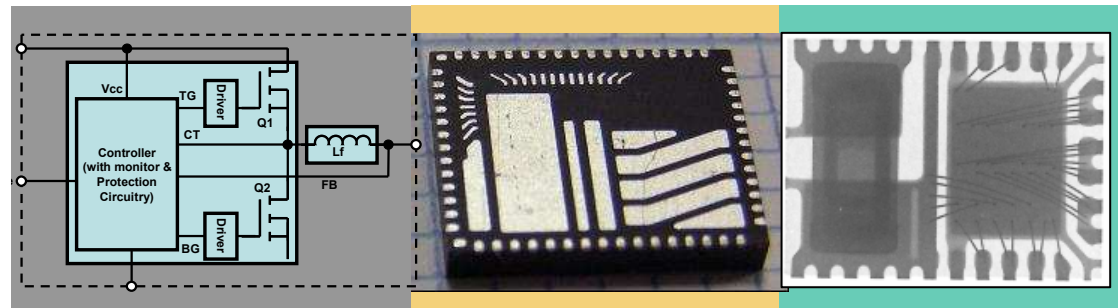


A 2010 Overview of Micro-Integrated Power Conversion and Management Solutions



Arnold Alderman, Anagenesis, Inc

Ada Cheng, Anagenesis, Inc

Los Angeles. CA, USA

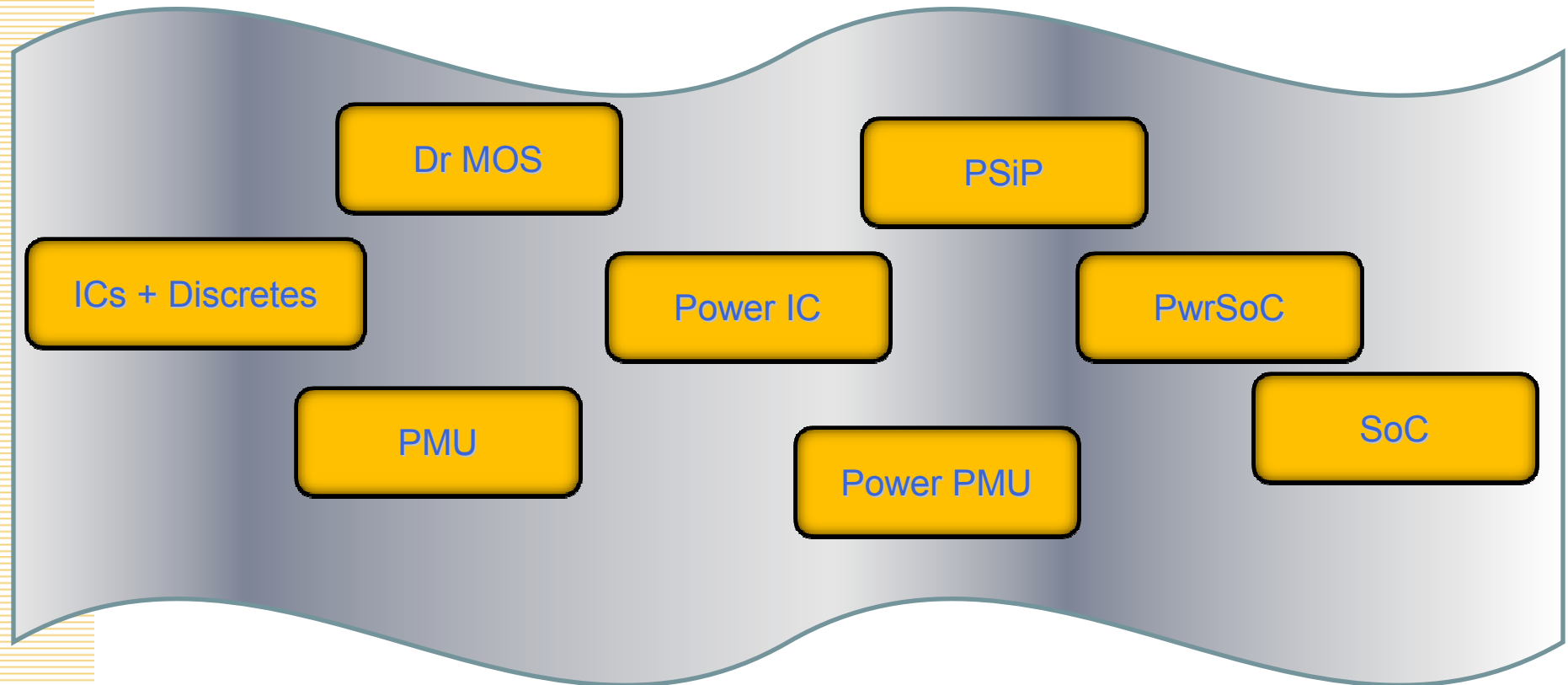


PWR
SOC 10

October 15, 2010

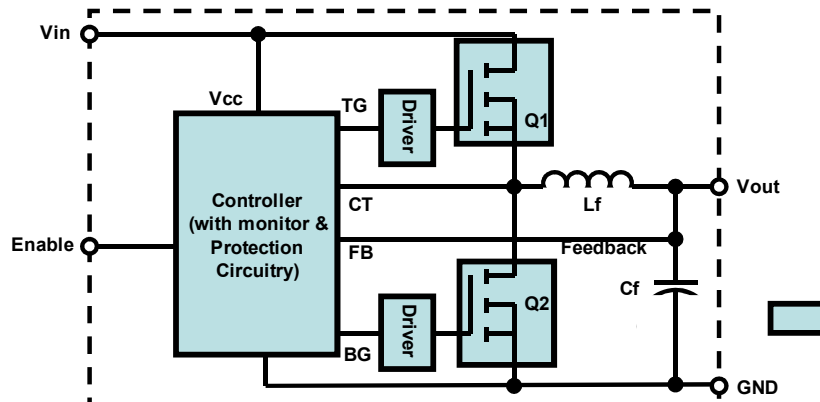
- Integration Landscape
- The Integration Paths
- PwrSoC Influencing Technologies
- PSiP Compelling Features
- Market Landscape
- PwrSoC Progress
- The Market Players
- The PSiP and PwrSoC Market
- Future PSiP and PwrSoC Trends

The Product Landscape

