MEMS Switches

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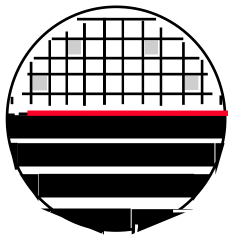

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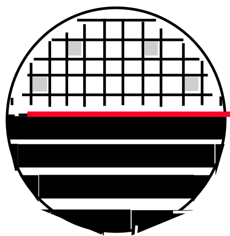
OUTLINE

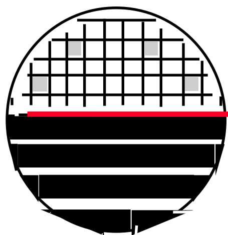
Introduction

Actuation



INTRODUCTION

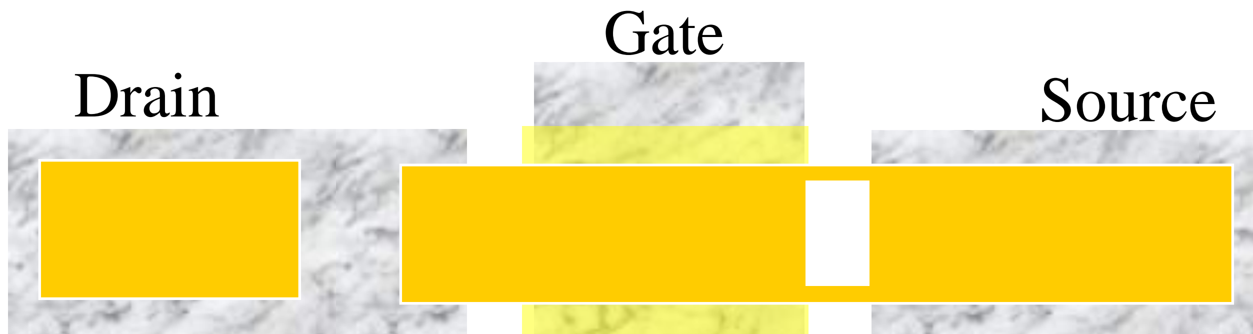
Excellent Isolation >40dB@10Ghz
Low Loss <1dB@2Ghz
Low On Resistance <1 ohm
High Q >10,000
Low Power Consumption (almost zero)
High Currents ~1 Amp and 10 Amp Peak
Small Size
Low Actuation Voltage <6 Volts
Reliability >10E9 Cycles
Fast Operation 10-100 µsec
Small Packaging



