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Electronics in Our Daily Life Today and Packaging Trends Influencing the Future

S. Manian Ramkumar
Rochester Institute of Technology

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MMET-PS Department
CAST

ELECTRONICS IN OUR DAILY LIFE TODAY AND PACKAGING TRENDS INFLUENCING THE FUTURE

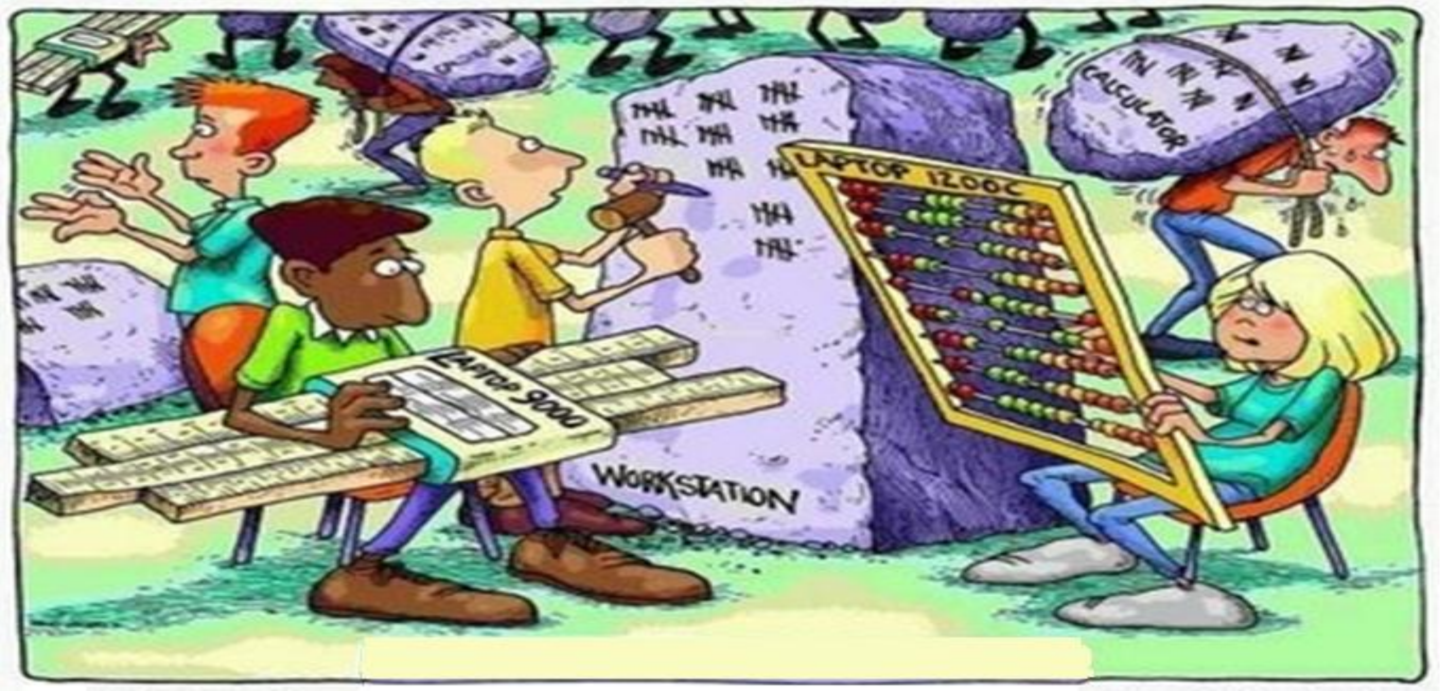
April 14th, 2009

Dr. S. Manian Ramkumar

Agenda

- Electronics
  - Imagine a world without Electronics
  - Influence on lifestyle
  - Markets and trends
- Electronics Packaging Levels and Trends
- Electronics Assembly
- Microsystems and Medical Electronics
- The Center for Electronics Manufacturing and Assembly @ RIT
  - Education , Industry Training and Scholarship
- Q & A session

World Without Electronics…



Influence of Electronics Today

Electronics is Almost Everywhere

The Electronics Industry

Electronics Industry

<u>Military & Aerospace</u>
Radars, Missiles, Satellites, etc.

<u>Computer & Business Equipment</u>
Calculators, PCs, Notebooks, Copiers etc.

<u>Communications</u>
Mobile Phones, Pagers, Headsets, LAN Cards etc.

<u>Industrial & Medical Systems</u>
Controls, Robots, Implants, Hearing Aids, etc.

<u>Automotive</u>
Entertainment, Airbags, ABS, Ignition Control, Navigation, etc.

<u>Consumer Electronics</u>
VCRs, Camcorders, Audio, Headsets, Games, etc.

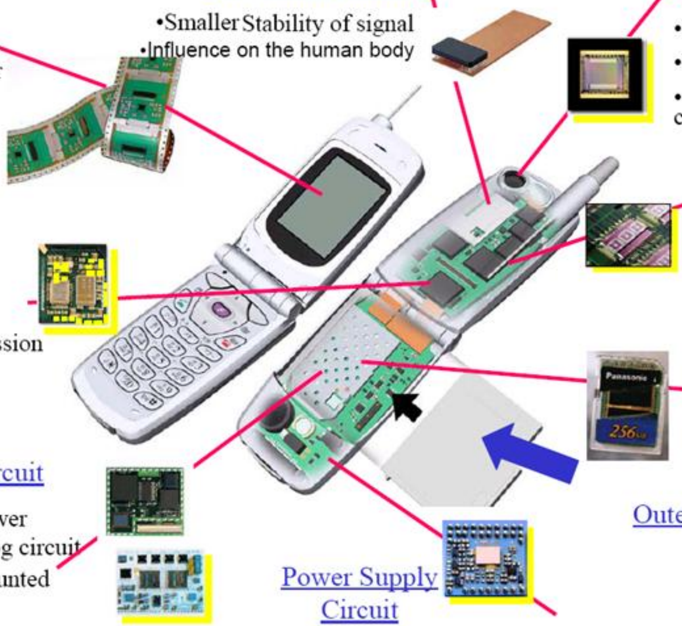
The Market

- **Electronic Industry**
  - Largest manufacturing industry in the world
  - Growing twice as fast as the global economy
  - Very dynamic, propelled by constant technological change
  - $3.2 Trillion by 2012
  - Major US markets are medical, defense and aerospace electronics

Global Market Trend for Electronic Product Assembly

Continuous Miniaturization

A Look Inside a Cell Phone



LCD Circuit
- Larger display, Color display
- Lower power consumption
- Higher resolution

Embedded Antenna
- Smaller Stability of signal
- Influence on the human body

Camera Circuit
- Smaller
- Lower power consumption
- One unit of lens and control circuit

DSP CPU BB
- Dual CPU: Transmission /Application

Memory Circuit
- Memory area for downloaded software
- Higher memory capacity

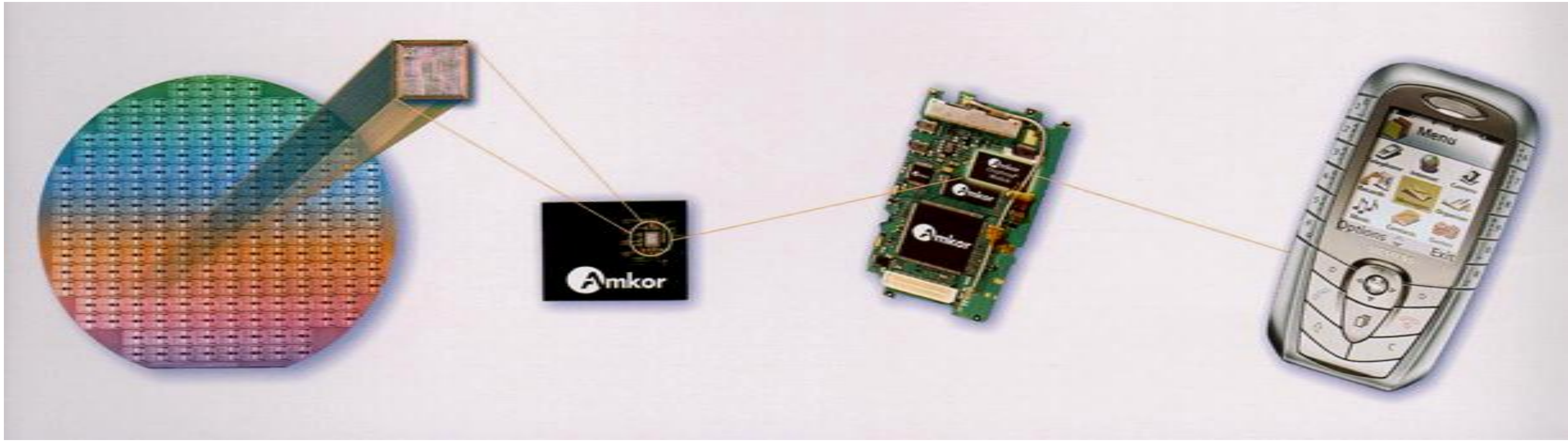
Plug In Memory Card
- Smaller, thinner
- Higher memory capacity

