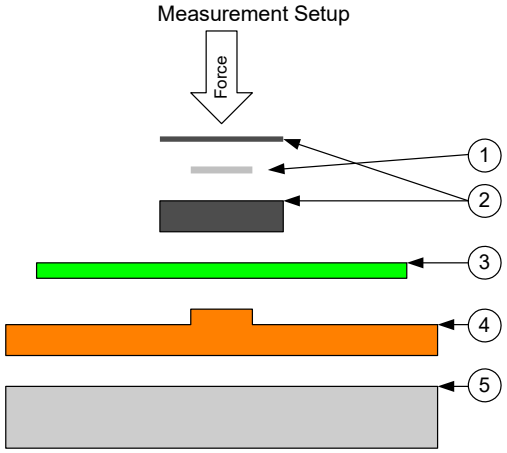
TTC Application: Die Attachment Evaluation

The keys to making good thermal measurements for evaluating, comparing, and monitoring die attachment processes for performance, repeatability, and quality are careful heat flow management and sufficient heat generation. The former requires that nearly all applied heat flows through the die attachment material and the latter requires that enough heat is applied so that small temperature differences in the heat flow path can be measured.

Both requirements can be realized with a Thermal Test Chip (TTC) and the thermal setup shown below. The main setup elements are:

1) The TTC selection is based on:
    a. Must be capable of dissipating enough power to provide sufficient temperature drop across the Die Attachment Material (DAM) to observe performance, repeatability, and quality differences and variations.
    b. Must be small enough to keep evaluation cost low and to minimize DAM application processes variations.
    c. Must be a wire bond version, not a flip chip version, mounted in a suitable Package.
2) The Package must have the following attributes:
    a. An internal high thermal conductivity metallic die paddle area for mounting the TTC.
    b. External access to the die paddle opposite side.
    c. Sufficient wire bond pads to accommodate all the required TTC electrical connections.
    d. An “un-filled” die cavity to minimize direct heat flow from the TTC top surface into the cavity area.
    e. The ability to accept either a metal or silicon cover for protecting the wire bonds and the TTC top surface.
3) The Thermal Test Board (TTB) design addresses the following issues:
    a. Electrical interface between TTC/Package and the measurement circuitry.
    b. Direct thermal access to the external die paddle surface, by virtue of a cutout through the TTB below the Package.
    c. Low thermal conductivity to allow minimal heat flow from the Package into the board.
4) The Heat Sink (HS) design provides:
    a. A protrusion that passes through the TTB to contact the exposed Package die paddle area.
    b. The protrusion/die paddle area should match as closely as possible that of the exposed die paddle area.
    c. The protrusion to surface should be finished to 4,000 grit smoothness.
5) The Cold Plate Should have cooling capacity sufficient to handle the power dissipated in the TTC.



The Force applied to the top of the Package must be sufficient to minimize the thermal interfaces between the bottom of the Package and the top of the protrusion, and between the bottom of the HS and the top of the CP. A drop or two of silicone oil in each interface should be sufficient. The apparatus providing the Force should have minimal heat flow capability.