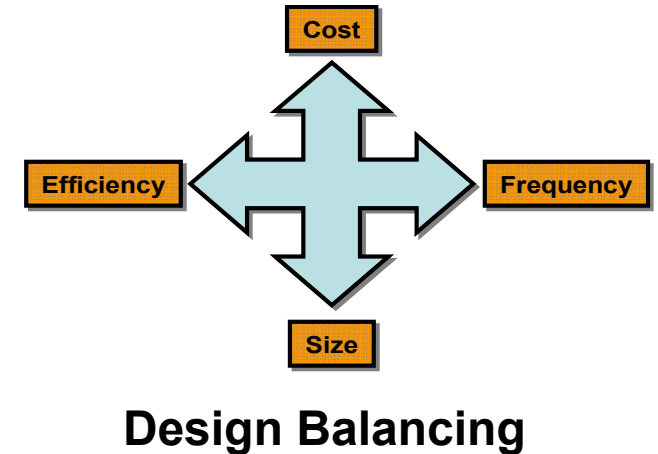
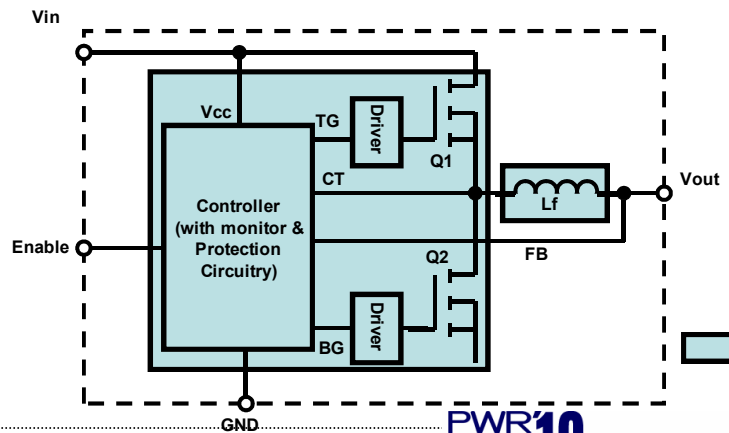


Integrated Converter Solutions

- To more integrated solutions
 - Power Supply in Package (PSiP)



- Power Supply on Chip (PwrSoC)



PSiP - Power Supply in Package

Number of Components

2

A PSiP or PwrSoC:

Less than 1"X1"X1"

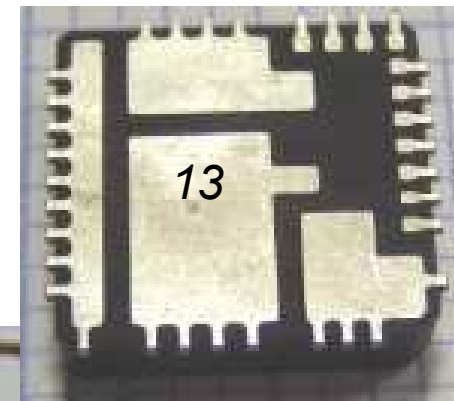
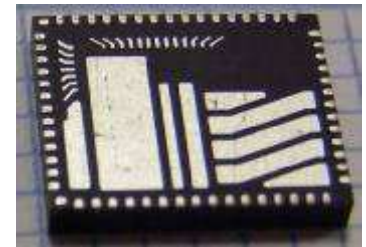
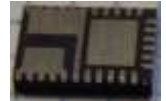
Encapsulated

Contains L

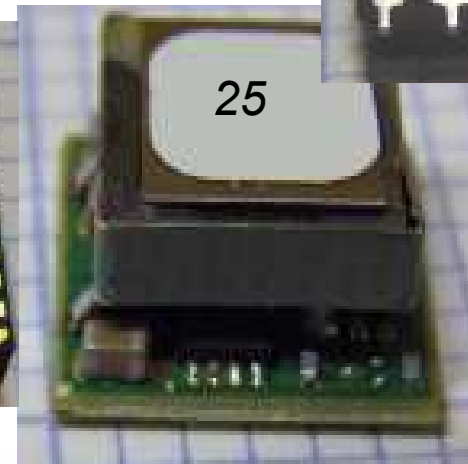
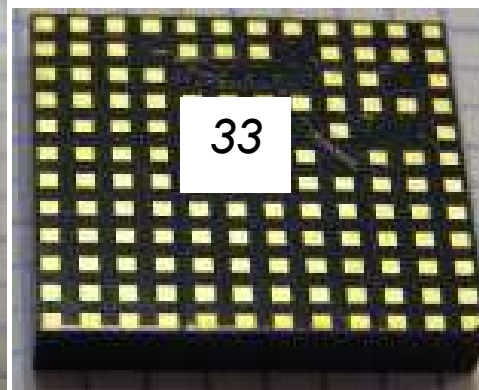
PwrSoC

