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Tool-Less Thermal Tool Thermal Interface Material Holder and Package Pusher

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INTRODUCTION

- Test systems at Intel labs utilize TT's (Thermal Tools) in automation or alternatively manual MoW (Mode of Work)
- Equipment engineers, who design the systems for testing, are required to design for high quality performance, with minimal sustaining time between Intel products
- Two necessary conditions are needed to run thermal tests; PKG (Package) electrical activation and TT coupling to enable temperature control during testing
- TIM (Thermal Interface Material) is being used as an intermediate layer between TT pedestal and unit die in order to lower thermal contact resistance

CHALANGES

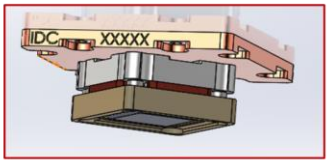
- Previous thermal solutions whether automated or manual MoW included separate mechanisms for PKG load actuation, TT coupling, and TIM retention
- The use of these separate mechanisms increases assembly/disassembly and sustaining time from product to product. It also increases costs, and creates a non-uniform TIM placement

SOLUTION

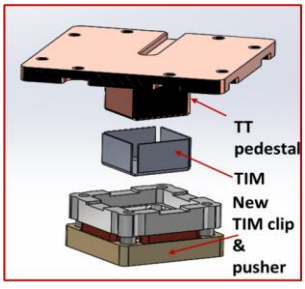
- A new user friendly plug and play concept was developed to contain all the above-mentioned in one structure, as shown below
- Advantages of these solutions:
  - Tool-less structure
  - Easy to assemble/disassemble
  - Ejects unit from pedestal on deactivation
  - Easily scales for all product sizes
  - Minimal parts to deal with quick transition from product to product
  - Off the shelf elastic material used for force application
  - Enables uniformly spread TIM on pedestal "nose"
  - Made from PEEK polymer
  - Does not leave marks on PKG due to electrical contact

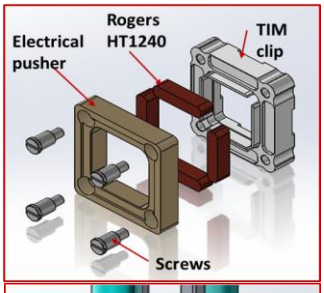
TECHNICAL APPROACH

TT pedestal with TIM clip and pusher mechanism

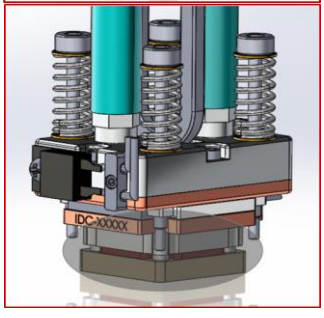


Exploded views





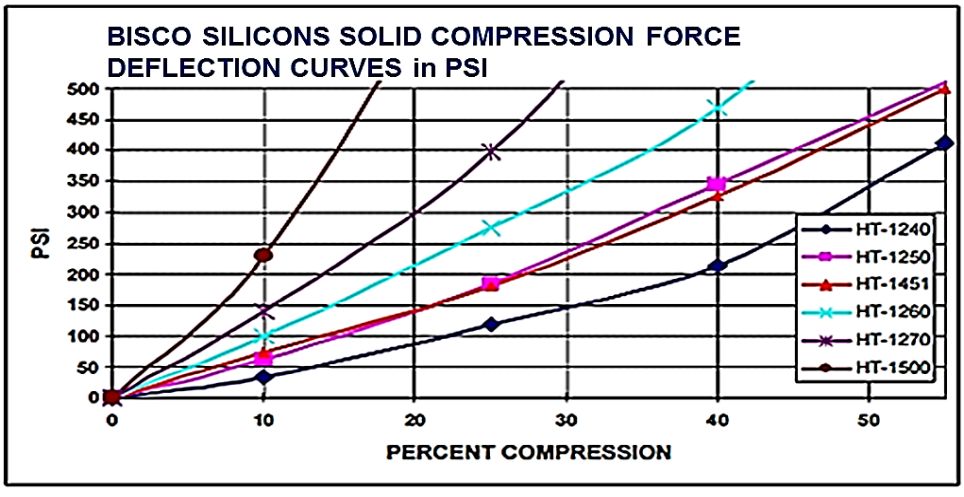
TIM clip and PKG
Pusher mechanical principals



TIM clip and PKG
pusher on LCTT (Liquid Cooling TT)

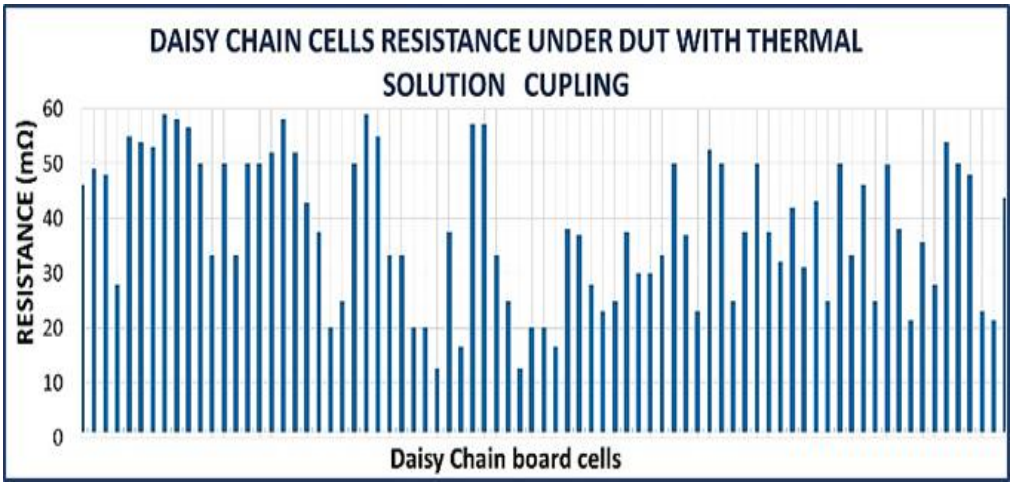
LOAD CLCULATIONS

- External load and the proportion of die/PKG load is dictated from the socket for an appropriate electrical resistance
- PKG loads are applied by utilizing an off the shelf elastic material (Rogers silicon) with well-defined elastic properties
- Theses material behave relatively linearly, as can be seen in the below curves



- Silicon HT 1240; 3.18mm thickness compressed to 2mm applies 45Kgf on a DUT has 1358 pogo-pins (33gr/pin; using Force to Pressure linear formula F [Lbf] = P [PSI] x A [in2])

EXPERIMENTAL RESULTS



SUMMARY

- The solution was tested with liquid cooling TT (LCTT) and air cooling TT (ACTT) on a daisy chain board and a mechanical thermal test vehicle (TTV) DUT with ISC (polymer) socket
- It showed a very good performance, displaying low average electrical resistance below 60 mΩ per ball cell, as required by socket manufacturer
- This solution has proved itself to provide reliable and quality electrical and thermal coupling, while being easy to maintain and operate
- It is currently being used in over 50 different products without failure on LCTT and ACTT in manual and automated MOW with great success in Intel labs
- It usable for product segments from 12x12mm up to 76x56.5mm PKG sizes

Acknowledgments

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