



Fairchild Semiconductor

Justin Chiang

Executive Vice President & General Manager,
Power Conversion, Industrial and Automotive (PCIA)

Analyst Day

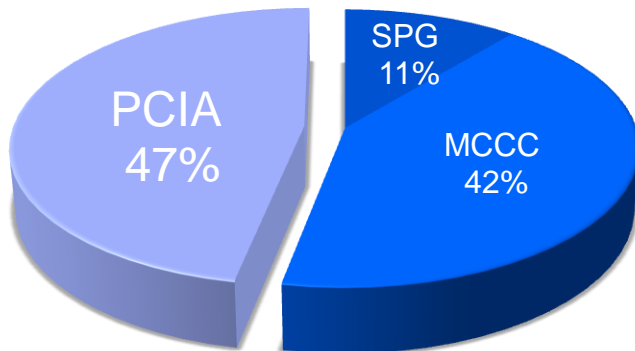
September 16, 2010

www.fairchildsemi.com

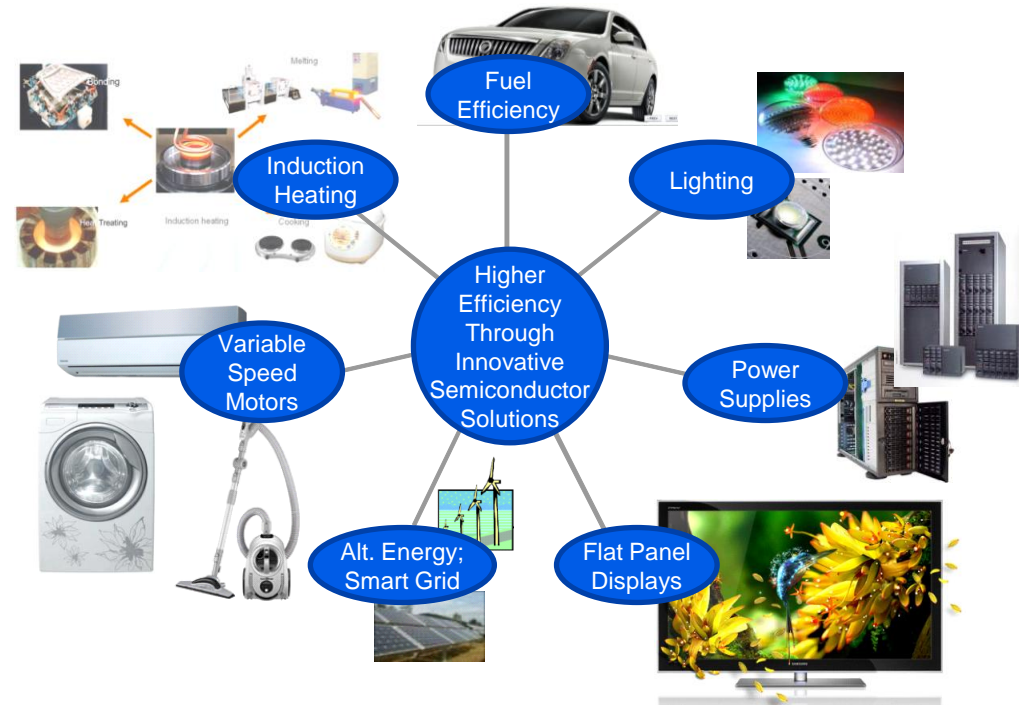
the
power
franchise™



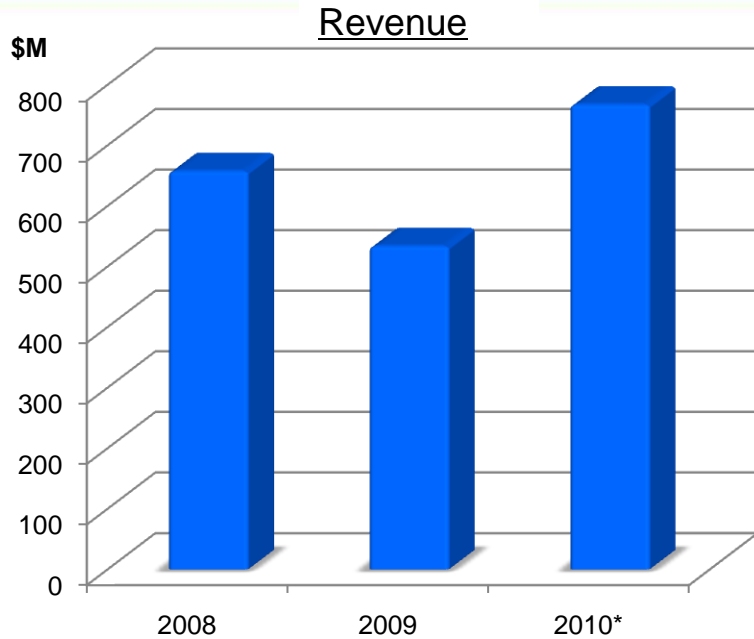
2010 - Sales



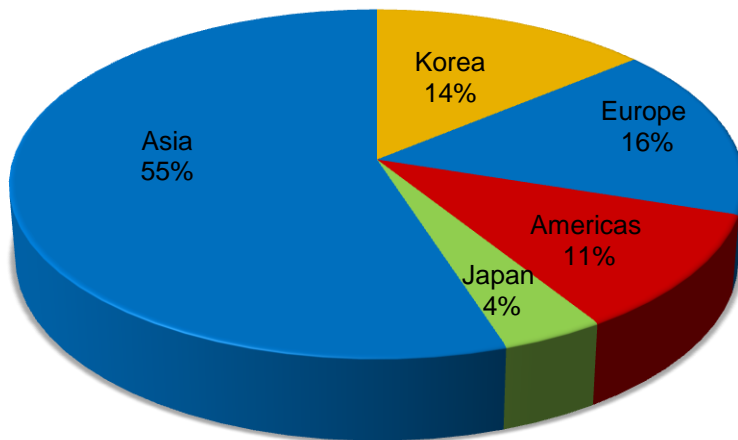
What Drives Our Business?



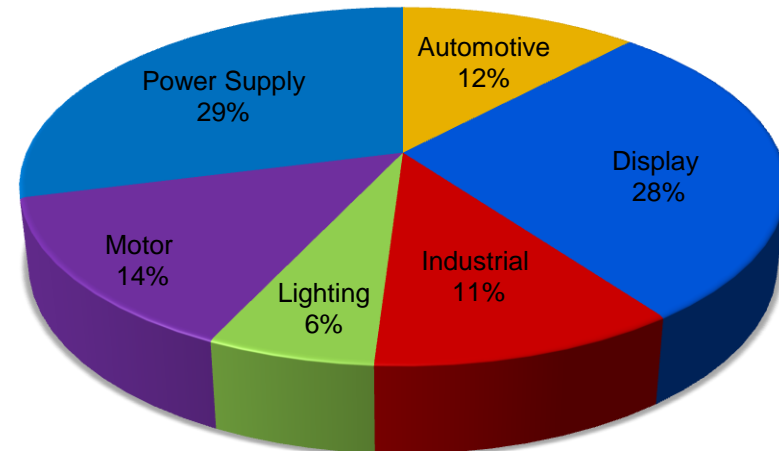
- Focus on improving the efficiency of customer s' applications
- Provide value through innovative Power Solutions
- Leverage our expertise in Discrete Technology, IC technology and Packaging Technology



- **2010 will exceed 2008 levels**
 - **Currently forecasting 17% growth from '08-'10**
- **All segments and regions showing growth**



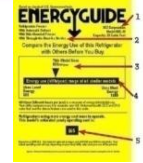
By Region



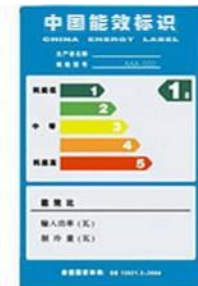
By Segment



- Eco-friendly policies are moving the market WW
 - Energy Labeling, Energy Efficiency
 - Adoption of inverters in motor control applications
 - Change from traditional lighting to LED, CFL
 - Regional Examples:
 - EU: EPBD (Energy Performance of Building Directive) : All new buildings should consume zero energy from 2019
 - EU: New Energy Labeling system
 - For Eco-Design: <B grade prohibited for sale after July 2010
 - Only A-20% & A-40% products can be sold after July, 2013/14
 - US: Energy Star strengthening (eg, SEER12 → SEER16 for A/C)
 - China: New Energy Labeling System from June, 2010
 - Japan: ‘Top Runner’ program with APF since 2006
- Clean energy and IT advances create whole new markets
 - Renewable energy; PV Inverter
 - Smart Grid; E-Vehicle Charger and Smart Metering



