

# Micro & Nano Systems, market trends and growth opportunities

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MICRO NANO

# About enablingMNT

- The enablingMNT team utilizes its members' extensive experience and its wide network of industry contacts to offer organizations customized services in the fields of micro and nano technologies.
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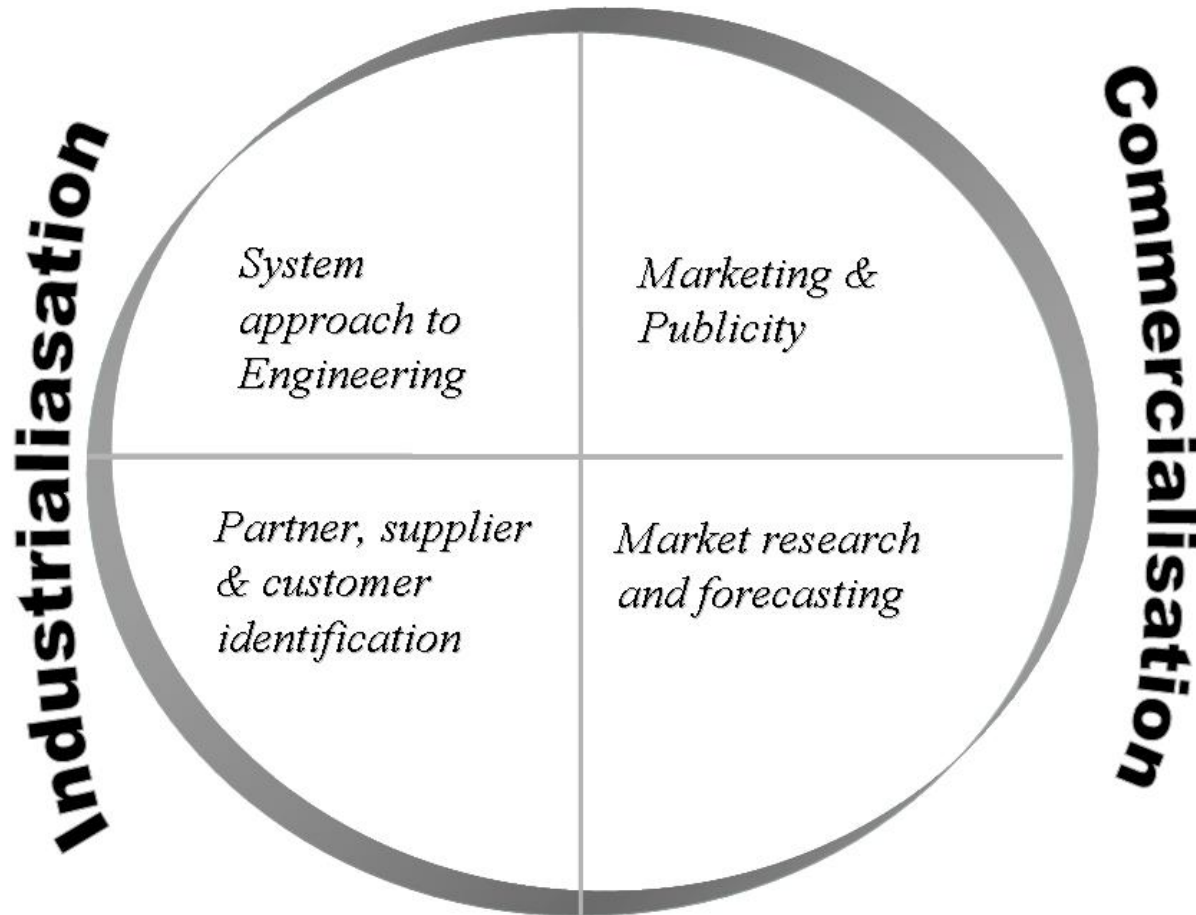
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# Business Development by enablingMNT



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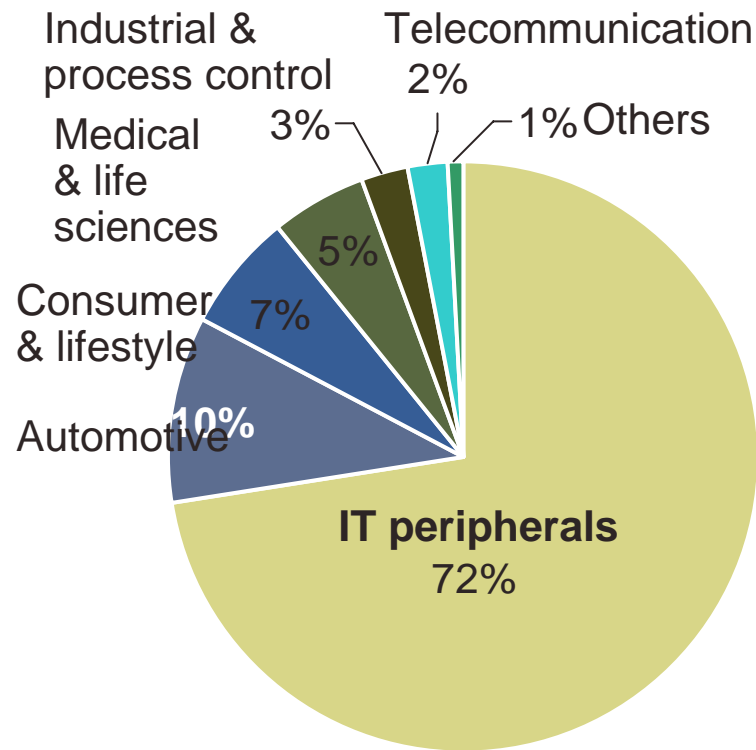
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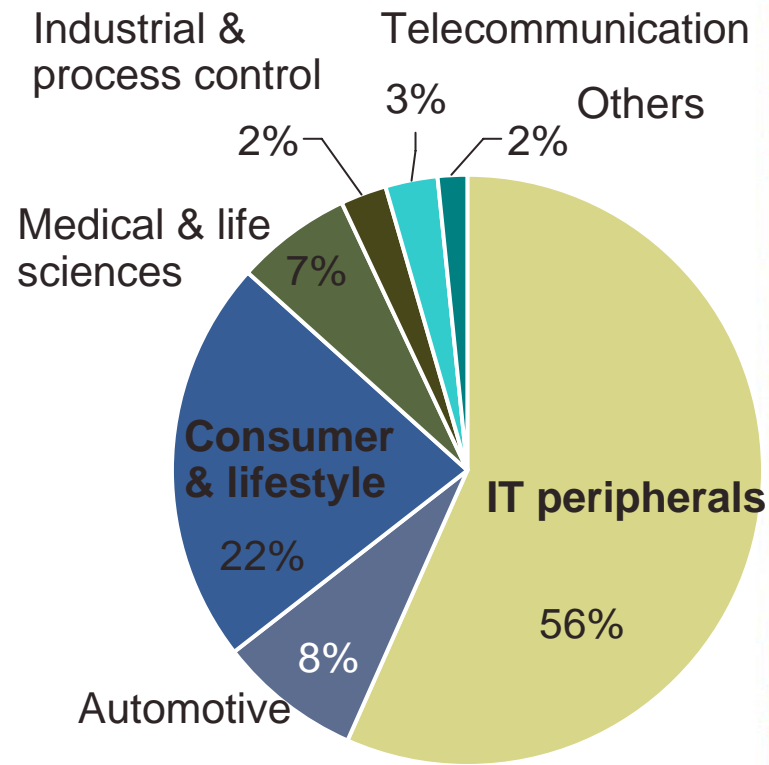
# Nexus Market Study 2005- 2009

**2004**



(total \$11.5 billions)

**2009**



(total \$24 billions)

