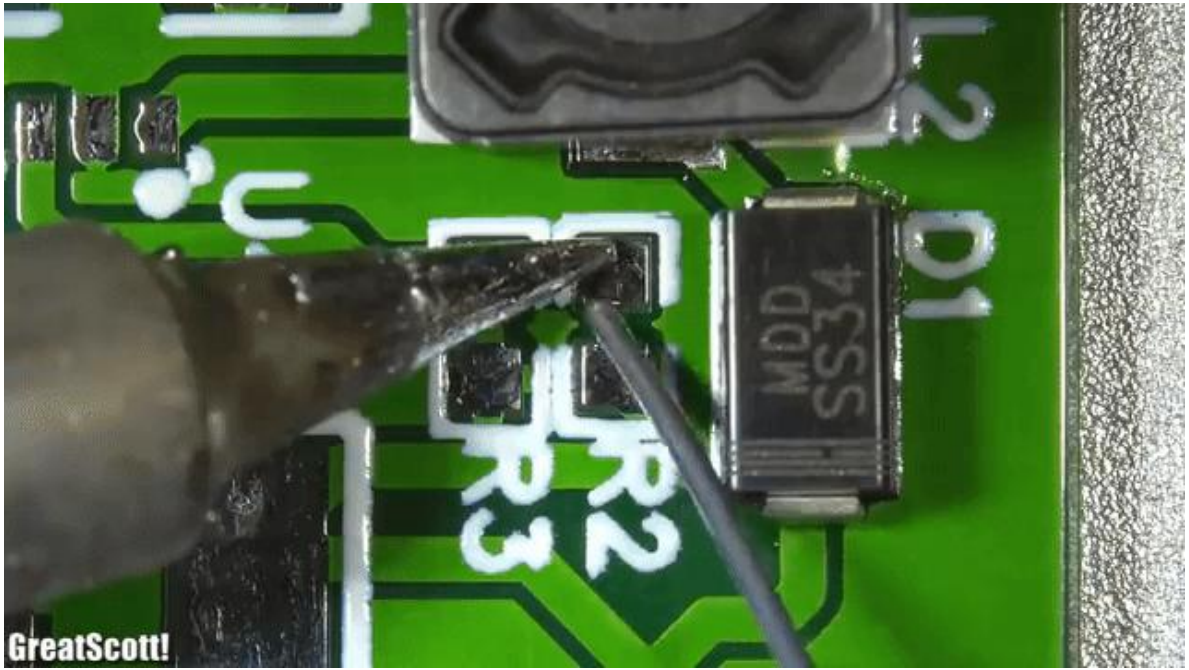
Soft Core Wires



For SMD

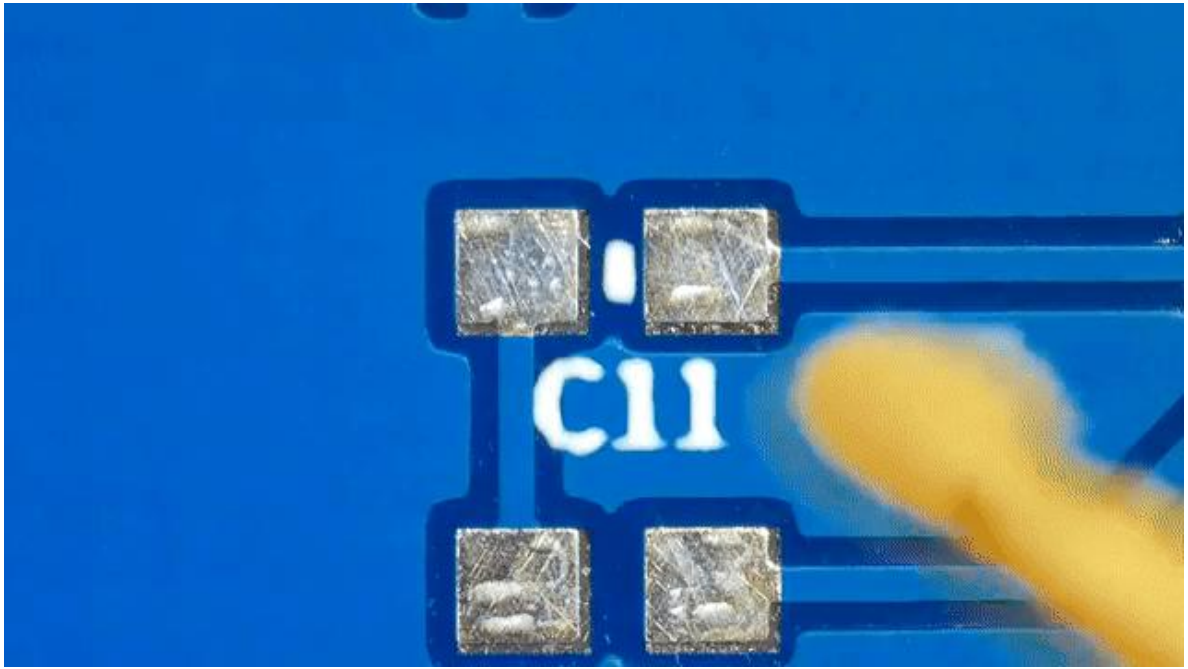
SMD soldering

- First put solder on one pad
- Place component
- Heat first pad, then second pad and to finish again the first pad



SMD soldering

- Extra flux can go a long way to help, it helps to prevent oxidation and help with flowing of the solder
- Good example of using too much solder



Start small

- Use tweezers to place the components.
- Start with large resistors and the small capacitors
- Then work on the ic’s and led’s