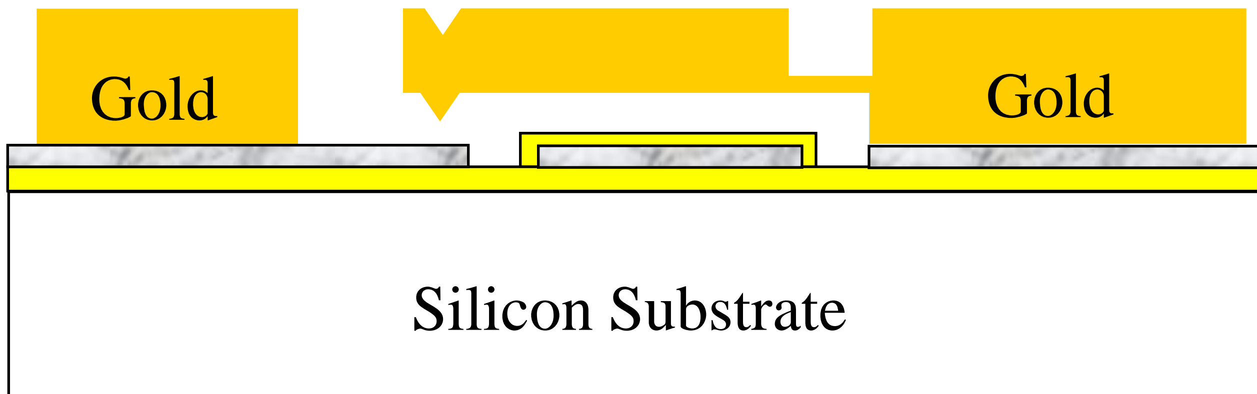
APPLICATIONS

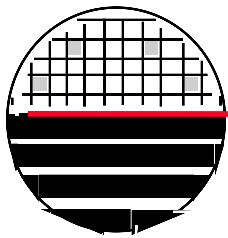
Area	*System*	*Device*
Phased Array	Communication and Radar Systems	Switch (ground , space, airborne, missile)
Switching and Reconfigurable Networks	Wireless Communication (portable, base station) switches Satellite (Communication and Radar) Airborne (Communication and Radar)	Switch
Low power oscillators and amplifiers	Wireless	Varactors and inductors
	Satellite	
	Airborne	