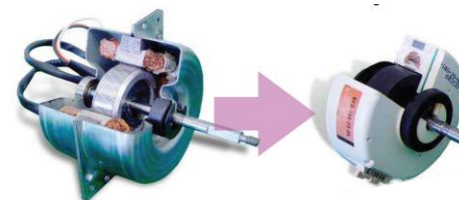
Energy		Washing machine
Manufacturer Model		
More efficient		
A		
B		B
C		
D		
E		
F		
G		
Less efficient		
Energy consumption kWh/cycle <small>(Based on standard test results for 80°C cotton cycle) Actual energy consumption will depend on how the appliance is used</small>		1.75
Washing performance <small>A higher G score</small>	A	BCDEFG
Spin drying performance <small>A higher G score</small>	A	BCDEFG
Capacity (cotton) kg		5.0
Water consumption		5.5
Noise (dB(A) re 1 pW)		5.2
		7.8
<small>Further information contained in product brochure</small>		





- Brushless DC (BLDC) motors
 - Improved performance and efficiency
 - Lowers total cost of ownership
 - Reduced size = raw material savings
- Fairchild is well positioned to help our customers capitalize on the move from Mechanical control to Electronic solutions (inverters)
 - Our Smart Power Modules facilitate this transition easing the design requirements
 - Our IC's can simplify the control of these motors

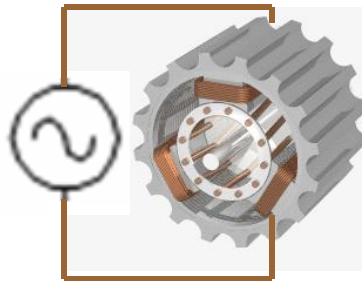
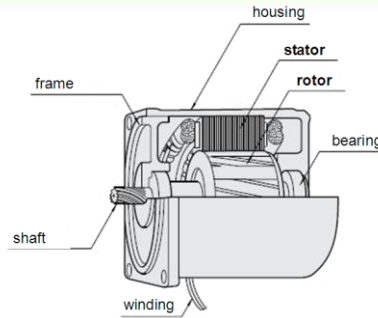
	AC	BLDC
Size/Weight	100%	70% of AC @1HP 55% of AC @2HP
Raw material cost	AC >= BLDC driven by size/weight	
Efficiency	40~45%	70~75%
Speed control	Difficult	Easy & Linear
Accuracy of Speed	3~5%	0.5%
Torque control	Poor	Controllable





AC Induction motor

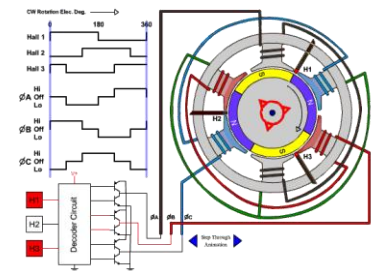
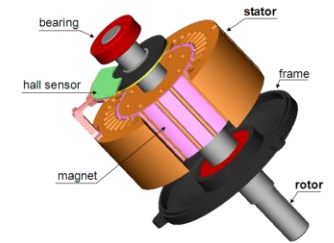
- The induction motor is also known as a *rotating transformer*.
- Power is supplied to the **rotor** by electromagnetic induction.
 - This method of transferring power to the rotor lowers the efficiency.
- The motor turns because of the magnetic force exerted between a stationary electromagnet (stator) and the rotating electromagnet (rotor).
 - The phase difference requires greater current and current losses to achieve power.
- The stator is also powered by AC, the low frequency (50/60 Hz) requires a bigger magnetic-core and more windings to couple the current from stator to rotor.



**VAC: 110V/220V;
50/60 Hz**

BLDC motor

- A Brushless DC motor has permanent magnets on the rotor which eliminates the problems of inducing current to the moving armature.
- An IC controller keeps the stator current in phase with the permanent magnets of the rotor
 - This requires less current to turn the motor with the same out force
 - Resulting in greater efficiency and smaller size.



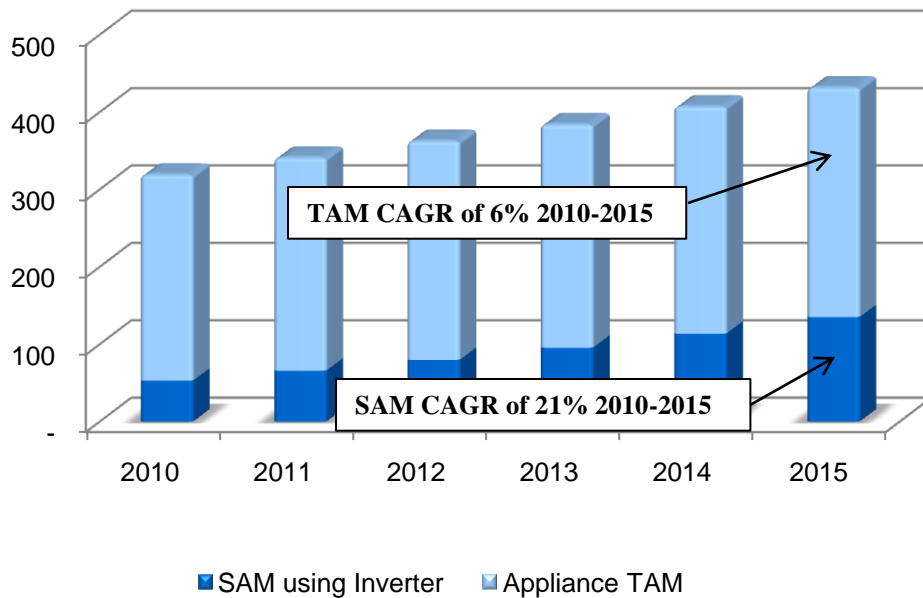
Power loss	Induction Motor	BLDC Motor
Capacitor loss (phase shift)	X	
Controller loss		X
Stator copper loss	X	X
Stator iron loss	X	X
Rotor copper loss	X	
Rotor iron loss	X	
Mechanical loss	X	X
Harmonic voltage & current loss	High	Low

The speed and efficiency of AC induction motor is restricted by its power source (the line voltage and frequency). The power source of BLDC motor is controlled by semiconductor devices, which can achieve high efficiency at various speed and output load.

“Inverterization” Drives SAM Expansion in Appliances



M Units



- Washing machines, refrigerators, air conditioners all require inverter driven motors to meet energy savings regulations
- Content: \$2 - \$20/system
- Our SPM solutions:
 - Reduce total system cost
 - Reduce development time
 - Optimize performance
 - Provide higher reliability
 - Reduce board space
- In 2009, SPM revenue remained flat to 2008
- Expect SPM revenue to more than double from 2010 to 2012

TAM growth of end markets is modest, but Inverter % grows rapidly

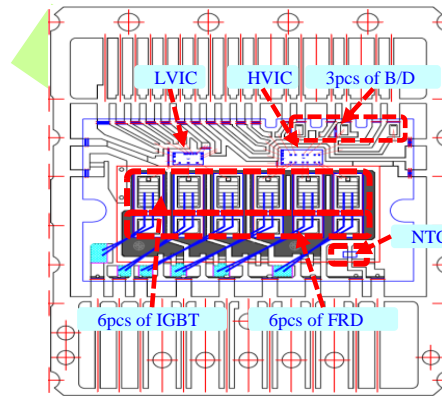
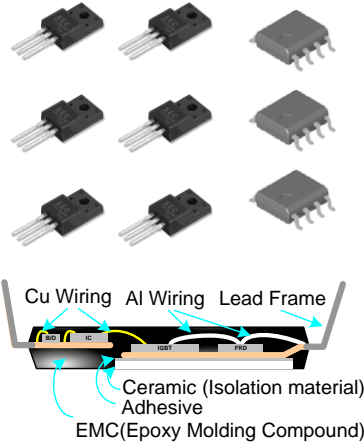
Source; IMS, iSuppli, Fuji Chimera, Darnell, WSTS etc



