

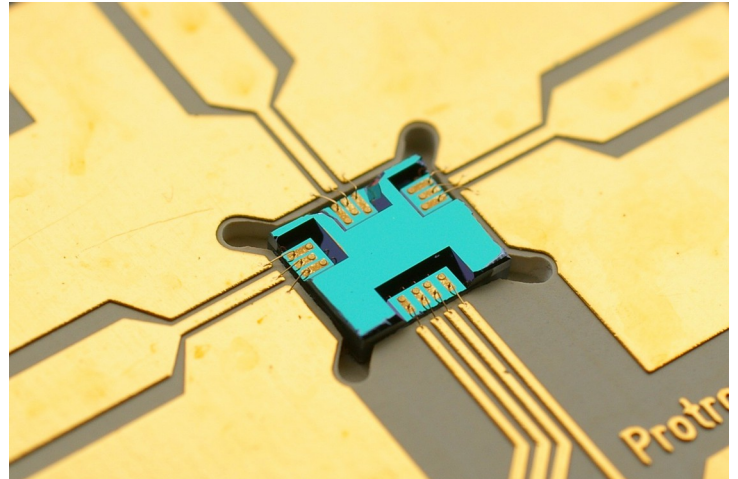
# Micromechanical RF Switches

## General Description

MEMS RF switches are miniaturized mechanical devices for switching high frequency electromagnetic signals.

The advantages of MEMS RF switches compared to PIN diodes and FETs are minimum insertion loss, good isolation, a superior signal linearity, and a very low power consumption.

The metallic ohmic contacts of Protron's RF switch are actuated by silicon electrostatic comb drives. The switch can be used for frequencies from DC to 20GHz (40GHz switch in development). A hermetic zero-level packaging avoids contamination.



SPDT RF switch on PCB

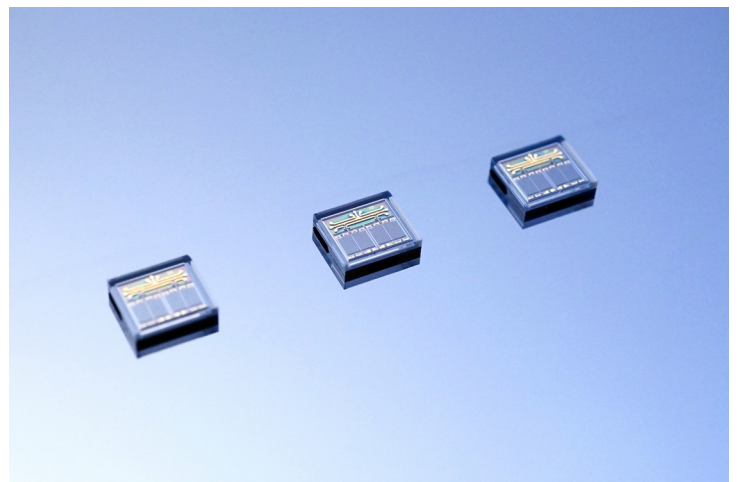
## Details

### Actuator

The electrostatic comb drive is made by deep reactive ion etching in mono crystalline silicon. The high aspect ratio and the multitude of parallel plates result in a high contact force.

### Waveguide, Contact

The coplanar waveguides of the switch and the ohmic contacts are made of electroplated gold alloy. The massive structure enables the switching of signal powers up to several hundred milliwatts and possesses a small electrical resistance. Furthermore, the robust metallic contact guarantees a high durability.



SPDT RF switches

## Main Features

- frequency range:  
DC to 20GHz (40GHz in development)
- RF power up to 30dBm
- hot switching performance
- electrostatic silicon actuator
- actuation voltage: 28V - 34V
- switching speed: < 200 $\mu$ s
- low power consumption
- electroplated ohmic contact and CPW lines
- superior insertion loss, isolation and linearity
- DC voltage isolated from RF path

## Design Variations

- SPST and SPDT designs available
- die size:  
SPST switch: 2.8 x 1.9mm<sup>2</sup>  
SPDT switch: 2.8 x 3.3mm<sup>2</sup>  
substrate height: 700 $\mu$ m
- impedance: 50 Ohm
- wire bond connection
- flip-chip design in development
- SMD packaging on request
- application specific designs on request

