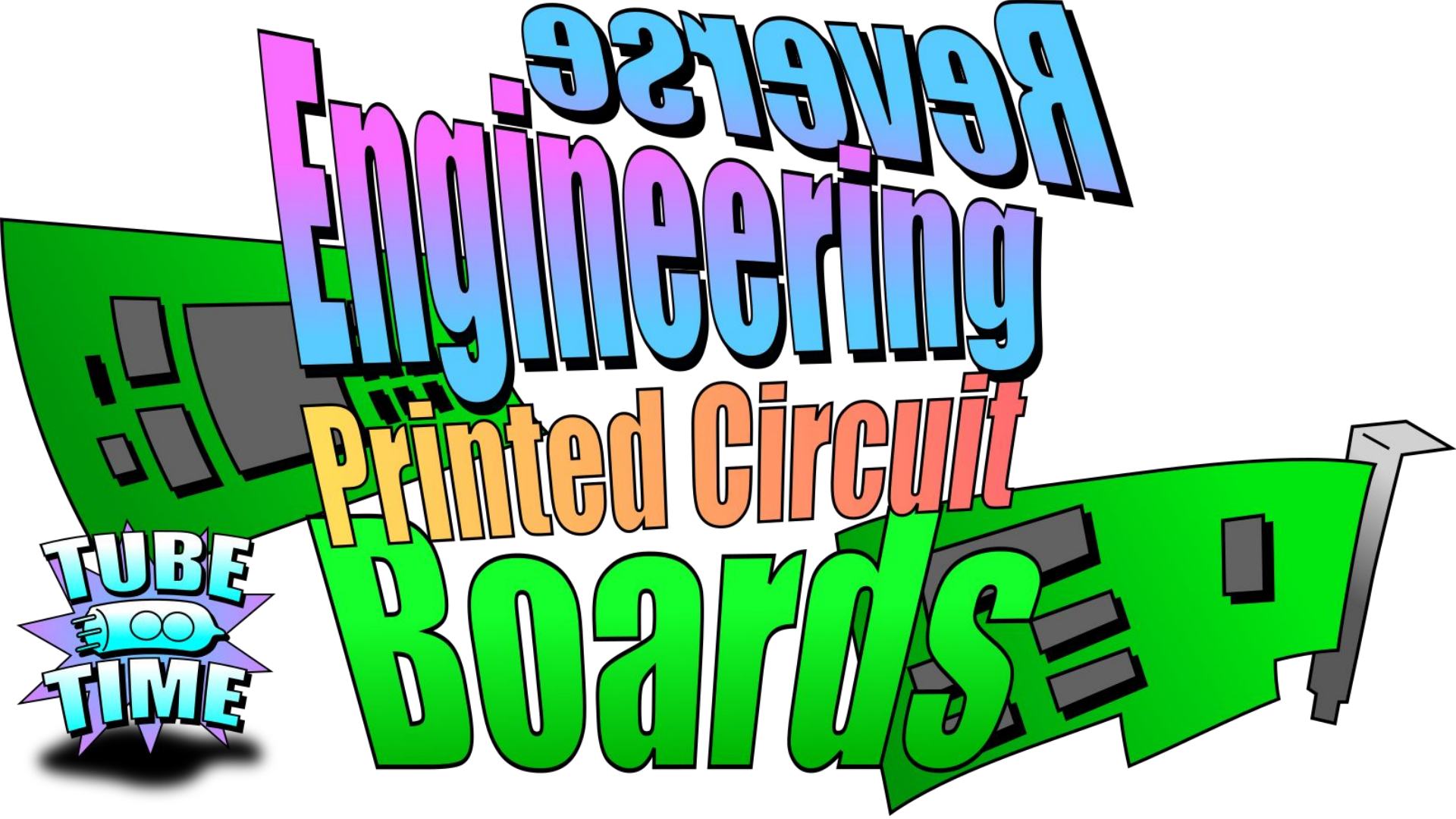

Reverse
Engineering
Printed Circuit
Boards
TUBE
TIME

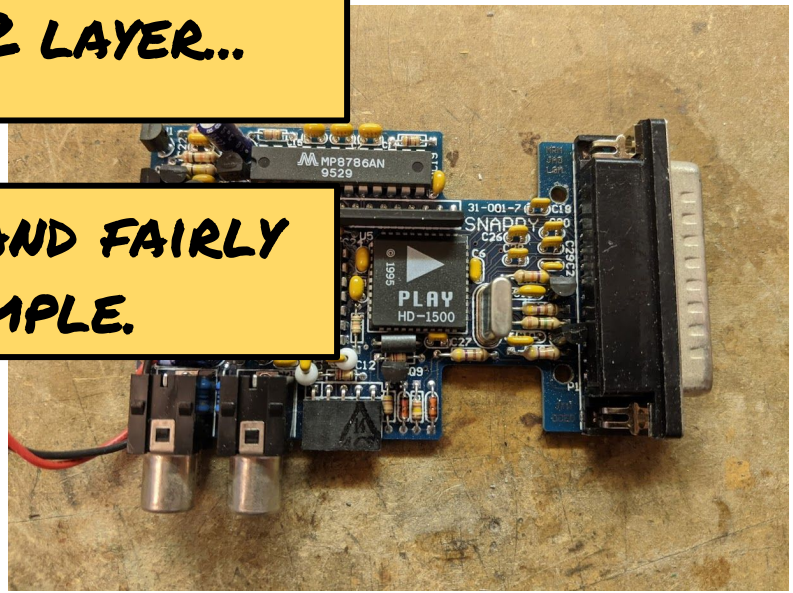
This is a hands on workshop!

I brought a board, and I hope you did too!

Your board for the workshop should be...

...2 layer...

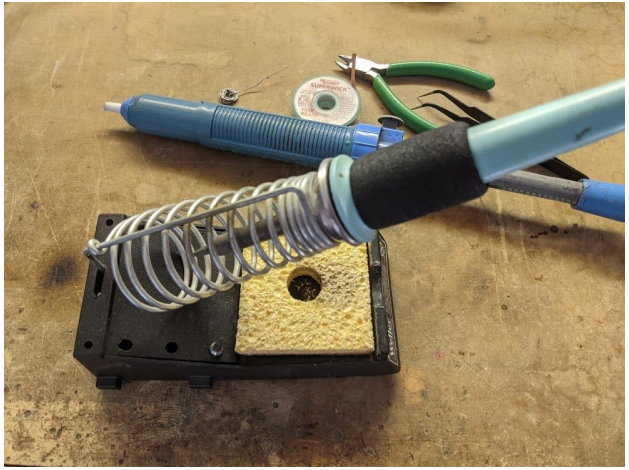
...And fairly simple.



You will also need...

A flashlight

Soldering tools
(optional)



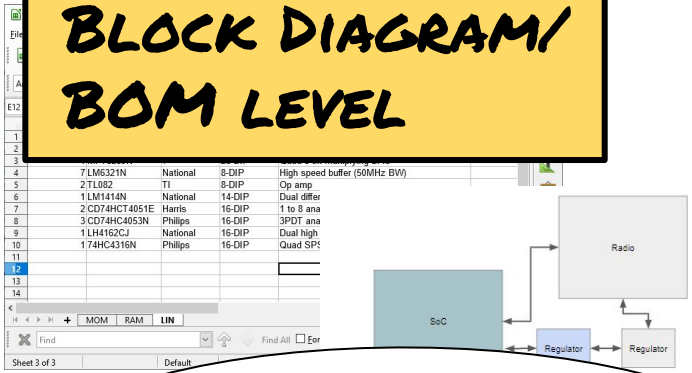
And software

KiCad

READY?

