EXECUTIVE SUMMARY

Programmable Multichip Module (PMCM) and Single-Step Microcircuit Enclosure
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The Kansas City Plant is a leader in perfecting microelectronics technologies for the most advanced and demanding electronic system applications. Two recent innovations, a Programmable Multichip Module (PMCM) and a Single-Step Microcircuit Enclosure, are important advancements in microelectronics design and miniaturization.

The PMCM is constructed on a Low Temperature Cofired Ceramic (LTCC) substrate. The module’s unique design segregates the active components (such as integrated circuits and diodes) from their support counterparts (such as capacitors, resistors, inductors or memory modules). Segregation provides access to the support area while allowing the active area to be protected.

The Single-Step Microcircuit Enclosure is a cost efficient cover designed for high-reliability applications. This new cover, which consists of nickel and gold plated Kovar with an attached solder preform, provides a hermetic seal to protect the active components and is attached to an LTCC network using a standard single-step manufacturing process.

Background

The Kansas City Plant manufactures microelectronics for high-reliability electronic system applications. The microelectronics used in these systems must withstand harsh operating conditions. In the past, engineers at the Kansas City Plant relied on conventional Hybrid Microcircuit (HMC) packages. These were often unsatisfactory in terms of performance and flexibility of configuration because the active and support components were usually commingled. Once sealed, components became inaccessible, making the microcircuit difficult to redesign or change. Developers using conventional Multichip Modules (MCM) had to commit, very early in the life cycle, both the active components and the support components to a particular design and for a specific product application. In addition, the widely-used two-step hermetic sealing procedure for MCMs increased processing time and the possibility that leaks would expose components to adverse environmental conditions.

Electronic system designs with higher density and performance require improvements in microcircuit processes and technologies. To meet these challenges, engineering teams at the Kansas City Plant developed the new PMCM and the Single-Step Microcircuit Enclosure. These microcircuit improvements can be used together or separately to meet the demanding specification requirements for electronic systems.

Advantages

Programmable Multichip Module

The PMCM, by improving microcircuit design and manufacturing options, makes true customer-defined configuration possible. It is programmable in that at least some of the support components, determined by the module’s intended use, are and remain removable and replaceable throughout the design and development process. Well-known reflow soldering techniques make it easy to replace support components, while the segregated configuration provides accessibility. Other improvements to existing MCM design and function are:

- Improved Performance: segregating the components reduces the number of inputs and outputs, shortens interconnections to integrated circuits, and reduces circuit size.
- Customization: users can select component values during electronic system development.
- Design Flexibility: developers can test a variety of component values before finalizing the design; this shortens the design cycle time by minimizing circuit redesign and rebuild time while providing new flexibility for reliability testing and for late-stage design changes.
- Cost Savings: PMCMs use standard materials and commercial components, either alone or in combination with customized components. Modules can also be used in multiple products.
- Reliability: active components, segregated from the support components, are attached to the substrate and are electrically interconnected by wire bonding. This area can be protected using any sealing technique, from standard seal rings and lids to the new Single-Step Microcircuit Enclosure.

Single-Step Microcircuit Enclosure

The innovative Single-Step Microcircuit Enclosure provides a cost-efficient method of sealing Microsystems against damaging external environments. A smaller microcircuit is possible because the area needed to accommodate the single-piece enclosure is smaller. In addition, the Single-Step Microcircuit Enclosure offers a number of substantial advantages that include:

- Improved Reliability: the one-piece construction reduces the risk of leaks, and results in a more rugged and reliable enclosure.
- Increased Process Yields: the single-step process required for sealing is a substantial improvement over the two interfaces needed for standard seal ring and lid processes.
- Cost Savings: the Single-Step Microcircuit Enclosure is made from readily available and industry accepted materials using standard process equipment; the actual cost to manufacture the enclosure is slightly less or equal to the seal ring and lid.

Applications

Both the PMCM and the Single-Step Microcircuit Enclosure offer measurable improvements in flexibility, cost and reliability. Key industries that will benefit from the advancements brought by these technologies include:

- Automotive: hybrid vehicle electronics, navigation systems, airbag electronics, and ABS/traction control systems.
- Telematics: vehicle-based electronic systems, mobile telephony, vehicle tracking/positioning, information services, and emergency assistance systems.
- Commercial and defense aircraft electronics: avionics, sensors, and telemetry systems.
- Consumer electronics: cell phones, sensors, and displays.
- Mobile communications.
- Medical devices and equipment.

Both the PMCM and the Single-Step Microcircuit Enclosure are proven technologies in current production and use at the Kansas City Plant. The patented Programmable Multichip Module (U.S. Patent No. 6700196) technology and the Single-Step Microcircuit Enclosure (Patent Pending - 10/774,926) are available for licensing through Honeywell Federal Manufacturing & Technologies (FM&T).

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