Applied Power Electronics Conference and Exposition

Long Beach Convention & Entertainment Center

March 20-24, 2016
# Table of Contents

## General Information
- Foreword ........................................ 2
- Conference Committee & Management .... 4
- Schedule-at-a-Glance .......................... 6
- General Information ............................. 16
- Important Rules, Notices & Conference Policies ... 20
- Conference Highlights ......................... 23
- Spouse & Guest Program ....................... 26
- Sponsor Meetings ............................... 28

## Conference Program

### SCHEDULE BY DAY
- Sunday, March 20, 2016 ...................... 32
- Monday, March 21, 2016 ..................... 35
- Tuesday, March 22, 2016 ................... 38
- Wednesday, March 23, 2016 ................. 60
- Thursday, March 24, 2016 ................. 91
- Professional Education Seminars .......... 125
- Plenary Session ............................... 140
- Rap Sessions .................................. 146
- Dialogue Session ............................. 150
- Dialogue Session Floor Plan ............... 180
- Convention Center Floorplan .............. 182

## 2016 Exhibitors Directory
- APEC 2016 Exposition ....................... 185
- APEC 2016 Partners .......................... 186
- Exposition Information ..................... 187
- Exhibitor Seminars ........................... 188
- Exhibit Hall Floor Plan ..................... 211
- Exhibitor Listing ............................. 213
- 2016 Supporting Publications .............. 276

For the latest news and information, access to on-line conference and hotel information download the APEC2016 mobile app on your mobile device. The app is accessible by scanning the below QR code, and can also be found directly through Google Play (Android) and iTunes App Store (IOS devices) when searching keyword “APEC”.
It is my utmost pleasure to welcome you to the 2016 IEEE Applied Power Electronics Conference and Exposition (APEC 2016), at the Long Beach Convention Center, in Long Beach, California.

As the Premier Event in Applied Power Electronics, APEC provides a unique opportunity to power electronics professionals from academia, national laboratories, and industry for exchange of technical knowledge, networking, and exposure to the vibrant indigenous culture.

The APEC 2016 organizing committee has been working wholeheartedly to compose this excellent technical conference for you. Thanks to their dedication and countless hours of work as well as APEC’s sponsors: IEEE Industry Applications Society (IAS), IEEE Power Electronics Society (PELS), and Power Sources Manufacturers Association (PSMA).

Like its predecessors, APEC 2016 offers a unique technical program for the power electronics community. We have a record breaking and unique conference and exposition planned for you to experience, with a comprehensive program remarkably attractive to the academic researchers, students, educators, industry, government agencies, and general public. The technical presentation papers are selected from an all-time record high 1212 digests submitted from 45 countries from across the globe. The exposition hits its record high participation with 263 exhibitors and 398 booths. The exhibitors will showcase their state-of-the-art technologies, products, and solutions on applied power electronics. Furthermore, this year in our progressively popular industry sessions we have 119 accepted presentations in 20 sessions.

The Professional Educational Seminars, offered by internationally renowned experts, start on Sunday, March 20th. Each of the 21 three-and-a-half hour educational seminars, selected from the record-high 52 submissions, provides an in-depth discussion of important and complex power electronics topics and combines practical application with theory. The Plenary Session, on Monday afternoon, consists of distinguished world-class speakers from industry and academia covering the key power electronics technologies, components, and innovations affecting our industry and the society.

This year, the 30th micro mouse competition will include teams from Japan, Taiwan, Singapore, China, United Kingdom and the United States. The increasingly popular rap sessions include three moderated debates on Future of Semiconductor Technology Development, Power Electronics for Internet of Things, and Advanced Refueling Technologies for Electric Vehicles. This year APEC sponsors have provided 43 travel grants to assist students’ participation in this unique conference. In addition, the APEC Mobile App provides access to an interactive directory and map of the exhibitors on their mobile device.

The Wednesday night social event “Surfin’ Safari” will be at the Pacific Ballroom – Long Beach Convention Center. The APEC social event provides you with the opportunity to let loose, enjoy great food and network with your colleagues. This year we are thrilled to have live entertainment from California’s premiere Beach Boy’s cover band, The Beach Toys!

With three convenient local airports, average high temperature of 68ºF (20 ºC) in March, an enjoyable voyage away from Catalina Island and a convenient trip from Disneyland and Universal Studios Hollywood, Long Beach is a prime location for APEC. In addition to conference outstanding program, I hope you and your families will enjoy your stay at Long Beach and its superlative attractions such as the Ports O’ Call Village, Point Vicente Lighthouse, Regal Queen Mary, the Shoreline Village, the Aquarium of the Pacific, its extensive museums, and many elite dining destinations.

I would like to take this opportunity to reiterate my appreciation to APEC attendees, exhibitors, reviewers, volunteers, sponsors, organizing committee members, and steering committee members. We are passionately looking forward to meeting you at APEC 2016, wish you a heartfelt welcome to APEC, and hope that you will have a memorable experience.

Warmest Regards,

Alireza Khaligh
General Chair
2016 IEEE Applied Power Electronics Conference and Exposition
### Conference Committee

<table>
<thead>
<tr>
<th>Members-at-Large</th>
<th>Conference Management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alireza Khaligh</strong></td>
<td><strong>Donna Johnson</strong></td>
</tr>
<tr>
<td>Conference Chair</td>
<td>Director, Conferences</td>
</tr>
<tr>
<td>University of Maryland</td>
<td>Courtesy Associates</td>
</tr>
<tr>
<td>at College Park</td>
<td></td>
</tr>
<tr>
<td><strong>Jonathan Kimball</strong></td>
<td><strong>Bobbie Praske</strong></td>
</tr>
<tr>
<td>Program Chair</td>
<td>Conference Manager</td>
</tr>
<tr>
<td>Missouri University of</td>
<td>Courtesy Associates</td>
</tr>
<tr>
<td>Science &amp; Technology</td>
<td></td>
</tr>
<tr>
<td><strong>Eric Persson</strong></td>
<td><strong>Ashley Kesack</strong></td>
</tr>
<tr>
<td>Assistant Program Chair</td>
<td>Conference Manager</td>
</tr>
<tr>
<td>Infineon Technologies</td>
<td>Courtesy Associates</td>
</tr>
<tr>
<td><strong>Siamak Abedinpour</strong></td>
<td></td>
</tr>
<tr>
<td>Publications Chair</td>
<td></td>
</tr>
<tr>
<td>Integrated Device</td>
<td></td>
</tr>
<tr>
<td>Technology Inc.</td>
<td></td>
</tr>
<tr>
<td><strong>Bilal Akin</strong></td>
<td><strong>Donna Johnson</strong></td>
</tr>
<tr>
<td>Grants and Awards Chair</td>
<td>Director, Conferences</td>
</tr>
<tr>
<td>University of Texas at</td>
<td>Courtesy Associates</td>
</tr>
<tr>
<td>Dallas</td>
<td></td>
</tr>
<tr>
<td><strong>Berker Bilgin</strong></td>
<td><strong>Bobbie Praske</strong></td>
</tr>
<tr>
<td>Rap Sessions Co-Chair</td>
<td>Conference Manager</td>
</tr>
<tr>
<td>McMaster University</td>
<td>Courtesy Associates</td>
</tr>
<tr>
<td><strong>Frank Cirolia</strong></td>
<td><strong>Ashley Kesack</strong></td>
</tr>
<tr>
<td>Social Media Chair</td>
<td>Conference Manager</td>
</tr>
<tr>
<td>Artesyn Embedded</td>
<td>Courtesy Associates</td>
</tr>
<tr>
<td>Technologies</td>
<td></td>
</tr>
<tr>
<td><strong>Jose Cobos</strong></td>
<td><strong>Aung Thet Tu</strong></td>
</tr>
<tr>
<td>Exhibition Co-Chair</td>
<td>PSMA</td>
</tr>
<tr>
<td>UniversidadPolitècnica</td>
<td>Power Sources Manufacturers Association</td>
</tr>
<tr>
<td>de Madrid</td>
<td></td>
</tr>
<tr>
<td><strong>Greg Evans</strong></td>
<td><strong>Siamak Abedinpour</strong></td>
</tr>
<tr>
<td>Publicity Chair</td>
<td>IAS</td>
</tr>
<tr>
<td>WelComm, Inc.</td>
<td>Integrated Device Technology</td>
</tr>
<tr>
<td><strong>Doug Hopkins</strong></td>
<td><strong>Frank Cirolia</strong></td>
</tr>
<tr>
<td>Special Projects Chair</td>
<td>PSMA</td>
</tr>
<tr>
<td>North Carolina State</td>
<td>Artesyn Embedded Technologies</td>
</tr>
<tr>
<td>University</td>
<td></td>
</tr>
<tr>
<td><strong>Mark Nelms</strong></td>
<td><strong>Jose Cobos</strong></td>
</tr>
<tr>
<td>Finance Chair</td>
<td>PELS</td>
</tr>
<tr>
<td>Auburn University</td>
<td></td>
</tr>
<tr>
<td><strong>Van Niemela</strong></td>
<td><strong>Conor Quinn</strong></td>
</tr>
<tr>
<td>Exhibition Co-Chair</td>
<td>Industry Session Co-Chair</td>
</tr>
<tr>
<td>GE Critical Power</td>
<td>Artesyn Embedded Technologies</td>
</tr>
<tr>
<td><strong>Tony O’Gorman</strong></td>
<td><strong>Pradeep Shenoy</strong></td>
</tr>
<tr>
<td>Industry Session Chair</td>
<td>Marketing Chair</td>
</tr>
<tr>
<td>PESC Inc.</td>
<td>Texas Instruments</td>
</tr>
<tr>
<td><strong>Omer C. Onar</strong></td>
<td><strong>Aung Thet Tu</strong></td>
</tr>
<tr>
<td>Rap Sessions Chair</td>
<td>Past General Chair</td>
</tr>
<tr>
<td>Oak Ridge National</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td></td>
</tr>
<tr>
<td><strong>David Otten</strong></td>
<td><strong>John Vigars</strong></td>
</tr>
<tr>
<td>MicroMouse Chair</td>
<td>Finance Co-Chair</td>
</tr>
<tr>
<td>Massachusetts Institute</td>
<td>Allegro MicroSystems</td>
</tr>
<tr>
<td>of Technology</td>
<td></td>
</tr>
<tr>
<td><strong>Eric Persson</strong></td>
<td><strong>Jin Wang</strong></td>
</tr>
<tr>
<td>Seminar Chair</td>
<td>Seminar Co-Chair</td>
</tr>
<tr>
<td>Infineon Technologies</td>
<td>Ohio State University</td>
</tr>
<tr>
<td><strong>Conor Quinn</strong></td>
<td><strong>Jane Wilson</strong></td>
</tr>
<tr>
<td>Industry Session Co-Chair</td>
<td>Spousal Hospitality Chair</td>
</tr>
<tr>
<td><strong>Pradeep Shenoy</strong></td>
<td></td>
</tr>
<tr>
<td>Marketing Chair</td>
<td></td>
</tr>
<tr>
<td><strong>Aung Thet Tu</strong></td>
<td></td>
</tr>
<tr>
<td>Past General Chair</td>
<td></td>
</tr>
<tr>
<td><strong>John Vigars</strong></td>
<td></td>
</tr>
<tr>
<td>Finance Co-Chair</td>
<td></td>
</tr>
<tr>
<td><strong>Jin Wang</strong></td>
<td></td>
</tr>
<tr>
<td>Seminar Co-Chair</td>
<td></td>
</tr>
<tr>
<td><strong>Jane Wilson</strong></td>
<td></td>
</tr>
<tr>
<td>Spousal Hospitality Chair</td>
<td></td>
</tr>
<tr>
<td><strong>Sheldon Williamson</strong></td>
<td></td>
</tr>
<tr>
<td>Member At Large</td>
<td></td>
</tr>
<tr>
<td>University of Ontario</td>
<td></td>
</tr>
<tr>
<td>Institute of Technology</td>
<td></td>
</tr>
<tr>
<td><strong>Maryam Saeedifard</strong></td>
<td></td>
</tr>
<tr>
<td>Member At Large</td>
<td></td>
</tr>
<tr>
<td>Texas Christian University</td>
<td></td>
</tr>
<tr>
<td><strong>Tonya Stanback</strong></td>
<td></td>
</tr>
<tr>
<td>Conference Manager</td>
<td></td>
</tr>
<tr>
<td>Courtesy Associates</td>
<td></td>
</tr>
<tr>
<td><strong>Michael Nercesian</strong></td>
<td></td>
</tr>
<tr>
<td>Exposition Manager</td>
<td></td>
</tr>
<tr>
<td>Courtesy Associates</td>
<td></td>
</tr>
<tr>
<td><strong>Tom Wehner</strong></td>
<td></td>
</tr>
<tr>
<td>Abstracts Management</td>
<td></td>
</tr>
<tr>
<td>Epapers LLC</td>
<td></td>
</tr>
</tbody>
</table>

### Conference Management

<table>
<thead>
<tr>
<th>Steering Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aung Thet Tu</strong></td>
</tr>
<tr>
<td>PSMA</td>
</tr>
<tr>
<td>Power Sources Manufacturers Association</td>
</tr>
<tr>
<td><strong>Siamak Abedinpour</strong></td>
</tr>
<tr>
<td>IAS</td>
</tr>
<tr>
<td>Integrated Device Technology</td>
</tr>
<tr>
<td><strong>Frank Cirolia</strong></td>
</tr>
<tr>
<td>PSMA</td>
</tr>
<tr>
<td>Artesyn Embedded Technologies</td>
</tr>
<tr>
<td><strong>Jose Cobos</strong></td>
</tr>
<tr>
<td>PELS</td>
</tr>
<tr>
<td>Universidad Politècnica de Madrid</td>
</tr>
<tr>
<td><strong>Babak Fahimi</strong></td>
</tr>
<tr>
<td>PELS</td>
</tr>
<tr>
<td>University of Texas at Dallas</td>
</tr>
<tr>
<td><strong>Alireza Khaligh</strong></td>
</tr>
<tr>
<td>IAS</td>
</tr>
<tr>
<td>University of Maryland at College Park</td>
</tr>
<tr>
<td><strong>Jonathan Kimball</strong></td>
</tr>
<tr>
<td>PELS</td>
</tr>
<tr>
<td>Missouri University of Science &amp; Technology</td>
</tr>
<tr>
<td><strong>Kevin Parmenter</strong></td>
</tr>
<tr>
<td>PSMA</td>
</tr>
<tr>
<td>Excelsys Technologies Ltd.</td>
</tr>
<tr>
<td><strong>Russell Spyker</strong></td>
</tr>
<tr>
<td>IAS</td>
</tr>
<tr>
<td>Wright Patterson AFB</td>
</tr>
</tbody>
</table>

### Steering Committee

<table>
<thead>
<tr>
<th>Aung Thet Tu</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSMA</td>
</tr>
<tr>
<td>Power Sources Manufacturers Association</td>
</tr>
<tr>
<td>Siamak Abedinpour</td>
</tr>
<tr>
<td>IAS</td>
</tr>
<tr>
<td>Integrated Device Technology</td>
</tr>
<tr>
<td>Frank Cirolia</td>
</tr>
<tr>
<td>PSMA</td>
</tr>
<tr>
<td>Artesyn Embedded Technologies</td>
</tr>
<tr>
<td>Jose Cobos</td>
</tr>
<tr>
<td>PELS</td>
</tr>
<tr>
<td>Universidad Politècnica de Madrid</td>
</tr>
<tr>
<td>Babak Fahimi</td>
</tr>
<tr>
<td>PELS</td>
</tr>
<tr>
<td>University of Texas at Dallas</td>
</tr>
<tr>
<td>Alireza Khaligh</td>
</tr>
<tr>
<td>IAS</td>
</tr>
<tr>
<td>University of Maryland at College Park</td>
</tr>
<tr>
<td>Jonathan Kimball</td>
</tr>
<tr>
<td>PELS</td>
</tr>
<tr>
<td>Missouri University of Science &amp; Technology</td>
</tr>
<tr>
<td>Kevin Parmenter</td>
</tr>
<tr>
<td>PSMA</td>
</tr>
<tr>
<td>Excelsys Technologies Ltd.</td>
</tr>
<tr>
<td>Russell Spyker</td>
</tr>
<tr>
<td>IAS</td>
</tr>
<tr>
<td>Wright Patterson AFB</td>
</tr>
</tbody>
</table>
**Schedule-at-a-Glance**

### SUNDAY, MARCH 20, 2016

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 a.m.</td>
<td>Registration</td>
<td>LBCC – EXHIBIT HALLS B/C</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Speaker Breakfast</td>
<td>LBCC – ROOM 201B</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S01: Exceeding 99% Efficiency for PFC and Isolated DC-DC Converters, GaN Versus Silicon</td>
<td>LBCC – ROOM 104A</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S02: The Invisible Schematic: Non-Identities in Circuit Elements and System Components</td>
<td>LBCC – ROOM 104B</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S03: Getting from 48 V to Load Voltage: Improving Low Voltage DC-DC Converter Performance with GaN Transistors</td>
<td>LBCC – ROOM 102AB</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S04: A Comprehensive Introduction to Implementing a Fully Digital Power-Factor-Correction Boost Converter</td>
<td>LBCC – ROOM 104C</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S05: Basic Power Electronics Design Tutorial</td>
<td>LBCC – ROOM 101A</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S06: Solid-State Transformers – Key Design Challenges, Applicability, and Future Concepts</td>
<td>LBCC – ROOM 103AB</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S07: Photovoltaic Modeling and Why It Matters for Power Electronics</td>
<td>LBCC – ROOM 101B</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S08: Stability and Damping of Grid-Connected Voltage-Source Converters</td>
<td>LBCC – ROOM 102AB</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S09: PMBus™: Review and New Capabilities</td>
<td>LBCC – ROOM 104A</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S10: Wide Bandgap Device Characterization</td>
<td>LBCC – ROOM 104B</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S11: High Performance Digital Control for Power Converters</td>
<td>LBCC – ROOM 104C</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S12: Non-linear Thermal Topics in Semiconductors and Electronics</td>
<td>LBCC – ROOM 101A</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S13: Power Architectures, Protection and Control of DC Microgrids</td>
<td>LBCC – ROOM 103AB</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>S14: Soft Switching Three-Phase Converters or Inverters</td>
<td>LBCC – ROOM 101B</td>
</tr>
</tbody>
</table>

### MONDAY, MARCH 21, 2016

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 a.m.</td>
<td>Speaker Breakfast</td>
<td>LBCC – ROOM 201B</td>
</tr>
<tr>
<td>7:30 a.m.</td>
<td>Registration</td>
<td>LBCC – EXHIBIT HALLS B/C</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Spouse and Guest Breakfast</td>
<td>HYATT REGENCY – PACIFIC ROOM</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Spouse and Guest Hospitality Room Open</td>
<td>HYATT REGENCY – PACIFIC ROOM</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>S15: Introduction to Fast Analytical Techniques: Application to Small-Signal Modeling</td>
<td>LBCC – ROOM 104A</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>S16: Reliability of Power Electronic Systems</td>
<td>LBCC – ROOM 102AB</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>S17: Addressing Challenges in High Power and High Voltage Designs with IGBTs</td>
<td>LBCC – ROOM 101A</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>S18: A State-Space Design Approach to Digital Feedback Control of DC/DC Converters</td>
<td>LBCC – ROOM 101B</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>S19: How to Go from Si to SiC Components in the Design of Converters Including Safety &amp; EMC</td>
<td>LBCC – ROOM 103AB</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>S20: Principles and Practices of Digital Current Regulation for AC Systems</td>
<td>LBCC – ROOM 104B</td>
</tr>
</tbody>
</table>

*Room assignments are tentative and subject to change. Please check for updates on APEC Mobile App.*
### KEY:
- **S** = Professional Education Seminars
- **R** = Rap Sessions
- **IS** = Industry Sessions
- **D** = Dialogue Sessions
- **T** = Technical Sessions

#### S21: Latest Technologies of LLC Converters for High Current, Fast Response, and Wide Input Voltage Range Applications
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 104C

#### Spouse and Guest Tour “Docent Estate Tour at the Huntington” departs (Registration Required)
- Time: 10:00 a.m.
- Location: HYATT REGENCY – PACIFIC ROOM

#### Opening Plenary Session
- Time: 1:30 p.m. – 5:00 p.m.
- Location: LBCC – GRAND BALLROOM

#### Exhibit Hall Welcome Reception
- Time: 5:00 p.m. – 8:00 p.m.
- Location: LBCC – EXHIBIT HALLS A/B/C

#### MicroMouse Contest
- Time: 8:00 p.m. – 10:00 p.m.
- Location: LBCC – HALL A

---

#### TUESDAY, MARCH 22, 2016

**Speaker Breakfast**
- Time: 7:00 a.m. – 8:00 a.m.
- Location: LBCC – GRAND BALLROOM

**Registration**
- Time: 7:30 a.m. – 5:00 p.m.
- Location: LBCC – EXHIBIT HALLS B/C

**Spouse and Guest Breakfast**
- Time: 8:00 a.m. – 9:00 a.m.
- Location: HYATT REGENCY – PACIFIC ROOM

**Spouse and Guest Hospitality Room Open**
- Time: 8:00 a.m. – 11:00 a.m.
- Location: HYATT REGENCY – PACIFIC ROOM

**IS01: Aiding Design Excellence**
- Time: 8:30 a.m. – 11:55 a.m.
- Location: LBCC – ROOM 201A

**IS02: 3D Power Packaging**
- Time: 8:30 a.m. – 11:55 a.m.
- Location: LBCC – ROOM 201B

**IS03: Smart Products for the Smart Grid**
- Time: 8:30 a.m. – 11:55 a.m.
- Location: LBCC – ROOM 202AB

**IS04: Wide Bandgap Semiconductors**
- Time: 8:30 a.m. – 11:55 a.m.
- Location: LBCC – ROOM 203AB

**T01: Three-Phase AC-DC Converters**
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 101A

**T02: High Frequency and Fast-Response DC-DC Converters**
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 104A

**T03: Microgrids and Hybrid Systems**
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 104B

**T04: Control Strategies for Inverters and Motor Drives**
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 103C

**T05: Si Devices and Power Module Packaging**
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 101B

**T06: DC-DC Converter Control**
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 102AB

**T07: Solar Energy Systems**
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 104C

**T08: Advanced Converter for Power Systems Used in Transportation**
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 103AB

**T09: Gate Drives, Failure Analysis, and Protection**
- Time: 8:30 a.m. – 12:00 p.m.
- Location: LBCC – ROOM 102C

**Spouse and Guest Tour “Tour the Stars” departs (Registration Required)**
- Time: 9:30 a.m.
- Location: HYATT REGENCY – PACIFIC ROOM

**Exhibit Hall Open**
- Time: 12:00 p.m. – 5:00 p.m.
- Location: LBCC – EXHIBIT HALLS A/B/C

**Exhibitor Seminars – Session #1 (Concurrent Sessions)**
- Time: 1:30 p.m. – 2:00 p.m.
- Location: See Page 181

**Exhibitor Seminars – Session #2 (Concurrent Sessions)**
- Time: 2:15 p.m. – 2:45 p.m.
- Location: See Page 191

**Exhibitor Seminars – Session #3 (Concurrent Sessions)**
- Time: 3:00 p.m. – 3:30 p.m.
- Location: See Page 195

**Exhibitor Seminars – Session #4 (Concurrent Sessions)**
- Time: 3:45 p.m. – 4:15 p.m.
- Location: See Page 199

**R1: Future of Semiconductor Technology Development**
- Time: 5:00 p.m. – 6:30 p.m.
- Location: LBCC – ROOM 104A

**R2: Power Electronics for Internet of Things: Will it happen?**
- Time: 5:00 p.m. – 6:30 p.m.
- Location: LBCC – ROOM 104B

**R3: Advanced Refueling Technologies for EVs**
- Time: 5:00 p.m. – 6:30 p.m.
- Location: LBCC – ROOM 104C
WEDNESDAY, MARCH 23, 2016

Speaker Breakfast ...................................................... 7:00 a.m. – 8:00 a.m. ..... LBCC – GRAND BALLROOM
Registration ............................................................... 8:00 a.m. – 3:00 p.m. ..... LBCC – EXHIBIT HALLS B/C
Spouse and Guest Breakfast ........................................... 8:00 a.m. – 9:00 a.m. ..... HYATT REGENCY – PACIFIC ROOM
Spouse and Guest Hospitality Room Open ......................... 8:00 a.m. – 11:00 a.m. – HYATT REGENCY – PACIFIC ROOM
IS05: Thermal Management ............................................ 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 201A
IS06: Modeling and Simulation ....................................... 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 201B
IS07: Very Low Power Applications ................................. 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 202AB
IS08: Alternative Energy in High Penetration Areas ............ 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 203AB
T10: Control of AC-DC Converters .................................. 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 102AB
T11: GaN-based DC-DC Converters .................................. 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 104A
T12: Electric Machines ................................................... 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 101A
T13: Advances in Magnetics ............................................ 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 101B
T14: System Design and Layout for Improved Performance .... 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 102C
T15: Modeling of AC Energy Converters and Systems .......... 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 104B
T16: Manufacturing, Test, and Reliability ......................... 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 103C
T17: Soft-Switching Converters in Renewable Energy Systems 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 104C
T18: Solid State Lighting ............................................... 8:30 a.m. – 10:10 a.m. ..... LBCC – ROOM 103AB
Exhibit Hall Open ....................................................... 10:00 a.m. – 2:00 p.m. ..... LBCC – EXHIBIT HALLS A/B/C
Exhibitor Seminars – Session #5 (Concurrent Sessions) .......... 10:30 a.m. – 11:00 a.m. – See page 202
Exhibitor Seminars – Session #6 (Concurrent Sessions) .......... 11:15 a.m. – 11:45 a.m. – See page 205
IS09: High Frequency Magnetics; Black Magic, Art or Science? 2:00 p.m. – 5:25 p.m. ..... LBCC – ROOM 201A
IS10: From the Board to the Datacenter ............................ 2:00 p.m. – 5:25 p.m. ..... LBCC – ROOM 201B
IS11: Medium Voltage Applications ................................. 2:00 p.m. – 5:25 p.m. ..... LBCC – ROOM 202AB
IS12: Transportation Power Electronics ............................ 2:00 p.m. – 5:25 p.m. ..... LBCC – ROOM 203AB
T19: Resonant and Soft Switching DC-DC Converters .......... 2:00 p.m. – 5:30 p.m. ..... LBCC – ROOM 101A
T20: Control Applications and Modulation Schemes ............. 2:00 p.m. – 5:30 p.m. ..... LBCC – ROOM 102C
T21: Advances in Wide BandGap Devices ......................... 2:00 p.m. – 5:30 p.m. ..... LBCC – ROOM 104A
T22: Motor Drive Design and Inverter Topologies ................. 2:00 p.m. – 5:30 p.m. ..... LBCC – ROOM 101B
T23: Modeling of Magnetic Circuits and Systems ............... 2:00 p.m. – 5:30 p.m. ..... LBCC – ROOM 102AB
T24: Inverter/Converter Control ...................................... 2:00 p.m. – 5:30 p.m. ..... LBCC – ROOM 103C
T25: Topics in Renewable Energy Systems I ....................... 2:00 p.m. – 5:30 p.m. ..... LBCC – ROOM 104B
T26: Electric Vehicle Charging Systems ............................ 2:00 p.m. – 5:30 p.m. ..... LBCC – ROOM 104C
T27: Utility Interface & Inverter Applications ..................... 2:00 p.m. – 5:30 p.m. ..... LBCC – ROOM 103AB
“Surfin’ Safari” Evening Social Event (Ticket Required) ........ 7:00 p.m. – 10:00 p.m. ..... LBCC – PACIFIC BALLROOM
<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 a.m.</td>
<td>Speaker Breakfast</td>
<td>LBCC – GRAND BALLROOM</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>Dialogue Presenter Breakfast</td>
<td>LBCC – EXHIBIT HALLS A/B</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Registration</td>
<td>LBCC – CONCOURSE LOBBY</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Spouse and Guest Breakfast</td>
<td>HYATT REGENCY – PACIFIC ROOM</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>IS13: Safety and Compliance</td>
<td>LBCC – ROOM 201A</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>IS14a: Topics in Power Integration</td>
<td>LBCC – ROOM 201B</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>IS14b: Power Electronics Industry in North America</td>
<td>LBCC – ROOM 201B</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>IS15: Power Electronics Applications</td>
<td>LBCC – ROOM 202AB</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>IS16: Power Semiconductors Enabling Next Generation Applications</td>
<td>LBCC – ROOM 203AB</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>T28: Isolated DC-DC Converters</td>
<td>LBCC – ROOM 104A</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>T29: Multilevel Converters</td>
<td>LBCC – ROOM 101A</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>T30: Multilevel and Matrix Converters for Motor Drives</td>
<td>LBCC – ROOM 102C</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>T31: System Design Techniques for Reduced EMI</td>
<td>LBCC – ROOM 101B</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>T32: Modeling of DC Energy Converters and Systems</td>
<td>LBCC – ROOM 102AB</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>T33: Gate Drive Techniques</td>
<td>LBCC – ROOM 103C</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>T34: Energy Storage Systems</td>
<td>LBCC – ROOM 104B</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>T35: Topics on Inductive and Capacitive Wireless Power Transfer</td>
<td>LBCC – ROOM 104C</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>T36: Wireless Power Transfer</td>
<td>LBCC – ROOM 103AB</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D01: AC-DC Converters</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D02: DC-DC Converters II</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D03: DC-DC Converters I</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D04: Utility Interface</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D05: Motor Drives and Inverters: Modeling and Control I</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D06: Motor Drives and Inverters: Modeling and Control II</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D07: Motor Drives and Inverters: Topologies</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D08: Advanced Components and Devices</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D09: System Design Considerations for Power Electronics</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D10: Modeling and Simulation</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D11: Control I</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D12: Control II</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D13: Renewable Energy Systems I</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D14: Renewable Energy Systems II</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>D15: Transportation Power Electronics</td>
<td>LBCC – EXHIBIT HALL A</td>
</tr>
</tbody>
</table>

**KEY:** S = Professional Education Seminars  
R = Rap Sessions  
IS = Industry Sessions  
D = Dialogue Sessions  
T = Technical Sessions
<table>
<thead>
<tr>
<th>KEY:</th>
<th>Professional Education Seminars</th>
<th>R = Rap Sessions</th>
<th>IS = Industry Sessions</th>
<th>D = Dialogue Sessions</th>
<th>T = Technical Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>D16:</td>
<td>Power Topologies, Distribution, and Control</td>
<td>11:30 a.m. – 1:30 p.m.</td>
<td>LBCC – EXHIBIT HALL A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D17:</td>
<td>Emerging and Renewable Power</td>
<td>11:30 a.m. – 1:30 p.m.</td>
<td>LBCC – EXHIBIT HALL A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS17:</td>
<td>Market Analysis</td>
<td>2:00 p.m. – 5:00 p.m.</td>
<td>LBCC – ROOM 201A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS18:</td>
<td>LED Lighting</td>
<td>2:00 p.m. – 3:15 p.m.</td>
<td>LBCC – ROOM 201B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS19a:</td>
<td>ElectroMagnetic Compatibility</td>
<td>2:00 p.m. – 3:15 p.m.</td>
<td>LBCC – ROOM 202AB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS19b:</td>
<td>Capacitors for Power Applications</td>
<td>4:10 p.m. – 5:25 p.m.</td>
<td>LBCC – ROOM 202AB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS20:</td>
<td>Active Devices</td>
<td>2:00 p.m. – 5:00 p.m.</td>
<td>LBCC – ROOM 203AB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T37:</td>
<td>Single-Phase AC-DC Converters</td>
<td>2:00 p.m. – 5:30 p.m.</td>
<td>LBCC – ROOM 102AB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T38:</td>
<td>Non-Isolated DC-DC Converters</td>
<td>2:00 p.m. – 5:30 p.m.</td>
<td>LBCC – ROOM 101A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T39:</td>
<td>Inverter Applications and Technologies</td>
<td>2:00 p.m. – 5:30 p.m.</td>
<td>LBCC – ROOM 101B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T40:</td>
<td>Modeling, Modulation and Control of Motor Drive</td>
<td>2:00 p.m. – 5:30 p.m.</td>
<td>LBCC – ROOM 102C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T41:</td>
<td>Gate Drivers and Integrated Packaging</td>
<td>2:00 p.m. – 5:30 p.m.</td>
<td>LBCC – ROOM 103C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T42:</td>
<td>Component Modeling</td>
<td>2:00 p.m. – 5:30 p.m.</td>
<td>LBCC – ROOM 103AB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T43:</td>
<td>Grid and Utility Interface</td>
<td>2:00 p.m. – 5:30 p.m.</td>
<td>LBCC – ROOM 104A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T44:</td>
<td>Topics in Renewable Energy Systems II</td>
<td>2:00 p.m. – 5:30 p.m.</td>
<td>LBCC – ROOM 104B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T45:</td>
<td>Envelope Tracking and Resonant Conversion</td>
<td>2:00 p.m. – 5:30 p.m.</td>
<td>LBCC – ROOM 104C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
General Information

Conference Location

Long Beach Convention & Entertainment Center
300 E Ocean Blvd
Long Beach, CA 90802
Phone: (562) 436-3636

In addition, APEC has several host hotels in the area which will be accommodating our participants.