Tx Rx Circuit
- Smaller & lower power consumption of analog circuit
- Decrease of # of mounted components

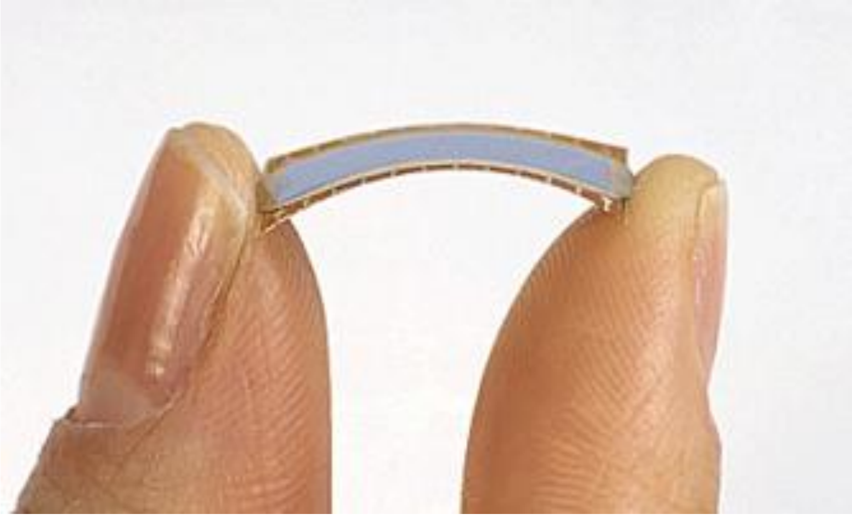
Power Supply Circuit
- Smaller Size

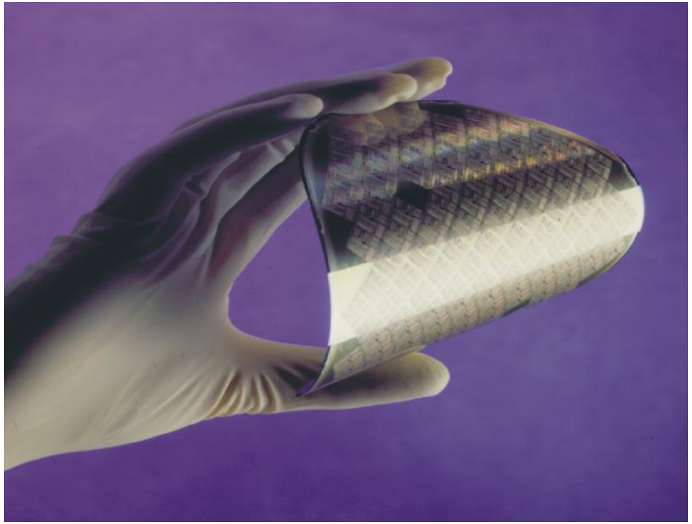
Outer Interface Circuit
- Bluetooth, USB interface
- MP3, GPS interface
- Memory Card interface

