JANUARY 2011

VETTE CORP. App News

DESIGN ACTIVITY

Vette NY Continues to Add Large CNC Capacity

Vette NY recently added its third large Hass CNC machine to keep pace with the growing demand for larger heat sinks, enclosures and cold plates.

The growing demand is being fueled in several key market areas:

Solar Energy, Wind Energy, Power Conversion, Smart Grid

Military and Aerospace

Communications, HPC - High Power Computing, Servers, Datacenters

Transportation, Electric Vehicles, Battery Chargers, Batteries

ITARS

Vette NY is in he final stages of becoming an ITARS certified facility by the US Government.

WEBSITE

Have you been to the Vette website lately ? There are many upgrades and more on the way.

We will be adding videos of key manufacturing operations as we have had many requests from engineers to better understand what goes into manufacturing a heatsink but have no travel budget.

The support and download features are also being expanded to add product catalogs, some standard products and pricing, DFM guidelines, plant certifications and the newsletters.

Need more information ? Please contact your local Vette Applications Engineer or Salesperson.

Heatsink Attachment Methods

After the last newsletter, we received requests for more information on the mounting of heatsinks with compression springs, the pins and specific material used; so here are a few more details and pictures.

Push Pins and Coil Springs - possibly the most common and lowest cost of all attachment methods.

Plastic push pins with springs are pushed through the heatsink and through the PCB. The pin heads expand on the other side of the PCB and lock the pins into place. Different spring materials and spring rates can be used to provide the needed normal force (pressure between the heat sink and the heat source) Plastic pins can generate 0-3 lbf / pin.

Common pin materials are POM and Nylon 66. Nylon needs to be reinforced with glass fiber strands, hence the “66” callout. UL94V-2 rating is standard and some customers are now requiring UL94V-0 and heat stabilized nylon compounds. Vette has performed long term tensile aging tests on plastic pins under load and can provide reliability data. Vette pins utilize a proven complex head design that allows for easy installation when being inserted through the heatsink and PCB, an then provides a positive lock against the PCB after it passes through it.

Coil springs are typically “instrument compression” type and made of a 300 series Stainless Steel. The instrument type normally refers to the fact that the spring wire is less than .030” diameter (0.75 mm) and the ends are coiled and cut at right angles to the wire. These are low cost and simple springs to produce.

As the spring wire diameter gets larger (typically over .030” or 0.75 mm), a straight end cut produces a drop in surface from one side of the spring to the other, at this point springs can then have their ends ground flat for a better fit, these are called ground compression springs.

Please note that it is both difficult and expensive to have the ends ground on small wire springs.

If a higher force is required, the spring material can be changed to spring (aka music) wire but that will need to be zinc-plated to prevent corrosion.

A good rule of thumb for spring force design is to operate at 20% below the uncompressed spring length and 20% above the solid spring height. The spring rates are only really linear between these two points.

Brass push pins can be designed with a slightly higher force (0-5 lbf / pin) and have higher side shear resistance. Side shear is important for drop tests of parts, typically a 40G test is used on commercial parts. All designs must have the sufficient number of pins and suitable even mounting locations.

A drawback to brass pins (or any pin with a slotted tip) is that they are not forgiving during installation and must be closely inspected to make sure that the round slotted pin tip compressed and then sprang back properly after PCB insertion. If it collapsed on one side, it must be replaced.

Heatsink Attachment Methods

Metal pins are typically 5-10 times the cost of a plastic pin.

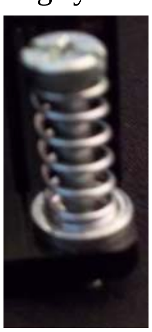
The next step up in force is to a metal screw/spring/clip combination. Similar to push pins and springs but with higher forces, this is now the most commonly used attachment method for CPU's in PC and Server applications. The screw/spring combination provides high normal forces, excellent life and enables the use of PCM and high performance thermal grease. High normal forces of up to 15 lbf / pin are possible. A mating threaded insert or backer plate is required in the PCB for each screw and spring.

The most common combination uses a groove in the screw body and an E-clip to retain the assembly in the heatsink. The screw is passed through the heatsink, the spring compressed and then the E-clip snapped into place to retain the assembly, ready for installation.

In the pictures shown, note the blue thread-locking compound used, sometimes called a "patch".

These screws are typically Stainless Steel or CRS (Cold Rolled Steel) with ground end compression springs. If CRS is used (it has greater strength), then it is usually a carbon steel often with a small lead content for good thread formation, zinc and nickel plating are common for both the screws and the spring (if the spring is the high force music wire). If it is a stainless steel spring then no plating is needed. Cadmium plating used to be common but now has RoHS limitations.

