



2006 Power Technology Roadmap Workshop

March 18, 2006

Hyatt Regency Hotel, Dallas, Texas

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Workshop History

- First Workshop: 1994, Orlando, Florida
 - Initiated By Bob Freund, AT&T Bell Laboratories
- Subsequent Workshops:
1997, 2000, 2003
- Future Workshops:
2008, 2010, ...



Industry Participants

- Artesyn Technologies
- Cisco Systems
- Darnell Group
- Dell
- Fairchild Semiconductor
- HP
- IBC Corporation
- Intel
- International Rectifier
- Magnetek
- Micro-Tech Consultants
- Northrop Grumman
- ON Semiconductor
- Raytheon
- Sandia National Laboratories
- Skyline Marketing
- Spang/Magnetics, Inc.
- Tyndall Center
- University Of Colorado At Boulder



Methodology

- Presentations
 - Users
 - Suppliers
 - Market Reports
 - Technology
- Breakout Groups
 - Complete Report Tables
 - Present Results

**Scribes
Take
Notes**

Report Tables

Four Product Categories		Four Classes Of Metrics		



Report Tables – Product Categories

AC-DC Front End Power Supplies			



Report Tables – Product Categories

AC-DC Front End Power Supplies	AC-DC External Power Supplies		



Report Tables – Product Categories

AC-DC Front End Power Supplies	AC-DC External Power Supplies	DC-DC Bus Converters	



Report Tables – Product Categories

**AC-DC Front End
Power Supplies**

**AC-DC External
Power Supplies**

**DC-DC
Bus Converters**

**Non-Isolated
DC-DC POL**



Report Tables – Product Categories

**Product Categories Selected
For Broad Market Use
& Technology Challenges**



Report Tables – Metrics Classes

General Requirements

General Requirements			



Report Tables – Metrics Classes

General Requirements

Circuit Design And Implementation



Report Tables – Metrics Classes

General Requirements

Circuit Design And Implementation

Component Technology

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Report Tables – Metrics Classes

General Requirements

Circuit Design And Implementation

Component Technology

**Packaging, Physical Design
Thermal Mgt, Assembly Technology**



Selected Results

- Strong Migration In POL Converters To “Down” Designs From Assembled Modules
 - At All Output Current Levels (Even 40 A)
 - Driven By Cost Requirements
- AC-DC Front End Power Supplies
 - 15-30% Cost/Price Reduction
 - Enabled By Component Price Reductions And Some Technology Improvements



Selected Results

- AC-DC External Power Supplies
 - Density Increases 75-100%
 - Efficiencies More Than 90% Available
- Isolated DC-DC Bus Converters
 - 12 V Output Becomes The Minority Product
 - Modest Increase In Density



Drivers, Enablers, Barriers

- Drivers
 - Energy Concerns/Need Higher Efficiency
 - External Power Supply Efficiency Standards On Verge Of Being Widely Adopted In The United States
- Enablers
 - Nothing New
- Barriers
 - Component Limitations
 - Some Good News On Magnetic Material Improvements
 - Thermal Management



Role Of Digital

- It's Coming
- Adoption Rate Steady, Not Exponential
 - ICs Not Yet Here
 - Some Resistance To Digital From Long Time Analog Engineers – And Suppliers!
 - Supplier With Best Tools Wins
 - Cost Parity Yet To Come
 - Digital Power Management Arriving Sooner Than Digital Control



Key Points & Observations

- Requirements For Higher Efficiency Create Multi-Billion Dollar Opportunities For Power Source Manufacturers To Become A Value Added Resource
- Example Market Opportunities
 - Photovoltaic Inverters
 - High Efficiency Lighting (e.g LEDs)
 - White Goods



Key Points & Observations

- Change In Next 4-5 Years Believed To Be Incremental - No Revolutions, Disruptions, Quantum Leaps Seen In The Technology
- One Of The Significant Changes
 - Use Of System-In-Package (SiP) Technology For DC-DC Converters