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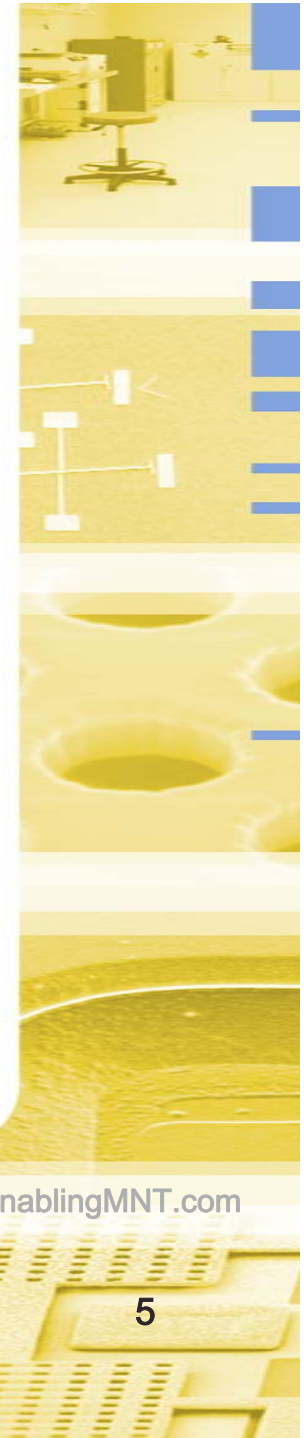
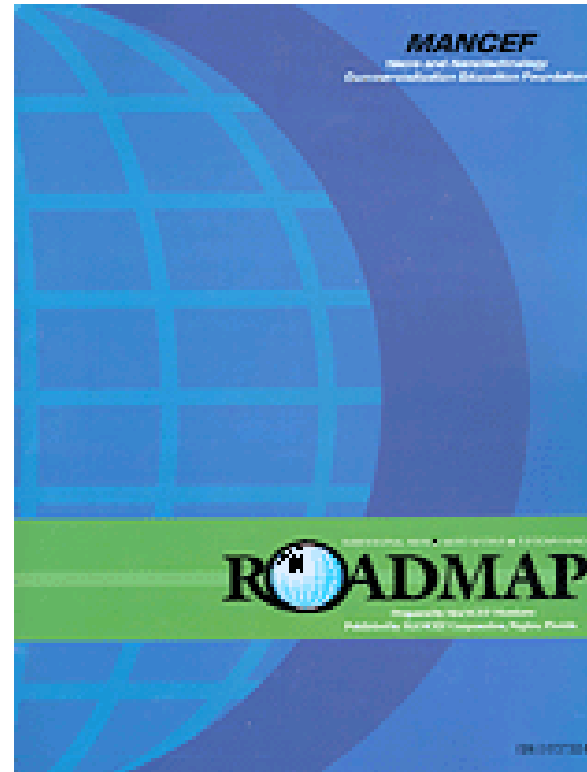
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# 2nd Edition International Micro-Nano Roadmap

- Assist in the commercial development of products and systems based on the Micro and Nano enabling technology base.
- The roadmap is designed to assist governments, organizations and individuals in the Micro or Nano value chain to develop their own strategic roadmap to improve their own chances for competitive advantage



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# Priorities in life

- Food/water
- Safety/health
- Social interaction
- Status
- Culture



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# General trends

- Food & Nutrition (& Water)
  - Rising prices
  - Overlap with health
- Health
  - Information hungry clients, we don't accept uncertainty
  - Increasing spending on health
    - Developed countries: rising age
    - Newly developed countries: increased income
- Safety
  - Who and what is where, is it a threat?
    - RFID
    - Home Defence
- Status, culture
  - Smaller and more interactive electronics:
    - ambient intelligence,
    - mobile electronics.
  - Large area thin film technologies (LCD, LED, wearable electronics)

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## Identified trends

- Food & Nutrition (& Water) will increasingly need microsystem technology to improve on efficiency in production & logistics and to make food more healthy.
- Health: from lab to point of care diagnostics.
- Safety: RFID and sensors will be increasingly used to track and trace (products and people).
- Ambient intelligence will invade our environment.
- Cost price of sensors and electronics will decrease.

# Technology trends

- Driving the electronic industry
  - First wave for semiconductor industry: PC.
  - Second: mobile phones.
  - Third: more sensing and actuation
- Merging of semiconductors and MEMS technologies.
- Increasing availability of affordable electronic processing.

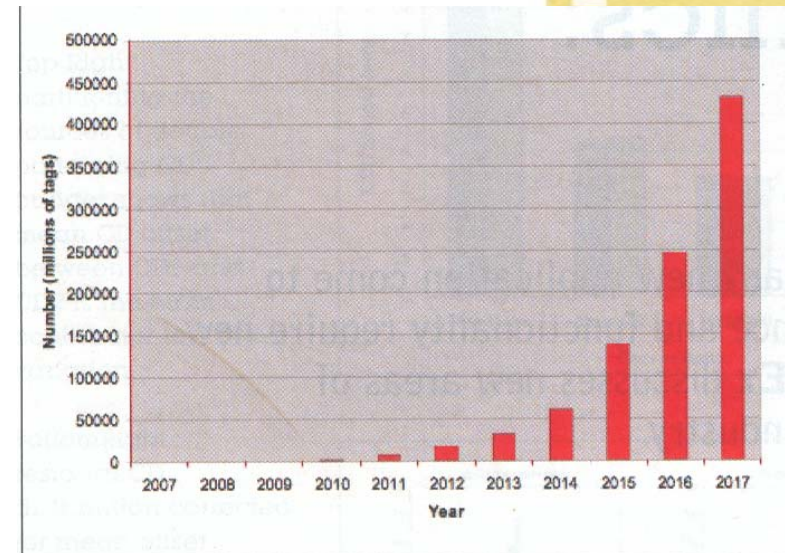
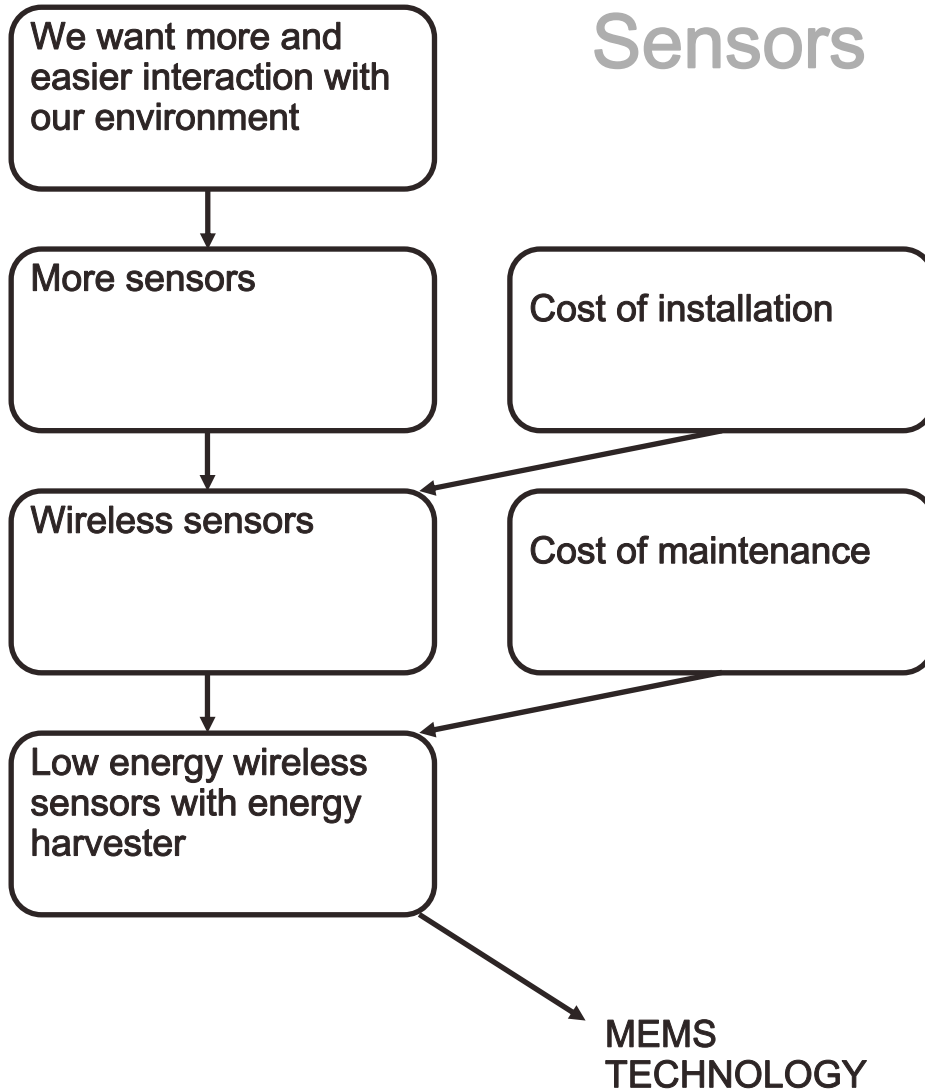


