

Schottky Diode Voltage Doubler

Application Note 956-4

Introduction

Diode detectors may be combined in various ways^[1] to produce higher output voltages than would be produced by a single diode. This note describes a microwave circuit that combines the detected output of two diodes to produce a detector with double the usual voltage sensitivity.

Circuit Description

Figure 1 shows a simple voltage doubler circuit that was assembled in HP Package 60 and tested at 2 GHz. In this version of the doubler, opposite polarity chips are needed. The shunt chip is a 5082-0009 detector. The series chip is a 5082-0023 mixer. Interchanging the chips does not affect performance. The circuit may also be assembled using

packaged diodes, in which case the polarity requirements may be met by physically reversing the packages, thus eliminating the need for opposite polarity diodes.

Note that the two diodes are in shunt at R.F. so the impedance is halved. Impedance matching circuits will thus be easier to design.

Performance

Measured performance of the voltage doubler at 2 GHz compared to a single diode is shown in Figure 2. A triple stub tuner was used to match the detectors at each input level. Figure 3 shows similar data with the tuner adjusted at -30 dBm and fixed at that position. The

doubler output is seen to be the sum of the detected voltage from two diodes in both cases.

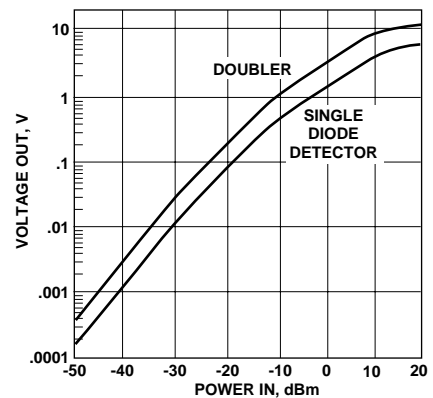


Figure 2. Voltage Doubler Tuned at Each Power Level.

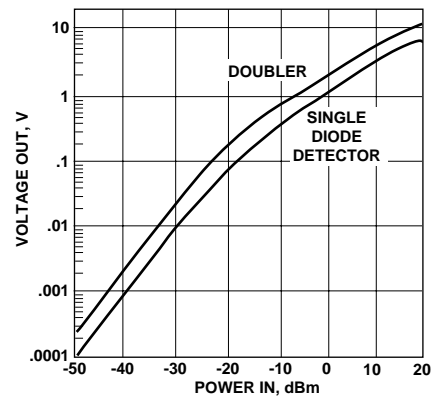


Figure 3. Voltage Doubler Tuned at -30 dBm.

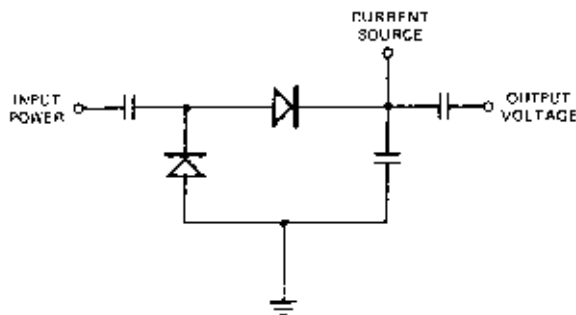


Figure 1. Voltage Doubler Schematic.

How It Works

The voltage doubler is a combination of a clamper, the shunt diode, and a detector. Diode clamping action has been discussed in Hewlett-Packard Application Note 942. The input sine wave, symmetrical about zero volts is raised by the clamper so that the minimum voltage is zero. The input to the series detector diode

is the input sine wave plus a d.c. component equal to the peak voltage. The detected voltage is then the peak-to-peak voltage of the sine wave, double the peak amplitude detected by a single diode.

Reference

1. E. Angelo, Jr., "Electronic Circuits", McGraw-Hill, 1958.

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