- Save the tall and through hole components until last!



And fixing them!

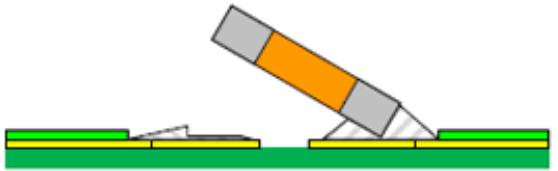
Finding Errors

Finding errors

- Visual inspection
- Voltage measurements at critical points
- Follow the signal
- Common errors:
  - Missing connections
  - Short circuits
  - Cold joints
  - Dry joints

Finding errors

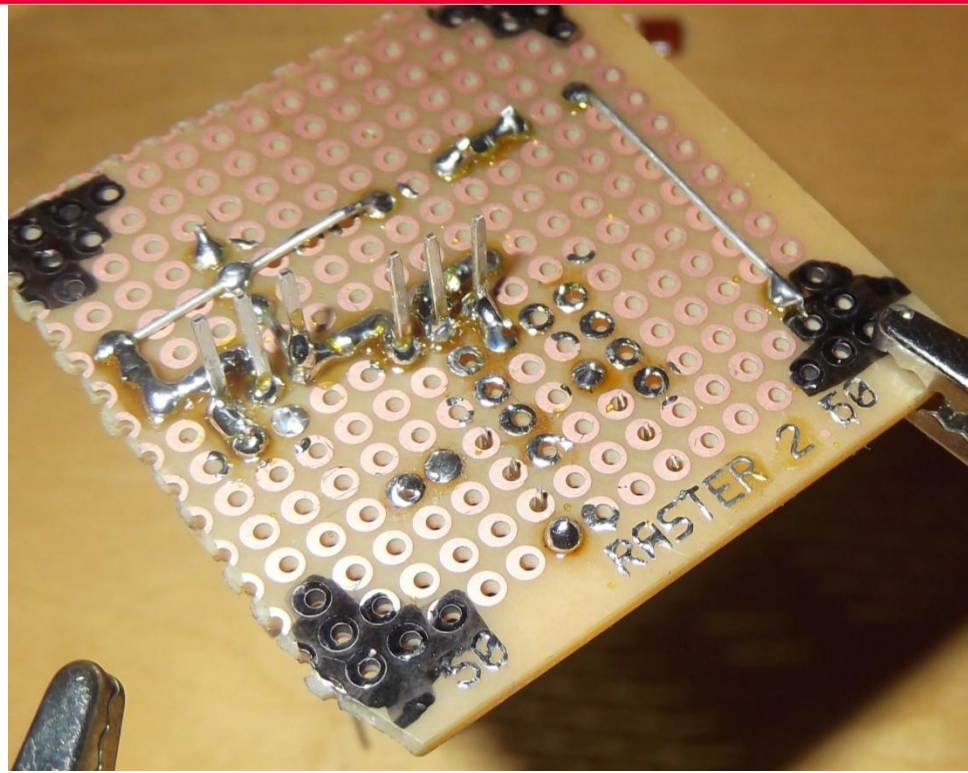
- Visual inspection
  - Common errors:
    - Missing connections
    - Short circuits
    - Cold joints
    - Dry joints
    - Tombstoning