Figure 2: Number of RFID tags on consumer goods 2007-2017

# Electronic industry hotspots

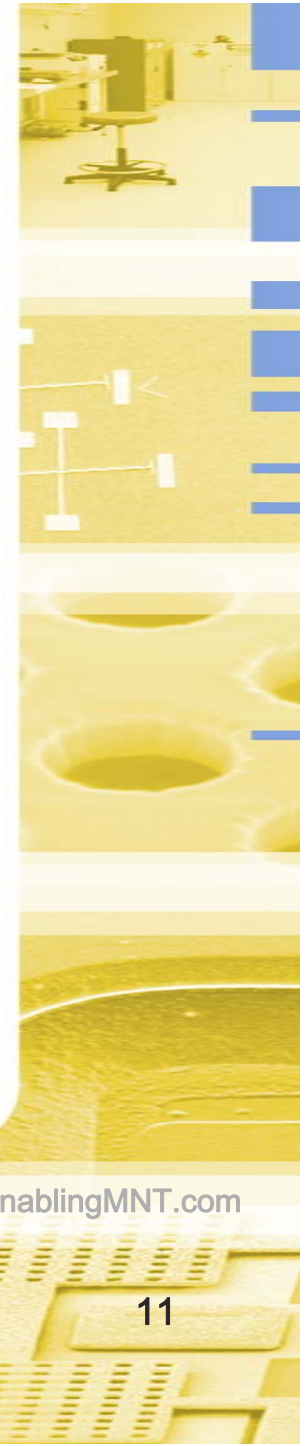
	Semiconductors	MST/MEMS
Was	PC	Automotive
Now	Consumer electronics	Consumer electronics
Future	Ambient intelligence, personal health, industrial applications	

# Sensors



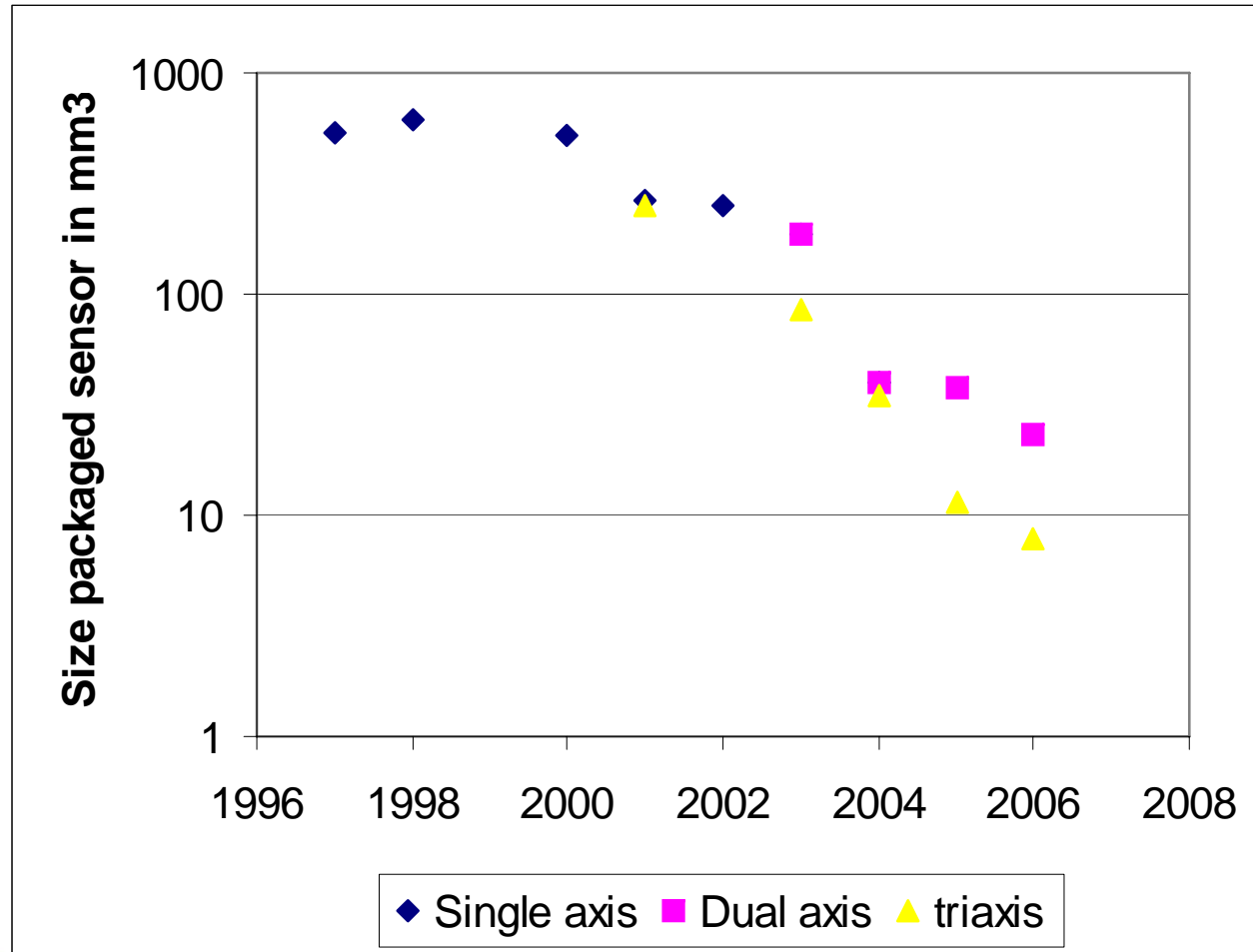
Sensors, most of them based on MEMS, will continue their march into high volume consumer products like cell phones, consumer electronics, laptops and notebooks, and digital cameras.

Industrial installations and our personal environment will follow



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# Evolution of accelerometers



