CASE STUDY

Design Review

A leading provider of heating, air conditioning, and refrigeration services and products contracted a new supplier for the manufacture of two motor speed drivers for residential and light commercial heat pump applications. This was the first electronic design developed/manufactured for the client by this particular supplier.

The client hired Ansys-DfR to perform a design review of the two motor speed drivers manufactured by their new supplier.

/ Approach

Ansys-DfR focused its assessment on clearly defining reliability goals, performing product qualification tests, and determining if the supplier's product design aligned to electronic industry best practices for optimum reliability performance.

/ Use Environment

Ansys-DfR gathered short-term ambient temperature data from the National Oceanic and Atmospheric Administration (US CLIM Data) to determine worst-case maximum temperature use environment for residential and light commercial heat pump applications. Additionally, Ansys-DfR compared electrical use environment specifications against industry standards using ANSI standard C84.1 (2011) and ITIC data.

/ Circuit Analysis

Ansys-DfR reviewed the motor speed driver circuit boards in respect to component de-rating, function, ESD, and EMC layout. In addition, Ansys-DfR performed a component stress analysis and reviewed critical components such as chip resistors, chip capacitors, electrolytic capacitors, film capacitors, and the printed board for common failure risk factors.

/ Design for Manufacturability

Ansys-DfR analyzed the device packaging, hole spacing, conformal coating material and package, solder material, and part placement to determine if the designs met manufacturability best practices.

/ Design for Reliability

Ansys-DfR used Sherlock Automated Design Analysis software to assess design reliability under vibration, mechanical shock, and thermal cycling (based on diurnal temperature variation).

/ Testing (Design Verification and Product Qualification)

Ansys-DfR reviewed the customer's qualification plan regarding its four subsections (reliability, electrical, environmental, and mechanical testing) to determine if the design and manufacturing processes of the supplier were sufficiently robust for a 15-year product lifetime.

/ Results

The Ansys-DfR design review analysis provided the client with critical insight into the reliability risk of taking on the new supplier, actionable recommendations to improve the supplier designs and increase the life cycle of the product, and qualification test recommendations to validate vendor reliability claims. The issues identified included low voltage margins in the circuit analysis, coupling between choke modes , material placement and selection in conflict with industry best practices, and inadequate mechanical support of the circuit board given the intended operational environment.

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