

# IFX Day 2007

Munich, March 13, 2007

## Automotive, Industrial & Multimarket Power Management & Drives

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Never stop thinking

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This presentation was prepared as of March 13, 2007 and is current only as of that date.

This presentation includes forward-looking statements about the future of Infineon's business and the industry in which it operates. These include statements relating to future developments in the world semiconductor market, including the market for memory products, Infineon's future growth, the benefits of research and development alliances and activities, Infineon's planned levels of future investment in the expansion and modernization of its production capacity, the introduction of new technology at its facilities, the continuing transitioning of its production processes to smaller structure sizes, cost savings related to such transitioning and other initiatives, Infineon's successful development of technology based on industry standards, Infineon's ability to offer commercially viable products based on its technology, Infineon's ability to achieve its cost savings and growth targets, and the impact of the carve-out of Qimonda, the group's memory products business, its initial public offering, and any further sales of Qimonda shares or other corporate financing measures in that regard.

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# Global Energy Trends: Substantial needs & highest level of awareness; IFX addressing since years



Dwindling resources require efficient energy management.

- Dwindling energy resources combined with growth in electrical energy demand of 2.6% p.a. worldwide forces us to use energy wisely.
- Saving energy is therefore, fast becoming a standard issue for all industrial, commercial and household applications.



Higher pollution, emissions and potential damage to the climate require "clean" solutions.

- Pollution as well as environmental and climate protection have become global concerns.
- Reducing pollution by minimizing energy wastage is fast becoming a standard requirement for all areas of public and private life.

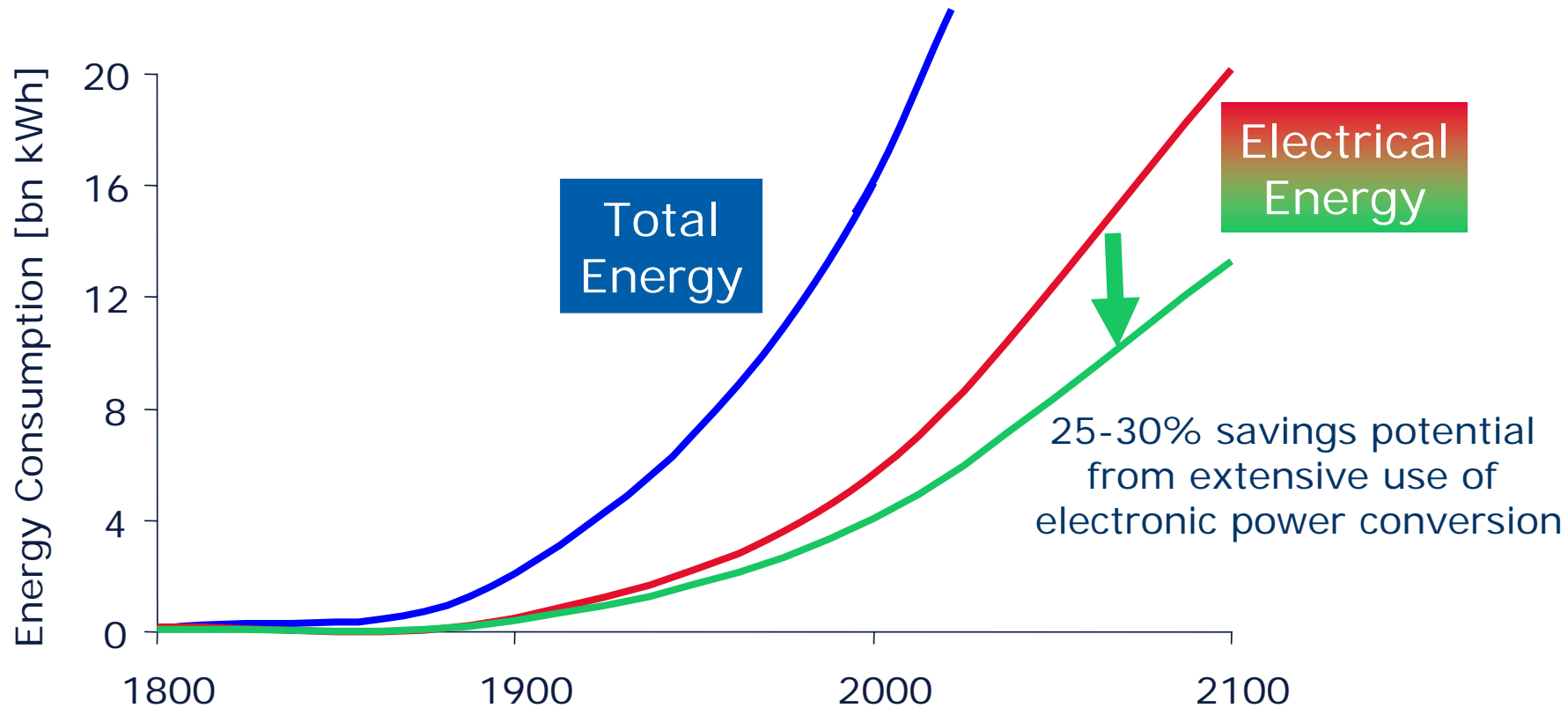


Infineon contributes to efficient energy management and to the effective reduction of pollution and emission.



- We deliver innovative, high performance solutions with best-in-class technologies that help our customers save energy and reduce pollution.
- We enable the use of available resources as efficiently as possible.

# Energy Demand and Electricity Consumption are on the Rise – We Can Help to "Do More With Less"



Savings of 25% are possible in current electrical energy consumption which equals the demand of the USA.

