

## Lumped Elements in Microwave Integrated Circuits (Dec. 1967 [T-MTT])

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*D.A. Daly, S.P. Knight, M. Caulton and R. Ekholdt. "Lumped Elements in Microwave Integrated Circuits (Dec. 1967 [T-MTT])." 1967 Transactions on Microwave Theory and Techniques 15.12 (Dec. 1967 [T-MTT]): 713-721.*

The use of lumped rather than distributed elements affords a considerable size reduction (typically a factor of 10 in area) in L- and S-band microwave integrated circuits. The electrical performance of such lumped elements is shown to be good enough to warrant their use in many applications where the size advantage or the resultant cost advantage is important. Miniature elements have been constructed which behave as true lumped reactive components up to at least 2.5 GHz. These elements have been evaluated using an impedance measurement method. Both inductors and capacitors have exhibited  $Q$ s greater than 50 at lower S band. Single-stage transistor power amplifiers at 2 GHz have been breadboarded using a simple arrangement of the lumped elements to match the measured impedances of the transistor pellet. These amplifiers have had gains as high as 4.7 dB at 2 GHz. The transistor used typically exhibits about 5 dB of gain in conventional coaxial circuitry. The loss in the lumped element matching networks has been about 0.5 dB greater than the loss in the distributed matching networks used in a microstrip amplifier built with the same type transistor. It is expected that the lumped circuit loss can be reduced as improved components are developed.

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