Power passives are integrated on semi substrate

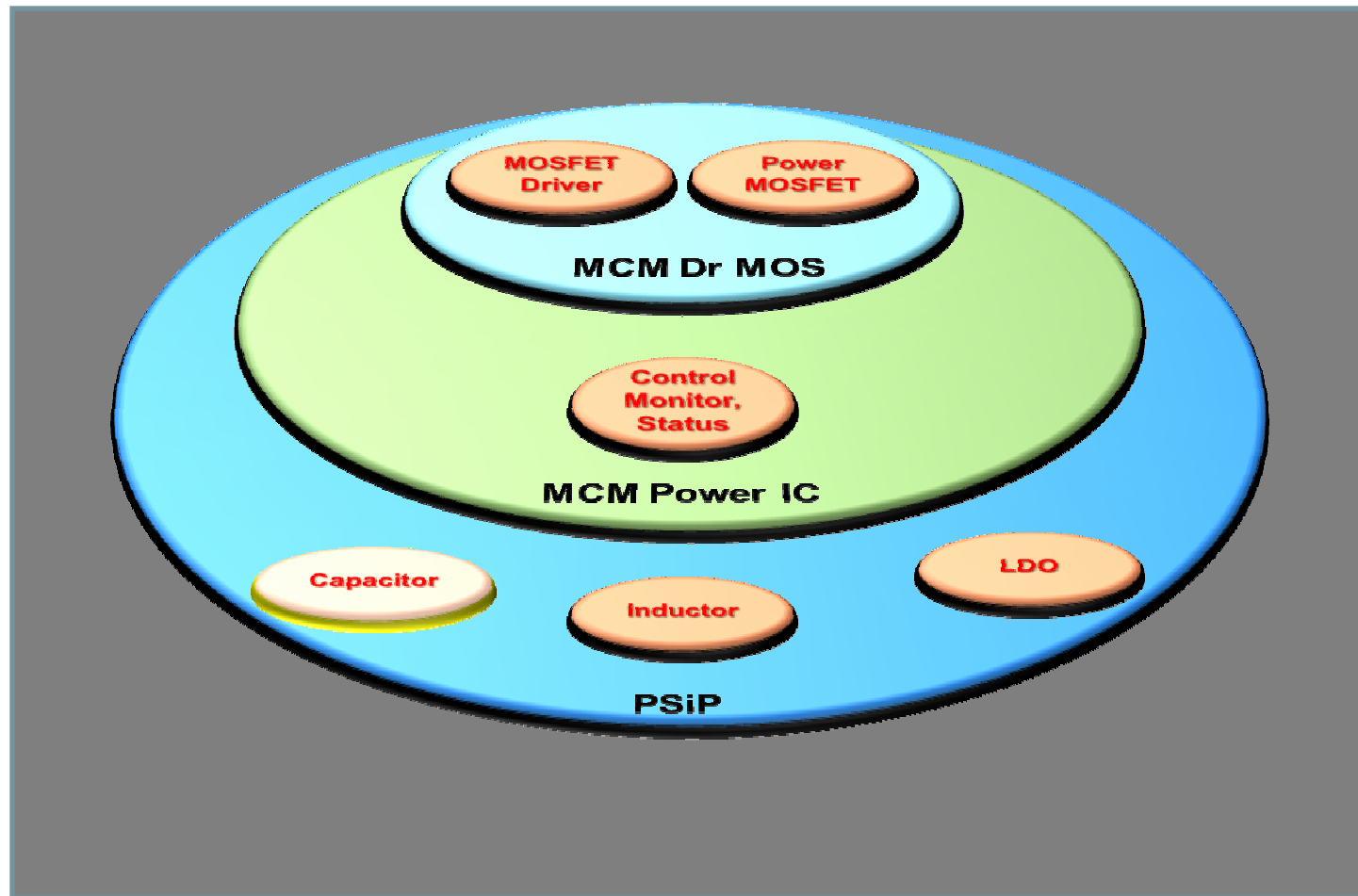
7



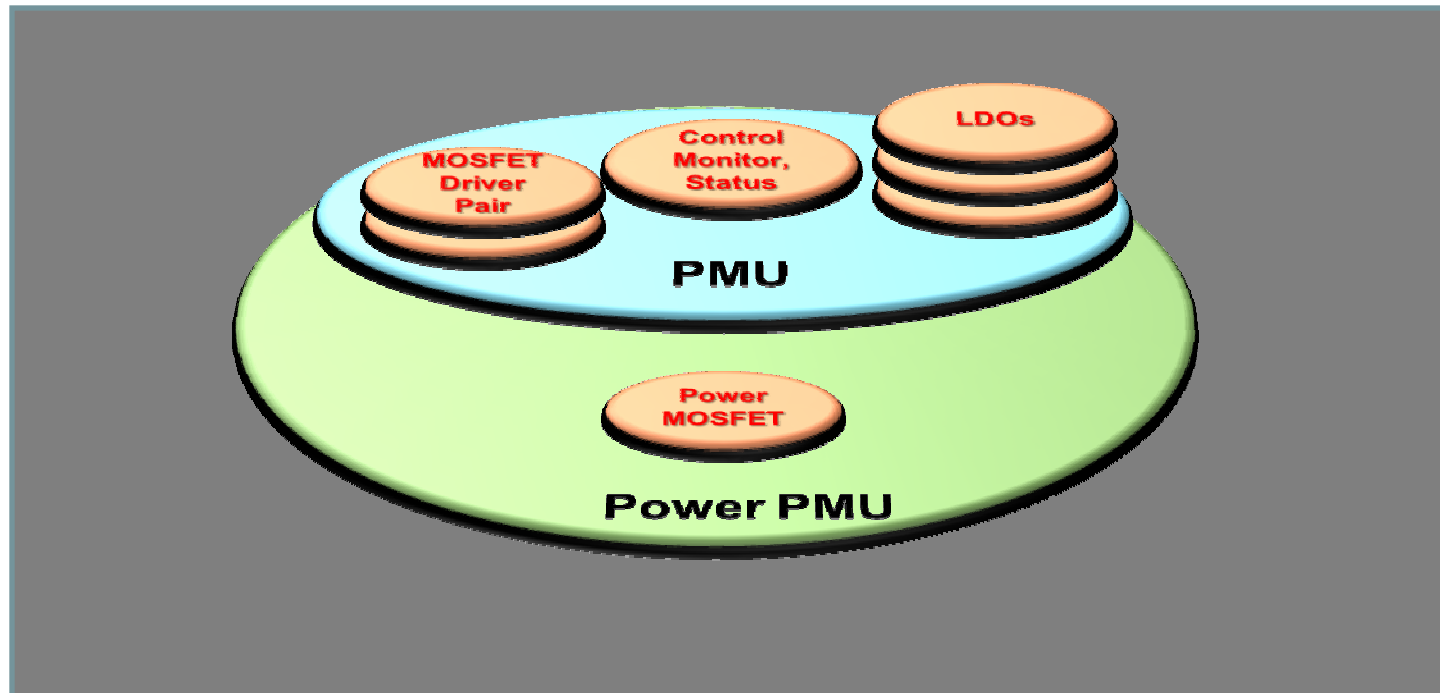