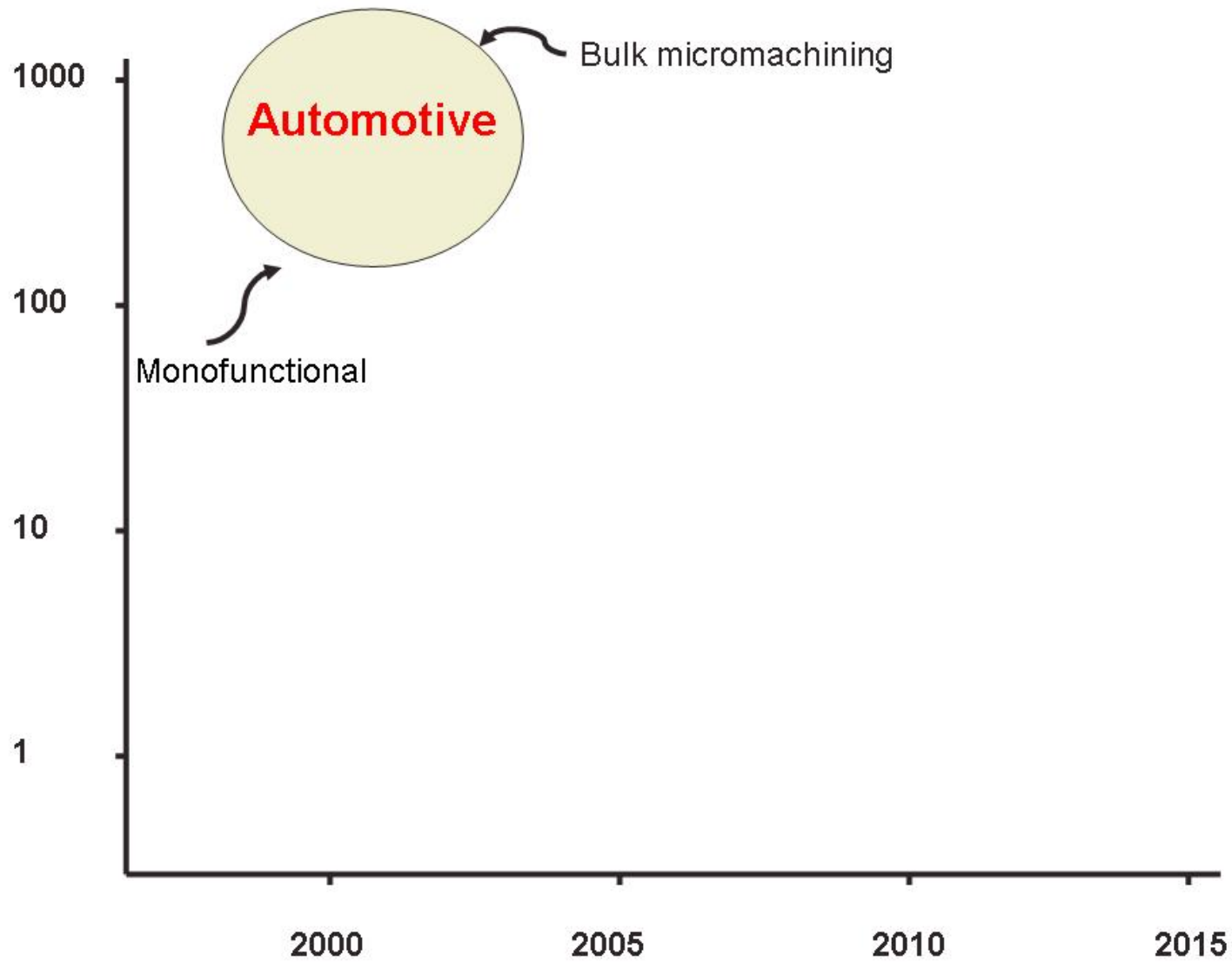
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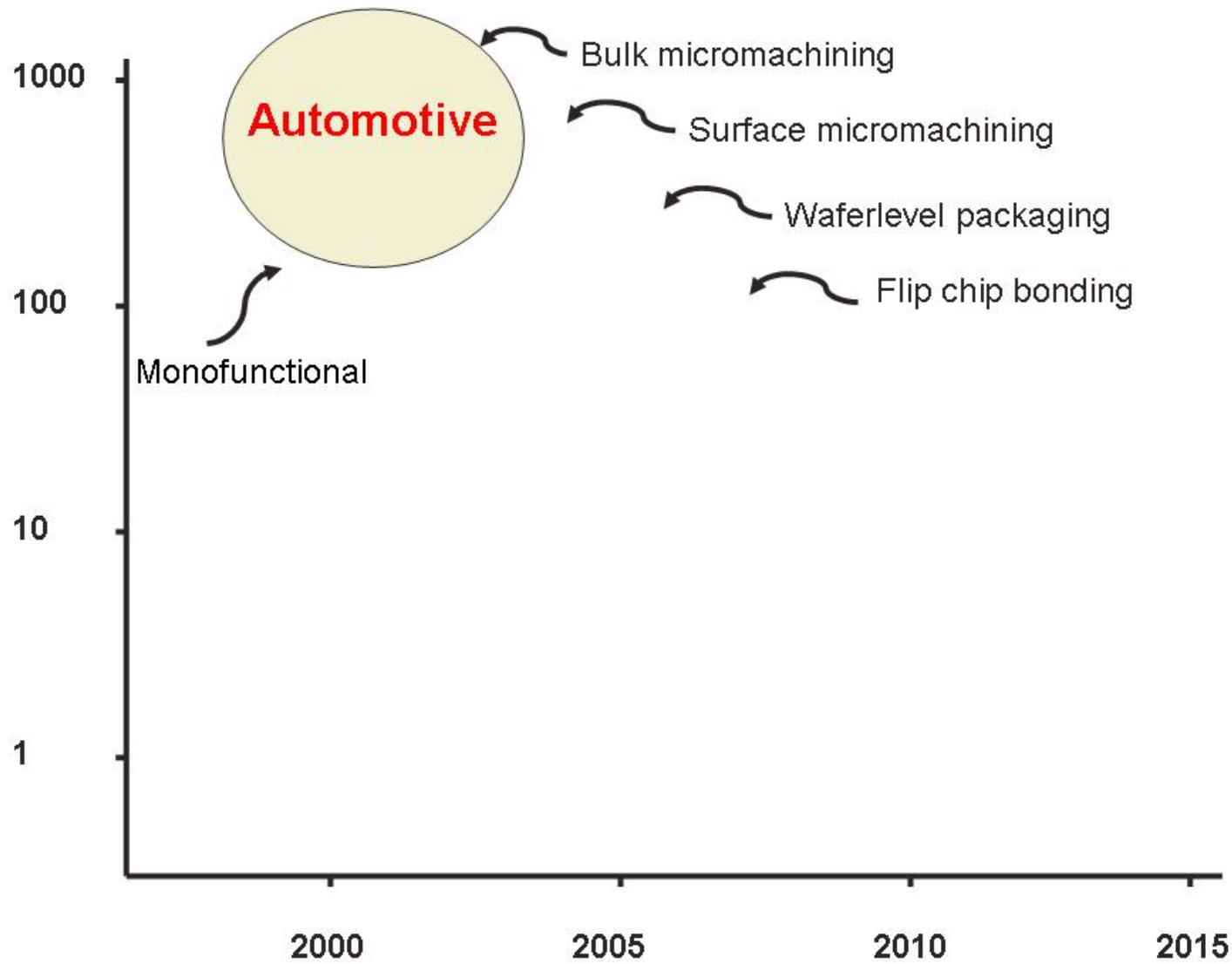