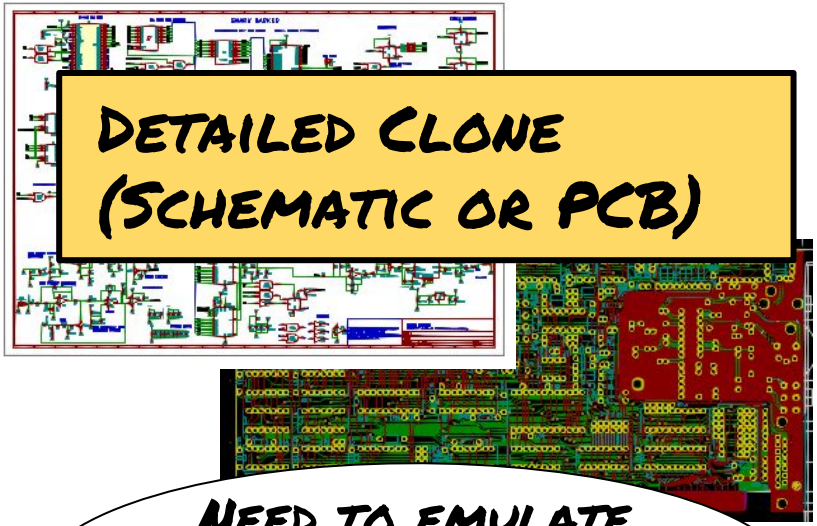
Two kinds of PCB Reverse engineering!

Block Diagram/ BOM level

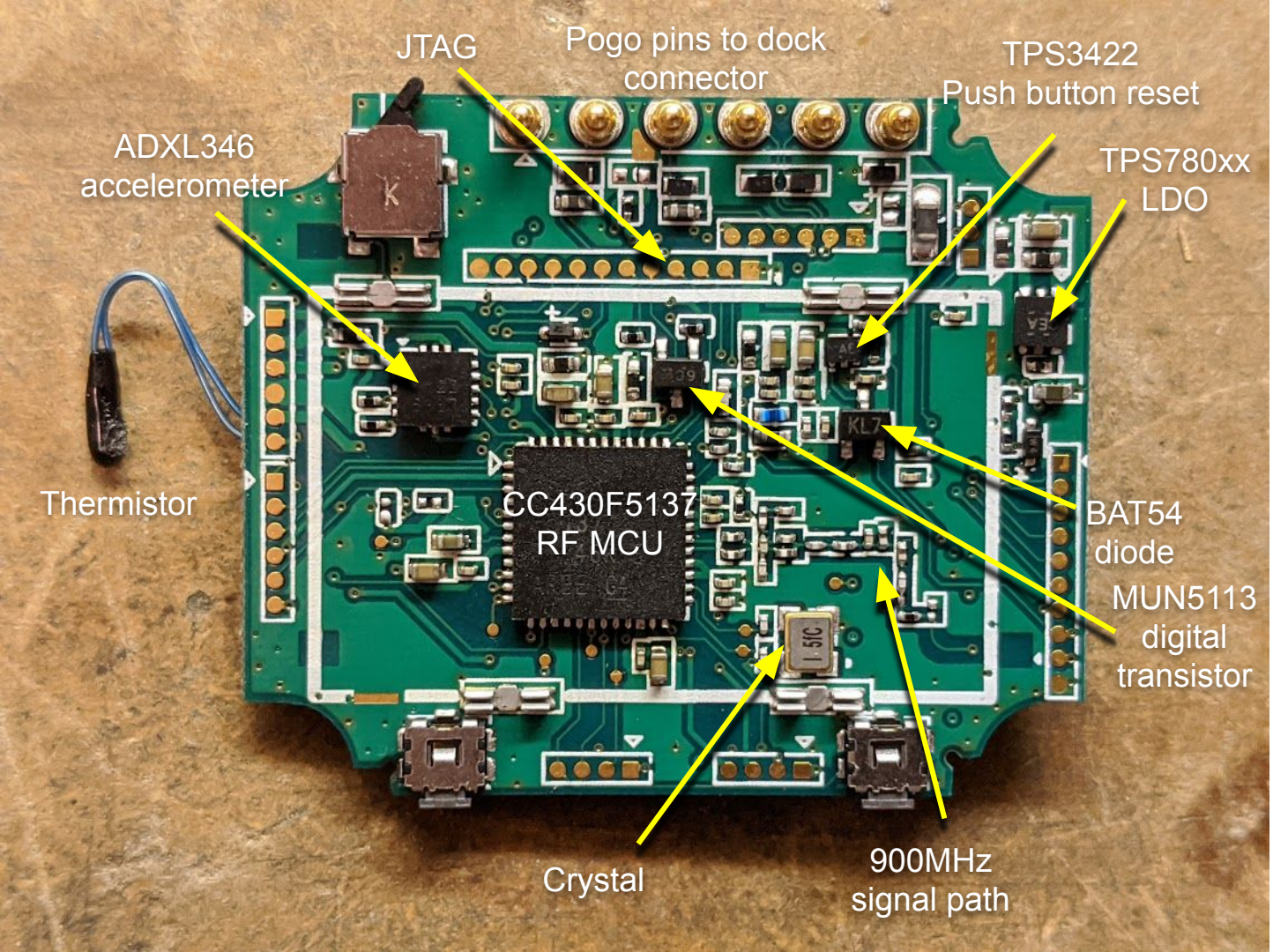


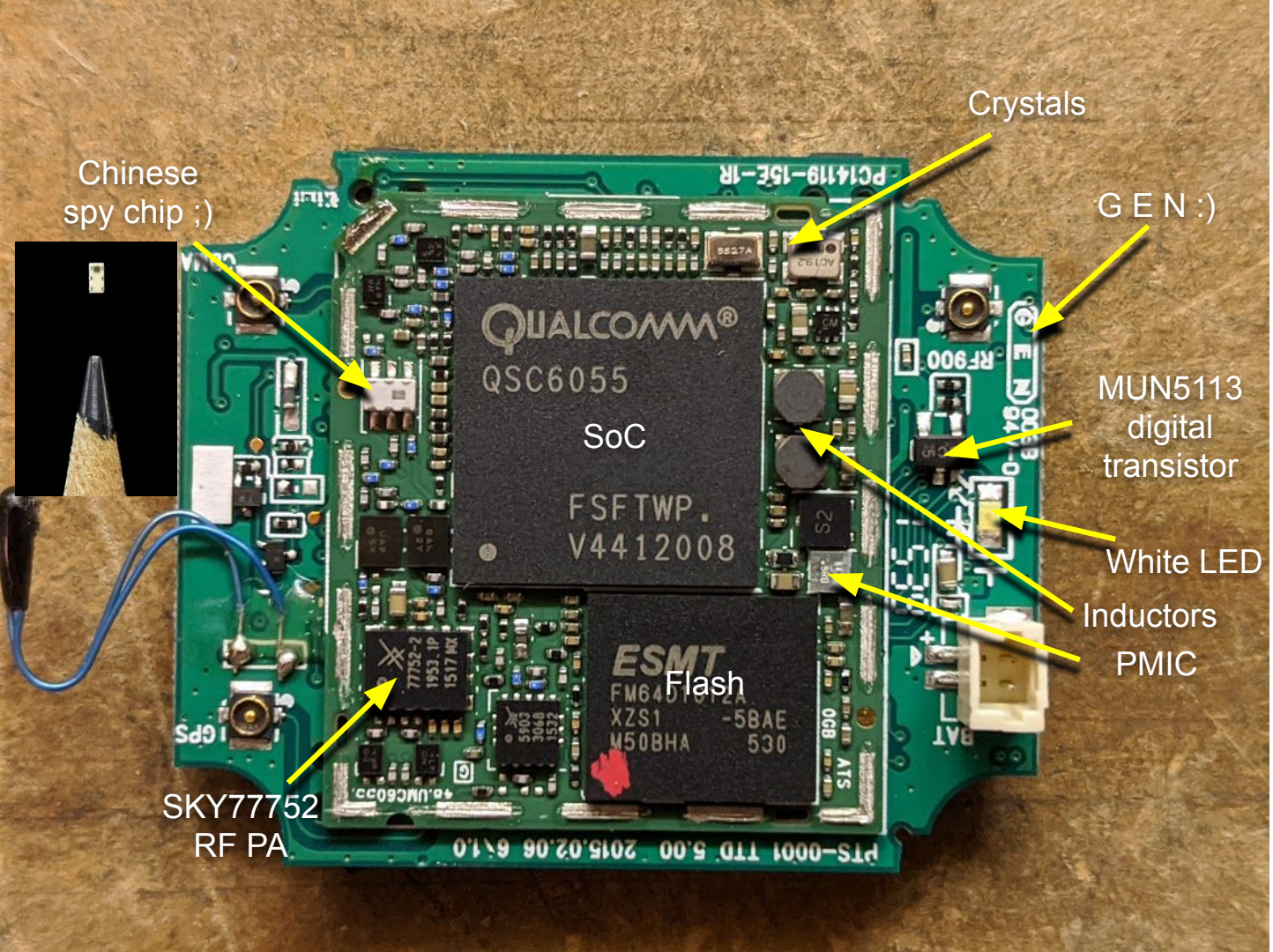
Good for a general idea of how it works!