Source: PSMA PSIP2PwrSoC Phase 2 Study



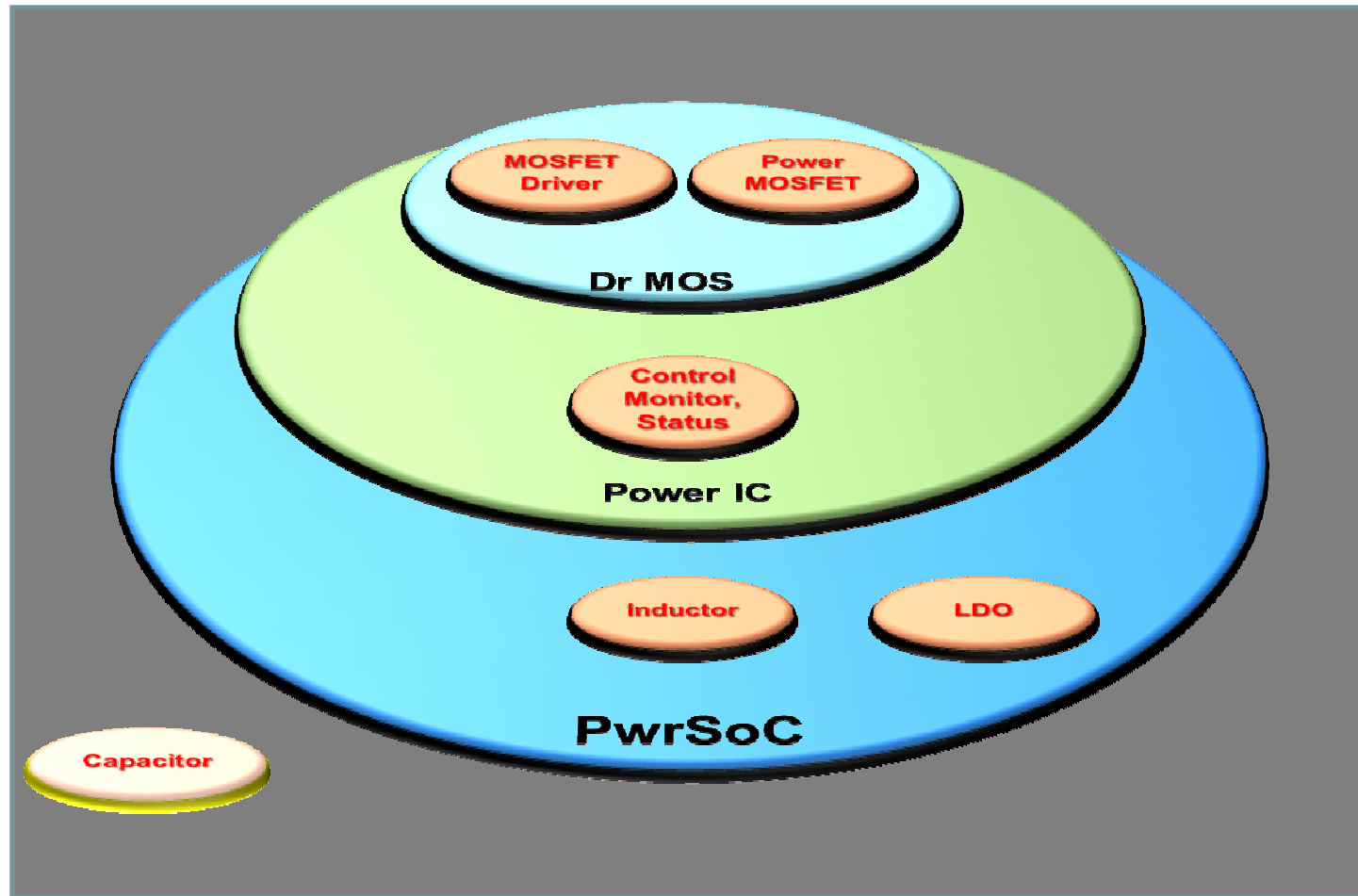
Integration Path to PSiP



