MCM & Hybrid Introduction

Designers are continually requesting smaller and more complex circuits with less real estate to support increasingly complex systems. The result has been smaller packaged microcircuits. The need for unique circuit requirements, often unavailable as a standard microcircuit, has become a problem as real estate restrictions prohibit the use of multiple discrete microcircuits. The solution in many cases is the integral use of chips and discrete parts on a common substrate in a single package, a design known as the Hybrid.

Hybrid designs have encompassed a variety of packaging techniques, e.g., cordwood, stacked flat packs, compartmentalized modules, multi stacked substrates, stick modules, and folded modules (flex circuits). The mixture of dice and discretes are mounted on a substrate PCB contained in a protective case, that might be hermetic sealed, potted (filled), or plastic encapsulated. These have specific advantages and disadvantages over conventional devices. Generally, all have circuit uniqueness, with size reduction as primary assets. Disadvantages are high fabrication costs, test and repair difficulty, and difficulty in achieving cost-effective sparing. Component obsolescence is also a problem, as Hybrids are usually custom designs of relatively low volume, often containing discontinued product. Further, reliability uncertainty can be a concern as internally packaged devices may be an unknown or nonstandard product.

The demand for higher density circuits, with lower real estate requirements, necessitates the need for smaller, more complex devices, i.e., the MCM. Unlike the Hybrid, the MCM is a chip-only technology with the substrate being an integral part of the product design, not simply a component carrier. The dice are mounted on, or embedded in, a multilayered substrate that is contained in a protective case that may be hermetic sealed or plastic encapsulated. Typically, the substrate consists of several layers, each containing circuitry or providing power and ground planes with vias interconnecting the layers. For the highest density designs, the dice are embedded in the substrate structure. Disadvantages for limited usage designs can be initial fabrication costs. Disadvantages for routine designs are test and repair difficulty and finding cost-effective spares. However, since only bare dies are involved and no individual discretes, obsolescence is less of a problem. MCMs usually have significantly fewer series connections from die to pinout, giving the potential for a more reliable product.

Closing Comments

Military specifications and support:

a. QML-PRF-38534 Hybrid/MCM performance specification.

b. QML-38534 Hybrid/MCM QML qualified manufacturers.

Other support sites:

a. http://www.ipc.org/ Institute for Interconnecting and Packaging Electronics Circuits.

b. http://www.jedec.org/ JEDEC Solid State Technology Division.

c. http://www.eia.org/ Electronic Industries Alliance.