

Pogo-Pin Solutions for Single and Multi-Port RFIC Probe Testing

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Although conventional RF probes provide reliable performance exceeding millimeter-wave band as high as 1.1 THz (M. F. Bauwens, N. Alijabbari, A. W. Lichtenberger, N. S. Barker, and R. M. Weikle, “A 1.1 THz micromachined on-wafer probe,” in *IEEE MTT-S Int. Microw. Symp. Dig.*, Jun. 2014), the inherent fragility of their traditional probe tips presents significant durability issues. To overcome these issues, this study introduces a novel design that uses pogo-pins as replacements for RF probe tips. The spring-loaded structure of pogo-pins enhances durability and repeatability, enabling the development of both multi-port and single-port probe systems.

The proposed probe system consists of four main components: pogo-pins as probe tips, a PCB for RF signal transmission, a housing for mechanical pogo-pin support, and an RF connector. Among these, the pogo-pins form an RF transmission line by grouping a single signal pin with surrounding ground pins. Figure 1(a) shows the multi-port probe card, presenting the improvements in signal loss achieved through optimizing the main components: PCB and housing designs. First, optimizing PCB reduced coupling by introducing a shielding ground plane between the signal traces and the housing in a 2-port configuration. In a 4-port configuration with minimum pitch of 522 μm , minimizing PCB dimensions and spacing signal lines yielded limited improvements. Second, housing optimization by replacing the dielectric housing's mid-section with a metallic structure significantly mitigated pin-to-pin coupling issue. Figure 1(b) illustrates the single-port probe design, which shares the same main structures as the pogo-pin probe card. This design features a smaller pitch of 250 μm and inclined pin configuration to support conventional IC pad design, ensuring minimal insertion loss beyond 40 GHz.

Experimental results demonstrate that, while conventional pogo-pin probe designs were limited to 20 GHz, the proposed designs extended the operating band beyond 40 GHz in both multi-port and single-port configurations. These advancements prove that pogo-pin-based probes can effectively replace previous RF probe tips.

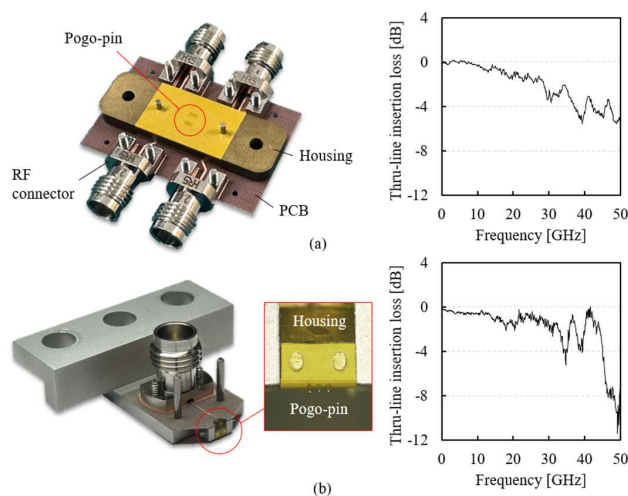


Figure 1. Photographs showing (a) four-port probe card for circuits with fixed port locations and (b) single-port probe for conventional circuit testing along with their respective performances.

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