# Today's Savings Potential from Using Electronic Power Conversion and Control



## Stand-by power (TV)



~ **90%** savings potential

## Power supply in a server



~ **12%** savings potential

## Lighting



~ **25%** savings potential  
(electronic ballast)

## Motor control



**30-40%** savings potential  
(rpm control)

## Traction drives



**20-30%** savings potential  
(energy recuperation)

## Climate control



**30-40%** savings potential  
(improved control)

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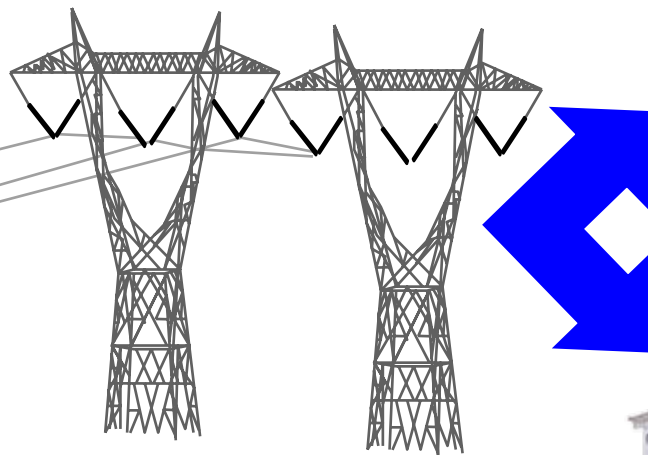
# Power Semiconductors and Power Modules for the Energy Supply Chain

Energy Supply Chain

Energy Generation



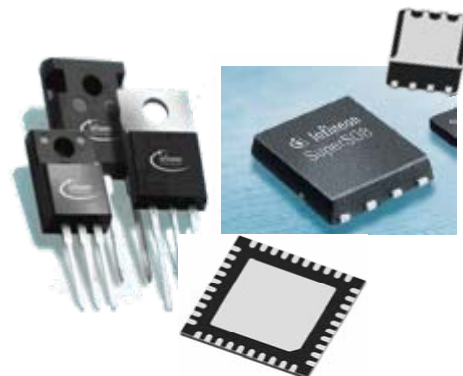
Energy Distribution



Energy Consumption



IFX Products



# Energy Generation and Distribution

## Grid Coupling and Long Range Energy Transport

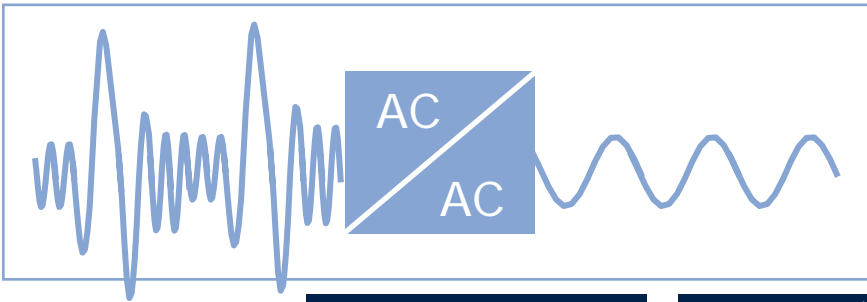


### Energy Generation

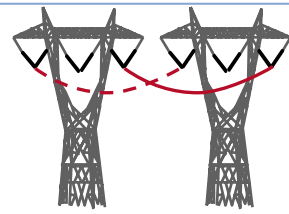


- Hydro Power
- Wind power
- Solar power
- Fuel cells

E.g. Wind Power : High efficiency coupling to grid

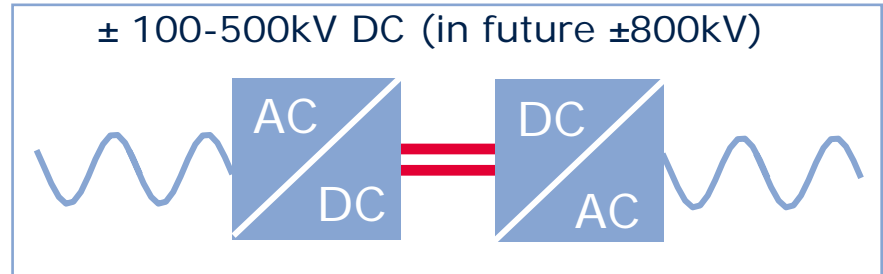


### Energy Distribution



- FACTS and SVC
- HVDC Transmission

E.g. HVDC Transmission : Grid coupling, low loss energy transport



#### Power Discretes Bipolar Products

#### Power / IGBT Modules

#### Power ICs

#### Micro- controllers

IFX products  
for energy  
generation  
and  
distribution

- Thyristor and Diodes
- PressPACK
- CoolMOS
- IGBT

- EasyPIM
- EasyPACK
- EconoPACK
- IHM modules
- BIP modules
- Stacks
- PrimePACK

- EiceDRIVER

- 8-bit  $\mu$ Cs
- 16-bit  $\mu$ Cs
- 32-bit TriCore ( $\mu$ C + DSP)

# Energy Consumption

## Focus is on Efficient Power Conversion



### Drives Applications Frequency Conversion

- Traction (trains)
- Speed controlled motors in
  - industrial
  - home
  - Pumps
- Automotive (Hybrids)



### AC/DC Power Supplies

- Computer & server
- Adapter
- Charger
- TV, DVD, etc.
- Lighting
- Game console