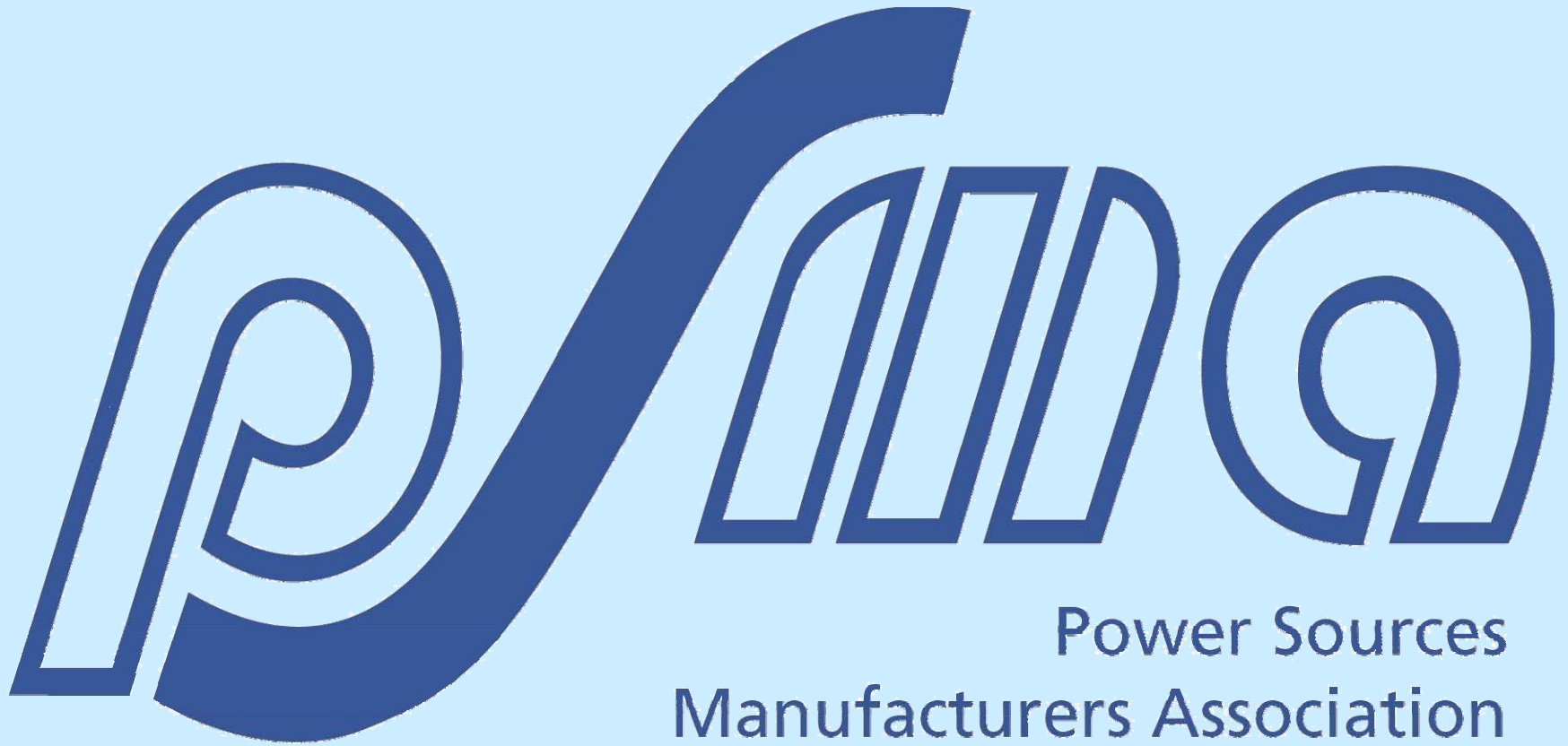
Workshop Report

- PSMA Publishes A Report On The Results Of The Workshop
 - PSMA Member Companies Each Get One Copy
 - Can Be Purchased By Anyone
- Includes
 - Presentations
 - Commentary Based On Scribes' Notes
 - All Tables
- APEC 2003 Report Was Popular
 - Several Hundred Copies Distributed
 - Second Printing Required



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**Thank You
For Your Time
And Attention**



Power Sources
Manufacturers Association

The Multinational Power Electronics Association