

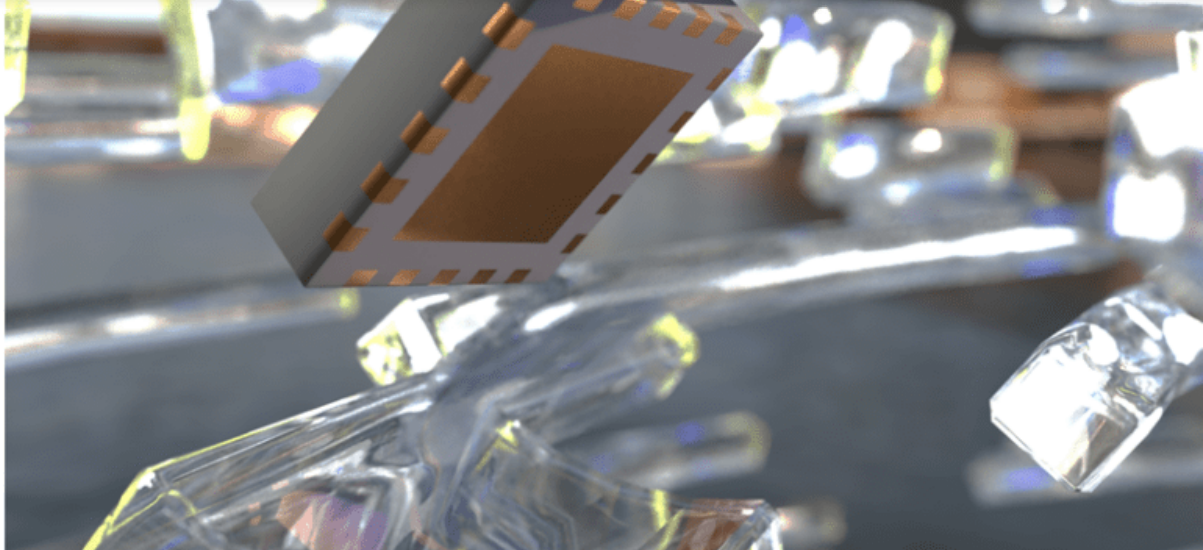
By [Tim Wooden](#) | July 25, 2023

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**Advances in semiconductor functionality, density, and chip-level integration are generating new challenges in testing. A test socket solution overcomes the challenges posed by traditional vertical spring probes and cantilever scrubbing contact designs, providing a new level of performance and reliability.**

Integrated circuit (IC) designers are increasingly migrating to quad flat no-lead (QFN) packages to meet the needs of applications that have a small outline or low-profile footprint yet still require best-in-class electrical requirements and performance. QFN packages feature direct-attach peripheral pad structures, a large ground block for thermal and electrical performance, and a very thin stack height, making them ideal for many designs, but they also bring some challenges to the Test & Measurement process. To meet these testing challenges, a test socket solution that is robust, reliable, and electrically “clean” is needed.



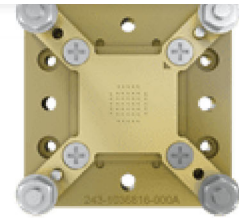
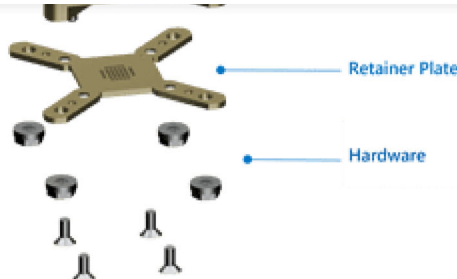
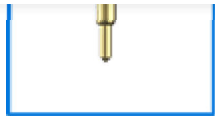


Quad flat no-lead package, or QFN, packs performance into a is a low-profile IC package.

As logic chips become more advanced, we are seeing a corresponding increase in pin counts, power consumption, and BGA package structures. However, for the majority of analog, mixed-signal, power, and RF devices, power and pin count take a back seat to electrical performance and reliability. Fabricated primarily on legacy (>16 nm) process nodes, these devices tend to have small numbers of I/O connections and ganged power connections. Device manufacturers make use of QFN packages to improve electrical performance while reducing the size, weight, and footprint of the equipment.



