



Honeywell Thermal Interface Materials Reliability Report

PTM7950

Rev.C

Honeywell



Executive Summary

Honeywell PTM7950, 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 $8.5\text{W/m}\cdot\text{K}$ and a low thermal impedance ($<0.04^\circ\text{C cm}^2/\text{W}$), suitable for high performance IC devices.

Conclusion :

PTM7950 has excellent thermal stability after different long term reliability tests including HAST 96hrs and High Temperature Baking 1000hrs, T/C-B 1000cycles and D85(85°C, 85%RH) 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.
- 35psi pressure pre-applied on the sandwich structure before test, but use 10psi pressure for D85.
- Measure TI data before and after each test read point.

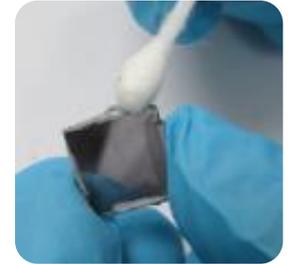
- **Test Items/Condition**

- Highly-Accelerated Stress Test (HAST) 96hrs
- Temperature Cycling Test 1000x
- High Temperature Baking Test 1000hrs
- 85°C & 85%RH 1000hrs

Test Procedure – Sandwich Structure



Turn on the oven and set the temp as 90°C before sample preparation.



Use EA and clean wiper to clean all Cu plates.



Clean the surfaces of Cu plate with EA, especially for the surfaces which contact samples, then put Cu plates into the 90°C oven for 5 min and cool Cu plates well.

Test Procedure – Sandwich Structure

#4



Measure the thickness of all Cu plates.

#5



Paste one sample with size 10 x 10mm on the center of Cu plate, press it to stick on well and cover another Cu plate on the sample.

#6



Put the sandwiched samples into the fixture with 35psi and fasten it.

Note: For D85's sample preparation, decrease the pressure of fixture to 10psi.

Test Procedure – Sandwich Structure

#7



Take vertically the fixture with sample into 90C oven for 60 min.

#8



Take out the sample after 60min, room temperature to cool the samples for 20 min, clean up the sandwiched samples and test the thickness and measure the final thickness of sandwiched sample.

#9

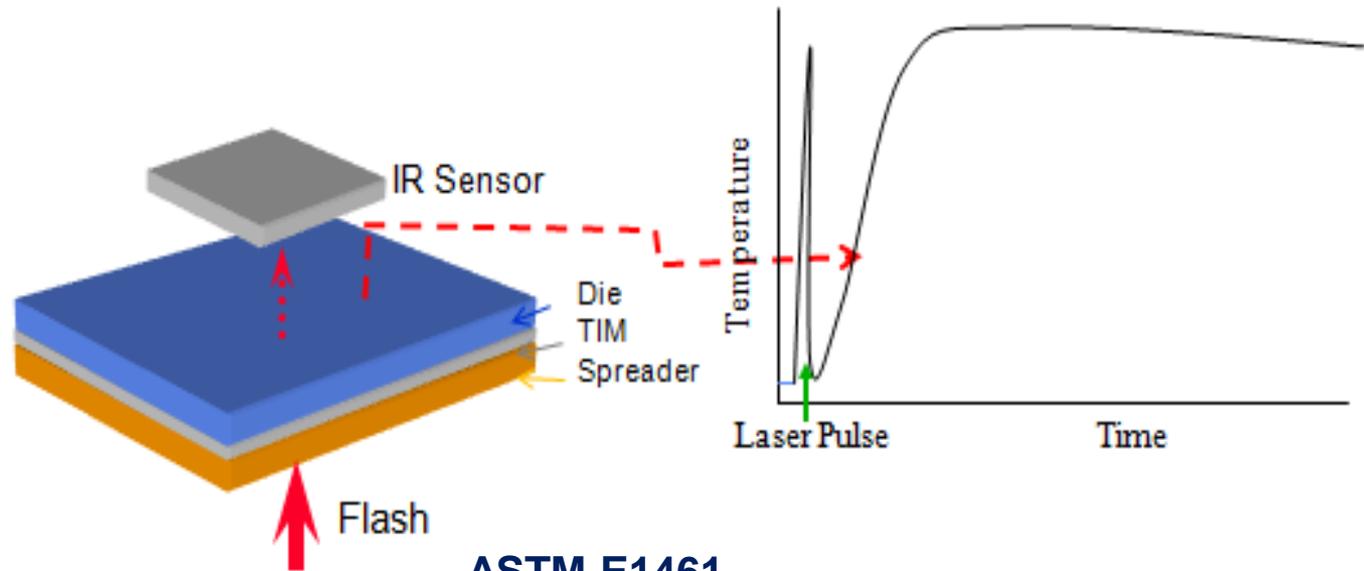


Spray the graphite spraying on both surface of sample with thin thickness, after the solvent dry out, test time zero TI with laser flash.