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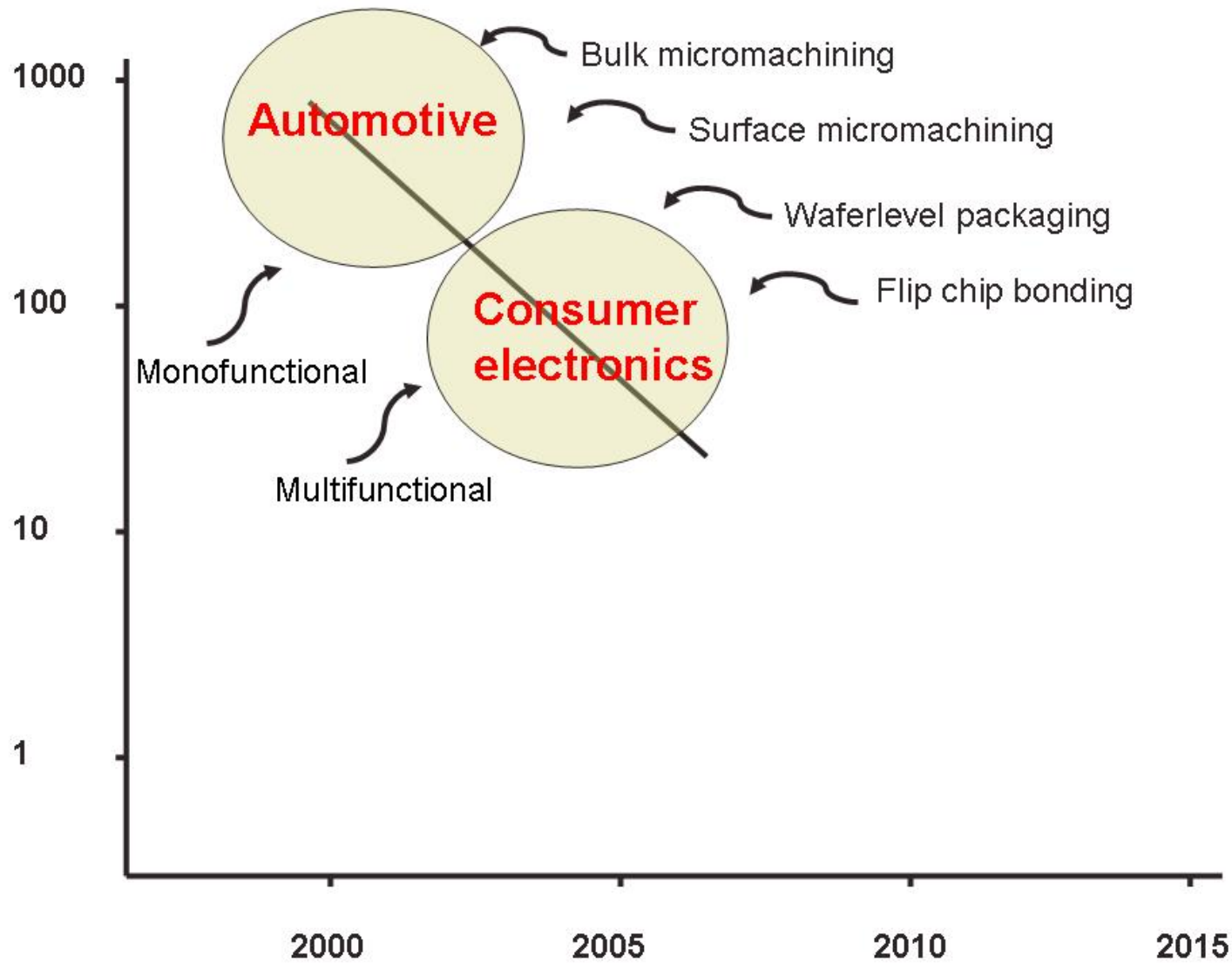


