

Lecture 4

Physical design considerations

Agenda

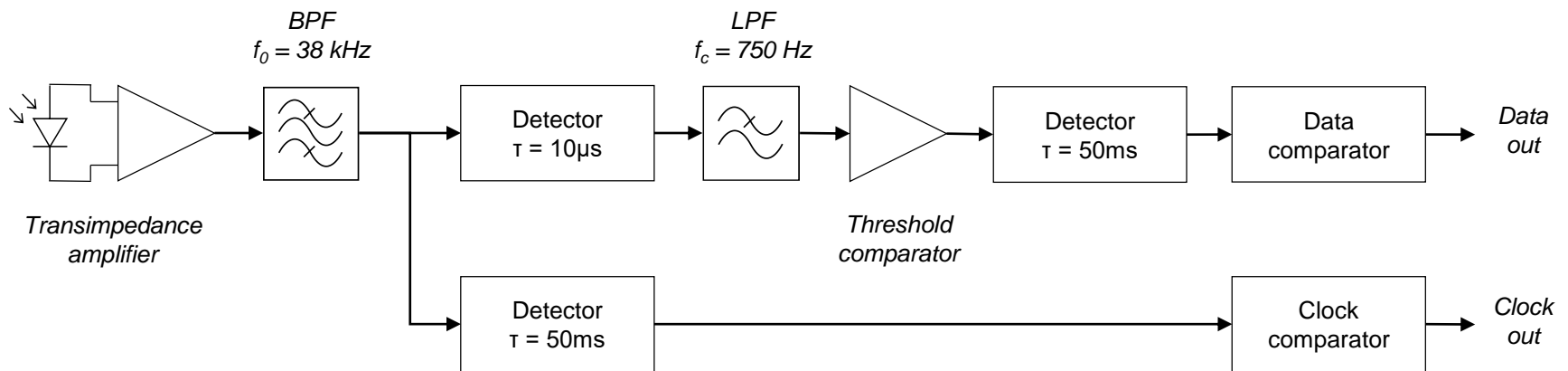
1. Schematic capture and component selection
2. PCB layout and fabrication
3. Design process demo: from breadboard to PCB
4. Lab 4 overview

Schematic capture and component selection

Ideation

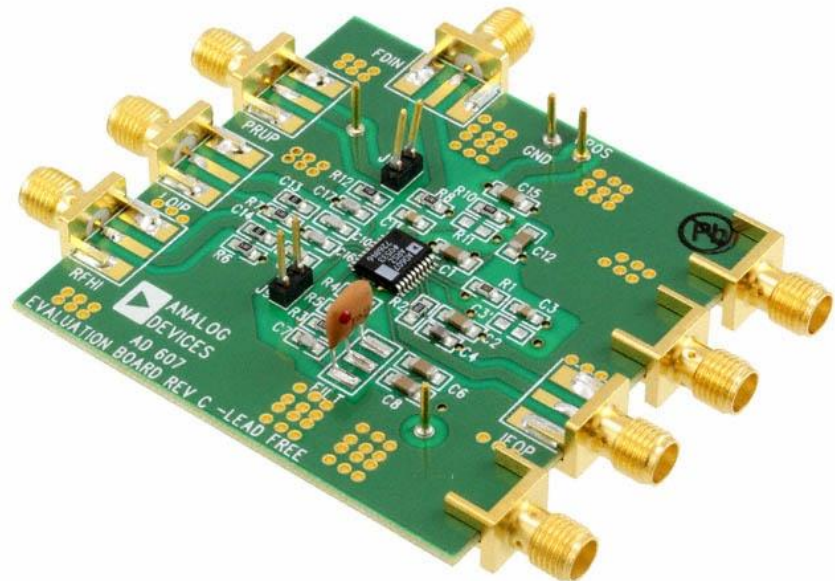
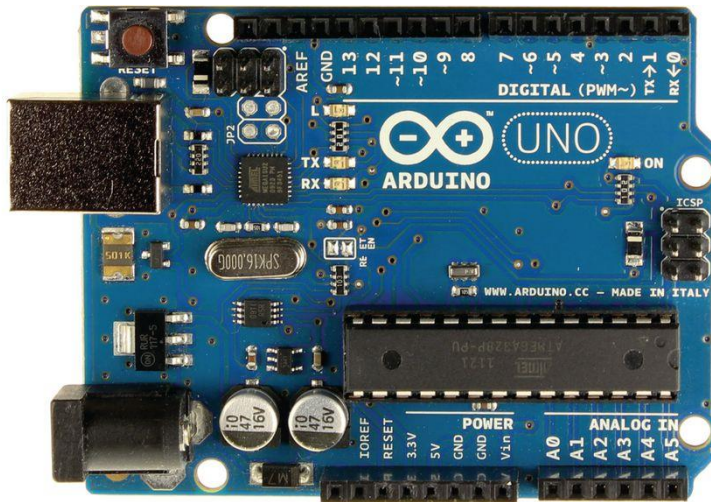
1. Draw **system block diagram**, determine which parts are necessary for each block
2. More detailed sketches for complicated blocks
3. Not necessary to have detailed list, only **specialized components** (ICs, transistors)

