

Recent Advances in Microwave Planar Filter Technology

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SUMMARY This invited paper aims to present an overview of our recent research and development (R&D) of advanced microwave planar filters, in particular with miniaturization and/or electronically tunable/reconfigurable functionalities, which are in demand for future communication/radar systems as well as emerging wireless applications.

Key words: microwave filters, planar filters, multilayer filters, tunable filters, reconfigurable filters

1. Introduction

Recently, there is an increasing demand for miniature and/or tunable/reconfigurable microwave planar filters. For the filter miniaturization, we have exploited multilayer liquid crystal polymer (LCP) technology [1]–[11]. LCP has been popular not only due to its superior electrical properties up to millimeter-wave frequencies [12], but also because itself is an excellent packaging material for system-on-package [13]. It has a stable low dielectric constant around 3 and low dielectric loss tangent 0.0025 over a wide frequency range. Compared to LTCC, LCP has much lower processing temperature around 280°C. Although LCP has lower dielectric constant than LTCC, which makes it more challenging for RF/Microwave circuit miniaturization, it makes LCP circuit design less sensitive to fabrication tolerances than LTCC, which is very important for multilayer laminated circuit. Although some cheaper PCB laminates can be used for miniature filter designs, LCP offers much higher flexibility on circuit thickness and a very strong coupling can be achieved with a separation as small as 25 μm . This is very important for the design of low frequency filters that requires large capacitances. Furthermore, in the LCP adhesive system [14], circuit layers (core films) and prepreg layers (bonding films) have almost the same characteristics, such as thermal expansion coefficient, dielectric constant and water absorption, which can be a great benefit for both filter designs and practical applications.

In addition to the filter miniaturization, electronically tunable or reconfigurable filters are also in increasing demand in current and emerging multifunctional communication and radar systems owing to their efficiency in use and flexibility in control of frequency spectrum. In general, to develop an electronically tunable or reconfigurable filter,

active switching or tuning elements such as semiconductor p-i-n and varactor diodes, RF microelectromechanical systems (MEMS) or other functional material-based components including ferroelectric capacitors need to be integrated within a passive filtering structure [15]. Planar filters can conveniently facilitate this kind of integration with a small size and to this end we have carried out R&D for tunable or reconfigurable planar filters are based on planar structures [16]–[33].

In the following parts, several typical advanced planar filters resulting from our R&D are highlighted.

2. Packaged LCP Filters

This section is to demonstrate the methods for integrating filters within a package as one of the stages in the manufacturing process, using LCP multilayer technology. Including the packaging in the manufacturing process will reduce the number of processes needed and thus, the final cost of the solution.

2.1 Hermetic Packaged UWB Filter

The concept for packaging with CPW input/output (I/O) ports is illustrated in Fig. 1, which consists of two layers of LCP substrate holding the packaged device in between. The bottom layer will interface between the host board and the packaged device through a CPW structure. Since the CPW structure has both signal and ground on the same plane, it will simplify the connection of the device to the host board. On the other side, the top layer is the ground plane for both the CPW structure and the packaged device. In this way, the CPW becomes grounded-CPW (G-CPW). However, to simplify, G-CPW will be referred as CPW in this paper. CPW and ground plane are connected through via-holes. On top



Fig. 1 Main concept for packaging with CPW input/output (I/O) ports.

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Recent Advances In Microwave Technology

H.N. Kritikos, Dwight L. Jaggard



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Recent Advances in Mechanical Engineering K.M. Pandey,R.D. Misra,P.K. Patowari,U.S. Dixit,2021-01-10 This book presents the select proceedings of the International Conference on Recent Advancements in Mechanical Engineering ICRAME 2020 It provides a comprehensive overview of the various technical challenges faced their systematic investigation contemporary developments and future perspectives in the domain of mechanical engineering The book covers a wide array of topics including fluid flow techniques compressible flows waste management and waste disposal bio fuels renewable energy cryogenic applications computing in applied mechanics product design dynamics and control of structures fracture and failure mechanics solid mechanics finite element analysis tribology nano mechanics and MEMS robotics supply chain management and logistics intelligent manufacturing system rapid prototyping and reverse engineering quality control and reliability conventional and non conventional machining and ergonomics This book can be useful for students and researchers interested in mechanical engineering and its allied fields **Recent Advances in Systems, Control and**

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Benkeblia,2024-09-09 The elapsing time from producer to consumer has significantly increased as a result of food marketing and trade globalization Consequently maintaining quality along the food value chain is becoming a significant challenge Postharvest losses are considered a major component of food loss and waste in the supply chain from farmers to consumers

due to improper handling storage transport preservation techniques and spoilage Postharvest science aims to extend the shelf life of fresh and perishable commodities and to reduce heavy losses thereby contributing to food security While significant progresses have been made in postharvest preservation and shelf life extension the continuous development of emerging technologies have changed our vision on postharvest science Furthermore recent advancements in molecular engineering of horticultural crops for quality improvement the development of genomics transcriptomics proteomics and metabolomics have led to a better understanding of the physiology and the biochemistry of the senescence processes resulting in better preservation and improved production of fresh crops This two volume work focuses on innovative technologies that extend and preserve shelf life of fruits and vegetables Volume 1 offers a review on the state of the art modern technologies in the postharvest field The accompanying Volume 2 explores advanced and novel technologies after harvest particularly the application of nanotechnologies to packaging materials

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Proceedings of 3rd International Symposium on Recent Advances in Microwave Technology (ISRAMT '91), August 18-21, 1991, Reno, Nevada, U.S.A. Banmali S. Rawat, Krishna K. Agarwal, 1991

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Recent Advances in Communication Networks and Embedded Systems Smain Femmam, Pascal Lorenz, 2024-05-11 This book is devoted to an enhanced version of selected papers presented at the 7th International Conference on Communication and Network Technology ICCNT 2023 The objective of the proceedings of ICCNT 2023 is to present the recent research results and technological advances in the fields of theoretical and experimental applications of embedded systems communications and signal processing decision as well as in emerging areas related to the tracks of the conference The specific topics of interest within the scope of this special issue include design tools for electronics and embedded systems embedded systems and software system on chip SoC multiprocessor system on chip MPSoC platforms and applications network on chip NoC design methodologies reconfigurable computing system design synthesis and optimization advanced communications circuits and systems for communications optical fibers applications optical communications sensors image laser applications in telemetry LiDAR system anemometry computer 3D vision range technique RF and wireless communications image and signal processing decision image and video processing technology compression coding and implementation cryptology and watermarking real time systems sensors and instrumentation data acquisition audio acoustic speech biomedical signal processing sensor microsystems and industrial sensors computer engineering and networks cloud computing technology internet technology computer security computing networks and data acquisition

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web in section iv simulations for the ofdm plc are given in matlab 2012a followed by the results conclusions are given in section v ii plc data transmission a plc can be modelled as in fig 1 the model consists of a plc transmitter the plc channel with noise and the receiver block

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