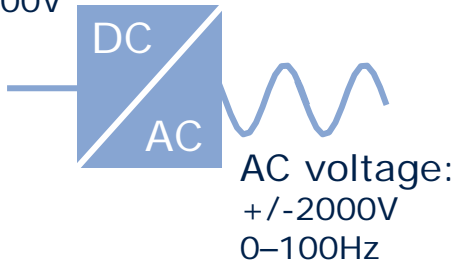


### DC/DC Power Conversion

- Motherboard
- Graphics card
- Notebook
- Telecom
- VRMs
- Server

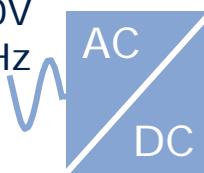


DC voltage:  
300-3000V



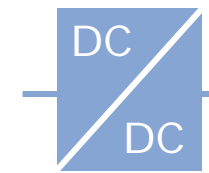
AC:

230V  
50Hz



DC:

48V<sub>DC</sub> Telecom  
19V<sub>DC</sub> Notebook  
12V<sub>DC</sub> Desktop  
6V<sub>DC</sub> Mobile charger



3.3V<sub>DC</sub> Logic  
2.5V<sub>DC</sub> DSP  
1.8V<sub>DC</sub> Memory  
1.2V<sub>DC</sub> CPU

#### Power Discretes Bipolar Products

- CoolMOS
- thinQ! family (SiC Diode)
- Highspeed IGBTs
- OptiMOS

#### Power / IGBT Modules

- EasyPIM
- EasyPACK
- IsoPACK
- EconoPACK
- Thyristor / Diode modules

#### Power ICs

- PWM & PFC ICs
- CoolSET
- Integrated switches
- Gate drivers
- Smart ballast
- EiceDRIVER

#### Micro- controllers

- 8-bit  $\mu$ Cs
- 16-bit  $\mu$ Cs
- 32-bit TriCore ( $\mu$ C + DSP)

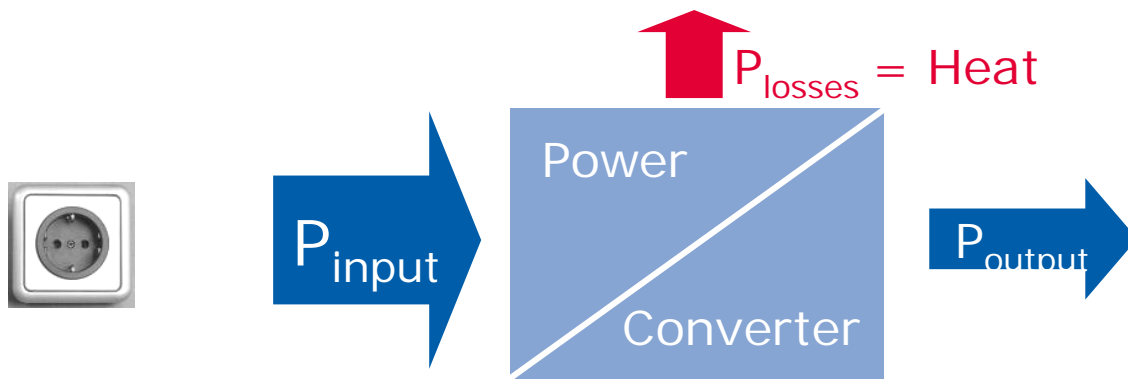
IFX Products  
for Energy  
Consumption

# Drivers for Power Semiconductors: Reduced Energy and Stand-by Losses, Form Factor, Comfort

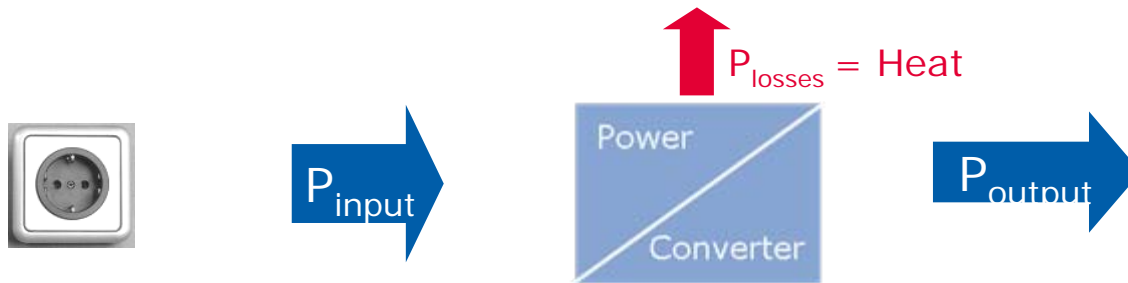


## The power conversion fundamentals

Without Power Management Solution



With Power Management Solution



## Our technologies and products offer ...

- ... increased energy efficiency through lower power losses
- ... increased energy efficiency through lower stand-by power
- ... improved form factor through higher energy efficiency

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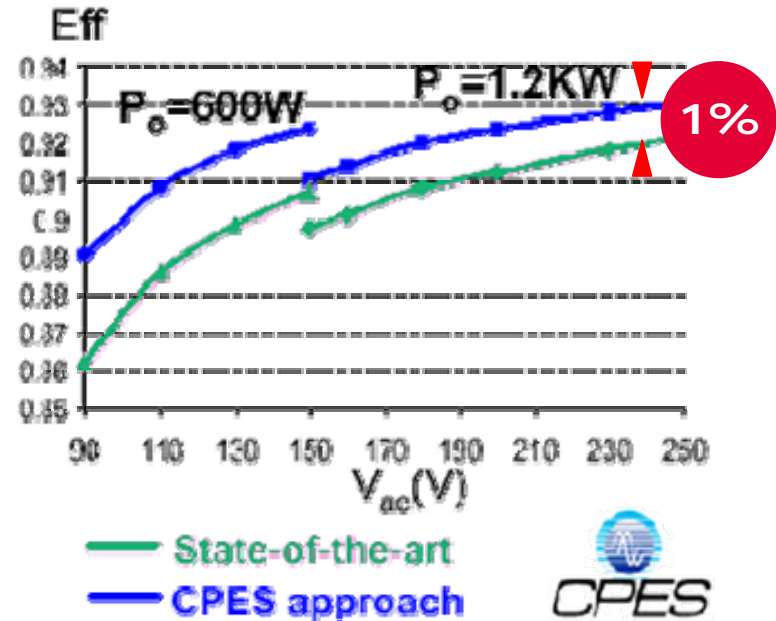
# Server Power Supplies Fit With CoolMOS, SiC and OptiMOS Enable Highest System Performance