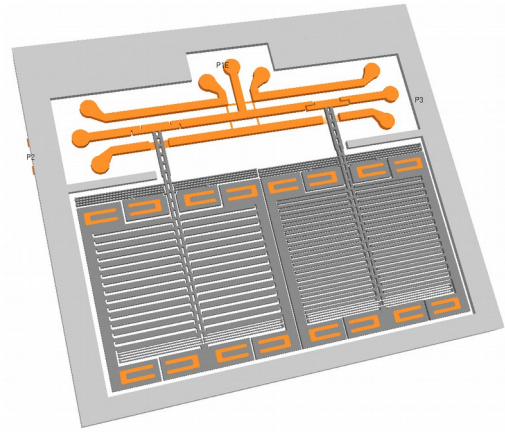
## Reliability Tests

### DC long term test

- hot switched (5V, 20mA): min.  $10^8$  cycles
- cold switched (5V, 20mA): min.  $10^9$  cycles
- variation of contact resistance: +/- 0.1Ohm

### RF long term test

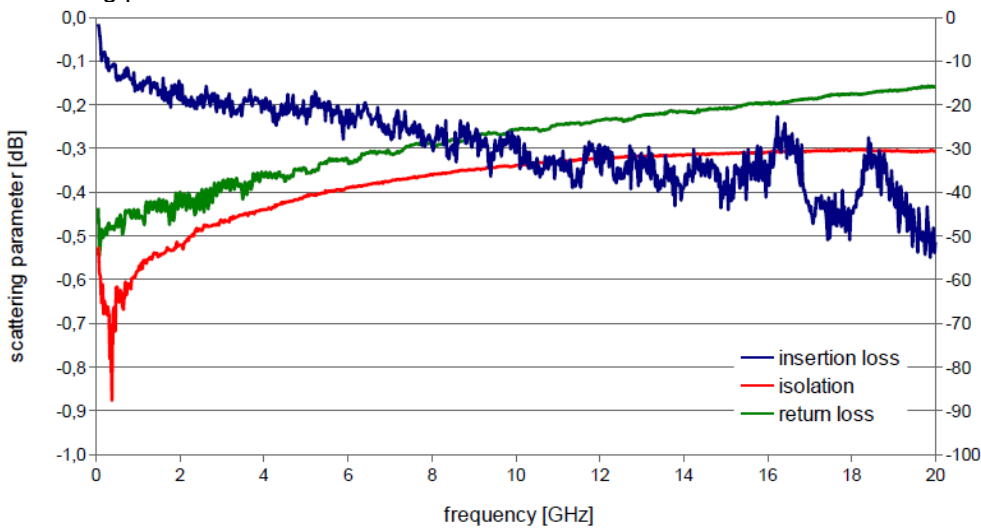
- hot switched (1GHz, 13dBm): min.  $10^8$  cycles
- variation of insertion loss: +/- 0.02 dB



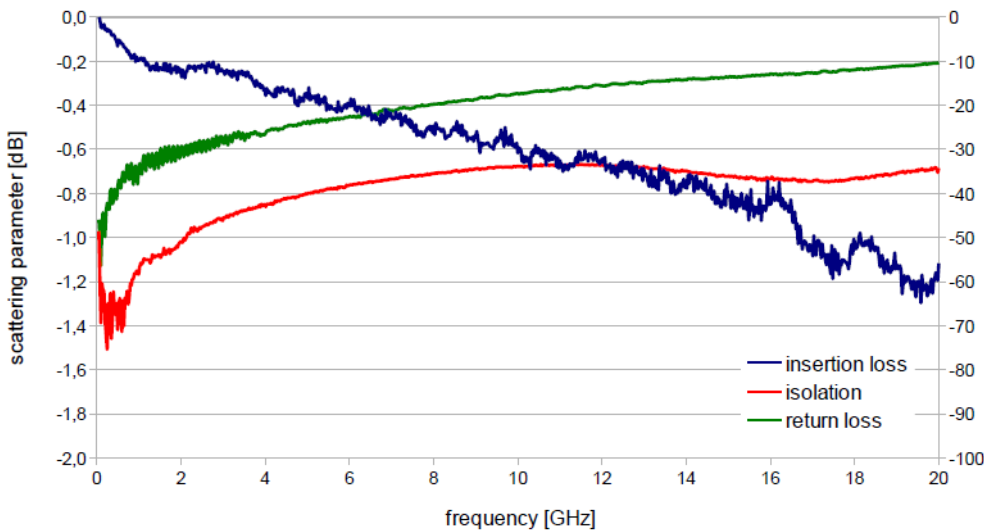
Sketch of SPDT switch

## RF Performance

### Scattering parameters SPST switch:



### Scattering parameters SPDT switch:



## Contact

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