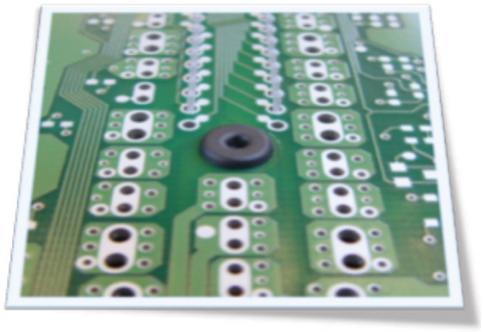
Heat Staking Fundamentals

Staking plastic using heat and pressure

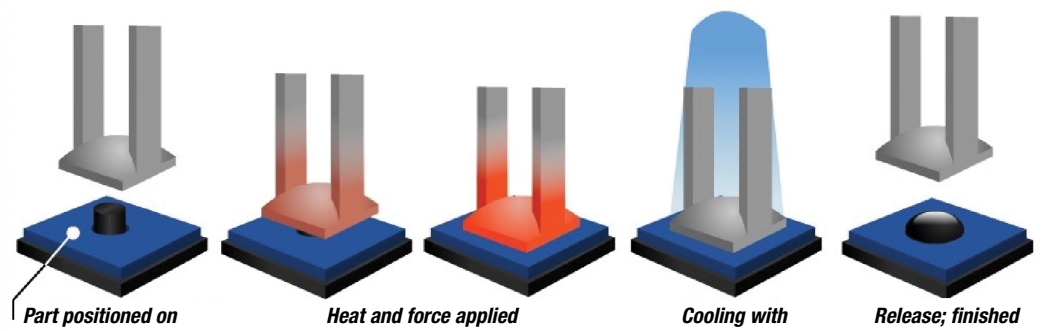
GENERAL PRINCIPLES



Heat staking is a process which utilizes pulsed heat to join two or more parts together where at least one part is made out of plastic. It works by heating a plastic part to just above the glass transition temperature while simultaneously applying force so that it is deformed. The part is then cooled (still under force) to complete the process.

STEP BY STEP:

- The thermode (or “hot bar”), with a defined cavity, comes down on the part (figure 1).
- Force is applied. Once required force is reached, the heating process (provided by a pulsed heat power supply) is initiated (figure 2).
- The part is heated to the glass transition temperature at which time it softens and is molded into the required shape and simultaneously fixed to the second part (figures 3 and 4).
- The part is cooled - still under force - to below glass transition temperature at which time it solidifies and the thermode is lifted from the part (figure 5).



Part positioned on plastic base with stake

figure 1

Heat and force applied

figure 2

figure 3

Cooling with compressed air

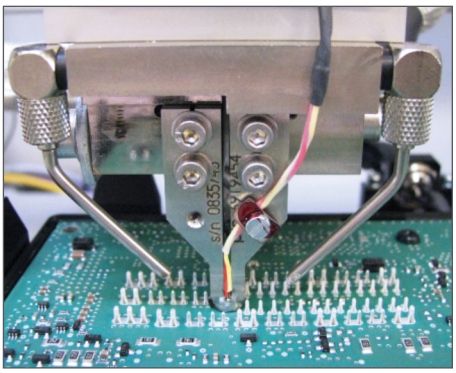
figure 4

Release; finished assembly

figure 5

WHY CHOOSE HEAT STAKING AS A JOINING PROCESS?

Heat staking is a repeatable, economical and safe way to join two pieces of plastic or plastic and another material. One big advantage of heat staking is the ability to use the base material - like PCB - to form the stud without having to make design changes, add extra material or use screws.



STAKING TECHNOLOGY COMPARISON

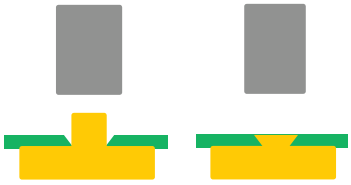
	Pulsed Heat	Cold Staking	Ultrasonic
Low heat affected zone protects adjacent electronics	X	X	
Very fast: can operate in the short window between glass transition and melt	X	X	X
Glass filled plastic can be deformed without embrittlement	X		
Can stake materials with up to 40% glass fill	X	X	X
Low stress on stud	X	X	X

VARIATIONS IN HEAT STAKE DESIGNS

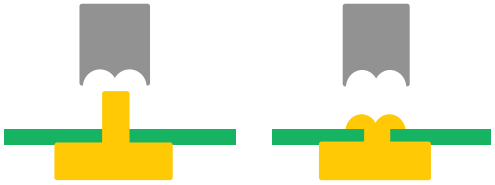
Stakes can be produced in a number of different designs. Design rules and guidelines will help to determine which stake design will best fit the application.

Dome shape. Used for small size pins.

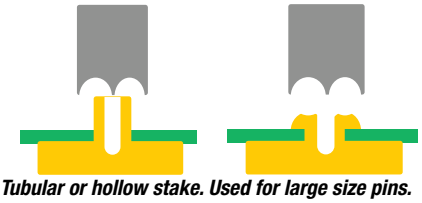
Tubular or hollow stake. Used for large size pins.



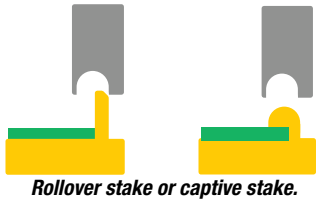
Countersunk stake.



Double dome shape. Used for medium size pins.



Tubular or hollow stake. Used for large size pins.



Rollover stake or captive stake.

TYPICAL APPLICATIONS

Heat staking applications are found in a variety of industries – including automotive, medical, IT & multimedia and consumer electronics.

Heat staking is suitable for:
- Thermoplastics
- Polycarbonate
- Metal to plastic
- PCBs
- Glass filled fiber plastic

Precise heat and pressure can reform studs made from the most commonly used plastics, such as polycarbonate (PC), glass-reinforced nylon (GFN), Polypropylene (PP, Polystyrene (Ps) and acrylonitrile butadiene styrene (ABS).