Expertise to integrate analog, discrete and high voltage technology together

Integration of discrete components

IGBTs/FRFETs HVICs LVIC **Peripherals**
 -Bootstrap diodes
 -NTC thermistor



Enhances Protection

SPM's built-in HVIC and LVIC with protection circuit

Optimizes Design

SPM optimizes driving characteristics for built-in power devices

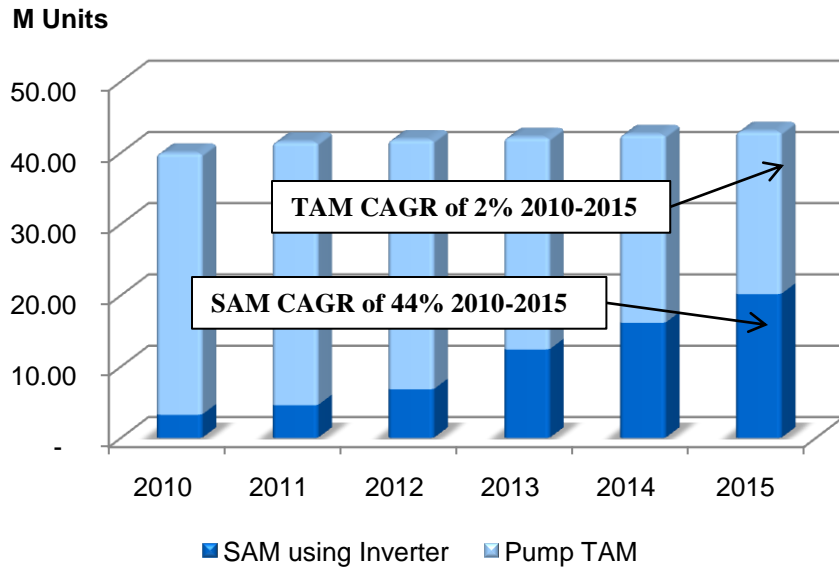
SPM integration, enhances productivity while simplifying manufacturing

Facilitates Manufacturing

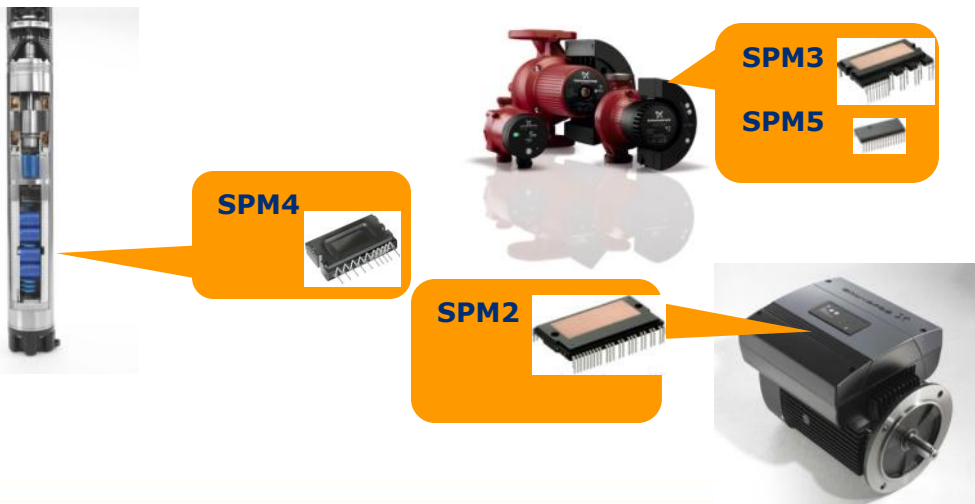


Summary

- Reduced total system cost
- Reduced development time
- Easy management
- Optimized control flexibility
- Higher reliability
- Board space savings

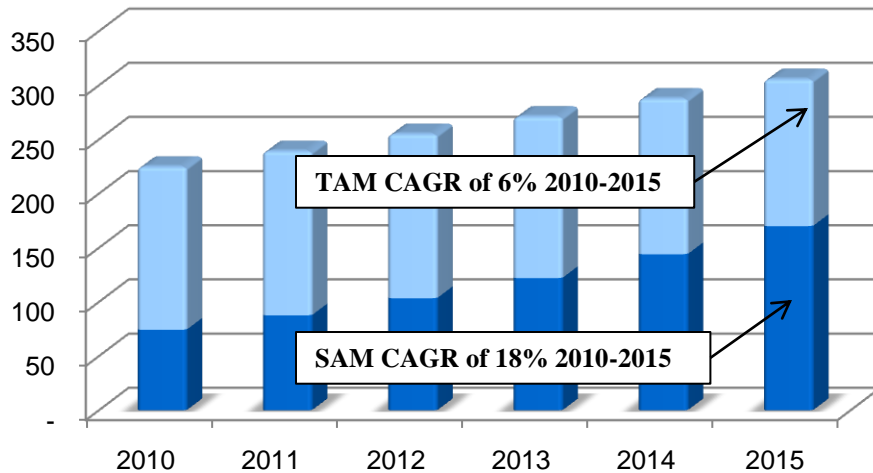


- Small overall pump growth but regulations in EU will push adoption of BLDC inverter
- Working with many of the world's leading customers
- Broad portfolio of SPM products to address many needs
 - SPM5 → Circulation pump
 - SPM4 → 2 ϕ General pump
 - 1200V SPM2 → 3 ϕ General pump
- Content \$
 - Circulation pump : \$2.5 ~ \$5.0
 - 2 ϕ General pump : \$18 ~ \$36
 - 3 ϕ General pump : \$27 ~ \$50





M Units



■ SAM using Inverter ■ Fan TAM



- In fans, like appliances, BLDC motor usage is rapidly outpacing traditional AC motors
- We provide both the IC control and power train
- Our SPM solutions outperform IGBT based one-chip solutions
 - MOSFET has superior efficiency in major fan motor area
 - MOSFET has superior ruggedness (10 times longer short circuit time)
- Our IC solutions provide customers with a simple way to implement control
- BOM\$ (40W ~ 70W fan motor)
 - Module(SPM5) \$1.6 ~ \$3.0
 - Motor control IC \$0.7 ~ \$ 1.4

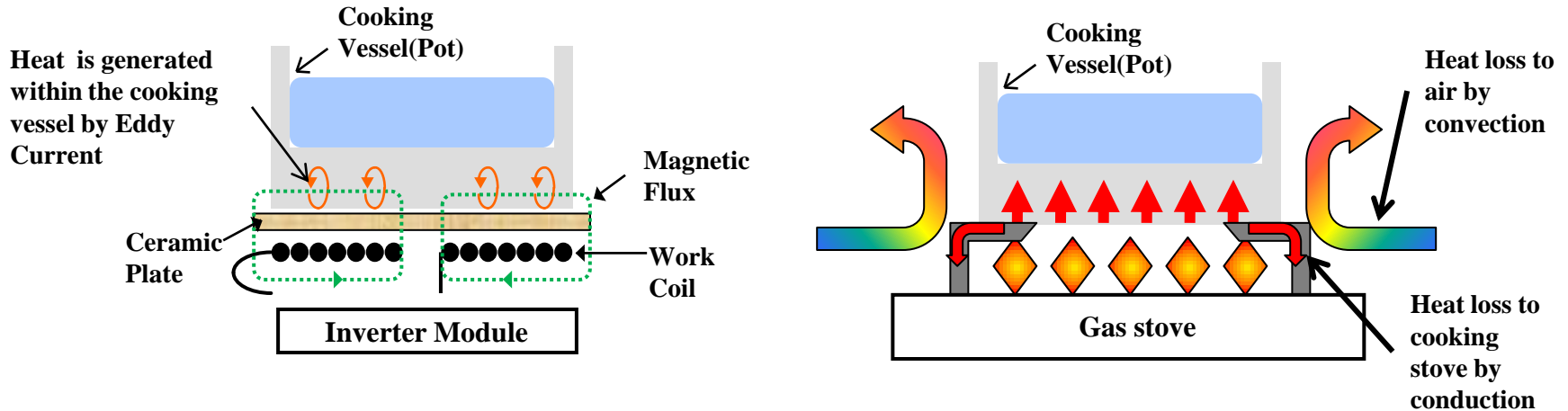


- The global penetration rate of inverter based Microwave Ovens (MWO) was estimated to be just over 10% in 2005
 - Adoption of inverter technology for MWO will improve the efficiency and the performance of MWO
 - The share of inverter based MWO is projected to grow to 40 ~ 50%
- Chinese manufactures start to design Induction Heated (IH) rice cookers as the demand of multifunction capabilities increase
- Energy Efficiency labeling program in Asia will also drive the market growth of IH rice cooker and inverter based MWO





✓ **Electromagnetic Induction + Skin Effect + Heat generation in cooking vessel**

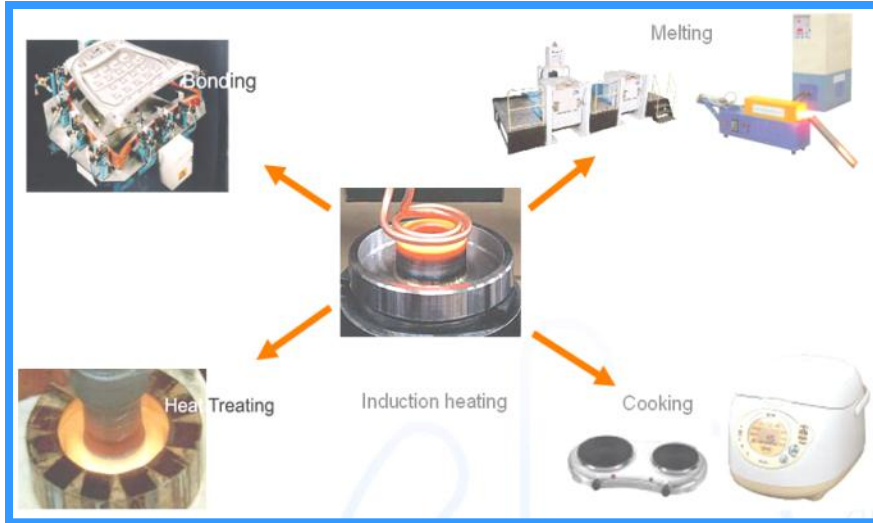


✓ **Conventional Heating Methods**

Cooking vessel is heated through thermal conduction or radiation from heat source including combustion of gas, hotplate with heating coil and thermal radiation from Halogen. So there is some amount of thermal energy loss due to conduction or convection during thermal energy transfer from heating source.

