



Honeywell Thermal Interface Materials Reliability Report

PTM6000

Rev.D

Honeywell



Executive Summary

Honeywell PTM6000, a high thermal conductive Phase Change Material (PCM) in pad format, was designed to minimize thermal resistance at interfaces and has the great excellent long term reliability.

Based on a novel polymer PCM system, this material exhibits excellent wetting at interfaces during typical operating temperature range, resulting in very low surface contact resistance.

A proprietary filler material provides high thermal conductivity $4.4\text{W/m}\cdot\text{K}$ and a low thermal impedance ($<0.10^\circ\text{C cm}^2/\text{W}$), suitable for high performance IC devices.

Conclusion :

PTM6000 has excellent thermal stability after different long term reliability tests including HAST 192hrs, T/C-B 4000x and High Temperature Baking 3000hrs.

Introduction

- **Purpose**

- This test is intended to provide the thermal performance stability data of Honeywell Thermal Interface Material via different accelerated conditions.

- **Test Method**

- Thermal Impedance via Laser Flash Test (ASTM E1461)

- **Test Procedure**

- 12x12mm standard dimension TIM is prepare for TI test.
- Measure TI data before and after each test read point.

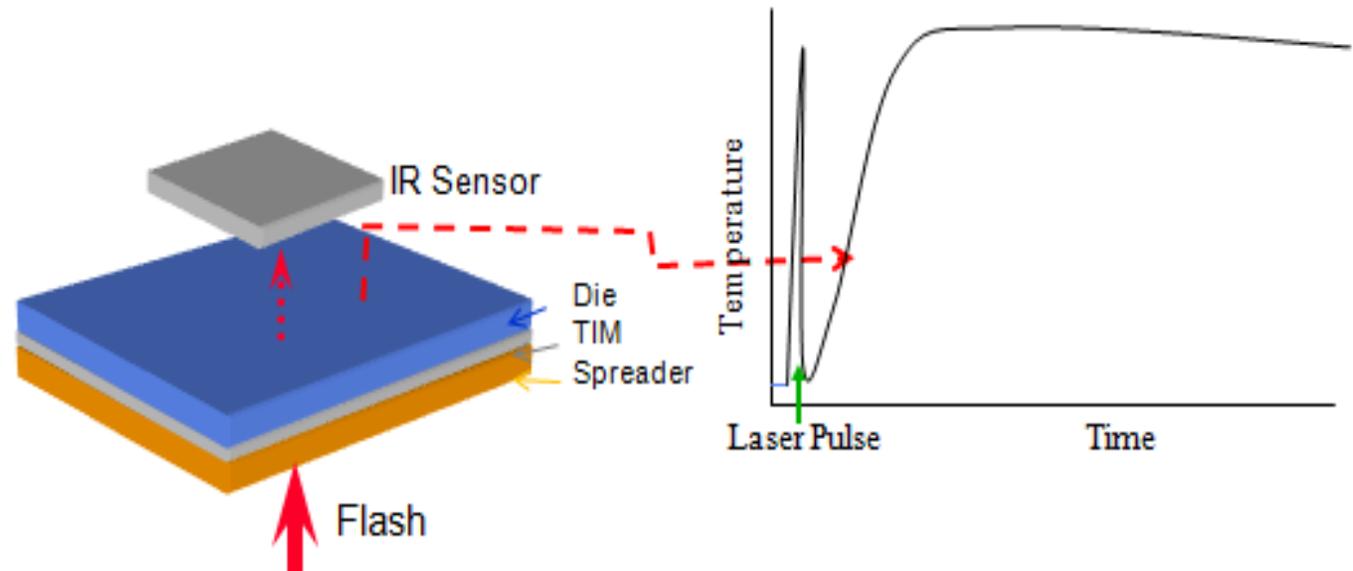
- **Test Items/Condition**

- Highly-Accelerated Stress Test (HAST) 240hrs
- Temperature Cycling Test 4400x
- High Temperature Baking Test 3400hrs

Thermal Impedance Test Method: Laser Flash



Netzsch Laser Flash™



- **TIM performance between Sandwich structure**

- Includes the CTE mismatch
- includes actual surface finish

- **Typical coupons:**

- 0.5"X0.5"X0.02"

- **ASTM E1461**

- *Determines Thermal Diffusivity*
- *Thermal Conductivity/Resistance Calculated*

$$k = (\alpha)(C_p)(\rho)$$

k = Thermal Conductivity (W/cmK)

α = Thermal Diffusivity (cm²/s)

C_p = Specific Heat Capacity (J/gK)

ρ = Density (g/cm³)

Reliability Test Condition

- **Highly-Accelerated Stress Test (HAST)**

- Standard: JESD22-A110-B
- Testing Condition: 130 °C, 85%RH, **240 hours**
- Chamber supplier: ESPEC EHS-411M
- Objective: Accelerate corrosive impact of high humidity and temperature on the thermal performance of the test structure