## Server fact sheet:

- "Google managed to increase the typical efficiency of power supplies from 60-70% to at least 90% efficiency, reducing lost energy by a factor of four." (EE Times/Google)
- Infineon is the leading semiconductor supplier for AC/DC power supplies in servers.
- 9.4 m server power supplies in 2007 with a CAGR of 10%. (source: iSuppli)
- Average semi BoM for power is \$15.

## Efficiency of Power Supplies

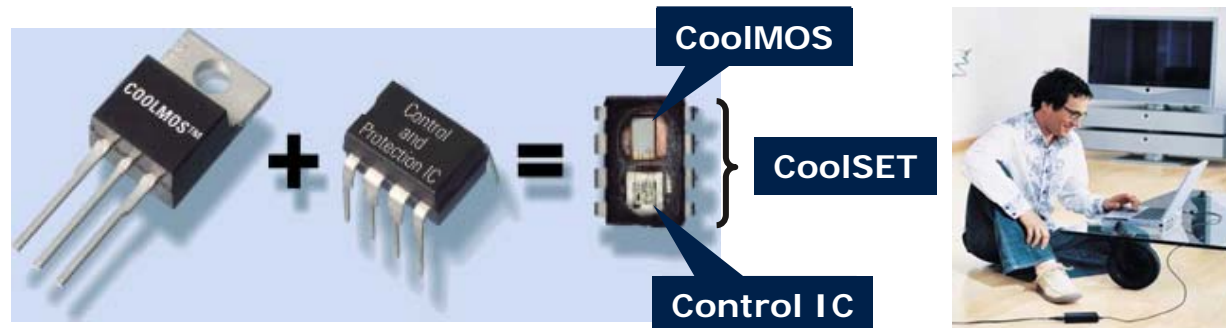
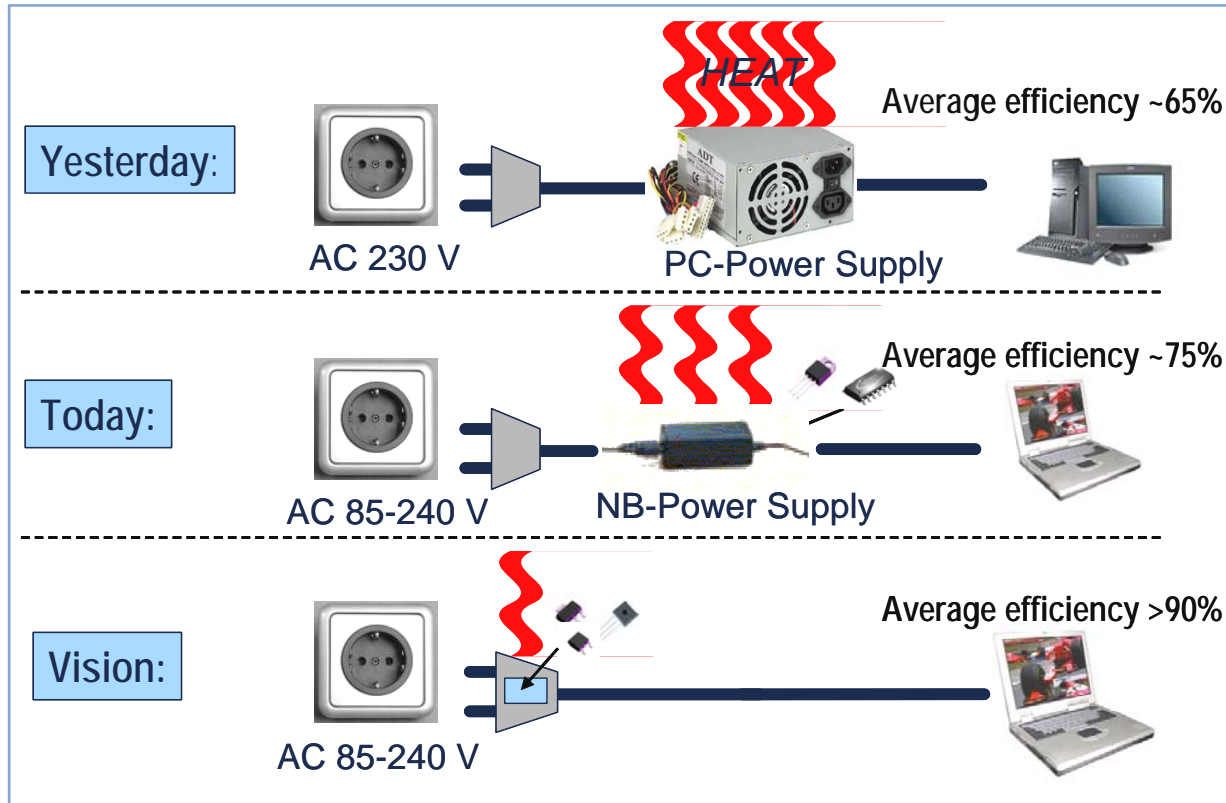


CoolMOS, SiC diodes and OptiMOS enable lower conduction and switching losses at higher switching frequencies. This results in higher efficiency and reduction of size of transformers, heat sinks and costs.