Electronics Package - Levels

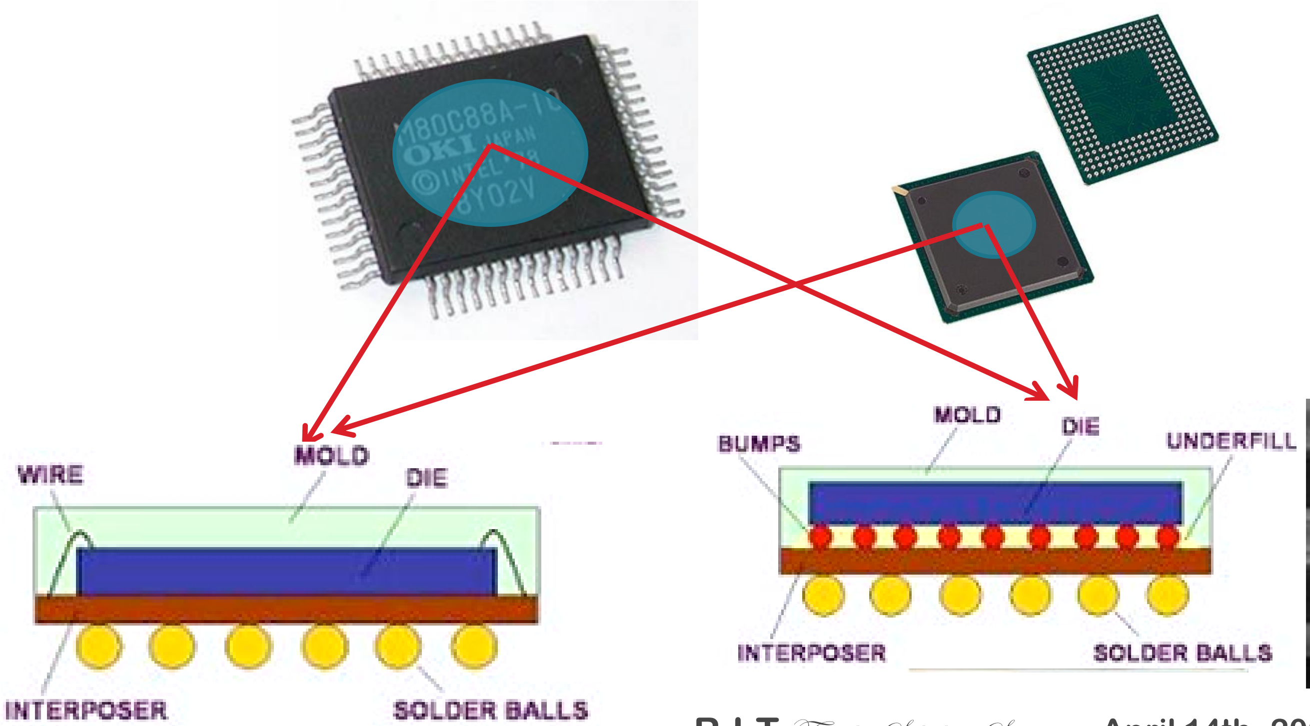


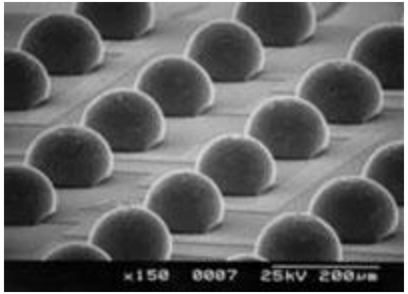
Flexible Silicon



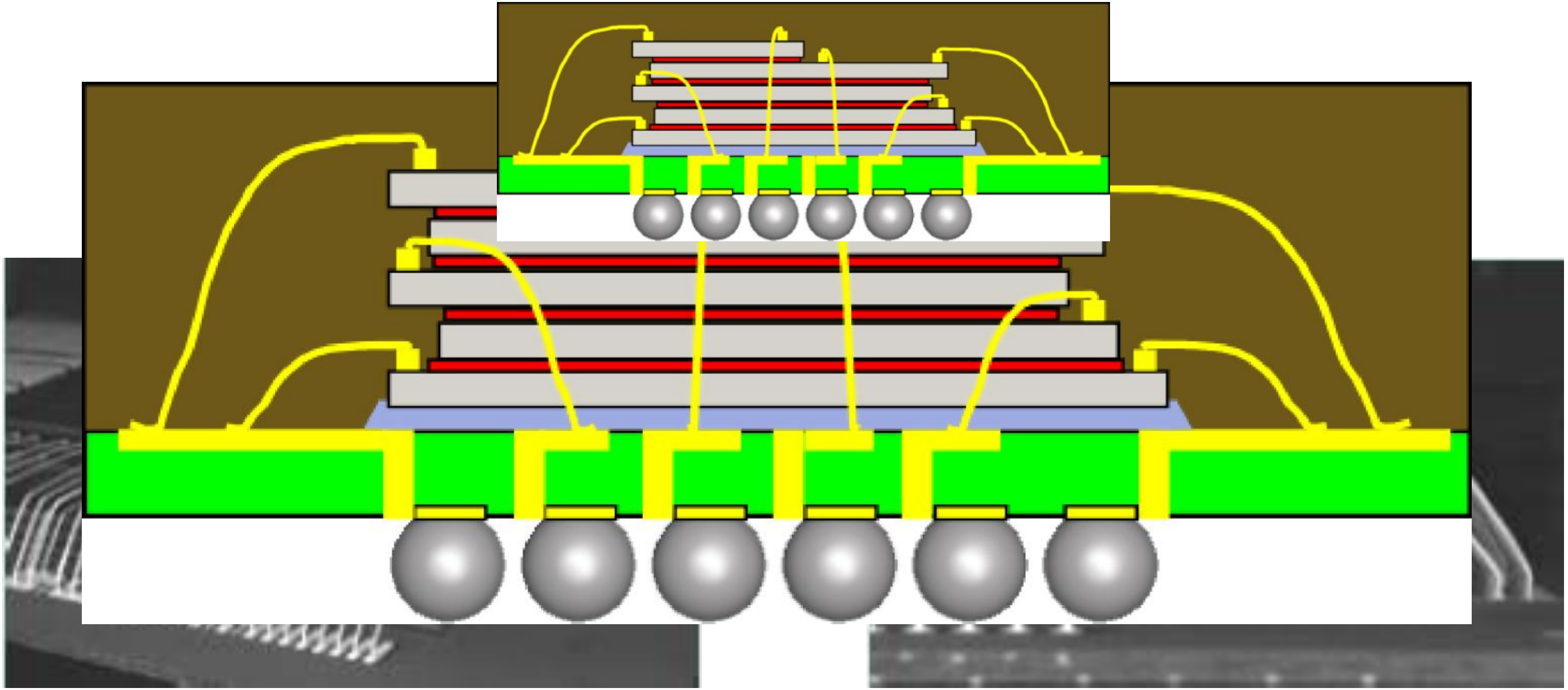


Component Level Package

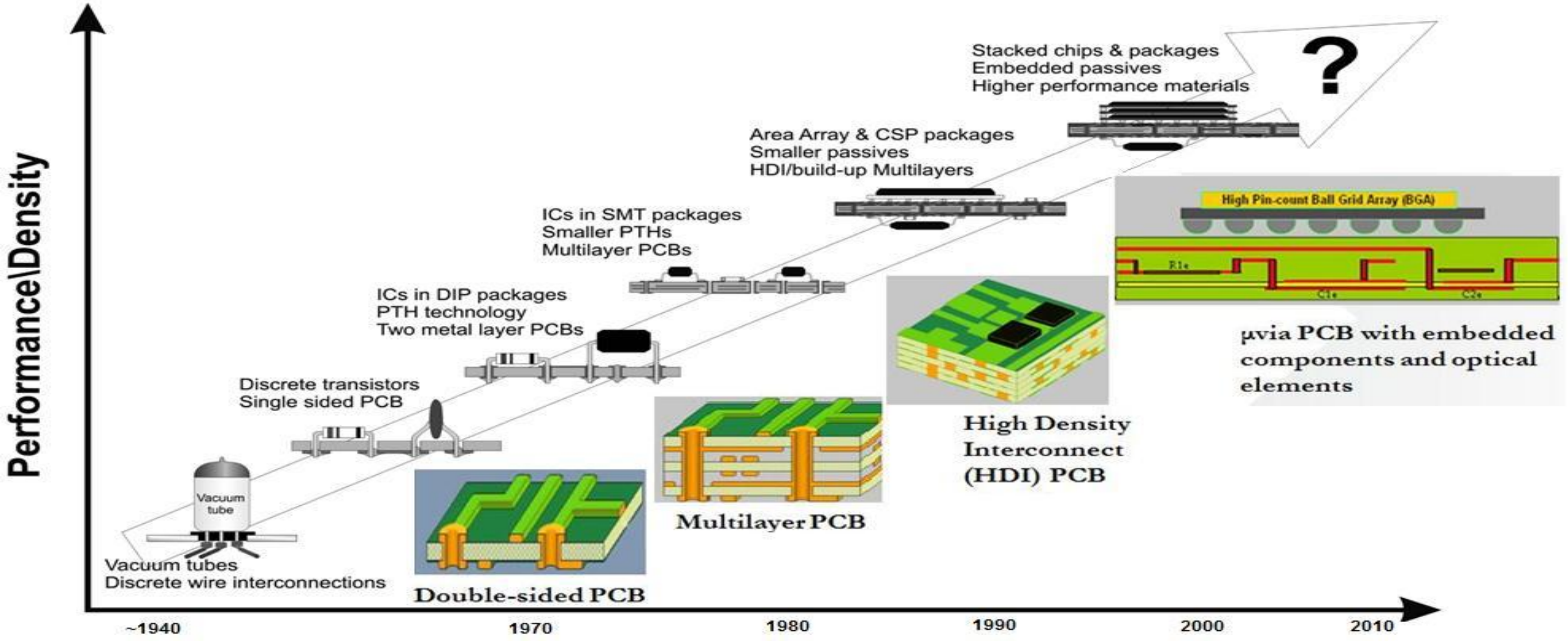




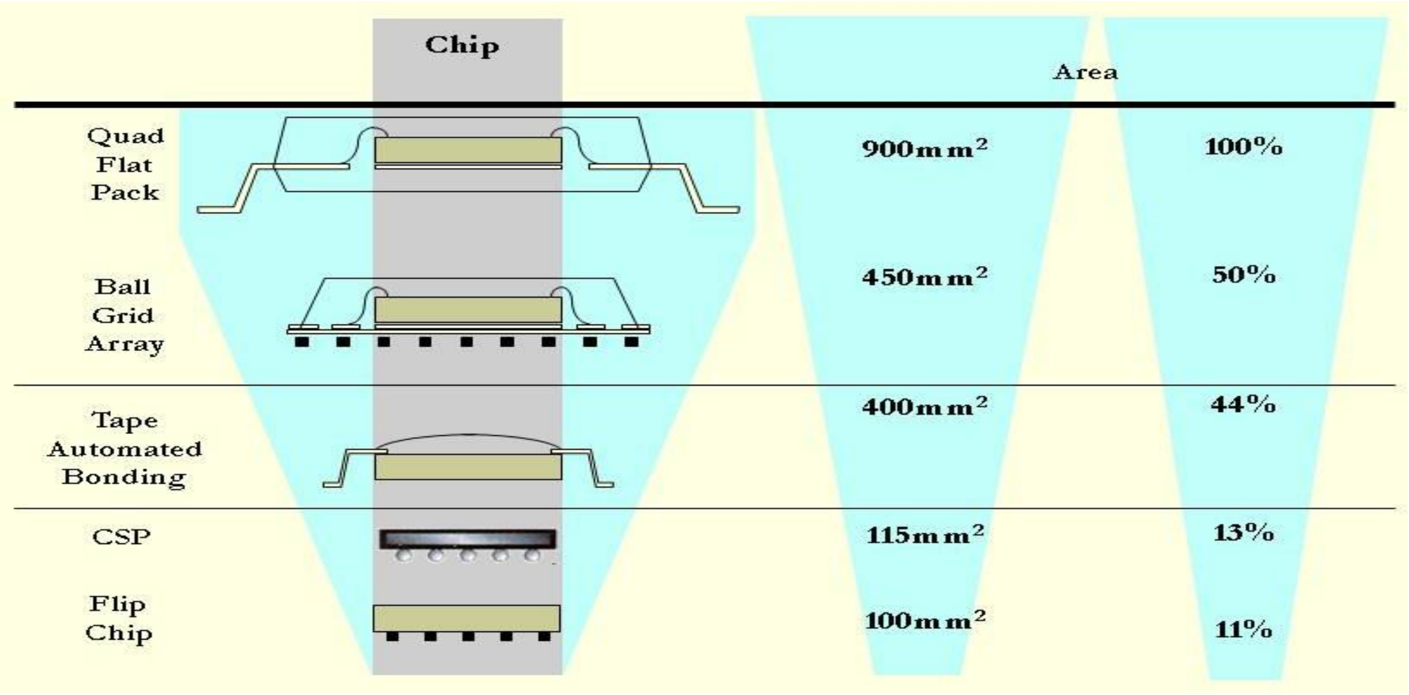