HAST chamber

- **Temperature Cycling Test**

- Standard: JESD22-A104C
- Testing Condition: -55 °C to 125 °C (TCB), **4400cycles**
- Chamber supplier: ESPEC EGNZ12-7.5CWL
- Objective: Determine the resistance of TIM to extremes of high and low temperatures, and its ability to withstand cyclical stresses



TC chamber

- **High Temperature Baking**

- Standard: JESD22-A103
- Testing Condition: 150 °C, **3400 hours**
- Oven supplier: BINDER
- Objective: Accelerate changes in TIM's material and performance characteristics relative to prolonged and elevated temperature

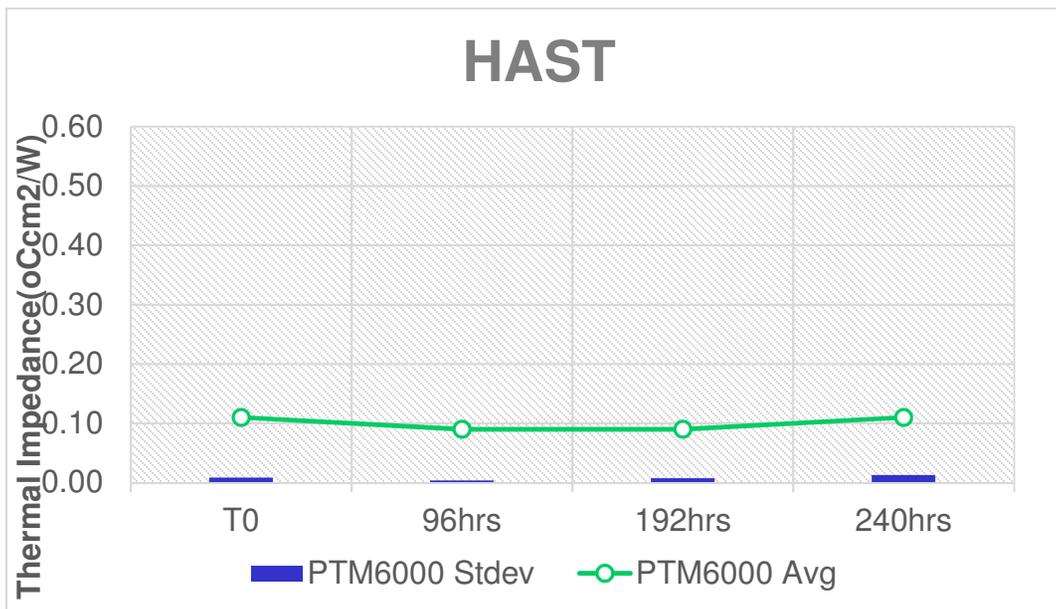


Oven

Highly-Accelerated Stress Test (HAST)

Test Condition: 130 °C, 85%RH, 240 hours

- Standard: JESD22-A110-B
- Testing Condition: 130 °C, 85%RH, 240 hours
- Objective: Accelerate corrosive impact of high humidity and temperature on the thermal performance of the test structure
- Sample size: 8 pcs samples.