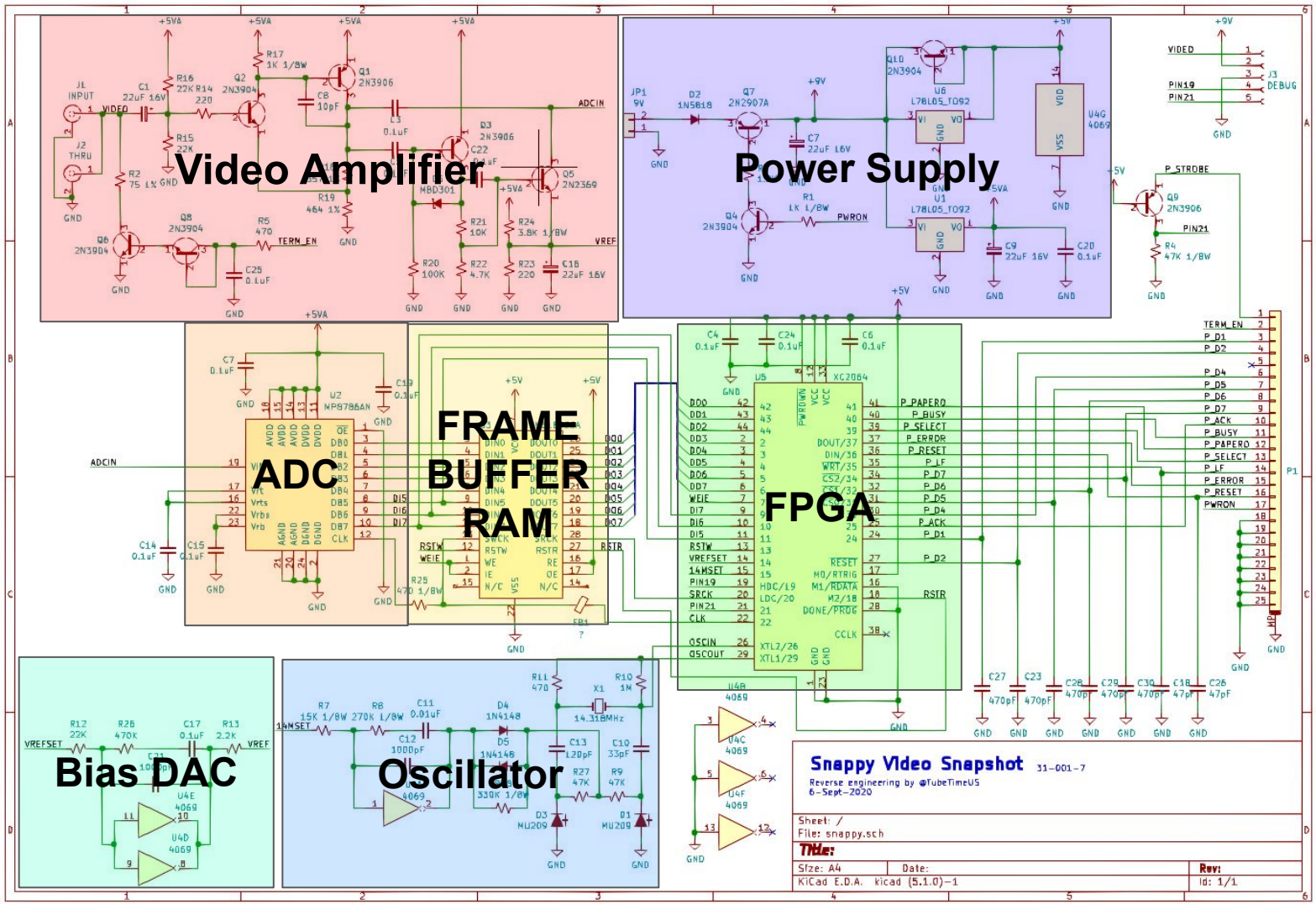
Detailed Clone (Schematic or PCB)

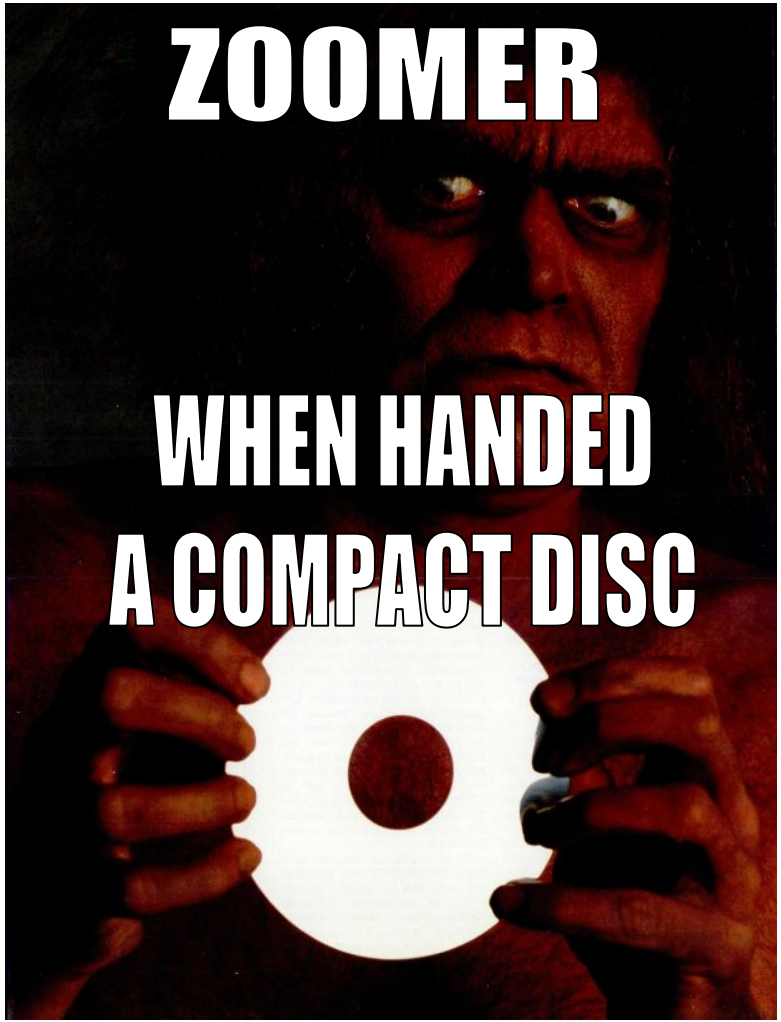


Need to emulate or clone it? Do it this way.


