

Abstract

A W-Band GaAs Monolithic Diode Mixer

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The initial development phase of a monolithic microstrip W-band balanced mixer using GaAs schottky diodes is reported. The wafer has been successfully processed and Figure 1 shows typical on-wafer measurements to 40 GHz using a Cascade prober. RF evaluation of individual chips is now imminent. A small signal model of the diode has been fitted to measured data and will be described. This model will be extrapolated and used if necessary for diagnostics on the first batch and for refinements to the mixer design. The prototype mixer designs were based on an estimated model of the diode characteristics.

For W-band operation, high quality Schottky diodes are required. Gold-plated air-bridges are employed to minimize parasitic capacitance to the 2.5 μ m diameter schottky contacts. Low resistance is ensured by using a Mott-type structure with a thick n⁺ layer under the cathode. Typical measured diode parameters are; $R_s=6\Omega$, $n<1.2$, $C_{j0}=20\text{fF}$. Figure 2 is a micrograph of the diode.

An important aspect of this work is that the microstrip networks were designed using field-theoretical software (LINMIC+) and attention was centred on the design of the embedding networks at the pump-harmonic and mixed product frequencies in order to minimise noise figure, conversion loss and LO power. Large signal analyses were performed using the program DIODEMX. Comparisons between measured and theoretical data will be given where appropriate.

RF evaluation of individual mixer chips will be described and will concentrate on the difficulty of performing precision chip measurements at W-band. A stepped-ridge to microstrip transition is currently being developed for this work and its performance will be reported.

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Figure 1. On-wafer diode S-parameter measurements to 40 GHz (Series)

REF: 74011

980 1479042 2001/08/04

MODEL: 15
 PARTNO: 2P0H, 2

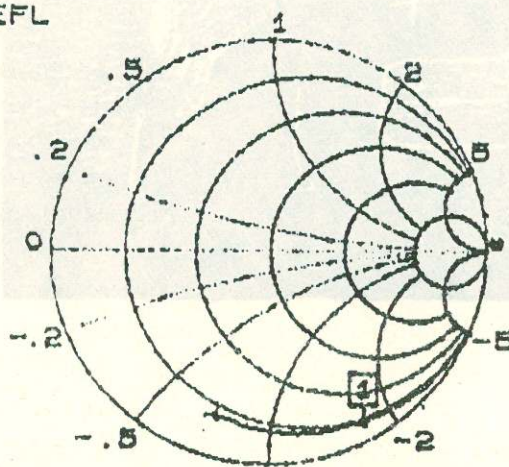
DATE: _____
 OPERATOR: _____

START: 1.5000 GHz
 STOP: 40.0000 GHz
 STEP: 100.0000 GHz

GATE WIDTH: _____
 GATE HOLD: _____
 GATE: _____
 RESOLUTION: _____

WINDON CORR: 0P - TUNE
 AVERAGING: 1 PTH
 LOSS CORR: 0P - TUNE

S11 FWD REFL
 IMPEDANCE



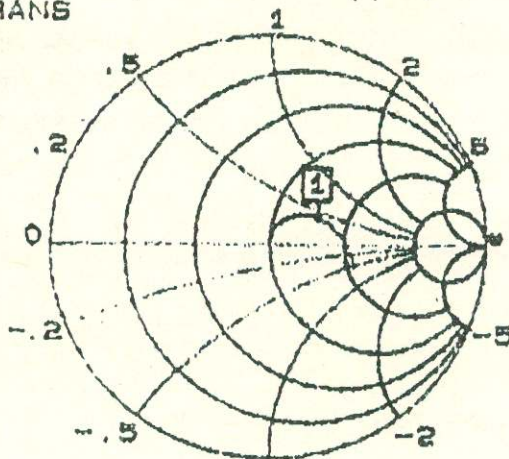
CH 1 - S11
 REF. PLANE
 -0.1498 mm

MARKER 1
 20.0000 GHz
 8.734 Ω
 -84.277 j Ω

MARKER TO MAX
 MARKER TO MIN

1.5000 - 40.0000 GHz

S21 FWD TRANS
 IMPEDANCE



1.5000 - 40.0000 GHz

Figure 2. Micrograph of the Mixer Diode

