Honeywell Thermal Interface Materials

Reliability Report

PTM7000

Rev.F

Honeywell

Executive Summary

Honeywell PTM7000, 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 6.5W/m ·K and a low thermal impedance (<0.06˚C cm^2/W), suitable for high performance IC devices.

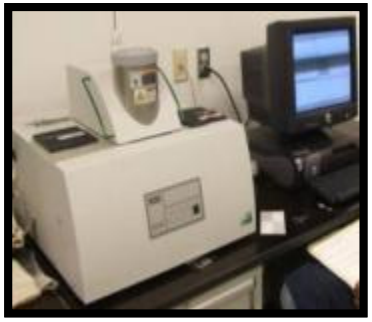
Conclusion :

PTM7000 has excellent thermal stability after different long term reliability tests including HAST 96hrs and High Temperature Baking 1000hrs, T/C-B 1000cycles .

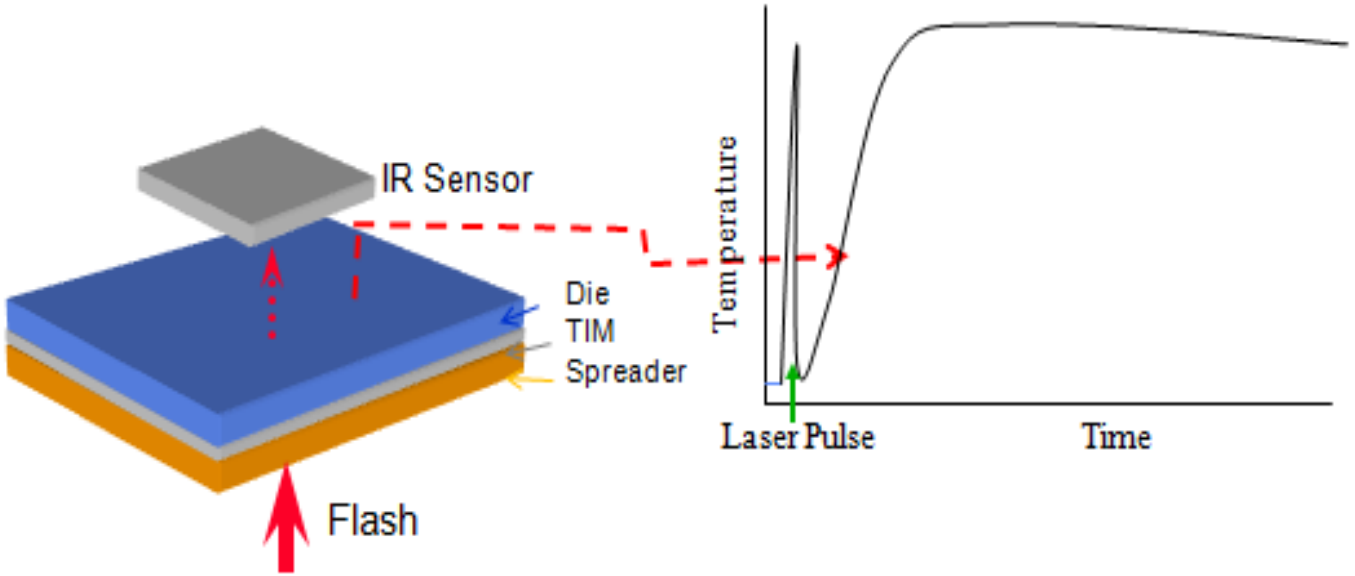
Introduction

- **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.
  - TIM is applied both Cu plates as sandwich structure.
  - 35 psi pressure pre-applied on the sandwich structure before test.
  - Measure TI data before and after each test read point.
- **Test Items/Condition**
  - Highly-Accelerated Stress Test (HAST) 96hrs
  - Temperature Cycling Test 1000x
  - High Temperature Baking Test 1000hrs

Thermal Impedance Test Method: Laser Flash



Netzsch Laser Flash™



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

k = Thermal Conductivity (W/cmK)
α = Thermal Diffusivity (cm^2/s)

$$\alpha = 0.13879L^2 / t_{1/2}$$

L=specimen thickness, meter

$t_{1/2}$=the time required for the temperature rise to reach 50% percent of ΔTmax