- **Hyatt Regency Long Beach**
  200 South Pine Avenue
  Long Beach, CA 90802
  Phone: (562) 491-1234

- **Renaissance Long Beach Hotel**
  111 E. Ocean Blvd
  Long Beach, CA 90802
  Phone: (562) 437-5900

- **Courtyard Long Beach Downtown**
  500 East First Street
  Long Beach, CA 90802
  Phone: (562) 435-8511

- **Hilton Long Beach Hotel & Exec Center**
  701 W. Ocean Blvd
  Long Beach, CA 90831
  Phone: (562) 983-3400

GET PLUGGED IN:

Follow us on
APEC – Applied Power Electronics Conference

Download our mobile app

Like us on
APEC: Applied Power Electronics Conference

Ground Transportation

Area Airports

- **Long Beach Airport – LGB**
  - Hotel direction: 7 mile(s) S
  - Alternate transportation: Super Shuttle; Private Shuttle service available only. Fee is 74.00 USD for up to 9 passengers reservation required.
  - Bus service, fee: 1.25 USD (one way)
  - Estimated taxi fare: 23.00 USD (one way)

- **Los Angeles International Airport – LAX**
  - Hotel direction: 24 mile(s) NW
  - Alternate transportation: Super Shuttle; fee: 17 USD (one way); reservation required
  - Bus service, fee: 1.75+ USD (one way)
  - Estimated taxi fare: 70.00-80.00 USD (one way)

- **John Wayne Airport-Orange County – SNA**
  - Hotel direction: 24 mile(s) SE
  - Alternate transportation: Super Shuttle; fee: 37 USD (one way); reservation required
  - Estimated taxi fare: 75.00 USD (one way)

Parking

- **Long Beach Convention Center**
  Parking is $10 per car per entry to any of the Center’s lots.

- **Hilton Long Beach**
  $18/day self-parking; $22/day valet

- **Hyatt Long Beach**
  $24/day self-parking or valet

- **Renaissance Long Beach**
  $20/day self-parking; $26/day valet

- **Courtyard Long Beach**
  $19/day self-parking; $24/day valet

Getting Around Town

- **Passport Shuttle**
  Downtown Long Beach’s Passport Shuttle is designed to provide a direct connection between Pine Avenue retail and restaurant district and Long Beach Convention Center, Aquarium of the Pacific, Queensway Bay and Shoreline Village waterfront destinations. Shuttles run between these locations as often as every 15 minutes, every day.
Conference Registration

In order to participate in the 2016 APEC Conference you must be registered. Prepaid conference registration is required for the professional educational seminars, presentation sessions and dialogue sessions.

To register or pick up your conference materials please visit the APEC Conference Registration Center at the Long Beach Convention & Entertainment Center (Exhibit Halls B/C).

Saturday, March 19 . . . . . . . . . . 4:00 p.m. – 7:00 p.m.
Sunday, March 20 . . . . . . . . . . . 8:00 a.m. – 5:00 p.m.
Monday, March 21 . . . . . . . . . . . 7:30 a.m. – 5:00 p.m.
Tuesday, March 22 . . . . . . . . . . . 7:30 a.m. – 5:00 p.m.
Wednesday, March 23 . . . . . . . . . . 8:00 a.m. – 3:00 p.m.
Thursday, March 24* . . . . . . . . . . . 8:00 a.m. – 12:00 p.m.
(*Concourse Lobby)

Information for Presenters

Professional Education Seminar Presenters: breakfast will be provided for you the morning of your presentation. You should attend the breakfast only on the morning of your seminar. Breakfast will be served in Room 201B at the Long Beach Convention & Entertainment Center at 8:00 a.m. on Sunday and at 7:00 a.m. on Monday. After breakfast, you will receive brief instructions from the Professional Education Seminar Chairs.

Industry Sessions and Oral Technical Session Presenters: must attend a mandatory speaker breakfast on the morning of your presentation. Breakfast will be held at 7:00 a.m. each day, Tuesday-Thursday, in the Grand Ballroom at the Long Beach Convention & Entertainment Center. The Program Chair will host this breakfast at which you will be given your speaker ribbon and provided instructions. Immediately after breakfast you will be able to review your previously uploaded presentation with your session chair.

Dialogue Session Presenters: must attend a mandatory speaker breakfast in Hall A at the Long Beach Convention & Entertainment Center at 7:00 a.m. on Thursday. After breakfast and brief instructions you will be able to mount your presentation on the poster boards in the same room, using thumb tacks we will provide. Please do not go straight to your poster.

Speaker Ready Room: available to Professional Education Seminar, Industry Session and Oral Technical Session presenters should you need to review your presentation in advance of your session or make any edits. The speaker ready room is located in room 203C and is open during the following times:

SUNDAY, MARCH 20 . . . . . . . . . . . 8:00 a.m. – 5:00 p.m.
MONDAY, MARCH 21 . . . . . . . . . . . . 7:30 a.m. – 5:00 p.m.
TUESDAY, MARCH 22 . . . . . . . . . . . . 7:30 a.m. – 5:00 p.m.
WEDNESDAY, MARCH 23 . . . . . . . . . . . . 7:30 a.m. – 5:00 p.m.
THURSDAY, MARCH 24 . . . . . . . . . . . . . 7:30 a.m. – 12:00 p.m.

Purchasing of Conference Proceedings and Seminar Workbooks

Only copies on USB of the APEC Proceedings will be provided with the Full or Technical Sessions registration.

Conference registrants can purchase extra copies of the Conference Proceedings and Seminar Workbooks on USB through Early Registration. APEC reserves the right to limit quantities of APEC Proceedings or Seminar Workbooks sold to any one person or institution.

Conference Proceedings & Seminars on USB Payment Policy

For payments at the conference, APEC can accept credit cards (Master Card, Visa or American Express), or checks or money orders (payable in U.S dollars and drawn on an U.S. bank). Checks and money orders returned unpaid will be assessed and an additional handling charge of $50.

A LIMITED NUMBER of copies of the Conference Proceedings and Seminar Workbooks may be available for sale at the Conference Registration Center, starting at noon on Wednesday, March 23.

<table>
<thead>
<tr>
<th>On-site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference Proceedings (USB Only) $180</td>
</tr>
<tr>
<td>Seminar Workbook (USB only) $180</td>
</tr>
</tbody>
</table>

Publications purchased can be picked up at the registration desk.

> PURCHASING THROUGH THE IEEE
Post conference APEC Proceedings may be purchased through the IEEE.

> IEEE Single Copy Sales
44S Hoes Lane
Piscataway, New Jersey 08854 USA
P: (800) 678-4333 (USA & Canada)
or
(732) 981-0060
Web site: http://shop.ieee.org/ieeestore/
**Important Rules, Notices, & Conference Policies**

**Registration Cancellation & Refund Policy**

All registrations sent by mail or fax must include payment. Payment methods include credit card, check or money order.

Checks may be personal, business or certified. Checks and money orders must be payable in United States dollars and drawn on a United States bank.

Accepted credit cards: Master Card, Visa and American Express.

Please do not send cash. Checks and money orders returned unpaid or credit card payments for which payment was refused will be assessed an additional handling charge of $50.

Registrations must be submitted by March 18, after March 18 you must register on-site.

All requests for cancellation and refund of registration fees must be received in writing at the APEC offices no later than the close of business February 26, 2016. All refunds will be processed after the conclusion of the conference and will be subject to a $50 processing fee.

For those who register and are unable to attend the conference, any Proceedings, Seminars on USB or other materials to which you are entitled will be shipped to you within 30 days of the conclusion of the conference.

**Badges Required for Admission**

Badges are required for admission to all APEC events and activities. Badges are obtained by registering with the conference. APEC reserves the right to deny admission to any APEC event or activity to any person not showing an appropriate badge for that activity or event.

**Recording & Photography at APEC**

Video and audio recording may be conducted in the Exhibit area, the MicroMouse contest, and public areas of APEC, but nowhere else except by express written permission from the Conference Chair.

Still photography at APEC is permitted, but with limitations. The general principle is that people may be photographed but photographing presentations and other content is prohibited unless permission from the presenter(s) is obtained in advance. For more details, please see show management.

**Showcase Policy – NO SUITCASING!**

Please note that while all meeting attendees are invited to the showcase, any attendee who is observed to be soliciting business in the aisles or other public spaces, in another company’s booth, or in violation of any portion of the Exhibition Policy, will be asked to leave immediately. Additional penalties may be applied. Please report any violations you may observe to Show Management. Show Management recognizes that suitcasing may also take the form of commercial activity conducted from a hotel guest room or hospitality suite; a restaurant, club, or any other public place of assembly. For the purposes of this policy, suitcasing violations may occur at venues other than the exhibition floor and at other events. Show Management must be informed of any hospitality suites, and expressed consent must be received prior to the event.

**No Recruiting! No Recruiters!**

IEEE Policy #10.1.24 prohibits recruiting at IEEE sponsored conferences. Consequently, recruiters and recruiting advertisements will not be permitted in the APEC 2016 hotel space, meeting facilities or Exhibit Hall.

**Distributing Commercial Material at APEC**

**Rules For Non-Exhibitors**

Distribution of commercial material in the APEC 2016 hotel space (including directly to the hotel rooms of APEC participants), meeting space and Exhibit Halls by people or organizations not participating in the Exposition is prohibited.

APEC reserves the right to remove without notice any materials not in compliance with this policy.

**Rules For Exhibitors**

Exhibitors may only distribute commercial materials in their booth, at Exhibitor Seminars they are conducting and at press conferences they are holding. APEC reserves the right to remove without notice any materials not in compliance with this policy.
Privacy Policy

Information Provided During Registration
Contact information, which includes your name, affiliation, and mailing address, may be provided upon request to any partners and/or supporting publication participating in the APEC 2016 Exposition.

In addition APEC may use the information you provide to contact you with information about APEC 2016 or any future APEC.

No other use will be made of the information you provide. Your information will not be sold, distributed, leased or provided to any other person or organization except as described above.

Information Provided Other Than Through Registration
People who provide their names to APEC through the APEC Web site, direct contact, submitting a digest, volunteering to review or in any way other than registering for the conference, will not have their names and contact information distributed to any one or any organization, including APEC’s sponsors. APEC will use the contact information only for transmitting information related to APEC.

Conference registrants will have their names and contact information, including name, affiliation, and mailing address provided to the exhibitors and media partners in the APEC for which they register. Emails will only be provided to exhibitors through the Lead Retrieval systems used on the show floor. Registering for APEC gives permission for your name and contact information to be provided to the exhibitors and media partners and for the exhibitors and media partners to contact you during or after the conference. APEC will not otherwise distribute names and contact information received through the registration process.

Conference Highlights

Plenary Session
APEC 2016 Plenary is designed to cover the history of power, the current needs in energy efficiency and the future possibilities. Topics include: The Challenges of VHF Power Conversion; The Future of Power Electronic Design; Breaking Speed Limits with GaN Power ICs; Residential Nanogrids With Battery Storage – Is This Our Future?; The Future of Magnetic Design for Power Electronics; and finally, Why Do Power Supplies Fail? – A Real-World Analysis. Come see where power technology has been, and where it is headed.

Professional Education Seminars
This year APEC will offer 21 Professional Education Seminars to take place on Sunday, March 20 and Monday, March 21. Seminars cover a wide range of topics including device evaluation, circuit design, control techniques, system interactions, industry standards, etc.

Technical Sessions
APEC professionals like you participated in a rigorous peer review process and have carefully picked over 500 papers making up APEC’s Technical Sessions. The review process highlights the most innovative technical solutions, and provides the highest quality possible. The technical program includes papers of broad appeal scheduled for oral presentation from Tuesday morning through Thursday afternoon. Papers with a more specialized focus are available for discussion with authors at the dialogue session on Thursday at 11:30 a.m. The various technical venues cover all areas of technical interest to the practicing power electronics professional. The papers are sure to give you many new design ideas that you can apply to your work immediately.

Industry Sessions
At APEC 2016, the Industry Sessions track continues to expand. This year we’ve increased from 15 sessions to 20, facilitating the presentation of even more content and perspectives for various industries. This track runs in parallel with the traditional Technical Sessions Track. Speakers are invited to make a presentation only, without submitting a formal manuscript for the APEC Proceedings. This allows APEC to present information on current topics in power electronics from sources that would not other-
wise be present at an industry conference. While many of these sessions are technical in nature, some also target business-oriented people such as purchasing agents, electronic system designers, regulatory engineers, and other people who support the power electronics industry.

Rap Sessions

We have three exciting and contentious topics lined up for this year. Admission to all Rap Sessions is free with an Exhibits Only Registration and free refreshments will be available.

Exhibitor Seminars & Exposition

Looking for answers to the problems that are waiting for you when you get back to the office or lab? The APEC Exhibitor Seminars may have the answers you are looking for. These half hour presentations give you a more in-depth look at an Exhibitor’s products or services than you can get by just dropping by their booth. With presentations on so many topics, you are sure to find several of interest. The seminars will be held Tuesday afternoon and Wednesday afternoons.

Entrance to the Exhibition is open to all conference attendees, including holders of the free Exhibits Only registration!

MicroMouse Contest

APEC will once again host the World-Famous APEC MicroMouse Competition, the only event of its kind in North America, drawing contestants from all over the world. The contest will take place at the Long Beach Convention & Entertainment Center, in the back of Exhibit Hall A, on the evening of Monday, March 21 starting at 8:00 p.m. All are welcome!

Conference Social Event

Enjoy an evening with your toes in the sand and an umbrella drink in hand! The APEC social event is sure to provide the perfect venue for you and your colleagues to relax, unwind and enjoy live entertainment from California’s premiere Beach Boy’s cover band, The Beach Toys! Join us for this once in a lifetime event on Wednesday, March 23 – 7:00 p.m. to 10:00 p.m. in the Pacific Ballroom at the Long Beach Convention & Entertainment Center.

Young Professionals & Students Reception

(All Young Professionals and Students Welcome)

Sponsored by IEEE Power Electronics Society and Industrial Applications Society

Location:
Cafe Sevilla, 140 Pine Ave, Long Beach, CA 90802

Tuesday, March 22nd – 6:30 p.m. to 9:00 p.m.

Want to mingle, learn and have fun with best minds of IEEE? IAS and PELS give you this opportunity to learn from the life journey of the biggest leaders at APEC at this free networking event.

An evening filled with meeting new people, learning about the best practices in industry and academia, and having loads of fun with drinks and snacks. So make sure you don’t miss this wonderful chance to make new friends and meet new people.
Spouse & Guest Program

APEC welcomes the spouses and guests of the APEC conference participants into conference activities including the Plenary, Rap Sessions, the Exhibit Hall receptions and the MicroMouse Contest.

> **Spouse and Guest Hospitality Room**  
  Monday, March 21 – Thursday, March 24  
  8:00 a.m. – 11:00 a.m.  
  PACIFIC ROOM, HYATT REGENCY LONG BEACH

> **Spouse and Guest Breakfast**  
  Monday, March 21 – Thursday, March 24  
  8:00 a.m. – 9:00 a.m.  
  PACIFIC ROOM, HYATT REGENCY LONG BEACH

Optional Tours

> **Docent Estate Tour At The Huntington**  
  Monday, March 21  
  $95/per person  
  10:00 a.m. – 4:30 p.m. (6.5 hour tour)

The Huntington houses an extensive art collection with a focus in 18th and 19th-century European art and 17th to mid-20th-century American art. The property also includes The Huntington Library and approximately 120 acres of specialized botanical landscaped gardens, most notably the “Japanese Garden”, the “Desert Garden”, and the “Chinese Garden.” You will enjoy a delightful lunch at the Café, which overlooks the gardens.

INCLUSIONS: Round-trip motor coach transportation  
LUNCH AT CAFÉ (Choice of entrée, beverage and dessert)

> **TOUR THE STARS!**  
  Tuesday, March 22  
  $85/per person  
  9:30 a.m. – 4:30 p.m. (7 hour tour)

This is by far the best LA and Hollywood tour around! You will see all the familiar sights like the Hollywood sign, the Stars Walk of Fame, Rodeo Drive and even some stars homes. Your tour guide will even show you the “local” spots where the famous like to go. You will be given a lunch envelope with $15 cash for lunch at the famous Los Angeles Farmers Market. Snacks and water will be provided on the bus. We promise you won’t be disappointed!

The Los Angeles Farmers Market first opened in July 1934, it is also a historic Los Angeles landmark and tourist attraction. The Farmers Market features more than 100 restaurants, grocers, and tourist shops, and is located just south of CBS Television City. Unlike most farmers’ markets, which are held only at intervals, the Farmers’ Market of Los Angeles is a permanent installation and is open seven days a week. The dozens of vendors serve many kinds of food, both American cuisine from local farmers and restaurants and Los Angeles’ variety of local ethnic foods.

INCLUSIONS: Round trip motor coach transportation  
On-board tour guide  
$15 cash for lunch at eatery of your choice at Los Angeles Farmer’s Market  
Snacks and water on the bus
## Sponsor Meetings

### PELS Meetings

**TUESDAY, MARCH 22, 2016**

- PELS / IAS Joint Vehicle and Transportation Systems Meeting (TC4) 3:00 p.m. – 4:00 p.m. HYATT REGENCY – HARBOR AB
- IEEE IAS/PELS Young Professional Reception 6:30 p.m. – 10:00 p.m. OFFSITE – CAFE SEVILLA

**SATURDAY, MARCH 19, 2016**

- PSMA/PELS Workshop on High Frequency Magnetics 7:30 a.m. – 5:00 p.m. LBCC – ROOM 202

**SUNDAY, MARCH 20, 2016**

- IEEE International Future Energy Challenge (IFEC) Workshop 9:00 a.m. – 5:30 p.m. HYATT REGENCY – REGENCY A
- IEEE Smart Village Operations Steering Committee Meeting (Committee Members only) 9:00 a.m. – 5:00 p.m. HYATT REGENCY – SEAVIEW C
- International Technology Roadmap on Wide Band Gap Steering Committee 12:00 p.m. – 2:00 p.m. HYATT REGENCY – HARBOR AB
- PELS Industry Advisory Board and Magazine Advisory Dinner (Private Dining) 7:30 p.m. – 10:00 p.m. OFFSITE – L’OPERA RESTAURANT

**MONDAY, MARCH 21, 2016**

- PELS Membership Committee Meeting 8:30 a.m. – 11:30 a.m. HYATT REGENCY – SEAVIEW A
- ETTC Electronics Transformers Technical Committee 9:00 a.m. – 12:00 p.m. HYATT REGENCY – HARBOR AB
- PELS TC2.8 – Technical Subcommittee, IWIPP2017 & ICDCM2017 Planning 10:00 a.m. – 12:00 p.m. HYATT REGENCY – SHORELINE B
- Chapter Chair Forum 11:30 a.m. – 1:00 p.m. HYATT REGENCY – SEAVIEW A

**TUESDAY, MARCH 22, 2016**

- PELS Southern Conference Steering Committee (SPEC) 9:00 a.m. – 10:00 a.m. HYATT REGENCY – SEAVIEW A
- PELS Standards Committee Meeting 9:00 a.m. – 10:30 a.m. HYATT REGENCY – SEAVIEW B
- PELS Digital Media Meeting 9:00 a.m. – 10:00 a.m. HYATT REGENCY – SHORELINE AB
- IEMDC Steering Committee 9:30 a.m. – 11:30 a.m. HYATT REGENCY – HARBOR AB
- PELS Exec & CPSS Team Meeting 10:00 a.m. – TBD HYATT REGENCY – SHORELINE
- PELS TC6 – High Performance and Emerging Technologies 10:30 am – 12:00 p.m. HYATT REGENCY – SEAVIEW A
- PELS Fellows Committee (Members only) 12:00 p.m. – 1:00 p.m. HYATT REGENCY – HARBOR AB
- PELS TC1 – Power and Control Core Technologies 12:00 p.m. – 2:00 p.m. HYATT REGENCY – SEAVIEW B
- Transportation Electrification Community 1:30 p.m. – 2:30 p.m. HYATT REGENCY – HARBOR AB
- PELS TC2 – Power Conversion Systems and Components 2:00 p.m. – 3:30 p.m. HYATT REGENCY – SHORELINE AB
- PELS / IAS Joint Vehicle and Transportation Systems Meeting (TC4) 3:00 p.m. – 4:00 p.m. HYATT REGENCY – HARBOR AB
- PEDG Steering Committee 3:30 p.m. – 4:30 p.m. HYATT REGENCY – SEAVIEW B
- PELS TC7 – Communication Energy Systems 4:00 p.m. – 5:30 p.m. HYATT REGENCY – SHORELINE AB
- PELS TC3 – Motor Drives and Actuators 5:30 p.m. – 6:30 p.m. HYATT REGENCY – HARBOR AB
- IEEE IAS/PELS Young Professional Reception 6:30 p.m. – 9:00 p.m. OFFSITE – CAFE SEVILLA
- PELS TC5 – Sustainable Energy Technical Committee 6:30 p.m. – 7:30 p.m. HYATT REGENCY – SEAVIEW B
<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Venue</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday, March 23, 2016</td>
<td>8:00 a.m. – 9:00 a.m.</td>
<td>Hyatt Regency – Harbor AB</td>
<td>ECCE 2015/2016/2017 Organizing Committee</td>
</tr>
<tr>
<td></td>
<td>8:00 a.m. – 9:00 a.m.</td>
<td>Hyatt Regency – Regency C</td>
<td>IEEE PELS Women In Engineering Breakfast</td>
</tr>
<tr>
<td></td>
<td>9:00 a.m. – 10:00 a.m.</td>
<td>Hyatt Regency – Regency F</td>
<td>PELS Exec Team Meeting</td>
</tr>
<tr>
<td></td>
<td>9:00 a.m. – 2:00 p.m.</td>
<td>Hyatt Regency – Shoreline AB</td>
<td>Smart Village Development Committee</td>
</tr>
<tr>
<td></td>
<td>10:00 a.m. – 11:00 a.m.</td>
<td>Hyatt Regency – Harbor AB</td>
<td>PELS FinCom Meeting</td>
</tr>
<tr>
<td></td>
<td>11:30 a.m. – 1:30 p.m.</td>
<td>Hyatt Regency – Regency A</td>
<td>PELS Editorial Board – IEEE Transactions on Power Electronics</td>
</tr>
<tr>
<td></td>
<td>1:30 p.m. – 5:30 p.m.</td>
<td>Hyatt Regency – Regency BC</td>
<td>PELS Technical Operations &amp; Products Committee Meeting</td>
</tr>
<tr>
<td>Thursday, March 24, 2016</td>
<td>8:00 a.m. – 9:00 a.m.</td>
<td>Hyatt Regency – Regency C</td>
<td>PELS Conferences Committee Breakfast</td>
</tr>
<tr>
<td></td>
<td>9:00 a.m. – 12:00 p.m.</td>
<td>Hyatt Regency – Regency A</td>
<td>PELS Conferences Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>12:00 p.m. – 1:30 p.m.</td>
<td>Hyatt Regency – Seaview A</td>
<td>eT&amp;D Steering Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>2:00 p.m. – 4:00 p.m.</td>
<td>Hyatt Regency – Regency A</td>
<td>PELS JESTPE Editorial Board Meeting</td>
</tr>
<tr>
<td></td>
<td>2:00 p.m. – 3:30 p.m.</td>
<td>Hyatt Regency – Seaview A</td>
<td>Humanitarian PE Adhoc</td>
</tr>
<tr>
<td></td>
<td>3:00 p.m. – 4:30 p.m.</td>
<td>Hyatt Regency – Seaview C</td>
<td>PELS Constitution and Bylaws Committee</td>
</tr>
<tr>
<td></td>
<td>6:00 p.m. – 9:30 p.m.</td>
<td>Offsite – The Queen Mary</td>
<td>PELS Administrative Committee Dinner</td>
</tr>
<tr>
<td>Friday, March 25, 2016</td>
<td>8:00 a.m. – 9:00 a.m.</td>
<td>Hyatt Regency – Poolside</td>
<td>PELS Administrative Committee Breakfast (Companions Welcome)</td>
</tr>
<tr>
<td></td>
<td>9:00 a.m. – 3:00 p.m.</td>
<td>Hyatt Regency – Shoreline</td>
<td>PELS Administrative Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>11:30 a.m. – 12:30 p.m.</td>
<td>Hyatt Regency – Poolside</td>
<td>PELS Administrative Committee Lunch (Companions Welcome)</td>
</tr>
<tr>
<td>Saturday, March 19, 2016</td>
<td>7:30 a.m. – 5:00 p.m.</td>
<td>LBCC – Room 202</td>
<td>PSMA/PELS Workshop on High Frequency Magnetics</td>
</tr>
<tr>
<td>Monday, March 21, 2016</td>
<td>7:30 a.m. – 1:00 p.m.</td>
<td>LBCC – Room 202</td>
<td>PSMA Annual Meeting – followed by March BoD Meeting</td>
</tr>
<tr>
<td>Tuesday, March 22, 2016</td>
<td>8:00 a.m. – 10:00 a.m.</td>
<td>Hyatt Regency – Regency E</td>
<td>PSMA Energy Harvesting Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>8:00 a.m. – 10:00 a.m.</td>
<td>Hyatt Regency – Regency F</td>
<td>PSMA Semiconductor Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>10:00 a.m. – 12:00 p.m.</td>
<td>Hyatt Regency – Regency E</td>
<td>PSMA Safety &amp; Compliance Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>12:00 p.m. – 2:00 p.m.</td>
<td>Hyatt Regency – Regency E</td>
<td>PSMA Power Technology Roadmap Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>12:00 p.m. – 2:00 p.m.</td>
<td>Hyatt Regency – Regency F</td>
<td>PSMA Marketing Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>2:00 p.m. – 4:00 p.m.</td>
<td>Hyatt Regency – Regency E</td>
<td>PSMA Packaging Committee Meeting</td>
</tr>
<tr>
<td>Wednesday, March 23, 2016</td>
<td>8:00 a.m. – 10:00 a.m.</td>
<td>Hyatt Regency – Regency E</td>
<td>PSMA Energy Efficiency Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>8:00 a.m. – 10:00 a.m.</td>
<td>Hyatt Regency – Regency F</td>
<td>PSMA Capacitor Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>10:00 a.m. – 12:00 noon.</td>
<td>Hyatt Regency – Regency E</td>
<td>PSMA Magnetics Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>10:00 a.m. – 12:00 noon.</td>
<td>Hyatt Regency – Regency F</td>
<td>PSMA Transportation Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>12:00 p.m. – 1:00 p.m.</td>
<td>Hyatt Regency – Regency E</td>
<td>PSMA Industry-Education Committee Meeting</td>
</tr>
<tr>
<td></td>
<td>1:00 p.m. – 3:00 p.m.</td>
<td>Hyatt Regency – Regency E</td>
<td>PSMA Alternative Energy Committee Meeting</td>
</tr>
</tbody>
</table>
Sunday
March 20, 2016