Example block diagram (from Lab 4 handout)



Prototyping

- Prototype as much of the circuit as you can before designing PCB
- Use breadboards and evaluation boards, main goal is just to get the circuit working



Component selection

- **Distributors:** Digi-Key, Mouser, Arrow
- Important to think about quantity if necessary—use fewer values, parts to get quantity discounts



Futurlec

element14

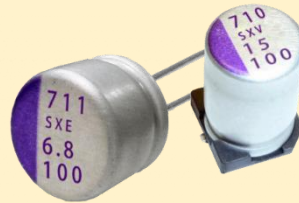


Choosing passives

- **Resistors:** power rating, tolerance, temperature coefficient
- **Capacitors:** voltage, temperature rating (85C vs. 105C), equivalent series resistance (ESR)
- **Inductors:** self-resonant frequency (SRF), current rating, DC resistance (DCR)



Electrolytic capacitor:
High ESR



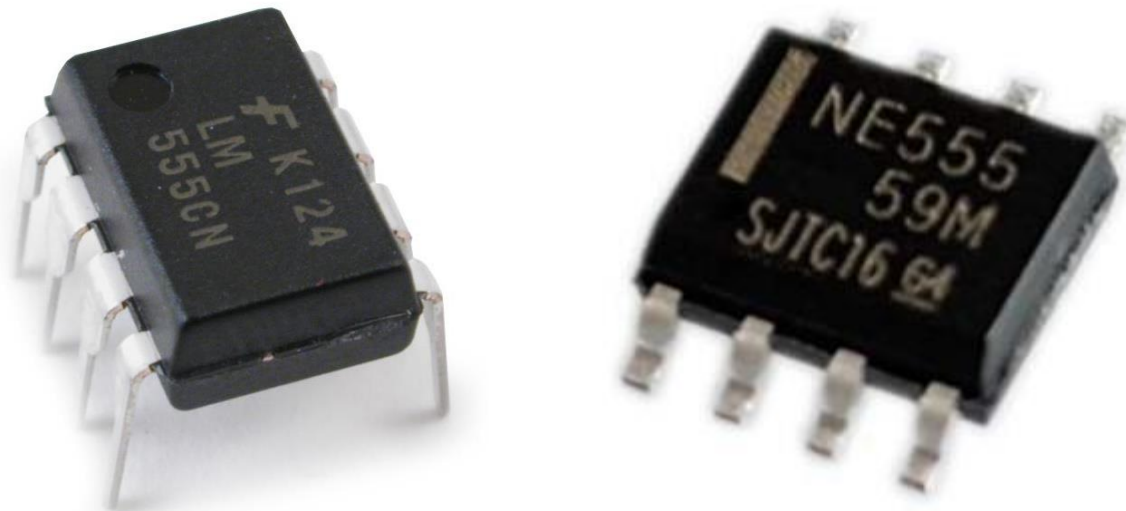
Solid polymer capacitor:
Low ESR



Ceramic capacitor (MLCC):
Very low ESR

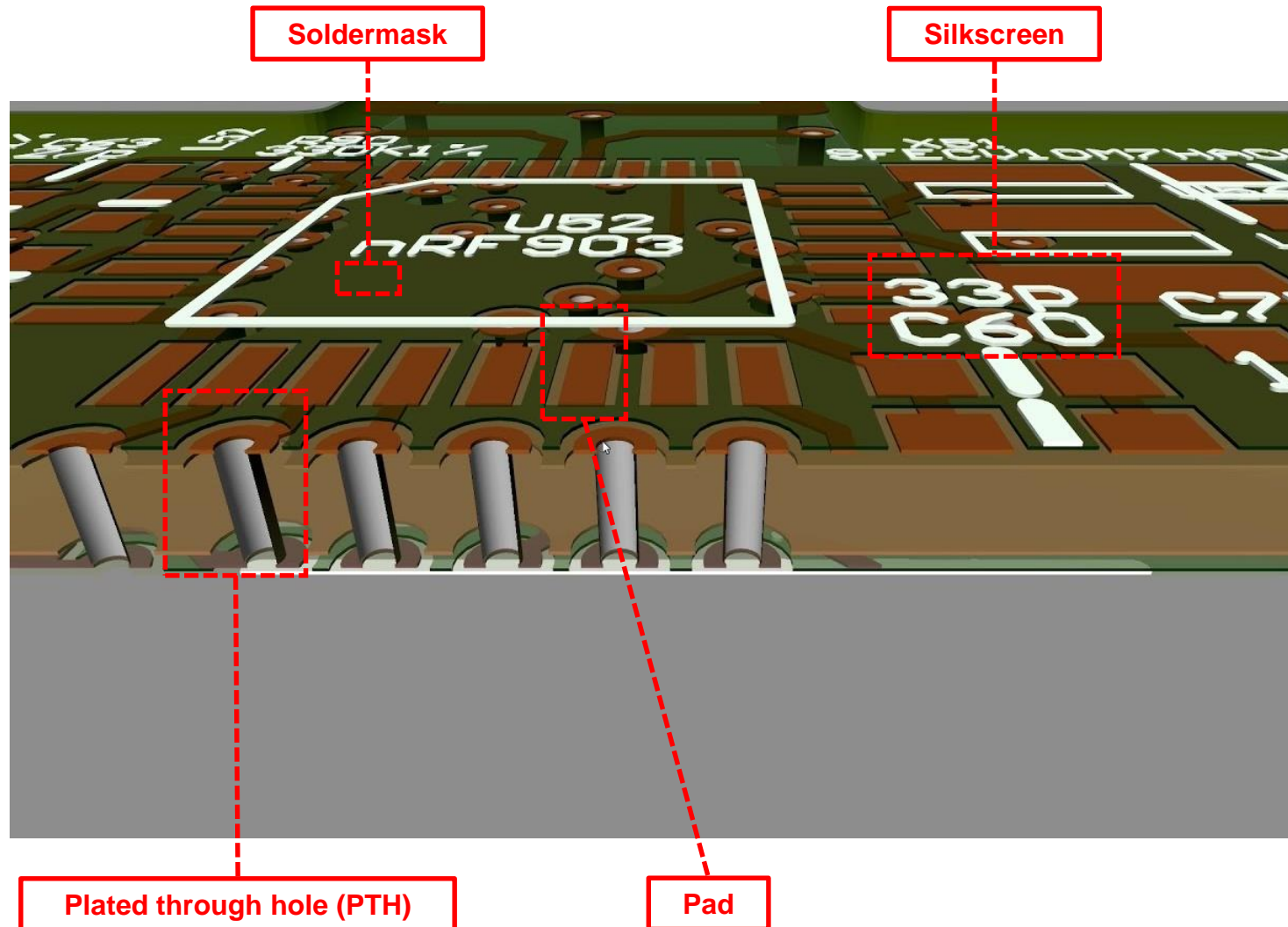
Choosing ICs

1. **Function:** What should the IC do?
2. **Specifications:** Supply voltage, frequency, supply current, temperature
3. **Packaging:** PTH or SMD, number of pins, pitch



