

1. Product Context (Dummy)

Product: Smart Environmental Monitoring Device

Company: ABC Technologies

Target Volume: 10,000 units/year

Use Case: Indoor & outdoor monitoring

Lifetime: 5 years

2. Design for Manufacturing (DFM) Rules

Goal: Reduce manufacturing complexity and cost

1. Use **standardized components** (resistors, capacitors, connectors) available from multiple suppliers.
2. Limit PCB layers to **≤ 4 layers** unless signal integrity requires more.
3. Maintain a **minimum trace width ≥ 6 mil** for manufacturability.
4. Avoid tight mechanical tolerances below **±0.1 mm** unless critical.
5. Prefer **snap-fit enclosures** over screws where structural strength allows.
6. Design parts to be **symmetrical** where possible to avoid orientation errors.

3. Design for Assembly (DFA) Rules

Goal: Minimize assembly time and errors

1. Reduce total number of parts; target **≤ 20 unique components**.
2. Use **one-directional assembly** (top-down preferred).
3. Minimize fasteners; if required, use **one screw type and size**.
4. Design connectors to be **keyed and polarized**.
5. Ensure all manual assembly steps can be completed in **<30 seconds per unit**.

4. Design for Cost (DFC) Rules

Goal: Control BOM and production costs

1. Target BOM cost **≤ 40% of product selling price**.
2. Avoid custom parts unless they reduce cost elsewhere.
3. Select materials with **stable long-term pricing**.
4. Minimize PCB area to reduce fabrication cost.
5. Avoid over-specification of components (e.g., temperature range beyond requirement).

5. Design for Reliability (DFR) Rules

Goal: Ensure long-term dependable operation

1. All components must operate within **70% of rated limits**.
2. Provide **ESD protection** on all external interfaces.
3. Use conformal coating for outdoor or humid environments.
4. Design thermal paths to keep junction temperatures **<85°C**.
5. Avoid moving parts where possible.

6. Design for Testability (DFT) Rules

Goal: Enable easy production and field testing

1. Provide **test points** for all critical signals and power rails.
2. Ensure test points are accessible without disassembly.
3. Implement **self-test firmware** on boot.
4. Support **UART or USB diagnostic interface**.
5. Target **>95% fault coverage** in production tests.

7. Design for Serviceability (DFS)

Goal: Simplify repair and maintenance

1. Product should be openable with **standard tools only**.
2. Modularize design (battery, PCB, enclosure separable).
3. Allow replacement of common failure components in **<10 minutes**.
4. Provide clear labeling and orientation marks.
5. Maintain backward compatibility for replacement modules.

8. Design for Sustainability (DFX-S)

Goal: Reduce environmental impact

1. Use **RoHS and REACH-compliant** materials.
2. Avoid permanent adhesives where recycling is required.
3. Mark plastic parts with material codes.
4. Optimize packaging to reduce volume and waste.
5. Target **≥80% recyclable materials by weight**.

9. DFX Compliance Checklist (Dummy)

DFX Area	Status	Notes
DFM	✓	PCB optimized
DFA	✓	Reduced fasteners
DFC	⚠	BOM slightly high
DFR	✓	Thermal verified
DFT	✓	Test points added
DFS	✓	Modular design
Sustainability	⚠	Packaging improvement needed