Silicon Chip Stacking



Packaging – Road Map

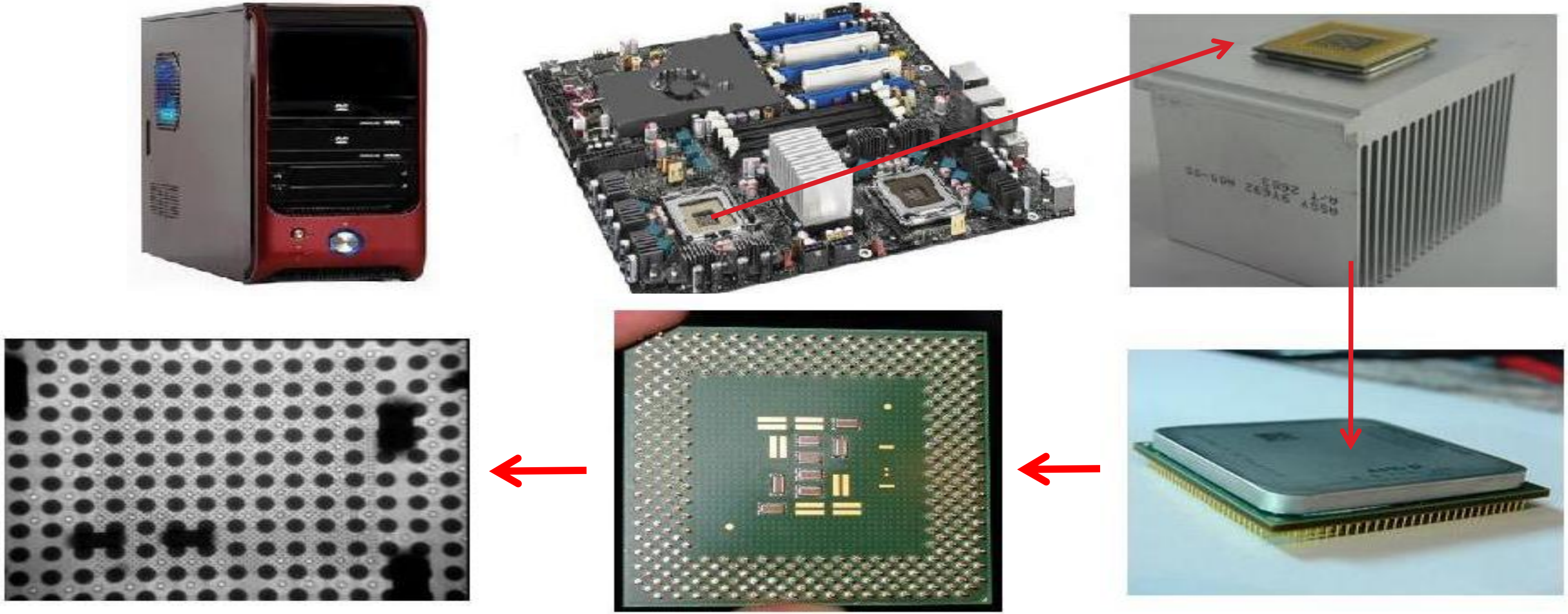


Size Reduction



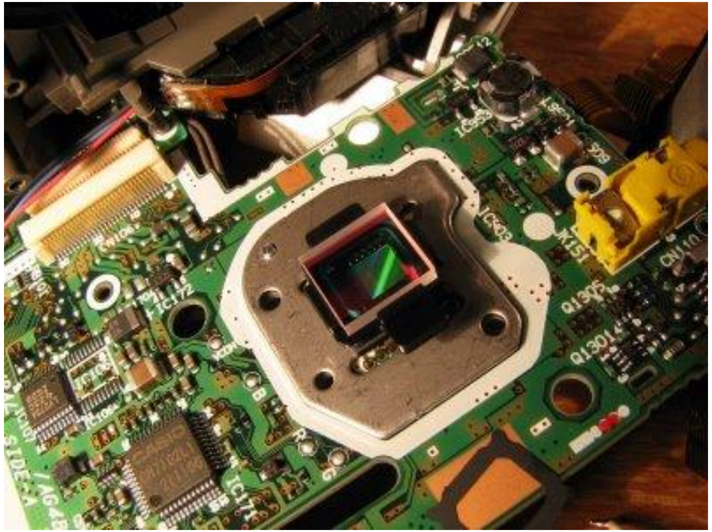
	Area	
Quad Flat Pack	900mm^2	100%
Ball Grid Array	450mm^2	50%
Tape Automated Bonding	400mm^2	44%
CSP	115mm^2	13%
Flip Chip	100mm^2	11%

