

Microfabricated Transmission-Line Transformers with DC Isolation.

Leonardo Ranzani⁽¹⁾, Ignacio Ramos⁽¹⁾, Zoya Popovic⁽¹⁾,
Dragan Maksimovic⁽¹⁾

(1) University of Colorado, Boulder, CO

A transmission line transformer (TLT) is a device that transforms a circuit impedance and is implemented with interconnected transmission lines. While traditional TLTs, operating at UHF and low microwave frequencies, are constructed from pairs of coaxial lines wound around ferrite cores, various compact implementations at higher frequency without magnetic materials have been demonstrated with multilayer circuit boards, monolithic microwave integrated circuits (MMIC) and air-filled microcoaxial lines implemented in the PolyStrata^(R) wafer-scale technology. Microfabricated Guanella TLTs in the microwave range typically span several GHz of bandwidth, but they are not suitable for impedance matching of power amplifiers and active devices because the input and output ports are shorted to ground and therefore lack DC isolation. A compact and DC-isolated TLT would be especially useful in small-size, low-loss and high-speed DC-to-DC converters.

In this talk wideband microfabricated transformers with up to 450V of DC isolation will be described. The devices were implemented in PolyStrata^(R) to achieve small size and low loss. DC isolation was obtained by use of the basic unit block shown in the figure below. It is made up of two micro-coaxial lines, where the inner conductor of the first line is connected to the outer conductor of the other. The basic unit block achieves a 1:1 impedance transformation at twice the characteristic impedance of the two coaxial lines and can be used as a part of a TLT to introduce DC isolation. If the lines have exactly the same length and for ideal interconnections, the device operating bandwidth is theoretically infinite. In practice line imbalances, non-ideal interconnections and parasitic electromagnetic modes limit the device bandwidth. A fabricated unit block operating from 1 to 12 GHz and a 1:4 DC isolated impedance transformer will be discussed. The transformers have 450 V of input/output DC isolation and are suitable for impedance matching of microwave power amplifiers and compact microwave DC to DC converters.