CANTILEVER TYPE SWITCH



$$F = \frac{\varepsilon_o \varepsilon_r A V^2}{2d^2}$$

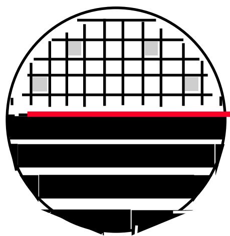




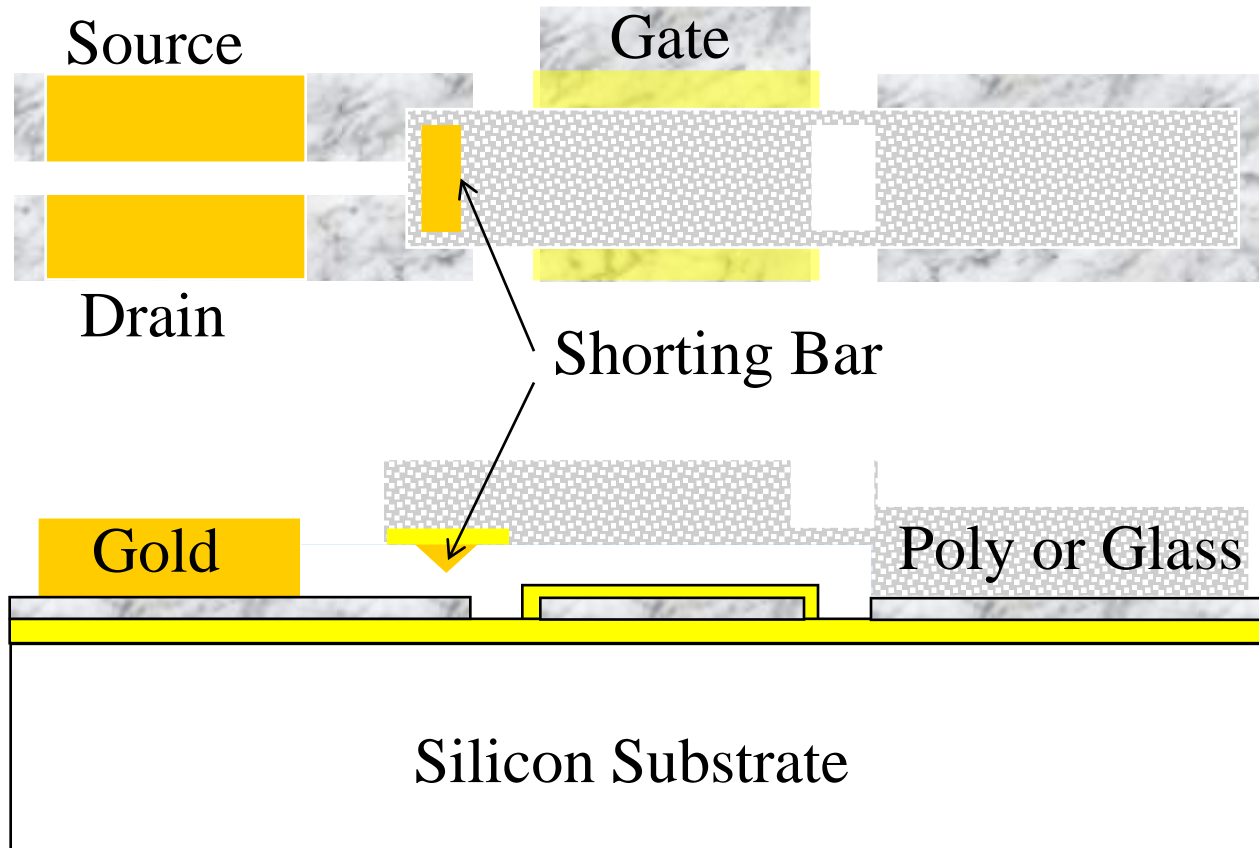
ADI MEMS SWITCH

Size 100 µm x 100 µm

Figure 1. ADI MEMS Switch Configuration



CANTILEVER TYPE SWITCH – SHORTING BAR



$$F = \frac{\varepsilon_o \varepsilon_r A V^2}{2d^2}$$

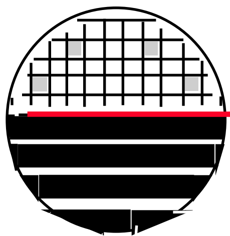
ROCKWELL SCIENCE CENTER MEMS DC SWITCH

Pull-down electrode

Anchor

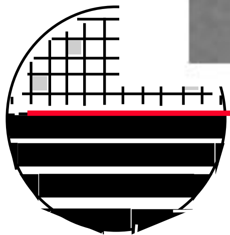
Metal contacts

Acc.V Magn 100 µm



SAMSUNG DC CONTACT SWITCH

Contact region

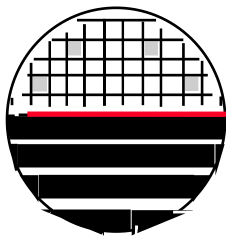


MOTOROLA FOLDED SPRING DC CONTACT SWITCH

Signal line
Anchor
Shorting bar
Top electrode
Folded spring
Microplatform
Stopping bumper
Contact post
Bottom Electrode

Microplatform
Shorting bar
Stopping bumper
DC bias
Signal line
Bottom electrode
Anchor

Contact post



UNIVERSITY OF TRENTO LOW ACTIVATION SWITCH

suspension spring

bridge

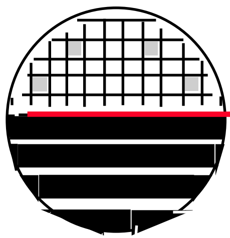
signal line

actuation electrode

CPW ground

thin contact flexure (Au)