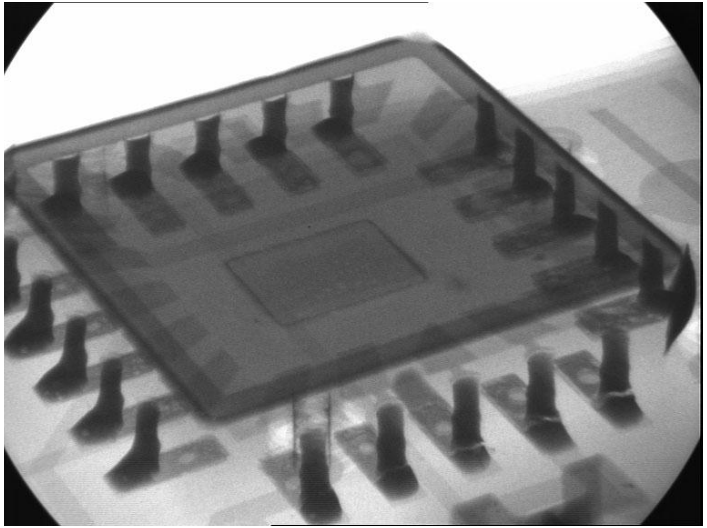
Inside a Computer



Inside a Laptop

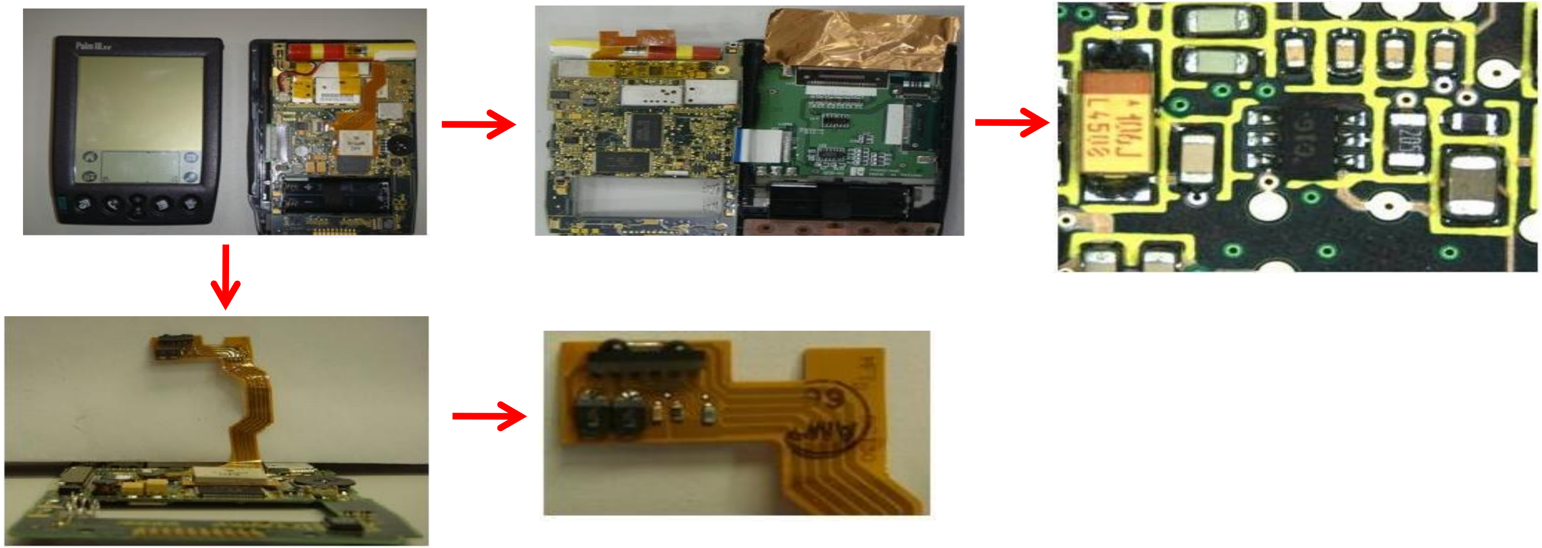
Digital Camera





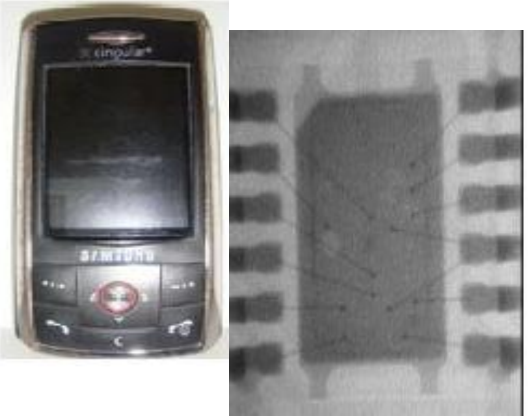
Inside an IPod Shuffle

Inside a Palm Pilot

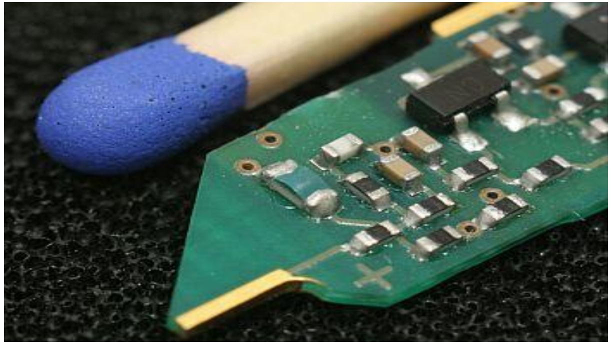


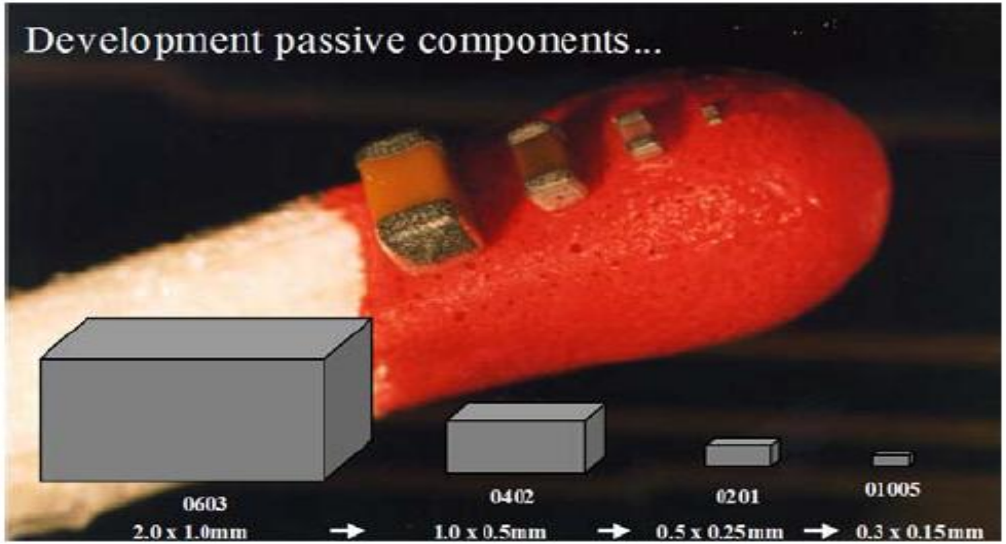
Form Factor Reduction

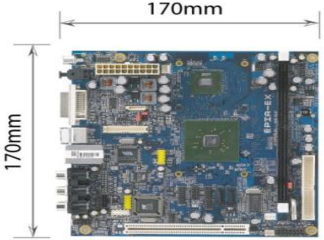
- ☐ Size
- ☐ Weight
- ☐ Circuit Density
- ☐ Features
- ☐ Battery
- ☐ Antenna



