NASA TECH BRIEF

Goddard Space Flight Center

Hermetic-Coaxial Package Design for Microwave Transistors

The problem:

The present electronics market offers a wide variety of semiconductor packages designed for a multitude of applications. Many are hermetically sealed components that satisfy low-frequency applications. However, the majority cannot be used with components designed for high-frequency, high-power levels, particularly in the microwave range. These packages are not designed for a usable and predictable characteristic impedance at RF frequencies. In addition, many are not designed to withstand hostile environments and cannot interface with various circuit configurations (such as coaxial, stripline, and microstripline).

The solution:

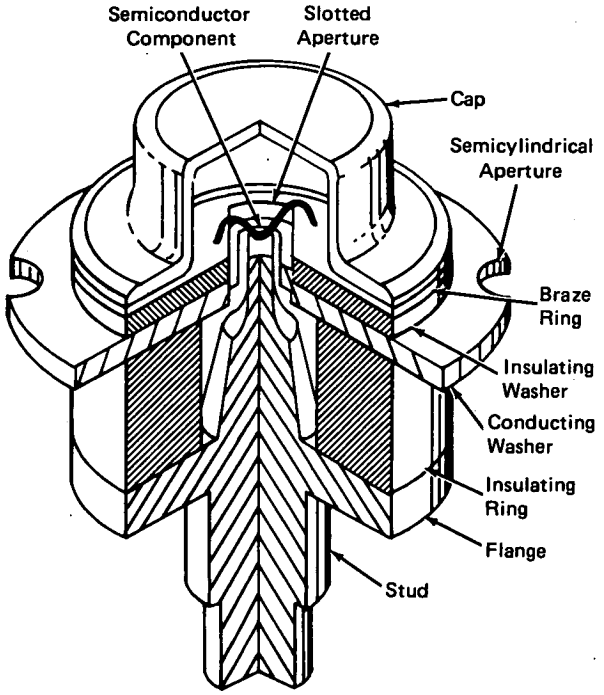
One semiconductor package has been developed for high power semiconductor devices that operate in the GHz-frequency range at several watts. The package is mechanically strong and can be used with a wide variety of circuits.

How it's done:

The package (see figure) includes a stud, an insulating ring, and electrically conductive washer, an insulating washer, a braze ring, and a cap. The stud is cylindrically shaped on one end and conically shaped on the other. The cylindrical end is undercut adjacent to the outer tip. The conical end terminates in a blade-shaped outer tip. This tip ends in a plateau for mounting a semiconductor component. The stud also includes a flange in the middle which supports an insulating ring. The insulating ring ends in a plane that intersects the blade portion of the conically shaped end.

An electrically conductive washer is mounted on the other surface of the insulating ring. The washer has a slotted aperture at its center which fits about the blade-shaped end of the stud but is separated from it. In addition, the washer has a pair of oppositely-located semicylindrical apertures on its periphery that allow the package to be bolted in place.

Located on the other surface of the electrically conductive washer is the insulating washer. The insulating washer also has a slotted aperture at its center. On the other side of the insulating washer is a braze ring. In essence, the braze ring is flat, washer shaped, and has a circular inner aperture that is considerably larger than the slotted aperture in the insulating washer. On the other side of the braze ring is the cap that rests on the opposite surface of the braze ring.



Hermetically-Sealed Semiconductor Package for High-Frequency, High-Power Components

(continued overleaf)

The stud is normally formed of silver or copper, as are the electrically conductive washer and the cap. The insulating ring is beryllium oxide (BeO), and the insulating washer is formed of alumina. Moreover, the BeO insulating ring is metalized with molybdenum manganese on both of its metal joining surfaces and then is plated with nickel. Similarly, the alumina insulator is also metalized on both metal contacting surfaces with molybdenum manganese but is plated with gold.

The package is assembled as follows. A subassembly comprised of the stud, the BeO insulating ring, the conductive washer, and the insulating washer is formed by mounting these items as illustrated and brazing them together in a high-temperature furnace (800° to 900° C). The semiconductor component is then mounted on the flat conical tip of the stud, and connections are made from the semiconductor component to the conductive washer and to the metalized upper surface of the insulating washer. Thereafter, the braze ring and the cap are mounted. The entire structure is then placed in a die mounter, and the cap is brazed to the insulating washer to seal hermetically the entire assembly.

Note:

Requests for further information may be directed to:

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Reference: TSP73-10427

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,705,255). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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