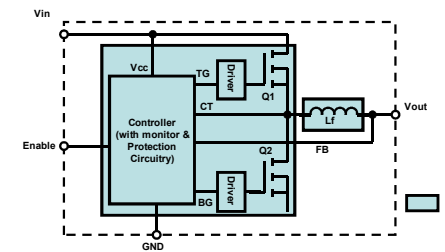
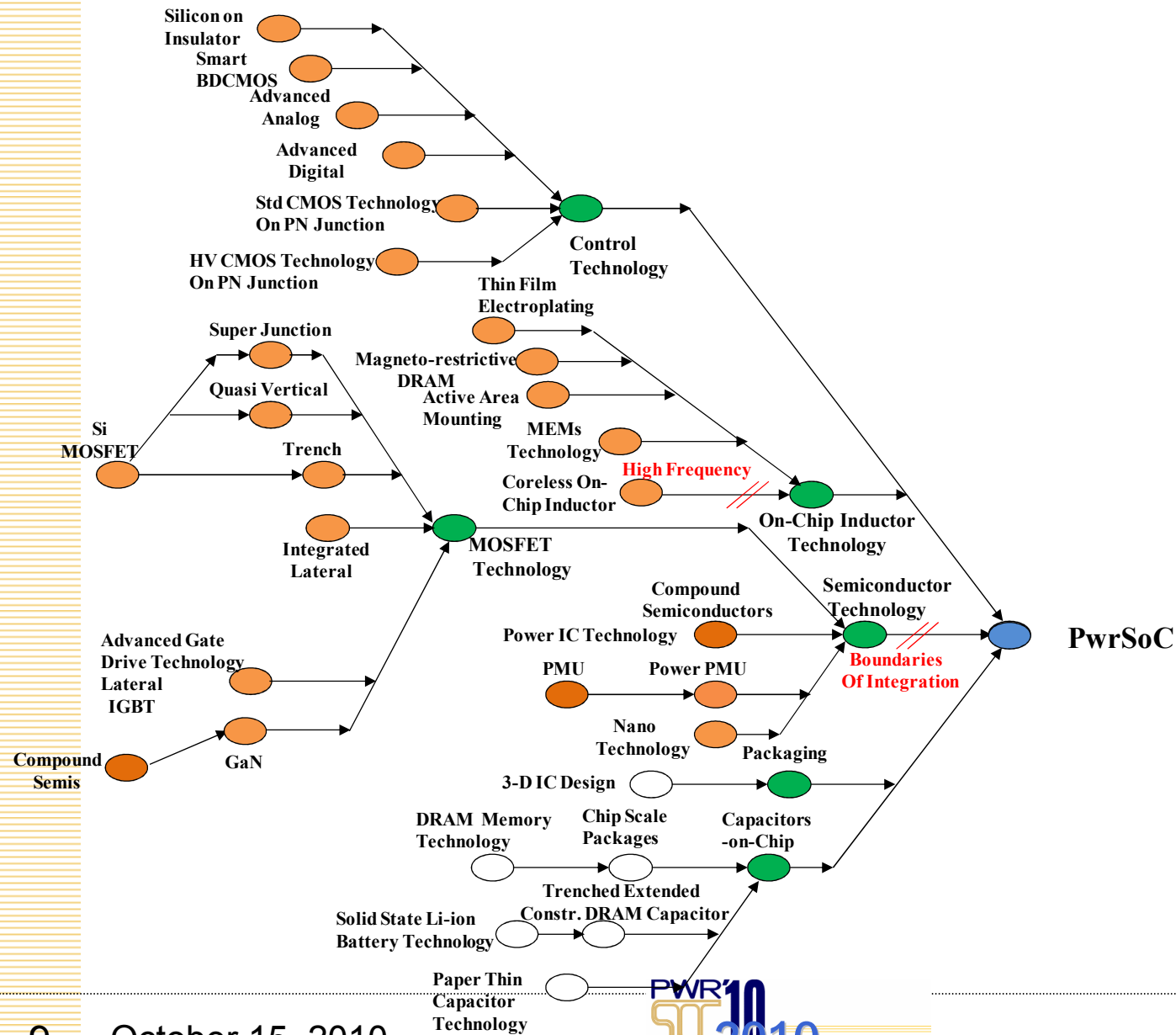
Silicon Integration Path to Power PMU