JTAG
Pogo pins to dock connector
TPS3422
Push button reset
ADXL346
accelerometer
TPS780xx
LDO
Thermistor
CC430F5137
RF MCU
BAT54
diode
MUN5113
digital
transistor
Crystal
900MHz
signal path


Crystals
Chinese
spy chip ;)
G E N :)
MUN5113
digital
transistor
SoC
White LED
Inductors
PMIC
Flash
SKY77752
RF PA
QUALCOMM®
QSC6055
FSFTWP.
V4412008
ESMT
XZS1 -5BAE
M50BHA 530


Video Amplifier
Power Supply
ADC
FRAME BUFFER RAM
FPGA
Bias DAC
Oscillator
Snappy Video Snapshot
31-001-7
Reverse engineering by @TubeTimeUS
6-Sept-2020
Sheet: /
File: snappy.sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. kicad (5.1.0)-1
Id: 1/1


ZOOMER
WHEN HANDED
A COMPACT DISC

Both methods start the same way...

So let's begin!

First, we need a Bill Of Materials (BOM)

	A	B	C	D
1	Designator	Package	Part Markings	Part Number/Value
2	Q1	SOT-23	K1N	?
3	U1	5x5 QFN-32	MEGA328P	ATmega328P
4	R1	0805	104	10K
5	C1	0603	-	?

Carefully examine the entire board. For each part, record:

Designator

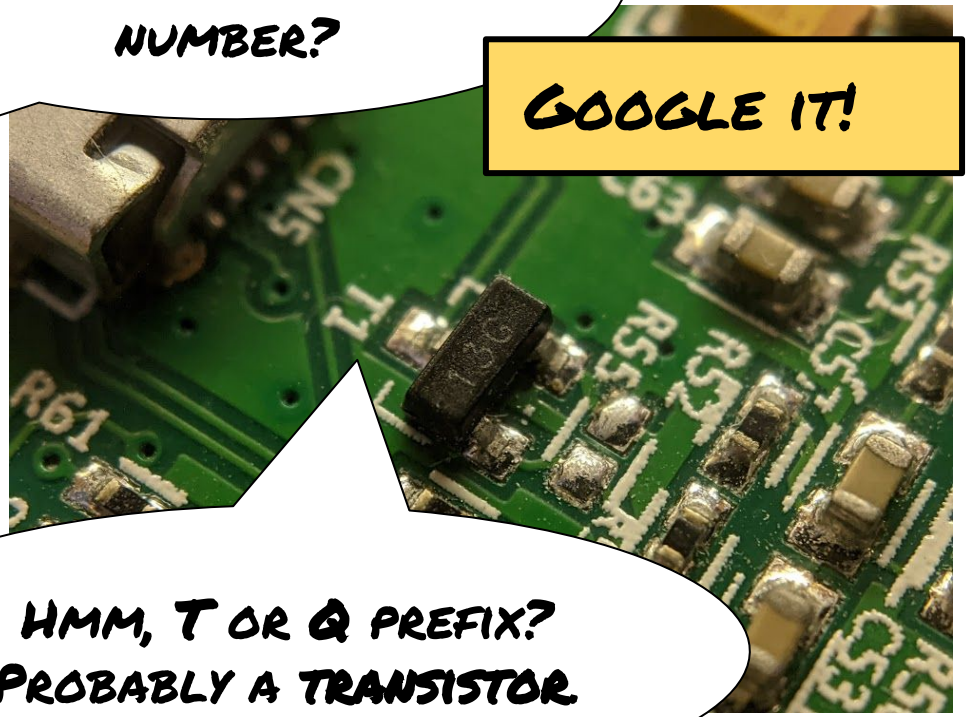
Package

Markings

	A	B	C	D
1	Designator	Package	Part Markings	Part Number/Value
2	Q1	SOT-23	K1N	?
3	U1	5x5 QFN-32	MEGA328P	ATmega328P
4	R1	0805	104	10K
5	C1	0603	-	?

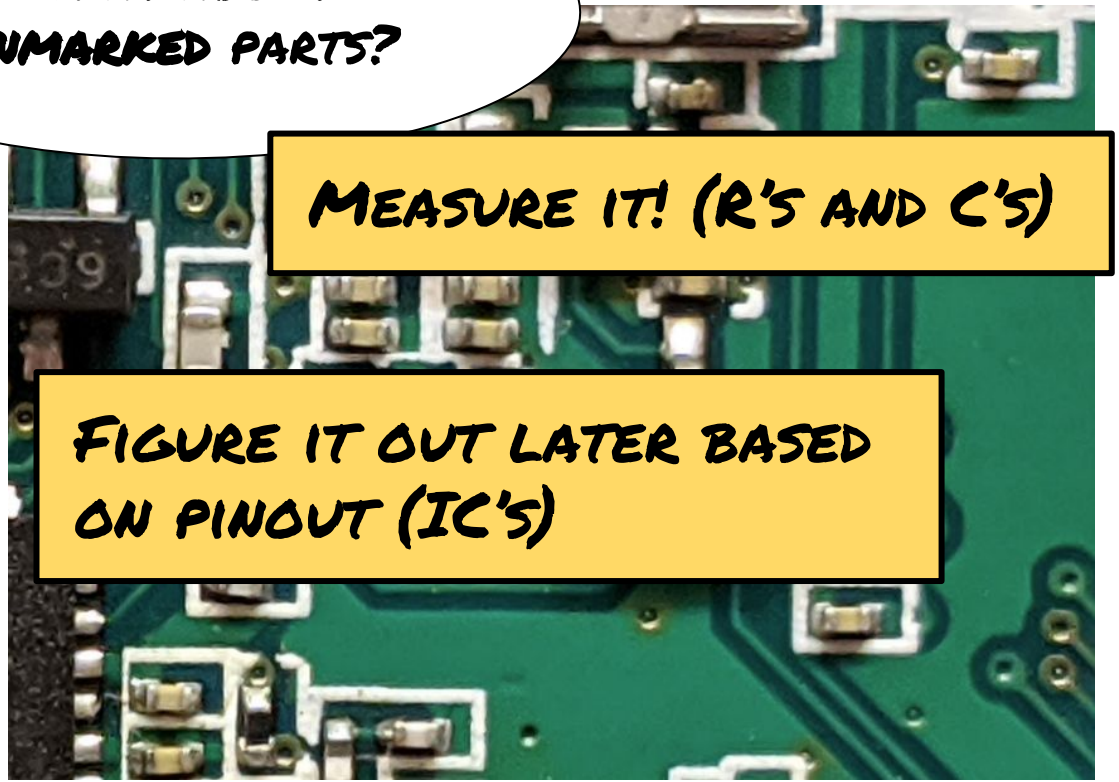
And part number, if you can figure it out!