8:00 a.m. – 9:00 a.m.
Speaker Breakfast
ROOM 201B

8:00 a.m. – 5:00 p.m.
Registration
EXHIBIT HALLS B/C

9:30 a.m. – 1:00 p.m.
Professional Education Seminars
(for detailed information see page 124)

S01: Exceeding 99% Efficiency for PFC and Isolated DC-DC Converters. GaN Versus Silicon
Ionel Jitaru, Rompower Energy Systems Inc., United States
ROOM 104A

S02: The Invisible Schematic: Non-Idealities in Circuit Elements and System Components
Ernest Wittenbreder, Technical Witts, Inc., United States
ROOM 104B

S03: Getting from 48 V to Load Voltage: Improving Low Voltage DC-DC Converter Performance with GaN Transistors
Alex Lidow¹, David Reusch¹, John Glaser¹,
¹Efficient Power Conversion Corporation, United States
ROOM 102AB

S04: A Comprehensive Introduction to Implementing a Fully Digital Power-Factor-Correction Boost Converter
Alex Dumais¹, Joel Steenis¹,
¹Microchip Technology, United States
ROOM 104C

S05: Basic Switching Power Supply Design
Marty Brown, Sierra Energy Management Systems, LLC, United States
ROOM 101A

S06: Solid-State Transformers – Key Design Challenges, Applicability, and Future Concepts
Johann Walter Kolar¹, Jonas Emanuel Huber¹,
¹Power Electronic Systems Laboratory, ETH Zurich, Switzerland
ROOM 103AB

S07: Photovoltaic Modeling and Why It Matters for Power Electronics
Katherine A. Kim¹, Jeehoon Jung¹,
¹Ulsan National Institute of Science and Technology (UNIST), Korea, South
ROOM 101B

2:30 p.m. – 6:00 p.m.
Professional Education Seminars
(for detailed information see page 124)

S08: Stability and Damping of Grid-Connected Voltage-Source Converters
Frede Blaabjerg¹, Xiongfei Wang¹,
¹Aalborg University, Denmark
ROOM 102AB

S09: PMBus™: Review and New Capabilities
Robert White, Embedded Power Labs, United States
ROOM 104A

S10: Wide Bandgap Device Characterization
Fred Wang¹, Zheyu Zhang¹, Edward Jones¹,
¹University of Tennessee, United States
ROOM 104B
Monday
March 21, 2016

7:00 a.m. – 8:00 a.m.
Speaker Breakfast
ROOM 201B

7:30 a.m. – 5:00 p.m.
Registration
EXHIBIT HALLS B/C

8:00 a.m. – 9:00 a.m.
Spouse and Guest Breakfast
PACIFIC ROOM – HYATT REGENCY

8:00 a.m. – 11:00 a.m.
Spouse and Guest Hospitality Room Open
PACIFIC ROOM – HYATT REGENCY

8:30 a.m. – 12:00 p.m.
Professional Education Seminars
(for detailed information see page 124)

S15: Introduction to Fast Analytical Techniques: Application to Small-Signal Modeling
Christophe Basso, ON Semiconductor, France
ROOM 104A

S16: Reliability of Power Electronic Systems
Frede Blaabjerg¹, Francesco Iannuzzo¹, Huai Wang¹, Ke Ma¹, ¹Aalborg University, Denmark
ROOM 102AB

S17: Addressing Challenges in High Power and High Voltage Designs with IGBTs
Vittorio Crisafulli¹, Dhaval Dalal², Tomas Krecek³, Dominic Li², ¹ON Semiconductor, Germany, ²ON Semiconductor, United States, ³ON Semiconductor, Czech Rep.
ROOM 101A

S11: High Performance Digital Control
Hamish Laird, ELMG Digital Power, New Zealand
ROOM 104C

S12: Non-linear Thermal Topics in Semiconductors and Electronics
Roger Stout, ON Semiconductor, United States
ROOM 101A

S13: Power Architectures, Protection and Control of DC Microgrids
Tomislav Dragićević¹, Josep M. Guerrero¹, Lexuan Meng¹, Xiaonan Lu², Juan C. Vasquez³,
¹Aalborg University, Denmark, ²Argonne National Laboratory, United States, ³Virginia Polytechnic Inst. & State Univ. / CPES, United States
ROOM 103AB

S14: Soft Switching Three-Phase Converters or Inverters
Mark Dehong Xu¹, Rui Li², ¹Zhejiang University, China, ²Shanghai Jiaotong University, China
ROOM 101B
S18: A State-Space Design Approach to Digital Feedback Control of DC/DC Converters
Dorin Neacsu, Technical University of Iasi, Romania, Romania
ROOM 101B

S19: How to Go From Si to SiC Components in the Design of Converters Including Safety and EMC
Supratim Basu¹, Tore M. Undeland², ¹Bose Research, India, ²Norwegian University of Science and Technology, Norway
ROOM 103AB

S20: Principles and Practices of Digital Current Regulation for AC Systems
Grahame Holmes, RMIT, Australia
ROOM 104B

S21: Latest Technologies of LLC Converters for High Current, Fast Response, and Wide Input Voltage Range Applications
Yan-Fei Liu, Queen’s University, Canada
ROOM 104C

10:00 a.m.
Spouse and Guest Tour “Docent Estate Tour at the Huntington” departs
PACIFIC ROOM – HYATT REGENCY

1:30 p.m. – 5:00 p.m.
Opening Plenary Session
(for detailed information see page xx)
GRAND BALLROOM

1:30 p.m. – 2:00 p.m.
The Challenges of VHF Power Conversion
Tony Sagneri, Finsix corp

2:00 p.m. – 2:30 p.m.
The Future of Power Electronic Design
Michael Harrison, Enphase Energy

2:30 p.m. – 3:00 p.m.
Breaking Speed Limits with GaN Power ICs
Dan Kinzer, Navitas Semiconductor

3:00 p.m. – 3:30 p.m.
Break

3:30 p.m. – 4:00 p.m.
Residential Nanogrids With Battery Storage – Is This Our Future?
Antonio Ginart, SonnenBatterie

4:00 p.m. – 4:30 p.m.
The Future of Magnetic Design for Power Electronics
Ray Ridley, Ridley Engineering

4:30 p.m. – 5:00 p.m.
Why Do Power Supplies Fail? – A Real-World Analysis
David Hill, Power Clinic

5:00 p.m. – 8:00 p.m.
Exhibit Hall Welcome Reception
EXHIBIT HALLS A/B/C

8:00 p.m. – 10:00 p.m.
MicroMouse Contest
BACK OF EXHIBIT HALL A
Tuesday
March 22, 2016

7:00 a.m. – 8:00 a.m.
**Speaker Breakfast**
GRAND BALLROOM

7:30 a.m. – 5:00 p.m.
**Registration**
EXHIBIT HALLS B/C

8:00 a.m. – 9:00 a.m.
**Spouse and Guest Breakfast**
PACIFIC ROOM – HYATT REGENCY

8:00 a.m. – 11:00 a.m.
**Spouse and Guest Hospitality Room Open**
PACIFIC ROOM – HYATT REGENCY

8:30 a.m. – 11:55 a.m.
**IS01: Aiding Design Excellence**
ROOM 201A

**Session Chairs:**
Ada Cheng, AdaClock
Paul Greenland, eIQ Energy

8:30 a.m. – 8:55 a.m.
**IS01.1: The Role of Patents in Great Designs: Maximize Rewards to Assignee and Inventor**
Louis Burgyan, Yuji Kakizaki, LTEC, United States

8:55 a.m. – 9:20 a.m.
**IS01.2: Developing a Power Engineering Career**
Marty Brown, Sierra Energy Management Systems, United States

9:20 a.m. – 9:45 a.m.
**IS01.3: Fundamentals of Electrical Power Measurements**
Yusuf Chitalwala, Yokogawa Corporation of America, United States

9:45 a.m. – 10:10 a.m.
**IS01.4: Today’s Power Conversion Devices Require a New Generation of Test and Measurement Technology**
Tom Neville, Tektronix, United States

10:40 a.m. – 11:05 a.m.
**IS01.5: Online Power Design Tools: Past, Present and Future**
Surinder Singh, Vinay Jayaram, Jeff Perry, Texas Instruments, United States

11:05 a.m. – 11:30 a.m.
**IS01.6: Part Selection Efficiency & Optimization Aiding Design Excellence**
Randall Restle, Digi-Key Electronics, United States

11:30 a.m. – 11:55 a.m.
**IS01.7: Manufacturing and Reliability Perspective for Design Excellence**
Aurora Craciun, Celestica, United States

8:30 a.m. – 11:55 a.m.
**IS02: 3D Power Packaging**
ROOM 201B

**Session Chairs:**
Brian Narveson, Narveson Innovative Consulting
Ernie Parker, Crane Aerospace & Electronics

8:30 a.m. – 8:55 a.m.
**IS02.1: Additive Manufacturing Technology for Power Electronics Applications**
Madhu Chinthavali, Oakridge National Laboratory, United States

8:55 a.m. – 9:20 a.m.
**IS02.2: Some Progress in Cooling and 3D Packaging for EV/HEV Inverters**
Yunqi Zheng, iPowerPak, United States

9:20 a.m. – 9:45 a.m.
**IS02.3: Embedded Power from POL to Off-Line Applications**
Fred Lee, CPES, Virginia Tech, United States

9:45 a.m. – 10:10 a.m.
**IS02.4: Unmet Challenges of Embedded Components for 3D Packaging**
Arnold Alderman, Anagenesis, Inc., United States

10:40 a.m. – 11:05 a.m.
**IS02.5: Interconnect Reliability — Considerations in Dense Power Packages**
Rick Fishbune, IBM, United States
11:05 a.m. – 11:30 a.m.

**IS02.6:** Integrated Magnetics for PwrSiP and PwrSoc  
Paul McCloskey, Tyndall National Institute, Ireland

11:30 a.m. – 11:55 a.m.

**IS02.7:** Liquid Cooled Transformer Based Power Converters with 3D Printed Micro-Channel Heat Sink  
Ernie Parker, Frank Fan Wang, Crane A&E, United States

---

8:30 a.m. – 11:55 a.m.

**IS03: Smart Products for the Smart Grid**  
ROOM 202AB

**Session Chairs:**  
Edward Herbert, Independent Consultant  
Dusty Becker, Independent

8:30 a.m. – 8:55 a.m.

**IS03.1:** Virtual Power Plants (VPP)  
Alexis Kwasinski, University of Pittsburgh, United States

8:55 a.m. – 9:20 a.m.

**IS03.2:** IIoT in Multi-Utility Smart Grid for Community & Smart City  
Bharat Shah, Satyam Bheemarasetti, Ravi Prasad Patruni, NeoSilica, United States

9:20 a.m. – 9:45 a.m.

**IS03.3:** SmartMeters-Beyond Billing  
Marshall Parsons, Grid Edge Solutions Advanced Technologies, United States

9:45 a.m. – 10:10 a.m.

**IS03.4:** DC Line Interactive Uninterruptible Power Supply (UPS) with Load Leveling  
Robert Cuzner¹, Ahmad Hamidi², Adel Nasiri²,  
¹University of Wisconsin, Madison, United States,  
²University of Wisconsin-Milwaukee, United States

10:40 a.m. – 11:05 a.m.

**IS03.5:** Advanced Control of PV Grid Connected Converters Through the Implementation of the Synchronous Power Controller Concept  
Pedro Rodriguez, Abengoa, Spain

11:05 a.m. – 11:30 a.m.

**IS03.6:** Voltage and VAR Regulation  
John Berdner, Enphase Energy, United States

11:30 a.m. – 11:55 a.m.

**IS03.7:** Fault Tolerance and Healing  
Alexis Kwasinski, University of Pittsburgh, United States

---

8:30 a.m. – 11:55 a.m.

**IS04: Wide Bandgap Semiconductors**  
ROOM 203AB

**Session Chairs:**  
Dennis Stephens, Continental Automotive Systems  
Odile Ronat, International Rectifier HiRel

8:30 a.m. – 8:55 a.m.

**IS04.1:** SiC Solution for Industrial Auxiliary Power Supplies  
Mitch Van Ochten, ROHM Semiconductor, United States

8:55 a.m. – 9:20 a.m.

**IS04.2:** An Industry First: Silicon Carbide Based Intelligent Power Module  
Nitesh Satheesh, Adam Fender, Albert Charpentier, AgileSwitch, LLC, United States

9:20 a.m. – 9:45 a.m.

**IS04.3:** Ultra-Wide-Bandgap Semiconductors for Generation-After-Next Power Electronics  
Robert Kaplar¹, Andrew Armstrong¹, Arthur Fischer¹, Albert Baca¹, Andrew Allerman¹, Daniel Mauch¹, Fred Zutavern¹, Michael King¹, Jack Flicker¹, Robert Brocato¹, Lee Rashkin¹, Jarod Delhotal¹, Lu Fang¹, Isik Kizilyalli², Ozgur Aktas², Jason Neely¹, ¹Sandia National Labs, United States, ²Avogy Inc., United States

9:45 a.m. – 10:10 a.m.

**IS04.4:** Application-Relevant Qualification of Emerging Semiconductor Power Devices  
Sandeep Bahl, Grant Smith, Texas Instruments, United States

10:40 a.m. – 11:05 a.m.

**IS04.5:** Introducing eGaN® IC Targeting Highly Resonant Wireless Power  
Michael de Rooij, Efficient Power Conversion, United States

11:05 a.m. – 11:30 a.m.

**IS04.6:** Scaling Power Electronic Converter SWaP Based on WBG and UWBG Device Characteristics  
Jason Neely, Jarod Delhotal, Robert Kaplar, Jack Flicker, Lee Rashkin, Sandia National Labs, United States

11:30 a.m. – 11:55 a.m.

**IS04.7:** GaN Takes Server Power Supplies’ Power Density to New Heights  
Jason Cuadra, Transphorm, Inc., United States
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 a.m. – 12:00 p.m.</td>
<td><strong>T01: Three-Phase AC-DC Converters</strong>&lt;br&gt;ROOM 101A&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;<strong>Track: AC-DC Converters</strong>&lt;br&gt;&lt;br&gt;<strong>Session Chairs:</strong>&lt;br&gt;Gerry Moschopoulos, Western University, Canada&lt;br&gt;Patrick Wheeler, University of Nottingham</td>
</tr>
<tr>
<td>8:30 a.m. – 12:00 p.m.</td>
<td><strong>T02: High Frequency and Fast-Response DC-DC Converters</strong>&lt;br&gt;ROOM 104A&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;<strong>Track: DC-DC Converters</strong>&lt;br&gt;&lt;br&gt;<strong>Session Chairs:</strong>&lt;br&gt;Olivier Trescases, University of Toronto&lt;br&gt;Jeff Nilles, Texas Instruments</td>
</tr>
<tr>
<td>10:40 a.m. – 11:00 a.m.</td>
<td><strong>T01.6: Analysis, Design, and Evaluation of Three-Phase Three-Wire Isolated AC-DC Converter Implemented with Three Single-Phase Converter Modules</strong>&lt;br&gt;Laszlo Huber, Misha Kumar, Milan Jovanovic, Dinggang Ping, Gang Liu, Delta Electronics Shanghai Co., Ltd., China</td>
</tr>
<tr>
<td>11:00 a.m. – 11:20 a.m.</td>
<td><strong>T01.7: Startup Procedure for Three-Phase Three-Wire Isolated AC-DC Converter Implemented with Three Single-Phase Converter Modules</strong>&lt;br&gt;Misha Kumar, Laszlo Huber, Milan Jovanovic, Dinggang Ping, Gang Liu, Delta Electronics Shanghai Co., Ltd., China</td>
</tr>
<tr>
<td>11:20 a.m. – 12:00 p.m.</td>
<td><strong>T01.8: Control of a Single-Stage Three-Phase Boost Power Factor Correction Rectifier</strong>&lt;br&gt;Ayan Mallik, Bryan Faulkner, Alireza Khaligh, University of Maryland, United States</td>
</tr>
<tr>
<td>8:30 a.m. – 12:00 p.m.</td>
<td><strong>T01: Three-Phase AC-DC Converters</strong>&lt;br&gt;ROOM 101A&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;<strong>Track: AC-DC Converters</strong>&lt;br&gt;&lt;br&gt;<strong>Session Chairs:</strong>&lt;br&gt;Gerry Moschopoulos, Western University, Canada&lt;br&gt;Patrick Wheeler, University of Nottingham</td>
</tr>
<tr>
<td>8:30 a.m. – 12:00 p.m.</td>
<td><strong>T02: High Frequency and Fast-Response DC-DC Converters</strong>&lt;br&gt;ROOM 104A&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;<strong>Track: DC-DC Converters</strong>&lt;br&gt;&lt;br&gt;<strong>Session Chairs:</strong>&lt;br&gt;Olivier Trescases, University of Toronto&lt;br&gt;Jeff Nilles, Texas Instruments</td>
</tr>
<tr>
<td>8:30 a.m. – 8:50 a.m.</td>
<td><strong>T01.1: Hardware Implementation and Characterization of SiC-Based Hybrid Three-Phase Rectifier Employing Third Harmonic Injection</strong>&lt;br&gt;Markus Makoschitz¹, Michael Hartmann², Hans Ertl¹, Technische Universität Wien, Austria, Schneider Electric SE, Austria</td>
</tr>
<tr>
<td>8:50 a.m. – 9:10 a.m.</td>
<td><strong>T01.2: Voltage Oriented Control of the Three-Level Vienna Rectifier Using Vector Control Method</strong>&lt;br&gt;Jeevan Adhikari, Prasanna IV, Sanjib Kumar Panda, National University of Singapore, Singapore</td>
</tr>
<tr>
<td>9:10 a.m. – 9:30 a.m.</td>
<td><strong>T01.3: Compensation of Neutral Point Deviation in 3-Level NPC Converter Under Unbalanced Grid Conditions</strong>&lt;br&gt;Kyungsub Jung, Yongsug Suh, Chungbuk National University, Korea, South</td>
</tr>
<tr>
<td>9:30 a.m. – 9:50 a.m.</td>
<td><strong>T01.4: High Power Factor Modular Polyphase AC/DC Converters with Galvanic Isolation Based on Resistor Emulators</strong>&lt;br&gt;Javier Sebastián, Ignacio Castro, Diego G. Lamar, Aitor Vázquez, Kevin Martín, Universidad de Oviedo, Spain</td>
</tr>
<tr>
<td>9:50 a.m. – 10:10 a.m.</td>
<td><strong>T01.5: Reduced Duty-Cycle Loss and Output Inductor Current Ripple in a ZVS Switched Three-Phase Isolated PWM Rectifier</strong>&lt;br&gt;Jahangir Afsharian¹, Dewei David Xu¹, Tao Zhao², Bing Gong³, Zhihua Yang³, Ryerson University, Canada, Hefei University of Technology, China, Murata Power Solution, Canada</td>
</tr>
<tr>
<td>10:40 a.m. – 11:00 a.m.</td>
<td><strong>T01.6: Analysis, Design, and Evaluation of Three-Phase Three-Wire Isolated AC-DC Converter Implemented with Three Single-Phase Converter Modules</strong>&lt;br&gt;Laszlo Huber, Misha Kumar, Milan Jovanovic, Dinggang Ping, Gang Liu, Delta Electronics Shanghai Co., Ltd., China</td>
</tr>
<tr>
<td>11:00 a.m. – 11:20 a.m.</td>
<td><strong>T01.7: Startup Procedure for Three-Phase Three-Wire Isolated AC-DC Converter Implemented with Three Single-Phase Converter Modules</strong>&lt;br&gt;Misha Kumar, Laszlo Huber, Milan Jovanovic, Dinggang Ping, Gang Liu, Delta Electronics Shanghai Co., Ltd., China</td>
</tr>
<tr>
<td>11:20 a.m. – 12:00 p.m.</td>
<td><strong>T01.8: Control of a Single-Stage Three-Phase Boost Power Factor Correction Rectifier</strong>&lt;br&gt;Ayan Mallik, Bryan Faulkner, Alireza Khaligh, University of Maryland, United States</td>
</tr>
<tr>
<td>8:30 a.m. – 12:00 p.m.</td>
<td><strong>T01: Three-Phase AC-DC Converters</strong>&lt;br&gt;ROOM 101A&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;<strong>Track: AC-DC Converters</strong>&lt;br&gt;&lt;br&gt;<strong>Session Chairs:</strong>&lt;br&gt;Gerry Moschopoulos, Western University, Canada&lt;br&gt;Patrick Wheeler, University of Nottingham</td>
</tr>
<tr>
<td>8:30 a.m. – 12:00 p.m.</td>
<td><strong>T02: High Frequency and Fast-Response DC-DC Converters</strong>&lt;br&gt;ROOM 104A&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;<strong>Track: DC-DC Converters</strong>&lt;br&gt;&lt;br&gt;<strong>Session Chairs:</strong>&lt;br&gt;Olivier Trescases, University of Toronto&lt;br&gt;Jeff Nilles, Texas Instruments</td>
</tr>
<tr>
<td>8:30 a.m. – 8:50 a.m.</td>
<td><strong>T01.1: Hardware Implementation and Characterization of SiC-Based Hybrid Three-Phase Rectifier Employing Third Harmonic Injection</strong>&lt;br&gt;Markus Makoschitz¹, Michael Hartmann², Hans Ertl¹, Technische Universität Wien, Austria, Schneider Electric SE, Austria</td>
</tr>
<tr>
<td>8:50 a.m. – 9:10 a.m.</td>
<td><strong>T01.2: Voltage Oriented Control of the Three-Level Vienna Rectifier Using Vector Control Method</strong>&lt;br&gt;Jeevan Adhikari, Prasanna IV, Sanjib Kumar Panda, National University of Singapore, Singapore</td>
</tr>
<tr>
<td>9:10 a.m. – 9:30 a.m.</td>
<td><strong>T01.3: Compensation of Neutral Point Deviation in 3-Level NPC Converter Under Unbalanced Grid Conditions</strong>&lt;br&gt;Kyungsub Jung, Yongsug Suh, Chungbuk National University, Korea, South</td>
</tr>
<tr>
<td>9:30 a.m. – 9:50 a.m.</td>
<td><strong>T01.4: High Power Factor Modular Polyphase AC/DC Converters with Galvanic Isolation Based on Resistor Emulators</strong>&lt;br&gt;Javier Sebastián, Ignacio Castro, Diego G. Lamar, Aitor Vázquez, Kevin Martín, Universidad de Oviedo, Spain</td>
</tr>
<tr>
<td>9:50 a.m. – 10:10 a.m.</td>
<td><strong>T01.5: Reduced Duty-Cycle Loss and Output Inductor Current Ripple in a ZVS Switched Three-Phase Isolated PWM Rectifier</strong>&lt;br&gt;Jahangir Afsharian¹, Dewei David Xu¹, Tao Zhao², Bing Gong³, Zhihua Yang³, Ryerson University, Canada, Hefei University of Technology, China, Murata Power Solution, Canada</td>
</tr>
<tr>
<td>10:40 a.m. – 11:00 a.m.</td>
<td><strong>T01.6: Analysis, Design, and Evaluation of Three-Phase Three-Wire Isolated AC-DC Converter Implemented with Three Single-Phase Converter Modules</strong>&lt;br&gt;Laszlo Huber, Misha Kumar, Milan Jovanovic, Dinggang Ping, Gang Liu, Delta Electronics Shanghai Co., Ltd., China</td>
</tr>
<tr>
<td>11:00 a.m. – 11:20 a.m.</td>
<td><strong>T01.7: Startup Procedure for Three-Phase Three-Wire Isolated AC-DC Converter Implemented with Three Single-Phase Converter Modules</strong>&lt;br&gt;Misha Kumar, Laszlo Huber, Milan Jovanovic, Dinggang Ping, Gang Liu, Delta Electronics Shanghai Co., Ltd., China</td>
</tr>
<tr>
<td>11:20 a.m. – 12:00 p.m.</td>
<td><strong>T01.8: Control of a Single-Stage Three-Phase Boost Power Factor Correction Rectifier</strong>&lt;br&gt;Ayan Mallik, Bryan Faulkner, Alireza Khaligh, University of Maryland, United States</td>
</tr>
<tr>
<td>8:30 a.m. – 12:00 p.m.</td>
<td><strong>T01: Three-Phase AC-DC Converters</strong>&lt;br&gt;ROOM 101A&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;<strong>Track: AC-DC Converters</strong>&lt;br&gt;&lt;br&gt;<strong>Session Chairs:</strong>&lt;br&gt;Gerry Moschopoulos, Western University, Canada&lt;br&gt;Patrick Wheeler, University of Nottingham</td>
</tr>
<tr>
<td>8:30 a.m. – 12:00 p.m.</td>
<td><strong>T02: High Frequency and Fast-Response DC-DC Converters</strong>&lt;br&gt;ROOM 104A&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;&lt;br&gt;<strong>Track: DC-DC Converters</strong>&lt;br&gt;&lt;br&gt;<strong>Session Chairs:</strong>&lt;br&gt;Olivier Trescases, University of Toronto&lt;br&gt;Jeff Nilles, Texas Instruments</td>
</tr>
<tr>
<td>8:30 a.m. – 8:50 a.m.</td>
<td><strong>T01.1: Hardware Implementation and Characterization of SiC-Based Hybrid Three-Phase Rectifier Employing Third Harmonic Injection</strong>&lt;br&gt;Markus Makoschitz¹, Michael Hartmann², Hans Ertl¹, Technische Universität Wien, Austria, Schneider Electric SE, Austria</td>
</tr>
<tr>
<td>8:50 a.m. – 9:10 a.m.</td>
<td><strong>T01.2: Voltage Oriented Control of the Three-Level Vienna Rectifier Using Vector Control Method</strong>&lt;br&gt;Jeevan Adhikari, Prasanna IV, Sanjib Kumar Panda, National University of Singapore, Singapore</td>
</tr>
<tr>
<td>9:10 a.m. – 9:30 a.m.</td>
<td><strong>T01.3: Compensation of Neutral Point Deviation in 3-Level NPC Converter Under Unbalanced Grid Conditions</strong>&lt;br&gt;Kyungsub Jung, Yongsug Suh, Chungbuk National University, Korea, South</td>
</tr>
<tr>
<td>9:30 a.m. – 9:50 a.m.</td>
<td><strong>T01.4: High Power Factor Modular Polyphase AC/DC Converters with Galvanic Isolation Based on Resistor Emulators</strong>&lt;br&gt;Javier Sebastián, Ignacio Castro, Diego G. Lamar, Aitor Vázquez, Kevin Martín, Universidad de Oviedo, Spain</td>
</tr>
<tr>
<td>9:50 a.m. – 10:10 a.m.</td>
<td><strong>T01.5: Reduced Duty-Cycle Loss and Output Inductor Current Ripple in a ZVS Switched Three-Phase Isolated PWM Rectifier</strong>&lt;br&gt;Jahangir Afsharian¹, Dewei David Xu¹, Tao Zhao², Bing Gong³, Zhihua Yang³, Ryerson University, Canada, Hefei University of Technology, China, Murata Power Solution, Canada</td>
</tr>
</tbody>
</table>
8:50 a.m. – 9:10 a.m.

**T02.2:** A 10-MHz Isolated Class-Phi2 Synchronous Resonant DC-DC Converter
Yuan Zhou, Zhiliang Zhang, Xuwen Zou, Zhou Dong, Xiaoyong Ren, Nanjing University of Aeronautics and Astronautics, China

9:10 a.m. – 9:30 a.m.

**T02.3:** 865 MHz Switching-Speed Step-Down DC-DC Power Converter for Envelope Tracking
Vivek Mehrotra, Andrea Arias, Joshua Bergman, Charles Neft, Miguel Urteaga, Berinder Brar, Teledyne Scientific Company, United States

9:30 a.m. – 9:50 a.m.

**T02.4:** Current Parking Regulator for Zero Droop/Overshoot Load Transient Response
Sudhir Kudva, William Dally, Thomas Greer III, Carl Thomas Gray, Nvidia Corporation, United States

9:50 a.m. – 10:10 a.m.

**T02.5:** A 5MHz, 24V-to-1.2V, AO2T Current Mode Buck Converter with One-Cycle Transient Response and Sensorless Current Detection for Medical Meters
Xugang Ke¹, Joseph Sankman², Dongsheng Ma¹, ¹University of Texas at Dallas, United States, ²Texas Instruments Inc., United States

10:40 a.m. – 11:00 a.m.

**T02.6:** Capacitively-Aided Switching Technique for High-Frequency Isolated Bus Converters
Seungbum Lim, Alex Hanson, Juan Santiago-González, David Perreault, Massachusetts Institute of Technology, United States

11:00 a.m. – 11:20 a.m.

**T02.7:** A 10 MHz, 48-to-5V Synchronous Converter with Dead Time Enabled 125 Ps Resolution Zero-Voltage Switching
Alexander Barner¹, Jürgen Wittmann², Thoralf Rosahl¹, Bernhard Wicht², ¹Robert Bosch GmbH, Germany, ²Hochschule Reutlingen, Germany

11:20 a.m. – 11:40 a.m.

**T02.8:** Plug-and-Play Electronic Capacitor for VRM Applications
Or Kirshenboim, Alon Cervera, Bar Halivni, Eli Abramov, Mor Mordechai Peretz, Ben-Gurion University of the Negev, Israel

11:40 a.m. – 12:00 p.m.

**T02.9:** Adaptive Voltage Positioning (AVP) Design of Multi-Phase Constant on-Time I² Control for Voltage Regulators with Ramp Compensations
Kuang-Yao Cheng, Yipeng Su, Texas Instruments Inc., United States

8:30 a.m. – 12:00 p.m.