Visual Inspection

Clearly not finished

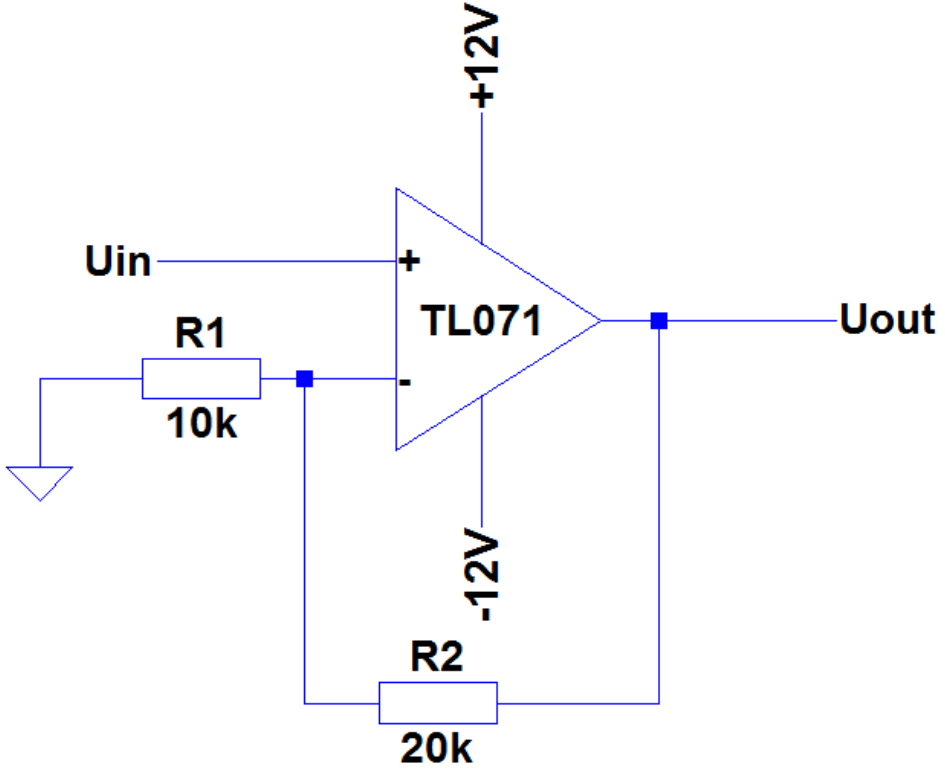
Fast and simple method to find faulty or missing connections



Voltage measurement

What voltages do you expect at every node?