HAST chamber

PTM6000 remain reliable up to 192hrs for HAST

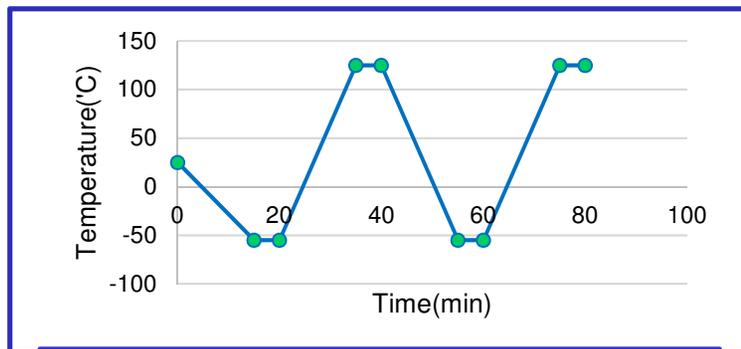
Temperature Cycling Test Testing

Test Condition: -55~+125 °C, 4400 cycles

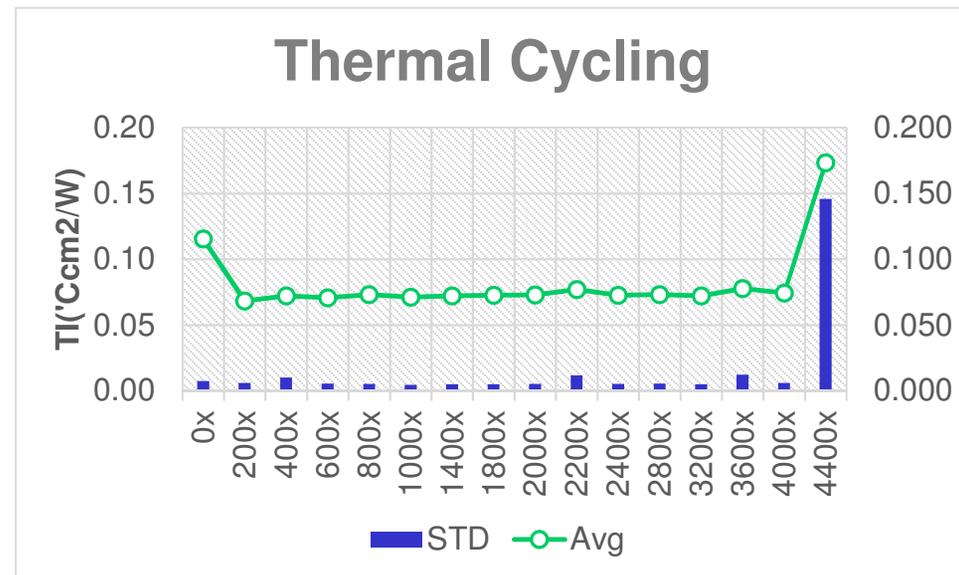
- Standard: JESD22-A104C
- Testing Condition: -55 °C to 125 °C (TC-B), 4400 cycles
- Objective: Determine the resistance of TIM to extremes of high and low temperatures, and its ability to withstand cyclical stresses
- Sample size: 8 pcs samples.



TC chamber



- Ramp time: 15mins
- Dwelling time @ -55°C and 125°C: 5mins
- Every cycle: 40mins

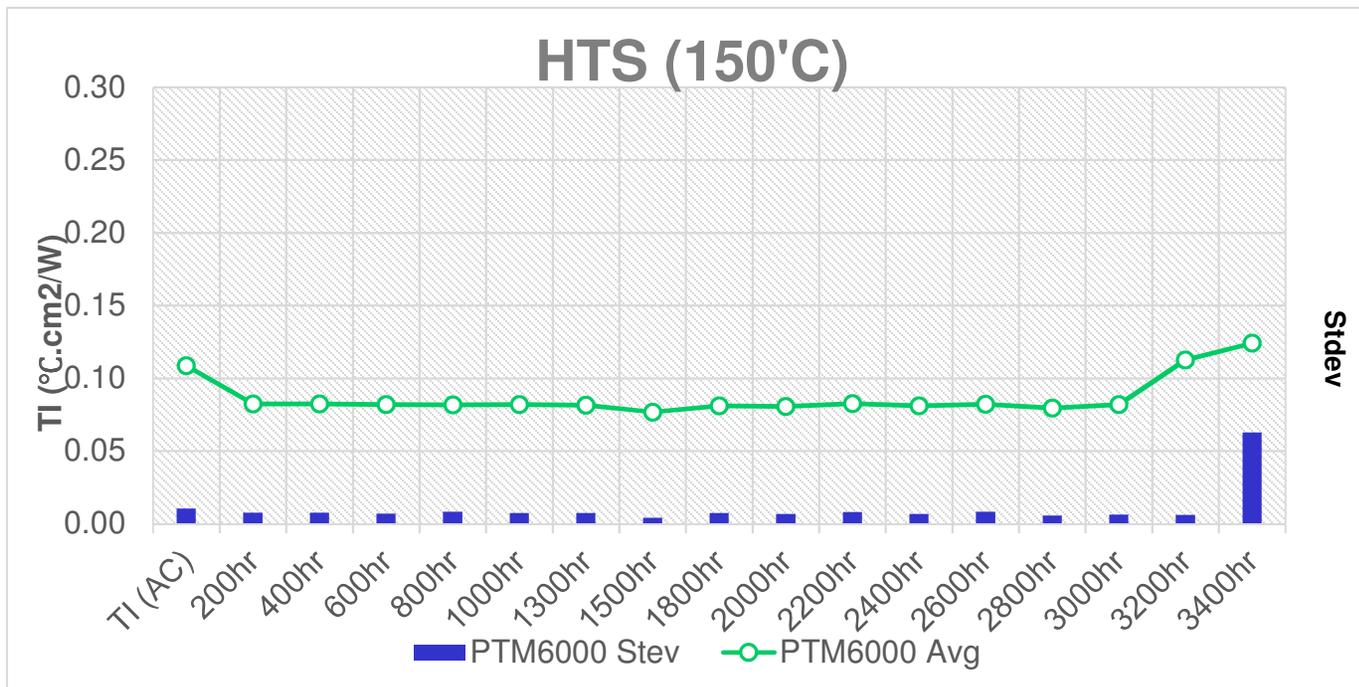


PTM6000 remain reliable up to 4000 cycles for thermal cycling test

High Temperature Baking

Testing Condition: 150 °C, 3400 hours

- The samples were placed into the test chamber at 150 °C for 3400 hours. After the 200 hours, the sandwich samples were taken out and left at room temperature. Measurements of the samples for each were taken after a minimum of 2 hours. The process was repeated every 200hrs to 3400 hours.
- Sample size: 8 pcs samples.



PTM6000 remain reliable up to 3000hrs for 150C baking

THANK YOU

Honeywell

www.honeywell.com