DCU hardware design rules in pursuit of ISO standards

* **Traceability and Documentation:** Tools that enable comprehensive design documentation and change history tracking to satisfy ISO 9001 and IATF 16949 compliance.
* **Component Selection:** Use libraries that include ISO-certified and AEC-Q100 qualified components for automotive-grade reliability.
* **Design for Reliability:** Tools supporting robust design practices like controlled impedance, thermal management, redundant circuits, and EMI suppression.
* **DFM and DFT Features:** Ability to perform Design for Manufacturing and Design for Test analyses to minimize defects and ensure manufacturability within ISO-managed processes.
* **Validation and Verification:** Integrations that facilitate simulation, signal integrity analysis, and electrical rule checks necessary to verify compliance with safety standards like ISO 26262.
* **Workflow Integration:** Support for quality management processes, project management, and engineering change orders enforced by ISO systems.

Enclosure:

121 pin aluminum housing (like the one from Gtake) OEM Part NO: JO121-1 from JORCH can be found on ali express, and sometimes amazon complete with the connector.

Processor: TMS320F2838x

Dev board: TMS320F28388D controlCARD

PCB design guidelines

1. **Component Orientation and Placement**
   * Align similar components in the same direction for easier inspection and assembly.
   * Space inductors apart and orient them at right angles to reduce crosstalk.
   * Separate analog and digital components physically.
   * Keep high-power or tall components spaced to optimize heat dissipation and soldering quality.
2. **Lead Placement to Prevent Coupling**
   * Avoid placing leads close together to reduce magnetic coupling.
   * Align return current paths near main paths and provide holistic grounding under leads.
3. **Signal Routing**
   * Use multiple vias (2–4) for layers carrying high current to improve reliability and thermal dissipation.
   * Place power and ground planes on inner layers for shielding and controlled impedance.
   * Route traces as short and straight as possible, alternating vertical and horizontal directions for different layers.
   * Consider vibration, mass and mechanical strain.
4. **Thermal Management**
   * Use copper planes and thermal vias to dissipate heat from high-power components.
   * Apply heatsinks and thermally conductive pads where needed.
   * Choose high Tg materials for boards in elevated temperature environments.
   * Consider thermal mass, nearby components, and the direction of heat flow.
5. **Design Rule Checks (DRC)**
   * Perform frequent DRCs to ensure correct spacing, connectivity, and rule adherence for manufacturability and electrical integrity.
6. **Adhere to Automotive Design Standards**
   * Follow standards like IATF 16949, IPC-6012 Class 3, AEC-Q100, and SAE J3016 for reliability, quality, and safety.
   * For example, maintain hole position accuracy within 100 microns and proper drill size to dielectric thickness ratios.
7. **Grounding and Through-Hole Mounting**
   * Use plated and grounded mounting holes to support grounding and reduce impedance issues.
8. **Optimize RF Circuits**
   * Use linear front-end devices and high-performance RF filters.
   * Minimize interference by proper component selection and placement.
9. **Good Grounding Practices**
   * Establish single-point grounding and continuous low-impedance ground regions.
   * Watch out for ground loops
10. **Prevent Electromagnetic Interference (EMI)**

* Minimize loop areas, use magnetic shielding, and route leads rationally.
* Use differential pairs and increase power filtering with decoupling capacitors.
* Use communication protocols like CAN bus to reduce wiring complexity and interference.