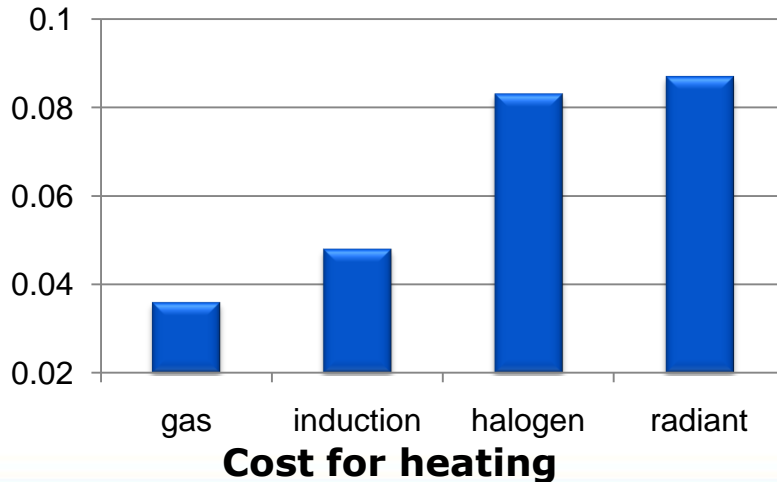
✓ **Induction Heating Methods**

Only electromagnetic energy is transferred to cooking vessel from Induction cooker, so there is no thermal energy transfer resulting in no thermal energy loss during the process. All the transferred electromagnetic energy is used to heat the cooking vessel itself.

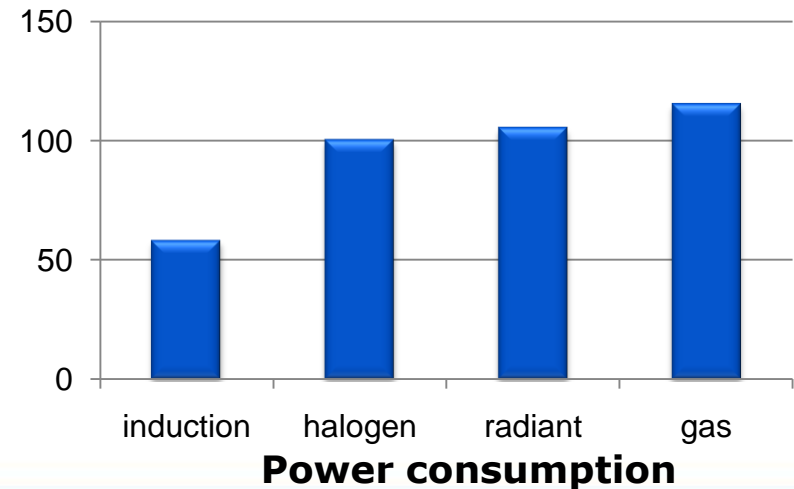


Cooking Method	Efficiency	
Induction	90%	
Halogen	58%	
Electric	47%	
Gas	40%	

Cost of heating ½ litre of water from 20° C to 95° C

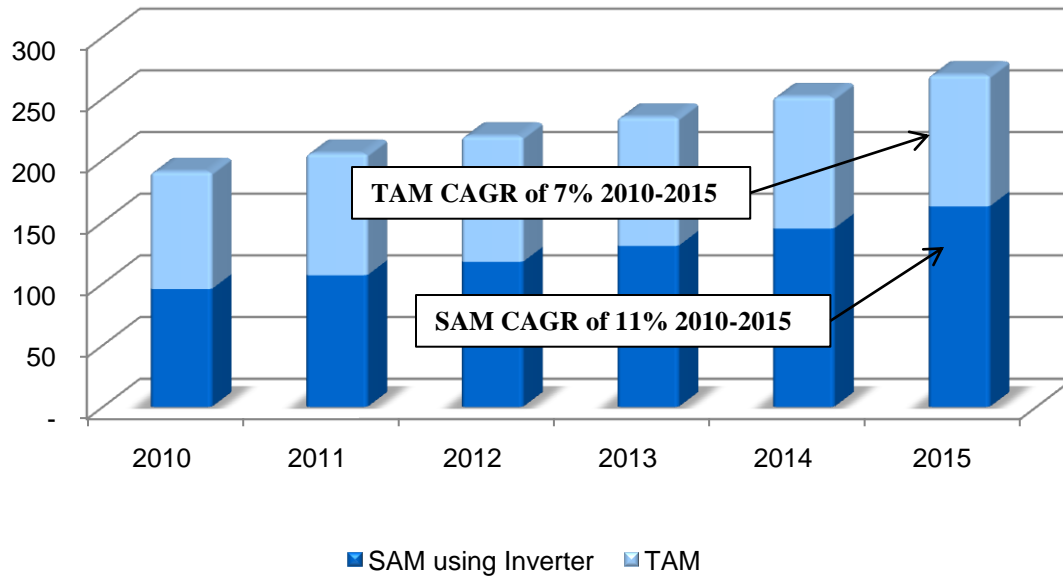


Power Consumption for heating ½ litre of water from 20° C to 95° C

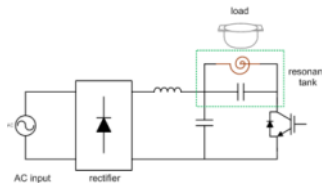
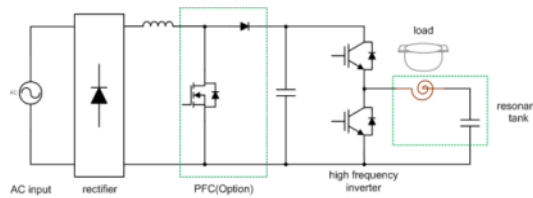




M Units



- Energy Savings and increased functionality driving adoption of inverters in cooking applications
 - Particularly strong in Asia and EU
- FCS provide a broad family of IGBT's and Drivers for these applications
- Content:
 - IH cooktop:
 - 8 x 600V IGBT or 4 x 1200V IGBT
 - \$3.70 ~ \$7.60/system
 - IH tabletop:
 - 1200V IGBT,
 - \$0.60 ~ \$0.95/system
 - MWO :
 - 2 x 600V IGBT or 1-2 1000V IGBT,
 - \$0.85~ \$1.6/system
 - Rice Cooker :
 - 1000V IGBT or 1200V IGBT,
 - \$0.85 ~ \$1.90/system
- Key Customers Include: BSH Balay, Fagor, Midea, Fushibao, Panasonic, Hitachi, Cuckoo

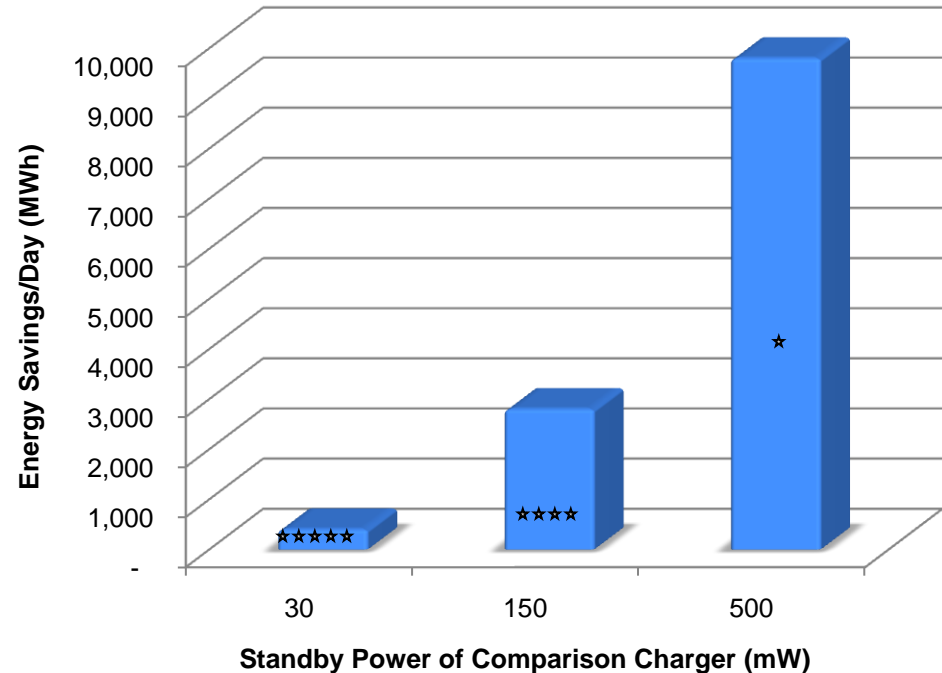




Why is this important?

