# Questions from Last Week

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June 2025

# Questions from Last Time

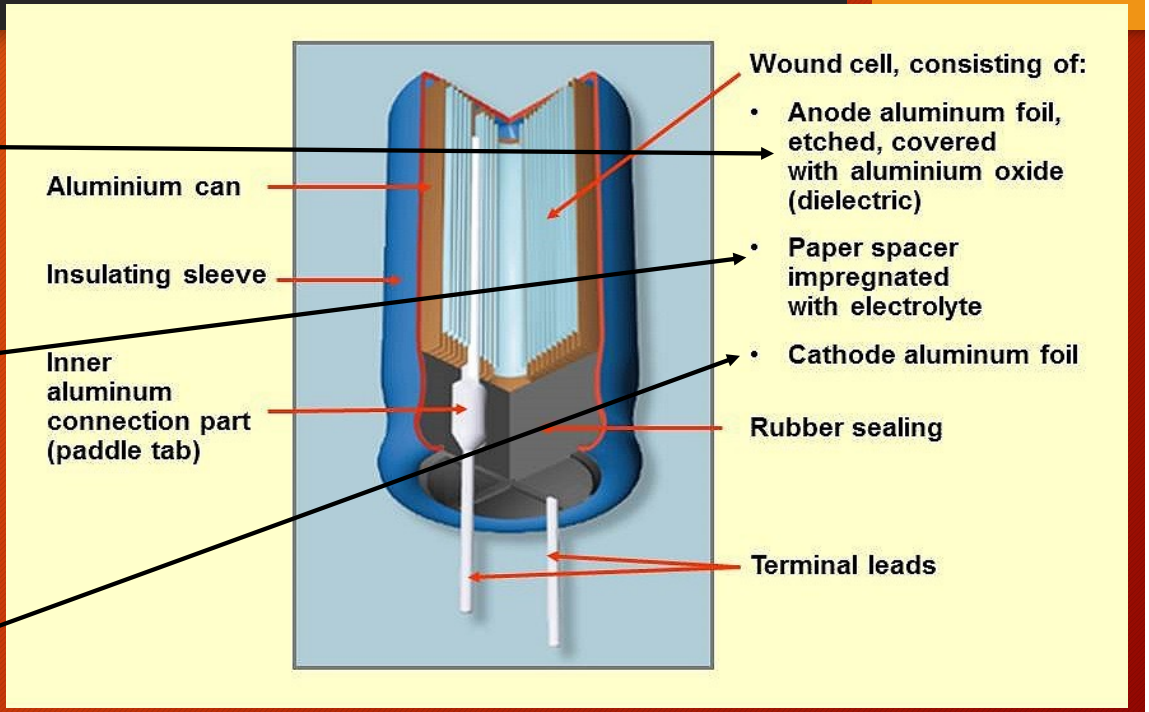


- How are Electrolytic Capacitors constructed?
- You did not cover Back EMF from relays.

# How does an Electrolytic Capacitor Work



- An electrolytic capacitor has a positive plate made of a metal that forms an insulating oxide layer through anodization.
  - The oxide layer acts as the dielectric of the capacitor.
- The electrolyte covers the surface of this oxide layer, serving as the cathode or negative plate of the capacitor.
  - The electrolyte can be solid, liquid, or gel
- A Second metal layer surrounds the electrolyte to make the electrical connection




https://en.wikipedia.org/wiki/Electrolytic_capacitor

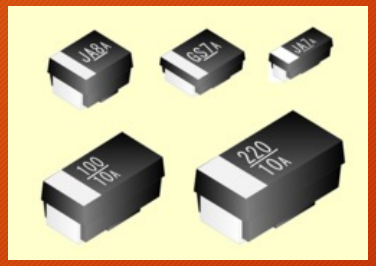
# Types of Electrolytic Capacitors



- Aluminum,
  - These are the ones that leak

- Tantalum

- Niobium




| Electrolytic capacitor family | Electrolyte |
|---|---|
| Aluminium-electrolytic capacitor etched foils | Non-solid, organic electrolyte, e.g. GBL, DMF, DMA, |
| | Non-solid, e.g. borax, glycol |
| | Non-solid, water based |
| | Solid, polymer |
| | Hybrid, polymer and non-solid |
| Tantalum electrolytic capacitor, sintered anode | Non-solid, sulfuric acid |
| | Solid, manganese dioxide |
| | Solid, polymer |
| Niobium oxide-electrolytic capacitor sintered anode | Solid, manganese dioxide |
| | Solid, polymer |

# Back EMF from Inductors



- When relays are connected to electronic circuits, we must protect against the voltage spike that is caused when the relay is de-energized
- The coil of the relay stores electromagnetic energy
- When the relay is de-energized, the electromagnetic field calapses and generates a volage of opposite polarity to the voltage that energized the relay
- This voltage is called Back Electromagnetive Force or Back EMF
- We protect against this by placing a diode across the relay in opposite polarity to the energizing voltage (See next slide)

# Back EMF protection



- With the button open, transistor, Q1 has base current that results in Q2's base be zero volts and relay is off
- When the button is closed, Q1 has zero base current that results in the base of Q2 having current flow and closes the relay
- When the button is released, the diode prevents the back emf from getting greater than 0.7 volts and protects Q2