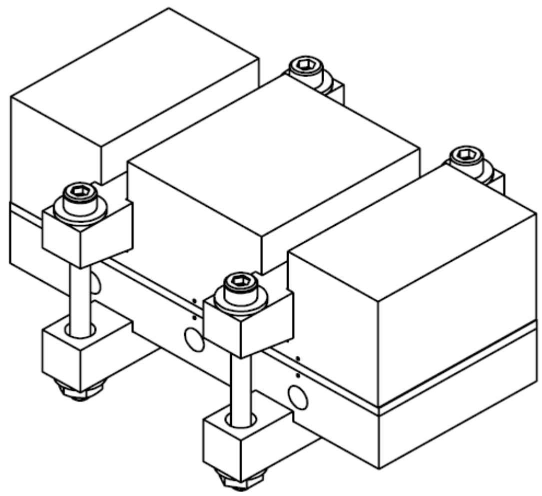
Tflex 300TG Thermal Reliability Report

Summary

The Laird Technologies gap filler reliability test procedure has been designed to characterize the long-term performance of a gap pad while being subjected to isothermal conditions, repeated extremes in temperature, and moderate heat - high humidity environments. Specimens are placed within application-related fixtures under set conditions and at regular intervals the thermal properties of the specimens are measured.

Fixture Setup

The test fixture is rectangular with dimensions of 2” x 5” (surface area of 10 in^2). It consists of an aluminum heater plate and an extruded aluminum heat sink “cooler plate”. The heater plate contains 3 holes for insertion of cartridge heaters. Both plates contain 3 sets of thermocouple holes drilled for measurement of the temperature very near the surfaces mated by the gap pad. Each test fixture accommodates 3 test positions. The heater and cooler plates are held together by metal straps which span the width of the plates (2 sets per test fixture) and are bolted to each other. Cartridge heaters are inserted into the heater plate holes. A specified power from a power supply is input to the heaters to obtain a constant 70^0C across the heater plate. This will ensure a constant heat flow is maintained through the gap filler during data acquisition. A cooling fan is centered on top of the heat sink during testing to facilitate realistic air flow and cooling. Test values are measured in an ambient laboratory environment.



Theory

The data being collected during this testing is the temperature difference between the surfaces of the heater and cooler plate. Thermal resistance (R_{th}) is defined as the temperature difference (ΔT) between two surfaces for a given heat flow (ΔP). That is: $R_{th} = \Delta T / \Delta P$. In this testing, heat flow is controlled and constant, therefore, $R_{th} \alpha \Delta T$. This relationship indicates that a constant value of ΔT throughout the test program requires R_{th} to also remain constant, indicating a highly reliable system and thus a gap pad that is not influenced by the test conditions.

Types of Reliability Testing

Thermal Shock
In thermal shock testing, the test fixtures containing the specimens are transitioned between -40^{0}C and 160^{0}C with a 1 hour hold to reach thermal equilibrium at each temperature extreme. The transfer time between the oven temperatures is quick, typically less than 20 seconds. 1000 cycles “Shocks” are performed on each fixture.

Isothermal Bake
In isothermal bake testing, fixtures are maintained at 160^{0}C for 1000 hours.

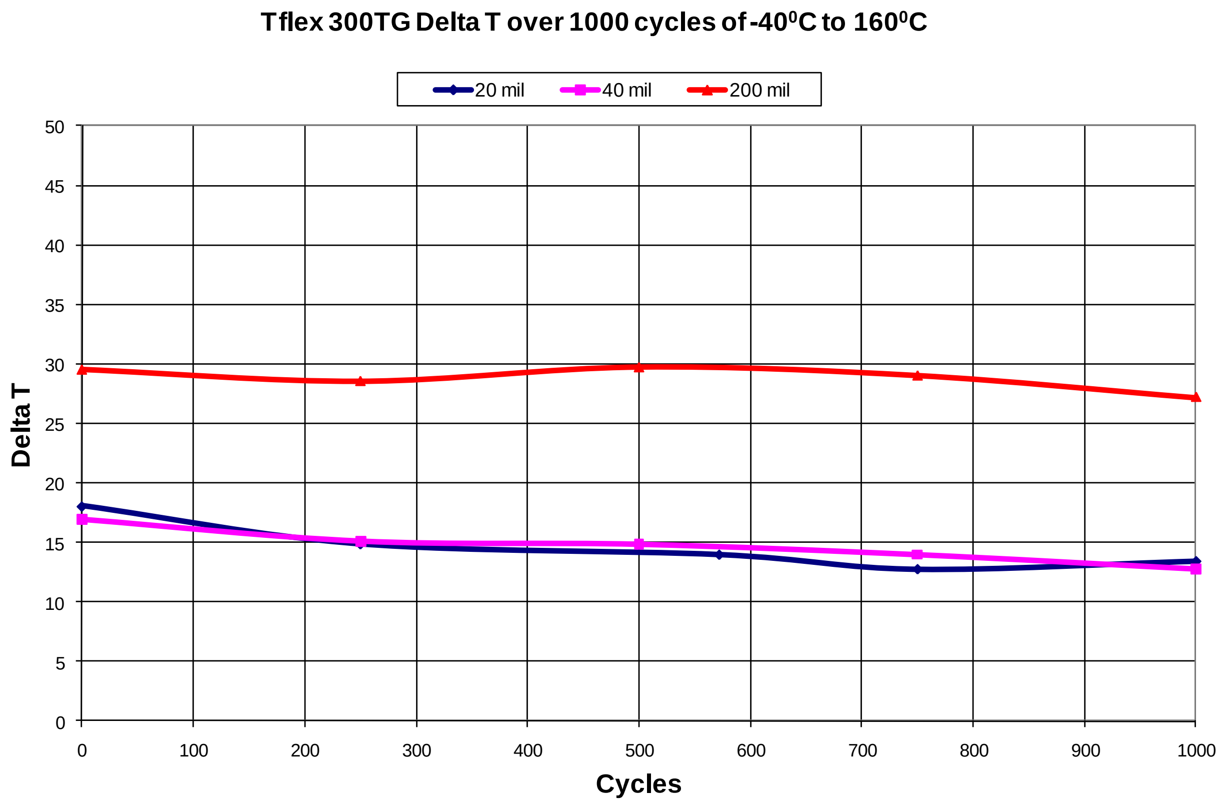
HAST
In HAST testing, the fixtures are maintained in conditions of moderate temperature (85^{0}C) and high humidity (85%) for the duration of the test.