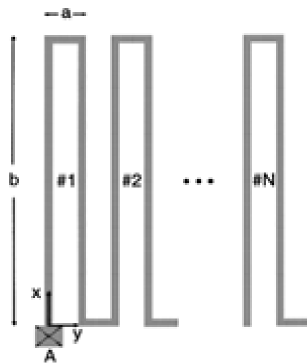
bridge

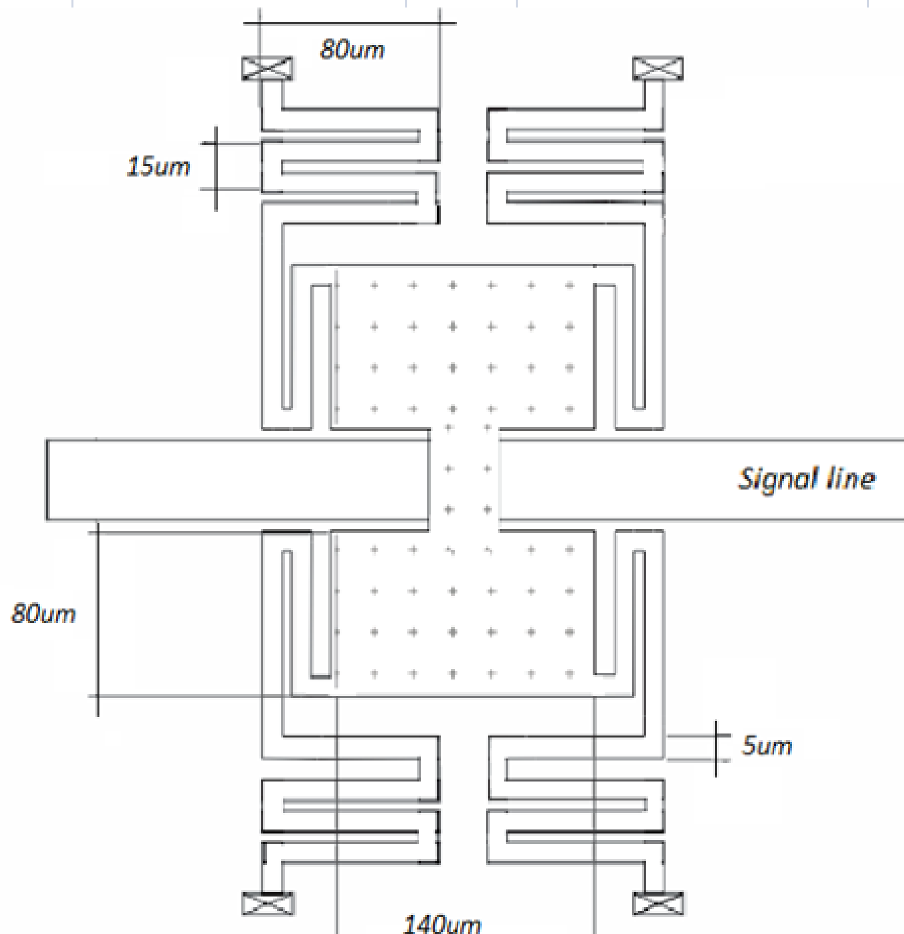


ARTUR NIGMATULIN DESIGN

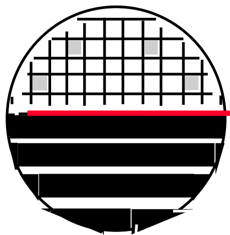
Number of turns in meander	3
Primary length (a)	1.50E-05
Secondary length (b)	1.00E-04
Thickness (t)	2.00E-06
Beam width (w)	5.00E-06
Poly (Youngs Modulus) (E)	1.60E+11
Poly (Poissons Ratio) (v)	0.22
Shear Modulus (G)	6.56E+10
X-axis moment of inertia (Ix)	3.33E-24
Z-axis moment of inertia (Iz)	2.08E-23
Polar moment of inertia (Ip)	2.42E-23
Torsion Constant J	9.98E-24
Initial gap (g0)	2.00E-06
Area	1.12E-08
Number of meanders	4
Spring constant of 1 meander	0.498796
Actuation Electrodes length	1.40E-04
Actuation Electrodes width	8.00E-05

Total spring constant	K	1.995183044
Pull down voltage	Vp	6.919204614





ARTUR NIGMATULIN DESIGN



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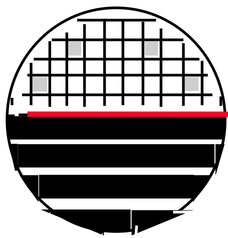
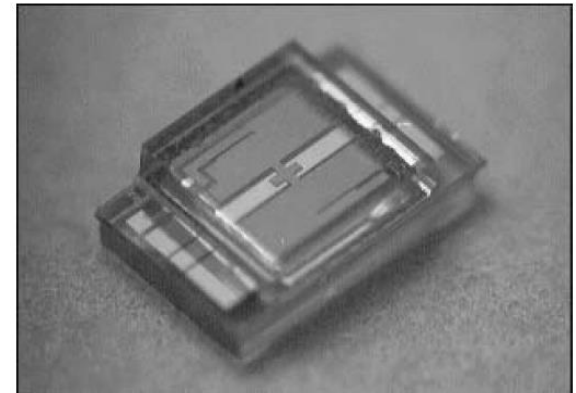
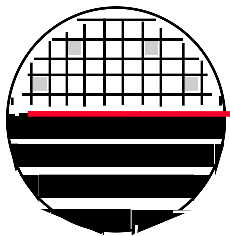


