Application Note

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MPC8260 PowerQUICC II™ Thermal Resistor Guide

The MPC8260 PowerQUICC II™ is a highly integrated device with an advanced communication processor (CPM), on board SRAM, DMA and a G2 core. The package for the MPC8260 is a 480 ball, 37.5x37.5mm TBGA (tape ball grid array) that provides excellent thermal dissipative properties.

THERM0 and THERM1

There are specific features implemented on the MPC8260 to assist the system designer with thermal management. To determine the actual junction temperature during functional operation, the MPC8260 has two dedicated pins (AA1[THERM0] and AG4[THERM1]). These pins tie directly to an internal resistor that has a value that varies linearly with temperature. The typical resistor value is approximately 900 ohms at room temperature and increases to approximately 1175 ohms at 105°C. The actual value for the resistor varies from device to device but the linear relationship between temperature and resistance is consistent. To accurately measure the junction temperature, the thermal resistor must be characterized as a function of temperature for each device. The thermal resistor is intended for engineering development only; not for control of fans or any other thermal management operation.

Procedure

The procedure for determining the actual junction temperature during device operation is simple. A limited amount of equipment is needed for this procedure: a multimeter capable of resistance measurements, a temperature meter with a thermal couple that can be placed near the MPC8260 device and a method for obtaining a controlled ambient temperature for the application using the MPC8260. The temperature meter is only needed to improve accuracy of the characterization. If the method for achieving ambient temperature is accurate then this equipment is unnecessary. Refer to Figure 1.

To measure the junction temperature, do the following:

1. Provide a means to attach a Digital Multimeter between the Therm0 and Therm1 pins. Set the meter to resistance measurement mode. The accuracy of the digital multimeter does not significantly influence these measurements.
2. Set the ambient temperature and measure the associated resistance; see Table 2 for a list of typical ambient temperatures to measure. No power should be applied to the MPC8260 or the system.

3. Record the resistance values at each ambient temperature. Note that it is necessary to wait a sufficient time for the thermal mass to achieve equilibrium. It is not uncommon to wait 30 minutes between temperatures before taking resistance measurements.
4. Set the ambient temperature to the system-specified requirements. Provide power to the MPC8260 device and measure the thermal resistor after waiting for the thermal mass to achieve equilibrium.
5. Plot the non-powered thermal resistance measurements (Y-axis) as a function of temperature (X-axis) and fit a linear function to the points.
6. Plot the resistance data points for the powered device and project horizontally to the right until it meets the previously characterized non-powered thermal resistance line. At the point where the lines meet, drop to the X-axis to read the junction temperature of the MPC8260 during a powered condition. Figure 2 represents an example of this type of analysis. In this example, an ambient of 75°C resulted in 105°C device junction temperature.

Table 1. Signal Definition for Thermal Resistor

Signal	Ball Location	Function
Therm0	AA1	Ties to internal thermal resistor
Therm1	AG4	Ties to internal thermal resistor

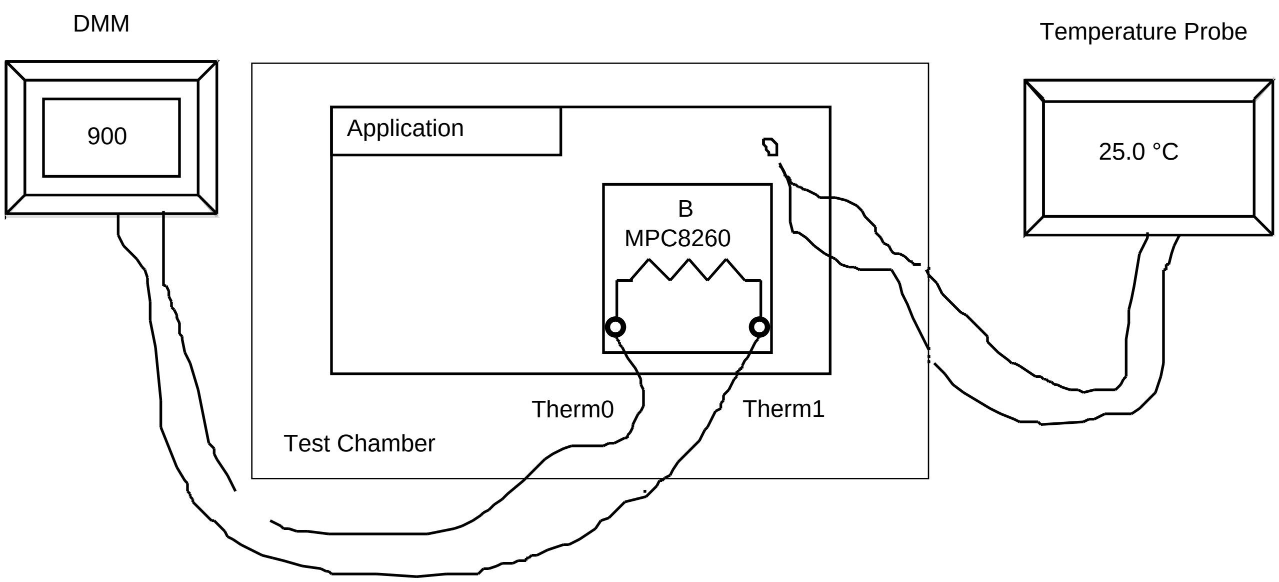
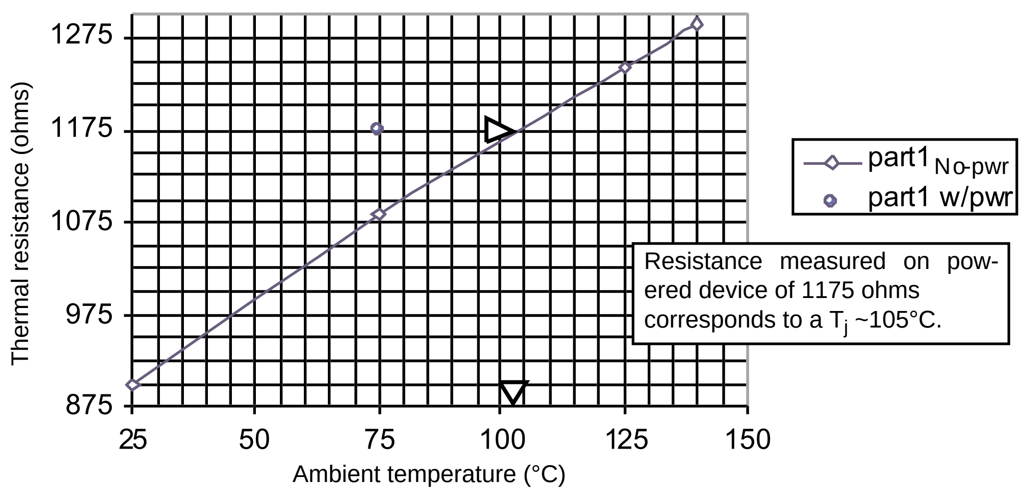


Figure 1. Diagram of Thermal Measurement Setup

Table 2. Worksheet for Recording Resistance Measurements vs. Temperature

Component Serial No.	System ID	Non-Powered Measurements in Ω				Powered Measurements in Ω	
		25°C	50°C	75°C	100°C	System Specification	70°C



In this example, linear fit equation for the non-powered measurements is y = 3.3784x + 820.

Figure 2. PowerQUICC II (HiP3) Temperature Characterization

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