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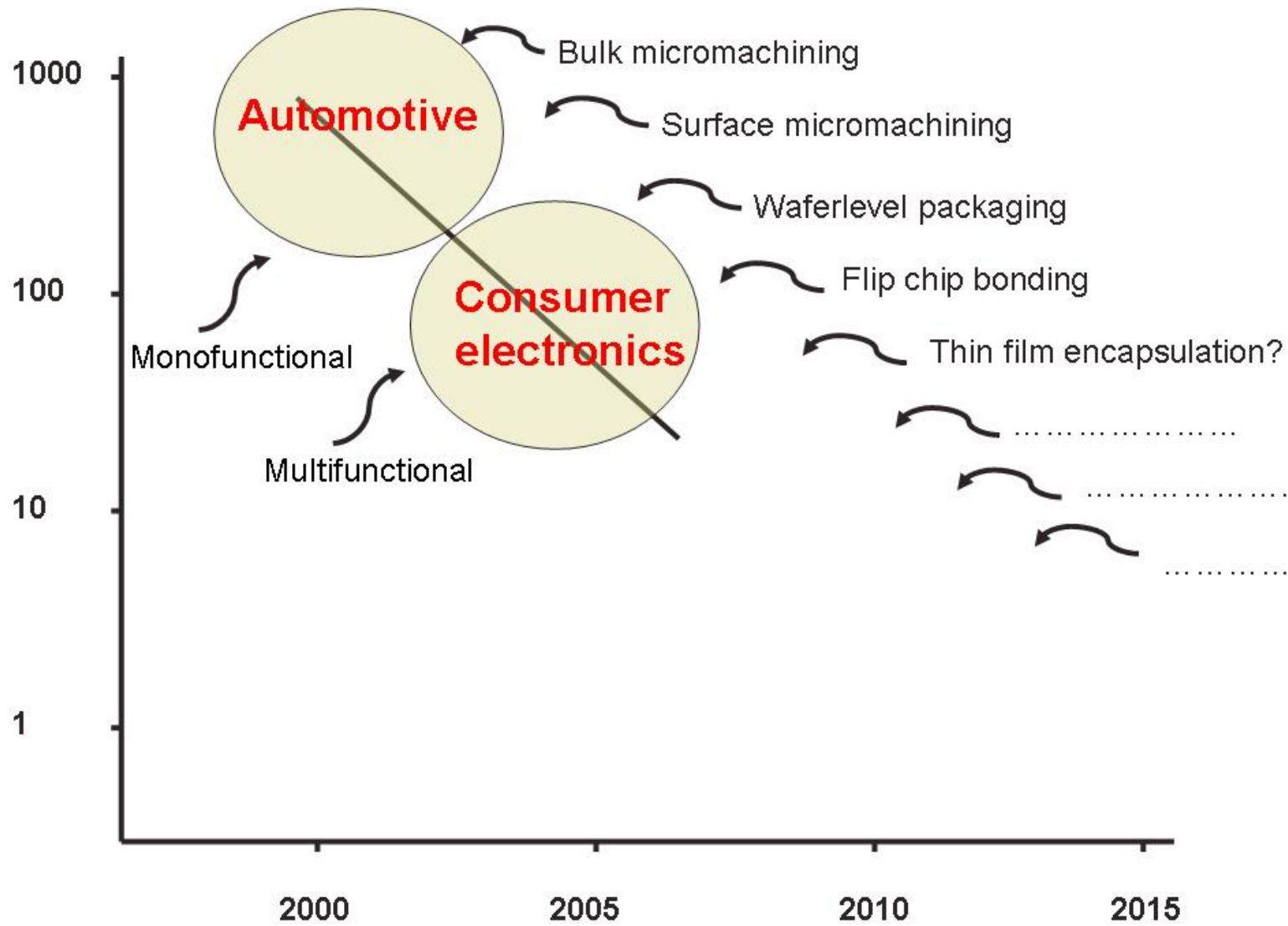
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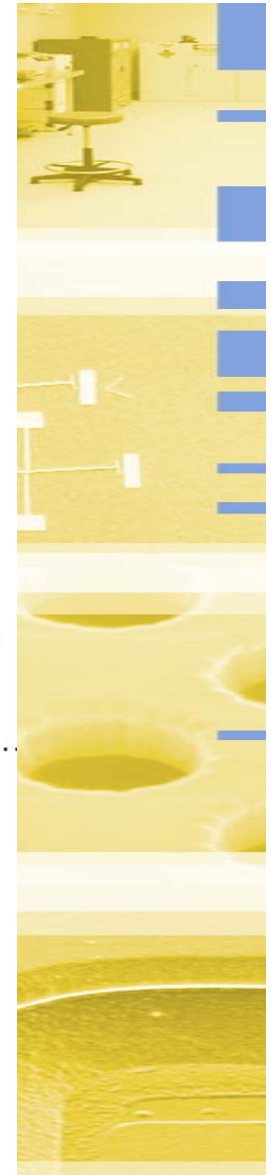
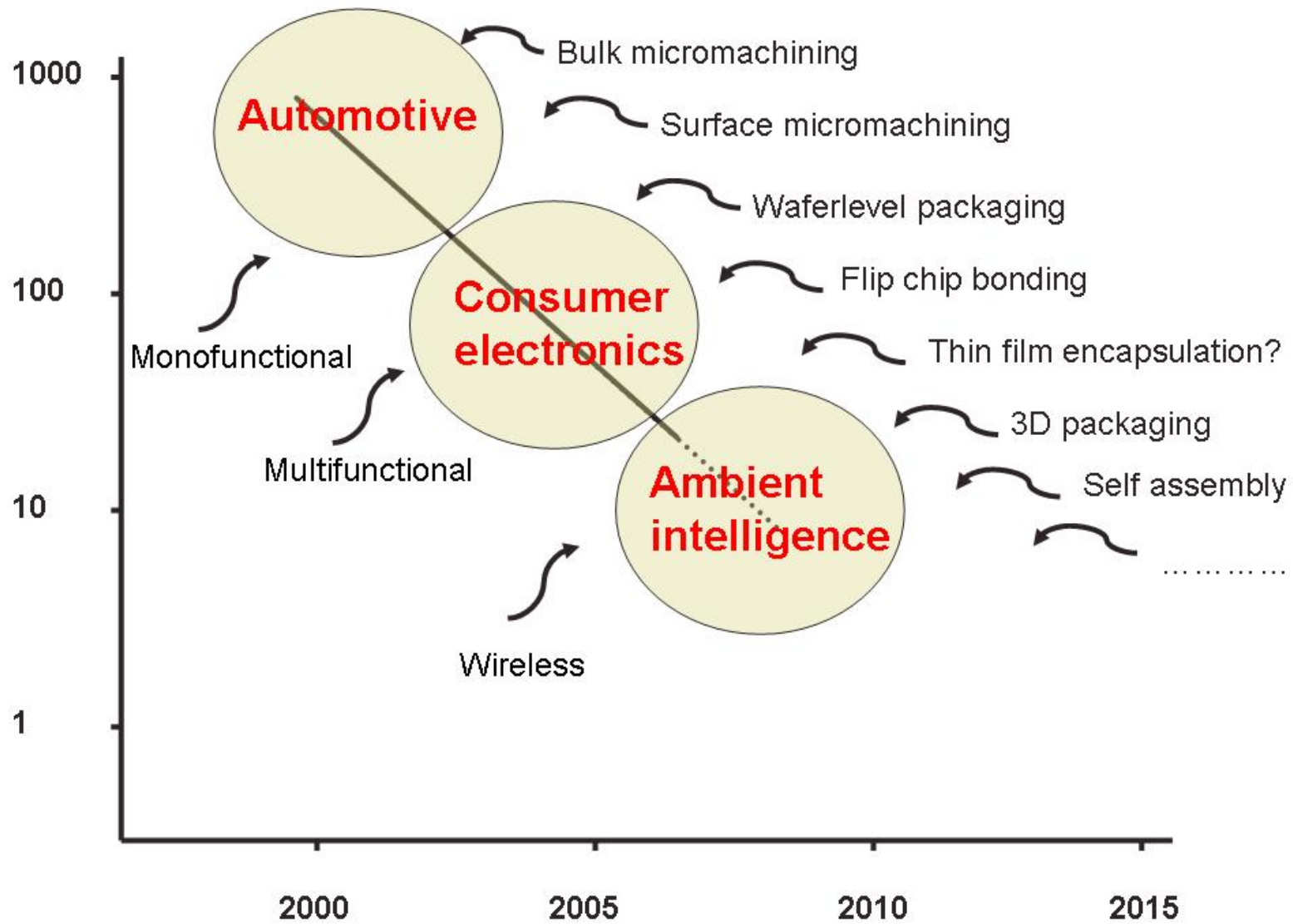
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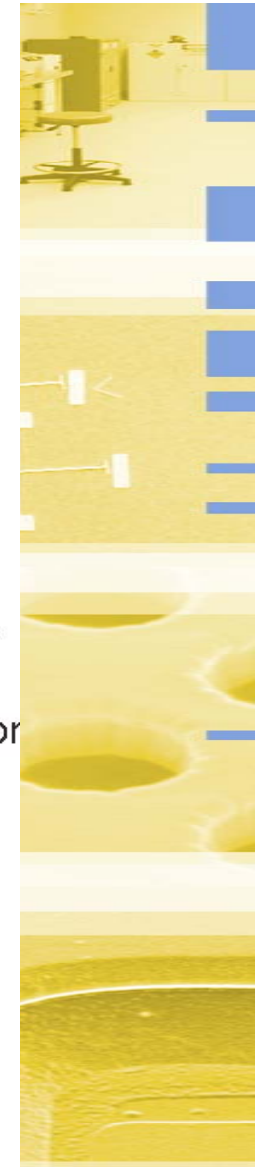
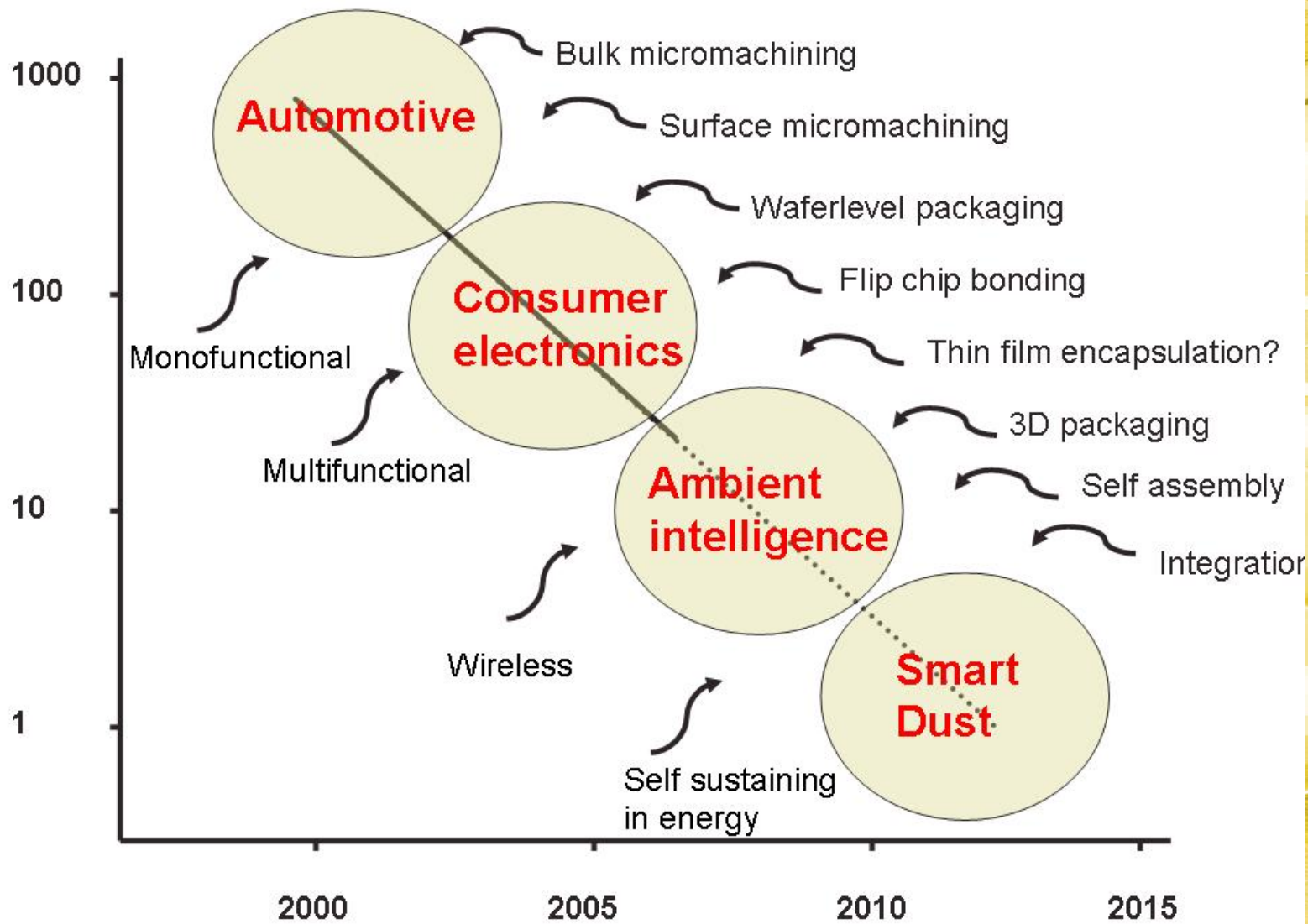


