

Small West German firm develops high-density hybrid IC package

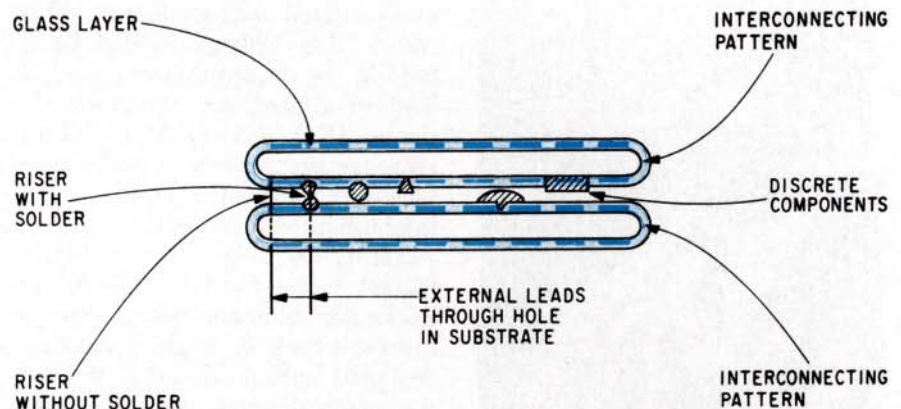
Two-year-old Microelectronic and its founder, Andreas Lewicki, is helping reshape that country's industry by product innovation

Bavaria is rapidly becoming West Germany's Route 128. Electronics firms, foreign and domestic, large and small, now think of Bavaria and adjacent south German areas first when setting up production plants. What's more, energetic young engineers, lost in the hierarchy of large German corporations, are starting up their own companies.

Typical of this new breed of company is Microelectronic, based in Oberdischingen, a small town near the Danube southwest of Ulm. Built on the hybrid integrated circuit expertise of its founder and owner, Andreas Lewicki, its latest product is a piggyback, double-substrate system that packs four times more components into a package than conventional approaches.

On his own. Lewicki, 35, is a former AEG-Telefunken research engineer who has patented about two dozen innovations in the electronics field during the last five years. His expertise has made him a frequently called-upon consultant among West German electronics firms, aerospace companies and research institutes.

Using his personal savings and the royalties from his book on microelectronics—the first authoritative German book on that subject—Lewicki set up shop two years ago in an unobtrusive building in rural Oberdischingen. He based his hopes on a formula that has worked well for a number of U. S. companies. "Develop new design concepts before your competitors do, shorten the production process, and



Doubled up. The Space-Pack, two spaced substrates soldered together, has four usable surfaces. Eighty components fit in a 1 by 0.5 by 0.2 inch cube.

then shoot for fast delivery," he says. He built much of his production equipment himself; its value is about \$100,000. This year, Lewicki's initial investment in his company will start to pay off.

Space probe. The latest from Microelectronic is the so-called Space-Pack, a hybrid circuit package to be introduced in September. Intended mainly for aerospace applications, it's also a space-saving device and looks very much like a small sandwich. It consists of two pieces of thick-film ceramic substrate with a small space between them. Because components are placed on each side of the two substrates, the assembly yields four surfaces of hybrid circuitry. The inner surfaces are kept from touching each other by risers equally spaced along two edges of the bottom substrate. A small high-melting-point solder lump applied at each riser makes the assembly mechanically rigid.

Using this packaging concept it's possible to put as many as 80 components into a package with a 1 by 0.5 inch surface area and a thickness from 0.1 to 0.2 inch. Such component density is roughly four times higher than that of conventional hybrid circuit packages of the same size. Yet, an 80-component Space-Pack will cost only twice as much as a standard component hybrid package produced in small quantities.

Space-Pack assemblies come in various sizes and with leads arranged in different ways. In addition to the standard 1 by 0.5 inch version, Lewicki has readied units that are two-thirds and one-third that size. He's also considering making units of other shapes and dimensions to meet customers' special requests.

The company offers the Space-Packs as dual in-line packages with cylindrical leads or as flatpack devices with gold-over-nickel-plated

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Kovar ribbon leads. In another configuration leads are brought out from one edge so that the package can be installed vertically.

