

## **HERMETIC SEALING WITH LASER TECHNOLOGY**

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Conventional hermetic sealing methods of the past - epoxies, solder seals and mechanical seals - cannot fulfill the microwave electronics requirement of 100% protection against moisture. Many sophisticated products in the microwave electronics industry must perform flawlessly in hostile environments, and therefore must have the protection of hermetic sealing. The most reliable method for these unique sealing requirements is laser welding. Unlike its counterparts, the laser welding process allows for the removal and resealing of a previously welded cover with the same integrity as the initial seal.

### **A Comparison of Sealing Methods**

Epoxies can be cured slowly at room temperature or quickly at elevated temperatures. They can be tailored for flexibility and conductivity, and epoxy-sealed packages can be reworked. However, the drawback of epoxies is their inability to provide a true, long term hermetic seal. Epoxy seals fail humidity and salt spray tests because of their high moisture diffusion rates.

Solder seals can be effective, although achieving such a seal can be extremely labor intensive and damaging to the electronic circuit. The process is very time consuming, and the technician must be highly skilled as the unit can be easily over-heated, and the high risk of flux entering the unit can affect long term reliability. With the cover closure being the final assembly step, the choice of solders must be a low melting temperature alloy in order to prevent re-flow of the components inside. At low temperatures, metallurgical wetting is not an aggressive process. While active fluxes can improve the wetting, they may also destroy the circuit due to their highly corrosive nature.

Mechanical seals are prohibitive because of space requirements for mounting hardware and gasket grooves. Effective RFI - EMI closure is not provided unless secondary seals or special materials are used. The high moisture diffusion rates (not unlike epoxy), prevent long-term reliability in adverse environments.

Without question, the most effective method of accomplishing a true hermetic seal is with laser welding technology. These seals provide cost effective hermeticity and long term reliability with the most intricate microwave components. The laser has the unique ability to weld with high precision and without thermal damage. Heat-affected zones are virtually non-existent. Sensitive components near weld areas are not exposed to excessive heat. Most importantly, the laser can be made part of a controlled atmosphere hermetic sealing system, where packages can be baked out for moisture content and back filled with inert/tracer gas before welding. This eliminates the need for separate backfill operations by capturing inert/tracer gas inside the package. Within the microwave electronics industry, aggressive testing requirements sometimes require opening a sealed unit for rework of internal components. The laser has the unique ability to re-weld these units without loss of hermetic integrity.

The only drawback to installing a laser hermetic sealing system is the high cost of capital equipment, which typically could exceed one million dollars, plus additional costs of set-up, development and operation. The more economic approach is to rely on the services of a qualified subcontractor who specializes in this technology.