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INTRODUCTION

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All electronics contain; semiconductor devices, capacitors and other components that are vulnerable to thermally accelerated failure mechanisms. Thermal design becomes vital to improving the reliability of any design. Unfortunately, thermal design can be very difficult because of the mathematical analysis of fluid dynamics for complex geometries. Although this will remain true for the foreseeable future, this application note will cover the basics of thermal design for DC-DC converters using a simplified resistor model of heat transfer. We will focus on the thermal design for the semiconductor devices, but all of these techniques can be applied to other components. The resistor model is very useful for quickly estimating
your design requirements, such as the PCB size and whether airflow is required. Finite element analysis software can then be used to analyze the design in more detail. The listed reference material is home to additional data and many useful thermal calculators, covering material that is beyond
the scope of this application note.

Our discussion of thermal design will begin with the definition of parameters used in datasheets such as θJA and θJC, and end with some rules of thumb for the thermal design of a DCDC converter, including their derivation. An accompanying spreadsheet (see References) uses these derivations to quickly provide a ballpark figure for the thermal performance of your design.

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