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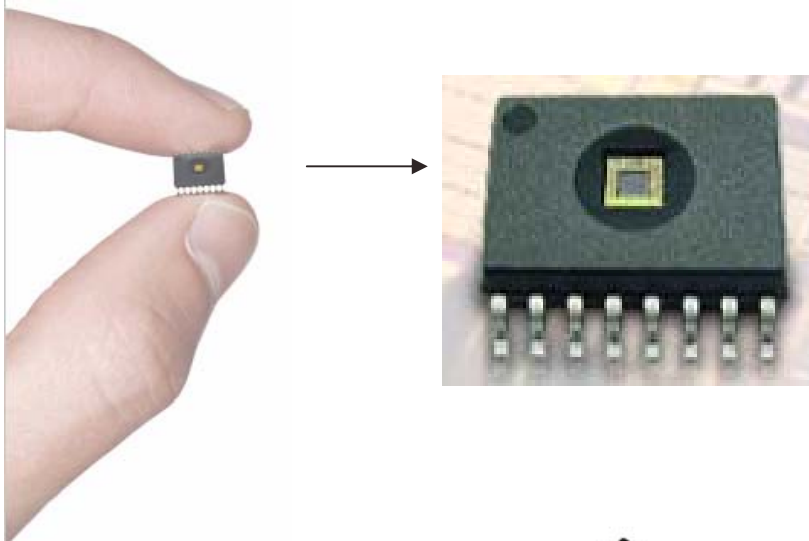
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# Examples



Chipsensors develops single-chip wireless sensors which will offer a combination of temperature, humidity and light measurement, with or without microcontroller and RF interfaces.

Freescall 12,8 \* 10.3 \* 2,5 mm package containing:

XY accelerometer,  
pressure sensor,  
temperature sensor,  
Microcontroller, ad  
RF transmitter.



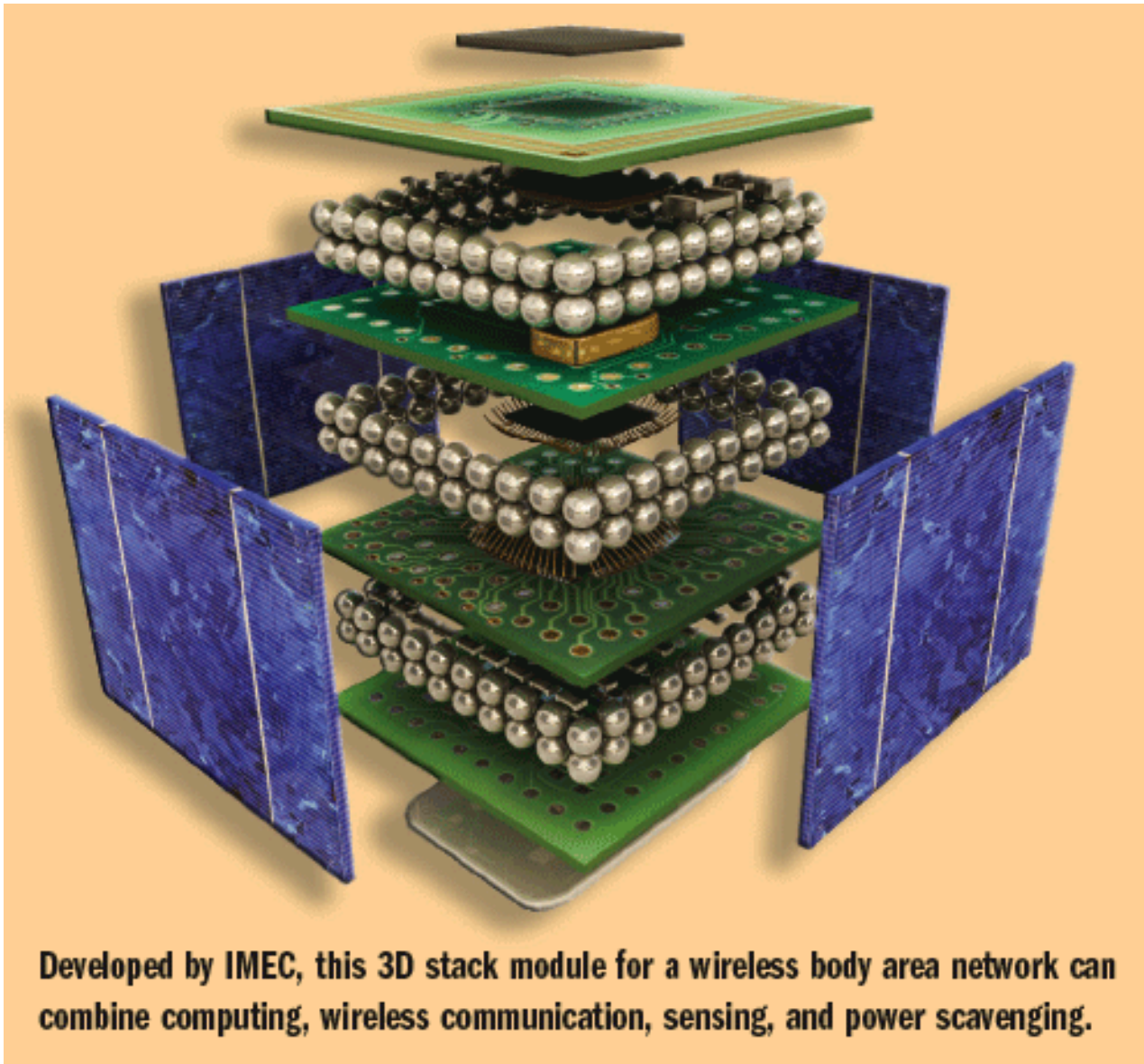
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**Developed by IMEC, this 3D stack module for a wireless body area network can combine computing, wireless communication, sensing, and power scavenging.**

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# Standards and trends

- Industrialization means making choices related to the processes and materials used.
- Following industrial trends and standards is often a good strategy.
- The success of the semiconductor and the magnetic head industry in improving functionalities and bringing cost down year after year had much to do with following roadmaps, standards and industrial trends.

How would you connect your phone with your PC?