Results

The thicknesses of Tflex 300TG tested were 20mil (0.508mm), 40mil (1.016mm), and 200mil (5.08mm). Two fixtures for each thickness were assembled and tested for all three reliability testing types (3 test positions for each unit). The data reported is the average of each value for the two fixtures.

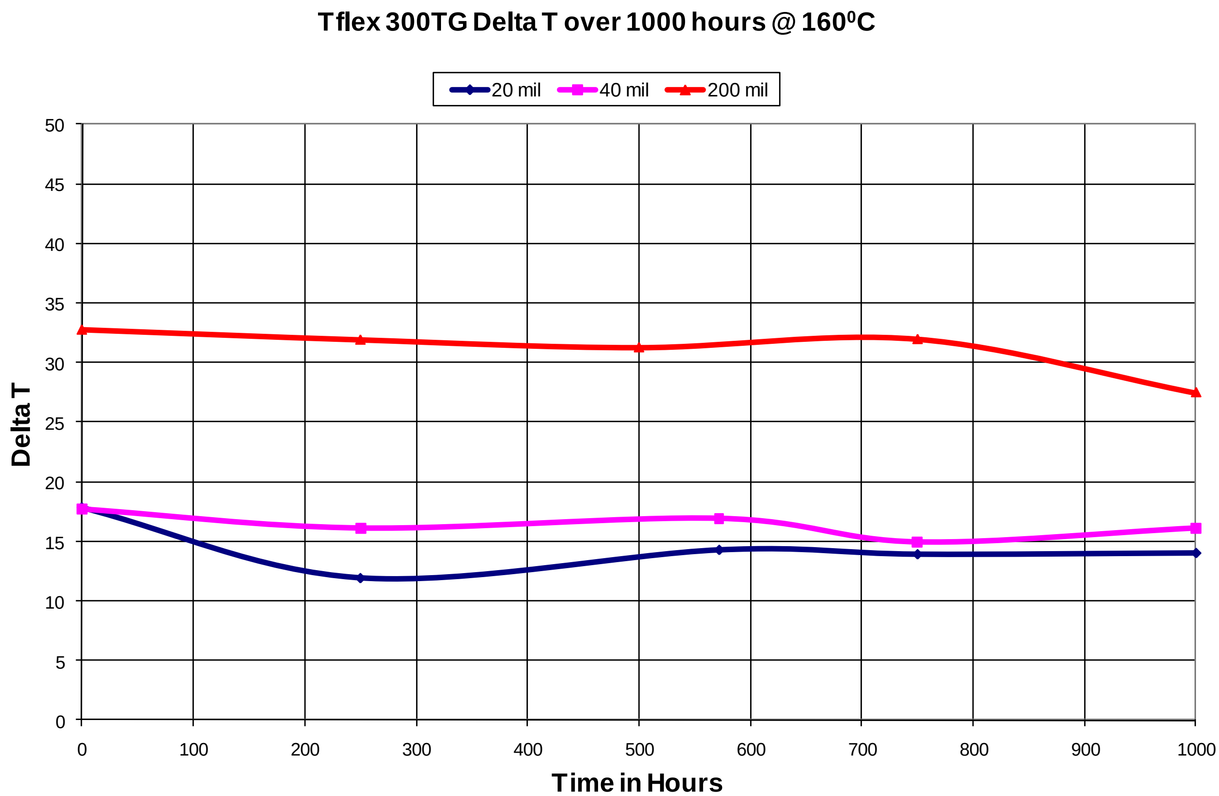
The change in temperature (ΔT) vs. time / # of cycles tested is reported below:

Thermal Shock



Material	Cycles	Avg ΔT
Tflex 320TG	0	18.05
	250	14.88
	500	14.00
	750	12.78
	1000	13.45
Tflex 340TG	0	16.97
	250	15.12
	500	14.85
	750	13.97
	1000	12.75
Tflex 3200TG	0	29.52
	250	28.55
	500	29.72
	750	29.02
	1000	27.20

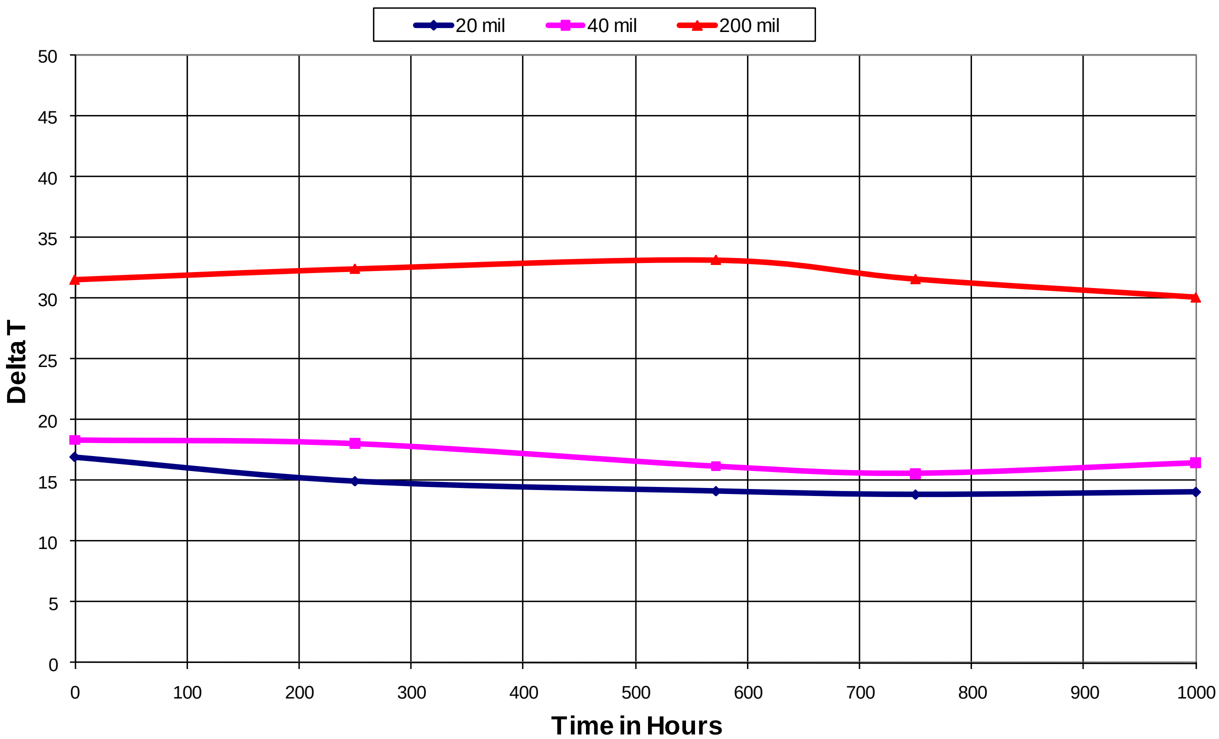
Isothermal Bake



Material	Hours	Avg ΔT
Tflex 320TG	0	17.85
	250	11.92
	500	14.28
	750	13.92
	1000	14.02
Tflex 340TG	0	17.68
	250	16.12
	500	16.92
	750	14.97
	1000	16.12
Tflex 3200TG	0	32.78
	250	31.93
	500	31.28
	750	31.98
	1000	27.48

HAST

Tflex 300TG Delta T over 1000 hours @ 85⁰C/85% Humidity



Material	Hours	Avg ΔT
Tflex 320TG	0	16.97
	250	14.97
	500	14.15
	750	13.87
	1000	14.08
Tflex 340TG	0	18.37
	250	18.07
	500	16.18
	750	15.60
	1000	16.47
Tflex 3200TG	0	31.53
	250	32.43
	500	33.17
	750	31.58
	1000	30.07

Conclusion:

The graphs and data show that Tflex 300TG performed on average better at the end point for Thermal Shock, Isothermal Bake, and HAST testing than at Time T_0. The ΔT was reduced 19.40%, 15.48%, and 10.67% respectively during the duration of testing. This small decrease in ΔT is most likely due to the pads natural ability to wet-out the surfaces in which it is in contact with. This wetting effect is caused by the pad filling the microscopic voids on the surfaces of the heat-generating component and heat sink. For instance, if the heat sink was placed atop the component without a thermal interface material, these small irregularities will not be filled, and the overall ΔT would be higher. Based upon this data, no thermal degradation was evidenced and therefore, it is shown that Tflex 300TG will continue to perform as designed in applications under harsh environmental conditions similar to those tested.

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9/18/2009

Revision Log

Rev	Summary of Change	Requested By	Approval Date
A	Initial Release	Michael Craig	11/09/09
ARAS-A	No Change - Load to ARAS	J. Rozycka	09/23/2015