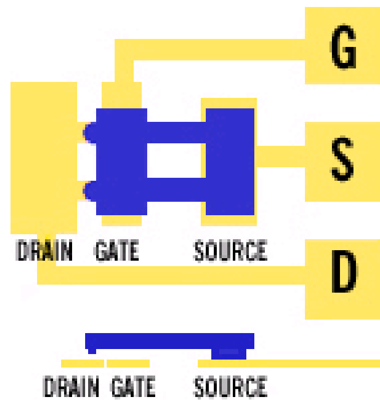
COMMERCIAL MEMS SWITCHES

Omron Co.
2SMES-01





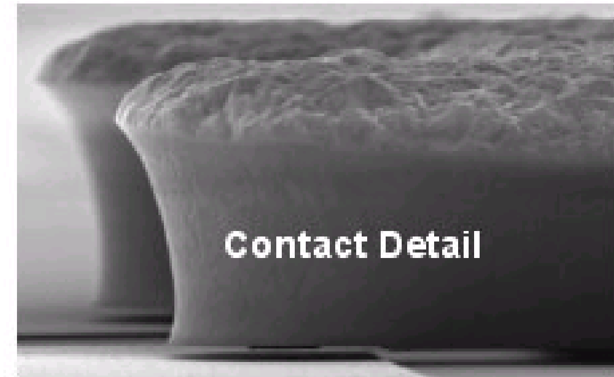
COMMERCIAL MEMS SWITCHES

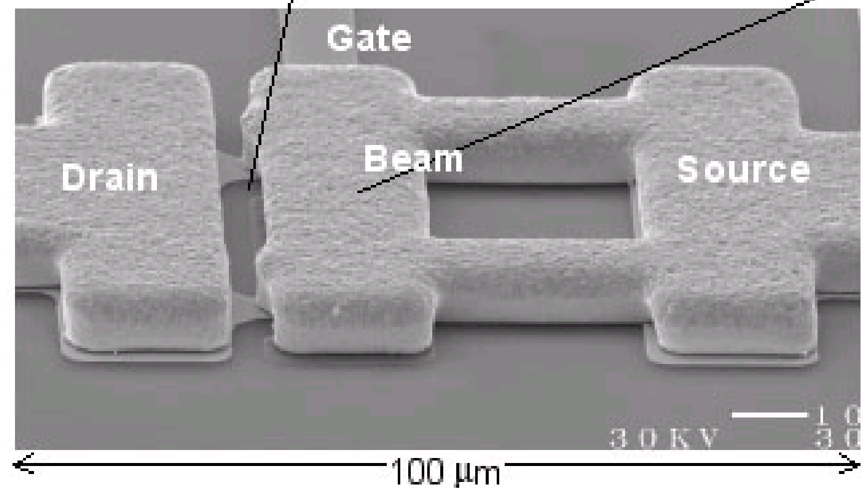


Radant MEMS Switch *(continued)*

Operation

Under the cap, the beam is deflected by applying a voltage between the gate and source electrodes. The free end of the beam contacts the drain and completes an electrical path between the drain and the source.



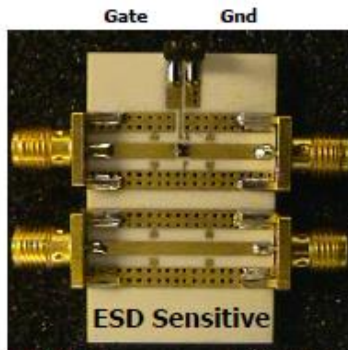


RADANT MEMS RMSW200 SWITCH

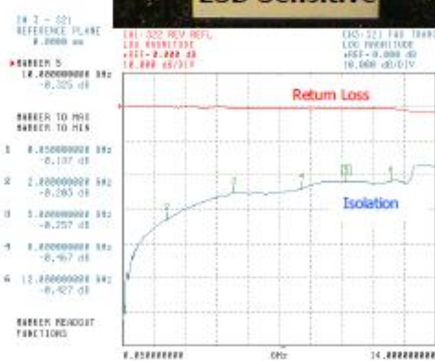
RMSW200-EV12
Evaluation Test Board
DC to 12 GHz for
RMSW200™

General Description

The evaluation test board has one RMSW200™ SPST RF switch connected to two SMA RF connectors, as well as a calibration line. The board requires an external supply to provide the gate actuation voltage.