- Check DC first
- Then follow the signal through the circuit



Fixing errors

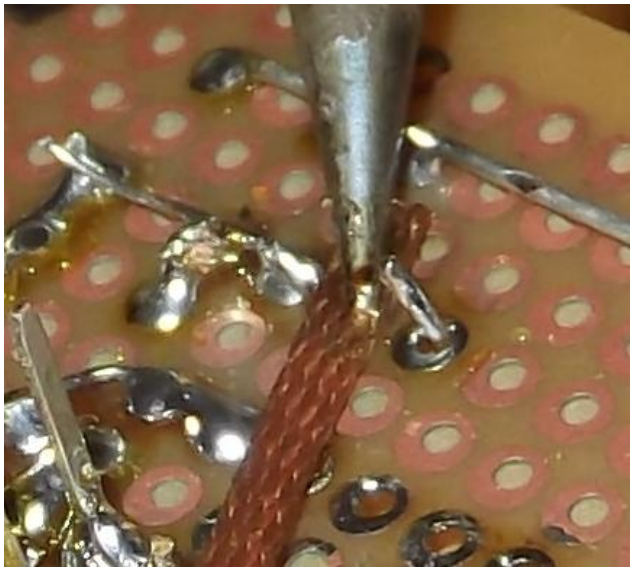
Desoldering Pump



Flux

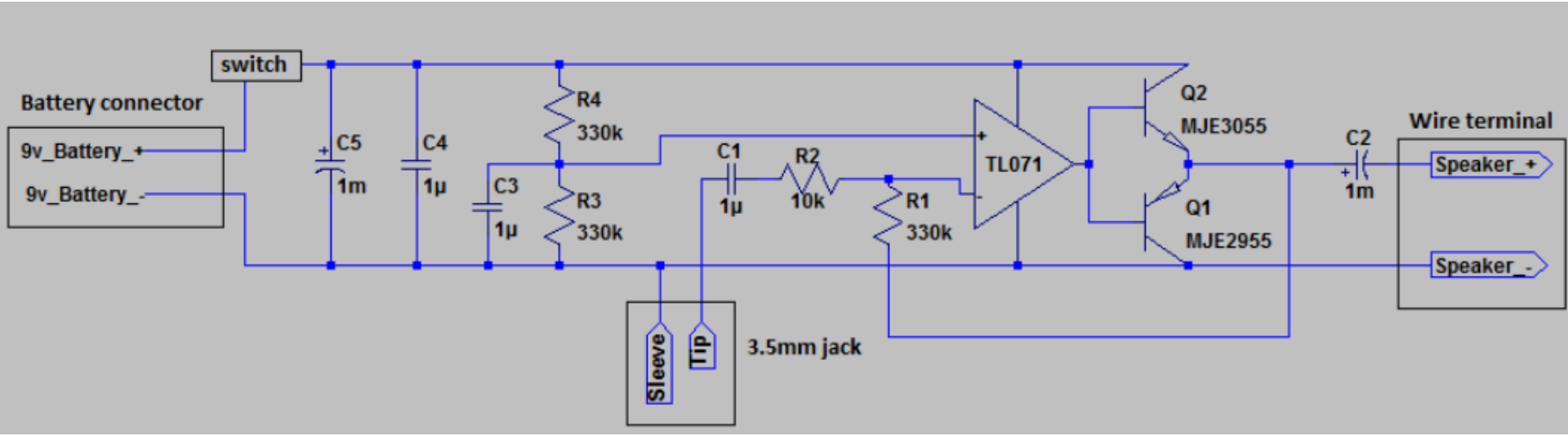


Desoldering Wick



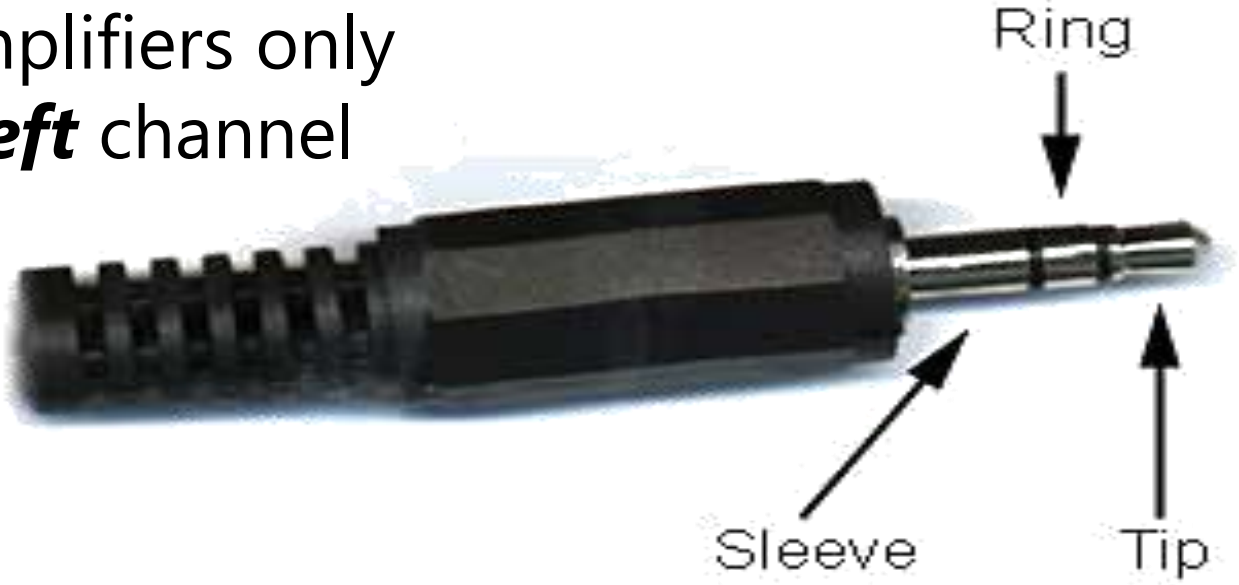