**T03: Microgrids and Hybrid Systems**
ROOM 104B

**Track: Power Electronics for Utility Interface**

**SESSION CHAIRS:**
Yunwei Li, University of Alberta
Josep Guerorro, Aalborg University in Denmark

8:30 a.m. – 8:50 a.m.

**T03.1:** Reactive Power Support Capabilities of Nonsynchronous Interconnection Systems in Microgrid Applications
Yong-Duk Lee, Sung-Yeul Park, University of Connecticut, United States

8:50 a.m. – 9:10 a.m.

**T03.2:** Zero Standby Power High Efficiency Hot Plugging Outlet for 380VDC Power Delivery System
Kai Tan, Chang Peng, Pengkun Liu, Xiaqing Song, Alex. Q Huang, North Carolina State University, United States

9:10 a.m. – 9:30 a.m.

**T03.3:** Design of Control System for Smooth Mode Transfer in Smart Microgrid Application
Mingzhi Gao¹, Canhui Zhang¹, Maohang Qiu¹, Min Chen¹, Aron Levy², ¹Zhejiang University, China, ²Technology Dynamics Inc., United States

9:30 a.m. – 9:50 a.m.

**T03.4:** Resonance Propagation Modeling and Analysis of AC Filters in a Large-Scale Microgrid
Yusi Liu, Chris Farnell, Alan Mantooth, Juan Carlos Balda, Roy McCann, Cheng Deng, University of Arkansas, United States

9:50 a.m. – 10:10 a.m.

**T03.5:** A New Bidirectional DC-DC Converter for Fuel Cell, Solar Cell and Battery Systems
Ankur Patel, Vicor Corporation, United States
10:40 a.m. – 11:00 a.m.  
**T04.6: Addressing the Unbalance Loading Issue in Multi-Drive Systems with a DC-Link Modulation Scheme for Harmonic Reduction**  
Yongheng Yang¹, Pooya Davari¹, Firuz Zare², Frede Blaabjerg¹, ¹Aalborg University, Denmark, ²Danfoss Power Electronics A/S, Denmark

9:10 a.m. – 9:30 a.m.  
**T04.3: Synchronization Strategies in Cascaded H-Bridge Multi Level Inverters for Carrier Based Sinusoidal PWM Techniques**  
Saroj Kumar Sahoo, Tanmoy Bhattacharya, Indian Institute of Technology Kharagpur, India

9:30 a.m. – 9:50 a.m.  
**T04.4: Design and Implementation of a Sinusoidal Flux Controller for Core Loss Measurements**  
Burak Tekgung, Ali Boymugri, Asif Chowdhury, Yilmaz Sozer, University of Akron, United States

9:50 a.m. – 10:10 a.m.  
**T04.5: Implementation of Deadbeat-Direct Torque and Flux Control for Synchronous Reluctance Machines to Minimize Loss Each Switching Period**  
Michael Saur¹, Francisco Ramos¹, Aday Perez¹, Dieter Gerling³, Robert Lorenz², ¹Universität der Bundeswehr München, Germany, ²University of Wisconsin-Madison, United States

10:40 a.m. – 11:00 a.m.  
**T03.6: A Multiport Isolated DC-DC Converter**  
Yan-Kim Tran, Drazen Dujic, École Polytechnique Fédérale de Lausanne, Switzerland

11:00 a.m. – 11:20 a.m.  
**T03.7: A Seamless Transfer Control Method with High Load Sharing Performance for Modular ESS**  
Jung-Hoon Ahn¹, Won-Yong Sung¹, Chang-Yeol Oh¹, Byoung-Kuk Lee¹, Yun-Sung Kim², ¹Sungkyunkwan University, Korea, South, ²Donghaelecomm Corporation, Korea, South

11:00 a.m. – 11:20 a.m.  
**T04.7: Input Current Interharmonics in Adjustable Speed Drives Caused by Fixed-Frequency Modulation Techniques**  
Hamid Soltani¹, Pooya Davari¹, Poh Chiang Loh¹, Frede Blaabjerg¹, ¹Aalborg University, Denmark, ²Danfoss Power Electronics A/S, Denmark

11:20 a.m. – 11:40 a.m.  
**T03.8: A Plug-and-Play Ripple Mitigation Approach for DC-Links in Hybrid Systems**  
Sinan Li, Albert Ting Leung Lee, Siew-Chong Tan, Shu Yuen Ron Hui, University of Hong Kong, Hong Kong

11:40 a.m. – 12:00 p.m.  
**T03.9: Active Control of Low Frequency Common Mode Voltage to Connect AC Utility and 380 V DC Grid**  
Fang Chen, Rolando Burgos, Dushan Boroyevich, Xuning Zhang, Virginia Polytechnic Institute and State University, United States

8:30 a.m. – 12:00 p.m.  
**T04: Control Strategies for Inverters and Motor Drives**  
ROOM 103C

**Track: Motor Drives and Inverters**

**Session Chairs:**  
Bilal Akin, University of Texas, Dallas  
Babak Nahid-Mobarakeh, University of Lorraine

8:30 a.m. – 8:50 a.m.  
**T04.1: A Three-Level Space Vector Modulation Scheme for Paralleled Two Converters to Reduce Zero-Sequence Circulating Current and Common Mode Voltage**  
Zhongyi Quan, Yunwei Li, University of Alberta, Canada

8:50 a.m. – 9:10 a.m.  
**T04.2: Nonlinearity Analysis and Linear Modulation Method for Two Level Voltage Source Inverter with Low Switching to Operating Frequency Ratio**  
Yongjae Lee, Jung-Ik Ha, Seoul National University, Korea, South

9:10 a.m. – 9:30 a.m.  
**T04.3: Synchronization Strategies in Cascaded H-Bridge Multi Level Inverters for Carrier Based Sinusoidal PWM Techniques**  
Saroj Kumar Sahoo, Tanmoy Bhattacharya, Indian Institute of Technology Kharagpur, India

9:30 a.m. – 9:50 a.m.  
**T04.4: Design and Implementation of a Sinusoidal Flux Controller for Core Loss Measurements**  
Burak Tekgung, Ali Boymugri, Asif Chowdhury, Yilmaz Sozer, University of Akron, United States

9:50 a.m. – 10:10 a.m.  
**T04.5: Implementation of Deadbeat-Direct Torque and Flux Control for Synchronous Reluctance Machines to Minimize Loss Each Switching Period**  
Michael Saur¹, Francisco Ramos¹, Aday Perez¹, Dieter Gerling³, Robert Lorenz², ¹Universität der Bundeswehr München, Germany, ²University of Wisconsin-Madison, United States

10:40 a.m. – 11:00 a.m.  
**T04.6: Addressing the Unbalance Loading Issue in Multi-Drive Systems with a DC-Link Modulation Scheme for Harmonic Reduction**  
Yongheng Yang¹, Pooya Davari¹, Firuz Zare², Frede Blaabjerg¹, ¹Aalborg University, Denmark, ²Danfoss Power Electronics A/S, Denmark

11:00 a.m. – 11:20 a.m.  
**T04.7: Input Current Interharmonics in Adjustable Speed Drives Caused by Fixed-Frequency Modulation Techniques**  
Hamid Soltani¹, Pooya Davari¹, Poh Chiang Loh¹, Frede Blaabjerg¹, Firuz Zare², ¹Aalborg University, Denmark, ²Danfoss Power Electronics A/S, Denmark

11:20 a.m. – 11:40 a.m.  
**T04.8: Low-Frequency Voltage Ripples in the Flying Capacitors of the Nested Neutral-Point-Clamped Converter**  
Amer Ghias¹, Josep Pou², Salvador Ceballos³, Vassilios Agelidis², ¹University of Sharjah, U.A.E., ²University of New South Wales, Australia, ³TECNALIA, Spain

11:40 a.m. – 12:00 p.m.  
**T04.9: DC Bus Capacitor Discharge of Permanent Magnet Synchronous Machine Drive Systems for Hybrid Electric Vehicles**  
Ziwei Ke¹, Julia Zhang¹, Michael Degner², ¹Oregon State University, United States, ²Ford Motor Company, United States

8:30 a.m. – 12:00 p.m.  
**T04: Control Strategies for Inverters and Motor Drives**  
ROOM 103C

**Track: Motor Drives and Inverters**

**Session Chairs:**  
Bilal Akin, University of Texas, Dallas  
Babak Nahid-Mobarakeh, University of Lorraine

8:30 a.m. – 8:50 a.m.  
**T04.1: A Three-Level Space Vector Modulation Scheme for Paralleled Two Converters to Reduce Zero-Sequence Circulating Current and Common Mode Voltage**  
Zhongyi Quan, Yunwei Li, University of Alberta, Canada

8:50 a.m. – 9:10 a.m.  
**T04.2: Nonlinearity Analysis and Linear Modulation Method for Two Level Voltage Source Inverter with Low Switching to Operating Frequency Ratio**  
Yongjae Lee, Jung-Ik Ha, Seoul National University, Korea, South
8:30 a.m. – 12:00 p.m.

T05: Si Devices and Power Module Packaging
ROOM 101B

**Track: Devices and Components**

**Session Chairs:**
Iulian Nistor, Corporate Research, ABB Inc.
Brian Rowden, GE Global Research

---

8:30 a.m. – 8:50 a.m.

**T05.1: Coss Hysteresis in Advanced Superjunction MOSFETs**
Jeff Fedison, Michael Harrison, Enphase Energy, Inc., United States

8:50 a.m. – 9:10 a.m.

**T05.2: Compact Electrothermal Models for Unbalanced Parallel Conducting Si-IGBTs**
Roozbeh Bonyadi, Olayiwola Alatise, Ji Hu, Zaria Davletzhanova, Yeganeh Bonyadi, Jose Ortiz-Gonzalez, Li Ran, Philip Mawby, University of Warwick, United Kingdom

9:10 a.m. – 9:30 a.m.

**T05.3: General 3D Lumped Thermal Model with Various Boundary Conditions for High Power IGBT Modules**
Amir Sajjad Bahman, Ke Ma, Frede Blaabjerg, Aalborg University, Denmark

9:30 a.m. – 9:50 a.m.

**T05.4: Improved 6.5kV FREEMD-Pair Based on SiC JFET and Si IGBT**
Xiaoqing Song, Alex. Q Huang, Chang Peng, Liqi Zhang, North Carolina State University, United States

9:50 a.m. – 10:10 a.m.

**T05.5: On the Comparative Assessment of 1.7 kV, 300 a Full SiC-MOSFET and Si-IGBT Power Modules**
Muhammad Nawaz, Kalle Iives, ABB Corporate Research, Sweden

10:40 a.m. – 11:00 a.m.

**T05.6: Suppression of Reverse Recovery Ringing 3.3kV/450A Si/SiC Hybrid in Low Internal Inductance Package Next High Power Density Dual, nHPD2**
Katsuaki Saito¹, Daisuke Kawase², Masamitsu Inaba³, Keiichi Yamamoto³, Katsunori Azuma³, Seiichi Hayakawa³, ¹Hitachi Europe Ltd., United Kingdom, ²Hitachi Power Semiconductor Device, Ltd.,

---

11:00 a.m. – 11:20 a.m.

**T05.7: New Layout Concepts in MW-Scale IGBT Modules for Higher Robustness During Normal and Abnormal Operations**
Paula Diaz Reigosa, Francesco Iannuzzo, Stig Munk-Nielsen, Frede Blaabjerg, Aalborg University, Denmark

11:20 a.m. – 12:00 p.m.

**T05.8: Design, Package, and Hardware Verification of a High Voltage Current Switch**
Ankan De, Adam Morgan, Vishnu Mahadeva Iyer, Haotao Ke, Xin Zhao, Kasunaidu Vechalapu, Subhashish Bhattacharya, Douglas C. Hopkins, North Carolina State University, United States

---

8:30 a.m. – 12:00 p.m.

T06: DC-DC Converter Control
ROOM 102AB

**Track: Control**

**Session Chairs:**
Sombuddha Chakraborty, Texas Instruments
Rafael Pena Alzola, University of British Columbia

---

8:30 a.m. – 8:50 a.m.

**T06.1: Closed-Loop Design and Time-Optimal Control for a Series-Capacitor Buck Converter**
Timur Vekslender, Ofer Ezra, Yevgeny Bezdenezhnykh, Mor Mordechai Peretz, Ben-Gurion University of the Negev, Israel

8:50 a.m. – 9:10 a.m.

**T06.2: Unified Constant On/Off-Time Hybrid Compensation for Fast Recovery in Digitally Current-Mode Controlled Point-of-Load Converters**
K Hariharan, Santanu Kapat, Siddhartha Mukhopadhyay, Indian Institute of Technology Kharagpur, India

---

8:50 a.m. – 9:10 a.m.

**T06.3: Closed-Loop Design and Time-Optimal Control for a Series-Capacitor Buck Converter**
Timur Vekslender, Ofer Ezra, Yevgeny Bezdenezhnykh, Mor Mordechai Peretz, Ben-Gurion University of the Negev, Israel

---

11:20 a.m. – 12:00 p.m.

**T06.4: Design, Package, and Hardware Verification of a High Voltage Current Switch**
Ankan De, Adam Morgan, Vishnu Mahadeva Iyer, Haotao Ke, Xin Zhao, Kasunaidu Vechalapu, Subhashish Bhattacharya, Douglas C. Hopkins, North Carolina State University, United States
8:30 a.m. – 12:00 p.m.

**T07: Solar Energy Systems**

**ROOM 104C**

**Track: Renewable Energy Systems**

**Session Chairs:**

Babak Fahimi, *University of Texas, Dallas*

Morgan Kiani, *Texas Christian University*

---

**T07.1: Analysis, Modeling and Control of an Interleaved Isolated Boost Series Resonant Converter for Microinverter Applications**

Luciano Garcia-Rodriguez¹, Cheng Deng¹, Juan Carlos Balda¹, Andres Escobar-Mejia²,

¹University of Arkansas, United States,

²Universidad Tecnologica de Pereira, Colombia

---


Ariya Sangwongwanich, Yongheng Yang, Frede Blaabjerg, Huai Wang, *Aalborg University, Denmark*

---

**T07.3: Advanced Slip Mode Frequency Shift Islanding Detection Method for Single Phase Grid Connected PV Inverters**

Bahador Mohammadpour, Majid Pahlevani, Sajjad Makhdoomi Kaviri, Praveen Jain,

*Queen’s University, Canada*

---

**T07.4: Direct MPPT Control of PWM Converters for Extreme Transient PV Applications**

Ignacio Galiano Zurbriggen, Francisco Paz, Martin Ordonez, *University of British Columbia, Canada*

---

**T07.5: Feeding Partial Power Into Line Capacitors for Low Cost and Efficient MPPT of Photovoltaic Strings**

Ali Elrayyah¹, Mohammed Badawey², Yilmaz Sozer³, ¹Qatar Environment and Energy Institute, Qatar,

²University of Akron, United States,

³Yanshan University, China,

⁴Aalborg University, Denmark

---

**T07.6: Single Phase Cascaded H5 Inverter with Leakage Current Elimination for Transformerless Photovoltaic System**

Xiaoqiang Guo¹, Xiaoyu Jia¹, Zhigang Lu¹, Josep Maria Guerrero², ¹Qatar Environment and Energy Institute, Qatar,

²Aalborg University, Denmark
11:00 a.m. – 11:20 a.m.

**T07.7:** Optimal Low Switching Frequency Pulse Width Modulation of Current-Fed Three-Level Inverter for Solar Integration
Gnana Sambandam Kulothungan, Akshay Kumar Rathore, Amarendra Edpuganti, Dipti Srinivasan, National University of Singapore, Singapore

11:20 a.m. – 11:40 a.m.

**T07.8:** Low Leakage Current Single-Phase PV Inverters with Universal Neutral-Point-Clamping Method
Liwei Zhou, Feng Gao, Shandong University, China

11:40 a.m. – 12:00 p.m.

**T07.9:** Modular Subpanel Photovoltaic Converter System: Analysis and Control
Yuan Li¹, Yue Zheng², Su Sheng², Brad Scandrett³, Brad Lehman², ¹Sichuan University/Northeastern University, China, ²Northeastern University, United States, ³Powerfilm, United States

---

**TUESDAY**

8:30 a.m. – 12:00 p.m.

**T08:** Advanced Converter for Power Systems used in Transportation
ROOM 103AB

**Track: Transportation Power Electronics**

**Session Chairs:**
Omer Onar, Oak Ridge National Laboratory
Khurram Afridi, University of Colorado, Boulder

8:30 a.m. – 8:50 a.m.

**T08.1:** Integrated DC-DC Converter Design for Electric Vehicle Powertrains
Saeed Anwar, Weimin Zhang, Fred Wang, Daniel Jes Costinett, University of Tennessee, United States

8:50 a.m. – 9:10 a.m.

**T08.2:** A 1 MHz Bi-Directional Soft-Switching DC-DC Converter with Planar Coupled Inductor for Dual Voltage Automotive Systems
Chenhao Nan, Raja Ayyanar, Arizona State University, United States

9:10 a.m. – 9:30 a.m.

**T08.3:** A Bridgeless Totem-Pole Interleaved PFC Converter for Plug-in Electric Vehicles
Yichao Tang, Weisheng Ding, Alireza Khaligh, University of Maryland, United States

9:30 a.m. – 9:50 a.m.

**T08.4:** Stability Analysis of Hybrid AC/DC Power Systems for More Electric Aircraft
Mehdi Karbalaye Zadeh¹, Roghayeh Gavagsaz-Ghoachani², Babak Nahid-Mobarakeh³, Serge Pierfederici⁴, Marta Molinas¹, ¹Norwegian University of Science and Technology, Norway, ²Université de Lorraine, France

9:50 a.m. – 10:10 a.m.

**T08.5:** On the Concept of the Multi-Source Inverter
Lea Dorn-Gomba, Pierre Magne, Clement Barthelmebs, Ali Emadi, McMaster University, Canada

10:40 a.m. – 11:00 a.m.

**T08.6:** Time-Domain Analysis of a Wide-DC-Range Series Resonant Dual-Active-Bridge Bidirectional Converter with a New Passive Auxiliary Circuit
Alireza Safaei, Praveen Jain, Alireza Bakhshai, Queen’s University, Canada

11:00 a.m. – 11:20 a.m.

**T08.7:** A New High Capacity Compact Power Modules for High Power EV/HEV Inverters
Seiichiro Inokuchi, Mitsubishi Electric Corporation, Japan
Shoji Saito¹, Arata Izuka¹, Yuki Hata¹, Shinji Hatae¹, Toshiya Nakano², Eric R. Motto², ¹Mitsubishi Electric Corporation, Japan, ²Powerex, Inc., United States

11:20 a.m. – 11:40 a.m.

**T08.8:** Modular Pet, Two-Phase Air-Cooled Converter Cell Design and Performance Evaluation with 1.7kV IGBTs for MV Applications
Frederick Kieferndorf, Uwe Drofenik, Francesco Agostini, Francesco Canales, ABB Switzerland Ltd, Switzerland

11:40 a.m. – 12:00 p.m.

**T08.9:** A Phase Shift Full Bridge Based Reconfigurable PEV Onboard Charger with Extended ZVS Range and Zero Duty Cycle Loss
Haoyu Wang, ShanghaiTech University, China
8:30 a.m. – 12:00 p.m.

**T09: Gate Drives, Failure Analysis, and Protection**

ROOM 102C

**Track: Power Electronics Applications**

**Session Chairs:**
Zhiliang Zhang, Nanjing University of Aeronautics and Astronautics
Indumini Ranmuthu, Texas Instruments

---

8:30 a.m. – 8:50 a.m.

**T09.1: Series Arc Fault Detection Method Based on Statistical Analysis for DC Microgrids**
Gab-Su Seo¹, Jung-Ik Ha¹, Bo-Hyung Cho¹, Kyu-Chan Lee², ¹Seoul National University, Korea, South, ²Smart Power Supply Co., Ltd., Korea, South

---

8:50 a.m. – 9:10 a.m.

**T09.2: Arc Welding Inverter with Embedded Digital Active EMI Controller**
Junpeng Ji, Wenjie Chen, Xu Yang, Xi'an Jiaotong University, China

---

9:10 a.m. – 9:30 a.m.

**T09.3: A Thermo-Sensitive Electrical Parameter with Maximum dIC/dt During Turn-Off for High Power Trench/Field-Stop IGBT Modules**
Yuxiang Chen¹, Haoze Luo¹, Wuhua Li¹, Xiangning He¹, Jun Ma², Guodong Chen², Ye Tian², Enxing Yang², ¹Zhejiang University, China, ²Shanghai Electric, China

---

9:30 a.m. – 9:50 a.m.

**T09.4: A Software Frequency Response Analysis Method to Monitor Degradation of Power MOSFETs in Basic Single-Switch Converters**
Serkan Dusmez¹, Manish Bhardwaj², Lei Sun¹, Bilal Akin¹, ¹University of Texas at Dallas, United States, ²Texas Instruments Inc., United States

---

9:50 a.m. – 10:10 a.m.

**T09.5: A New Capacitance Estimation Method of Supercapacitor Bank Using a Bank Impedance and Current Injection**
Junwon Lee, Hyunsik Jo, Hanju Cha, Chungnam National University, Korea, South

---

10:40 a.m. – 11:00 a.m.

**T09.6: Gate Driver Design for 1.7kV SiC MOSFET Module with Rogowski Current Sensor for Shortcircuit Protection**
Jun Wang, Zhiyu Shen, Christina Dimarino, Rolando Burgos, Dushan Boroyevich, Virginia Polytechnic Institute and State University, United States

---

11:00 a.m. – 11:20 a.m.

**T09.7: 2 MHz High-Density Integrated Power Supply for Gate Driver in High-Temperature Applications**
Remi Perrin¹, Bruno Allard¹, Cyril Buttay¹, Nicolas Quentin¹, Wenli Zhang², Rolando Burgos², Dushan Boroyevich², Philippe Preciat³, Donatien Martineau³, ¹Université Claude Bernard Lyon 1, France, ²Virginia Polytechnic Institute and State University, United States, ³Labinal Power Systems, France

---

11:20 a.m. – 11:40 a.m.

**T09.8: Design Consideration of Gate Driver Circuits and PCB Parasitic Parameters of Paralleled E-Mode GaN HEMTs in Zero-Voltage-Switching Applications**
Juncheng Lu¹, Alan Brown², Matt McAmmond², Di Chen³, Julian Styles³, Hua Bai¹, ¹Kettering University, United States, ²Hella Corporate Center USA Inc., United States, ³GaN Systems Inc., Canada

---

11:40 a.m. – 12:00 p.m.

**T09.9: A Gate Driver of SiC MOSFET for Suppressing the Negative Voltage Spikes in a Bridge Circuit**
Qi Zhou, Feng Gao, Shandong University, China

---

9:30 a.m.

**Spouse and Guest Tour “Tour the Stars” departs**
PACIFIC ROOM – HYATT REGENCY

---

12:00 p.m. – 5:00 p.m.

**Exhibit Hall Open**
EXHIBIT HALLS A/B/C
1:30 p.m. -2:00 p.m.

Exhibitor Seminars – Session #1
(for detailed information see page 188)

COILCRAFT
New Power Inductors for High Frequency
DC-DC Converters
ROOM 101A

DINO-LITE SCOPES (BIGC)
Dino-Lite Digital Microscope: Edge Series
ROOM 101B

HYDRO-QUÉBEC RESEARCH INSTITUTE
(IREQ)
Simulating Power Electronics Converters
Using MATLAB/SimPowerSystems.
The Right Balance between Performance
and Fidelity
ROOM 102AB

INFINEON TECHNOLOGIES
MOSFET Driver IC Solutions from Infineon
Technologies
ROOM 103AB

LEM USA
New ASIC based Open Loop Transducers
ROOM 201A

NXP SEMICONDUCTORS USA, INC.
Introducing new Motor Drivers featuring
Functional Safety and Higher Torque
ROOM 201B

STMICROELECTRONICS
Silicon Carbide MOSFET Benefits in
Automotive Applications
ROOM 202AB

TEXAS INSTRUMENTS
Big Batteries: take a walk on the high side
with TI’s 100-V FET driver
ROOM 203AB

3:00 p.m. -3:30 p.m.

Exhibitor Seminars – Session #3

AGILESWITCH, LLC
An Industry First – Silicon Carbide
based Intelligent Power Module
ROOM 101A

FAIR-RITE PRODUCTS CORP.
Low loss 67 Material for High Frequency
Power Applications
ROOM 101B

MAGSOFT CORORATION
Fast computation of Inductance,
Capacitance, Current Density in
conductor arrangements
ROOM 102AB

MONOLITHIC POWER SYSTEMS (MPS)
High Performance PMSM Servo System
Using MPS e.Motion Technology
ROOM 103AB

ON SEMICONDUCTOR
Energy Efficient Innovations
ROOM 201A

2:15 p.m. -2:45 p.m.

Exhibitor Seminars – Session #2

AAVID THERMALLOY LLC
Aavid Thermalloy Expands Capabilities &
Products with Niagara Acquisition
ROOM 101A

COGNIPower
The Practical Side of Faster, Smaller,
More Efficient Power Converters
ROOM 101B

MAGNETICS
Large XFLUX® and Block Structures for
High Current Applications
ROOM 102AB

NH RESEARCH, INC.
Testing Vehicle Power & V2G Applications
ROOM 103AB

POWEREX, INC.
New DIPIPM™s Featuring More Integration
and Lower Cost
ROOM 201A

SIMPLIS TECHNOLOGIES
Designing Digitally Controlled Systems
with SIMPLIS
ROOM 201B

MOUSER ELECTRONICS
An Integrated Filter and Power Converter
Electric Vehicle Powertrain Solution
ROOM 203AB

VISHAY INTERTECHNOLOGY
Performance Components for Power
Applications
ROOM 202AB
3:45 p.m. - 4:15 p.m.

Exhibitor Seminars – Session #4

FAIRCHILD SEMICONDUCTOR
1200V Smart Power Module for Low-Power Industrial Motor Drive Applications
ROOM 101A

INTERSIL
Digital Power Design Featuring Intersil’s ChargeMode and Hybrid Digital Controllers
ROOM 101B

KEMET ELECTRONICS CORPORATION
Capacitor Modeling and Simulation
ROOM 102AB

SCHUNK HOFFMANN CARBON TECHNOLOGY
Aluminium Graphite: The Optimal Thermal Management Solution for High Reliability Applications
ROOM 103AB

SYNOPSYS
Accurate Modeling and Simulation of Contemporary Power Converters using Saber
ROOM 201A

TAIWAN SEMICONDUCTOR
Improved Efficiency in LED Lighting Control
ROOM 201B

WURTH ELECTRONICS MIDCOM
Custom Flyback Transformers Made Easy
ROOM 203AB

5:00 p.m. – 6:30 p.m.

Rap Sessions
(for detailed information see page 146)

Rap Session 1: Future of Semiconductor Technology Development
ROOM 104A

Rap Session 2: Power Electronics for Internet of Things: Will it happen?
ROOM 104B

Rap Session 3: Advanced Refueling Technologies for EVs
ROOM 104C
Wednesday
March 23, 2016

7:00 a.m. – 8:00 a.m.
Speaker Breakfast
GRAND BALLROOM

8:00 a.m. – 3:00 p.m.
Registration
EXHIBIT HALLS B/C

8:00 a.m. – 9:00 a.m.
Spouse and Guest Breakfast
PACIFIC ROOM – HYATT REGENCY

8:00 a.m. – 11:00 a.m.
Spouse and Guest Hospitality Room Open
PACIFIC ROOM – HYATT REGENCY

8:30 a.m. – 10:10 a.m.
IS05: Thermal Management
ROOM 201A

SESSION CHAIRS:
Peter Resca, Advanced Thermal Solutions, Inc.

8:30 a.m. – 8:55 a.m.
IS05.1: Thermal Challenges and Solutions for Industrial Solid State Lighting Applications
Peter Resca, Advanced Thermal Solutions, Inc., United States

8:55 a.m. – 9:20 a.m.
IS05.2: Thermally Managing High Power Devices Using Heat Pipe Assemblies
Abdul Samad Jawed, Cliff Weasner, Ahmed Zaghlol, Mersen, Canada

9:20 a.m. – 9:45 a.m.
IS05.3: Using Web Based Tools for the Thermal Design of a Power Converter
Ahmed Zaghlol, Jeremy Howes, David Levett, Greg Schendel, Mersen, Canada, Tesla Energy, United States, Infineon, United States, Parker SSD Drives, United States

9:45 a.m. – 10:10 a.m.
IS05.4: Reflowable Thermal Devices Protecting High-Power Automotive Electronics
Barry Brents, TE Connectivity, United States

8:30 a.m. – 10:10 a.m.
IS06: Modeling and Simulation
ROOM 201B

SESSION CHAIRS:
Cahit Gezgin, Infineon Technologies
Brian Thomas, Independent Consultant

8:30 a.m. – 8:55 a.m.
IS06.1: System-Level Crosstalk-Induced Efficiency Impact of DCDC Converter: Simulation to Measurement Correlation
Joerg Goller, Jie Chen, Rajen Murugan, Texas Instruments, Inc., United States

8:55 a.m. – 9:20 a.m.
IS06.2: Switching Voltage Regulator Modeling Methodology for Simulation Based Power Delivery Design
Wei Xu, Jiangqi He, David Figueroa, Intel Corporation, United States

9:20 a.m. – 9:45 a.m.
IS06.3: CoolSPICE: a New Electrical and Thermal Circuit Simulator for Power Circuit Design with New Wide Bandgap Device Capabilities
Akin Akturk, Neil Goldsman, Zeynep Dilli, Simon Peggs, CoolCAD Electronics LLC, United States

9:45 a.m. – 10:10 a.m.
IS06.4: Power Converter System Stress and Mechanical Analysis Within an Integrated Design Environment
Rehan Iqbal, Carl Bycraft, Mentor Graphics, United States
8:30 a.m. – 10:10 a.m.

IS07: Very Low Power Applications
ROOM 202AB

SESSION CHAIRS:
Edward Stanford, Power Deliver Consultants
Nick Gruendler, Celestica

8:30 a.m. – 8:55 a.m.

