MEMS-BASED CHARGE PUMP

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,431,201	08/30/2016	2013-123

BRIEF DESCRIPTION

The reduction of power supply voltage with each new generation of CMOS technology continues to complicate the design of charge pumps needed for high voltage applications that integrate into systems alongside transistor chips -- such as the increasing number of MEMS-based gyroscopes, timing oscillators, and gas sensors. Moreover, the aggressive scaling in CMOS resulting in lower dielectric and junction breakdown voltages has compelled the use of customized CMOS processes -- including increased gate oxide thickness and/or added deep-n-wells. Clearly, advances in transistor technology are moving in the opposite direction of the needs of high voltage MEMS applications.

To address this trend, researchers at UC Berkeley have developed a MEMS-based charge pump. This design avoids the turn-on voltage and breakdown limitation of CMOS. With much higher breakdown voltages than transistor counterparts, the demonstrated MEMS charge pump implementation should eventually allow voltages higher than 50V desired for capacitive-gap transduced resonators that currently dominate the commercial MEMS-based timing market.

APPLICATIONS

High voltage applications that integrate into systems alongside transistor chips. The majority of high volume micromechanical applications prefer high voltage for best performance -- including accelerometers, gyroscopes, frequency references, timing oscillators, etc.

FEATURES/BENEFITS

- Removes turn-on voltage drops inherent in transistor-based switches, thereby allowing charge pumping even when the supply voltage is less than a threshold voltage.

- Offers a practically limitless output voltage range that is unconstrained by the breakdown voltages that limit transistor-based charge pumps.

- Eliminates the need for special high voltage CMOS where large voltages are required, thereby allowing the use of virtually any CMOS process for MEMS-based products.

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OTHER INFORMATION

CATEGORIZED AS

- **Communications**
  - Networking
  - Wireless
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- **Environment**
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- **Engineering**
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