Cp = Specific Heat Capacity (J/gK)
ρ = Density (g/cm^3)

ASTM E1461

- **Thermal Impedance Both Ni-plated Cu Surfaces**
  - Includes the CTE mismatch
  - Includes actual surface finish
- **Typical Coupons:**
  - Ni-plate copper, 0.5”X0.5”X0.03”
- **Suitable for Accelerated Life Test**

Reliability Test Condition

- **Highly-Accelerated Stress Test (HAST)**
  - Standard: JESD22-A110-B
  - Testing Condition: 130°C, 85%RH, **96 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), **1000cycles**
  - 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

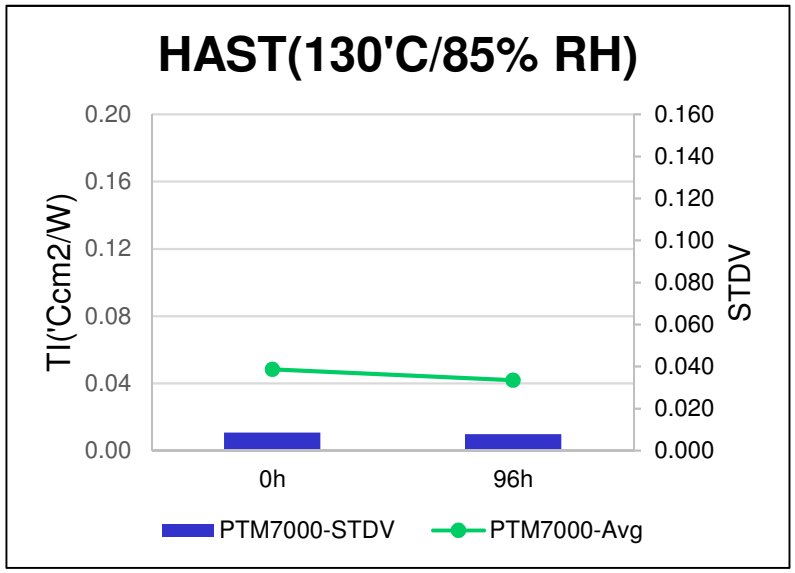
- **High Temperature Baking**
  - Standard: JESD22-A103
  - Testing Condition: 150°C, **1000 hours**
  - Oven supplier: BINDER
  - Objective: Accelerate changes in TIM's material and performance characteristics relative to prolonged and elevated temperature

Oven

Highly-Accelerated Stress Test (HAST)

Test Condition: 130℃, 85%RH, 96 hours

- Standard: JESD22-A110-B
- Testing Condition: 130℃, 85%RH, 96 hours
- Objective: Accelerate corrosive impact of high humidity and temperature on the thermal performance of the test structure
- *Sample size: 4 pcs samples*.



HAST chamber

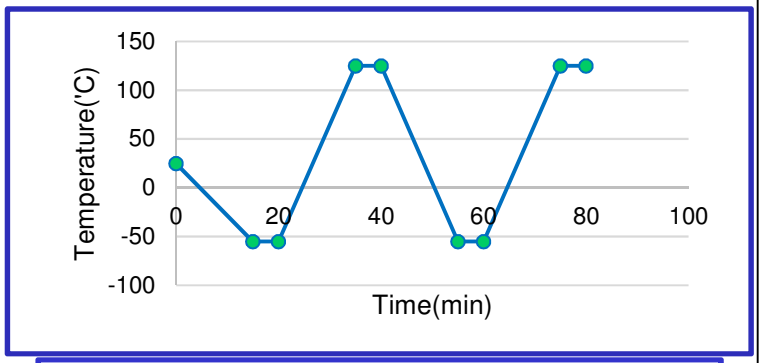
PTM7000 remain reliable up to 96hrs for HAST