IS07.1: Energy Harvesting Is Not Fiction Anymore
Lorandt Fölkel, Wurth Elektronik eiSos GmbH, Germany

8:55 a.m. – 9:20 a.m.

IS07.2: A New Way to Power the World with High Efficiencies
Michael Freeman, Semitrex, United States

9:20 a.m. – 9:45 a.m.

IS07.3: System Architecture That Extends Battery Life
Matthew Tyler, ON Semiconductor, United States

9:45 a.m. – 10:10 a.m.

IS07.4: Primary Side Regulation in Flyback Converters Delivers Low Cost, High Reliability and Energy Efficiency
Ramanan Natarajan, Bing Lu, Brent McDonald, Vaibhav Desai, Peter Fundaro, Texas Instruments, United States

8:30 a.m. – 10:10 a.m.

IS08: Alternative Energy in High Penetration Areas
ROOM 203AB

SESSION CHAIRS:
Michael Harrison, Enphase Energy
Bharat Shah, Independent Consultant

8:30 a.m. – 8:55 a.m.

IS08.1: The Growth of Renewable Energy in California
David Hochschild, California Energy Commission, United States

8:55 a.m. – 9:20 a.m.

IS08.2: Shine and Drive: the Symbiotic Relationship Between Renewables, Electric Vehicles, and the Grid
Carla Peterman, California Public Utilities Commission, United States

9:20 a.m. – 9:45 a.m.

IS08.3: Modernizing the Grid and Enabling Distributed Energy Resources
Heather Sanders, Southern California Edison, United States

9:45 a.m. – 10:10 a.m.

IS08.4: Promoting Renewable Energy Technologies Through Research, Testing and Standards
Tim Zgonena, Underwriters Laboratories, United States

8:30 a.m. – 10:10 a.m.

T10: Control of AC-DC Converters
ROOM 102AB

Track: AC-DC Converters

SESSION CHAIRS:
Tsorng-Juu Liang, National Cheng-Kung University (Taiwan)
Laszlo Balogh, Fairchild Semiconductor

8:30 a.m. – 8:50 a.m.

T10.1: Interleaved Boost Based AC/DC Bidirectional Converter with Four Quadrant Power Control Based on One-Cycle Controller (OCC)
Snehal Bagawade, Praveen Jain, Queen’s University, Canada

8:50 a.m. – 9:10 a.m.

T10.2: A New Control Scheme to Improve Load Transient Response of Single Phase PWM Rectifier with Auxiliary Current Injection Circuit
Naga Brahmendra Gorla, Sandeep Kolluri, Pritam Das, Sanjib Kumar Panda, National University of Singapore, Singapore

9:10 a.m. – 9:30 a.m.

T10.3: Active Capacitor with Ripple-Based Duty Cycle Modulation for AC-DC Applications
Ching-Chieh Yang, Yang-Lin Chen, Yaow-Ming Chen, National Taiwan University, Taiwan

9:30 a.m. – 9:50 a.m.

T10.4: Novel Approach to Current-Mode Control in DCM/CCM Boundary Boost PFC
Giovanni Gritti, Claudio Adragna, STMicroelectronics, Italy
8:30 a.m. – 10:10 a.m.
**T11: GaN-based DC-DC Converters**
ROOM 104A

**Track: DC-DC Converters**

**SESSION CHAIRS:**
Alexis Kwasinski, *University of Pittsburgh*
Regan Zane, *Utah State*

---

8:30 a.m. – 8:50 a.m.
**T11.1: High Efficiency 20-400 MHz PWM Converters Using Air-Core Inductors and Monolithic Power Stages in a Normally-Off GaN Process**
Alihossein Sepahvand, Yuanzhe Zhang, Dragan Maksimovic, *University of Colorado Boulder, United States*

---

8:50 a.m. – 9:10 a.m.
**T11.2: Thermal Evaluation of Chip-Scale Packaged Gallium Nitride Transistors**
David Reusch, Johan Strydom, Alex Lidow, *Efficient Power Conversion Corporation, United States*

---

9:10 a.m. – 9:30 a.m.
**T11.3: Over 300kHz GaN Device Based Resonant Bidirectional DCDC Converter with Integrated Magnetics**
Gang Liu¹, Dan Li¹, Yungtaek Jang², Jianqiu Zhang¹, ¹Fudan University, China, ²Delta Products Corporation, United States

---

9:30 a.m. – 9:50 a.m.
**T11.4: Effective Control & Software Techniques for High Efficiency GaN FET Based Flexible Electrical Power System for Cube-Satellites**
Ashish Shrivastav, Shikhar Singh, Anirudh Mahajan, Subhashish Bhattacharya, *North Carolina State University, United States*

---

9:50 a.m. – 10:10 a.m.
**T11.5: A 98.8% Efficient Bidirectional Full-Bridge Isolated DC-DC GaN Converter**
Rakesh Ramachandran, Morten Nymand, *University of Southern Denmark, Denmark*
8:30 a.m. – 10:10 a.m.

**T13: Advances in Magnetics**

**ROOM 101B**

**Track: Devices and Components**

**Session Chairs:**
Matthew Wilkowski, *Altera Corporation*
Charles Sullivan, *Dartmouth*

---

**T13.1: Passive Integration Using FMLF Technique for Integrated Boost Resonant Converters**
Cheng Deng¹, Luciano Andres Garcia Rodriguez¹, Juan Zou², Juan Carlos Balda¹, ¹University of Arkansas, United States, ²Xiangtan University, China

8:30 a.m. – 8:50 a.m.

---

**T13.2: Magnetic Characterization Technique and Materials Comparison for Very High Frequency IVR**
Dongbin Hou, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States

8:50 a.m. – 9:10 a.m.

---

**T13.3: Large-Signal Power Circuit Characterization of on-Silicon Coupled Inductors for High Frequency Integrated Voltage Regulation**
Santosh Kulkarni¹, Zoran Pavlovic¹, Satya Kubendran¹, Claudio Carretero², Ningning Wang¹, Cian O’Mathuna¹, ¹Tyndall National Institute / University College Cork, Ireland, ²Universidad de Zaragoza, Spain

9:10 a.m. – 9:30 a.m.

---

**T13.4: Point-of-Load Inductor with High Swinging and Low Loss at Light Load**
Ting Ge¹, Khai Ngo¹, Jim Moss², ¹Virginia Polytechnic Institute and State University, United States, ²Texas Instruments Inc., United States

9:30 a.m. – 9:50 a.m.

---

**T13.5: Iron Loss Evaluation of Three-Phase Inductor for Three-Phase PWM Inverter**
Hiroaki Matsumori¹, Toshihisa Shimizu¹, Koushi Takano², Ishii Hitoshi², ¹Tokyo Metropolitan University, Japan, ²Iwatsu Test Instrument Corporation, Japan

9:50 a.m. – 10:10 a.m.

---

---

8:30 a.m. – 10:10 a.m.

**T14: System Design and Layout for Improved Performance**

**ROOM 102C**

**Track: System Integration**

**Session Chairs:**
Jeff Niles, *Texas Instruments*
Ernie Parker, *Crane Aerospace & Electronics*

---

**T14.1: CMOS Gate Drive IC with Embedded Cross Talk Suppression Circuitry for SiC Devices**
Jeffery Dix, Zheyu Zhang, Benjamin J. Bialock, University of Tennessee, United States

8:30 a.m. – 8:50 a.m.

---

**T14.2: Optimal Design of a Voltage Regulator Based Resonant Switched-Capacitor Converter IC**
Eli Abramov, Alon Cervera, Mor Mordechai Peretz, Ben-Gurion University of the Negev, Israel

8:50 a.m. – 9:10 a.m.

---

**T14.3: Novel Highly Integrated Current Measurement Method for Drive Inverters**
Niklas Langmaack, Guenter Tareilus, Markus Henke, Technische Universität Braunschweig, Germany

9:10 a.m. – 9:30 a.m.

---

**T14.4: A Novel DBC Layout for Current Imbalance Mitigation in SiC MOSFET Multichip Power Modules**
Helong Li, Stig Munk-Nielsen, Szymon Beczkowski, Xiongfei Wang, Aalborg University, Denmark

9:30 a.m. – 9:50 a.m.

---

**T14.5: A Double-End Sourced Multi-Chip Improved Wire-Bonded SiC MOSFET Power Module Design**
Miao Wang, Fang Luo, Longya Xu, Ohio State University, United States

9:50 a.m. – 10:10 a.m.
8:30 a.m. – 10:10 a.m.

**T15: Modeling of AC Energy Converters and Systems**
ROOM 104B

**Track: Modeling and Simulation**

**Session Chairs:**
Jaber Abu Qahouq, The University of Alabama
Xiongfei Wang, Aalborg University

8:30 a.m. – 8:50 a.m.

**T15.1: Comparing Extended Kalman Filter and Particle Filter for Estimating Field and Damper Bar Currents in Brushless Wound Field Synchronous Generator for Stator Winding Fault Detection and Diagnosis**
Sivakumar Nadarajan¹, Sanjib Kumar Panda¹, Bicky Bhangu², Amit Kumar Gupta²,
¹National University of Singapore, Singapore,
²Rolls-Royce Singapore Pte. Ltd., Singapore

8:50 a.m. – 9:10 a.m.

**T15.2: Analytical Determination of Conduction Power Losses for Active Neutral-Point-Clamped Multilevel Converter**
Vahid Dargahi¹, Arash Khoshkbar Sadigh², Keith Corzine¹, ³Clemson University, United States,
²Extron Electronics, United States

9:10 a.m. – 9:30 a.m.

**T15.3: Multifrequency Small-Signal Model of Voltage Source Converters Connected to a Weak Grid for Stability Analysis**
Xing Li, Hua Lin, Huazhong University of Science and Technology, China

9:30 a.m. – 9:50 a.m.

**T15.4: A New Approach to Control the Modified LinVerter for High Frequency Applications**
Peyman Farhang, Stefan Mátéfi-Tempfli, University of Southern Denmark, Denmark

9:50 a.m. – 10:10 a.m.

**T15.5: Small-Signal Terminal Characteristics Modeling of Three-Phase Boost Rectifier with Variable Fundamental Frequency**
Zeng Liu¹, Jinjun Liu¹, Dushan Boroyevich²,
¹Xi’an Jiaotong University, China,
²Virginia Polytechnic Institute and State University, United States

8:30 a.m. – 10:10 a.m.

**T16: Manufacturing, Test, and Reliability**
ROOM 103C

**Track: Manufacturing, Quality, and Business Issue**

**Session Chairs:**
Jim Marinos, Payton Group
Brian Narveson, Narveson Innovative Consulting

8:30 a.m. – 8:50 a.m.

**T16.1: Reliability Analysis of a High-Efficiency SiC Three-Phase Inverter for Motor Drive Applications**
Juan Colmenares, Diane-Perle Sadik, Patrik Hilber, Hans-Peter Nee, KTH Royal Institute of Technology, Sweden

8:50 a.m. – 9:10 a.m.

**T16.2: RCP Evaluation of Electrolytic Capacitor Degradation for SMPS Failure Prediction**
Hiroshi Nakao¹, Yu Yonezawa¹, Yoshiyasu Nakashima¹, Fujio Kurokawa²,
¹Fujitsu Laboratories LTD., Japan,
²Nagasaki University, Japan

9:10 a.m. – 9:30 a.m.

**T16.3: Modular Test System Architecture for Device, Circuit and System Level Reliability Testing**
Roland Sleik¹, Michael Glavanovics¹, Sascha Einspieler³, Annette Muetze², Klaus Krischan²,
¹Kompetenzzentrum Automobil- und Industrieelektronik GmbH, Austria,
²Technische Universität Graz, Austria

9:30 a.m. – 9:50 a.m.

**T16.4: EMI Noise Cancelation by Optimizing Transformer Design Without Need for the Traditional Y-Capacitor**
Yongjiang Bai¹, Wenjie Chen¹, Ruirui He¹, Dan Zhang², Xu Yang¹, ³Xi’an Jiaotong University, China,
²Silergy Corp., China

9:50 a.m. – 10:10 a.m.

**T16.5: Manufacturing, Assembly and Production Qualifications of High Density, High Reliability POL DC-DC Converters**
Fariborz Musavi, CUI Inc, United States
8:30 a.m. – 10:10 a.m.
T17: Soft-Switching Converters in Renewable Energy Systems
ROOM 104C

**Track: Renewable Energy Systems**

**Session Chairs:**
Afridi Khurram, *University of Colorado Boulder*
Katherine Kim, *Ulsan NIST*

8:30 a.m. – 8:50 a.m.
**T17.1: Power Flow Control and ZVS Analysis of Three Limb High Frequency Transformer Based Three-Port DAB**
Ritwik Chattopadhyay, Subhashish Bhattacharya, *North Carolina State University, United States*

8:50 a.m. – 9:10 a.m.
Sanjida Mouy, John Lam, Vineet Srivastava, Ron Church, *York University, Canada, Cistel Technology, Canada*

9:10 a.m. – 9:30 a.m.
**T17.3: Analysis and Design of Impulse Commutated ZCS Three-Phase Current-Fed Push-Pull DC/DC Converter**
Radha Sree Krishna Moorthy, Akshay Kumar Rathore, *National University of Singapore, Singapore*

9:30 a.m. – 9:50 a.m.
**T17.4: ZCS Resonant Converter Based Parallel Balancing of Serially Connected Batteries String**
Ilya Zeltser, Or Kirshenboim, Nadav Dahan, Mor Mordechai Peretz, *Rafael Advanced Defense Systems Ltd., Israel, Ben-Gurion University of the Negev, Israel*

9:50 a.m. – 10:10 a.m.
**T17.5: A Novel Topology of High Voltage and High Power Bidirectional ZCS DC-DC Converter Based on Serial Capacitors**
Lejia Sun, Fang Zhuo, Feng Wang, Tianhua Zhu, *Xi’an Jiaotong University, China*

8:30 a.m. – 10:10 a.m.
T18: Solid State Lighting
ROOM 103AB

**Track: Power Electronics Applications**

**Session Chairs:**
Jim Spangler, *Spangler Prototype Inc*
Nan Chen, *ABB*

8:30 a.m. – 8:50 a.m.
**T18.1: Control Scheme for TRIAC Dimming High PF Single-Stage LED Driver with Adaptive Bleeder Circuit and Non-Linear Current Reference**
Weizhong Ma, Xiaogao Xie, Yang Han, Hao Deng, *Hangzhou Dianzi University, China*

8:50 a.m. – 9:10 a.m.
**T18.2: Three Phase Converter with Galvanic Isolation Based on Loss-Free Resistors for HB-LED Lighting Applications**
Ignacio Castro, Diego G. Lamar, Manuel Arias, Javier Sebastián, Marta H. Hernando, *Universidad de Oviedo, Spain*

9:10 a.m. – 9:30 a.m.
**T18.3: A ZV-ZCS Electrolytic Capacitor-LessAC/DC Isolated LED Driver with Continous Energy Regulation**
John Lam, Nader El-Taweel, *York University, Canada*

9:30 a.m. – 9:50 a.m.
**T18.4: High Efficiency and Power Density GaN-Based LED Driver**
Eric Faraci, Michael Seeman, Bin Gu, Yogesh Ramadass, Brohlin Brohlin, *Texas Instruments Inc., United States*

9:50 a.m. – 10:10 a.m.
**T18.5: A Novel LED Drive System Based on Matrix Rectifier**
Baoping Shi, Bo Zhou, Jiadan Wei, Xianhui Qin, Yuanyu Yang, Bing Liu, *Nanjing University of Aeronautics and Astronautics, China*

10:00 a.m. – 2:00 p.m.
**Exhibit Hall Open**
EXHIBIT HALLS A/B/C
10:30 a.m. -11:00 a.m.

Exhibitor Seminars – Session #5

ADAPTIVE POWER SYSTEMS
Advanced Power Conversion Test Equipment
ROOM 101A

EFFICIENT POWER CONVERSION CORPORATION (EPC)
GaN...Changing the Way We Live
ROOM 101B

MERSEN
Safety and Reliability for Power Electronics
ROOM 102AB

MICROCHIP TECHNOLOGY INC.
Brutes and Brains: When Adding Intelligence to Power Supplies Makes Sense
ROOM 103AB

RENESEAS ELECTRONICS AMERICA INC.
Lithium Ion Battery Charging and Fuel Gauging for better functionality
ROOM 101B

SBE, INC.
High Performance Integrated DC Link Capacitor/Bus Structures and AC Filter Capacitors
ROOM 202AB

11:15 a.m. -11:45 a.m.

Exhibitor Seminars – Session #6

Panel:
Eaton, Power Systems Design, Vicor, GaN Systems
Next Generation of Power Supplies
ROOM 101A

ABC TRADING BEIJING CO. LTD.
BsT-x measuring system for soft magnetic materials under high excitation
ROOM 101B

AMANTYS POWER ELECTRONICS LTD
Intelligent Gate Drives – Delivering the Silicon Squeeze
ROOM 102AB

ANALOG DEVICES INC
Ultra Low Noise LDOs Maximize Signal Chain Performance
ROOM 103AB

2:00 p.m. – 5:25 p.m.

IS09: High Frequency Magnetics; Black Magic, Art or Science?
ROOM 201A

Session Chairs:
Edward Herbert, Independent Consultant
Stephen Carlsen, Raytheon

2:00 p.m. – 2:25 p.m.

IS09.1: High Frequency Magnetics: Black Magic, Art or Science? Magnetics Core Loss
Ray Ridley, Ridley Engineering Inc., United States

2:25 p.m. – 2:50 p.m.

IS09.2: Selecting Magnetics for High Frequency Converters Practical Hints and Suggestions for Getting Started
Len Crane, Coilcraft, United States

2:50 p.m. – 3:15 p.m.

IS09.3: The Future for SMPS Magnetics
Weyman Lundquist, West Coast Magnetics, United States

3:15 p.m. – 3:40 p.m.

IS09.4: Accurate Estimation of Losses of Power Inductor in Power Electronics Applications
Ranjith Bramanpalli, Wurth Elektronik, Germany

4:10 p.m. – 4:35 p.m.

IS09.5: Litz Wire: a Practical Discussion of its Uses and Limitations in High Frequency Transformers
Kyle Jensen, Rubadue Wire Company, Inc., United States
2:00 p.m. – 5:25 p.m.

**IS10: From the Board to the Datacenter**
ROOM 201B

**Session Chairs:**
Brian Zahnstecher, *PowerRox LLC*
Wisam Moussa, *Infineon Technologies*

---

**IS10.1: The Technology Behind the World’s Smallest 12V, 10A Voltage Regulator**
Pradeep Shenoy, *Texas Instruments, United States*

---

**IS10.2: Noise Characterization of Switching Buck Regulators for EMI Analysis**
Chunlei Guo¹, Yaxiao Qin², Huafeng Wang², Eric Braun², Jinghai Zhou², Jiangqi He¹, David Figueroa¹, ¹*Intel Corporation, United States, ²Monolithic power systems, United States*

---

**IS10.3: 48V Power Delivery to Grantley Reference Board**
Donghwi Kim, Jiangqi He, David Figueroa, *Intel, United States*

---

**IS10.4: PMBus on Linux: PMBus Support Options for the Linux Platform**
Michael Jones, *Linear Technology, United States*

---

**IS10.5: System Power Simplification Utilizing PMBus™ Zone Capabilities**
Travis Summerlin, *Texas Instruments, United States*

---

**IS10.6: Power-Defined Software In The Data Center**
Brian Zahnstecher, *PowerRox, United States*

---

5:00 p.m. – 5:25 p.m.

**IS10.7: Data Center Market and Technology Trends in Power Electronics**
Mattin Grao Txapartegi, Pierric Gueguen, *YOLE DEVELOPPEMENT, France*
2:00 p.m. – 5:25 p.m.

**IS12: Transportation Power Electronics**
ROOM 203AB

**Session Chairs:**
Ralph Taylor, Delphi Electronics & Safety
Fred Weber, FTW LLC

**2:00 p.m. – 2:25 p.m.**

**IS12.1: More Electric and Electric Aircraft**
Kaushik Raja, UT Dallas, United States

**2:25 p.m. – 2:50 p.m.**

**IS12.2: Overview of the Unique Requirements and Challenges for Power Electronics in Mining Equipment**
Dustin Selvey, Caterpillar, United States

**2:50 p.m. – 3:15 p.m.**

**IS12.3: Medium and Heavy-Duty Vehicle Duty Cycles for Electric Powertrains**
Kenneth Kelly, Kevin Bennion, Eric Miller, Bob Prohaska, National Renewable Energy Laboratory, United States

**3:15 p.m. – 3:40 p.m.**

**IS12.4: Fuel Cells for Material Handling Systems**
Fernando Corral, Plug Power, United States

**4:10 p.m. – 4:35 p.m.**

**IS12.5: Design and Implementation of a LLC-ZCS Converter for Hybrid/Electric Vehicles**
Davide Giacomini, Cesare Bocchiola, International Rectifier, Italy

**4:35 p.m. – 5:00 p.m.**

**IS12.6: EV-Grid Integration (EVGI) Control and System Implementation**
Mithat Kisacikoglu, NREL, United States

**5:00 p.m. – 5:25 p.m.**

**IS12.7: Assessing the North American Supply Chain for Traction Drive Motors**
Steven Boyd¹, Christopher Whaling²,
¹Department of Energy, Vehicle Technologies Office, United States, ²Synthesis Partners, LLC, United States

---

2:00 p.m. – 5:30 p.m.

**T19: Resonant and Soft Switching DC-DC Converters**
ROOM 101A

**Track: DC-DC Converters**

**Session Chairs:**
Mahshid Amirabadi, Northeastern University
Mehdi Ferdowsi, Missouri University of Science and Technology

**2:00 p.m. – 2:20 p.m.**

**T19.1: LLC Synchronous Rectification Using Coordinate Modulation**
Mehdi Mohammadi, Navid Shafiei, Martin Ordóñez, University of British Columbia, Canada

**2:20 p.m. – 2:40 p.m.**

**T19.2: Low Parasitics Planar Transformer for LLC Resonant Battery Chargers**
Mohammad Ali Sakeri, Navid Shafiei¹, Martin Ordóñez¹, Marian Craciun², Chris Botting²,
¹University of British Columbia, Canada, ²Delta-Q Technologies Corporation, Canada

**2:40 p.m. – 3:00 p.m.**

**T19.3: New Symmetrical Bidirectional L3C Resonant DC-DC Converter with Wide Voltage Range**
Minjae Kim, Shinyoung Noh, Sewan Choi, Seoul National University of Science and Technology, Korea, South

**3:00 p.m. – 3:20 p.m.**

**T19.4: Influence of the Junction Capacitance of the Secondary Rectifier Diodes on Output Characteristics in Multi-Resonant Converters**
Stefan Ditze¹, Thomas Heckel², Martin März¹, 
¹Fraunhofer Institute for Integrated Systems and Device Technology, Germany, ²Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

**3:20 p.m. – 3:40 p.m.**

**T19.5: A Triple Active Bridge DC-DC Converter Capable of Achieving Full-Range ZVS**
Ling Jiang, Daniel Jes Costinett, University of Tennessee, United States

**3:40 p.m. – 4:00 p.m.**

**T19.6: A Novel High Gain Step-Up Resonant DC-DC Converter for Automotive Application**
Fei Shang¹, Mahesh Krishnamurthy¹, Alexander Isurin², ¹Illinois Institute of Technology, United States, ²Vanmer Inc., United States
4:30 p.m. – 4:50 p.m.

**T19.7:** Series Injection Enabled Full ZVS Light Load Operation of a 15kV SiC IGBT Based Dual Active Half Bridge Converter
Awneesh Tripathi, Sachin Madhusoodhanan, Krishna Mainali, Kasunaidu Vechalapu, Subhashish Bhattacharya, North Carolina State University, United States

2:00 p.m. – 5:30 p.m.

**T19.8:** Soft Switching for Half Bridge Current Doubler for High Voltage Point of Load Converter in Data Center Power Supplies
Yutian Cui\(^1\), Weimin Zhang\(^1\), Leon M. Tolbert\(^2\), Daniel Jes Costinet\(^1\), Fred Wang\(^1\), Benjamin J. Blalock\(^1\), \(^1\)University of Tennessee, United States, \(^2\)University of Tennessee / Oak Ridge National Laboratory, United States

5:10 p.m. – 5:30 p.m.

**T19.9:** An Algorithm to Analyze Circulating Current for Multi-Phase Resonant Converter
Yang Chen\(^1\), Zhiyuan Hu\(^1\), Laili Wang\(^1\), Tianshu Liu\(^1\), Wenbo Liu\(^1\), Yan-Fei Liu\(^1\), Jahangir Afsharian\(^2\), Zhihua Yang\(^2\), Hongliang Wang\(^1\), \(^1\)Queen’s University, Canada, \(^2\)Murata Power Solutions, Canada

2:00 p.m. – 5:30 p.m.

**T20: Control Applications and Modulation Schemes**
ROOM 102C

**Track: Power Electronics for Utility Interface**

**Session Chairs:**
Ali Khajehaddin, University of Alberta
Paul Bauer, Delft University of Technology

T20.1: A Simple Active Damping Method for Active Power Filters
Huawei Yuan, Xinjian Jiang, Tsinghua University, China

2:00 p.m. – 2:20 p.m.

**T20.2:** Simultaneous Voltage and Current Compensation of the 3-Phase Electric Spring with Decomposed Voltage Control
Shuo Yan, Tianbo Yang, Chi Kwan Lee, Siew-Chong Tan, Shu Yuen Ron Hui, University of Hong Kong, Hong Kong

T20.3: Self-Synchronization Operation of Global Synchronous Pulsewidth Modulation with Communication Fault Tolerant and Simplified Calculation Capabilities
Tao Xu, Feng Gao, Shandong University, China

2:40 p.m. – 3:00 p.m.

T20.4: Design Considerations and Predictive Direct Current Control of Active Regenerative Rectifiers for Harmonic and Current Ripple Reduction
Alberto Berzoy, Ahmed Abdelfatah Mohamed, Osama Mohammed, Florida International University, United States

3:00 p.m. – 3:20 p.m.

T20.5: A Robust Controller for Medium Voltage AC Collection Grid for Large Scale Photovoltaic Plants Based on Medium Frequency Transformers
Bahaa Hafez\(^1\), Prasad Enjeti\(^2\), Shehab Ahmed\(^2\), \(^1\)Texas A&M University, United States, \(^2\)Texas A&M University at Qatar, Qatar

4:10 p.m. – 4:30 p.m.

T20.6: Optimal Low Switching Frequency Pulse Width Modulation of Current-Fed Five-Level Inverter for Solar Integration
Ghana Sambandam Kulothungan, Akshay Kumar Rathore, Amarendra Edpuganti, Dipti Srinivasan, National University of Singapore, Singapore

4:30 p.m. – 4:50 p.m.

T20.7: Design and Implementation of Division-Summation Digital Controlled Multi-Function Inverter to Achieve APF, Active Power Injection and Rectification
Tsai-Fu Wu\(^1\), Hui-Chung Hsieh\(^2\), Li-Chun Lin\(^1\), Chih-Hao Chang\(^1\), \(^1\)National Tsing Hua University, Taiwan, \(^2\)National Chung Cheng University, Taiwan

4:50 p.m. – 5:10 p.m.

**T20.8:** Operation and Analysis of an Improved Transformerless Unified Power Flow Controller
Yang Liu\(^1\), Shuitao Yang\(^2\), Fang Zheng Peng\(^1\), \(^1\)Michigan State University, United States, \(^2\)Michigan State University & Ford Motor Company, United States

5:10 p.m. – 5:30 p.m.

**T20.9:** Design Consideration of Converter Based Transmission Line Emulation
Bo Liu\(^1\), Shuoting Zhang\(^1\), Sheng Zheng\(^1\), Yiwei Ma\(^1\), Fred Wang\(^1\), Leon M. Tolbert\(^2\), \(^1\)University of Tennessee, United States, \(^2\)University of Tennessee / Oak Ridge National Laboratory, United States
2:00 p.m. – 5:30 p.m.

**T21: Advances in Wide BandGap Devices**
ROOM 104A

**Track: Devices and Components**

**Session Chairs:**
Doug Hopkins, North Carolina State University
Alex Huang, North Carolina State University

---

2:00 p.m. – 2:20 p.m.

**T21.1: Short-Circuit Characterization of 10 kV 10A 4H-SiC Mosfet**
Emanuel-Petre Eni, Szymon Beczkowski, Stig Munk-Nielsen, Tamas Kerekes, Remus Teodorescu, Aalborg University, Denmark

---

2:20 p.m. – 2:40 p.m.

**T21.2: Record-Low 10mOhm SiC MOSFETs in TO-247, Rated at 900V**
Vipindas Pala, Gangyao Wang, Brett Hull, Scott Allen, Jeffrey Casady, John Palmour, Wolfspeed/Cree, Inc., United States

---

2:40 p.m. – 3:00 p.m.

**T21.3: Performance Evaluation of Multiple Si and SiC Solid State Devices for Circuit Breaker Application in 380VDC Delivery System**
Kai Tan, Pengkun Liu, Xijun Ni, Chang Peng, Xiaqing Song, Alex. Q Huang, North Carolina State University, United States

---

3:00 p.m. – 3:20 p.m.

**T21.4: Evaluation of High Voltage Cascode GaN HEMTs in Parallel Operation**
He Li¹, Xuan Zhang¹, Lucheng Wen¹, John Alex Brothers¹, Chengcheng Yao¹, Ke Zhu¹, Jin Wang¹, Liming Liu², Jing Xu², Joonas Puukko,¹Ohio State University, United States, ²ABB Inc., United States

---

3:20 p.m. – 3:40 p.m.

**T21.5: A New Driving Concept for Normally-on GaN Switches in Cascode Configuration**
Bernhard Zojer, Infineon Technologies Austria, Austria

---

4:10 p.m. – 4:30 p.m.

