* Temperature control for electronics
  + θJC is thermal resistance between Junction and Case1
    - Lower thermal resistance is better to prevent overheating
  + Passive systems
    - Coatings/tapes2
      * Absorptivity and Emissivity controlled
      * Optical Solar Reflectors (OSRS)
      * MLI Blankets
      * Flexible OSR Tapes
      * Radiators can also be coated
    - PCB embedded heat pipes2
      * Rely on phase change
      * Part of the electrical design
    - Thermal straps2
      * Copper or graphene
      * Used commonly in CubeSats due to its flexibility in transferring heat
    - Radiators
  + Active systems
    - Cryocoolers2
      * Very effective, but very heavy (~4kg)
    - Thermal Storage2
      * Phase Change Materials (PCMS) store energy with minimal temperature change
* Processors and Microcontrollers
  + MSP430 Series
    - Low power, efficient microcontrollers frequently used for small satellites3
    - MSP430FR59694
  + STM32 Series5
  + RISC-V Series
    - OBC-Cube-Polar6
* Battery Choice
  + Ni-Cd Batteries
    - Nickel cathode, Cadmium Anode
    - Electrolyte: Potassium hydroxide
    - Advantages: Lightweight, cheap
    - Disadvantages: Overcharging/overheating risk
  + NiH2 Batteries
    - Advantages: Safe overcharging/discharging, higher specific energy
    - Disadvantages: High self-discharge rate, low volumetric energy density, high-pressure storage needed
  + Li-ion Batteries
    - Advantages: Dense energy, long lifetime, wide operating temperatures
    - Disadvantages: Internal resistance at low temperatures

#### References

1 [Junction-to-Case Thermal Resistance in Thermal Design - Technical Articles](https://www.allaboutcircuits.com/technical-articles/junction-to-case-thermal-resistance-in-thermal-design/)

2 Young, J. A. C. (2023). **Next-generation CubeSats and SmallSats thermal control subsystem**. In *Thermal Systems Engineering*. Blue Canyon Technologies, Lafayette, CO, United States.

3 **Candidate Cubesat Processors** Steven M. Guertin, JPL NASA

4 [N7 Space](https://n7space.com/index.php/msp-taste-toolchain/)

5 [Microcontroller for Cubesat: STM32F407 and More 2022 Embedded Technology Information EmbedIc](https://www.embedic.com/technology/details/microcontroller-for-cubesat--stm32f407-and-more-2022)

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