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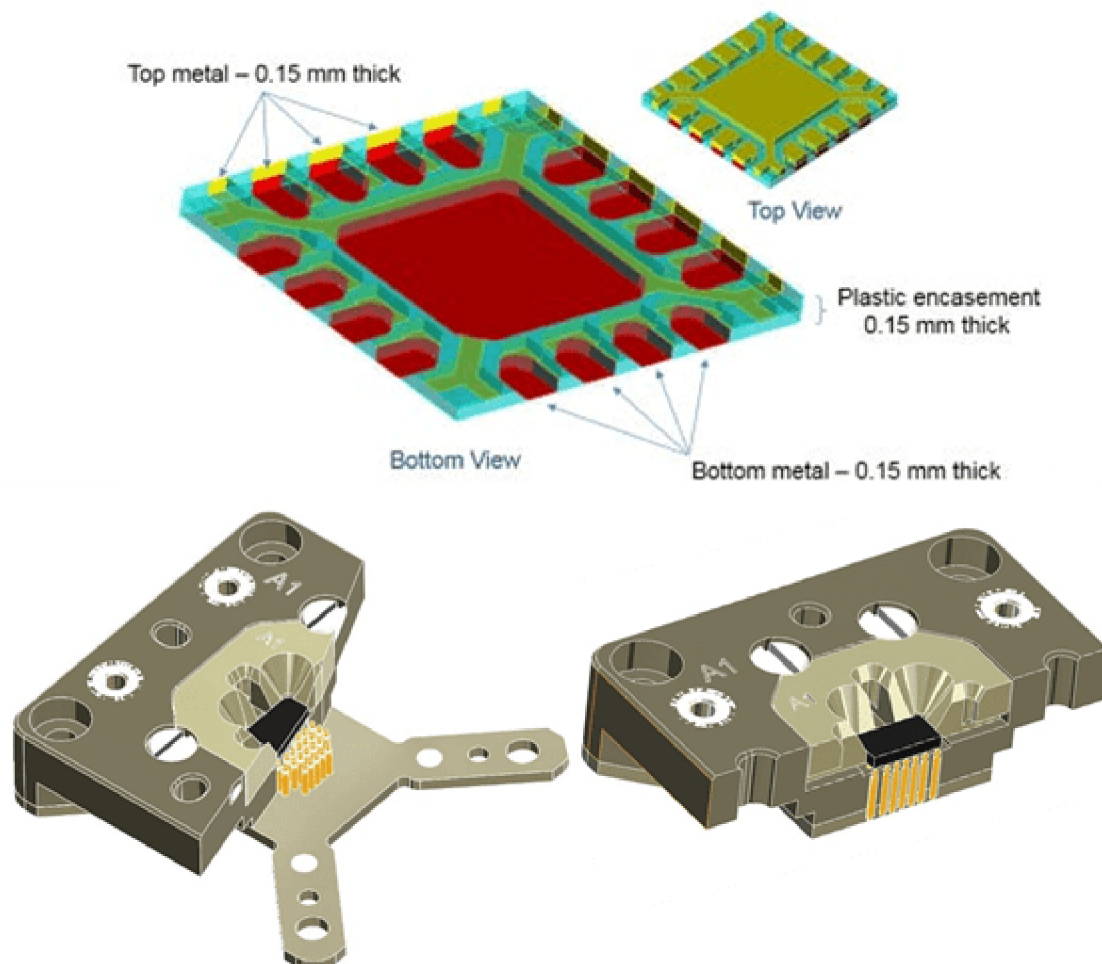
socket bottom view

QFN packages use traditional wire bonding and molding encapsulation techniques to protect the silicon die. They also use “near chip scale” pad layouts on the periphery, along with a large “ePad” or “exposed paddle.” With electrical pads fully contained inside the outline of the molded plastic package body, QFN’s eliminate many of the handling and reliability challenges of their QFP and SOIC predecessors. When a QFN is soldered onto a PCB, the connection is as short as possible, and – aside from certain coefficient of thermal expansion (CT) considerations – extremely robust. QFN’s feature a very large ground pad in the center of the rectangular package body, which facilitates not only excellent electrical performance, but greatly improves thermal dissipation. Instead of venting heat generated by the IC upward through the package body, the heat in a QFN ePad can be drawn downward into the PCB to thermal vias, greatly improving stability and performance.