**T21.6: Avoiding Divergent Oscillation of Cascode GaN Device Under High Current Turn-Off Condition**
Weijing Du, Xiucheng Huang, Fred C. Lee, Qiang Li, Wenli Zhang, Virginia Polytechnic Institute and State University, United States

---

4:30 p.m. – 4:50 p.m.

**T21.7: Temperature-Dependent Turn-on Loss Analysis for GaN HFETs**
Edward A. Jones¹, Fred Wang¹, Daniel Jes Costinett¹, Zheyu Zhang¹, Ben Guo²,¹University of Tennessee, United States, ²United Technologies Research Center, United States

---

4:50 p.m. – 5:10 p.m.

**T21.8: Analysis of Parasitic Elements of SiC Power Modules with Special Emphasis on Reliability Issues**
Diane-Perle Sadik¹, Juan Colmenares¹, Hans-Peter Nee¹, Konstantin Kostov², Florian Giezendanner³, Per Ranstad⁴,¹KTH Royal Institute of Technology, Sweden, ²Acroo Swedish ICT AB, Sweden, ³Alstom Power Sweden AB, Sweden

---

5:10 p.m. – 5:30 p.m.

**T21.9: Static and Dynamic Characterization of GaN HEMT with Low Inductance Vertical Phase Leg Design for High Frequency High Power Applications**
Nidhi Haryani, Xuning Zhang, Rolando Burgos, Dushan Boroyevich, Virginia Polytechnic Institute and State University, United States

---

2:00 p.m. – 5:30 p.m.

**T22: Motor Drive Design and Inverter Topologies**
ROOM 101B

**Track: Motor Drives and Inverters**

**Session Chairs:**
Yingying Kuai, Caterpillar Inc.
Jin Wang, The Ohio State University

---

2:00 p.m. – 2:20 p.m.

**T22.1: A Family of Single-Phase Current Source Converters with Double Outputs**
Louelson Costa¹, Maurice B. R. Correa¹, Montie Vitorino¹, Gutemberg Dos Santos¹, Darlan Fernandes²,¹Universidade Federal de Campina Grande, Brazil, ²Universidade Federal da Paraíba, Brazil

---

2:20 p.m. – 2:40 p.m.

**T22.2: Multiple-Output Boost Resonant Inverter for High Efficiency and Cost-Effective Induction Heating Applications**
Hector Sarnago, Oscar Lucia, José Miguel Burdio, Universidad de Zaragoza, Spain
2:40 p.m. – 3:00 p.m.

**T22.3:** Development of 2-kW Interleaved DC-Capacitor-Less Single-Phase Inverter System
Runruo Chen, Hulong Zeng, Deepak Gunasekaran, Yunting Liu, Fang Zheng Peng, Michigan State University, United States

3:00 p.m. – 3:20 p.m.

**T22.4:** Single Stage Transformer Isolated High Frequency AC Link Based Open End Drive Srikant Gandikota, Ned Mohan, University of Minnesota, United States

3:20 p.m. – 3:40 p.m.

**T22.5:** A Quasi-Z-Source Integrated Multi-Port Power Converter with Reduced Capacitance for Switched Reluctance Motor Drives
Fan Yi, Wen Cai, University of Texas at Dallas, United States

4:10 p.m. – 4:30 p.m.

**T22.6:** A Fault-Tolerant Topology of T-Type NPC Inverter with Increased Thermal Overload Capability
Jiangbiao He¹, Lixiang Wei², Nabeel Demerdash¹, ¹Marquette University, United States, ²Rockwell Automation, United States

4:30 p.m. – 4:50 p.m.

**T22.7:** A Novel Analysis and Design Method of Phase Lead Filters in Repetitive Controllers for Pulse-Width Modulated Inverters
Shunfeng Yang¹, Peng Wang¹, Yi Tang¹, Michael Zagrodnik², Xiaolei Hu¹, King-Jet Tsang¹, ¹Nanyang Technological University, Singapore, ²Rolls-Royce Singapore Pte. Ltd., Singapore

4:50 p.m. – 5:10 p.m.

**T22.8:** Research on the Filter of Load Side Converter in BDFG Based Ship Shaft Power Generation System
Melin Wang, Hua Lin, Hongbin Yang, Xingwei Wang, Huazhong University of Science and Technology, China

5:10 p.m. – 5:30 p.m.

**T22.9:** Investigation of Common Mode Current Related DC-Bus Overvoltage in Multiple Converter Systems
Jiangbiao He, Zoran Vrankovic, Patrick Ozimek, Craig Winterhalter, Rockwell Automation, United States

---

2:00 p.m. – 5:30 p.m.

**T23:** Modeling of Magnetic Circuits and Systems
ROOM 102AB

**Track: Modeling and Simulation**

**SESSION CHAIRS:**
Ed Herbert
Jin Ye, San Francisco State University

2:00 p.m. – 2:20 p.m.

**T23.1:** High Frequency AC Inductor Analysis and Design for Dual Active Bridge (DAB) Converters
Zhe Zhang, Michael A.E. Andersen, Danmarks Tekniske Universitet, Denmark

2:20 p.m. – 2:40 p.m.

**T23.2:** A Comprehensive Assessment of PM Motor Topology Impact on Magnet Defect Fault Signatures
Mohsen Zafarani, Taner Goktas, Bilal Akin, University of Texas at Dallas, United States

2:40 p.m. – 3:00 p.m.

**T23.3:** High Frequency Modeling for Transformer Common Mode Noise Coupling Path Based on Multiconductor Transmission Line Theory
Peipei Meng¹, Xiangming Zhang², ¹Wuhan University of Technology, China, ²Naval University of Engineering, China

3:00 p.m. – 3:20 p.m.

**T23.4:** Leakage Flux Modeling of Multi-Winding Transformer Using Permeance Magnetic Circuit
Min Luo¹, Drazen Dujic¹, Jost Allmeling², ¹École Polytechnique Fédérale de Lausanne, Switzerland, ²Plexim, Switzerland

3:20 p.m. – 3:40 p.m.

**T23.5:** Modeling Magnetic Devices Using SPICE: Application to Variable Inductors
Marcos Alonso¹, Gilberto Martínez², Marina Perdigão³, Marcelo Cosetin⁴, Ricardo N. do Prado⁴, ¹Universidad de Oviedo, Spain, ²Continental Automotive Singapore Pte Ltd, Mexico, ³Universidade de Coimbra, Portugal, ⁴Universidade Federal de Santa Maria, Brazil
4:10 p.m. – 4:30 p.m.

**T23.6:** Investigation of a Thermal Model for a Permanent Magnet Assisted Synchronous Reluctance Motor  
Joseph Herbert, Akm Arafat, Guo-Xiang Wang, Seungdeog Choi, University of Akron, United States

4:30 p.m. – 4:50 p.m.

**T23.7:** Design Procedure for Multi-Phase External Rotor Permanent Magnet Assisted Synchronous Reluctance Machines  
Sai Sudheer Reddy Bonthu, Seungdeog Choi, University of Akron, United States

4:50 p.m. – 5:10 p.m.

**T23.8:** Applicability and Limitations of an M2Spice-Assisted “Planar-Magnetics-in-the-Circuit” Simulation Approach  
Samantha Gunter¹, Minjie Chen¹, Stephanie Pavlick¹, Rose Abramson¹, Khurram K. Afridi², David Perreault¹, ¹Massachusetts Institute of Technology, United States, ²University of Colorado Boulder, United States

2:00 p.m. – 5:30 p.m.

**T24:** Inverter/Converter Control  
ROOM 103C

**Track: Control**

**Session Chairs:**  
Siavash Pakdelian, UMass Lowell  
Behrooz Mirafzal, Kansas State University

2:00 p.m. – 2:20 p.m.

**T24.1:** Solution of Input Double-Line Frequency Ripple Rejection for High-Efficiency High-Power Density String Inverter in Photovoltaic Application  
Xiaonan Zhao, Lanhua Zhang, Rachael Born, Jih-Sheng Jason Lai, Virginia Polytechnic Institute and State University, United States

2:20 p.m. – 2:40 p.m.

**T24.2:** Fractional-Order Phase Lead Compensation for Multi-Rate Repetitive Control on Three-Phase PWM DC/AC Inverter  
Zhichao Liu¹, Bin Zhang¹, Keliang Zhou², ¹University of South Carolina, United States, ²University of Glasgow, United Kingdom

2:40 p.m. – 3:00 p.m.

**T24.3:** A Robust Modified Model Predictive Control (MMPC) Based on Lyapunov Function for Three-Phase Active-Front-End (AFE) Rectifier  
M. Parvez¹, Saad Mehkilef¹, Nadia Mei Lin Tan², Hirofumi Akagi³, ¹University of Malaya, Malaysia, ²Universiti Tenaga Nasional, Malaysia, ³Tokyo Institute of Technology, Japan

3:00 p.m. – 3:20 p.m.

**T24.4:** Adaptive Reference Model Predictive Control for Power Electronics  
Yun Yang, Siew-Chong Tan, Shu Yuen Ron Hui, University of Hong Kong, Hong Kong

3:20 p.m. – 3:40 p.m.

**T24.5:** Power Switch Lifetime Extension Strategies for Three-Phase Converters  
Serkan Dusmez, Enes Ugur, Bilal Akin, University of Texas at Dallas, United States

4:10 p.m. – 4:30 p.m.

**T24.6:** Current Controller Modeling for an Interleaved Boost with Voltage Multiplier Cells for PV Applications  
Alessandro Pevere, Urmimala Chatterjee, Johan Driesen, Katholieke Universiteit Leuven, Belgium

4:30 p.m. – 4:50 p.m.

**T24.7:** New Active Capacitor Voltage Balancing Method for Five-Level Stacked Multicell Converter  
Arash Khoshkbar Sadigh¹, Vahid Dargahi², Keith Corzine², ¹Extron Electronics, United States, ²Clemson University, United States

4:50 p.m. – 5:10 p.m.

**T24.8:** Gate Signal Jitter Elimination and Noise Shaping Modulation for High-SNR Class-D Power Amplifiers  
Mario Maurer, Arda Tüysüz, Johann Walter Kolar, Eidgenössische Technische Hochschule Zürich, Switzerland

5:10 p.m. – 5:30 p.m.

**T24.9:** Analysis and Compensation of Inverter Nonlinearity for Three-Level T-Type Inverters  
Hyeon-Sik Kim, Yong-Cheol Kwon, Seung-Jun Chee, Seung-Ki Sul, Seoul National University, Korea, South
2:00 p.m. – 5:30 p.m.

**T25: Topics in Renewable Energy Systems I**
ROOM 104B

**Track: Renewable Energy Systems**

**SESSION CHAIRS:**
Fei Gao, University of Technology of Belfort-Montbéliard
Kent Wanner, John Deere

2:00 p.m. – 2:20 p.m.

**T25.1: Front-End Isolated Quasi-Z-Source DC-DC Converter Modules in Series for Photovoltaic High-Voltage DC Applications**
Yushan Liu¹, Haitham Abu-Rub¹, Baoming Ge²,¹Texas A&M University at Qatar, Qatar,²Texas A&M University, United States

2:20 p.m. – 2:40 p.m.

**T25.2: Analysis of Non Detection Zone for Multiple Distributed PCS Based on Equivalent Single PCS Using Reactive Power Approach**
Byeong-Heon Kim, Seung-Ki Sul, Seoul National University, Korea, South

2:40 p.m. – 3:00 p.m.

**T25.3: Optimal Power Scheduling for a Grid-Connected Hybrid PV-Wind-Battery Microgrid System**
Adriana Luna¹, Nelson Diaz¹, Mehdi Savaghebi¹, Juan C. Vásquez¹, Josep Maria Guerrero¹, Kai Sun², Guoliang Chen³, Libing Sun³,¹Aalborg University, Denmark, ²Tsinghua University, China, ³Shanghai Solar Energy & Technology Co., Ltd., China

3:00 p.m. – 3:20 p.m.

**T25.4: High Efficiency Power Converter for a Doubly-Fed SOEC/SOFC System**
Kevin Tomas-Manez, Alexander Anthon, Zhe Zhang, Danmarks Tekniske Universitet, Denmark

3:20 p.m. – 3:40 p.m.

**T25.5: A Hierarchical Active Balancing Architecture for Li-Ion Batteries**
Han-Dong Gui¹, Zhiliang Zhang¹, Dong-Jie Gu¹, Yang Yang¹, Zhouyu Lu¹, Yan-Fei Liu²,¹Nanjing University of Aeronautics and Astronautics, China,²Queen’s University, Canada

4:10 p.m. – 4:30 p.m.

**T25.6: A Series-DG Based Autonomous Islanding Microgrid**
Beihua Liang¹, Yunwei Li², Jinwei He¹, Chengshan Wang¹,¹Tianjin University, China, ²University of Alberta, Canada

4:30 p.m. – 4:50 p.m.

**T25.7: An Enhanced Droop Control Scheme for Resilient Active Power Sharing in Parallelled Two-Stage PV Inverter Systems**
Hongpeng Liu¹, Yongheng Yang², Xiongfei Wang², Poh Chiang Loh², Frede Blaabjerg², Wei Wang¹, Dianguo Xu¹,¹Harbin Institute of Technology, China, ²Aalborg University, Denmark

4:50 p.m. – 5:10 p.m.

**T25.8: Voltage Closed-Loop Virtual Synchronous Generator Control of Full Converter Wind Turbine for Grid-Connected and Stand-Alone Operation**
Yiwei Ma¹, Liu Yang¹, Fred Wang¹, Leon M. Tolbert²,¹University of Tennessee, United States,²University of Tennessee / Oak Ridge National Laboratory, United States

5:10 p.m. – 5:30 p.m.

**T25.9: DC Voltage Ripple Quantification for a Flywheel-Battery Based Hybrid Energy Storage System**
Christopher Lashway, Ahmed Elsayed, Osama Mohammed, Florida International University, United States

2:00 p.m. – 5:30 p.m.

**T26: Electric Vehicle Charging Systems**
ROOM 104C

**Track: Transportation Power Electronics**

**SESSION CHAIRS:**
Jim Spangler, Spangler Prototype Inc
Hadi Malek, Ford

2:00 p.m. – 2:20 p.m.

Nari Kim, Jung-Hoon Ahn, Dong-Hee Kim, Byoung-Kuk Lee, Sungkyunkwan University, Korea, South
<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Speakers</th>
<th>Location</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>T26.2</td>
<td>A Pulse Width Modulated LLC Type Resonant Topology Adapted to Wide Output Voltage Range</td>
<td>Haoyu Wang, ShanghaiTech University, China</td>
<td>Room 103AB</td>
<td>2:20 p.m. – 2:40 p.m.</td>
</tr>
<tr>
<td>T26.3</td>
<td>A Series Resonant Circuit for Voltage Equalization of Series Connected Energy Storage Devices</td>
<td>Yanqi Yu, Raed Saasaa, Wilson Eberle, University of British Columbia, Canada</td>
<td>Room 103AB</td>
<td>2:40 p.m. – 3:00 p.m.</td>
</tr>
<tr>
<td>T26.4</td>
<td>Implementation of 3.3-kW GaN-Based DC-DC Converter for EV on-Board Charger with Series-Resonant Converter That Employs Combination of Variable-Frequency and Delay-Time Control</td>
<td>Yuntaek Jang¹, Milan Jovanovic¹, Juan Ruiz¹, Misha Kumar¹, Gang Liu²,¹ Delta Products Corporation, United States,²Delta Electronics Shanghai Co., Ltd., China</td>
<td>Room 103AB</td>
<td>3:00 p.m. – 3:20 p.m.</td>
</tr>
<tr>
<td>T26.5</td>
<td>Dual Active Bridge-Based Full-Integrated Active Filter Auxiliary Power Module for Electrified Vehicle Applications with Single-Phase Onboard Chargers</td>
<td>Ruoyu Hou, Ali Emadi, McMaster University, Canada</td>
<td>Room 103AB</td>
<td>3:20 p.m. – 3:40 p.m.</td>
</tr>
<tr>
<td>T26.6</td>
<td>All-SiC Inductively Coupled Charger with Integrated Plug-in and Boost Functionalities for PEV Applications</td>
<td>Madhu Chinthavali¹, Omer Onar¹, Steven Campbell¹, Leon M. Tolbert²,¹ Oak Ridge National Laboratory, United States,²University of Tennessee / Oak Ridge National Laboratory, United States</td>
<td>Room 103AB</td>
<td>4:10 p.m. – 4:30 p.m.</td>
</tr>
<tr>
<td>T26.7</td>
<td>Switching Condition and Loss Modeling of GaN-Based Dual Active Bridge Converter for PHEV Charger</td>
<td>Lingxiao Xue¹, Dushan Boroyevich¹, Paolo Mattavelli²,¹ Virginia Polytechnic Institute and State University, United States,²Università degli Studi di Padova, Italy</td>
<td>Room 103AB</td>
<td>4:30 p.m. – 4:50 p.m.</td>
</tr>
<tr>
<td>T26.8</td>
<td>Analysis of Cascaded Multi-Output-Port Converter for Wireless Plug-in Hybrid/On-Board EV Chargers</td>
<td>Erdem Asa¹, Kerim Colak², Dariusz Czarkowski¹,¹ New York University, United States,²Istanbul Ulasim A.S., Turkey</td>
<td>Room 103AB</td>
<td>4:50 p.m. – 5:10 p.m.</td>
</tr>
<tr>
<td>T26.9</td>
<td>Comparative Analysis of High Step-Down Ratio Isolated DC/DC Topologies in PEV Applications</td>
<td>Zhiqing Li, Haoyu Wang, ShanghaiTech University, China</td>
<td>Room 103AB</td>
<td>5:10 p.m. – 5:30 p.m.</td>
</tr>
</tbody>
</table>

**2:00 p.m. – 5:30 p.m.**

**T27: Utility Interface & Inverter Applications**

**ROOM 103AB**

**Track: Power Electronics Applications**

**Session Chairs:**

Akshay Kumar Rathore, Concordia University
Yichao Tang, Texas Instruments

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Speakers</th>
<th>Location</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>T27.1</td>
<td>DC to Single-Phase AC Voltage Source Inverter with Power Decoupling Circuit Based on Flying Capacitor Topology for PV System</td>
<td>Hiroki Watanabe, Keisuke Kusaka, Keita Furukawa, Koji Orikawa, Jun-Ichi Itoh, Nagaoka University of Technology, Japan</td>
<td>Room 103AB</td>
<td>2:00 p.m. – 2:20 p.m.</td>
</tr>
<tr>
<td>T27.2</td>
<td>GaN FET and Hybrid Modulation Based Differential-Mode Inverter</td>
<td>Sudip Mazumder¹, Ankit Gupta², Shirish Raizada², Harshit Soni², Nikhil Kumar², Paromita Mazumder¹, Parijat Bhattachaerjee¹,¹ NextWatt LLC, United States,²University of Illinois at Chicago, United States</td>
<td>Room 103AB</td>
<td>2:20 p.m. – 2:40 p.m.</td>
</tr>
<tr>
<td>T27.3</td>
<td>Thermal and Electrical Co-Design of a Modular High-Density Single-Phase Inverter Using Wide-Bandgap Devices</td>
<td>Steven Chung¹, Miad Nasr¹, David Guirguis¹, Masafumi Otsuka¹, Shahab Poshtkouhi¹, David K.W. Li¹, Vishal Palaniappan¹, David Romero¹, Cristina Amon¹, Olivier Orr², Olivier Trescases¹,¹ University of Toronto, Canada,²Solantro Semiconductor, Canada</td>
<td>Room 103AB</td>
<td>2:40 p.m. – 3:00 p.m.</td>
</tr>
<tr>
<td>T27.4</td>
<td>Reactive Power Compensation with Improvement of Current Waveform Quality for Single-Phase Buck-Type Dynamic Capacitor</td>
<td>Xinwen Chen, Ke Dai, Huazhong, Chen Xu, Ziwei Dai, Li Peng, Huazhong University of Science and Technology, China</td>
<td>Room 103AB</td>
<td>3:00 p.m. – 3:20 p.m.</td>
</tr>
</tbody>
</table>
Thursday
March 24, 2016

7:00 a.m. – 8:00 a.m.

Speaker Breakfast
GRAND BALLROOM

7:00 a.m. – 8:00 a.m.

Dialogue Presenter Breakfast
HALL A

8:00 a.m. – 12:00 p.m.

Registration
LOBBY LEVEL – LBCC

8:00 a.m. – 9:00 a.m.

Spouse and Guest Breakfast
PACIFIC ROOM – HYATT REGENCY

8:00 a.m. – 11:00 a.m.

Spouse and Guest Hospitality Room Open
PACIFIC ROOM – HYATT REGENCY

8:30 a.m. – 11:30 a.m.

IS13: Safety and Compliance
ROOM 201A

Session Chairs:
Kevin Parmenter, Excelsys
Jim Spangler, Independent Consultant

8:30 a.m. – 8:55 a.m.

IS13.1: Surges and Transients Can't Read Specifications – How to Meet Specifications and Protect Against Real-World Threats
Tim Patel, Littelfuse, Inc., United States

8:55 a.m. – 9:20 a.m.

IS13.2: Component Level Safety Certification in Systems-IEC60747-17/UL1577
Mark Cantrell, Analog Devices, United States

Thursday
March 24, 2016

3:20 p.m. – 3:40 p.m.

T27.5: Circulating Current Reduction for a Division-Summation Digital Controlled Transformerless UPS
Tsai-Fu Wu¹, Ting-Hao Shiu¹, Po-Heng Lin¹, Li-Chun Lin¹, Jia-Wei Huang¹, National Tsing Hua University, Taiwan, "Industrial Technology Research Institute, Taiwan

4:10 p.m. – 4:30 p.m.

T27.6: A Multi-Function Three-Level Dynamic Voltage Corrector with Wide Correction Range and Short Circuit Fault Isolation
Jiankun Cao, Pengling Ding, Haichun Liu, Shaojun Xie, Nanjing University of Aeronautics and Astronautics, China

4:30 p.m. – 4:50 p.m.

T27.7: Effects and Analysis of Minimum Pulse Width Limitation on Adaptive DC Voltage Control of Grid Converters
Bo Sun, Ionut Trintis, Stig Munk-Nielsen, Josep Maria Guerrero, Aalborg University, Denmark

4:50 p.m. – 5:10 p.m.

T27.8: Improved Three-Phase Micro-Inverter Using Dynamic Dead Time Optimization and Phase-Skipping Control Techniques
Seyed Milad Tayebi, Xianmin Mu, Issa Batarseh, University of Central Florida, United States

5:10 p.m. – 5:30 p.m.

T27.9: Correcting Current Imbalances in Three-Phase Four-Wire Distribution Systems
Vinson Jones, Juan Carlos Balda, University of Arkansas, United States

7:00 p.m. – 10:00 p.m.

“Surfin’ Safari” Evening Social Event
PACIFIC BALLROOM
(located adjacent to the Long Beach Convention and Entertainment Center)
### IS13.3: Introduction to EMC and EMC Standards
Ghery Pettit, Pettit EMC Consulting LLC, United States

9:20 a.m. – 9:45 a.m.

### IS13.4: Type Testing Primer for Power Converters and Transformers
Brian O’Connell, Tamura Corp of America, United States

9:45 a.m. – 10:10 a.m.

### IS13.5: IEC 60601-1-2, 4th Edition
Darryl Ray, Darryl Ray EMC Consulting, LLC, United States

10:40 a.m. – 11:05 a.m.

### IS13.6: Sources for Regulatory Information and Related Search Techniques – How to Find Safety and Compliance Information
Kevin Parmenter, Jim Spangler, Excelsys Technologies Ltd., United States

11:05 a.m. – 11:30 a.m.

---

### IS14a: Topics in Power Integration
ROOM 201B

**Session Chair:**
Dave Hurst, NextEnergy

8:30 a.m. – 10:10 a.m.

#### IS14a.1: Floating High Voltage Switches Integrated with Standard Logic
Tom Simmonds, TLSI, United States

8:30 a.m. – 8:55 a.m.

#### IS14a.2: AC/DC to UHV: How Application Requirements Drive IC Technology Requirements
Don Disney, GLOBALFOUNDRIES, Singapore

8:55 a.m. – 9:20 a.m.

#### IS14a.3: Multi-Chip Power Module Layout & Design Using Q3D Extractor and PowerSynth
Andalib Nizam¹, Atanu Dutta¹, Tom Vrotsos¹, Alan Mantooth¹, Steven Pytel Jr.²,
¹University of Arkansas, ²ANSYS, Inc.

9:20 a.m. – 9:45 a.m.

#### IS14a.4: PowerSoC & PowerSiP Markets Are Preparing. Are You?
Alex Avron, Point The Gap, France

9:45 a.m. – 10:10 a.m.

### IS14b: Power Electronics Industry in North America
ROOM 201B

**Session Chair:**
Dave Hurst, NextEnergy

10:40 a.m. – 11:05 a.m.

#### IS14b.1: Driving Collaboration for Power Electronics Technology Road Mapping Industry Survey
Dave Hurst, NextEnergy, United States

11:05 a.m. – 11:30 a.m.

#### IS14b.2: Driving Collaboration for Power Electronics Technology Roadmapping Review
Swad Komanduri, Dave Hurst, Roland Kibler, Dan Radomski, NextEnergy, United States

8:30 a.m. – 11:30 a.m.

### IS15: Power Electronics Applications
ROOM 202AB

**Session Chair:**
Bill Peterson, E&M Power

8:30 a.m. – 8:55 a.m.

#### IS15.1: Direct Current Emulator: Wideband Load / Source for Power System Simulation and Testing
William Peterson, E&M Power, United States

8:55 a.m. – 9:20 a.m.

#### IS15.2: Digital Power Conversion
Herman Vaneijikelenburg, Adaptive Power Systems, United States

9:20 a.m. – 9:45 a.m.

#### IS15.3: Latest Solutions to Meet Power Conversion Needs on the “More Electric Aircraft”
Kaz Furmanczyk, Crane Aerospace & Electronics, United States

9:45 a.m. – 10:10 a.m.

#### IS15.4: Drive System Loss Reduction by Allpole Sine Filters
Dennis Kampen, BLOCK Transformatoren-Elektronik GmbH, Germany

10:40 a.m. – 11:05 a.m.

#### IS15.5: Peak Current Controlled ZVS Full Bridge Converter with Digital Slope Compensation
Sabarish Kalyanaraman, Ramesh Kankanala, Microchip Technology (India) Pvt Ltd, India

10:40 a.m. – 11:05 a.m.
8:30 a.m. – 11:30 a.m.

**IS15.6: Protection of Wide Band Gap Semiconductor Devices Used in High Power/High Voltage Applications**
Barry Kirkorian, Mersen USA, United States

---

8:30 a.m. – 11:20 a.m.

**T28: Isolated DC-DC Converters**
ROOM 104A

**Track: DC-DC Converters**

**SESSION CHAIRS:**
Dragan Maksimovic, University of Colorado, Boulder
Zhong Ye, Texas Instruments

8:30 a.m. – 8:50 a.m.

**T28.1: New Design Methodology for Megahertz-Frequency Resonant DC-DC Converters Using Impedance Control Network Architecture**
Yushi Liu, Ashish Kumar, Jie Lu, Dragan Maksimovic, Khurram K. Afridi, University of Colorado Boulder, United States

8:50 a.m. – 9:10 a.m.

**T28.2: Dual Voltage Regulations of Single Switch Flyback Converter Using Variable Switching Frequency**
Jin-Woong Kim, Jung-Ik Ha, Seoul National University, Korea, South

9:10 a.m. – 9:30 a.m.

**T28.3: On-Chip PLL-Based Methods for Synchronizing Active Switches Across the Isolation Boundary in DC-DC Converters**
Shahab Poshtkouhi, Miad Fard, Olivier Trescases, University of Toronto, Canada

9:30 a.m. – 9:50 a.m.

**T28.4: An Isolated Soft-Switching Buck-Boost Converter Utilizing Two Transformers and Embedded Bidirectional Switches on Secondary-Side for Wide Voltage Applications**
Tingting Liu\(^1\), Hongfei Wu\(^1\), Yan Xing\(^1\), Kai Sun\(^2\), 1Nanjing University of Aeronautics and Astronautics, China, 2Tsinghua University, China

9:50 a.m. – 10:10 a.m.

**T28.5: Effect of Transformer Design on Operation of Fundamental Duty Modulation for Dual-Active-Bridge Converter**
Wooin Choi, Moonhyun Lee, Bo-Hyung Cho, Seoul National University, Korea, South

---

8:30 a.m. – 11:30 a.m.

**IS16: Power Semiconductors Enabling Next Generation Applications**
ROOM 203AB

**SESSION CHAIRS:**
Carl Blake, Independent Consultant
John Palmour, Wolfspeed

8:30 a.m. – 8:55 a.m.

**IS16.1: Outlook for Semiconductors & Power Discretres & Modules**
Dale Ford, IHS, United States

8:55 a.m. – 9:20 a.m.

**IS16.2: Silicon Carbide Devices for Energy Efficient Infrastructure**
Ranbir Singh, GeneSiC Semiconductor Inc., United States

9:20 a.m. – 9:45 a.m.

**IS16.3: GaN Vs. Silicon – Overcoming Barriers to the Rise of GaN**
Joe Engle, Alex Lidow, EPC, United States

9:45 a.m. – 10:10 a.m.

**IS16.4: Unlocking the Power of GaN**
Dan Kinzer, Navitas Semiconductor, United States

9:10 a.m. – 9:30 a.m.

**IS16.5: GaN in a Silicon World: Competition or Coexistence**
Tim McDonald, Infineon, United States

10:40 a.m. – 11:05 a.m.

**IS16.6: Advanced High Power-Density Thermal Packages & Mother-Boards Enable Ultimate Power GaN & SiC Performance & Efficiency**
Courtney Furnival, Arnold Alderman, Semiconductor Packaging Solutions, United States

11:05 a.m. – 11:30 a.m.
10:40 a.m. – 11:00 a.m.