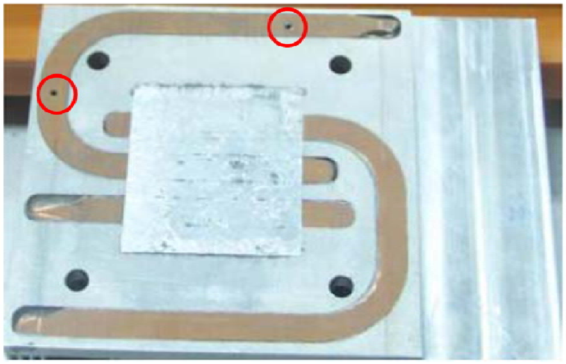
The E-clip is best made from plated spring steel. High performance beryllium copper was often seen but now declining in use due to impending RoHS regulations. These are common and low cost fastening systems.



Another combination includes a swaged custom boss (in place of the E-clip) which is passed through the heat sink and then swaged into position. This has the advantage (or disadvantage depending on your thought process) of not being removable once installed. In order to countersink the base of the heatsink for the swage, the heatsink must be CNC machined which is a substantial added cost. These parts are typically sole sourced, longer lead time, more expensive and have larger minimum buys.

It is important in any fastening system to callout and specify known and reliable components BUT to also allow the heat sink supplier to source the materials to the same specification. Typically if a sole source supplier is on the drawing, then the heat sink manufacturer has to buy that part regardless of the cost. Most heat sink suppliers have certified vendors who can provide quality lower cost alternates.

Heat Pipe Heatsink Production Thermal Test Station

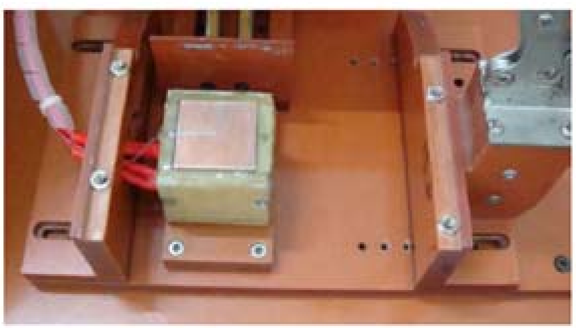


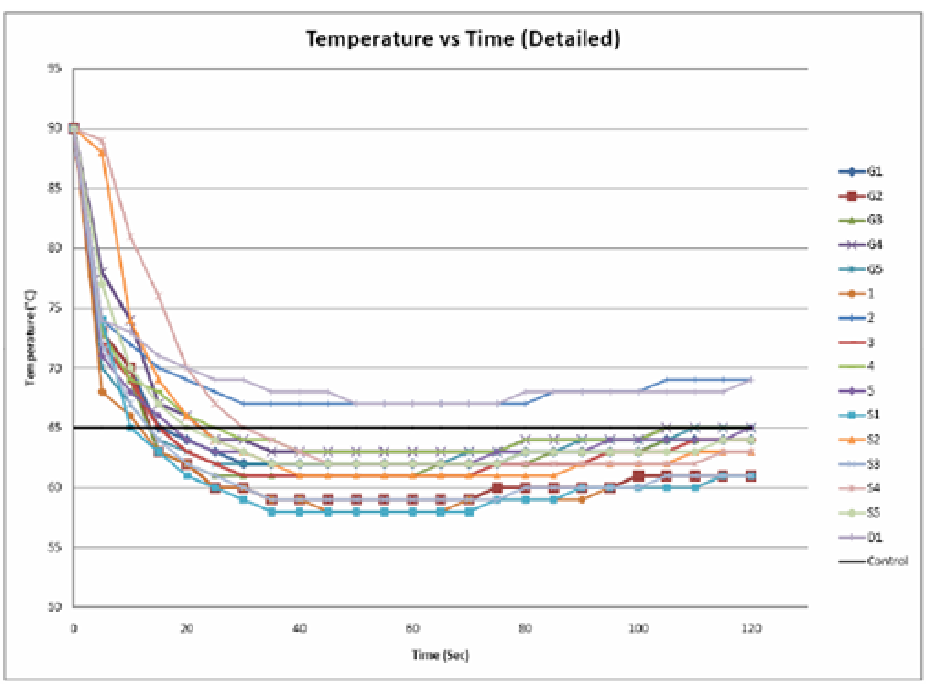
This heat sink was a major customers first extruded design with embedded soldered heat pipes in the base. This being their first heat pipe design, the customer had concerns over the assembly and reliability of the soldering process. Vette designed and built a production thermal tester which was used for verification.

This photo on the left shows a "golden fail" unit where one of the three heat pipes was intentionally compromised so that both good and bad parts (qualified by the end customer) could be tested for equipment and method qualification.

The heat sink had a one hour thermal equilibrium time in the customers enclosure, far too costly for a production test and so the production tester used an engineered 60 second test cycle.

The test data shows temperature readings on a heater block maintained at 90C. When the heat sink was mounted the temperature would drop. The golden fail units produced less of a temperature drop (the upper two curves) than good units (the lower curves) allowing a test criteria of 65C and 60 seconds to be set.





This was then programmed into the tester logic. The tester was designed with minimal fool-proof controls with an on switch, a ready light, a test start button operating a 60 second timer and then two simple test results lights, green for pass and red for fail.

Over 20,000 units were tested before its use was discontinued because the customer was more than satisfied with the results and we were then able to reduce the sell price.