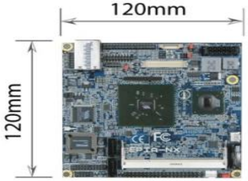
Product Miniaturization



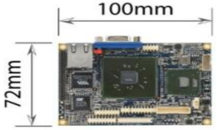




Mini-ITX

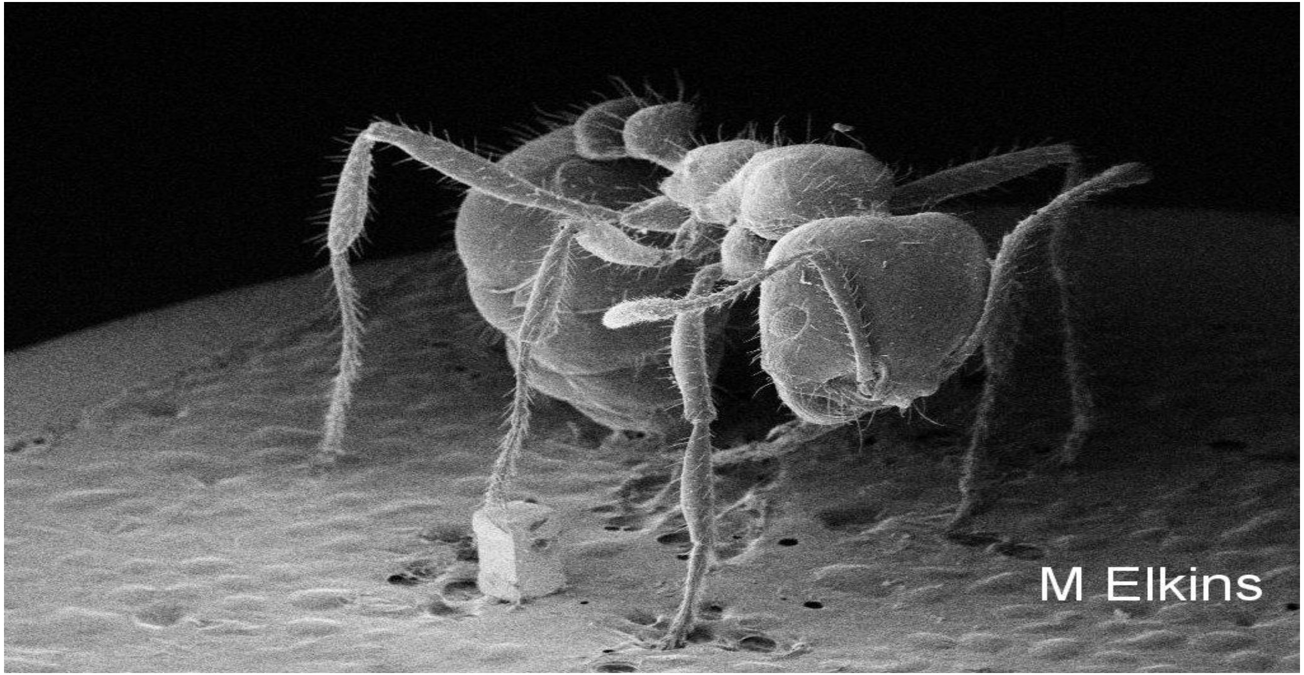


Nano-ITX

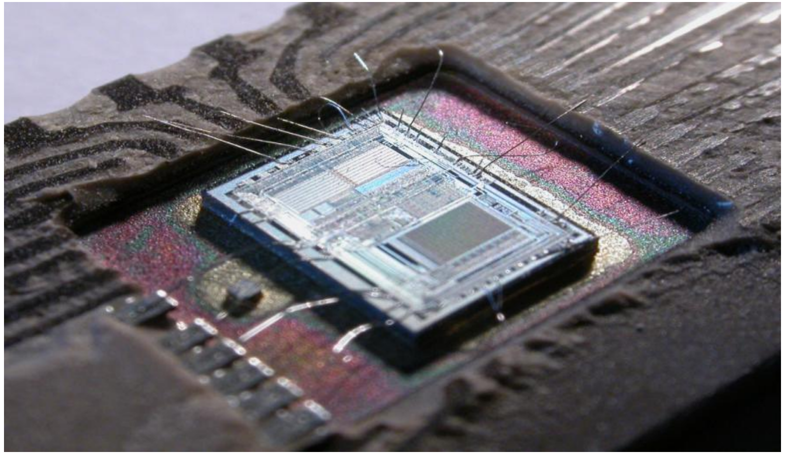


Pico-ITX

Component Miniaturization

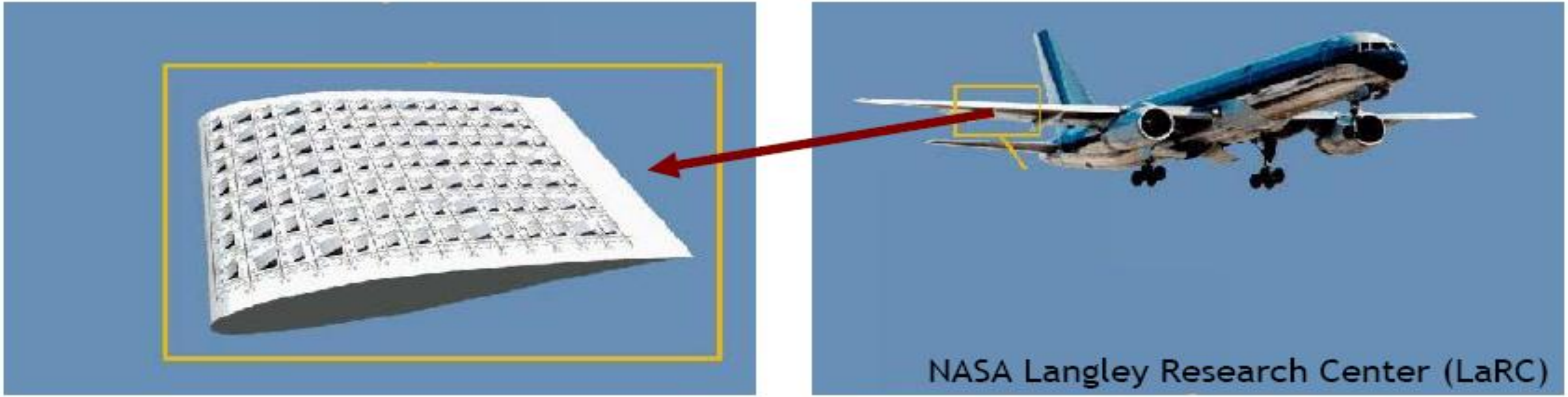


Product Miniaturization



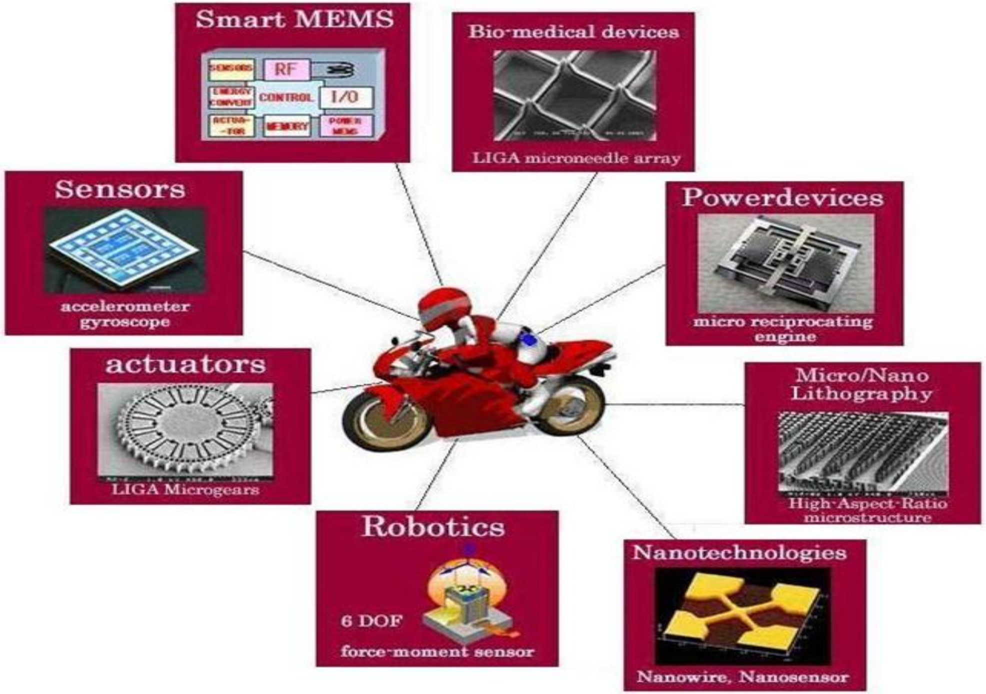
PCB Assembly Process

MEMS Piezo Actuators for Macro Actuation

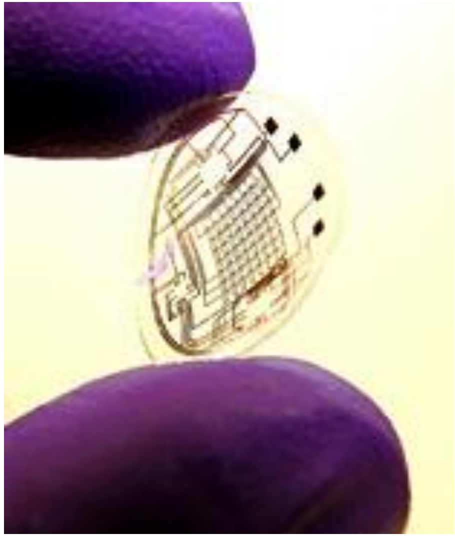


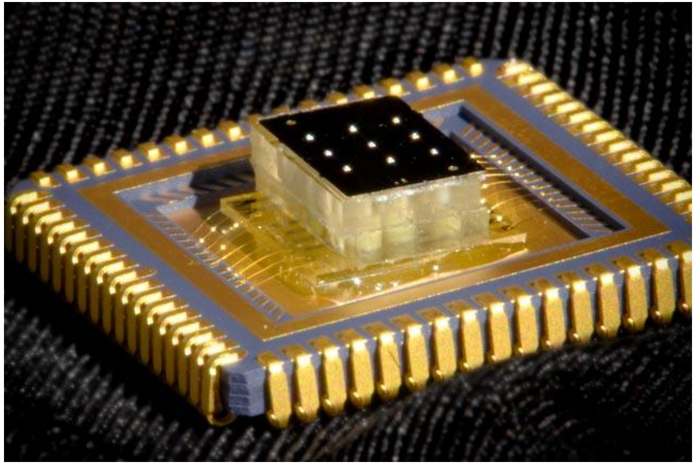
NASA Langley Research Center (LaRC)