Thermal Impedance Test Method: Laser Flash



Netzsch Laser Flash™



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

k = Thermal Conductivity (W/cmK)

α = Thermal Diffusivity (cm²/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 ΔT_{max}

C_p = Specific Heat Capacity (J/gK)

ρ = Density (g/cm³)

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

Reliability Test Condition

- **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

- **85°C & 85%RH (D85)**

- Standard: IEC61215
- Testing Condition: 85°C, 85%RH, **1000 hours**
- Chamber supplier: ESPEC
- Objective: Accelerate corrosive impact of high humidity and temperature on the thermal performance of the test structure

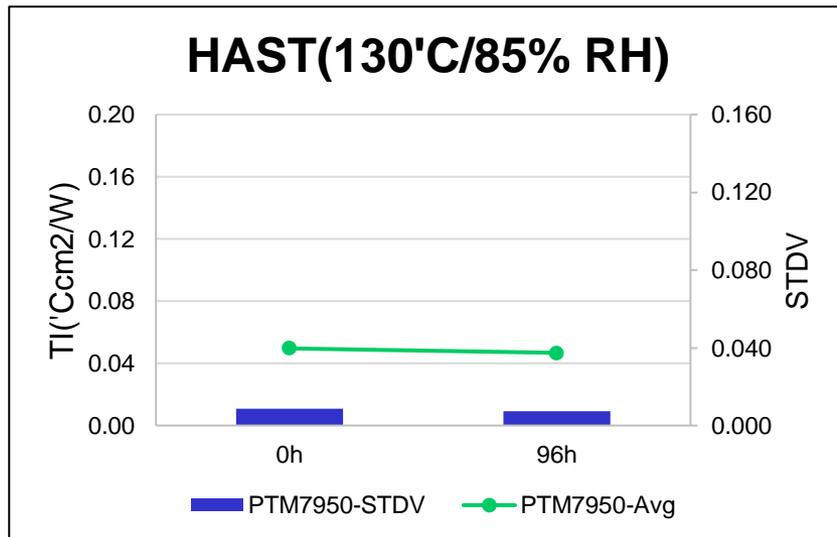


TH D85 chamber

Highly-Accelerated Stress Test (HAST)

Test Condition: 130°C, 85%RH, 96 hours

- Standard: JESD22-A110-B
- Testing Condition: 130°C, 85%RH, 96 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

PTM7950 remain reliable up to 96hrs for HAST

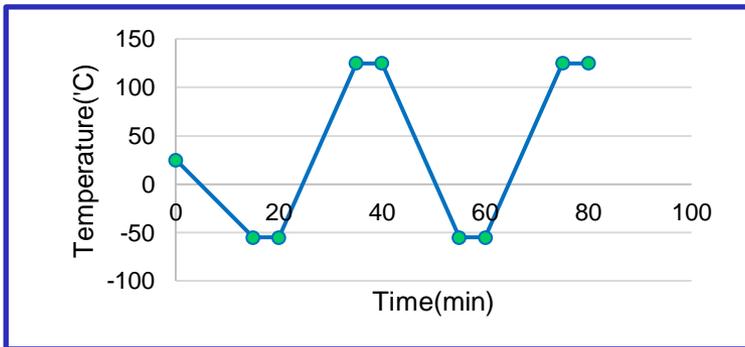
Temperature Cycling Test Testing

Test Condition: -55~+125°C, 1000 cycles

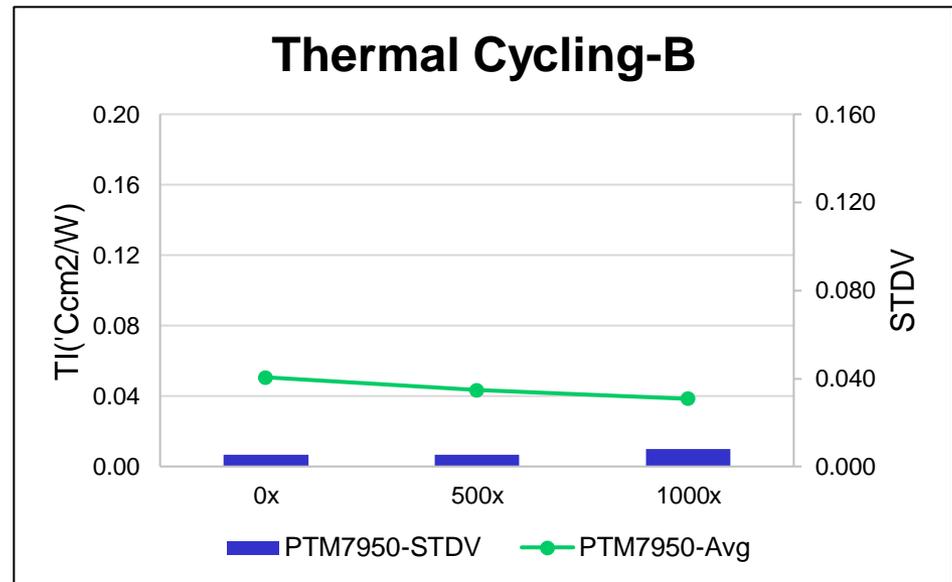
- Standard: JESD22-A104C
- Testing Condition: -55°C to 125°C (TCB), 1000 cycles
- Objective: Determine the resistance of TIM to extremes of high and low temperatures, and its ability to withstand cyclical stresses
- Sample size: 8 pcs samples.