# Meeting Weight and Size Requirements is Crucial in Power Supply Applications

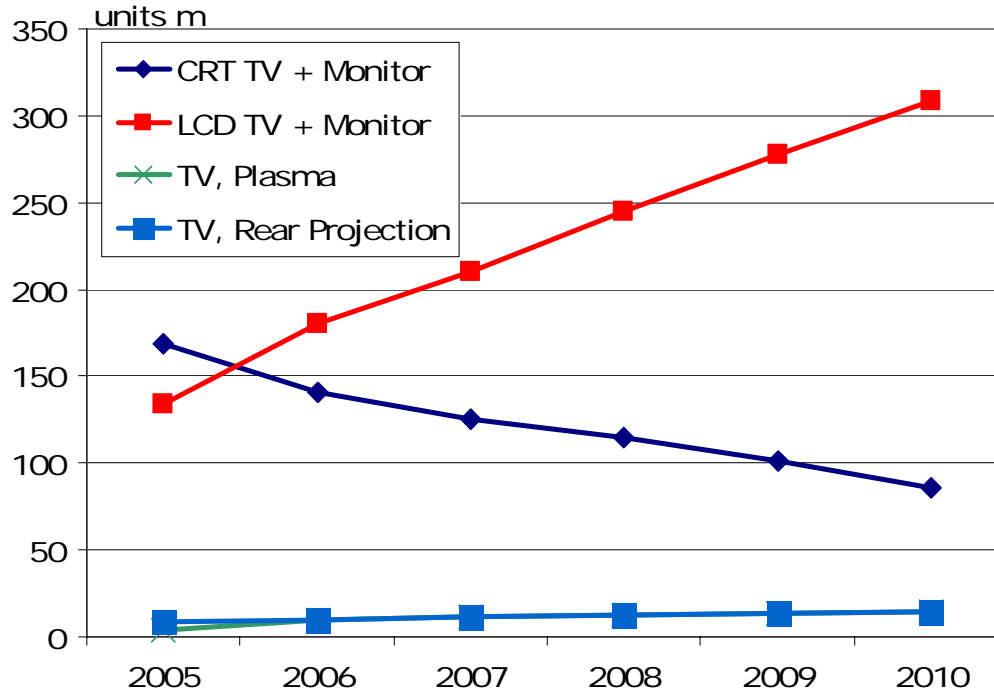
## Adapter fact sheet:

- Form factor and stand-by requirements demand highly efficient power semiconductors, e.g. CoolMOS and efficient control IC like CoolSET.
- Infineon is a leading semiconductor supplier for AC/DC adapters for notebooks and consumer applications (set top boxes, DVD recorder).
- 171 m adapters per year in 2007 with a CAGR of 11%.  
(source: iSuppli)
- Average semi BoM for power is ~ \$2.



# Growth Drivers: Replacement of CRT Monitors and TVs by Flat Panel Displays

## Forecast for CRT and Flat Panel Displays



Source: Gartner, November 2006

## IEA Standby Recommendations

Rated Output Power	Phase 1 Jan. 2001	Phase 2 Jan. 2003	Phase 3 Jan. 2005
> 0.3W and < 15W	1.0W	0.75W	0.30W
> 15W and < 50W	1.0W	0.75W	0.50W
> 50W and < 75W	1.0W	0.75W	0.75W



## Growth Drivers

- Flat panel displays outpace CRT technology due to consumer preferences for flat, light weight design and wide screens.
- The flat design requires improved efficiency of power supplies.
- New regulations limit maximum stand-by power consumption of TVs and monitors.



**Growing demand for CoolMOS, OptiMOS and Power Management ICs**



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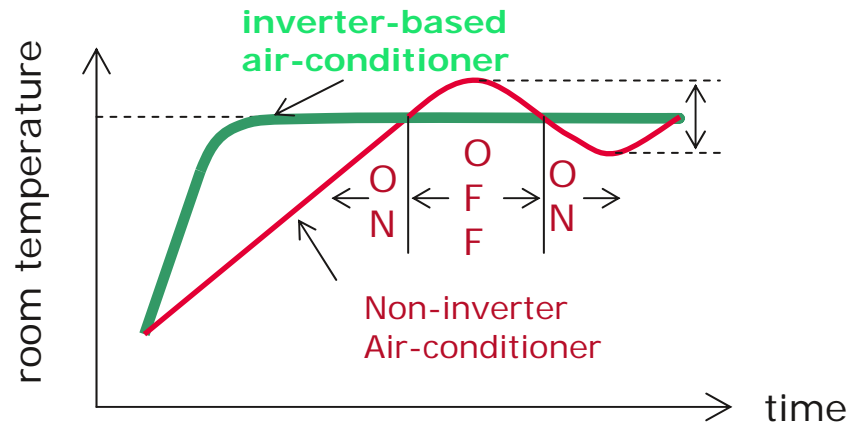
# Motor Drives is about RPM Control, Leading to Increase in Power Density, Efficiency and Reliability



## Drives fact sheet:

- Conventional motor drives will be replaced by intelligent inverter-based motors saving upto 40% energy.
- Infineon has developed a leading position for all enabling technologies:
  - > IGBT, Diodes, CLT
  - > Module packages.
- 12.2 m industrial drives in 2007 with a CAGR of 9.8%.  
(source: IMS, December 2005)
- Semi BoM for power \$10-1,000, depending on application.