How do I figure out this part number?



Hmm, T or Q prefix? Probably a transistor.

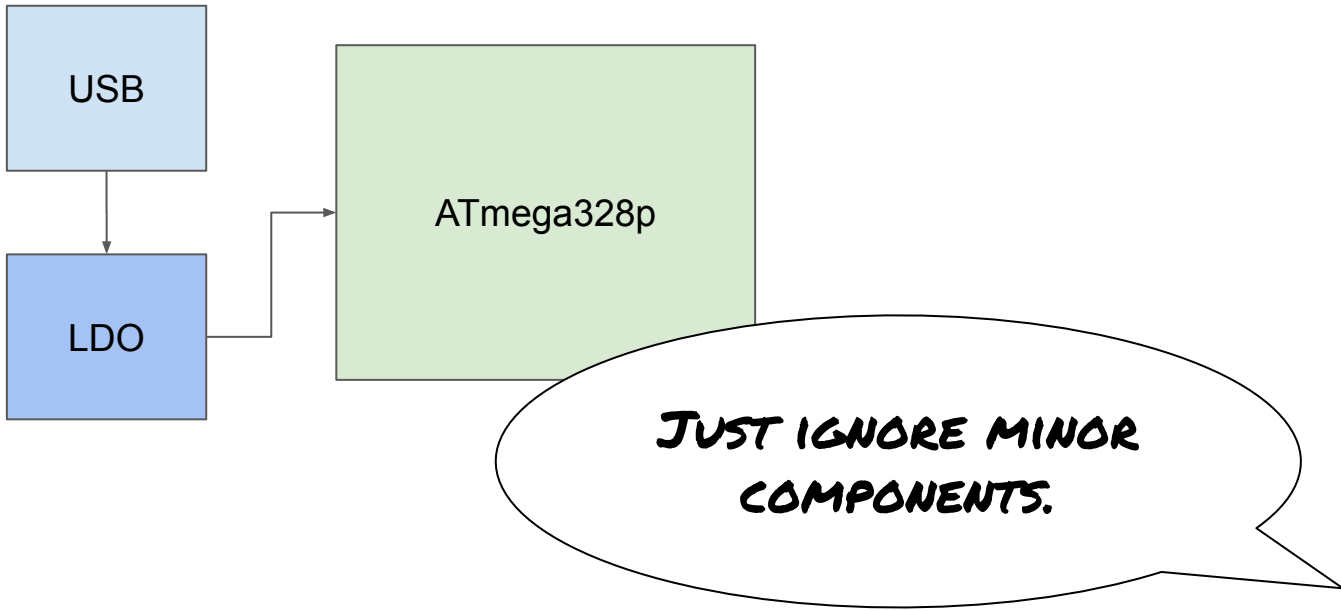
What about unmarked parts?



Measure it! (R's and C's)

Figure it out later based on pinout (IC's)

Block Diagram Time!



Now it is your turn!

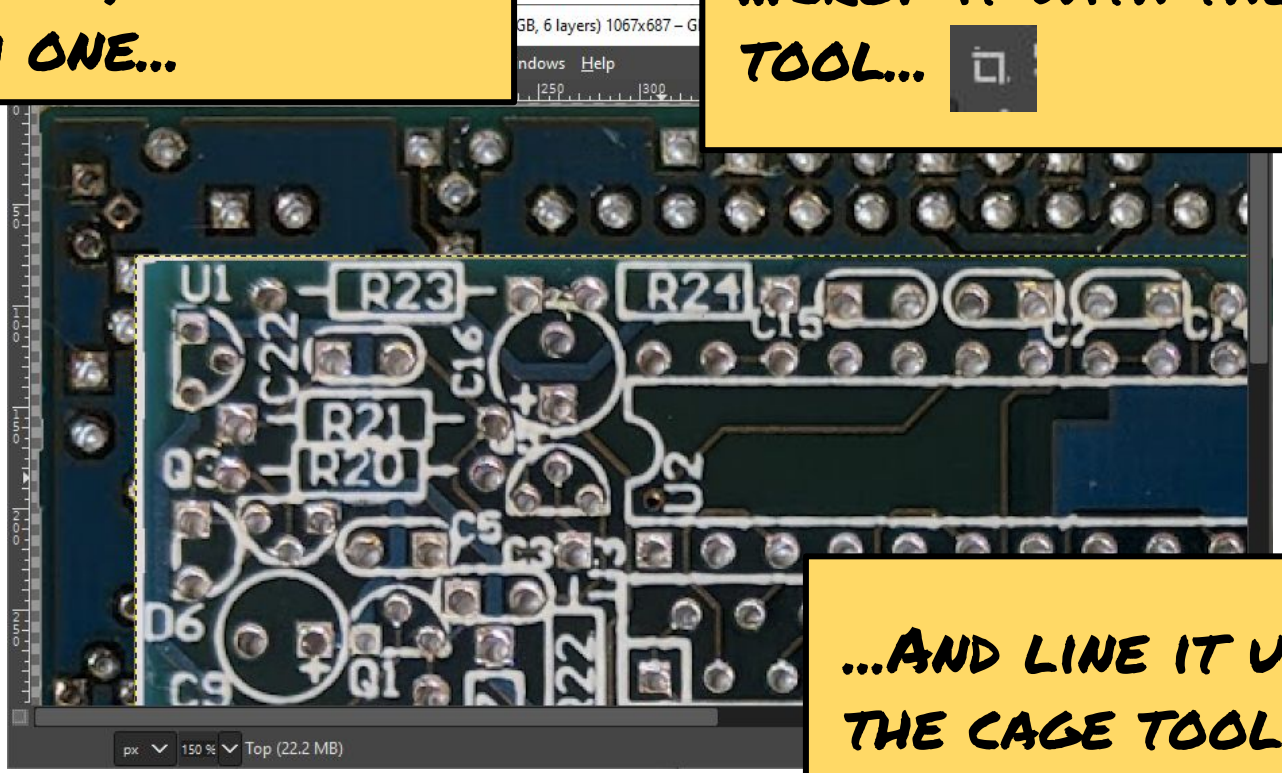
This is the real hard part.

We need high resolution photos of the top and bottom.

Only good for 2-layer and some 4-layer boards.