TC chamber



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

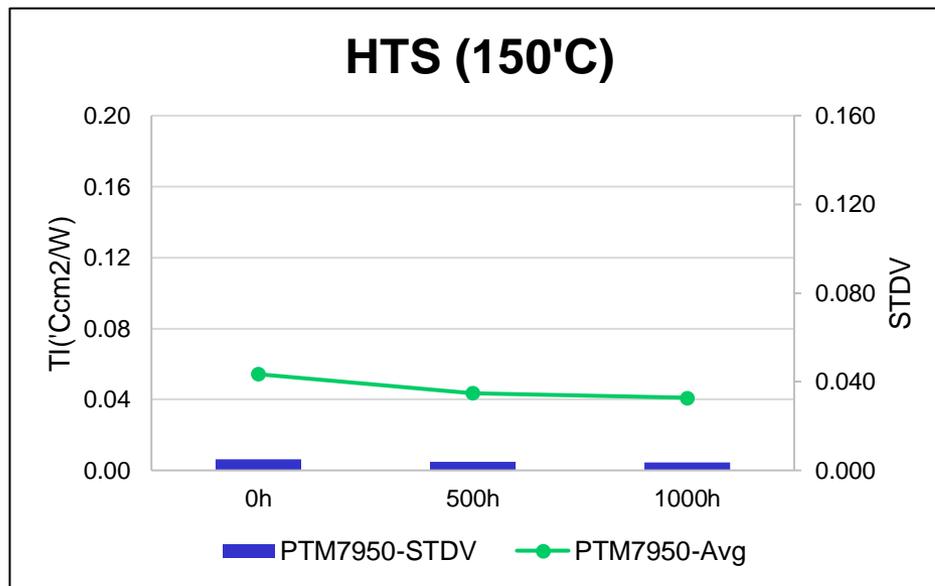


PTM7950 remain reliable up to 1000 cycles for thermal cycling test.

High Temperature Baking

Testing Condition: 150°C, 1000 hours

- The samples were placed into the test chamber at 150°C 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: 8 pcs samples.

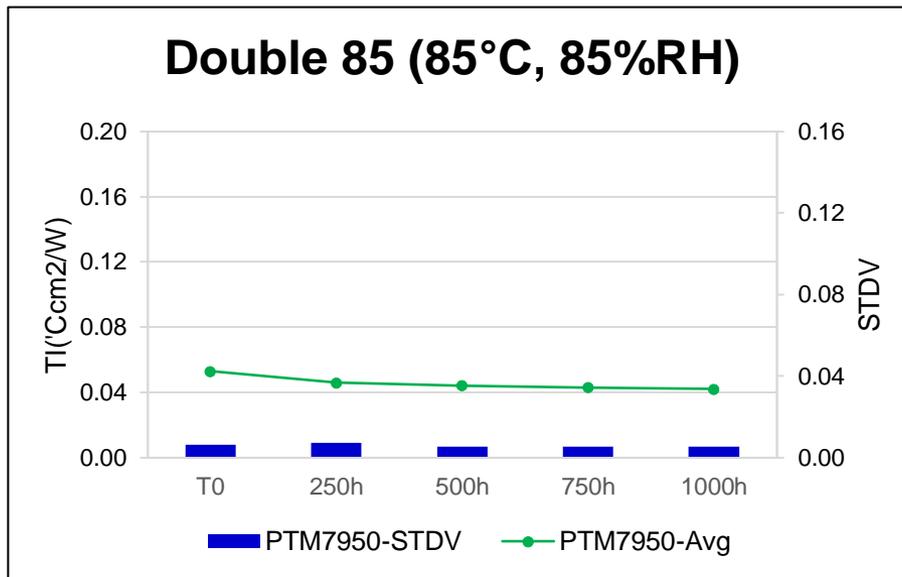


PTM7950 remain reliable up to 1000hrs for 150°C baking

85°C & 85%RH (D85)

Testing Condition: 85°C & 85%RH, 1000 hours

- Standard: IEC61215
- Testing Condition: 85°C, 85%RH, **1000 hours**
- Objective: Accelerate corrosive impact of high humidity and temperature on the thermal performance of the test structure
- Sample size: 8 pcs samples.



TH D85 chamber

PTM7950 remain reliable up to 1000hrs for D85

THANK YOU

Honeywell

www.honeywell.com