Depending on size and circuit complexity Space-Packs will sell from \$10 to \$100 apiece in quantities up to 25 units. At production runs of 100 and more the unit price will drop by as much as 50%.

Tipping the lid. One thing that keeps prices of Space-Packs rela-



Entrepreneur. Andreas Lewicki gambled his savings on his technical expertise.

tively low is that they can do without expensive ceramic, metal or glass capsules normally used for protection with other types of high-quality hybrid circuits. These capsules, usually consisting of a small trough and a lid, cost up to \$10 apiece. Instead Space-Packs use pre-encapsulated components. Furthermore, all thick-film components are protected by a glass layer hermetically fused onto the substrate. This kind of protection not only eliminates the capsules but also does away with hermetically sealing the lid onto a trough, with inert gas environments required for lid sealing, and with helium detector leakage tests.

Repairability is another advantage Space-Packs offer. By unsol-

dering and removing the upper substrate with a special tool, access can be gained to critical or defective components. After component replacement the upper substrate can easily be resoldered.

Space-Packs have higher reliability than conventional hybrid circuit packages because they require a smaller number of external leads for a given circuit complexity. For instance, the number of leads for an 80-component Space-Pack is four times less than that required for, say, four 20-component hybrid packages. Reliability is further enhanced by the use of hermetically encapsulated semiconductors. This means that leakage caused by a hole in the encapsulation does not lead to a complete circuit breakdown. With conventional hybrid circuits using lid-trough capsules, a hole in that capsule might lead to a total failure of the circuit.

Aerospace firms are the main market target for Lewicki. Space-Packs can be made for anyone in need of a limited supply of custom-designed hybrid circuits. Potential customers, Lewicki says, are makers of specialized measuring equipment, communications gear and of computer-interface units. Other potential users are research institutes and nuclear reactor operators who must often design their own test and evaluation equipment. These are customers for whom Microelectronic is already designing conventional hybrid circuit packages. New customers, Lewicki hopes, will be automobile, photo equipment and clock makers in need of small runs of special hybrid devices for use during product development, test and evaluation.

On the rise. A typical high-complexity Space-Pack assembly—for example, a multi-stage pulse stretcher or a multiple analog amplifier with frequency compensation—contains some 40 resistors and about the same number of other components such as capacitors and semiconductor devices of both discrete or integrated form. Most resistors are thick-film devices produced by high-resolution screening. Generally, each surface contains up to ten such resistors. The other components are soldered

onto the interconnecting patterns of the Space-Pack's two inner surfaces. The substrates are conventional high-alumina ceramic.

Interconnections between components on the two surfaces of each substrate are made around the substrate edges—an interconnecting scheme that eliminates the need for boring or punching holes all over the substrate surface. This scheme also helps reduce manufacturing time and, thus, device cost.

The risers, which are spaced about 0.1 inch apart, have various functions. In addition to keeping the two substrate pieces apart, they provide a base for small lumps of solder that hold the Space-Pack together. Furthermore, they provide electrical connections from components mounted on one inner surface. Interconnections between components mounted on the same substrate surface are, of course, made by the conductor patterns on that surface.

For dual in-line packages, the risers are made by extending the Space-Pack's external leads through holes in the bottom substrate. In other versions, even the holes are eliminated because leads come out from between the substrates. The height of the risers is determined by the thickest component mounted on either of the two inner surfaces.

For protection, the Space-Pack's outer surfaces, containing thick-film components, are hermetically sealed by a layer of glass. Glass layers also protect the inner surfaces except where pre-encapsulated discrete or integrated devices are soldered onto the interconnecting patterns and thus project outward from the surface. To prevent foreign particles from shorting the risers, the area between the substrates can be filled with epoxy resin or with the silicon rubber.

The unit operates at temperatures from -65 to 175°C and meets the humidity tests spelled out in U. S. military specifications. The weight of a 1 by 0.5 inch Space-Pack with 45 components and 20 external leads is roughly one-twelfth of an ounce.

Microelectronic, 7931 Oberdisingen, West Germany. [290]