

# **A microwave chaos generator circuit employing a resonant tunneling diode**

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A chaotic generator circuit using a nanodevice, resonant tunneling diode (RTD), has been fabricated and characterized in a microwave frequency range. It is a non-linear high frequency oscillator circuit in which non-linearities arise due to RTD. The RTD is a high-speed nanodevice based on III-V compound semiconductors. Ultra-high frequency oscillations at around 2 THz have been already demonstrated for the oscillators using an InP-based RTD. Our circuit uses an InP-based RTD for the negative differential resistance device in van der pol oscillator. It is well known that the van der pol oscillators show complex chaotic behavior as well as period adding behavior when perturbed with external sinusoidal forcing signal. Using RTD, ultra-high frequency chaos signals higher than microwave frequencies can be generated easily with this circuit. This may open up various applications such as secure communications. In this study, we also implement a control circuit that enables/disables chaotic oscillations and resets the circuit to the same initial state. This permits us to observe non-periodic chaos signals with a sampling oscilloscope.

First, we performed simulation of our circuit to investigate its behavior, which aided to find out optimum operating conditions for the circuit. Then, the circuit was integrated using chip elements and an RTD on a PCB substrate. The RTD was interconnected with circuit employing bonding wires. After that, behavior of the circuit was demonstrated experimentally with a various-frequency input. Microwave circuits are usually difficult to handle because many parasitic effects occur at high frequency. After overcoming all barriers, fruitful results had been achieved. Complex chaos signals were clearly observed on sampling oscilloscope. Period adding behavior was also clearly shown in our experiments.