FMEA Analysis Report
ESP32-C6 Development Board

Failure Mode and Effects Analysis
for Electronic Circuit Board

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Executive Summary

This FMEA analysis evaluates the ESP32-C6 Development Board circuit design to identify potential failure modes and assess associated risks. The analysis examined 15 components across 5 subsystems.

Key Findings

Metric	Value	Status
Total Failure Modes Analyzed	2	■ Attention
Critical Risk Modes (RPN ≥ 300)	2	■ Attention
High Risk Modes (125 ≤ RPN < 300)	0	✓ Good
Average RPN Score	357.0	■ Attention

System Overview

Development board featuring ESP32-C6 microcontroller with USB-C interface

Subsystems

• **USB-C Interface**: USB-C connector with ESD protection

• **Power Supply**: 5V to 3.3V linear regulation

• **ESP32-C6 MCU**: Main microcontroller with WiFi/BLE

• **Debug Interface**: Programming and debugging header

• **Status LED**: User indication LED

FMEA Analysis Table

ID	Component	Failure Mode	Effect	S	O	D	RPN	Risk
1	USB-C Connector	Solder joint failure	Loss of power/data	9	6	7	378	Critical
2	AMS1117	Thermal shutdown	System power loss	8	7	6	336	Critical

Risk Assessment Matrix

Risk Level	RPN Range	Count	Action Required
Critical	≥ 300	2	Immediate action required
High	125-299	0	Action required before production
Medium	50-124	0	Monitor and improve if feasible
Low	< 50	0	Acceptable risk level

Recommendations

Priority Actions

• **USB-C Connector** - Solder joint failure: Add mechanical support and thicker copper pours

• **AMS1117** - Thermal shutdown: Improve thermal management with vias and copper pour

General Recommendations

• Implement design review process with focus on high-RPN items

• Establish component derating guidelines (50-80% of maximum ratings)

• Add test points for critical signals to improve detection capability

• Implement thermal analysis and management for power components

• Establish incoming inspection procedures for critical components

• Document lessons learned and update FMEA regularly