## Example of an inverter-based solution and its advantages:



- Energy saving of ~ 30-40%
- Permanent control without disturbing noise and fluctuations
- Needs 1/3 of the original time to reach desired temperature



# Infineon Power Modules Enable Higher Power Density and Thus Lower System Cost



6 x 75 A  
1200V **IGBT2**  
0.9 kW/inch<sup>3</sup>



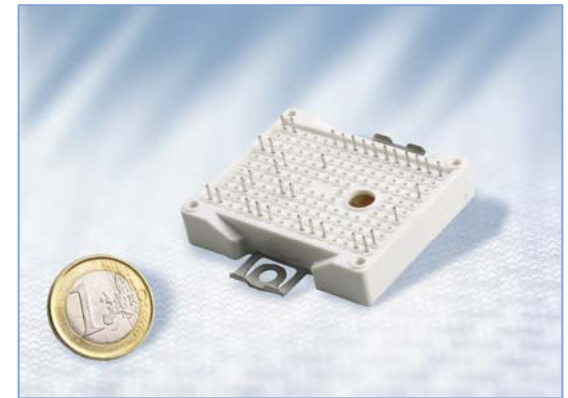
3 x 62 mm modules

6 x 75 A  
1200V **IGBT3**  
5.6 kW/inch<sup>3</sup>



1 x EconoPACK Module

6 x 75 A  
1200V **IGBT4**  
11 kW/inch<sup>3</sup>



1 x Easy2B Module

On average, Infineon IGBT modules improved the power density by over 20% every year on a component level.

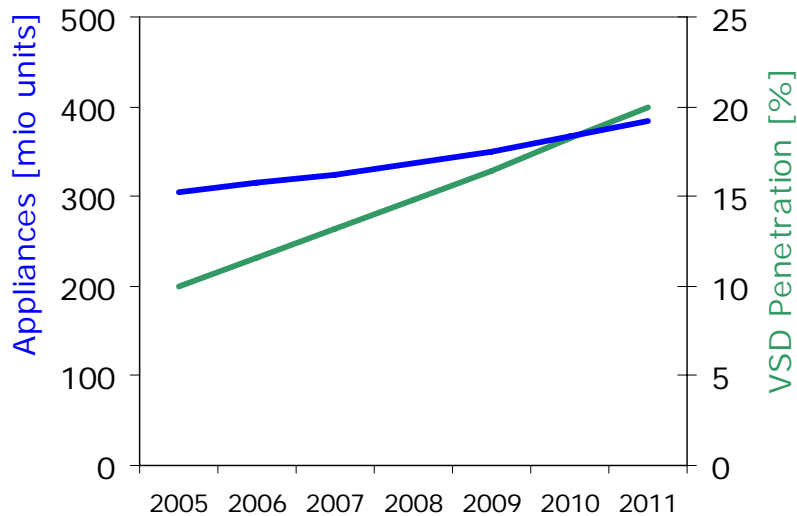
1995

2001

2007

# Growth Drivers: Growing Demand For Home Appliances With Variable Speed Drives

## Forecast for Major Home Appliances Based on Variable Speed Drive (VSD)

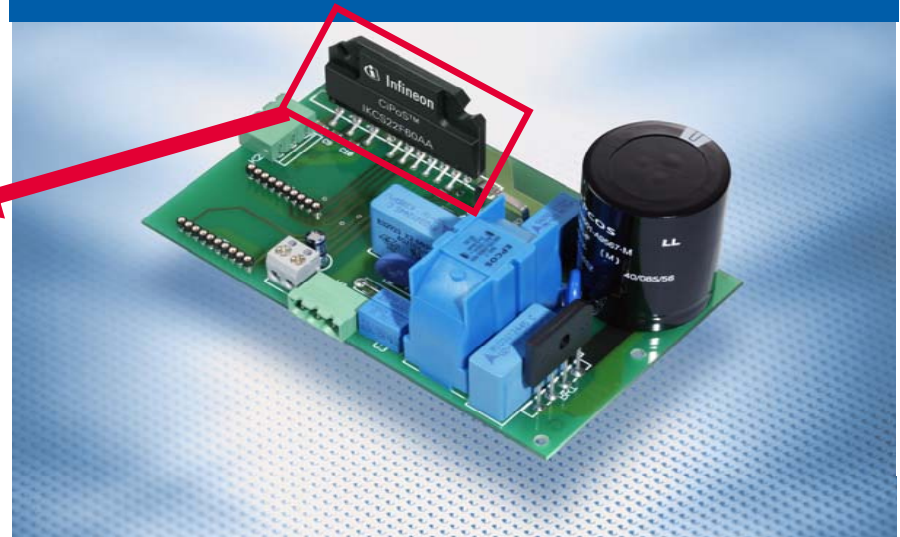


Source: IMS, February 2007

## Growth Drivers

- Penetration of VSD is still small and is expected to rise sharply.
- Major appliances are air condition, washing machine, dryer, fridge and freezer.
- Infineon all-in-one CiPoS solution is ready to take advantage of this market.