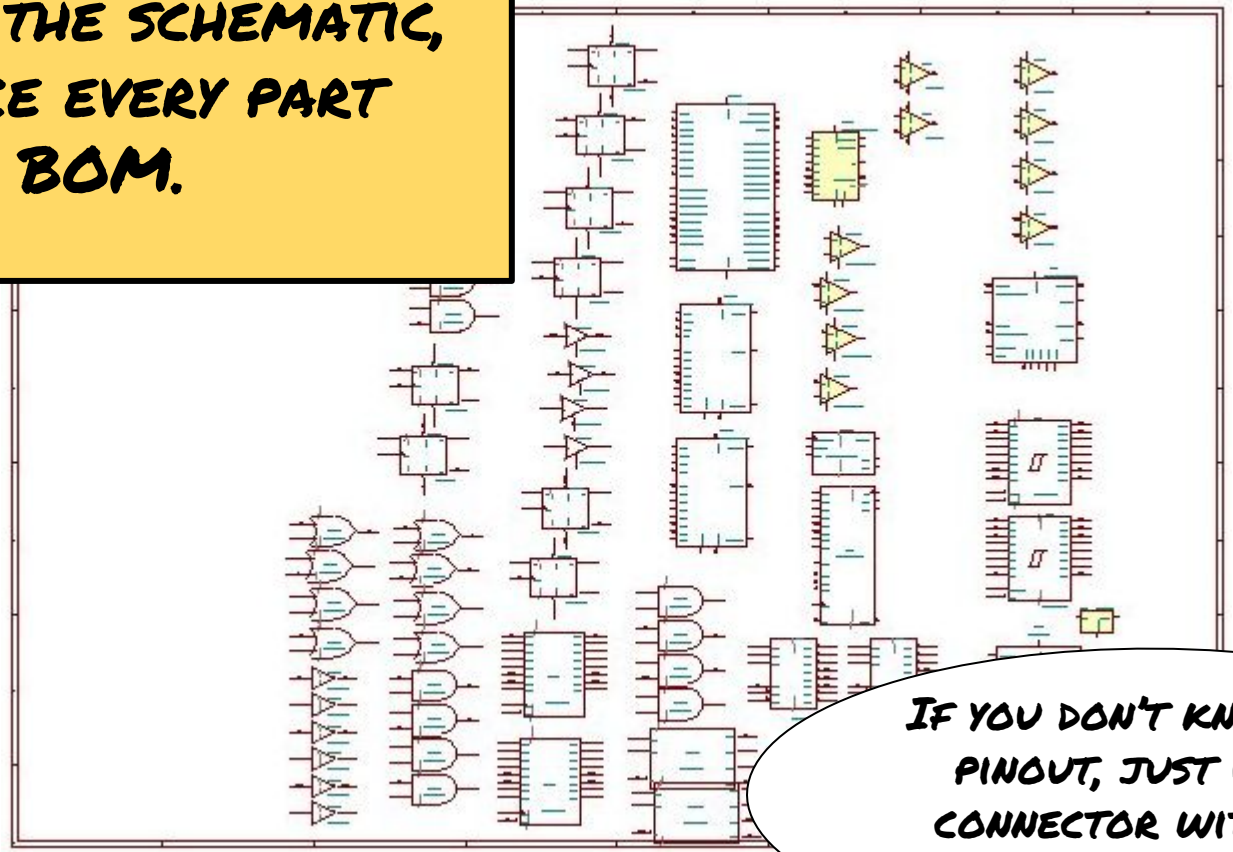
Import the images into GIMP, flip the bottom one...

...Crop it with the crop tool...



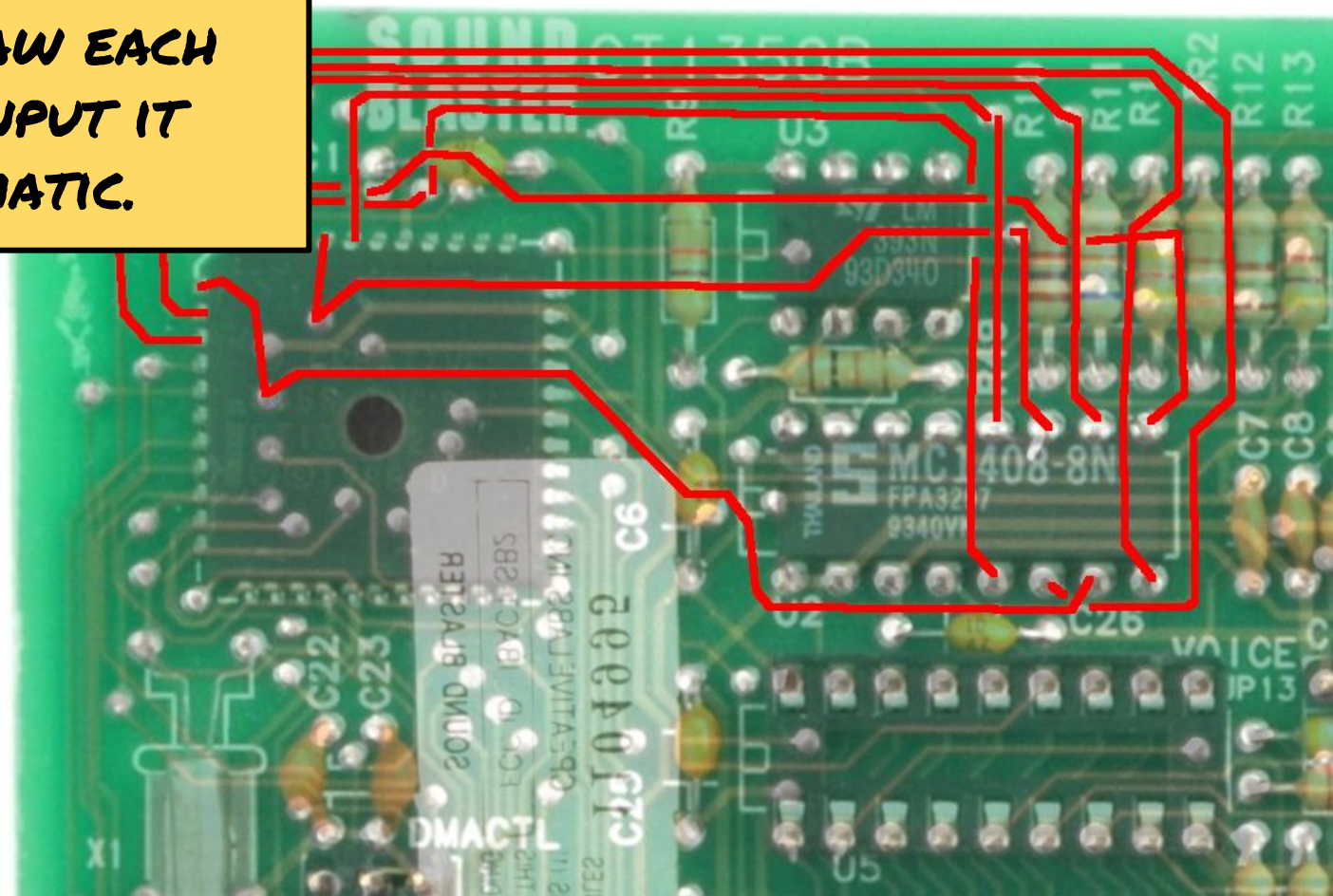
...And line it up using the cage tool.

To start the schematic, just place every part from the BOM.



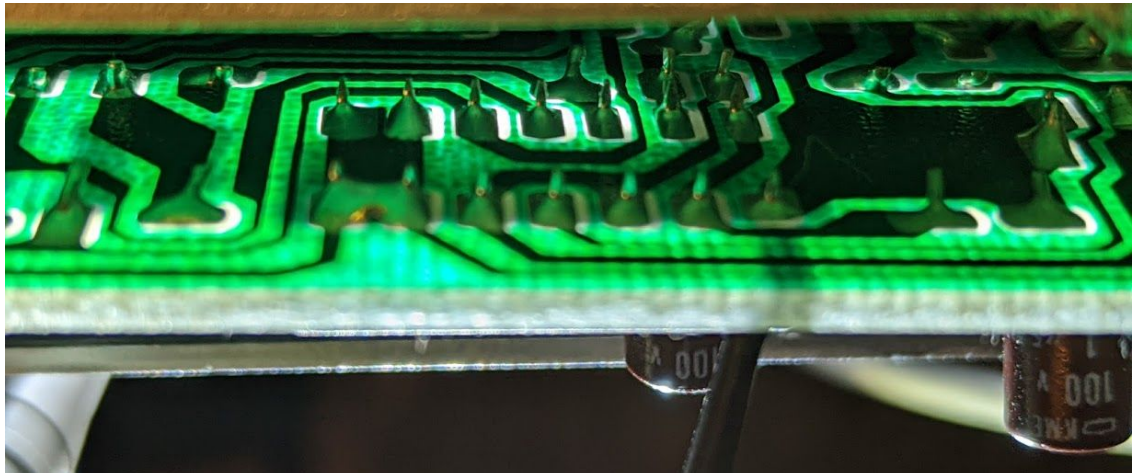
If you don't know the pinout, just use a connector with the same number of pins.