T28.6: **A High Step-Up Bidirectional Isolated Dual-Active-Bridge Converter with Three-Level Voltage-Doubler Rectifier for Energy Storage Applications**
Xiaohai Zhan¹, Hongfei Wu¹, Yan Xing¹, Hongjuan Ge¹, Xi Xiao², ¹Nanjing University of Aeronautics and Astronautics, China, ²Tsinghua University, China

11:00 a.m. – 11:20 a.m.

T28.7: **Digitized Self-Oscillating Loop for Piezoelectric Transformer-Based Power Converters**
Marzieh Ekhtiari, Thomas Andersen, Zhe Zhang, Michael A.E. Andersen, Danmarks Tekniske Universitet, Denmark

8:30 a.m. – 11:20 a.m.

**T29: Multilevel Converters**

**ROOM 101A**

**Track: Power Electronics for Utility Interface**

**Session Chairs:**
Maryam Saeedifard, Georgia Tech
Julia Zhang, Oregon State University

8:30 a.m. – 8:50 a.m.

T29.1: **An Isolated Topology for Reactive Power Compensation with a Modularized Dynamic-Current Building-Block**
Hao Chen¹, Anish Prasai², Deepak Divan¹, ¹Georgia Institute of Technology, United States, ²Varentec, United States

8:50 a.m. – 9:10 a.m.

T29.2: **Design and Control of a Compact MMC Submodule Structure with Reduced Capacitor Size Using the Stacked Switched Capacitor Architecture**
Yuan Tang¹, Minjie Chen², Li Ran¹, ¹University of Warwick, United Kingdom, ²Massachusetts Institute of Technology, United States

9:10 a.m. – 9:30 a.m.

T29.3: **Fundamental Frequency Sorting Strategy for Capacitor Voltage Balance of Modular Multilevel Converters with Phase Disposition PWM**
Kun Wang, Yan Deng, Wenyu Li, Hao Peng, Guipeng Chen, Xiangning He, Zhejiang University, China

9:30 a.m. – 9:50 a.m.

T29.4: **Active Voltage Balancing Control for 10kV Three-Level Converter Using Series-Connected HV-IGBTs**
Shiqi Ji¹, Ting Lu¹, Zhengming Zhao¹, Hualong Yu¹, Fred Wang², ¹Tsinghua University, China, ²University of Tennessee, United States

10:40 a.m. – 11:00 a.m.

T29.5: **Average-Value Model of Modular Multilevel Converters Considering Capacitor Voltage**
Heya Yang¹, Yuxiang Chen¹, Wuhua Li¹, Xiangning He¹, Wei Sun², Yongning Chi², Yan Li², ¹Zhejiang University, China, ²China Electric Power Research Institute, China

8:30 a.m. – 11:20 a.m.

**T30: Multilevel and Matrix Converters for Motor Drives**

**ROOM 102C**

**Track: Motor Drives and Inverters**

**Session Chairs:**
SeonHwan Hwang, Kyungnam University, Korea
Xiaohu Liu, GE

8:30 a.m. – 8:50 a.m.

T30.1: **New Flying-Capacitor-Based Multilevel Converter with Optimized Number of Switches and Capacitors Controlled with a New Logic-Form-Equation Based Active Voltage Balancing Technique**
Vahid Dargahi¹, Arash Khoshkbar Sadigh², Keith Corzine¹, ¹Clemson University, United States, ²Extron Electronics, United States
8:50 a.m. – 9:10 a.m.

**T30.2:** New Low-Cost Five-Level Active Neutral-Point Clamped Converter
Hongliang Wang¹, Lei Kou¹, Yan-Fei Liu¹, Paresh Sen¹, Sucheng Liu², ¹Queen's University, Canada, ²Anhui University of Technology, China

9:10 a.m. – 9:30 a.m.

**T30.3:** Medium Voltage (>= 2.3 kV) High Frequency Three-Phase Two-Level Converter Design and Demonstration Using 10 kV SiC MOSFETs for High Speed Motor Drive Applications
Sachin Madhusoodhanan, Krishna Mainali, Awneesh Tripathi, Kasunaidu Vechalapu, Subhashish Bhattacharya, North Carolina State University, United States

9:30 a.m. – 9:50 a.m.

**T30.4:** Novel Three Phase Multi-Level Inverter Topology with Symmetrical DC-Voltage Sources
Ahmed Salem, Emad M. Ahmed, Mahrous Ahmed, Mohamed Orabi, Aswan University, Egypt

9:50 a.m. – 10:10 a.m.

**T30.5:** A 2 kW, Single-Phase, 7-Level, GaN Inverter with an Active Energy Buffer Achieving 216 W/in^3 Power Density and 97.6% Peak Efficiency
Yutian Lei, Christopher Barth, Shibin Qin, Wen Chuen Liu, Intae Moon, Andrew Stillwell, Derek Chou, Thomas Foulkes, Zichao Ye, Zitao Liao, Robert Pliawa-Podgurski, University of Illinois Urbana-Champaign, United States

10:40 a.m. – 11:00 a.m.

**T30.6:** Indirect Matrix Converter Based Open-End Winding AC Drives with Zero Common-Mode Voltage
Saurabh Tewari¹, Ranjan Gupta², Apurva Somani³, Ned Mohan¹, ¹University of Minnesota, United States, ²First Solar, Inc., United States, ³Dynapower Company LLC, United States

11:00 a.m. – 11:20 a.m.

**T30.7:** Precharging Strategy for Soft Startup Process of Modular Multilevel Converters Based on Various SM Circuits
Jiangchao Qin¹, Suman Deb Nath², Maryam Saeedifard³, ¹Arizona State University, United States, ²Oak Ridge National Laboratory, United States, ³Georgia Institute of Technology, United States

8:30 a.m. – 11:20 a.m.

**T31:** System Design Techniques for Reduced EMI
ROOM 101B

**Track: System Integration**

**Session Chairs:**
John Vigars, Allegro Microsystems
Doug Hopkins, North Carolina State University

8:30 a.m. – 8:50 a.m.

**T31.1:** Conducted EMI Analysis and Filter Design for MHz Active Clamp Flyback Front-End Converter
Xiucheng Huang, Junjie Feng, Fred C. Lee, Qiang Li, Yuchen Yang, Virginia Polytechnic Institute and State University, United States

8:50 a.m. – 9:10 a.m.

**T31.2:** EMC Investigation of a Very High Frequency Self-Oscillating Resonant Power Converter
Jeppe Arnsdorf Pedersen, Arnold Knott, Michael A.E. Andersen, Danmarks Tekniske Universitet, Denmark

9:10 a.m. – 9:30 a.m.

**T31.3:** Numerical Optimization of Passive Line Filter Components for Suppression of Electromagnetic Interference (EMI)
Carsten Henkenius¹, Norbert Fröhleke¹, Joachim Böcker¹, Heiko Figge², ¹Universität Paderborn, Germany, ²Delta Energy Systems Germany GmbH, Germany

9:30 a.m. – 9:50 a.m.

**T31.4:** Electromagnetic Noise Coupling and Mitigation for Fast Response on-Die Temperature Sensing in High Power Modules
Chengcheng Yao¹, Pengzhi Yang¹, Mingzhi Leng¹, He Li¹, Lixing Fu¹, Jin Wang¹, Ke Zou², Chingchi Chen², ¹Ohio State University, United States, ²Ford Motor Company, United States

9:50 a.m. – 10:10 a.m.

**T31.5:** Ultra-Low Inductance Vertical Phase Leg Design with EMI Noise Propagation Control for Enhancement Mode GaN Transistors
Xunxing Zhang, Zhiyu Shen, Nidhi Haryani, Dushan Boroyevich, Rolando Burgos, Virginia Polytechnic Institute and State University, United States
10:40 a.m. – 11:00 a.m.

**T31.6:** Decoupling of Interaction Between WBG Converter and Motor Load for Switching Performance Improvement
Zheyu Zhang¹, Fred Wang¹, Leon M. Tolbert², Benjamin J. Blalock¹, Daniel Jes Costinett¹,
¹University of Tennessee, United States,
²University of Tennessee / Oak Ridge National Laboratory, United States

11:00 a.m. – 11:20 a.m.

**T31.7:** Control and Characterization of Electromagnetic Emissions in Wide Band Gap Based Converter Modules for Ungrounded Grid-Forming Applications
Robert Cuzner¹, Seyed Rasoul Hosseini¹, Andrew Lemmon², James Gafford³, Michael Mazzola³,
¹University of Wisconsin-Milwaukee, United States,
²University of Alabama, United States,
³Mississippi State University, United States

8:30 a.m. – 11:20 a.m.

**T32:** Modeling of DC Energy Converters and Systems
ROOM 102AB

Track: Modeling and Simulation

**SESSION CHAIRS:**
Santanu Kapat, IIT Kharagpur
Sombuddha Chakraborty, Texas Instruments

8:30 a.m. – 8:50 a.m.

**T32.1:** A Practical Switching Time Model for Synchronous Buck Converters
Yuan Rao, Surinder Singh, Taisuke Kazama,
Texas Instruments Inc., United States

8:50 a.m. – 9:10 a.m.

**T32.2:** Off-Line Identification of Digitally Controlled Power Converters Using an Analog Frequency Response Analyzer
Marco Meola¹, Anthony Kelly², Zentrum Mikroelektronik Dresden AG, Germany,
²Altera Corporation, Ireland

9:10 a.m. – 9:30 a.m.

**T32.3:** Extended Wide-Load Range Model for Multi-Level DC-DC Converters and a Practical Dual-Mode Digital Controller
Nenad Vukadinovic¹, Aleksandar Prodic¹, Brett Miwa², Cory Arnold², Michael Baker²,
¹University of Toronto, Canada,
²Maxim Integrated, United States

9:30 a.m. – 9:50 a.m.

**T32.4:** Burst Mode Control and Switched-Capacitor Converters Losses
Michael Evzelman, Regan Zane,
Utah State University, United States

10:40 a.m. – 11:00 a.m.

**T32.5:** Equivalent Circuit Modeling of LLC Resonant Converter
Shuiliin Tian, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States

11:00 a.m. – 11:20 a.m.

**T32.6:** Small Signal Modeling of the Hysteretic Modulator with a Current Ripple Synthesizer
Yi Huang, Chun Cheung, Intersil Corporation, United States

8:30 a.m. – 11:20 a.m.

**T33:** Gate Drive Techniques
ROOM 103C

Track: Control

**SESSION CHAIRS:**
Christopher Bridge, SIMPLIS Technologies
Martin Ordonez, University of British Columbia

8:30 a.m. – 8:50 a.m.

**T33.1:** Design and Evaluation of Isolated Gate Driver Power Supply for Medium Voltage Converter Applications
Krishna Mainali, Sachin Madhusoodhanan, Awneesh Tripathi, Kasunaidu Vechalapu, Ankan De, Subhashish Bhattacharya,
North Carolina State University, United States

8:50 a.m. – 9:10 a.m.

**T33.2:** General-Purpose Clocked Gate Driver (CGD) IC with Programmable 63-Level Drivability to Reduce Ic Overshoot and Switching Loss of Various Power Transistors
Koutarou Miyazaki¹, Seiya Abe², Masanori Tsukuda², Ichiro Omura², Keiji Wada³, Makoto Takamiya¹, Takayasu Sakurai¹,
¹University of Tokyo, Japan,
²Kyushu Institute of Technology, Japan,
³Tokyo Metropolitan University, Japan
9:10 a.m. – 9:30 a.m.

**T33.3: An Integrated SiC CMOS Gate Driver**
Matthew Barlow¹, Shamim Ahmed, Alan Mantooth, Matt Francis², ¹University of Arkansas, United States, ²Ozark Integrated Circuits, Inc., United States

9:30 a.m. – 9:50 a.m.

**T33.4: Digital Active Gate Drives Using Sequential Optimization**
Daniel Rogers¹, Boris Murmann², ¹Oxford University, United Kingdom, ²Stanford University, United States

9:50 a.m. – 10:10 a.m.

**T33.5: One Adaptive Turn-Off Method for PFC Converter with Voltage Spike Limitation**
Qunfang Wu, Qin Wang, Lan Xiao, Jialin Xu, Hongxu Li, Nanjing University of Aeronautics and Astronautics, China

10:40 a.m. – 11:00 a.m.

**T33.6: A Digital Implementation for PWM Phase-Frequency Synchronization in SMPS Systems**
Luca Bizjak¹, Emanuele Bodano¹, Ante Gotovac², Sergii Tkachov³, ¹Infineon Technologies Austria AG, Italy, ²Infineon Technologies Austria AG, Croatia, ³Infineon Technologies Austria AG, Ukraine

11:00 a.m. – 11:20 a.m.

**T33.7: A High Accuracy and High Bandwidth Current Sense Circuit for Digitally Controlled DC-DC Buck Converters**
David Stack¹, Anthony Kelly¹, Thomas Conway², ¹Altera Corporation, Ireland, ²University of Limerick, Ireland

8:30 a.m. – 11:20 a.m.

**T34: Energy Storage Systems**
ROOM 104B

**Track: Renewable Energy Systems**

**SESSION CHAIRS:**
Wei Qiao, University of Nebraska Lincoln
Yilmaz Sozer, University of Akron

8:30 a.m. – 8:50 a.m.

**T34.1: Modular Multilevel Dual Active Bridge DC-DC Converter with ZVS and Fast DC Fault Recovery for Battery Energy Storage Systems**
Yuxiang Shi, Rui Li, Hui Li, Florida State University, United States

8:50 a.m. – 9:10 a.m.

**T34.2: An Analytical Framework to Design a Dynamic Frequency Control Scheme for Microgrids Using Energy Storage**
Ajit Renjit¹, Feng Guo², Ratnesh Sharma², ¹Ohio State University, United States, ²NEC Laboratories America, Inc., United States

9:10 a.m. – 9:30 a.m.

**T34.3: Comparative Evaluation of LiFePO4 Cell SOC Estimation Performance with ECM Structure and Noise Model/Data Rejection in the EKF for Transportation Application**
Hyunjun Lee¹, Jounghu Park¹, Jonghoon Kim², ¹Soongsil University, Korea, South, ²Chosun University, Korea, South

9:30 a.m. – 9:50 a.m.

**T34.4: A Power Sharing Scheme for Series Connected Offshore Wind Turbines in a Medium Voltage DC Collection Grid**
Michael Daniel, Prasad Enjeti, Texas A&M University, United States

9:50 a.m. – 10:10 a.m.

**T34.5: Fault Ride-Through Performance Evaluation of an Interleaved Grid-Connected Converter Employing Low Switching Frequency**
Lorand Bede¹, Ghanshyamsinh Gohil¹, Mihai Ciobotaru², Tamas Kerekes¹, Remus Teodorescu¹, Vassilios Agelidis², ¹Aalborg University, Denmark, ²University of New South Wales, Australia

10:40 a.m. – 11:00 a.m.

**T34.6: Analysis of Two Charging Modes of Battery Energy Storage System for a Stand-Alone Microgrid**
Jongmin Jo, Hanju Cha, Chungnam National University, Korea, South

11:00 a.m. – 11:20 a.m.

**T34.7: Proposition and Experimental Verification of a Bi-Directional Isolated DC/DC Converter for Battery Charger-Discharger of Electric Vehicle**
Ryota Kondo, Yusuke Higaki, Masaki Yamada, Mitsubishi Electric Corporation, Japan
8:30 a.m. – 11:20 a.m.

**T35: Topics on Inductive and Capacitive Wireless Power Transfer**

**ROOM 104C**

**Track: Transportation Power Electronics**

**Session Chairs:**
Chris Mi, San Diego State University
Omer Onar, Oak Ridge National Laboratory

8:30 a.m. – 8:50 a.m.

**T35.1: A CLLC-Compensated High Power and Large Air-Gap Capacitive Power Transfer System for Electric Vehicle Charging Applications**

Fei Lu¹, Hua Zhang², Heath Hofmann¹, Chris Mi²,
¹University of Michigan-Ann Arbor, United States,
²University of Michigan-Dearborn, United States

8:50 a.m. – 9:10 a.m.

**T35.2: A Large Air-Gap Capacitive Power Transfer System with a 4-Plate Capacitive Coupler Structure for Electric Vehicle Charging Applications**

Hua Zhang¹, Fei Lu², Heath Hofmann², Weiguo Liu³, Chris Mi¹,
¹University of Michigan-Dearborn, United States,
²University of Michigan-Ann Arbor, United States,
³Northwestern Polytechnical University, China

9:10 a.m. – 9:30 a.m.


Katsuhiro Hata, Takehiro Imura, Yoichi Hori,
University of Tokyo, Japan

9:30 a.m. – 9:50 a.m.

**T35.4: Uniform-Gain Frequency Tracking of Wireless EV Charging for Improving Alignment Flexibility**

Yabiao Gao¹, Antonio Ginart², Kathleen Farley³,
Zion Tsz Ho Tse¹, ¹University of Georgia, United States,
²Sonnenbatterie GmbH / University of Georgia, United States,
³Southern Company Services, Inc., United States

9:50 a.m. – 10:10 a.m.

**T35.5: Design and Optimization of a Multi-Coil System for Inductive Charging with Small Air Gap**

Christopher Joffe, Andreas Roßkopf, Stefan Ehrlich, Christian Dobmeier, Martin März,
Fraunhofer Institute for Integrated Systems and Device Technology, Germany

10:40 a.m. – 11:00 a.m.

**T35.6: Core Design for Better Misalignment Tolerance and Higher Range of Wireless Charging for HEV**

Mostak Mohammad¹, Sangshin Kwak²,
Seungdeog Choi³, ¹University of Akron, United States,
²Chung-ang University, Korea, South

11:00 a.m. – 11:20 a.m.

**T35.7: A 25 kW Industrial Prototype Wireless Electric Vehicle Charger**

Mariusz Bojarski¹, Erdem Asa², Kerim Colak³,
Dariusz Czarkowski⁴, ¹Hevo Power Inc., United States,
²New York University / Hevo Power Inc., United States,
³Istanbul Ulasm A.S., Turkey,
⁴New York University, United States

8:30 a.m. – 11:20 a.m.

**T36: Wireless Power Transfer**

**ROOM 103AB**

**Track: Power Electronics Applications**

**Session Chair:**
Michael Masquelier, WAVE
Xiong Li, Texas Instruments

8:30 a.m. – 8:50 a.m.

**T36.1: Full-Bridge Series Resonant Multi-Inverter Featuring New 900-V SiC Devices for Improved Induction Heating Appliances**

Mario Pérez-Tarragona, Hector Sarnago, Oscar Lucía, José Miguel Burdio,
Universidad de Zaragoza, Spain

8:50 a.m. – 9:10 a.m.

**T36.2: A Novel Phase Control of Single Switch Active Rectifier for Inductive Power Transfer Applications**

Kerim Colak¹, Erdem Asa², Dariusz Czarkowski³,
¹Istanbul Ulasm A.S., Turkey,
²New York University / Hevo Power Inc., United States,
³New York University, United States

9:10 a.m. – 9:30 a.m.

**T36.3: Optimal Shaped Dipole-Coil Design and Experimental Verification of Inductive Power Transfer System for Home Applications**

Tan Duy Nguyen, Eunsoo Lee, Byeungguk Choi, Chuntaek Rim,
Korea Advanced Institute of Science and Technology, Korea, South
9:30 a.m. – 9:50 a.m.

**T36.4:** A Novel Time-Sharing Current-Fed ZCS High Frequency Inverter-Applied Resonant DC-DC Converter for Inductive Power Transfer
Kyohei Konishi¹, Tomokazu Mishima¹, Mutsuo Nakaoka², ¹Kobe University, Japan, ²University of Malaya, Malaysia

9:50 a.m. – 10:10 a.m.

**T36.5:** Optimization of Coils for Magnetically Coupled Resonant Wireless Power Transfer System Based on Maximum Output Power
Dan Jiang, Yong Yang, Xinyu Liu, Xinbo Ruan, Xuling Chen, Nanjing University of Aeronautics and Astronautics, China

10:40 a.m. – 11:00 a.m.

**T36.6:** Online Regulation of Receiver-Side Power and Estimation of Mutual Inductance in Wireless Inductive Link Based on Transmitter-Side Electrical Information
Jeff Po Wa Chow, Henry Shu-Hung Chung, Chun Sing Cheng, City University of Hong Kong, Hong Kong

11:00 a.m. – 11:20 a.m.

**T36.7:** Dynamic Period Switching of PRS-PWM with Run-Length Limiting Technique for Spurious and Ripple Reduction in Fast Response Wireless Power Transmission
Takahiro Moroto, Toru Kawajiri, Hiroki Ishikuro, Keio University, Japan

11:30 a.m. – 1:30 p.m.

**Dialogue Sessions**
(for detailed information see page 150)
HALL A

2:00 p.m. – 5:00 p.m.

**IS17:** Market Analysis
ROOM 201A

**Session Chairs:**
Chris Jones, Artesyn Embedded Technologies
Greg Evans, WelComm

2:00 p.m. – 2:25 p.m.

**IS17.1:** The New Competitive Environment for Power Semiconductors
Victoria Fodale, Michael Markides, IHS Technology, United States

2:25 p.m. – 2:50 p.m.

**IS17.2:** Discrete Vs. Integrated Power Solutions
IHS Technology
Jonathan Liao, Richard Eden, Michael Markides, IHS Global Inc., United States

3:15 p.m. – 3:40 p.m.

**IS17.3:** GaN on Si HEMT vs SJ Mosfet: Technology and Cost Comparison of Next Generation 600/650V Power Devices
Elena Barbarini, System Plus Consulting, France

4:10 p.m. – 4:35 p.m.

**IS17.4:** Market Forecasts for Silicon Carbide & Gallium Nitride Power Semiconductors
IHS Technology
Jonathan Liao, Richard Eden, Michael Markides, IHS Technology, United Kingdom

4:35 p.m. – 5:00 p.m.

**IS17.5:** Si IGBT and SiC: Which Repartition for Power Devices?
Pierre Gueguen, Yole Développement, France

2:00 p.m. – 3:15 p.m.

**IS18:** LED Lighting
ROOM 201B

**Session Chairs:**
Aung Thet Tu, Independent Consultant
Brian Johnson, Texas Instruments

2:00 p.m. – 2:25 p.m.

**IS18.1:** Damping Circuit for Dimmable Retrofit LED Lamps
Nagaraja Chikkegowda, OSRAM, United States

2:25 p.m. – 2:50 p.m.

**IS18.2:** Smart Lighting and the Future of Illumination Markets
Robert F. Karlisle Jr., Rensselaer Polytechnic Institute, United States

2:50 p.m. – 3:15 p.m.

**IS18.3:** The Challenges (and Surprises) of Closed-Loop LED Color and Color Temperature Control
Cary Eskow, Avnet Electronics, United States
2:00 p.m. – 3:15 p.m.
**IS19a: ElectroMagnetic Compatibility**
ROOM 202AB

**Session Chairs:**
Kevin Parmenter, *Excelsys*
Jim Spangler, *Independent Consultant*

2:00 p.m. – 2:25 p.m.
**IS19a.1: The Behavior of Electro-Magnetic Radiation of Storage Inductor in DC-DC Converters**
Ranjith Bramanpalli, *Wurth Elektronik, Germany*

2:25 p.m. – 2:50 p.m.
**IS19a.2: EMC Filter Solutions for Switch Mode Power Supplies**
Nikila Kareesan, *SCHURTER, Inc., United States*

2:50 p.m. – 3:15 p.m.
**IS19a.3: Inductor Noise in the Buck Converter GPU Circuit**
David Yu, Andrew Chu, *ITG Electronics, Inc., China*

4:10 p.m. – 5:25 p.m.
**IS19b: Capacitors for Power Applications**
ROOM 202AB

**Session Chairs:**
Kevin Parmenter, *Excelsys*
Jim Spangler, *Independent Consultant*

4:10 p.m. – 4:35 p.m.
**IS19b.1: New Component Technologies Enable More Robust and Reliable Power System Design**
Chris Reynolds, *AVX, United States*

4:35 p.m. – 5:00 p.m.
**IS19b.2: Non-Traditional Supercapacitor Topologies for Traditional Circuit Issues**
Nihal Kularatna, *The University of Waikato, New Zealand*

5:00 p.m. – 5:25 p.m.
**IS19b.3: Proposal of Precise SPICE Model of Conductive Polymer Aluminum Solid Capacitors**
Shun Koyama, Tomoyuki Goutsu, *Nippon Chemi-Con Corporation, Japan*

2:00 p.m. – 5:00 p.m.
**IS20: Active Devices**
ROOM 203AB

**Session Chairs:**
Sal Akram, *Fairchild Semiconductor*
Kumar Gandharva, *Infineon*

2:00 p.m. – 2:25 p.m.
**IS20.1: Advantages and Optimized Control of Reverse Conducting Diode Controlled RCDC IGBT’s**
David Levett, Tim Frank, *IFNA, United States*

2:25 p.m. – 2:50 p.m.
**IS20.2: If It Ain’t Broke Why Fix It? Design Improvements to the PrimePACK™ IGBT Module for Commercial, Construction and Agricultural Vehicle (CAV) Traction Drives**
David Levett, Tim Frank, *IFNA, United States*

2:50 p.m. – 3:15 p.m.
**IS20.3: Hybrid Si-SiC High Power Modules for Cost Effective High Voltage, High Current, High Frequency Switching**
Eric Motto, John Donlon, Mike Rogers, *Powerex Inc., United States*

3:15 p.m. – 3:40 p.m.
**IS20.4: A New High Power IGBT Module Package**
Timothy Frank, David Levett, *Infineon Technologies, United States*

4:10 p.m. – 4:35 p.m.
**IS20.5: Test Setup for Accelerated Lifetime Determination of IGBT Modules**
Bram Geene, *Prodrive Technologies, Netherlands*

4:35 p.m. – 5:00 p.m.
**IS20.6: HybridMOS: Product Development Contributing to Improved Energy Savings**
Hiroyuki Ogurisu, Mitch Van Ochten, *ROHM Semiconductor, United States*
2:00 p.m. – 5:30 p.m.

**T37: Single-Phase AC-DC Converters**

ROOM 102AB

**Track: AC-DC Converters**

**Session Chairs:**
Dusty Becker, Emerson Network Power
Pritam Das, National University of Singapore

2:00 p.m. – 2:20 p.m.

**T37.1:** A Flyback AC/DC Converter Using Power Semiconductor Filter for Input Power Factor Correction
Chung-Pui Tung, Henry Shu-Hung Chung, City University of Hong Kong, Hong Kong

2:20 p.m. – 2:40 p.m.

**T37.2:** Reducing the Variation Range of the Switching Frequency for CRM Boost PFC Converter by Injecting 3rd Harmonic Into the Input Current
Yi Wang, Kai Yao, Nanjing University of Science and Technology, China

2:40 p.m. – 3:00 p.m.

**T37.3:** A Sustained Increase of Input Current Distortion in Active Input Current Shapers to Eliminate Electrolytic Capacitor for Designing AC to DC HB-LED Drivers for Retrofit Lamps Applications
Diego G. Lamar¹, Manuel Arias¹, Alberto Rodriguez¹, Javier Sebastian¹, Arturo Fernandez², Jose Villarejo³, "Universidad de Oviedo, Spain, ²European Space Agency, Netherlands, ³Universidad de Cartagena, Spain

3:00 p.m. – 3:20 p.m.

**T37.4:** Reduced Current Stress Bridgeless Cuk PFC Converter with New Voltage Multiplier Circuit
Yi-Hung Liao, National Penghu University of Science and Technology, Taiwan

3:20 p.m. – 3:40 p.m.

**T37.5:** Implementation of Multi-Level Bridgeless PFC Rectifiers for Mid-Power Single Phase Applications
Trong Tue Vu, George Young, Eisergy Ltd., Ireland

4:10 p.m. – 4:30 p.m.

**T37.6:** US Mains Stacked Very High Frequency Self-Oscillating Resonant Power Converter with Unified Rectifier
Jeppe Arnsdorff Pedersen, Mickey P. Madsen, Jakob D. Monster, Thomas Andersen, Arnold Knott, Michael A.E. Andersen, Danmarks Tekniske Universitet, Denmark

4:30 p.m. – 4:50 p.m.

**T37.7:** Digital-Based Interleaving Control for GaN-Based MHz CRM Totem-Pole PFC
Zhengyang Liu, Zhengrong Huang, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States

4:50 p.m. – 5:10 p.m.

**T37.8:** A Novel AC-to-DC Adaptor with Ultra-High Power Density and Efficiency
Yan-Cun Li, Fred C. Lee, Qiang Li, Xiucheng Huang, Zhengyang Liu, Virginia Polytechnic Institute and State University, United States

5:10 p.m. – 5:30 p.m.

**T37.9:** A Single-Stage Single-Phase Isolated AC-DC Converter Based on LLC Resonant Unit and T-Type Three-Level Unit for Battery Charging Applications
Yikai Gao, Wen Cai, Fan Yi, University of Texas at Dallas, United States

2:00 p.m. – 5:30 p.m.

**T38: Non-Isolated DC-DC Converters**

ROOM 101A

**Track: DC-DC Converters**

**Session Chairs:**
Pradeep Shenoy, Texas Instruments
Juan Rivas-Davila, Stanford

2:00 p.m. – 2:20 p.m.

**T38.1:** DC-DC Power Converter Controller for SOC Balancing of Paralleled Battery System
Jaber Abu Qahouq, Lin Zhang, Yuan Cao, Bharat Balasubramanian, University of Alabama, United States

2:20 p.m. – 2:40 p.m.

**T38.2:** Ultra-Step-Up DC-DC Converter with Integrated Autotransformer and Coupled Inductor
Yam Siwakoti, Frede Blaabjerg, Poh Chiang Loh, Aalborg University, Denmark

2:40 p.m. – 3:00 p.m.

**T38.3:** Optimal Dynamic Phase Add/Drop Mechanism in Multiphase DC-DC Buck Converters
Anandha Ruban T T¹, Preetam Tadeparthy¹, Sankaran Aniruddhan², Vikram Gakhar¹, Muthusubramanian Venkateswaran¹, "Texas Instruments India Pvt. Ltd., India, ²Indian Institute of Technology Madras, India
3:00 p.m. – 3:20 p.m.

