

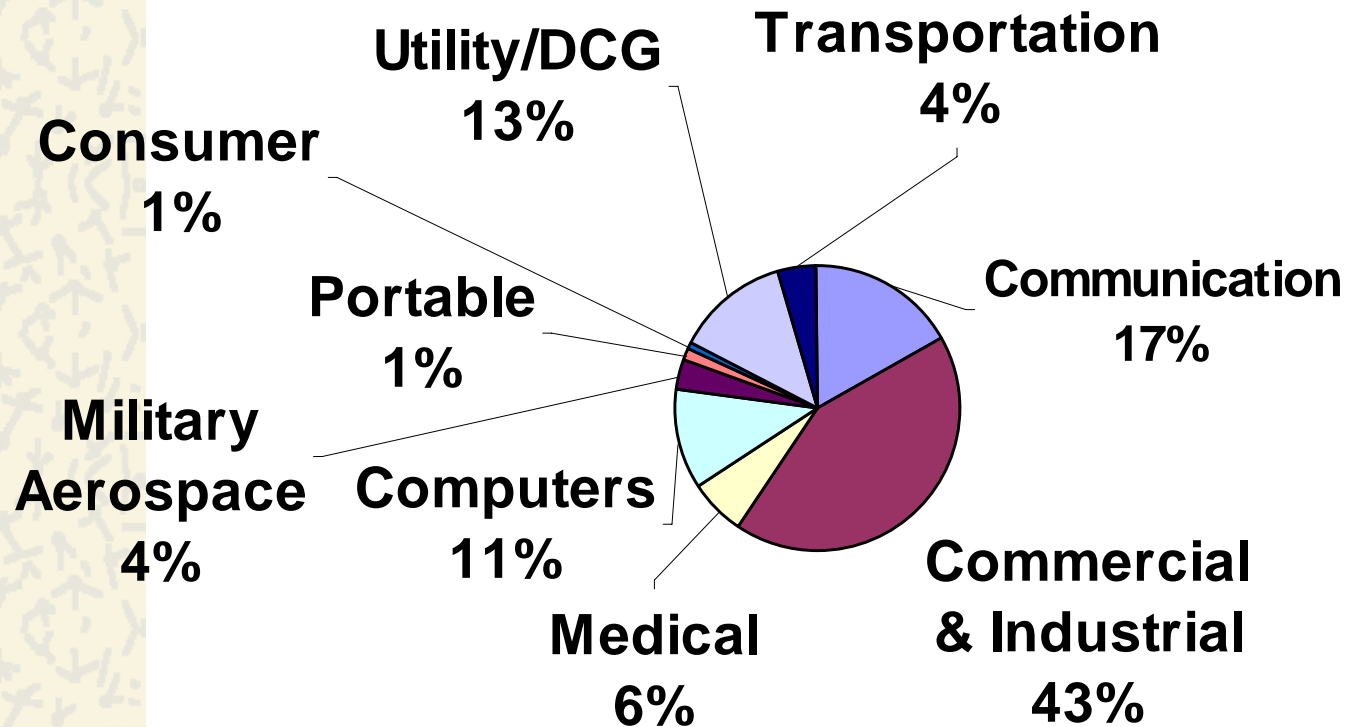


# Power Electronics Futures

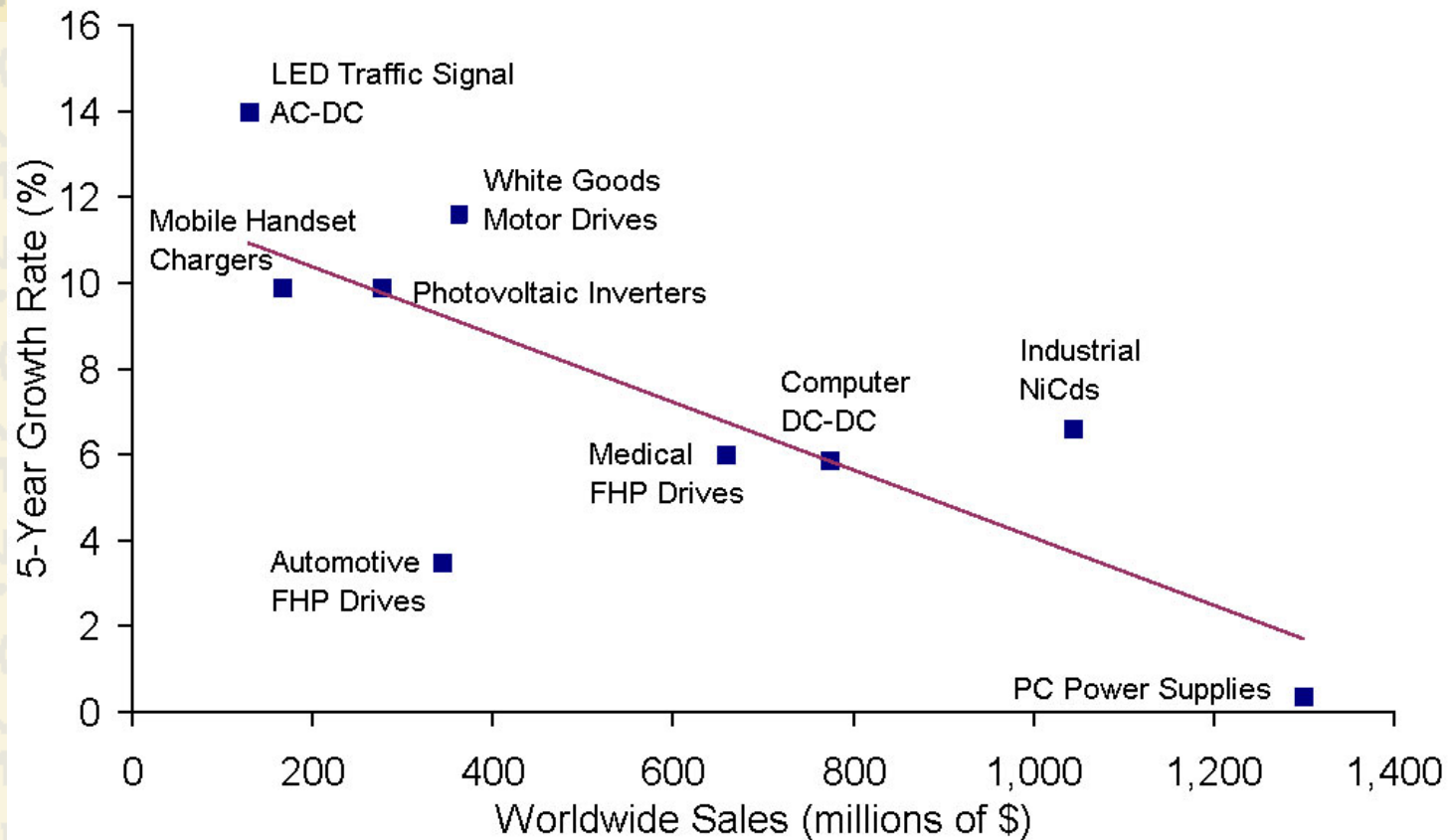
Jeff Shepard  
Darnell Group

# Expansive Market

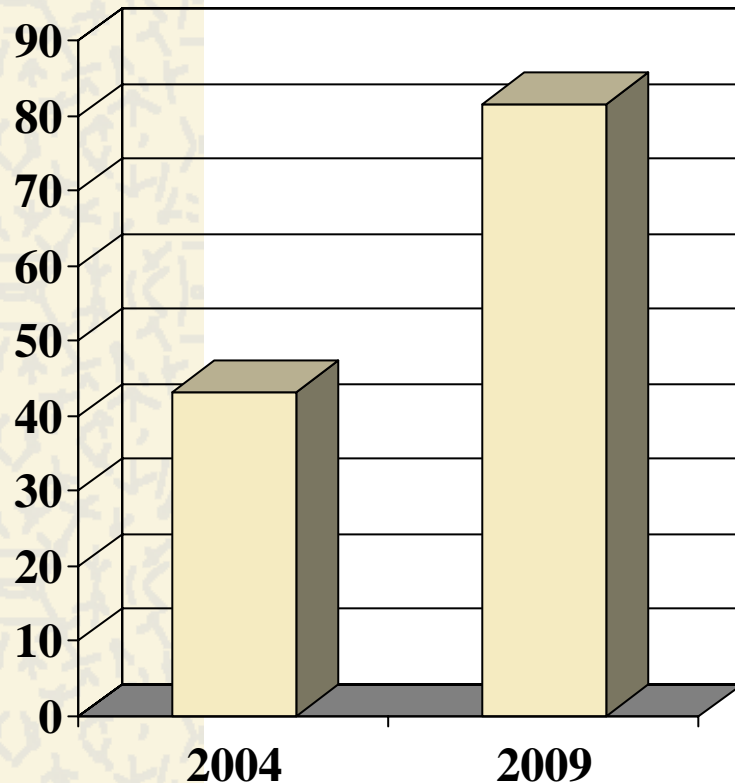
\$18.2B in 2003



# Growth Rate Comparison



# Notebook Opportunities



millions of units

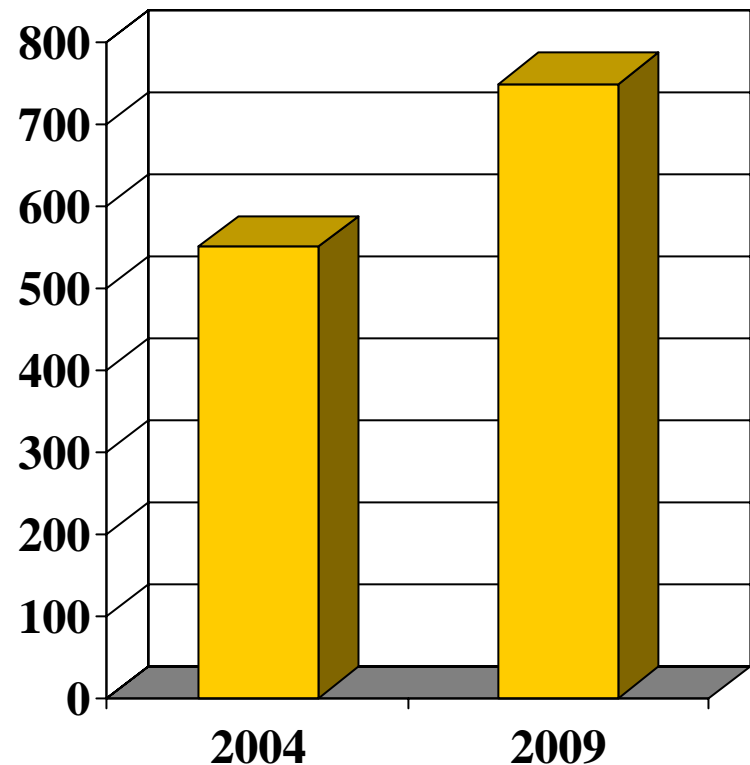
- ✦ Growing faster than desktop segment
- ✦ Power demands growing
  - Larger monitors
  - Wireless connectivity
  - Longer run times

# Wireless Mobility

- ✧ Universal connectivity
  - Notebook computers
  - Mobile phone handsets
- ✧ Increasingly power hungry devices
  - All day computing
  - Camera phones with hard disk drives
- ✧ More power (and more power management) is needed

# Mobile Phone Handsets

- ✦ Substantial market
- ✦ 550 million units '04
- ✦ 750+ million units '09
- ✦ Handsets increasing in sophistication
- ✦ Growing demand for more power



millions of units

# Emerging Devices



- ✦ Compaq tablet PC
  - Tablet PC goal is all day wireless computing

- ✦ Nokia camera handset
  - High resolution photos
  - Hard disk drives
  - Television handsets



- ✦ More Power Needed

# Industrial NiCd Batteries



Large  
format  
NiCds  
from Saft

Small  
format  
NiCds from  
Panasonic



- ✦ Electric utility substations
- ✦ Railway signaling
- ✦ Portable power tools
- ✦ Lift trucks
- ✦ Emergency lighting