Create some new layers, and draw each trace as you input it into the schematic.



Tricks:

- Use a multimeter to “buzz out” mystery connections
- Shine a flashlight through the board
- Remove parts to look underneath



Removing parts...

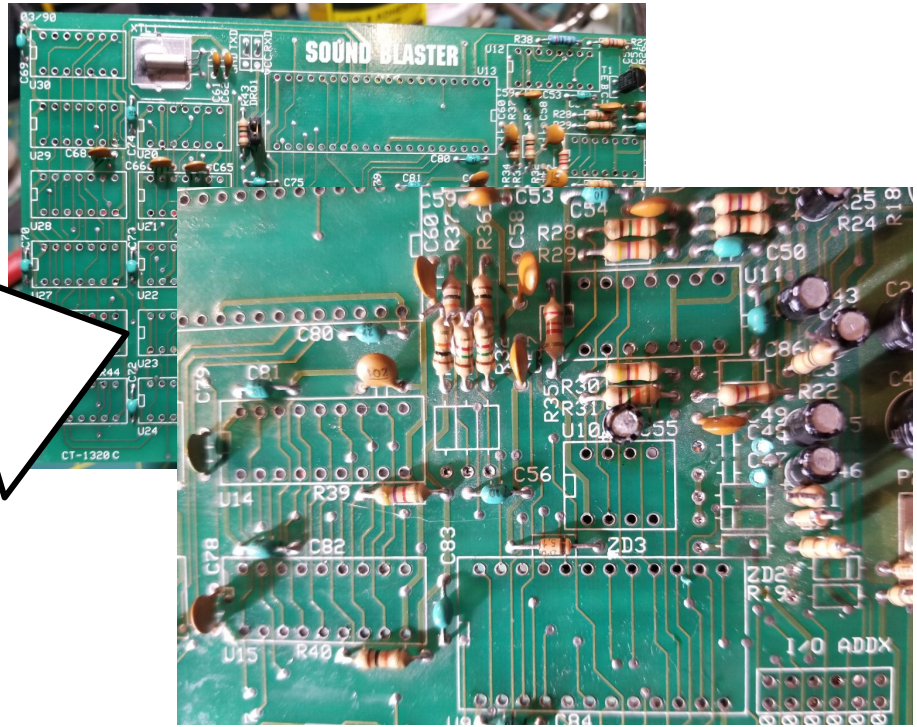
Tube Time
@TubeTimeUS

wanted: your *broken* old Sound Blaster 1.0, 1.5, or 2.0 cards. that DSP needs to get dumped. (pic from Wikipedia)