MEMS - Applications

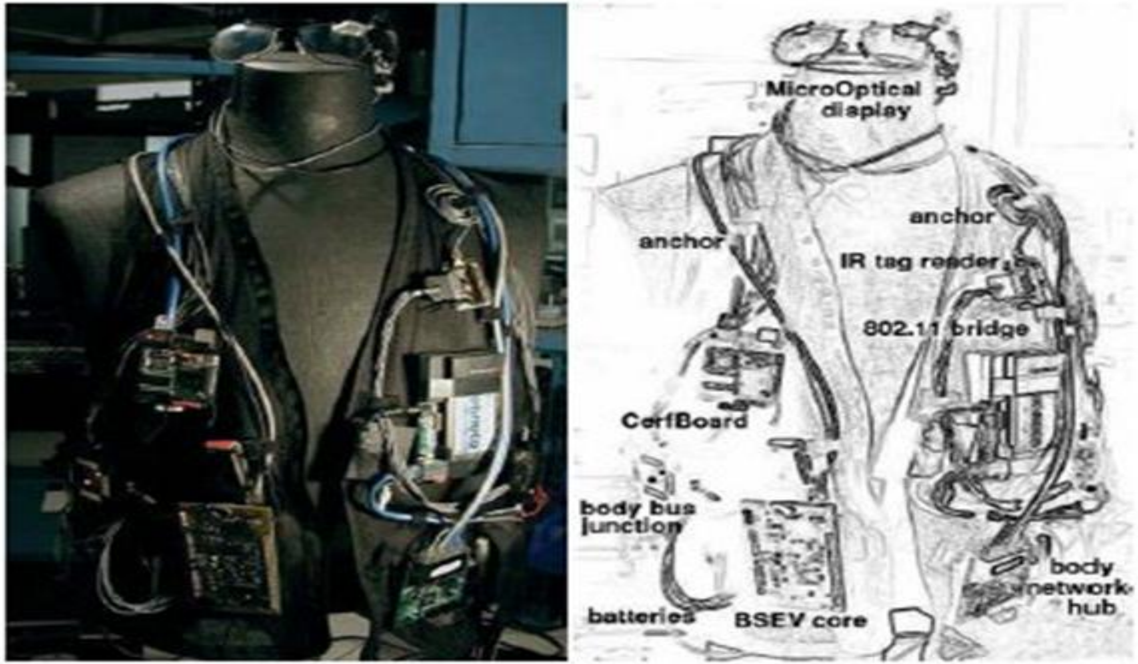


Medical Electronics





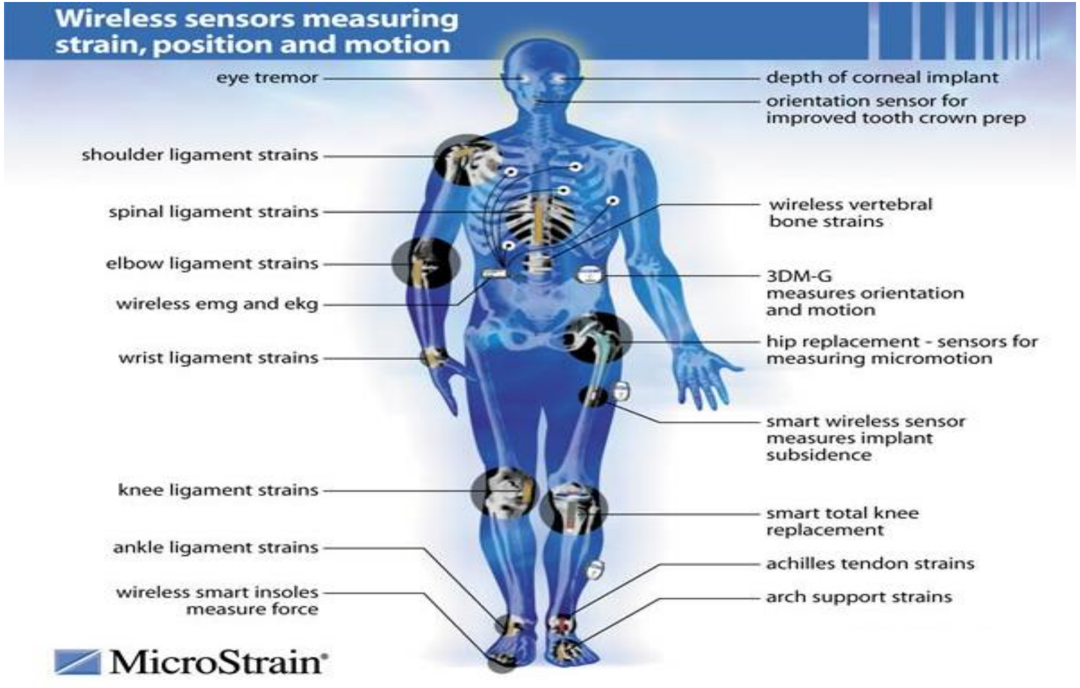
Networked Body Monitoring Systems

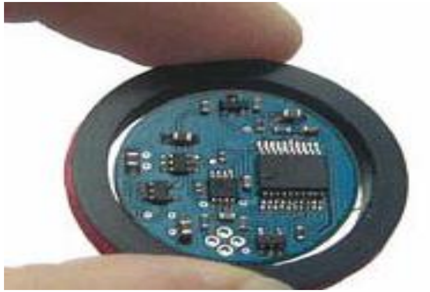


Source: http://www.media.mit.edu/wearables/mithril/

MEMS based Robotic Surgery

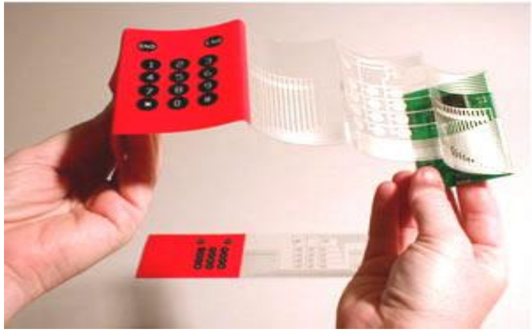
Implantable Strain Sensors

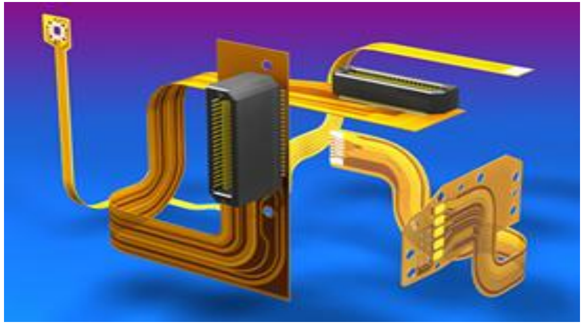




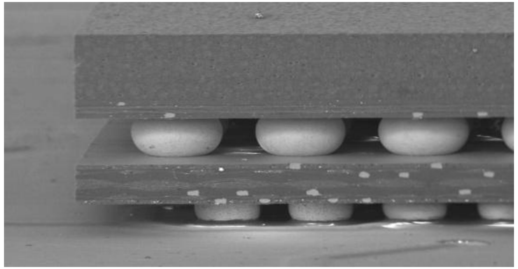
Wearable Electronics

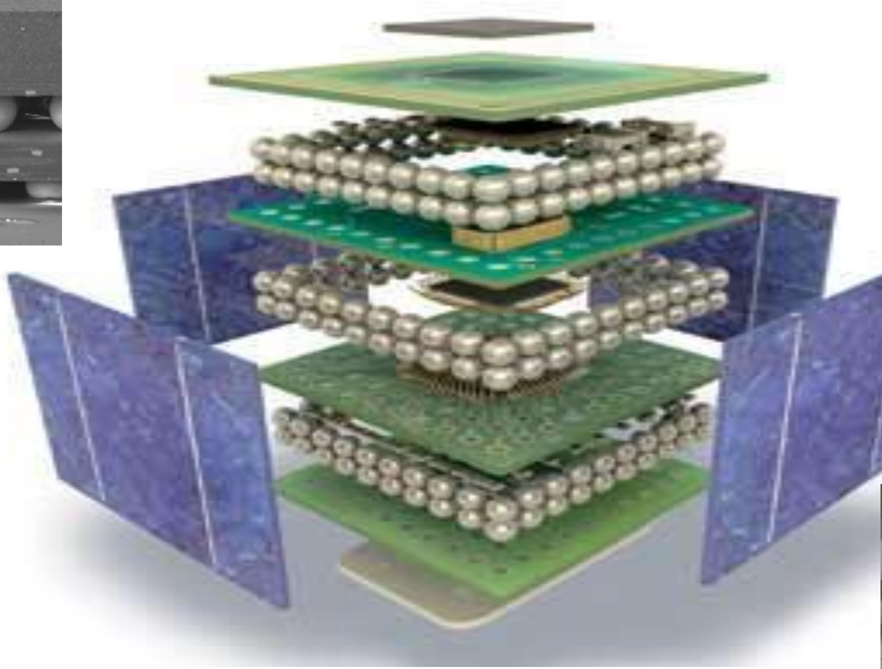
Flexible and Molded Substrates

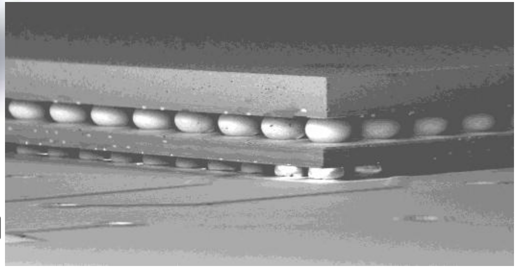




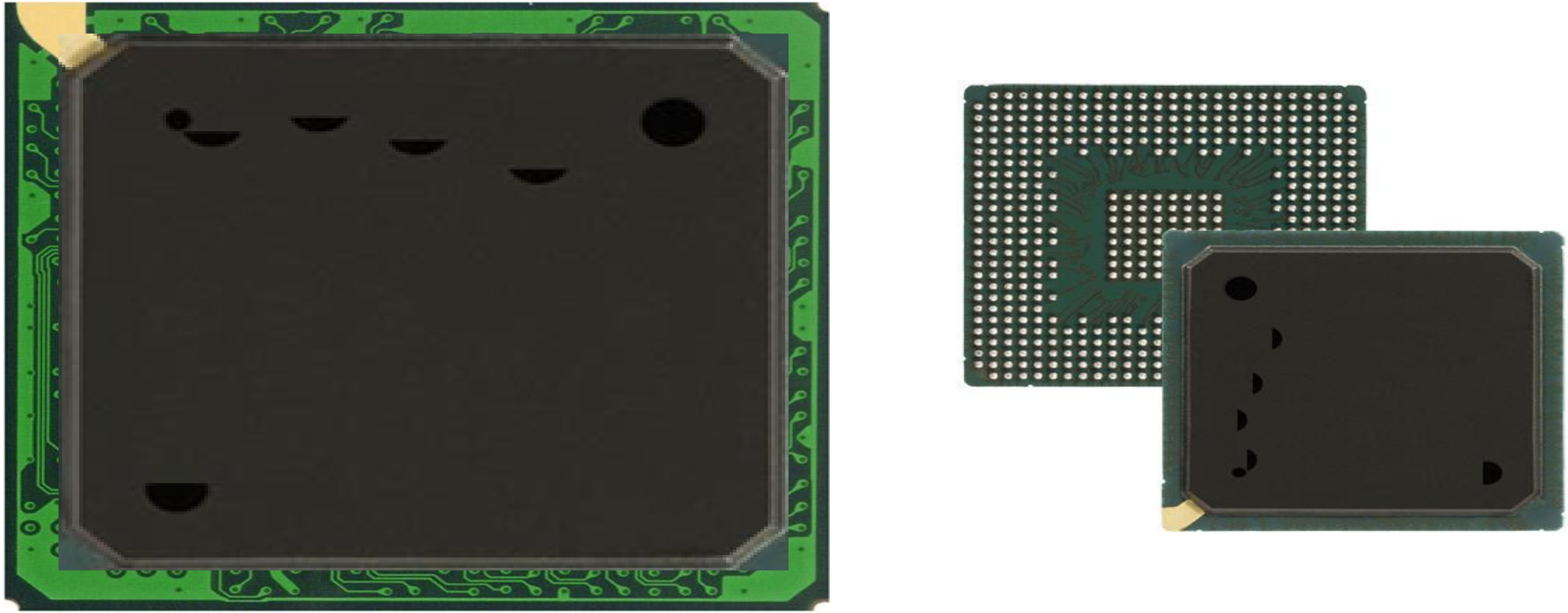
3-D Packages







Multi Chip Modules (MCM)



Technology Drivers

- Small form factor
- Faster and miniaturized Components
- Flexible Electronics
- Increased quality and reliability
- Efficient Thermal Management
- Faster time to market
- High Product variety
- Low Cost

CENTER FOR ELECTRONICS MANUFACTURING AND ASSEMBLY (CEMA)

"QUICK TURNAROUND, VALUE ADDED, ELECTRONICS PACKAGING SERVICES TO COMPANIES"

April 14th, 2009

Dr. S. Manian Ramkumar - Director

Scholarship @ CEMA

- **Scholarship of Discovery**
  - Applied research on materials and processes
- **Scholarship of Teaching**
  - Educational program for RIT undergraduate and graduate students
  - Onsite or on campus training for industry
  - Workshops and professional development courses at conferences
- **Scholarship of Application**
  - Analytical evaluation of PCB assemblies
  - Process development, optimization and implementation
- **Scholarship of Integration**
  - Product development and prototype assembly

CEMA – Facilities & Equipment

CEMA - Donors

ACE PRODUCTION TECHNOLOGIES
KEEP IT SIMPLE SOLDERING

A.P.E

ARLINK
DESIGNED FOR A CHANGING WORLD

Assembléon

Asymtek
A NORDSON COMPANY

EDSYN