Corresponding market for  
industrial NiCd chargers



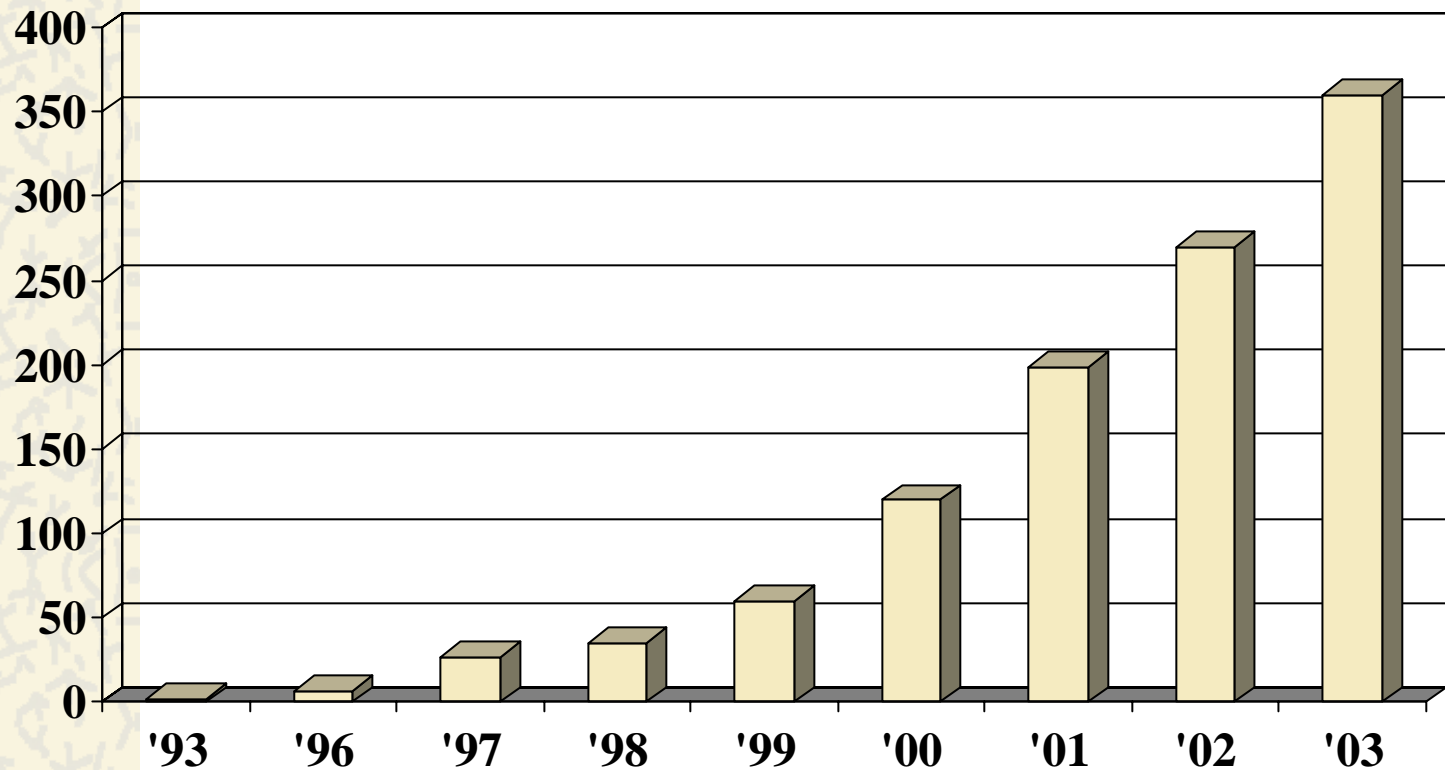
# Distributed & Cogeneration

- ✧ Wind turbines
- ✧ Photovoltaics
- ✧ Microturbines
- ✧ Fuel cells
- ✧ Gensets
- ✧ Combined heat and power

# DCG Power Converters

- ✦ Inverters
- ✦ Dc-dc converters
- ✦ Variable frequency converters
- ✦ Static transfer switches
- ✦ Monitoring and control

# Grid-Connected Solar Power



Megawatts

# Photovoltaics

- ☀ Inverters are key system component
- ☀ >10% annual growth worldwide
  - \$276 million 2003
  - \$445 million 2008
- ☀ New competitors entering the market



Uni-Solar  
PV shingles



Atlantis  
Energy  
Systems'  
SunSlates  
shingles

# Fuel Cells

Metallic  
Power  
zinc-air  
fuel cell



- ✦ Power electronics are a key component
- ✦ Early commercialization
- ✦ Variety of approaches



NFCRC  
220-kW  
SOFC &  
micro-  
turbine  
hybrid

# North America White Goods



GE Profile  
Harmony



Kenmore  
Elite

- ✦ New DoE regulations
- ✦ Residential clothes washers
  - Mandated reduction in energy use
  - Requires motor drives to achieve
- ✦ Also regulations for other appliances

# Exciting Futures

- ✦ Numerous emerging & growing opportunities
  - Solid state lighting
  - Automotive power electronics
  - Motor drives in medical equipment
- ✦ Beginning of a new era in power electronics
- ✦ Rapidly growing positive environmental impact
- ✦ Growing variety of exciting futures