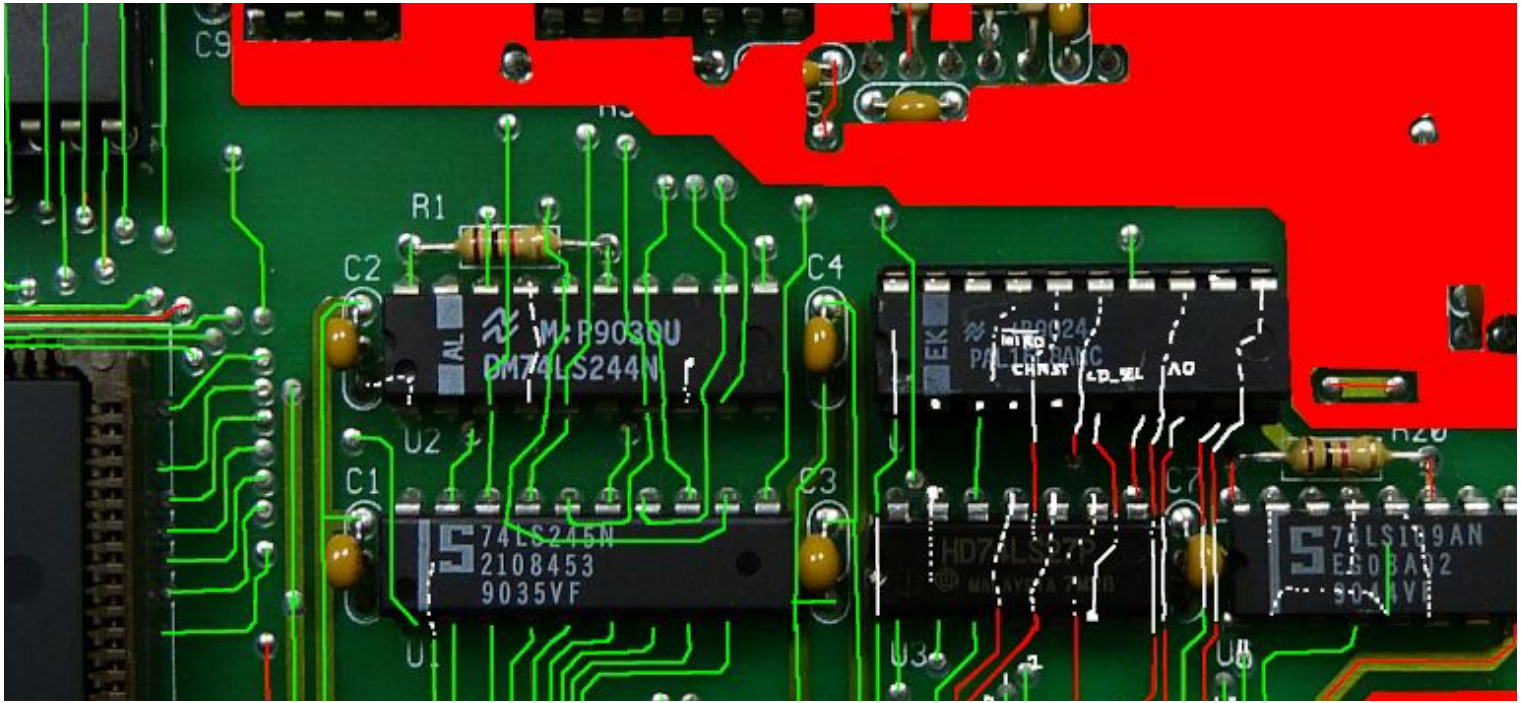
12:59 PM - 17 Jul 2018

77 Retweets **169** Likes

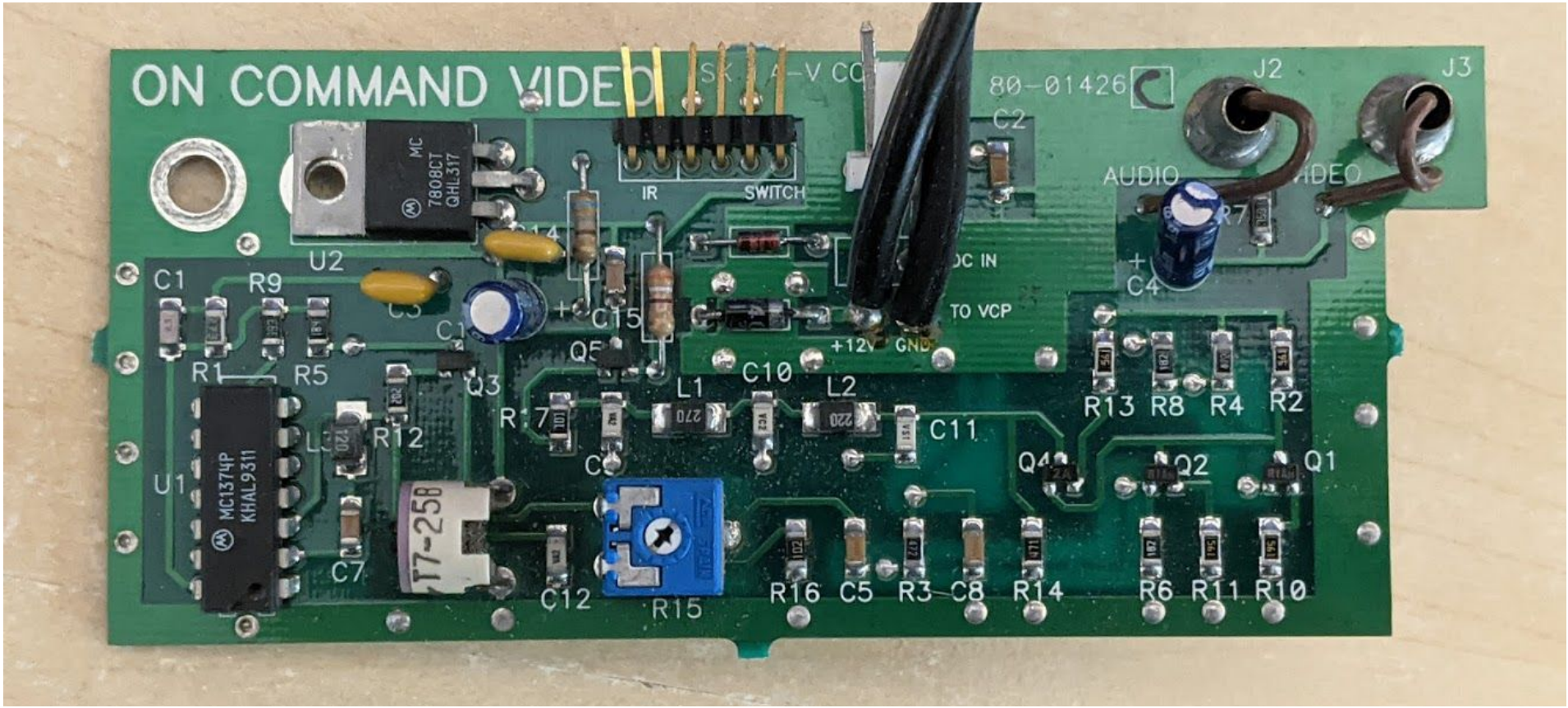
14 77 169

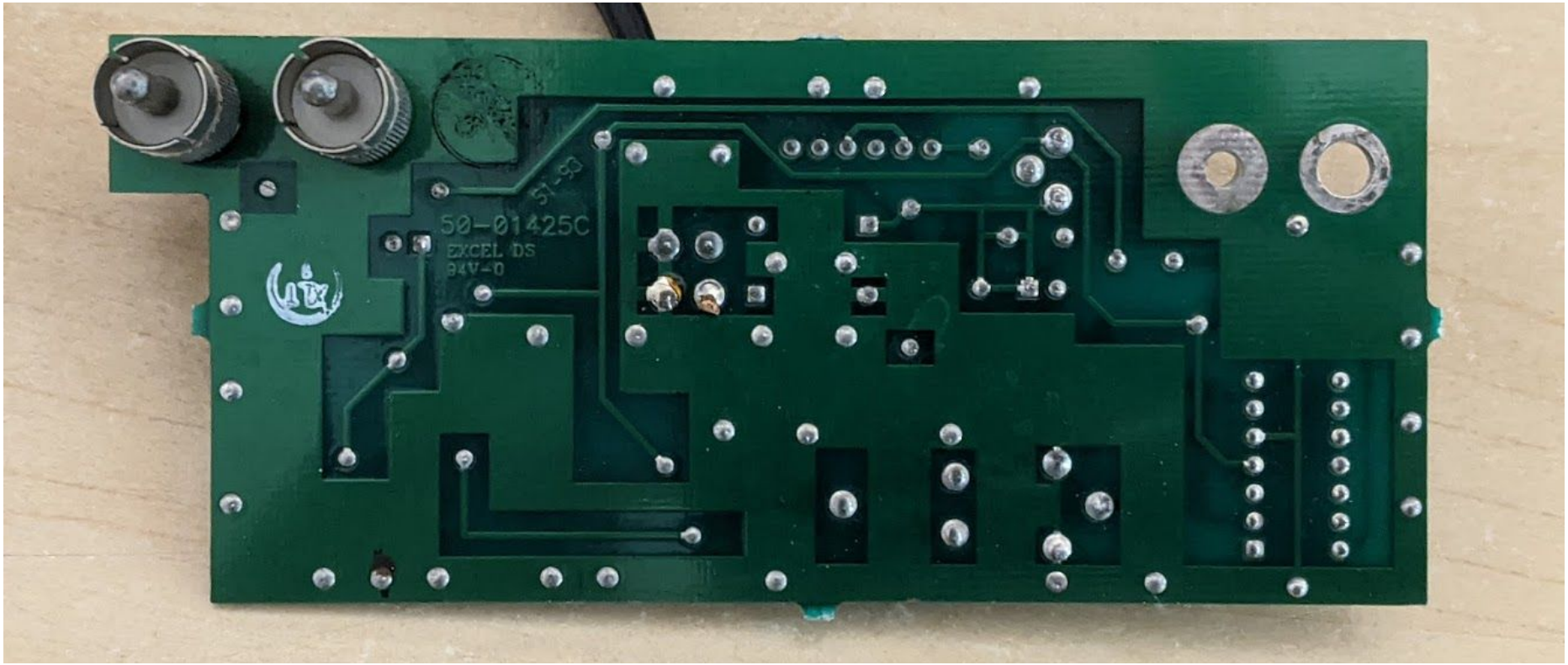


Sometimes you must guess.



Now it is your turn!

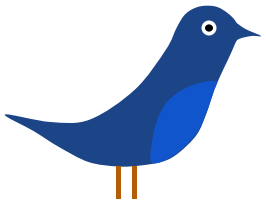

ON COMMAND VIDEO
80-01426
J2
J3
AUDIO
IR
SWITCH
DC IN
TO VCP
+12V
GND
U2
7808CT
QHL317
U1
MC1374P
KHAL9311
C1
R9
R1
R5
Q3
R12
C7
C12
R15
L1
C10
L2
C11
R7
R13
R8
R4
R2
Q4
Q2
Q1
R16
C5
R3
C8
R14
R6
R11
R10
C4
R7

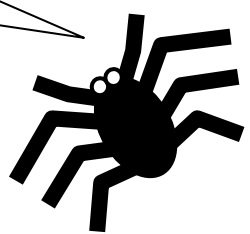

50-01425C
EXCEL DS
94V-0

Thanks For Coming!

@TubeTimeUS

http://tubetime.us





Back Up Slides

Top Mark Resources

- Google topmark in quotes along with the package name.
- Topmark database: https://alltransistors.com/smd-search.php
- Maxim topmark search https://www.maximintegrated.com/en/design/packaging/topmark.html
- TI topmark search https://www.ti.com/packaging/docs/partlookup.tsp

Don’t know what the package is?

- Package names: https://www.topline.tv/SOT.html