Power Supply Design

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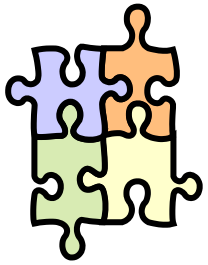
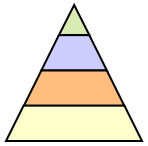
A brief overview of how the obvious is not quite so self-evident.





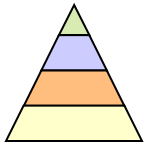
Begin with a **system-level** set of requirements, necessarily including:

1. An existing system that needs powering, typically expressed as a high-level **block-diagram**. Team activity!
2. A power budget:
   - Identifies supply voltages and maximum currents.
   - Specifications for each supply “rail”:
     - Efficiency requirements.
     - Form-factor considerations.
     - Heat Dissipation.
     - Regulation and noise.
     - Safety and reliability.
3. Team schedules a power system **concept design review**.

⇒ This leads to a preliminary engineering design.

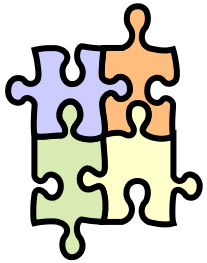
Engineering Design Considerations

1. **Voltage or Current Sources.**
   Most supplies are voltage sources; fixed or adjustable.
2. **Efficiency**.
   Linear regulators; Switching regulators.
3. **Power-On** and **Power-off** transient behavior.
   Sequencing of several "rails".
   Minimum or maximum voltage rise times.
4. **Power Dissipation**.
   Hardware layout and heat-sink; see NSC 1980 heat flow app note.
5. **Stability**: Regulation; Tolerance.
   Noise regulation.
6. **Use of Appropriate Diodes**.
   Schottky or silicon?
   Recovery time.
7. **Analog and Digital isolation**.
   Ground loops and proper attention to bypassing.



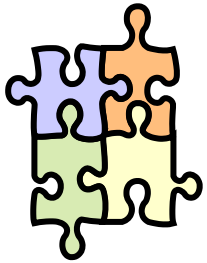
Design References

1. AN-556 *(Introduction to Power Supplies.)*
2. AN-1148 *(Linear Regulators)*
3. Heatsinks *(Important heatflow analysis basics)*
4. AN-1229 *(SIMPLE SWITCHER© PCB layout guidelines)*
5. AN-1118 *(Bipolar 12V supply from +5V)*
6. AN-1149 *(Switching layout guidelines)*
7. AN-1197 *(Selecting inductors for switching regulators)*
8. AN-118 *(Novel circuit provides polar 12V from +5V)*



Example Components

1. LM317 *(Classic adjustable linear regulator)*
2. LP2950/51 *(Low-power linear LDO's)*
3. LM3670 *(1MHz ultra low power buck switcher)*
4. 11DQ05/6 *(Schottky diodes)*
5. 1N581X *(Schottky diodes)*
6. LM25XX *(Three single-sheet buck examples)*
7. Triacs *(Thyrister example)*



Student Power Budget Examples

1. Ex-1a *(Glove Mouse 123A.)*
2. Ex-1b *(Glove Mouse 123B)*
3. Ex-2 *(Greenwharf 123B)*
4. Ex-3 *(Lex 123B)*
5. Ex-4 *(Radar Bird Detector 123B)*