- Current specs for cell phone chargers require <500mW under standby conditions
- Most chargers have standby power in the range of 30-150mW
- FCS has launched a <10mW solution
- Typical chargers are in standby >20 hours every day
- More than 1B chargers are sold annually

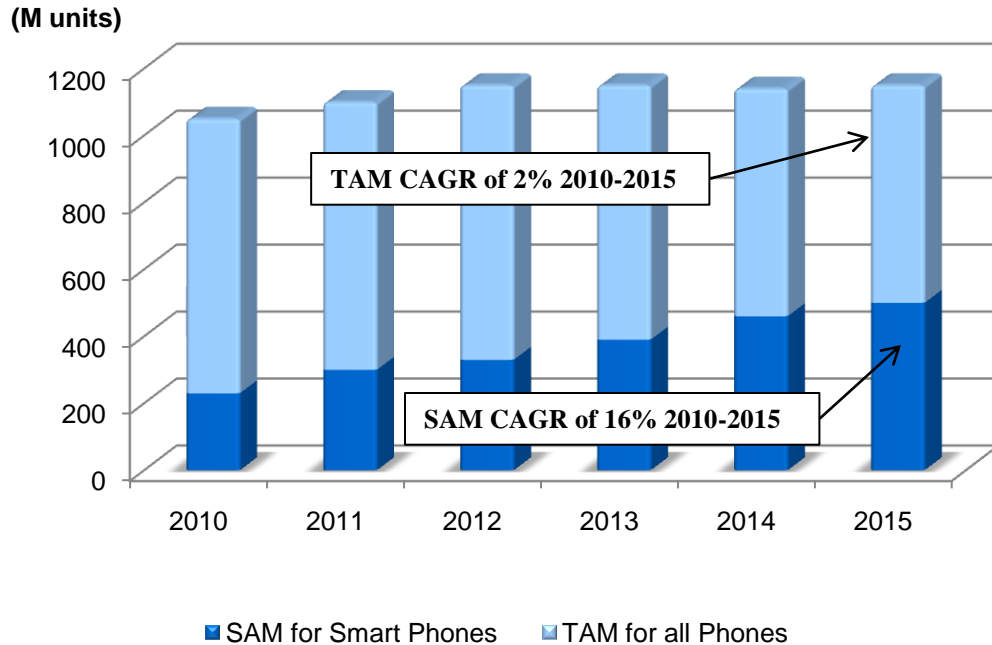
Potential Energy Savings with conversion to FCS IC



Energy Rating System :

No-load consumption score chart	
Five stars = most energy efficient	
★★★★★	≤ 0.03W
★★★★	> 0.03W to 0.15W
★★★	> 0.15W to 0.25W
★★	> 0.25W to 0.35W
★	> 0.35W to 0.5W
No stars	> 0.5W

Most chargers are rated 4-stars now



- Smart Phones require increased power to drive additional performance
 - 5W+ needed from charger
- FCS controllers provide a unique feature set:
 - Best-in-class standby power
 - Accurate current and voltage regulation
 - Reduced component count
- Content up to \$0.40 per charger





Std by of LCD TV/ LED TV

LCD/LED Monitor



NB



Green Mode PWM - Best
standby power performance
<100mW@25mW

PowerSwitch which meets PC
2013 EuP <0.5W@0.25W w/o
external circuitry

Green Mode PWM – best
combination of peak power
and standby <30mW@ no load

Std by of PC



Green Mode
PWM – only design
for NPB adapter w/
<30mW@ no load



Printer

Broad Portfolio of patents filed to secure our power
saving leading position



Strong Market Acceptance of our <75W solutions driven by our low load power and our high efficiency



Adoption drivers:

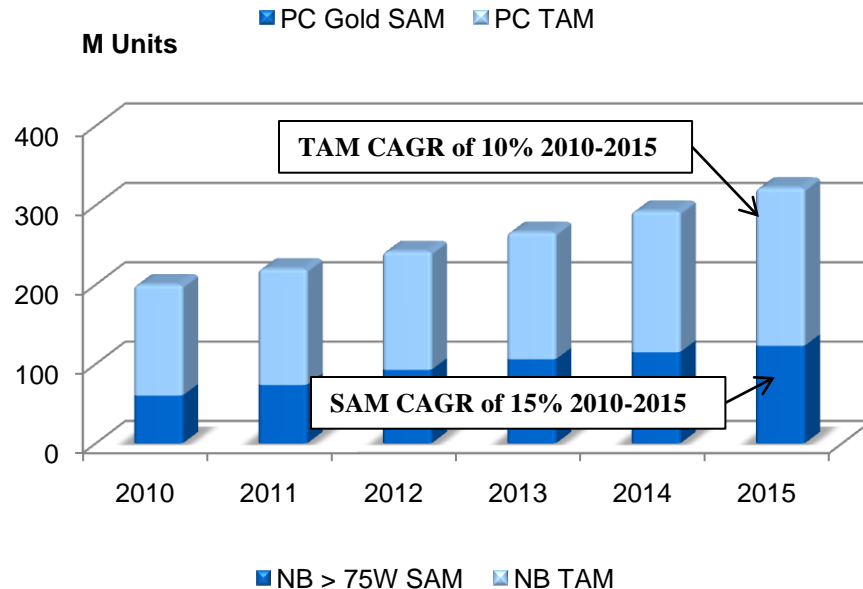
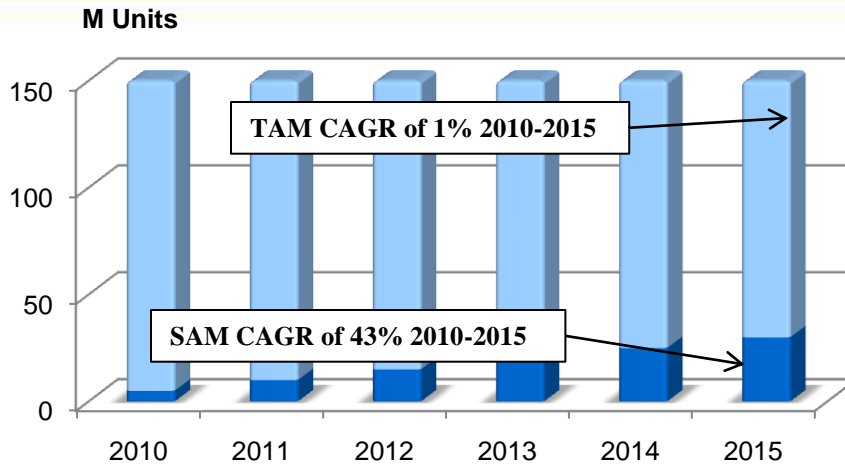
- Power Saving
- Peak power management (printer)
- Rich functionality
- Service support

Key Design in :

- NB: Acer, Dell, HP, Lenovo, Asus
- LCD Monitor: AOC, Innolux, LG
- Printer: HP, Samsung
- Game: Wii