EXFO

Glenbrook Technologies

SME

GSI Lumonics

INDIUM CORPORATION

KIC

malcom

Matec Instrument Companies

METCAL

MICRO CARE

NSF

SIEMENS DEMATIC

Speedline technologies

Universal

Vision ENGINEERING

HELLER INDUSTRIES

CEMA - Faculty Collaborators

- Dr. Carol Romanowski (Center for Multidisciplinary Studies)
- Dr. Scott Anson (CAST – MMET/PS)
- Dr. Robert Parody (Center for Quality and Applied Statistics)
- Dr. Robert Bowman (College of Engineering – EE)
- Dr. Joseph Voelkel (Center for Quality and Applied Statistics)
- Dr. Warren Koontz (CAST – ECTET)
- Dr. P. Venkatraman (College of Engineering – ME)
- Prof. Charles Swain (CAST – ECTET)
- Prof. TiLin Lu (CAST – MMET/PS)

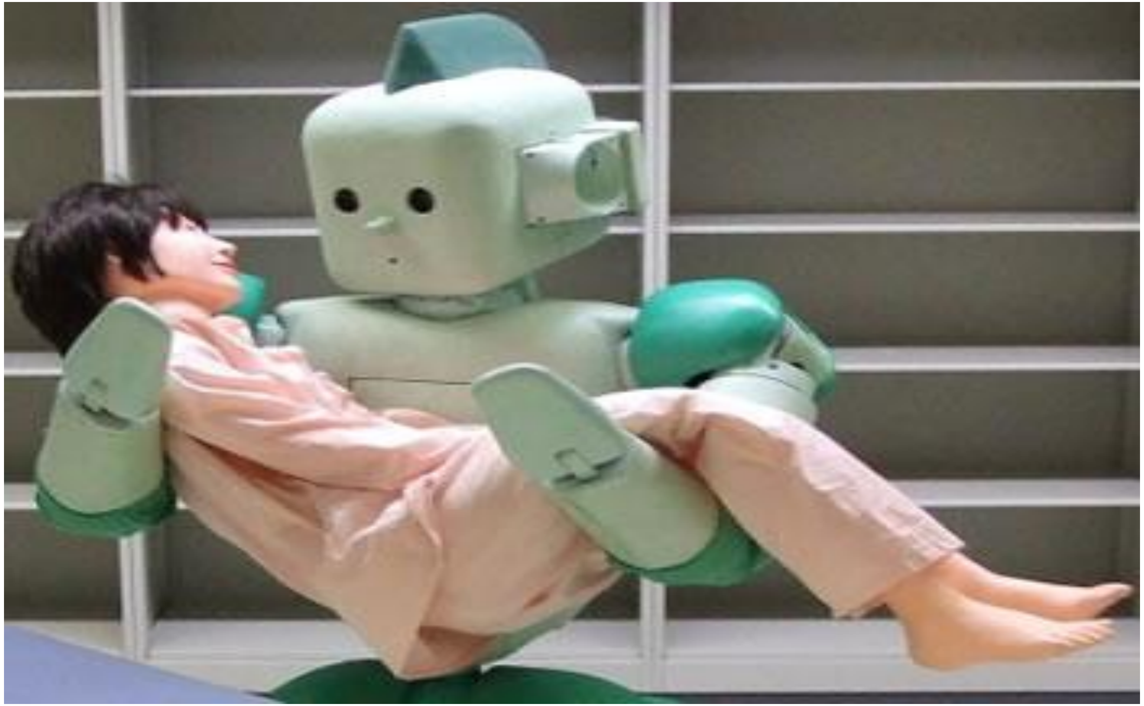
CEMA - Student Placement

- Aurora Opticals
- Benchmark Electronics
- Tyco Electronics
- Hughes Electronics
- Qualcomm
- Flextronics International
- Plexus
- Marquardt Switches
- TRW Automotive
- Honeywell
- Vansco Electronics
- Eaton Corporation
- Anaren Microwave
- REDCOM Laboratories
- IEC Electronics
- Tektronix
- Harris RF Communications
- SoPark Corporation
- Intel
- Universal Instruments
- Continental Automotive Electronics
- Delphi Electronics
- Lockheed Martin

CEMA - Significant Influence Locally

- Ashly Audio
- Biophan Technologies
- D3 Engineering
- Delphi Electronics
- Eastman Kodak Company
- Hand Held Products (Presently Honeywell)
- Harris Corporation
- Hover-Davis
- Illumitech
- Insight Avionics
- Lumetrics
- L-3 Communications
- Marquardt Switches
- Moog
- Nexpress Solutions
- Performance Technologies
- REDCOM Laboratories
- SCJ Associates
- Sopark
- SenDec
- Spectracom
- Surmotech
- TREK Inc.
- Vincent Associates
- Windsor Manufacturing Co.
- Xerox

Future with Electronics



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Thank you !