A COMPACT MILLIMETER-WAVE FINLINE
AND MICROSTRIP HYBRID
INTEGRATED FRONT-END

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ABSTRACT

Unlike usual millimeter-wave (MMW) beam lead mixer, an integrated mixer using packaged diodes with large junction area is designed, and a novel dielectric resonator stabilized microstrip oscillator is given. On these bases, a high performance MMW finline and microstrip hybrid integrated front-end has been developed with minimum double side band noise figure of 4 dB and frequency temperature coefficient of 5~10 PPm/°C. It has been fabricated in small amounts and works well in many MMW systems.

INTRODUCTION

An increasing demand for low-cost MMW components and entire subsystem modules for radar, radiometer and data communication applications has pushed forward the development of integrated, quasi-planar components and subsystems. Microstrip and finline are two kinds of the most important planar or quasi-planar transmission media taken for millimeter-wave integration and thus research was being carried out worldwide. A variety of such components and subsystems have been investigated recently[1-3].
Fig. 1 Principal layout of front-end, 1 is the longitudinal septum of finline, 2 is mixer diode, 3 is the protruding part of microstrip, 4 is the block capacitor, 5 is the dielectric resonator, 6 is the open circuit stub, 7 is Gunn diode, 8 is the dc bias.

**BALANCED MIXER**

The most essential part of the balanced mixer is 180° hybrid which realized by combinations of orthogonal transmission lines so called finline-microstrip hybrid resonating junction. The hybrid junction is similar to a finline magic T presented in [4] and acts as followers. A wave incident from the left on the slot of a finline (its electric field is represented by dashed arrows) provides antisymmetric inphase excitation of two mixer diodes. In case of perfect geometrical symmetry there occurs no excitation of the wave on the microstripline. A wave incident from the right on the microstripline (its electric field is represented by solid arrows) excites symmetric antiphase wave on diodes. The protruding part of the microstrip, i.e. the part without back-side metallization, acts as an antenna. Its optimum length, in order to match the microstrip input, is determined by theoretical analysis and experiment. If the finline side of the hybrid junction is used as signal (RF) input and the microstrip side as a local oscillator (LO) input in a common IF output, the LO currents cancel and the IF currents are inphase. In this way, an isolation of more than 30 dB between signal and LO is achieved using matched pairs of diodes. So this circuit is capable of being used as a balanced mixer.