## Infineon All-in-one CiPoS module



IGBTs + diodes  
+ gate driver  
+ temperature sensor  
+ passive components

# Growth Drivers: Hybrid Electric Vehicle Demands Huge Amounts of IGBTs and Diodes

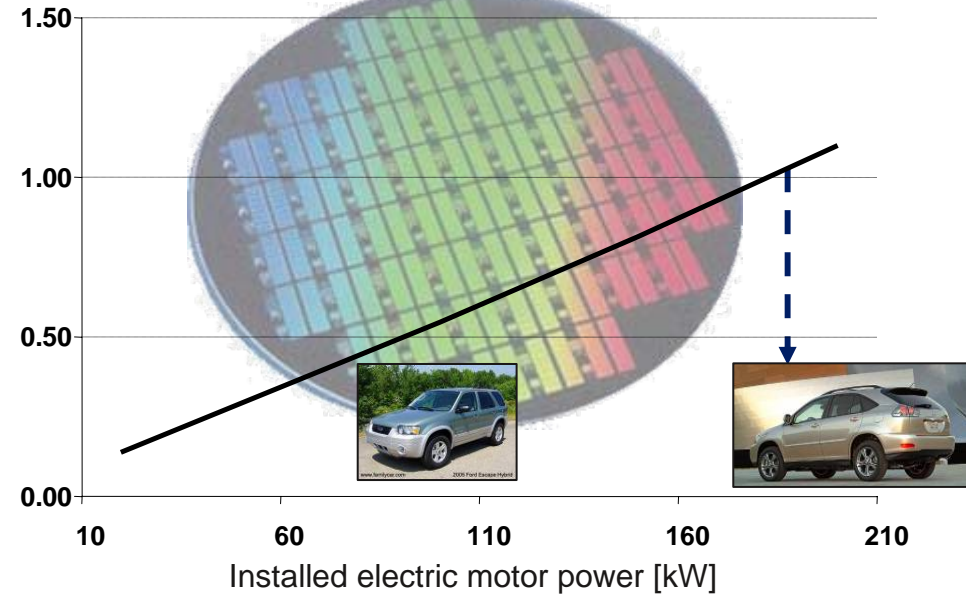


## Growth Drivers

- Fuel economy, CO<sub>2</sub> reduction and price are main drivers for Hybrid Electric Vehicles.
- Combining technology leadership in silicon with innovative high volume, and reliable packaging concepts, Infineon is well prepared to participate in this emerging market.
- Semiconductor content depending on topology and power:
  - ~20kW \$100 - \$250
  - ~200kW \$500 - \$1,000thereof, 50-80% is related to IGBT and diode chips in a module package.

## Estimated silicon area for power semiconductor per kW of equivalent electrical power

6" wafer per vehicle



HybridPACK1



HybridPACK2

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# Infineon Shapes the Computing and Telecom Industry Together With Leading OEMs



## Server/Datacom/Telecom



Lucent Technologies  
Bell Labs Innovations



SIEMENS

NOKIA



ALCATEL



Huawei Technologies



## Adapters



IBM

DELL

lenovo™

acer



We estimate that at least every 2nd server and every 4th adapter is running with IFX power semiconductors.

# We Set Standards With Innovative Packaging Concepts in the Industrial Drives Market



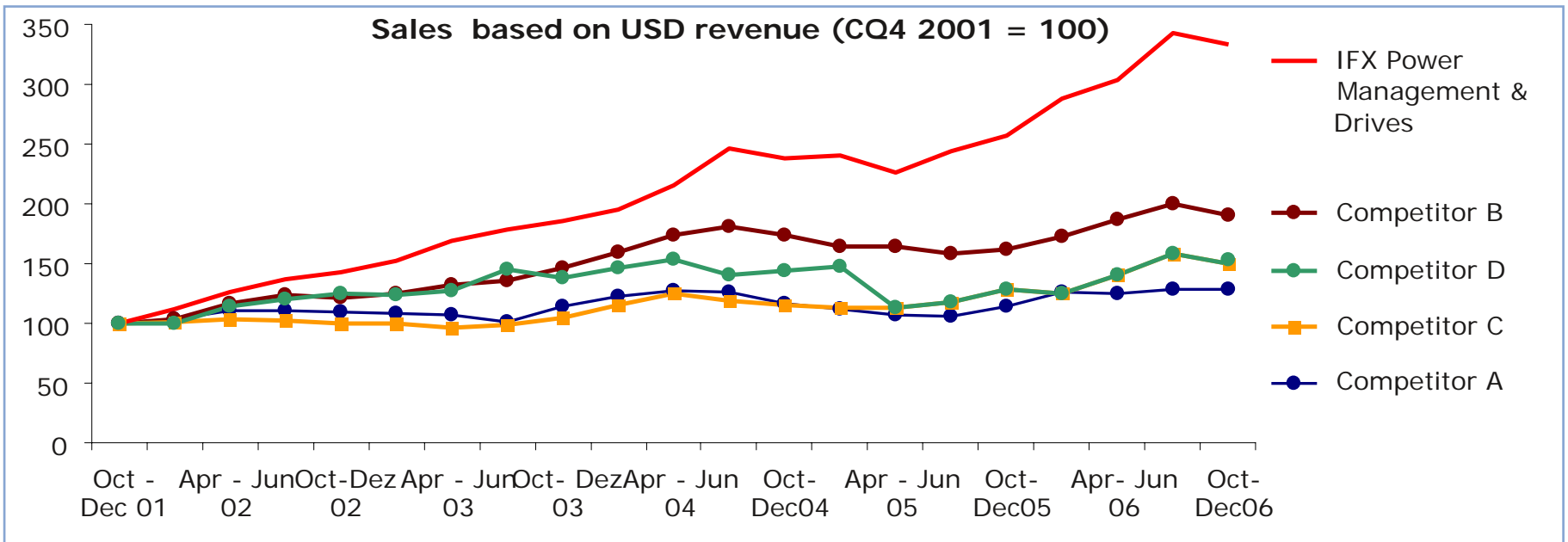
## Industrial Drives



One out of four industrial drives is equipped with Infineon's IGBT technology.