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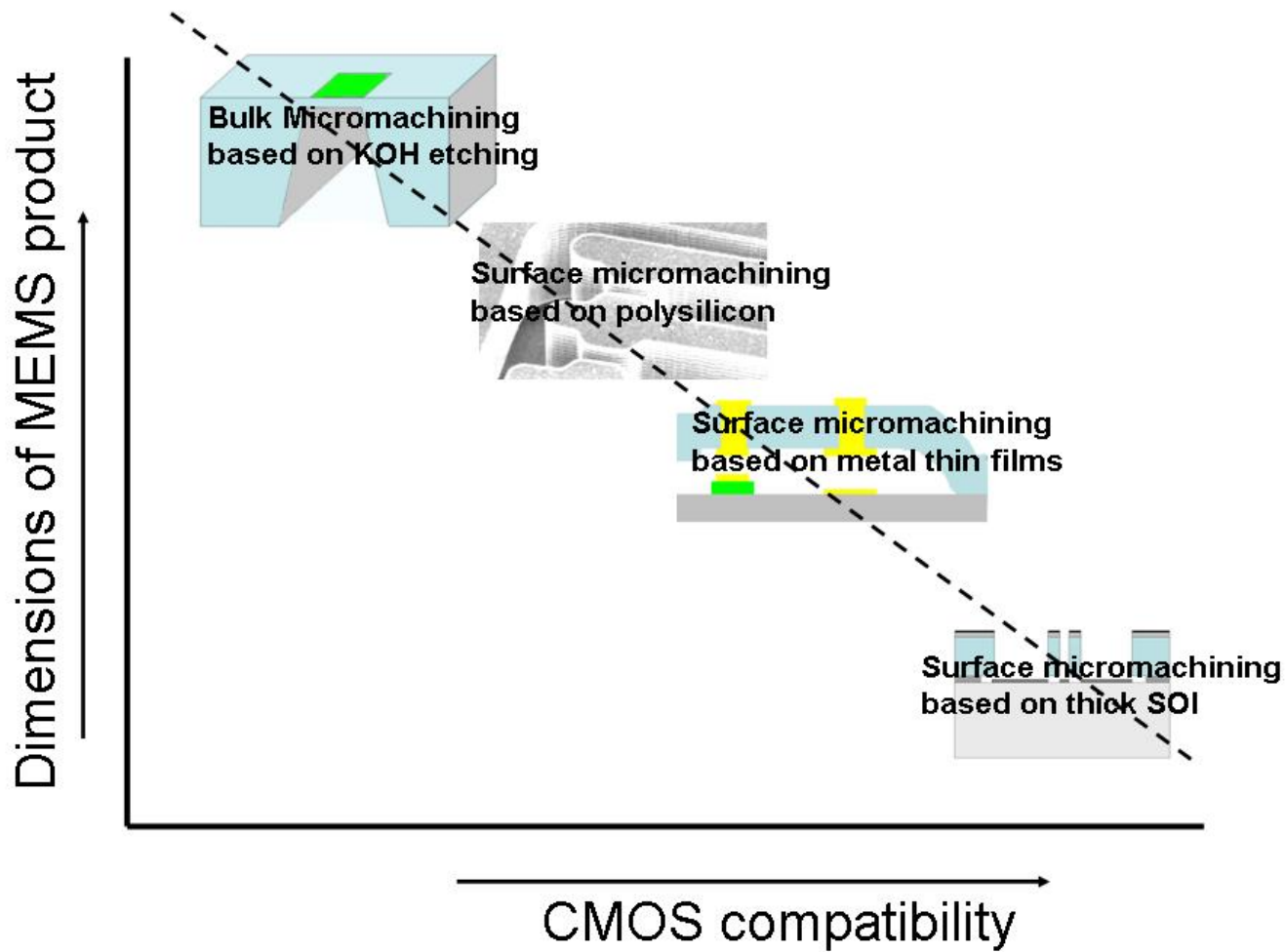
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# Development of MEMS processing



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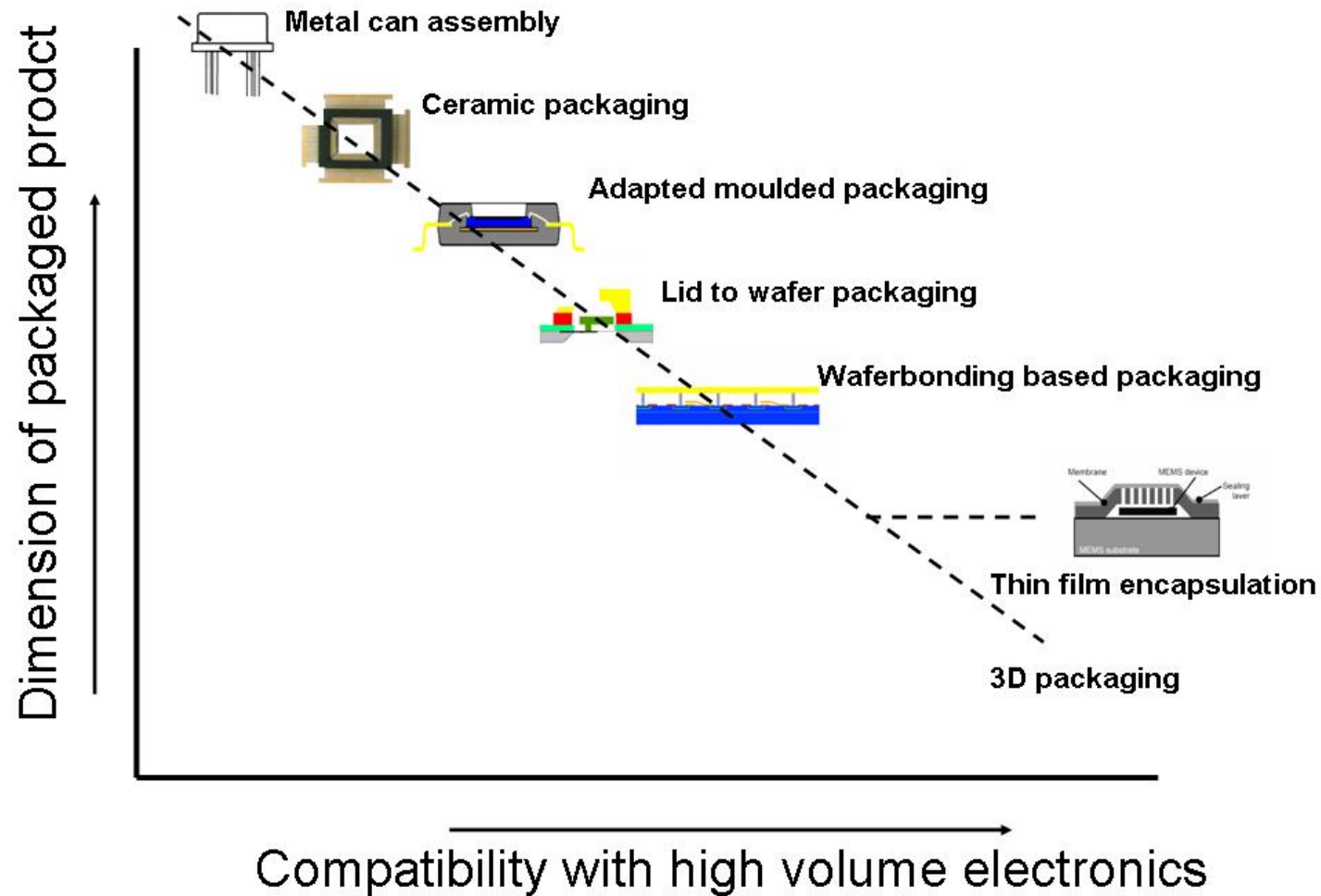
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# Evolution of MEMS packaging



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## Conclusion

- Sensors will be becoming smaller, wireless and self sustaining in energy
- MEMS technology and the increasing availability of low cost electronic processing will enable this technology revolution.

# Thanks to:

- Kees Groeneveld
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- Niklas Henelius
- Christian Schaefer
- Carlos Lee
- Dan Chilcott
- Kees Eijkel etc.
- Maria Holzner/Peter Wagner
- Hiro Takeuchi
- Analog Devices, Bosch, Tronics, Qinitiq, etc.
- Ayman El Fatatry, Patric Salomon, Lia Paschalidou, Keanu Zhang

- FHI
- Aquamarijn
- WTC
- Medspray
- U of New Mexico
- Adixen
- Silex
- IMT
- AML
- ASML
- Okmetic
- EVG
- Semi
- Delphi
- MESA+ (U. Twente)
- Siltronic
- Sumcosi
  
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# Further Reading ...

- enablingMNT Industry Reviews are available at € 280 each:
    - [Design & Engineering Companies for MST/MEMS](#), Jan 2007
  - [Foundries for MST/MEMS](#), Nov 2005
  - [Processing Service Suppliers for MST/MEMS](#), May 2005
  - [Test and Measurement Equipment and Services for MST/MEMS](#), Dec 2004
  - [Suppliers of Materials for MST/MEMS Production](#), Sep 2004
  - [MNT Web Directories and On-line Communication Channels](#), Aug 2004
  - [Equipment Suppliers for Nanofabrication](#), Apr 2004
  - [Back-End Manufacturing Equipment Suppliers for MST/MEMS](#), Nov 2003
  - [Front-End Manufacturing Equipment Suppliers for MST/MEMS](#), Nov 2003
- 
- Special edition:
  - enablingMNT review [MST/MEMS Activities in China - Industry and Key Research Centres](#) - August 2007

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# Thank you for your attention!

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