# Development of W-Band Low-Loss MEMS Switches

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**Abstract**

We have developed low-loss MEMS switches for 70-120 GHz applications. The MEMS switches are integrated on a high-resistivity silicon substrate, and are built in a coplanar-waveguide configuration. The MEMS switches are fabricated using a thin gold bridge, suspended 1.5-2.5 um above the center conductor of the cpw line. The MEMS bridge is 250 um long with a width of 25-40 um, depending in the height of the bridge. The inductance of the bridge is around 10 pH, and the MEMS switch is designed to resonate in the down-state position at 70-80 GHz by choosing the down-state capacitance to be only 500 fF. This results in a high isolation at W-band frequencies since, at resonance, the isolation is given by the series resistance of the switch and not by the down-state capacitance. Typical performance, to be shown at the conference, is an isolation better than 20 dB with an insertion loss of less than 0.1 dB at 80-100 GHz.

We have also developed two MEMS switches configured in a Pi-match circuit. In this case, the up-state reflection coefficient is less than —20 dB over the entire W-band frequency range, and the down-state isolation is better than —30 dB over 80-100 GHz. The Pi-match circuit is quite small (less than 100 um) and therefore, the insertion loss in the up-state position is only 0.2 dB. This represents state-of-the-art performance at W-band frequencies for MEMS switches, and is much better than PIN diode or FET switches.

The application areas of MEMS switches is in low-loss phase shifters, low-loss tunable matching networks at the input and output of multipliers, and low loss tunable filters for receiver applications.