Content ranges from \$0.16 - \$1.1



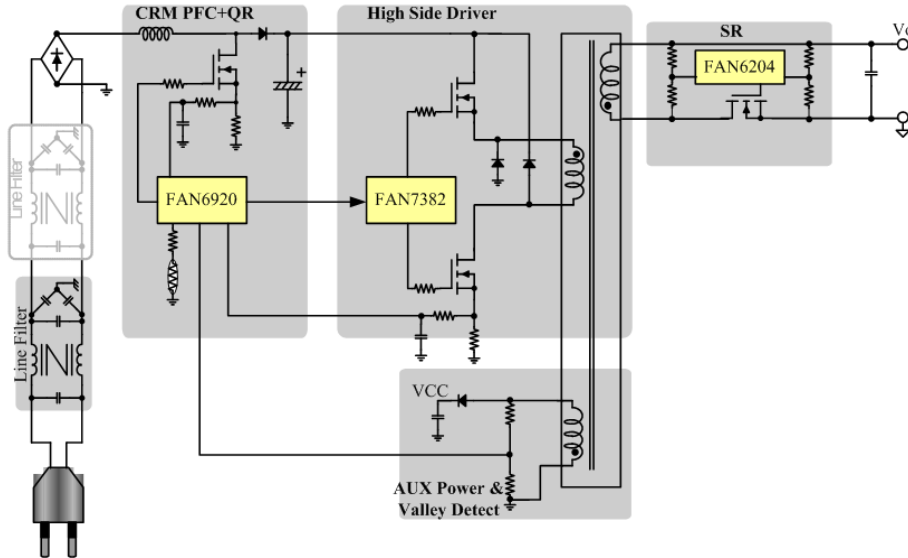
- Computing market continues to drive towards higher efficiency at full load while minimizing power at low loads
- FCS controllers provide a unique feature set:
 - Leading Patented Power Saving Technology
 - Higher efficiency
 - Reduced component count
 - Easy to design
- Content:
 - \$1.50-\$2.00 per PC
 - \$0.65-\$1.20 per NB adapter



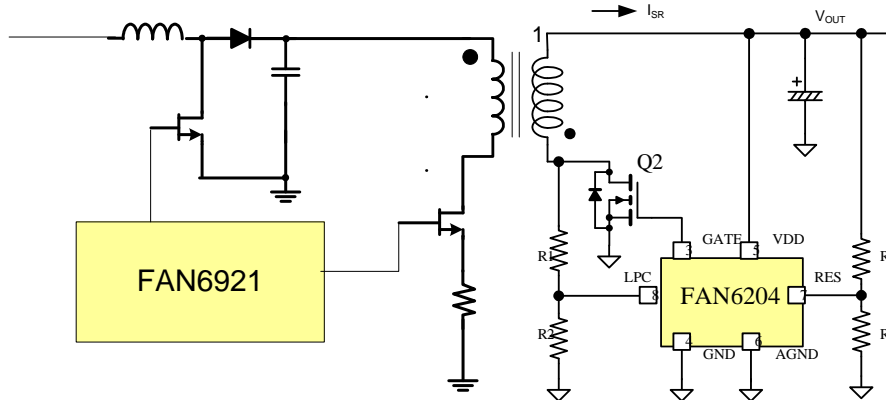
PFC + QR combo

High Side Driver

Syn. Rectifier Controller



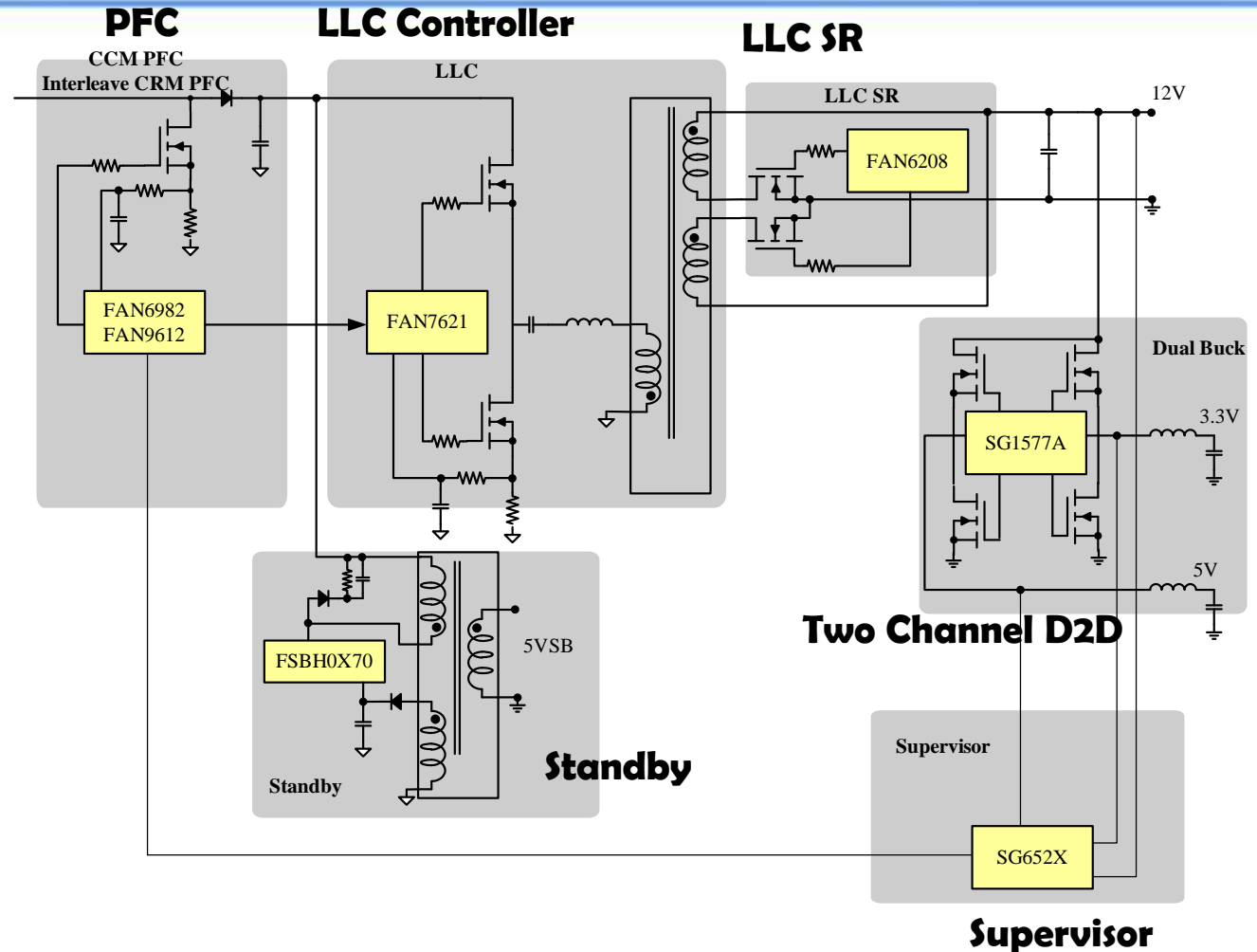
- Content: \$0.9~\$1.2
- Next gen of NB adaptor solutions to meet **92%+** efficiency
- High integration provides cost effective design
- Wider power range 75W~250W
- Allows for very slim design



PFC + QR combo

Syn. Rectifier Controller

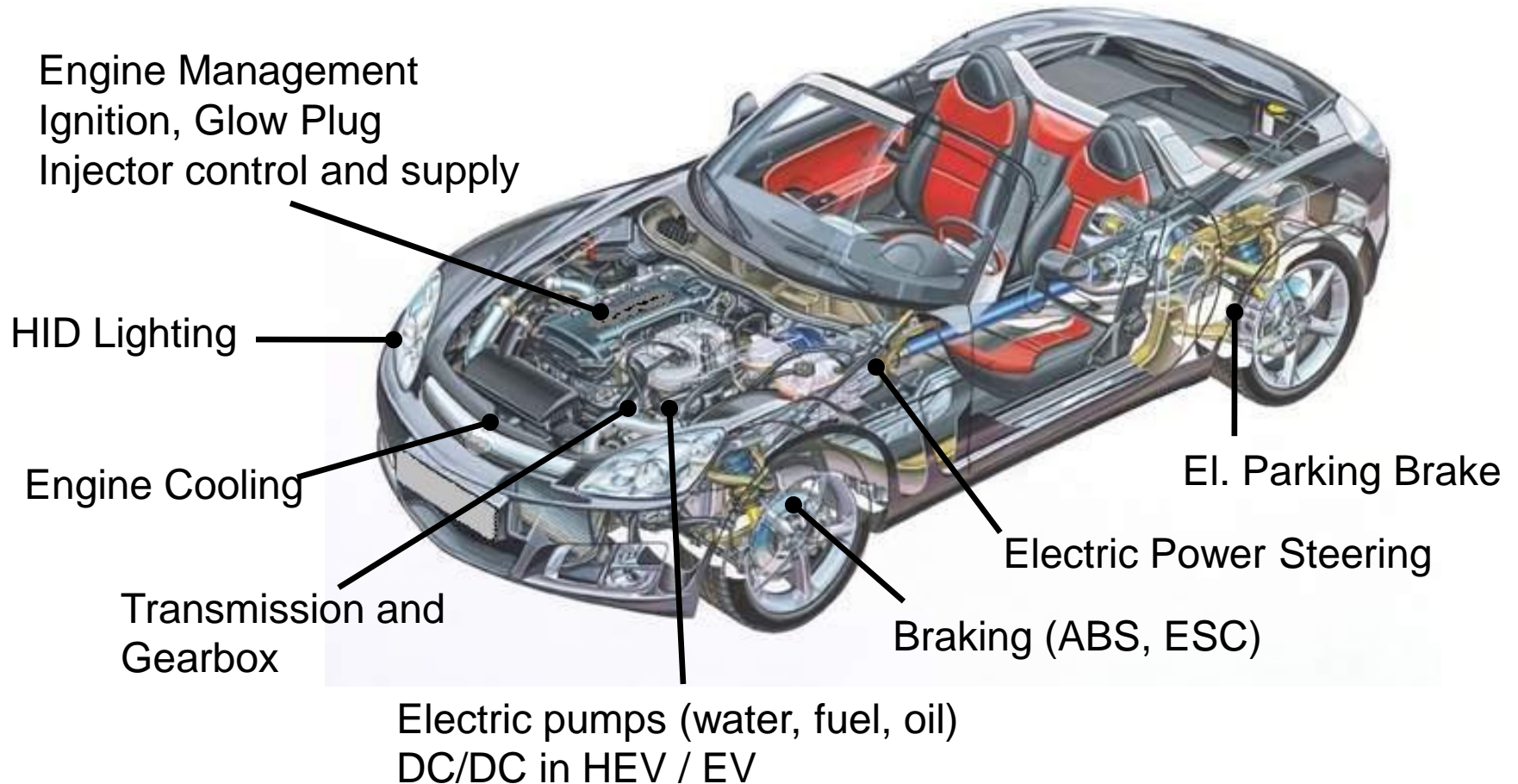
- Content: \$0.65~\$0.8
- Current mainstream solution for NB adaptors
- Meets 90%+ efficiency, high integration , 75W~150W