Switch Insertion Loss
(Test Board minus Calibration Line Loss)



Switch Isolation

Test Board Insertion Loss

Gate-Gnd Voltage	Signal Path State
+/- 90 V	ON
0 V	OFF

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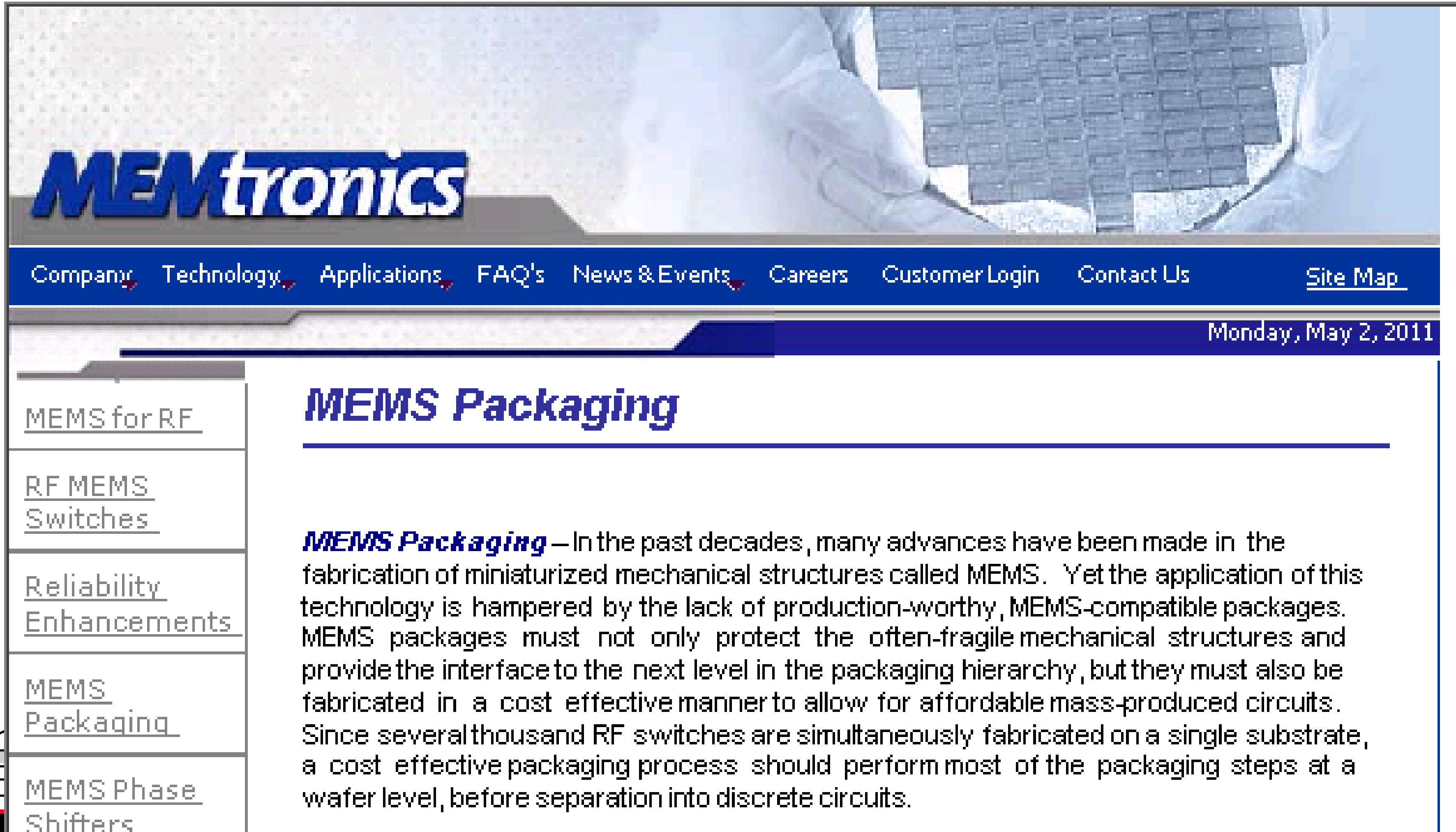
- Fax: 978-562-6277
- Email: sales@radantmems.com

Visit www.radantmems.com

COMMERCIAL MEMS SWITCHES



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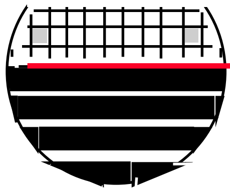

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