Infineon
Industrial Power Semiconductor
-Focus on Traction Segment in China

2009-01-08, Beijing

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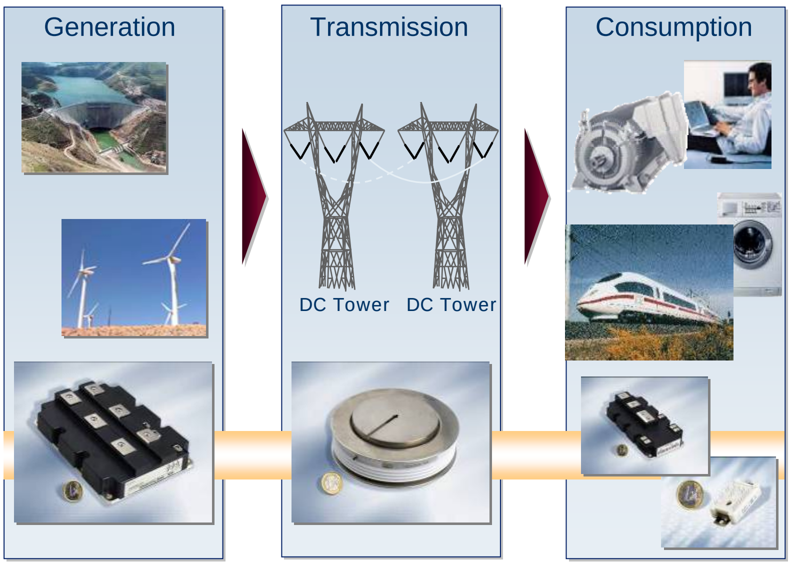
Consumer and Industrial Power Marketing
Infineon Technologies Hong Kong Limited

Never stop thinking

Infineon supplies products for efficient energy management along the entire power supply chain



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Technologies and Products for Industrial Power Applications

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Major applications of Infineon Industrial Power Semiconductor

Application	Chip-Technology	Packaging-Technology
Industrial Motor Drives 	▪ EmCon™ diode ▪ TrenchStop™ IGBT ▪ Bipolar	▪ EasyPIM™ ▪ EconoPACK™ ▪ IHM modules ▪ Thyristor & Diode modules ▪ Stacks
Traction/ Transportation 	▪ HV IGBT (1.7kV…6.5kV) ▪ High current diodes ▪ TrenchStop™ IGBT	▪ IHM / IHV modules ▪ Press Pack Discs
Power Supplies UPS, SMPS 	▪ Fast IGBT ▪ CoolMOS™ ▪ SiC Schottky Diodes	▪ EasyPACK ▪ Pressure contact modules ▪ 34mm modules ▪ 62mm modules
Renewable Energies Wind & Solar Power 	▪ EmCon™ diode ▪ TrenchStop™ IGBT ▪ High Power BIP	▪ EconoPACK™+ ▪ IHM modules ▪ BIP modules ▪ Stacks
Welding / Induction Heating 	▪ EmCon™ diode ▪ Fast IGBT ▪ High Power BIP	▪ Press Pack Discs ▪ PowerBLOCK ▪ EconoBRIDGE™ ▪ 62mm/ 34mm modules

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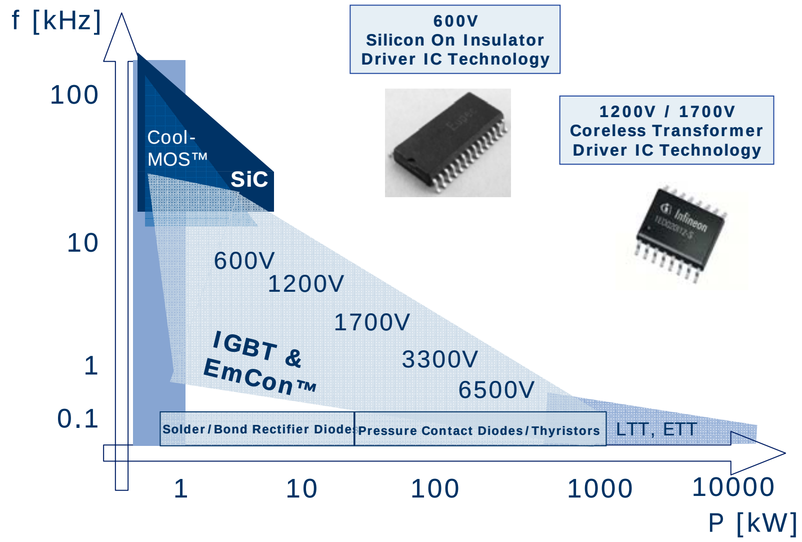
Chip Technologies for Industrial Power Applications



