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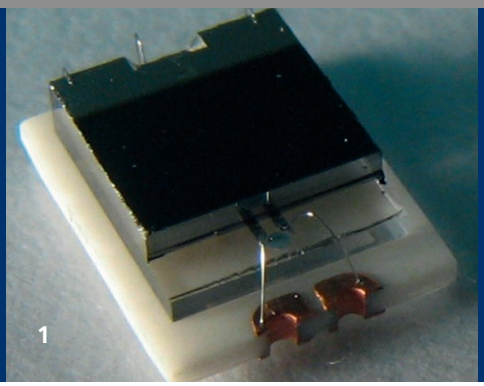

1 *Photography of the packaged device.*

RF-MEMS VARACTOR FOR HIGH POWER APPLICATIONS

Fraunhofer ENAS is part of

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In cooperation with

ZfM Zentrum für Mikrotechnologien

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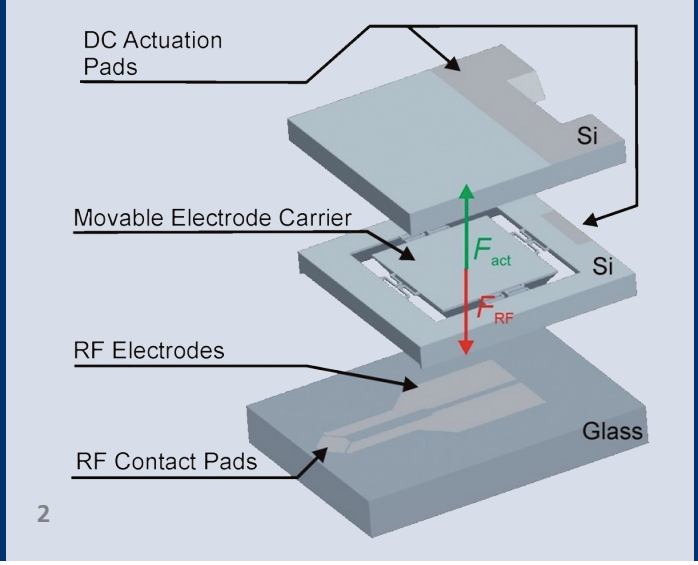
General Description

A parallel plate, metal-air-metal capacitance is the main part of this high Q-factor RF-MEMS varactor. The application of silicon bulk technology and wafer bonding processes allows the fabrication of large area electrodes with narrow electrode separation. Therewith, continuous tunability and rather high RF capacitance values (required for UHF applications) are obtained.
Typical reliability and functionality limiting issues of RF-MEMS varactors like charging and RF self-actuation are addressed by minimizing the electrode area covered with highly isolating dielectrics and by arranging the RF and DC actuation electrodes vertically (see Fig. 1). Since attractive forces, proportional to the square of the rms-voltage, are generated using the electrostatic principle, the DC actuation can be used to compensate detuning effects resulting from high RF amplitudes. Further on, intrinsic stability against high power RF bursts is achieved by the highly damped mechanical response. Consequently, it is prevented that resonance induced mechanical oscillation at narrow tone spacing and accompanying intermodulation generation occurs.
The diced and packaged device is shown in Fig. 2. Due to the use of a carrier substrate with plated castellation, it is possible to mount the device to a PCB by standard soldering techniques. Due to high resistivity silicon material the RF and DC are intrinsically isolated. Special biasing networks are therefore not required.

Features

- Continuously tunable RF-capacitance
- Intrinsic RF-DC-isolation
- Damped mechanical response (low generation of intermodulations)



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2 *Schematic drawing.*

Suggested Applications

Frequency agile circuitry in high power applications like transmitters of cellular base stations or RF based scientific measurement equipment (NMR, MRI).

Characteristics

Parameter	Value	Unit
RF Capacitance	1.4 – 2.1	pF
	5.6 – 7.3	pF
Frequency range	DC –4.0	GHz
Q factor at *f* < 2.0 GHz	> 100	1
max. RF Voltage (rms) CW / pulsed (r < 10 µs)	50 / > 100	V
DC Turning Voltage	0 – 25 ... 120	V
Chip size	(2.9 x 3.8 x 1.1)	mm³
	(4.1 x 4.9 x 1.1)	mm³

Photo acknowledgments:
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