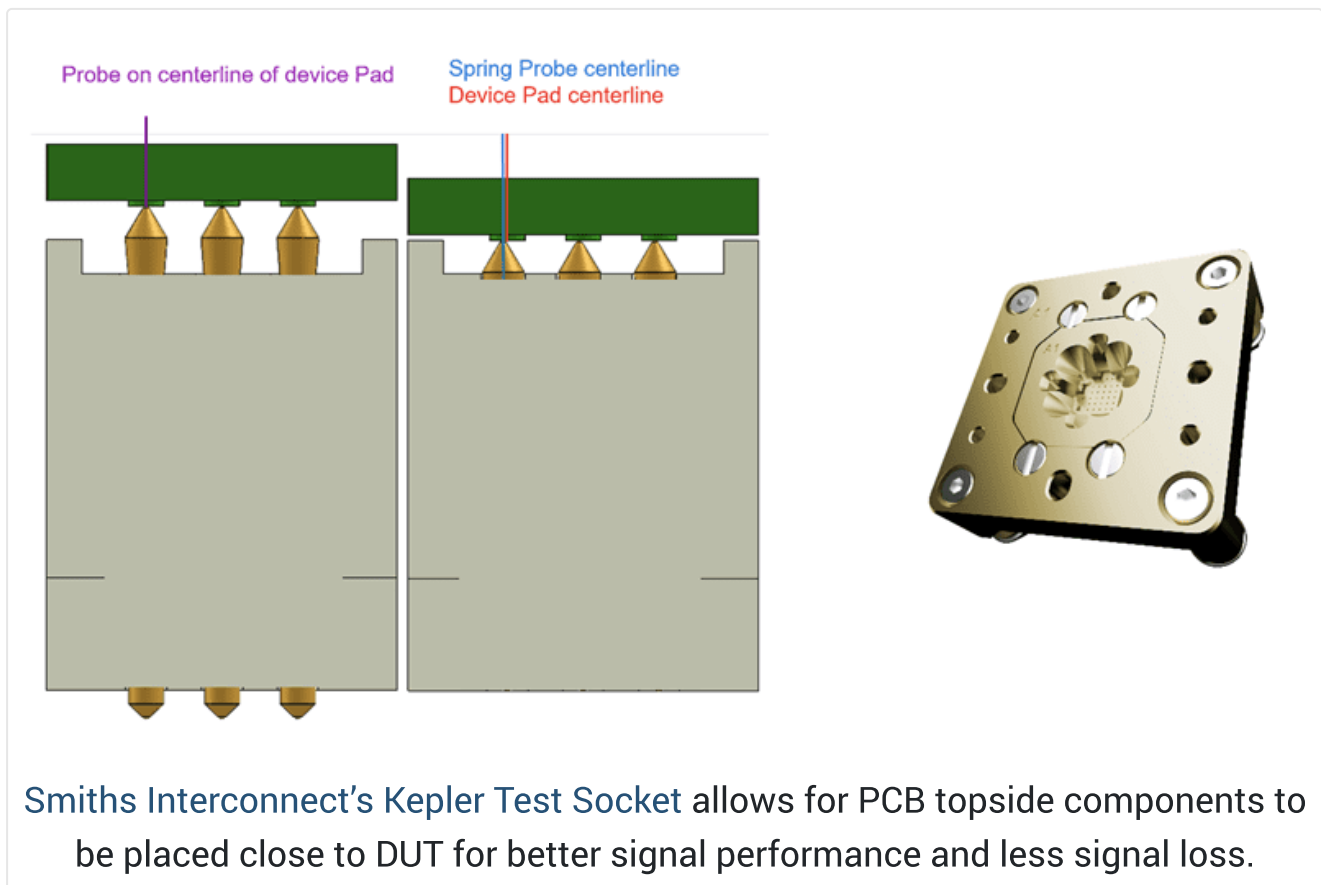
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To balance these needs, engineers look for a test socket solution with a short, highly controlled signal path and a robust mechanical structure. One key element of the mechanical structure that warrants special consideration is the wear rate on the surface pad of the PCB load board used to connect the socket to the automated test equipment (ATE). Load board costs routinely exceed \$50,000 to \$75,000, making it imperative that the socket actuation cause as little damage to the surface pads as possible. If the test socket causes pad damage, the test operations team may need to re-plate the PCB's surface pads, or, worse, replace the entire PCB.



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oxides with the same impact on PCB load board pads as a vertical spring probe, allowing for hundreds of thousands of cycles with little to zero maintenance. The Kepler is footprint-compatible with existing QFN offset socket solutions and can be implemented in short order for demanding high-volume IC applications.



As chip updates become faster and more complex, evaluation and qualification processes are evolving to provide higher test reliability in less test time. To realize these goals, a new generation of Test & Measurement components feature optimized design and superior mechanical performance. Today's test processes are an essential step in the goal to help designers successfully engineer new products and get them to market quickly.

Visit [Smiths Interconnect](#) to learn more about test solutions, including test sockets and reliable spring probe technology.





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