600V Silicon On Insulator Driver IC Technology

1200V / 1700V Coreless Transformer Driver IC Technology

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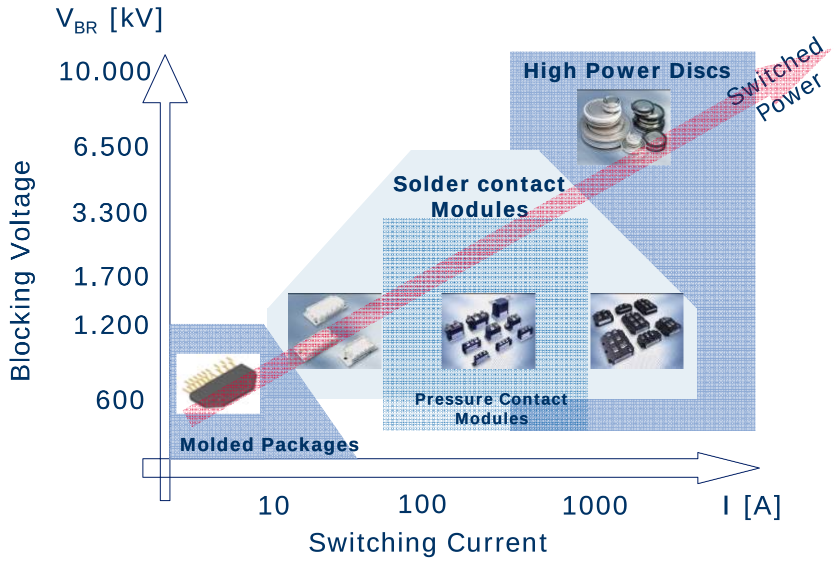
Packaging Technologies for Industrial Power Applications



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Market for High Power Semiconductors (>1kW)

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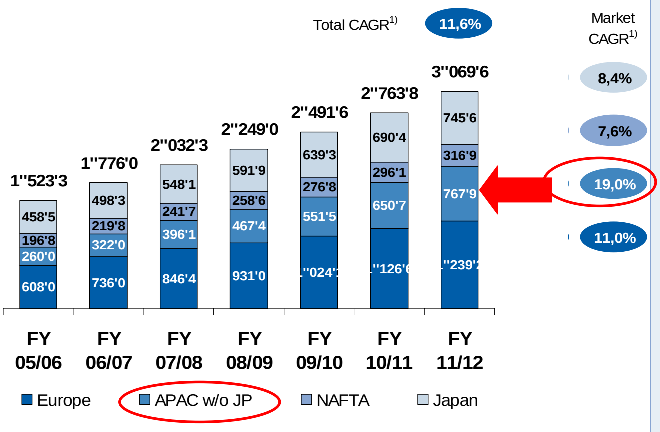
Double digit market growth driven by energy efficiency and CO_2 reduction

Market development by region, FY 05/06 – FY 11/12 [M. EUR]



Europe
- Strong growth pushed by renewable energy and drives
- **Emerging high power market in Russia**

APAC
- US & EU manufacturers shifting production to APAC
- Infrastructure is developing
- Chinas 5 Year Plan for Energy pushes power semiconductor biz

NAFTA
- Low cost, low performance drives are going offshore to Asia
- Growth driven by large drives
- Growing renewable energy market

Japan
- Arising willingness to use overseas suppliers
- Good access to APAC market

1) CAGR FY 06/07 – FY 11/12

Datasource: IMS research, WSTS, iSupply

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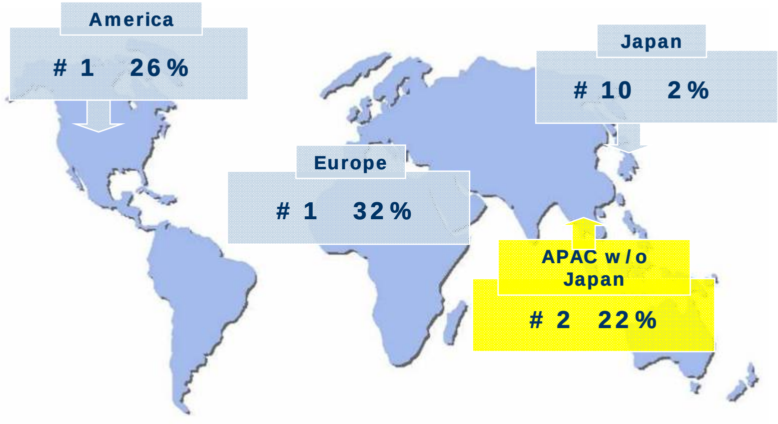
Infineon position in power semiconductor market (>1kW)

Worldwide

 # 2 21%



America

 # 1 26%

Japan

 # 10 2%

Europe

 # 1 32%

APAC w/o Japan

 # 2 22%

Source: IMS Research, September 2006

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- Market and product for traction segment in China