# Our Power Business has Outgrown Competition Since 2001 With Constantly Positive EBIT



# Infineon is the Global Market Leader for Power Semiconductors



## Global Power Semiconductor Market Ranking Market Size in 2005: USD 11.3 bn

Rank 2004	Rank 2005	Supplier	2005	2004	Change	
(1)	1	<b>Infineon</b>	9.4%	8.4%	1.0%-pt	↑
(3)	2	Fairchild	7.2%	7.6%	-0.4%-pt	↓
(2)	3	International Rectifier	7.1%	7.8%	-0.7%-pt	↓
(4)	4	STMicroelectronics	6.9%	7.0%	-0.1%-pt	↓
(5)	5	Toshiba	6.2%	6.5%	-0.3%-pt	↓
(6)	6	Vishay	5.7%	5.8%	-0.1%-pt	↓
(7)	7	Mitsubishi (incl. Powerex)	5.5%	5.1%	0.4%-pt	↑
(9)	8	Fuji Electric	4.6%	4.4%	0.2%-pt	↑
(8)	9	Renesas	4.4%	4.7%	-0.3%-pt	↓
(10)	10	ON Semiconductor	3.5%	3.8%	-0.3%-pt	↓

Source: IMS Research, Global Market for Power Semiconductors, September 2006

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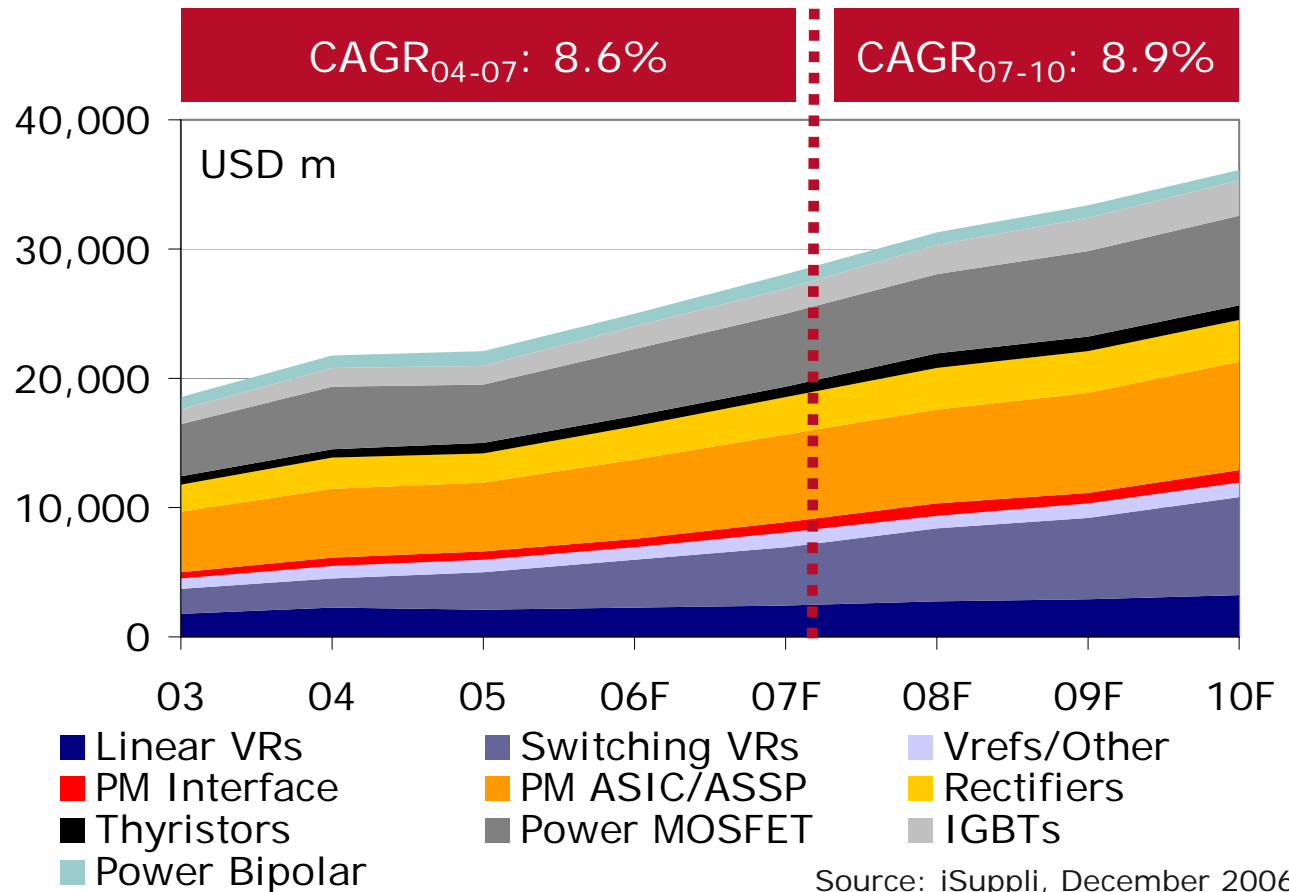
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# The Overall Power Semiconductor Market is Projected to Grow at 8.9% Per Year (2007–2010)



## Market development:

- 2006 was strong especially due to high consumer and wireless upward trend.
- It is projected that 2007 will be a very healthy year for the sector and above the recent historic mean growth of about 8.6% per year.



## Future market penetration

- Leverage existing strength in power semiconductors with new products (portfolio expansion).
- Penetrate new markets with new highly integrated solutions.

Infineon –  
Never stop thinking



Never stop thinking