Audio Amplifier

The Practical

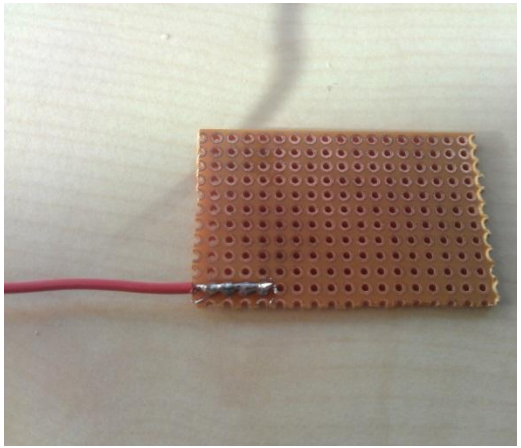


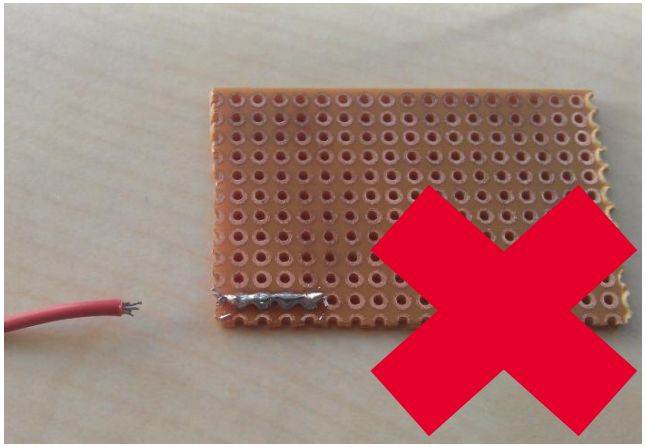
Jack Plug

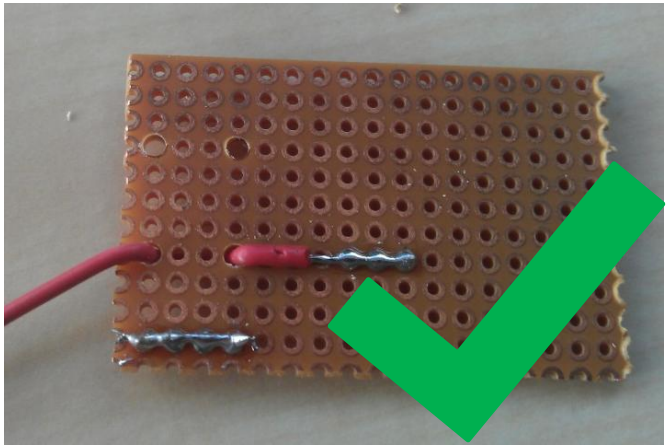
Mono amplifiers only use the ***left*** channel