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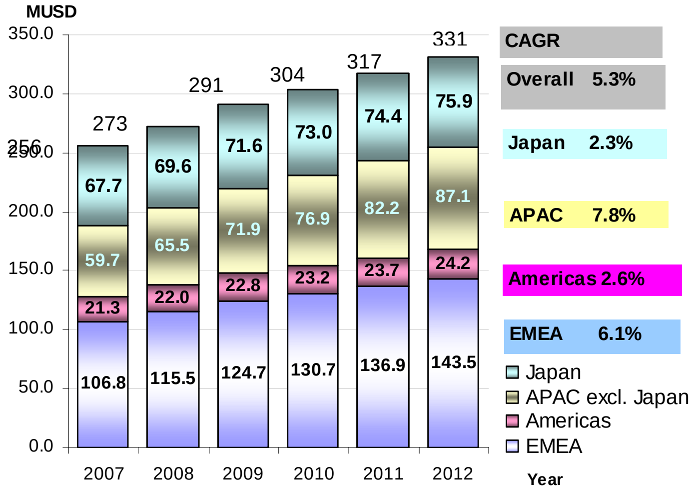
Asia have the fastest growth in traction market

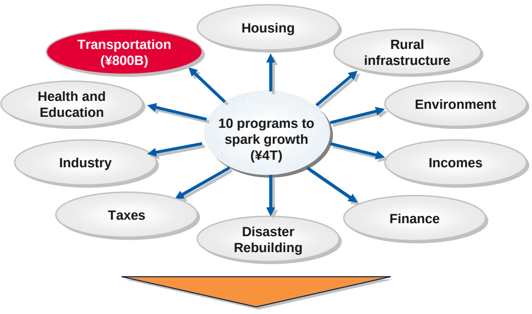
Worldwide market for power semiconductor in Traction (in MUSD)



CAGR	
Overall	5.3%
Japan	2.3%
APAC	7.8%
Americas	2.6%
EMEA	6.1%

Source: IMS research 2008

Government stimulus program to boost domestic demand



Highway and Road construction

Airport construction and expansion

Railway Construction

Investment in Railway Construction and Locomotive Purchasing

- 2 trillion RMB will be invested for railway construction, with 600 billion invested in 2009
  - ☐ 800 billion RMB from stimulus program, plus
  - ☐ 1.2 trillion RMB previously allocated budget
- 500 billion RMB is planned for purchasing locomotives and rolling stock in next 4 years with 300 billions budgeted for 2009 & 2010

China railway network backbone development plan

Source: China Railway Construction Corp

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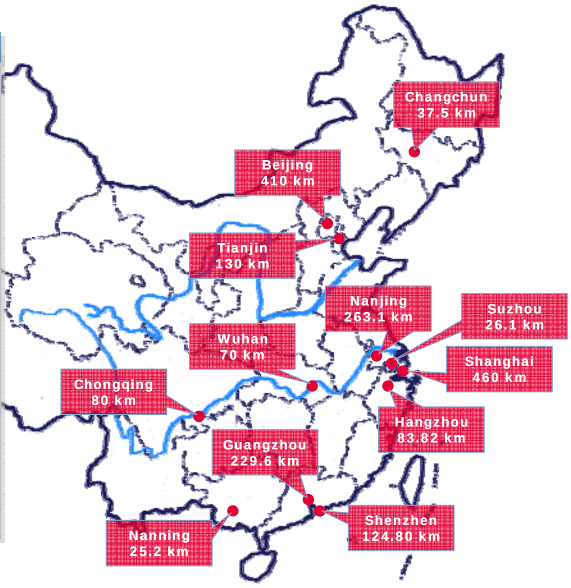
Urban mass transit railway planning by 2010

Comment

- In next 5 years, **25 cities** in China will have their Urban Mass Transit.
- **Tier 1 cities**, e.g. Beijing, Shanghais and Guangzhou, **still account for majority of the planning.**
- **Tier 2 cities**, e.g. Wuhan, Changchun and Suzhou, are also starting to undertake subway project.
- **Some tier 3 cities**, e.g. Hefei, Qingdao and Xiamen, are planning to start the subway project, **with a total mileage of 1000 km.**



Source: News issued by local government.