Silicon Integration Path to PwrSoC



PwrSoC Influencing Technologies

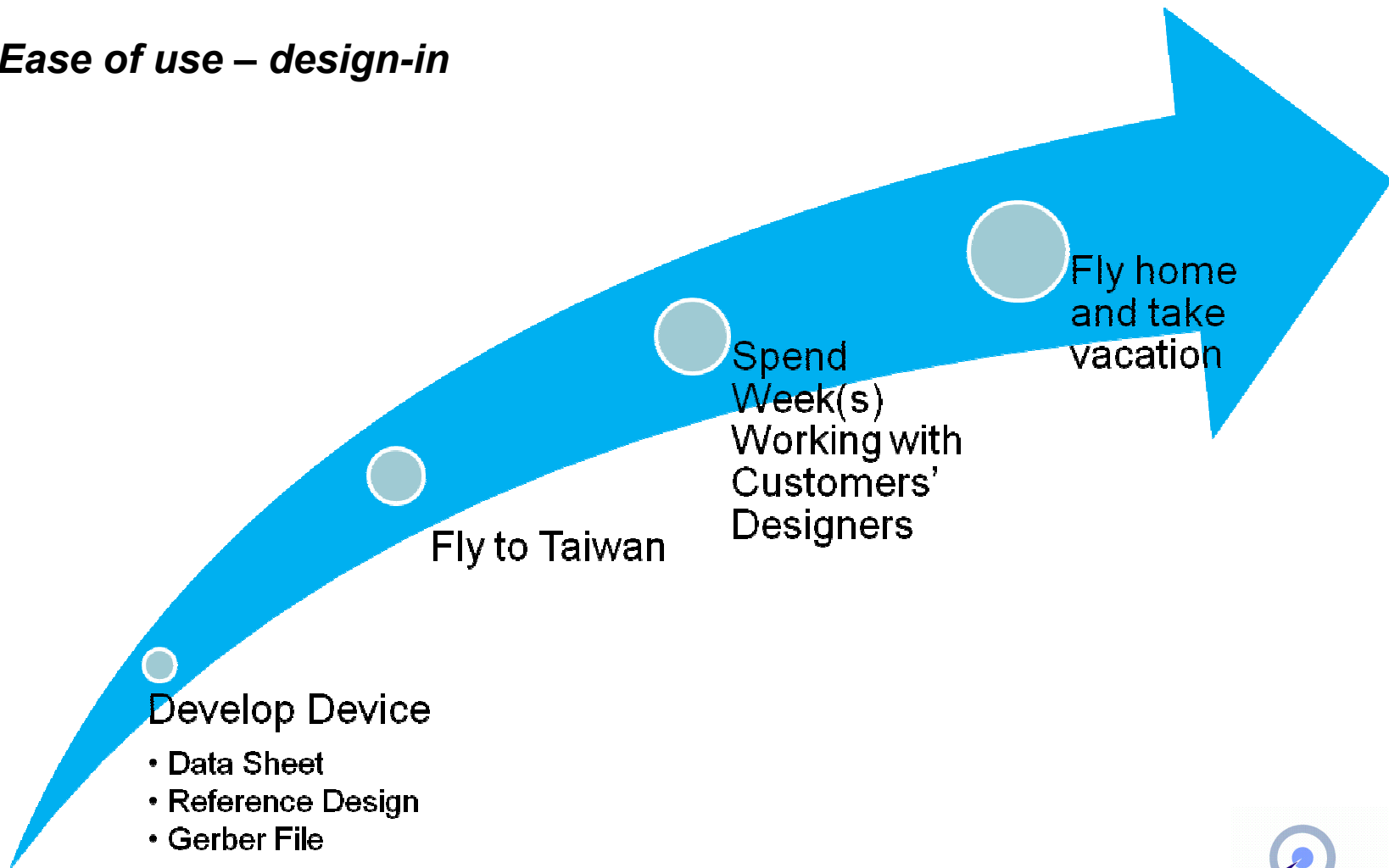


Why is PSiP Compelling?

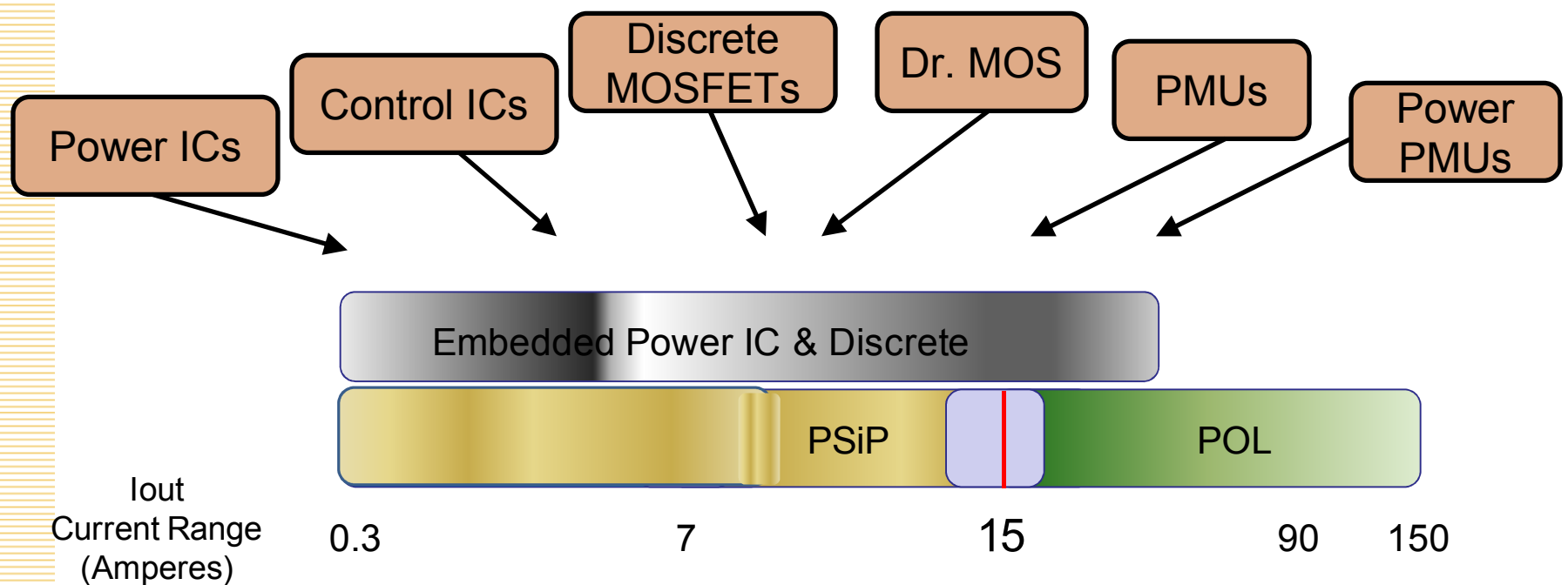
- Higher power density – space is a premium
- Higher efficiency – shorter interconnection, lower parasitics
- Ease of design; Simple layout – reference design not necessary
- Better thermal transfer
- Lower component count – higher reliability