PCB layout and fabrication

PCB cross-section

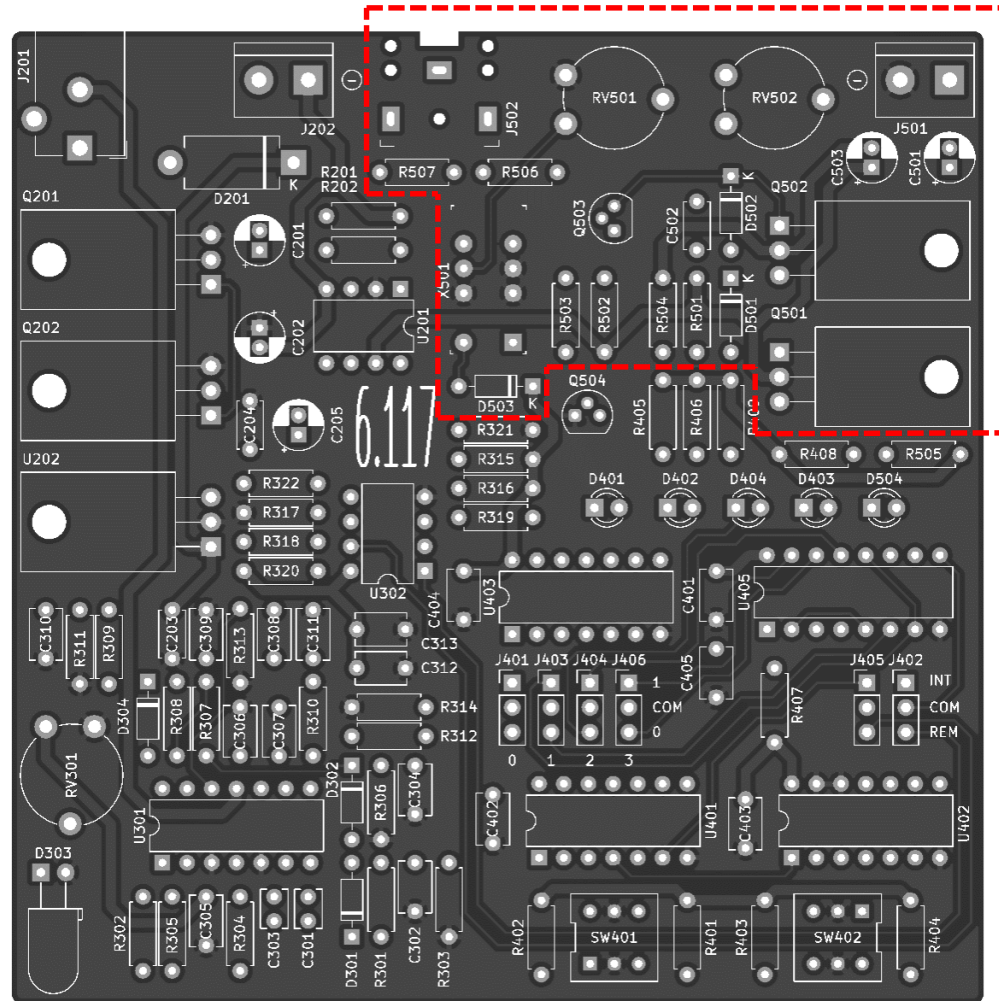


Design process demo

From breadboard to PCB

Lab 4 overview

Audio amplifier components



IR receiver components