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Infineon position in traction market

Infineon global market share in power semiconductor for traction market

Standard IGBT Modules	: 31.6%
Standard IGBT & IPM	: 22.0%
IGBT Modules & Bipolar Modules	: 23.7%

Source: IMS research 2007, Infineon internal estimation

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Infineon traction customers worldwide

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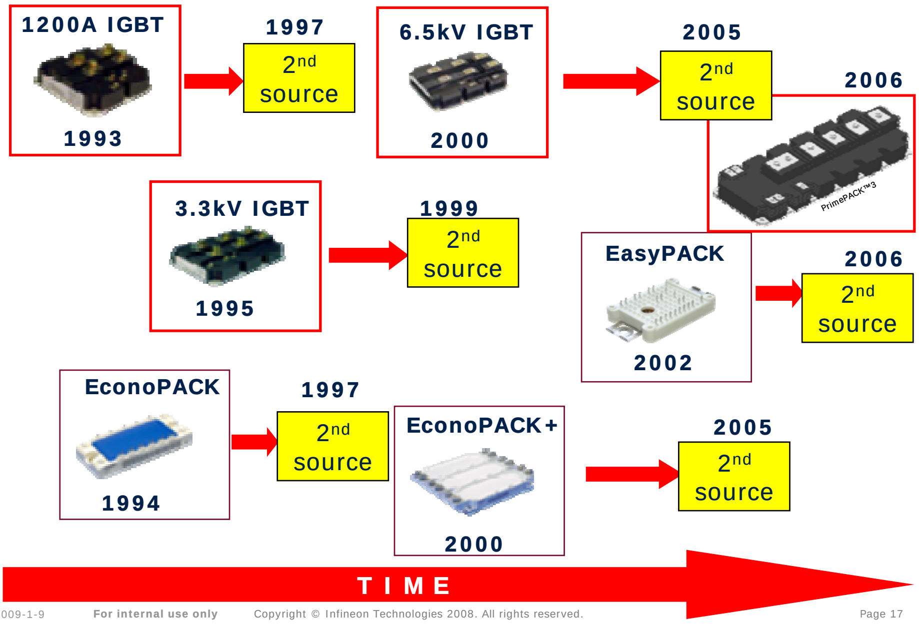
Infineon technology leadership in IGBT for traction - followers come 3 - 5 years later



1200A IGBT
1993

1997
2nd source

6.5kV IGBT
2000

2005
2nd source

2006

3.3kV IGBT
1995

1999
2nd source

EasyPACK
2002

2006
2nd source

EconoPACK
1994

1997
2nd source

EconoPACK+
2000

2005
2nd source

TIME

Traction application as the most demanding application in power electronics

- Highest requirements on reliability and lifetime
- Highest power : to 10MW
- Highest voltage : to 6.5kV per IGBT
- High current : to 600A per IGBT
- Most extreme storage and operation temperature: down to -55ºC
- Power and thermal cycling due to frequent start-stop operation
- Shock and vibration

Product Portfolio – IHV module

3.3 kV	Chip type
	KF2C
	KL2C*
New	HL3
New	HE3

6.5 kV	Chip type
	KF1*
	KF2
New	KE3

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Key applications of IHV module

- Traction
- High power industrial drives
- Pulsed power
- Transportation

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Key benefit of IHV module for traction application

IHV B-Series
for 1200V, 1700V and 3300V

- +150°C operating temperature
- -55°C storage temperature for 3.3kV IHV B-Series
- Increased power cycling capability
- Higher mechanically robustness
- Lower thermal resistance due to optimized thermal heat spreading
- RoHS compliant
- 100% mechanical compatible to IHV A-Series
- High power density for compact inverter designs

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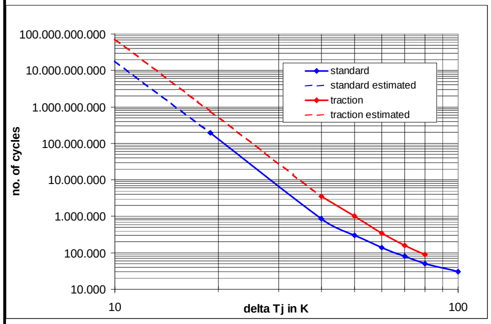
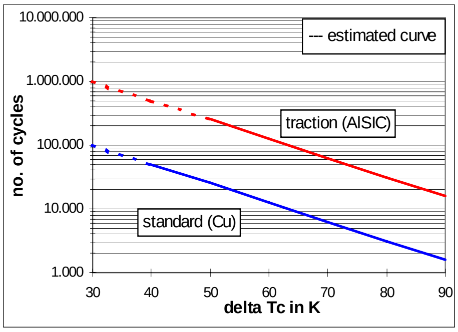
Power and thermal cycling capability comparsion of standard (Cu) and traction (AlSiC) modules



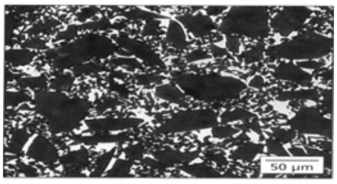
Power cycling capability of standard and traction modules at 125° C



Thermal cycling capability of standard and traction modules

AlSiC Base Plate:

70% SiC + 30% Al



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We commit.

We innovate.

We partner.

We create value.

infineon

Never stop thinking