The Taiwan Shuttle

Ease of use – design-in

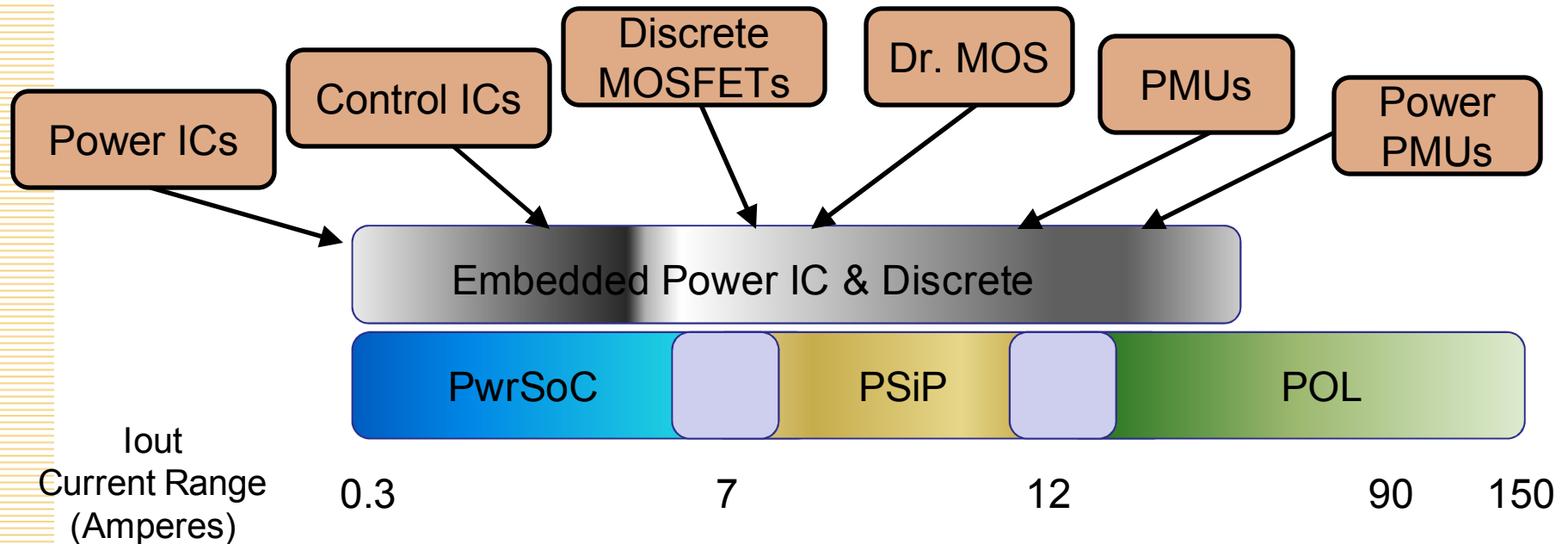


The Product Serving Landscape Today



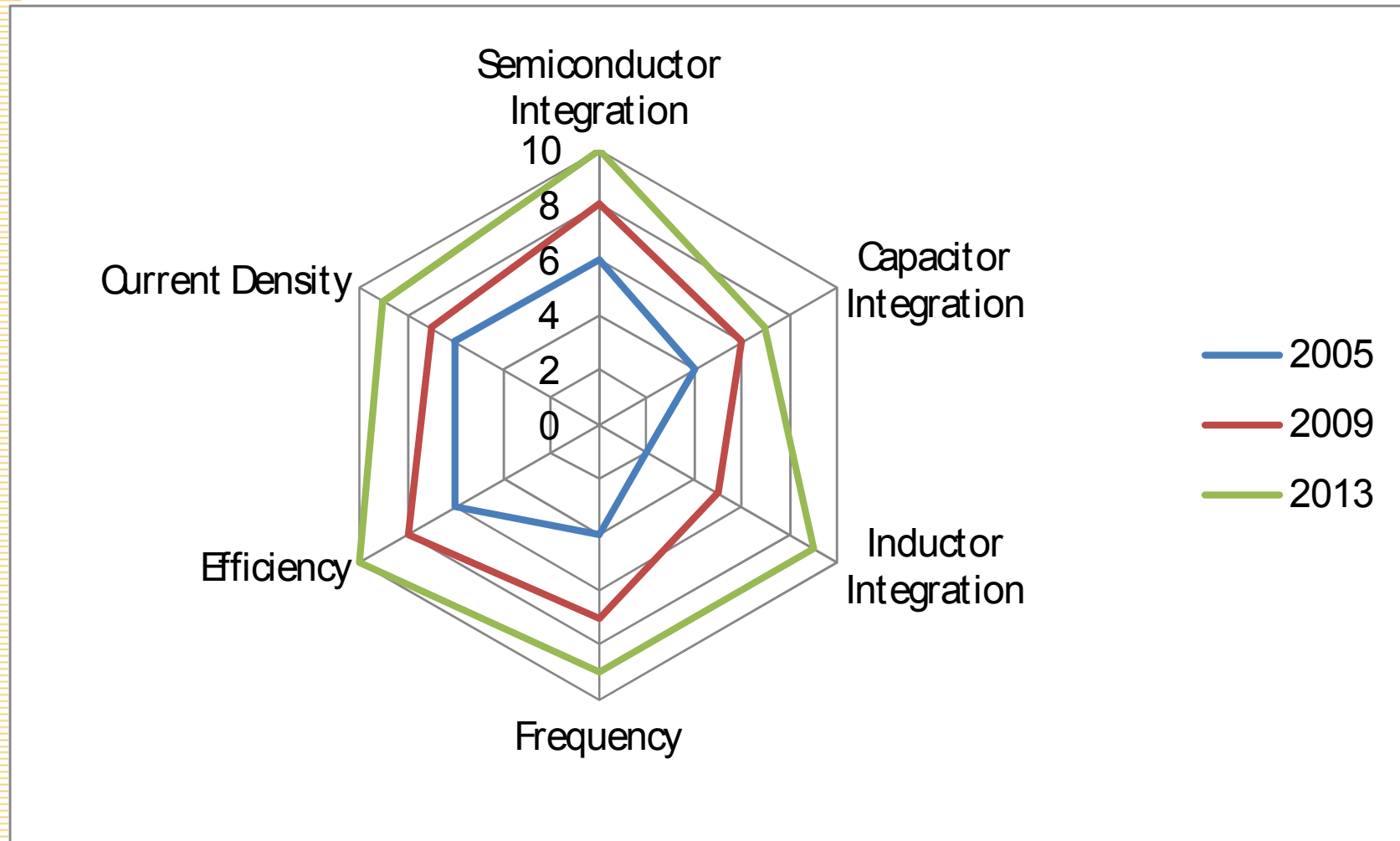
The Future Product Serving Landscape

- Products serving the market are:



- Other Options: New “On-Chip Power” Initiative.

PwrSoC Progress Snapshot 2009



Source: PSMA Report 2009

PSiP Players

- Key Established Leaders
 - Linear Technology, Enpirion, Micrel, Analog Devices
- Key Up and Coming
 - National Semiconductor, Intersil, Sharp

The PSiP & PwrSoC Market

- \$100 Million today (all PSiP)
- Projected Compound Annual Growth Rate – next 5 years
 - PSiP \approx 35%
 - PwrSoC \approx 166%
- Projected Market Size
 - \$2 Billion by 2020 (\approx 50/50 PSiP & PwrSoC with PwrSoC surpassing PSiP in subsequent years)

Future Product Trends

In the coming year or two we will see

- PSiP: More functionality for dc-dc converters – multi-phase, second source,
- Follow the Power IC developments regarding features and functionality.
- PSiP: Off-line isolated high voltage ac-dc converters.
- PwrSoC: Integrated inductor
- Integrated capacitor is further out
 - And still a ***big maybe*** for high current devices

More Information Sources

