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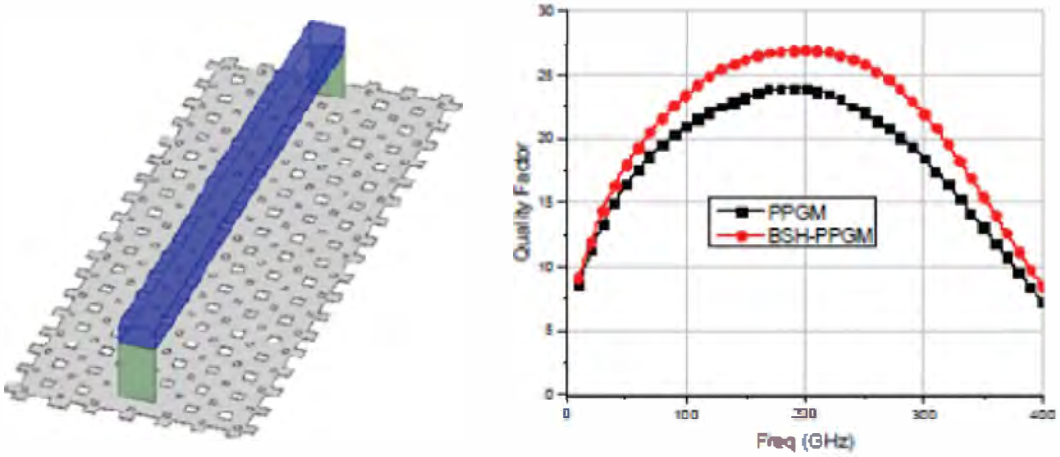
Technology Offer

A High Q Microstrip Line with Novel Big-Small-Holes Periodically Perforated Ground Metal in CMOS Process

Technology Overview

Demands for fully integrated monolithic microwave integrated circuits (MMICs) have increased in the 5G/6G wireless communication systems market. In 5G/6G frequency division, higher working frequencies enabled highly miniaturized and fully integrated MMICs and the development of miniaturized on-chip passive components is indispensable. The miniaturized on-chip passive components with low port impedances can greatly reduce the size of MMICs by removing bulky impedance transformation circuits between the passive components and low impedance field-effect transistors (FETs). To realize highly miniaturized and low-impedance on-chip passive components, a microstrip-line structure with a short guided-wavelength and low characteristic impedance should be developed. Most of current structures have achieved a short guided-wavelength and low characteristic impedance but few efforts have been put on quality factor optimization. In this study, we proposed a novel microstrip-line structure employing big-small-holes periodically perforated ground metal (BSH-PPGM) that has a higher Q than the conventional structure and PPGM structure, and which will allow the development of high-Q and low impedance passive components on 5G/6G MMICs.



Top view ofthe microstrip line structure employing the proposed BSH-PPGM and simulation results

Potential Applications

This invention is applied to RF/MMIC designs especially to high frequency circuits in 6G applications where quality factor is extremely tough. It can be used in other processes where both metal density and quality factor performance are required and can also be used to tune the bandwidth of the circuit passband and stopband in 5G/6G applications. Firstly, this invention can improve passive devices quality factor by optimizing ground metal structure by 12% without adding additional manufacturing cost. Foundries with RF department such as TSMC, GF could be interested in using this invention to improve their passive device models. Secondly, this invention can be used in RF/mm-Wave circuits where passive devices are used. IC design companies such as Skyworks, Infineon Technologies, Qualcomm and so on could be interested in this invention for the application of their 5G/6G products, such as Sky5 suite (SKY5 A1007, SKY5 9600-11...), Infineon MMICs(BGT24LTR22N16, BGT24LTR22...).

Benefits

The quality factor of the proposed BSH-PPGM microstrip line is 12% large than traditional PPGM structure and is 5% superior comparing to small holes PPGM structure. As a result, RF/mm-Wave circuits performance will be increased by using this high Q BSH-PPGM microstrip line such as LNA, noise figure will be optimized. When it is applicated in RF/mm-Wave circuits such as frequency multiplier where wide bandwidth is required, it can also provide tunable solutions by changing the BSH density of the proposed invention.

Please contact A/Prof. Boon Chirn Chye (NTU) for further discussions on this technology.

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