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Creative Disruption MEMS The Word

Josh Wolfe, Forbes/Wolfe Emerging Tech 04.22.08, 4:00 PM ET



In Pictures:
Top 10 MEMS Products

What are the most innovative electronics gadgets on the market today? Few would dispute nominees like **Apple's** iPhone or **Nintendo's** motion-sensing videogame console, the Wii.

But how many of us know that a key part of their technological edge comes from micro-electrical

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mechanical systems, or MEMS? In the case of these two motion sensing gadgets, tiny silicon-etched MEMS accelerometers detect motion and changes in orientation, allowing the iPhone users, for example, to rotate images or Web pages 90 degrees when the phone is turned on its side.

This is just the beginning. Soon programmers will take full advantage iPhone's triple-axis MEMS accelerometers to make impressive new motion sensing uses for iPhone, including videogames. **Nintendo's** (other-otc: [NTDOY](#) - [news](#) - [people](#)) Wii videogame system also uses MEMS. And "Guitar Hero III" players can thank MEMS for boosting their score when they raise the neck of a guitar-shaped videogame controller toward the living room ceiling.

In Pictures: Top MEMS Products

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Conceptually, MEMS straddle the threshold between the mechanical and digital worlds, converting physical forces into digital information, and fabricated with the same silicon-etch process used to make integrated circuit chips. Instead of transistors, the process yields tiny, micromachined structures. Package these structures with digital circuits, and you have a MEMS chip, which can become an accelerometer, resonator, gyroscope, switch pressure sensor, filter or even a microphone.

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Until about three years ago, the only places to find MEMS at work were in automotive airbag systems, industrial process controls, inkjet printers and projectors and displays. These areas, particularly inkjet printer heads, should continue to generate most revenue for the MEMS market in the near future.

In fact, **Hewlett-Packard** (nyse: [HPQ](#) - [news](#) - [people](#)), with \$850 million in annual MEMS revenues from its inkjet printer head business, supplanted **Texas Instruments** (nyse: [TXN](#) - [news](#) - [people](#)) as the top MEMS manufacturer last year, according to French market research firm Yole Développement. Texas Instruments derives its MEMS revenues largely from its digital light processor (DLP) technology, which steers and focuses light in high-resolution projectors and displays. Generally, MEMS and MEMS-based products don't contend with the same competitive pressures as semiconductors or displays, but as Texas Instruments demonstrates, they aren't immune to it, either. Texas Instrument's MEMS revenue dropped 10% from 2006 to 2007, according to Yole, as DLP chips have come under heavy pricing pressure in the past year.

It's a catch 22. As MEMS' average selling price has dropped, it has opened or expanded new end-markets for rapidly emerging MEMS technologies like tri-axis accelerometers and radio-frequency MEMS switches. But the relatively low average selling price that fuels volume growth also promises to put a drag on overall revenue growth for several years. Yole expects MEMS volumes to increase 30% over last year, while the growth in total market value will track closer to 9%. Revenue growth will accelerate as increasing volumes drive revenues closer to a compound annual growth rate of 12% to 13%, helping MEMS to exceed a projected \$13.4 billion market in 2012.

Where will this growth occur? Telecom, defense and aeronautics will continue to drive revenue for MEMS of all stripes. But from a product standpoint, the fastest growth will be seen in conventional device categories like accelerometers and radio frequency MEMS that target consumer applications.

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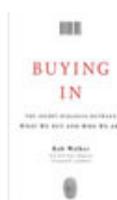
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Brands aren't making us, we're making brands.

MEMS accelerometers, in particular, are driven by the visible value of the Wii and iPhone, and have fueled steady or accelerating unit sales from 2006 to 2007 for companies like **STMicroelectronics** (nyse: [STM - news - people](#)), **Freescale Semiconductor** (nyse: [FSL - news - people](#)) and **Analog Devices** (nyse: [ADI - news - people](#)). Because they detect changes in motion and orientation, they're a natural fit for automotive airbag sensors. As automakers increase the number of airbags per car, the market for these devices is expected to continue growing by about 4%.

But the real action is away from the auto. According to ABI Research's Douglas McEuen, the emerging consumer sector could help spark 40% compounded annual growth for MEMS accelerometer units from 2007 to 2012, paced by 20% growth in sales.

Nintendo's Wii console alone surpassed 20 million units last year. Each console comes with a controller system that incorporates two MEMS chips, but players often double the fun by buying a second controller to play alongside friends.

Cellphones could become the next big growth driver.

"The handset market is over a billion mobile phones today, and adoption is still in the low single-digits there," said Mark Martin, general manager and vice president of **Micromachined Products at Analog Devices** (nyse: [ADI - news - people](#)). "But, in a billion-unit market, even a 20% adoption rate is huge, and that's just accelerometers--nevermind MEMS microphones."

The number of cellphone applications for MEMS microphones doubled between 2005 and 2006 to reach 20% of mobile phones manufactured, according to The Information Network. Then the rate of adoption hit the skids, slowing to 12.4% growth last year as a result of strong price pressure from Bluetooth devices and an overall slowdown of new phone production.

Cellphone handsets practically define their own separate MEMS sector, going beyond accelerometers and microphones to include RF switches and oscillators, and passive parts like filters, duplexers and resonators. The diversity and range of opportunities has attracted an increasing number of start-up companies that have targeted one or more of these applications.

Investors waiting for MEMS start-ups to go public are more likely to see them acquired by incumbents, probably when their technology shows some proven value. The leaders will likely be the current incumbents, like Analog Devices and Freescale. Both Analog and Freescale have reportedly developed wireless crash sensors that fit into the helmets of professional football players and transmit the severity of a big hit to staff on the sidelines.

In the end, as MEMS drop in price and expand in capability, the opportunities are limited only by entrepreneurs' imaginations.

In Pictures: Top MEMS Products

Josh Wolfe is editor of the Forbes Wolfe Emerging Tech Report. [Click here for more of his analysis of the evolving nanotechnology sector.](#)

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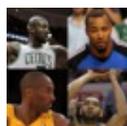
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