- **“Power Converter Miniaturization Trends – Power Supply in Package (PSiP) and Power Supply on a Chip (PwrSoC)”**, by Tyndall Institute Staff and Anagenesis, Inc., , Darnell Power Forum, September 2010
- **“Technology Report – Review of Commercial Developments in Power-Supply in Package and Power Supply on a Chip.”**, by Finbarr Waldron, John Slowey and Raymond Foley, Power Electronics Research Laboratory, University College, Cork Ireland, Arnold Alderman, Anagenesis, Inc., and Cian O’Mathuna, Tyndall National Institute, published by PSMA March 2009
- **Proceedings, San Jose, CA. “Power Supply on Chip (PwrSoC) -Update 2010”**, by Arnold Alderman, Anagenesis, Inc., and Cian O’Mathuna, Tyndall National Institute, presented by Arnold Alderman, APEC Special Session, February 2010
- **“Power Supply on Chip – Has the Ship Come In?”**, by Dr. Cian O’Mathuna, Tyndal National Institute, APEC Plenary Presentation, February 2009, IEEE
- **“Technology Report – Review of Commercial Developments in Power-Supply in Package and Power Supply on a Chip.”**, by Tyndall Institute Staff and Anagenesis, Inc., published by PSMA March 2009
- **“Market and Technology Report - Power Supply in a Package & Power Supply on a Chip,”** by Arnold Alderman and Vicky Panossian, Anagenesis, Inc., published by PSMA, February 2008

Thank You for Your Attention
Now on to the rest of the session...