Connecting the Jack

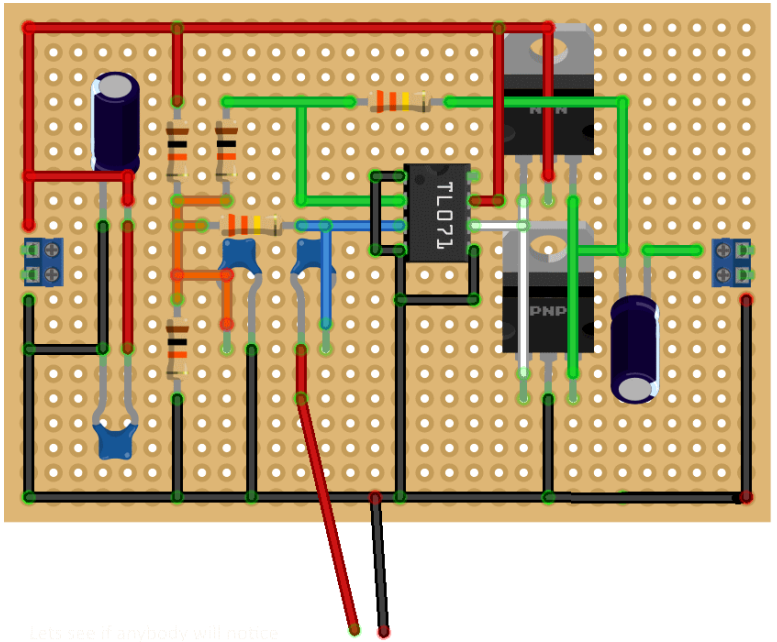




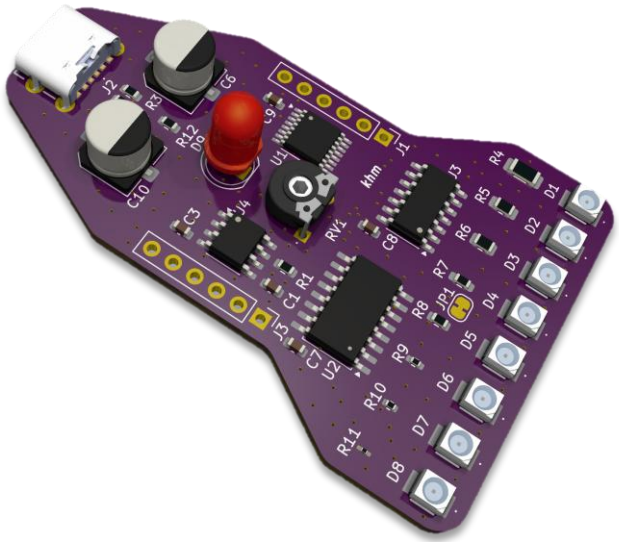


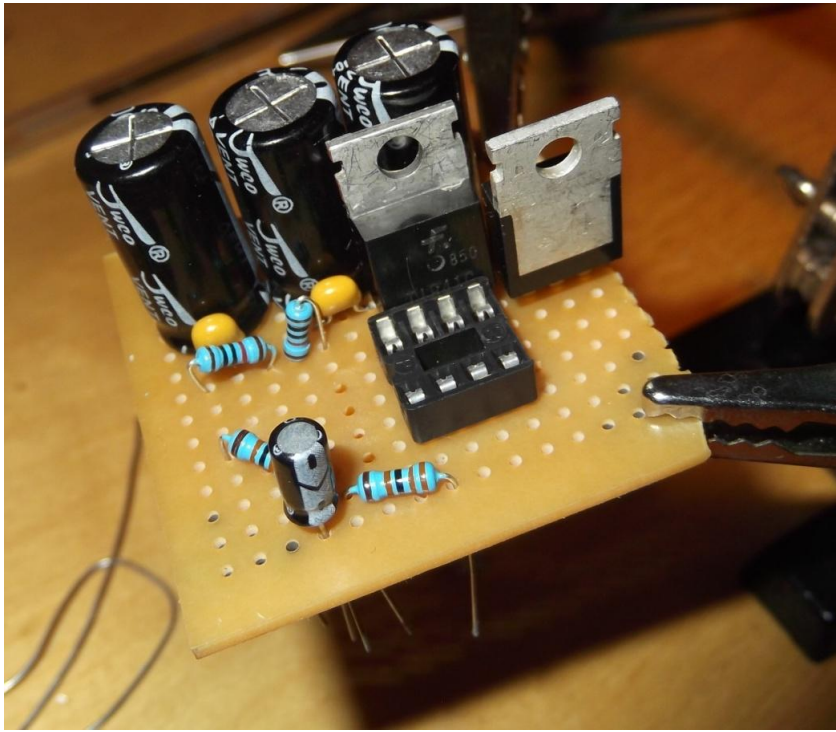
Soldering hints

- Layout
  - PNP & NPN
  - Capacitor polarity



Final Product





Documentation!

https://docs.scintilla.utwente.nl/masterclass/SolderingCourse2026



Good luck and happy soldering!

You can ask the MasterCLASS members for an example on how to solder a component. And all other questions ☺