- Content: \$1.5~ \$2.0
- Multiple sockets necessary to meet High efficiency necessary for 80+ gold
- Low standby power to meet 2013 EuP lot 6 regulation: <math><0.5W@0.2W</math>



Robust Auto Solutions for energy efficient applications



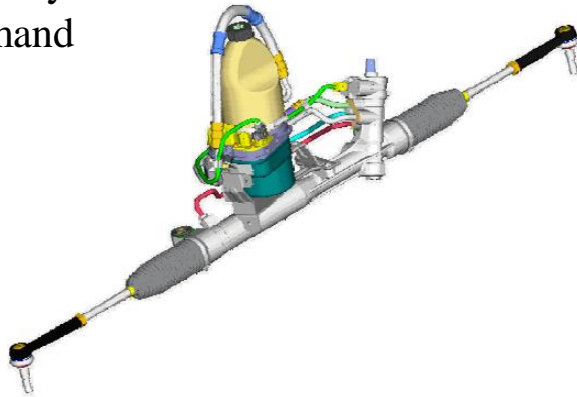


(HPS) Purely hydraulic power steering

Pump mechanically attached to the engine.
 Pump power output proportional to RPM
 Pump must satisfy assistance at min RPM, thus at high RPM energy is wasted.

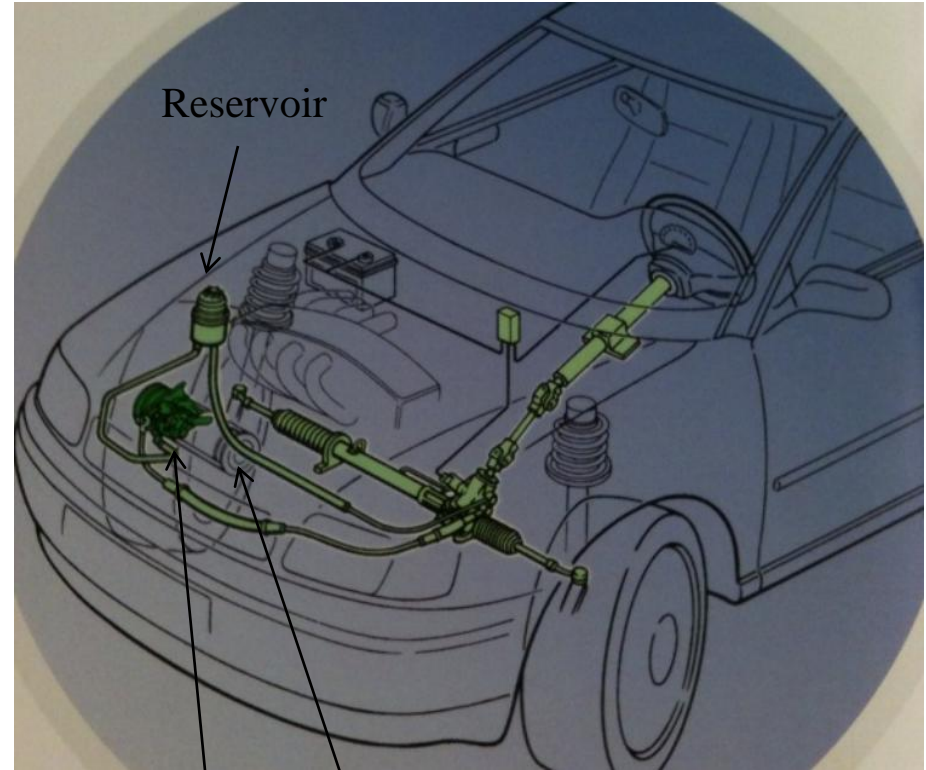
EHPS

Pump mounted locally
 Pump powered by an electrical motor only upon demand



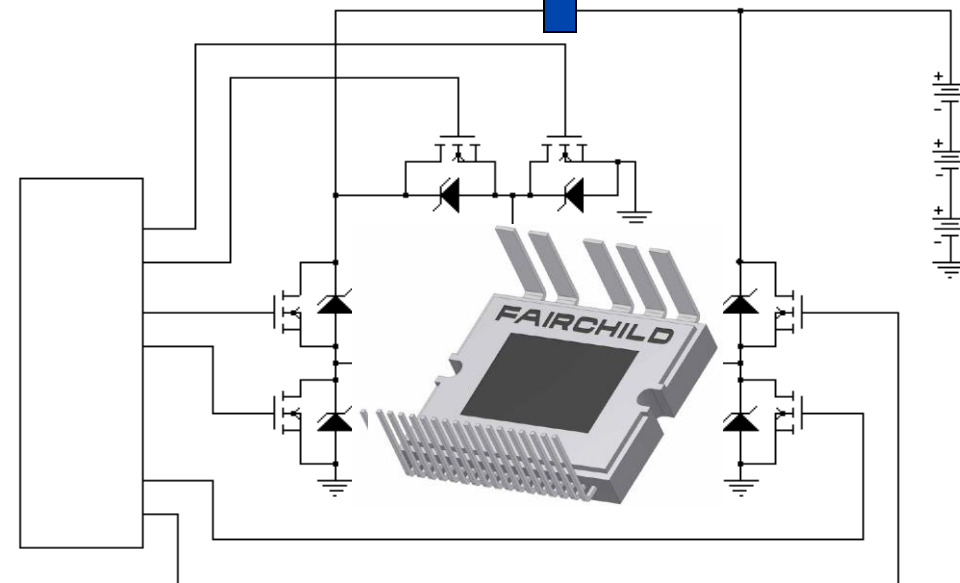
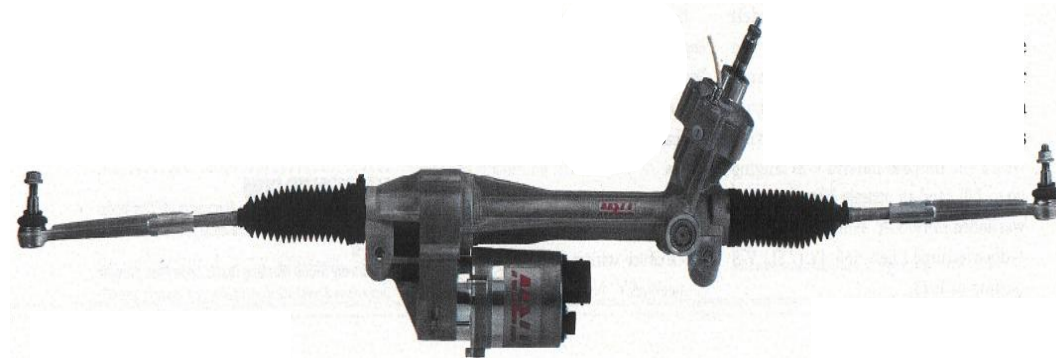
EPS

No Pump, no hydraulic fluid.
 An electrical motor provides assistance upon demand



Pulleys and belt from engine crankshaft power the pump
 Pump for HPS has to be beside the engine, thus requiring long hoses.