Temperature Cycling Test Testing

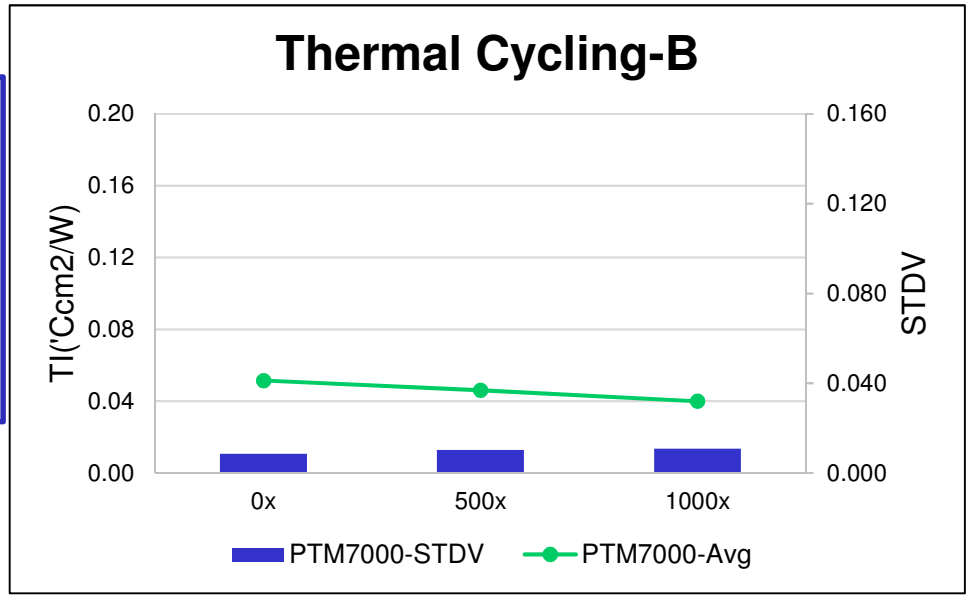
Test Condition: -55~+125℃, 1000 cycles

- Standard: JESD22-A104C
- Testing Condition: -55°C to 125°C (TCB), 1000 cycles
- Objective: Determine the resistance of TIM to extremes of high and low temperatures, and its ability to withstand cyclical stresses
- *Sample size: 4 pcs samples*.

TC chamber



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

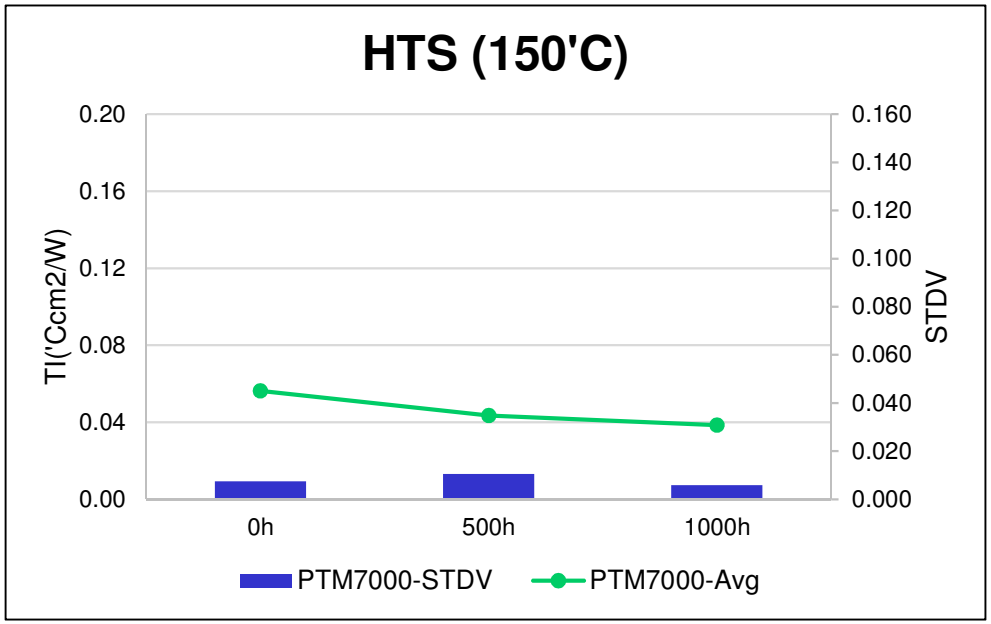


PTM7000 remain reliable up to 1000 cycles for thermal cycling test.

High Temperature Baking

Testing Condition: 150℃, 1000 hours

- The samples were placed into the test chamber at 150℃ for 1000 hours. After the 500 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 500hrs to 1000 hours.
- *Sample size: 4 pcs samples*.



Oven

PTM7000 remain reliable up to 1000hrs for 150°C baking

THANK YOU

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