Parametric Enclosure Design and Tolerance Stack-Up

Anderson Innovations — Technical Whitepaper

Abstract

This note documents our process for moving a breadboard-stage embedded prototype into a manufacturable, 3D-printed enclosure without loss of thermal or electrical margin.

1. From Breadboard to Board

Custom circuits are first validated on breadboard with a microcontroller and instrumented power rails, then transferred to a parametric CAD model whose dimensions are driven by measured component geometry.

2. Clearance and Tolerance

Connector cutouts, standoff heights and lid interfaces are computed from a documented tolerance stack-up that accounts for printer process variation, material shrink and assembly fit class.

3. Thermal and Acoustic Considerations

Vent geometry and internal volume are sized against measured dissipation. For voice-reactive devices, microphone porting and internal reflection paths are treated as design parameters.

4. Conclusion

Parametric models make the enclosure a computed consequence of the electronics rather than an afterthought, compressing hardware iteration to days.