Application: Automotive Power Modules for Electric Power Steering



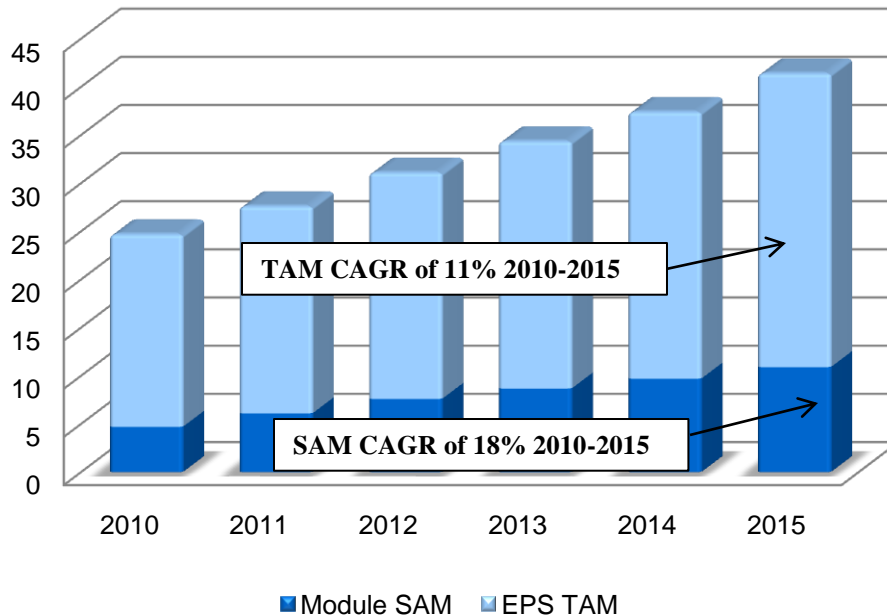
- EPS/EHPS:
 - Saves fuel (up to 7%)
 - Improves performance
 - Simplifies mechanical design

Increasingly adopted in new vehicles - conventional as well as EV/Hybrid
- APM Modules help to:
 - Optimize power output
 - Improve reliability
 - Ease design through integration of components
 - Ease installation due to compact design



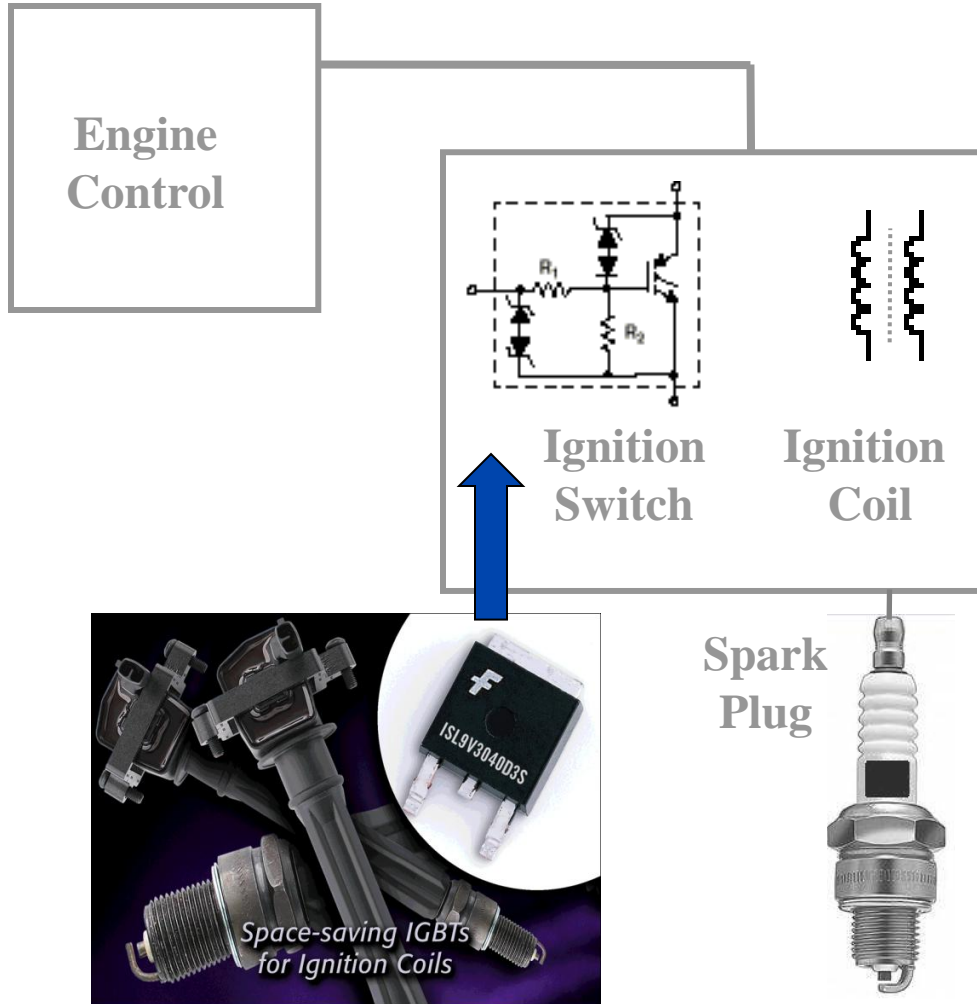


M Units



- \$12 to \$25 per system / vehicle
- **2009:** Fairchild sold modules for 300k vehicles
- **2010:** Modules for 900k vehicles will be sold by end of the year
 - *3 platforms and 5 car models*
- **Outlook 2012:** 2-3M Fairchild APM modules
 - *9 platforms with 20 car models will be in production by end 2012*
- Other hydraulic systems are all potential opportunities

Application: Automotive IGBTs for Ignition Systems

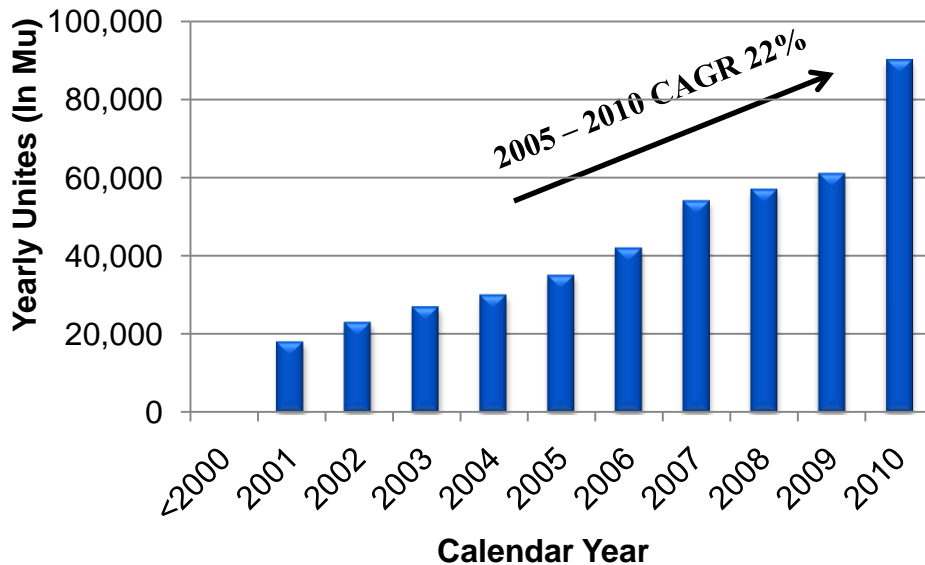


- **Fairchild supports the full portfolio of IGBTs for Ignition systems**
- **Fairchild Ignition IGBT products:**
 - Improve thermal management in a reduced footprint
 - Facilitate high system reliability
 - Best in class energy handling capability
 - Simplify design
 - Improve fuel efficiency

Fairchild is the number one supplier across all ignition architectures, from “Coil on Plug” to advanced multispark “Switch on Plug” systems



Ignition IGBT Sales History



- **Strong growth:**

- **2009:** 61Mu/year (Y-on-Y growth)
- **Forecast 2010:** 94Mu/year
- **2012:** targeting > 110Mu/year

- **Content:** \$2 to \$10 for a 4 cylinder gasoline vehicle

- **Further growth will be fueled by:**

- New technologies allowing for reduced die size hence smaller packages
- New Smart Ignition and Ignitor Module products



EcoSPARK®
delivers
benchmark
energy
capability per
unit area



- PCIA are in a “Target Rich” environment
 - While many of our end markets have single digit TAM growth...
 - ...Energy efficiency is driving double digit SAM growth.
- Our technology should allow us to take significant market positions
 - We have a unique combination of IC, Discrete and Packaging capabilities to create value added products