T38.4: A Universal Self-Calibrating Dynamic Voltage and Frequency Scaling (DVFS) Scheme with Thermal Compensation for Energy Savings in FPGAs
Shuze Zhao1, Ibrahim Ahmed1, Carl Lamoureux1, Ashraf Lotfi2, Vaughn Betz1, Olivier Trescases1,
1University of Toronto, Canada,
2Altera Corporation, United States

3:20 p.m. – 3:40 p.m.

T38.5: Morphing Switched-Capacitor Step-Down DC-DC Converters with Variable Conversion Ratio
Song Xiong, Ying Huang, Siew-Chong Tan, Shu Yuen Ron Hui, University of Hong Kong, Hong Kong

4:10 p.m. – 4:30 p.m.

T38.6: Compact Modular Switched-Capacitor DC/DC Converters with Exponential Voltage Gain
Ying Huang, Song Xiong, Siew-Chong Tan, Shu Yuen Ron Hui, University of Hong Kong, Hong Kong

4:30 p.m. – 4:50 p.m.

T38.7: Study and Implementation of a High Step-Up Voltage DC-DC Converter Using Coupled-Inductor and Cascade Techniques
Tsorng Juu Liang, Yung Ting Huang, Jian Hsing Lee, Lo Pang Yen Ting, National Cheng Kung University, Taiwan

4:50 p.m. – 5:10 p.m.

T38.8: 20 mV Input, 4.2 V Output Boost Converter with Methodology of Maximum Output Power for Thermoelectric Energy Harvesting
Taichi Ogawa, Takeshi Ueno, Takayuki Miyazaki, Tetsuro Itakura, Toshiba Corporation, Japan

5:10 p.m. – 5:30 p.m.

T38.9: Clarification of Relationship Between Current Ripple and Power Density in Bidirectional DC-DC Converter
Hoai Nam Le, Koji Orikawa, Jun-Ichi Itoh, Nagaoka University of Technology, Japan

2:00 p.m. – 5:30 p.m.

T39: Inverter Applications and Technologies
ROOM 101B

Track: Power Electronics for Utility Interface

SESSION CHAIRS:
Ali Khajehoddin, University of Alberta
Wen Cai, University of Texas, Dallas

2:00 p.m. – 2:20 p.m.

T39.1: Grid-Voltage Feedforward Based Control for Grid-Connected LCL-Filtered Inverter with High Robustness and Low Grid Current Distortion in Weak Grid
Jinming Xu, Qiang Qian, Shaojun Xie, Binfeng Zhang, Nanjing University of Aeronautics and Astronautics, China

2:20 p.m. – 2:40 p.m.

T39.2: Evaluation of PV Frequency-Watt Function for Fast Frequency Reserves
Jason Neely, Jay Johnson, Jarod Delhotal, Sigifredo Gonzalez, Matthew Lave, Sandia National Laboratories, United States

2:40 p.m. – 3:00 p.m.

T39.3: A Systematic Design Method and Verification for a Zero-Ripple Interface for PV/Battery-to-Grid Applications
Suvankar Biswas, Ned Mohan, William Robbins, University of Minnesota, United States

3:00 p.m. – 3:20 p.m.

T39.4: Grid-Voltage-Feedforward Active Damping for Grid-Connected Inverter with LCL Filter
Minghui Lu1, Xiongfei Wang1, Frede Blaabjerg1, S.M. Muyeen2, Ahmed Al-Durra2, Siyu Leng2,
1Aalborg University, Denmark, 2Petroleum Institute, U.A.E.

3:20 p.m. – 3:40 p.m.

T39.5: A High Power Density Single-Phase Inverter Using Stacked Switched Capacitor Energy Buffer
Colin McHugh, Sreyam Sinha, Jeffrey Meyer, Saad Pervaiz, Jie Lu, Fan Zhang, Hua Chen, Hyeokjin Kim, Usama Anwar, Ashish Kumar, Alihossein Sepahvand, Scott Jensen, Beomseok Choi, Daniel Seltzer, Robert Erickson, Dragan Maksimovic, Khurram K. Afridi, University of Colorado Boulder, United States
2:00 p.m. – 5:30 p.m.

**T40: Modeling, Modulation and Control of Motor Drive**

**ROOM 102C**

**Session Chairs:**
Jin Wang, *The Ohio State University*
River-Tin Ho Li, ABB

2:00 p.m. – 2:20 p.m.

**T40.1:** Modulation Technique for Common Mode Voltage Reduction in a Matrix Converter Drive Operating with High Voltage Transfer Ratio

Varsha Padhee¹, Ashish Kumar Sahoo², Ned Mohan³, ¹Rockwell Automation, United States, ²University of Minnesota, United States

2:20 p.m. – 2:40 p.m.

**T40.2:** Soft-Switched Discontinuous Pulse-Width Pulse-Density Modulation Scheme

Arash Rahnamae, Alireza Mojab, Hossein Riazmontazer, Sudip Mazumder, Milos Zefran, University of Illinois at Chicago, United States

2:40 p.m. – 3:00 p.m.

**T40.3:** A Novel Flux Estimator Based on SOGI with FLL for Induction Machine Drives

Rende Zhao¹, Zhen Xin², Poh Chiang Loh², Freda Blaabjerg³, ¹China University of Petroleum, China, ²Aalborg University, Denmark

3:00 p.m. – 3:20 p.m.

**T40.4:** Performance Characterization of Random Pulse Width Modulation Algorithms in Industrial and Commercial Adjustable Speed Drives

Kevin Lee¹, Guangtong Shen², Wenxi Yao³, Zhengyu Lu⁴, ¹Eaton Corporation Plc, United States, ²Purdue University, United States, ³Zhejiang University, China

3:20 p.m. – 3:40 p.m.

**T40.5:** Stability Analysis and Controller Synthesis for Digital Single-Loop Voltage-Controlled Inverters

Xiongfei Wang, Poh Chiang Loh, Freda Blaabjerg, Aalborg University, Denmark

4:10 p.m. – 4:30 p.m.

**T40.6:** High Efficiency, Hybrid Selective Harmonic Elimination Phase-Shift PWM Technique for Cascaded H-Bridge Inverters to Improve Dynamic Response and Operate in Complete Normal Modulation Indices

Amirhossein Moeini, Zhao Hui, Shuo Wang, University of Florida, United States

4:30 p.m. – 4:50 p.m.

**T40.7:** Implementation and Experimental Validation of Efficiency Improvement in PMSM Drives Through Switching Frequency Reduction

Parag Kshirsagar, Krishnan Ramu, Virginia Polytechnic Institute and State University, United States

4:50 p.m. – 5:10 p.m.

**T40.8:** Sensorless Speed Control of Symmetrical Triple-Star Nine-Phase Interior Permanent Magnet Machines

Olorunfemi Ojo, Medhi Ramezani, Tennessee Technological University, United States
2:00 p.m. – 5:30 p.m.

**T41: Gate Drivers and Integrated Packaging**

**ROOM 103C**

**Track: Devices and Components**

**SESSION CHAIRS:**

Qiang Li, *Virginia Tech*

Jean-Luc Schanen, *Ecole Nationale Supérieure de l’Énergie*

---

**T41.1: A High-Efficient Driving Isolated Drive-by-Microwave Half-Bridge Gate Driver for a GaN Inverter**

Shuichi Nagai, Yasufumi Kawai, Osamu Tabata, Songbaek Choe, Noboru Negoro, Tesuzo Ueda, *Panasonic Corporation, Japan*

---

**T41.2: Sensing Gallium Nitride HEMT Junction Temperature Using Gate Drive Output Transient Properties**

He Niu, Robert Lorenz, *University of Wisconsin-Madison, United States*

---

**T41.3: Design and Application of a 1200V Ultra-Fast Integrated Silicon Carbide MOSFET Module**

Suxuan Guo, Liqi Zhang, Yang Lei, Xuan Li, Wensong Yu, Alex. Q Huang, *North Carolina State University, United States*

---

**T41.4: Active Gate Charge Control Strategy for Series-Connected IGBTs**

Fan Zhang¹, Xu Yang¹, Yu Ren¹, Ying Chen¹, Ruifeng Gou², ¹Xi’an Jiaotong University, China, ²Xi’an XD Power Systems Co., LTD, China

---

**T41.5: A MV Intelligent Gate Driver for 15kV SiC IGBT and 10kV SiC MOSFET**

Awneesh Tripathi, Krishna Mainali, Sachin Madhusoodhanan, Akshat Yadav, Kasunaidu Vechalapu, Subhashish Bhattacharya, *North Carolina State University, United States*

---

**T41.6: Linear Temperature Sensors in High-Voltage GaN-HEMT Power Devices**

Richard Reiner, Patrick Waltereit, Beatrix Weiss, Matthias Wespel, Dirk Meder, Michael Mikulla, Rüdiger Quay, Oliver Ambacher, *Fraunhofer Institute for Applied Solid State Physics, Germany*

---

**T41.7: An Innovative Power Module with Power-System-in-Inductor Structure**

Laili Wang¹, Doug Malcolm¹, Yan-Fei Liu², ¹Sumida Technology, Canada, ²Queen’s University, Canada

---

**T41.8: Thermal Analysis of a Magnetic Packaged Power Module**

Laili Wang¹, Doug Malcolm¹, Wenbo Liu², Yan-Fei Liu², ¹Sumida Technology, Canada, ²Queen’s University, Canada

---

2:00 p.m. – 5:30 p.m.

**T42: Component Modeling**

**ROOM 103AB**

**Track: Modeling and Simulation**

**SESSION CHAIRS:**

Sheldon Williamson, *University of Ontario Institute of Technology*

Abhijit Pathak, *Infineon/IR*

---

**T42.1: Comprehensive Parametric Analyses of Thermally Aged Power MOSFETs for Failure Precursor Identification and Lifetime Estimation Based on Gate Threshold Voltage**

Serkan Dusmez, Bilal Akin, *University of Texas at Dallas, United States*

---

**T42.2: Modeling and Design Guidelines of High Density Power Inductor for Battery Power Unit**

Zhigang Dang, Jaber Abu Qahouq, *University of Alabama, United States*
### T42.3: Degradation of Low Voltage Metal Oxide Varistors in Power Supplies

Dawood Talebi Khanmiri\(^1\), Roy Ball\(^2\), Jerry Mosesian\(^3\), Brad Lehman\(^1\), \(^1\)Northeastern University, United States, \(^2\)Mersen-USA, United States

2:40 p.m. – 3:00 p.m.

### T42.4: Characterization and Modeling of SiC MOSFET Body Diode

Kang Peng, Soheila Eskandari, Enrico Santi, \(\)University of South Carolina, United States

3:00 p.m. – 3:20 p.m.

### T42.5: A Simple Behavioral Electro-Thermal Model of GaN FETs for SPICE Circuit Simulation

Liyao Wu, Maryam Saeedifard, \(\)Georgia Institute of Technology, United States

3:20 p.m. – 3:40 p.m.

### T42.6: Decomposition and Electro-Physical Model Creation of the CREE 1200V, 50A 3-Ph SiC Module

Adam Morgan, Yang Xu, Douglas C. Hopkins, Iqbal Husain, Wensong Yu, \(\)North Carolina State University, United States

3:40 p.m. – 4:00 p.m.

### T42.7: A Three-Legged MATLAB/Simulink Transformer Model Using a Fictitious Delta Winding

Thomas Nondahl, Jingbo Liu, Peter Schmidt, \(\)Rockwell Automation, United States

4:00 p.m. – 4:20 p.m.

### T42.8: A Lifetime Prediction Method for LEDs Considering Mission Profiles

Xiaohui Qu\(^1\), Huai Wang\(^2\), Xiaoqing Zhan\(^3\), Frede Blaabjerg\(^3\), Henry Shu-Hung Chung\(^3\), \(^1\)Southeast University, China, \(^2\)Aalborg University, Denmark, \(^3\)City University of Hong Kong, Hong Kong

4:20 p.m. – 4:40 p.m.

### T42.9: Enhanced Li-Ion Battery Modeling Using Recursive Parameters Correction

Jaegu Kim, Jung-Hoon Ahn, Byoung-Kuk Lee, \(\)Sungkyunkwan University, Korea, South

4:40 p.m. – 5:00 p.m.

---

### T43: Grid and Utility Interface

**ROOM 104A**

**Track: Control**

**Session Chairs:**
Manish Bhardwaj, Texas Instruments
Nan Chen, ABB

2:00 p.m. – 2:20 p.m.

### T43.1: Robust Sensorless Control of Grid Connected Converters with LCL Line Filters Using Frequency Adaptive Observers as AC Voltage Estimators

Vlatko Miskovic\(^1\), Vladimír Blasko\(^2\), Thomas Jahns\(^3\), Robert Lorenz\(^3\), Haojiong Zhang\(^1\), \(^1\)Danfoss Drives, United States, \(^2\)United Technologies Research Center, United States, \(^3\)University of Wisconsin-Madison, United States

2:20 p.m. – 2:40 p.m.

### T43.2: Active Stabilization of Direct Matrix Converter Input Side Filter Through Grid Current Control

Martin Leubner, Nico Remus, Marc Stübig, Wilfried Hofmann, Technische Universität Dresden, Germany

2:40 p.m. – 3:00 p.m.

### T43.3: Impedance-Based Stability Analysis of Single-Phase Inverter Connected to Weak Grid with Voltage Feed-Forward Control

Jiangfeng Wang\(^1\), Jinhui Yao\(^1\), Haibing Hu\(^1\), Yan Xing\(^1\), Xiaobin He\(^2\), Kai Sun\(^3\), \(^1\)Nanjing University of Aeronautics and Astronautics, China, \(^2\)Shanghai Institute of Space Power-Sources, China, \(^3\)Tsinghua University, China

3:00 p.m. – 3:20 p.m.

### T43.4: New Configuration of Dynamic Voltage Restorer for Medium Voltage Application

Arash Khoshkbar Sadigh\(^1\), Vahid Dargahi\(^2\), Keith Corzine\(^2\), \(^1\)Extron Electronics, United States, \(^2\)Clemson University, United States

3:20 p.m. – 3:40 p.m.

### T43.5: Studies on the Clustered Voltage Balancing Mechanism for Cascaded H-Bridge STATCOM

Daorong Lu\(^1\), Haibing Hu\(^1\), Yan Xing\(^1\), Xiaobin He\(^2\), Kai Sun\(^3\), Jinhui Yao\(^1\), \(^1\)Nanjing University of Aeronautics and Astronautics, China, \(^2\)Shanghai Institute of Space Power-Sources, China, \(^3\)Tsinghua University, China

3:40 p.m. – 4:00 p.m.
### SESSION 43: Thursday, 14:10 – 14:30

**T43.6:** Design of a Fast Response Time Single-Phase PLL with DC Offset Rejection Capability  
*Abhijit Kulkarni, Vinod John, Indian Institute of Science, India*

### SESSION 44: Thursday, 14:30 – 14:50

**T44.3:** Compensator-Less Structures for Droop Control of Single Phase Inverters in a Flexible Microgrid  
*Onkar Kulkarni, Suryanarayana Doolla, Baylon Fernandes, Indian Institute of Technology Bombay, India*

### SESSION 43: Thursday, 14:50 – 15:10

**T43.7:** Four New Applications of Second-Order Generalized Integrator Quadrature Signal Generator  
*Zhen Xin¹, Rende Zhao², Xiongfei Wang¹, Poh Chiang Loh¹, Frede Blaabjerg¹, ¹Aalborg University, Denmark, ²China University of Petroleum, China*

### SESSION 44: Thursday, 15:10 – 15:30

**T43.8:** Three-Phase Multiple Harmonic Sequence Detection Based on Generalized Delayed Signal Superposition  
*Yong Lu¹, Guochun Xiao¹, Xiongfei Wang², Frede Blaabjerg², ¹Xi’an Jiaotong University, China, ²Aalborg University, Denmark*

### SESSION 44: Thursday, 15:30 – 15:50

**T44.4:** Comparative Evaluation of the Loss and Thermal Performance of Advanced Three Level Inverter Topologies  
*Alexander Anthon¹, Zhe Zhang¹, Michael A.E. Andersen¹, Grahame Holmes², Brendan McGrath², Carlos Teixeira², ¹Danmarks Tekniske Universitet, Denmark, ²RMIT University, Australia*

---

### SESSION 44: Thursday, 16:00 – 16:20

**T44.1:** Stability Criterion and Controller Parameter Design of Radial-Line Renewable Systems with Multiple Inverters  
*Wenchao Cao, Xuan Zhang, Yiwei Ma, Fred Wang, University of Tennessee, United States*

**T44.2:** Stability Analysis and Improvement of Solid State Transformer (SST)-Paralleled Inverters System Using Negative Impedance Feedback Control  
*Qing Ye, Hui Li, Florida State University, United States*

**T44.3:** Compensator-Less Structures for Droop Control of Single Phase Inverters in a Flexible Microgrid  
*Onkar Kulkarni, Suryanarayana Doolla, Baylon Fernandes, Indian Institute of Technology Bombay, India*

**T44.4:** Comparative Evaluation of the Loss and Thermal Performance of Advanced Three Level Inverter Topologies  
*Alexander Anthon¹, Zhe Zhang¹, Michael A.E. Andersen¹, Grahame Holmes², Brendan McGrath², Carlos Teixeira², ¹Danmarks Tekniske Universitet, Denmark, ²RMIT University, Australia*

---

### SESSION 44: Thursday, 16:30 – 16:50

**T44.5:** Dual Buck Inverter with Series Connected Diodes and Single Inductor  
*Liwei Zhou, Feng Gao, Shandong University, China*

**T44.6:** Magnetic Integration of the Harmonic Filter Inductor for Dual-Converter Fed Open-End Transformer Topology  
*Ghanshyamsinh Gohil, Lorand Bede, Remus Teodorescu, Tamas Kerekes, Frede Blaabjerg, Aalborg University, Denmark*

**T44.7:** Mechanism Analysis and Mitigation of Instability in Grid-Connected Voltage Source Inverter with LCL Filters Based on Terminal Impedance  
*Teng Liu, Zeng Liu, Jinjun Liu, Qingyun Dou, Xi’an Jiaotong University, China*

---

### SESSION 44: Thursday, 17:00 – 17:20

**T44.8:** Seven-Switch Five-Level Active Neutral-Point Clamped Converter and Optimal Modulation Strategy  
*Hongliang Wang¹, Lei Kou¹, Yan-Fei Liu¹, Paresh Sen¹, Sucheng Liu², ¹Queen’s University, Canada, ²Anhui University of Technology, China*

**T44.9:** A Simple Variable Step Size Method for Maximum Power Point Tracking Using Commercial Current Mode Control DC-DC Regulators  
*Su Sheng, Brad Lehman, Northeastern University, United States*
THURSDAY

2:00 p.m. – 5:30 p.m.

**T45:** Envelope Tracking and Resonant Conversion
ROOM 104C

**Track: Power Electronics Applications**

**Session Chairs:**
Brian Zahnstecher, *PowerRox*
Davide Giacomini, *Infineon*

2:00 p.m. – 2:20 p.m.

**T45.1:** Envelope Tracking GaN Power Supply for 4G Cell Phone Base Stations
Yuanzhe Zhang, Johan Strydom, Michael de Rooij, Dragan Maksimovic, 1University of Colorado Boulder, United States, 2Efficient Power Conversion Corporation, United States

2:20 p.m. – 2:40 p.m.

**T45.2:** Envelope Tracking Power Supply for Volume-Sensitive Low-Power Applications Based on a Resonant Switched-Capacitor Converter
Alon Cervera, Mor Mordechai Peretz, Ben-Gurion University of the Negev, Israel

2:40 p.m. – 3:00 p.m.

**T45.3:** A Passive-Impedance-Matching Concept for Multi-Phase Resonant Converter
Hongliang Wang, Yang Chen, Yan-Fei Liu, Queen’s University, Canada

3:00 p.m. – 3:20 p.m.

**T45.4:** LLC Converter with Auxiliary Switch for Hold Up Mode Operation
Yang Chen, Hongliang Wang, Yan-Fei Liu, Jahangir Afsharian, Zhihua Yang, 1Queen’s University, Canada, 2Murata Power Solutions, Canada

3:20 p.m. – 3:40 p.m.

**T45.5:** A Common Capacitor Multi-Phase LLC Resonant Converter
Hongliang Wang, Yang Chen, Zhiyuan Hu, Laili Wang, Yajie Qiu, Wenbo Liu, Yan-Fei Liu, Jahangir Afsharian, Zhihua Yang, 1Queen’s University, Canada 2Murata Power Solutions, Canada

4:10 p.m. – 4:30 p.m.

**T45.6:** LLC Resonant Converter Design for Bendable Power Converter
Kwun Yuan Godwin Ho, M.H. Bryan Pong, Shu Yuen Ron Hui, University of Hong Kong, Hong Kong

4:30 p.m. – 4:50 p.m.

**T45.7:** Design Consideration of MHz Active Clamp Flyback Converter with GaN Devices for Low Power Adapter Application
Xiucheng Huang, Junjie Feng, Weijing Du, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States

4:50 p.m. – 5:10 p.m.

**T45.8:** A New Capacitor Voltage Balancing Control for Hybrid Modular Multilevel Converter with Cascaded Full Bridge
Mahendra B. Ghat, Anshuman Shukla, Richa Mishra, Indian Institute of Technology Bombay, India

5:10 p.m. – 5:30 p.m.

**T45.9:** Sensorless Scheduling of the Modular Multilevel Series-Parallel Converter: Enabling a Flexible, Efficient, Modular Battery
Stefan Goetz, Zhongxi Li, Angel Peterchev, Xinyu Liang, Chengduo Zhang, Srdjan Lukic, 1Duke University, United States, 2Tsinghua University, China, North Carolina State University, United States

4:30 p.m. – 4:50 p.m.

**T45.7:** Design Consideration of MHz Active Clamp Flyback Converter with GaN Devices for Low Power Adapter Application
Xiucheng Huang, Junjie Feng, Weijing Du, Fred C. Lee, Qiang Li, Virginia Polytechnic Institute and State University, United States

4:50 p.m. – 5:10 p.m.

**T45.8:** A New Capacitor Voltage Balancing Control for Hybrid Modular Multilevel Converter with Cascaded Full Bridge
Mahendra B. Ghat, Anshuman Shukla, Richa Mishra, Indian Institute of Technology Bombay, India

5:10 p.m. – 5:30 p.m.

**T45.9:** Sensorless Scheduling of the Modular Multilevel Series-Parallel Converter: Enabling a Flexible, Efficient, Modular Battery
Stefan Goetz, Zhongxi Li, Angel Peterchev, Xinyu Liang, Chengduo Zhang, Srdjan Lukic, 1Duke University, United States, 2Tsinghua University, China, North Carolina State University, United States
Professional Education Seminars

APEC strives to offer seminars with a practical mix of theory and application for the professional working in power electronics. APEC 2016 features 21 professional education seminars with a broad range of topics.

Sunday, March 20
9:30 a.m. – 1:00 p.m.

S01: Exceeding 99% Efficiency for PFC and Isolated DC-DC Converters, GaN Versus Silicon

Track: Control

Ionel Dan Jitaru
ROOM 104A

The new developments in semiconductor technology such as GaN and SiC may enable us to exceed the 99% efficiency power conversion for PFC and isolated DC-DC Converters. To reach that goal we have to start by reevaluating of the most suitable topologies in power conversion. Soft switching topologies have become popular in many applications in the last thirty years. Though we have more than 30 years tradition in soft switching topologies some of these topologies, have added too much complexity and their practical use becomes questionable with the availability of more ideal components.

A portion of the seminar describes the latest soft switching topologies which are addressing the soft switching both in primary and the secondary side.

Well known topologies are presented in the light of latest improvements, as well as new topologies which were recently derived.

A detailed power dissipation analysis in several applications will highlight the need for magnetic optimization. In spite of the significant progress in the semiconductor industry, the magnetics lags behind. The seminar will describe the impact of the parasitic elements in the magnetics in optimizing the performance of the power converters. In the quest for 99% efficiency the magnetics and the packaging become key factors in efficiency optimization.

The seminar will present the impact of Intelligent Power Processing in optimizing the efficiency and even in converting a traditional hard switching topology into a soft switching topology.
The presentation will be highlighted with many design examples and experimental results such as 99%+ efficiency PFC with power densities above 450W/in3, and 99% efficiency isolated DC-DC Converter.

**S02: The Invisible Schematic: Non-Idealities in Circuit Elements and System Components**

*Track: System Design*

Ernest H. Wittenbreder
ROOM 104B

The performance of a power electronics circuit is almost always different in some ways than the expected performance of the circuit that appears in the schematic capture for printed circuit board (PCB) layout. Often the captured schematic is more akin to a graphical representation of the bill of materials than to the circuit that behaves like a circuit consistent with the observed behavior. Almost all electronic components differ from their ideal electrical characteristics in some way. Each electronic component element is a circuit consisting of the ideal component plus invisible (non-ideal) elements, usually referred to as parasitic elements or intrinsic elements. In many cases there are components that exist in the circuit that do not appear in the captured schematic that can significantly affect the circuit behavior. These components may or may not be associated with circuit elements in the captured schematic, but may relate to the printed circuit board and/or the physical environment in which the power electronics product operates.

This seminar seeks to help design engineers become better aware of the invisible components or non-idealities in a power electronics circuit, to recognize the ways the invisible components affect circuit behavior, and to suggest methods for dealing with the problems that relate to behavior that results from invisible circuit elements.

This seminar is intended for beginner, intermediate, and advanced level power supply engineers who want a better awareness and understanding of the invisible circuit and associated design issues.

**S03: Getting from 48 V to Load Voltage: Improving Low Voltage DC-DC Converter Performance with GaN Transistors**

*Track: Power Semiconductors*

Alex Lidow, David Reusch, John Glaser
ROOM 102AB

Gallium Nitride (GaN) power semiconductors are being adopted in an increasing number of power conversion applications. The technology is rapidly developing and product experience in the field is expanding. This tutorial will begin with a discussion of the state-of-the art in GaN technology, including an overview of GaN technology, GaN transistor structures and the latest electrical performance.

Beyond the discrete transistor, the extension of GaN technology to fully integrated circuits will be discussed, furthering the potential of GaN to raise the bar in power conversion performance.

**S04: A Comprehensive Introduction to Implementing a Fully Digital Power-Factor-Correction Boost Converter**

*Track: Digital Control*

Alex Dumais, Joel Steenis
ROOM 104C

The purpose of this presentation is to provide an in-depth introduction to power factor correction (PFC) circuits, using a digital implementation. The presenters will cover all the necessary steps to develop the control system for a fully digital Boost PFC operating in continuous-conduction mode. The presentation will start by introducing the concept of PFC and why it is required, show the different active PFC solutions available, expand on the different types of boost topologies, and discuss their tradeoffs.

A large portion of the presentation focuses on deriving a model for the power stage that is conducive to controller design, designing the controller, and implementing the controller in a fixed-point processor. This presentation will end with additional algorithms that may improve overall performance, such as current total harmonic distortion (THD), power factor (PF), and efficiency. Attendees who do not have experience with digital power or designing PFCs should be able to leverage this material to develop their own digital PFC platform with a reduced time to market.

**S05: Basic Switching Power Supply Design**

*Track: Fundamentals*

Marty Brown
ROOM 101A

A short presentation overviewing what worked and what hadn’t during the author’s long and varied career as a power electronics engineer. It includes what we have to know, our sources for continued learning, the care and feeding of the engineering team, and the present day realities of engineering life. Also some tips on being a consultant.
S06: Solid-State Transformers – Key Design Challenges, Applicability, and Future Concepts

Track: Grid Power Electronics

Kolar Johann W., Jonas E Huber
ROOM 103AB

This seminar introduces participants to the Solid State Transformer (SST) concept in a comprehensive and easy to follow fashion. After a brief review of transformer basics and of the SST concept history, the motivation, requirements, and challenges associated with SST applications in future locomotives, smart grids, and for general isolated DC/DC conversion are identified. E.g., conceptual aspects like single vs. multi cell converter approaches, multi cell converter reliability, protection, etc. are discussed. Furthermore, the operation of high power isolated DC/DC converters is detailed, and modern WBG power semiconductors, medium frequency transformer design, multi cell converter control system partitioning, etc. are discussed. Finally, aspects of testing high power medium voltage systems and construction issues of modular medium voltage converters are summarized. To render the discussions more tangible, the challenges and potential solutions are illustrated using an exemplary 1MVA multi-cell distribution level SST system. Finally, future concepts such as uni-directional SSTs are addressed, and the most promising application scenarios for SSTs as well as future research areas are identified, before the seminar concludes with a critical evaluation of the SST concept. The seminar is tailored to serve the interests of a broad audience with academic or industrial backgrounds.

S07: Photovoltaic Modeling and Why it Matters for Power Electronics

Track: Inverters/Converters

Katherine A. Kim, Jeehoon Jung
ROOM 101B

Photovoltaic (PV) solar power is an important renewable energy resource for present-day and future power generation. As PV materials and efficiencies advance, the power electronics used in PV systems is also advancing. PV modeling is important for understanding PV cell operation and validating new converter and control concepts. Physical PV panels can be replaced with simulation that emulates a PV cell, panel, or full PV system and can be used for direct hardware testing using a power hardware-in-the-loop setup. The seminar will cover 1) current trends in PV applications and materials, and basic PV modeling, 2) PV emulation using power hardware-in-the-loop and related computational considerations, and 3) PV control and various PV power electronics applications using simulation and power hardware-in-the-loop. This seminar is geared towards people with entry- to intermediate-level background in PV systems.

S08: Stability and Damping of Grid-Connected Voltage-Source Converters

Track: Control

Frede Blaabjerg, Xiongfei Wang
ROOM 102AB

The ever-increasing penetration of grid-connected voltage-source converters challenges the power quality and stability of electric power grids. Besides the steady-state harmonic coupling caused by the switching operations, dynamic interactions among the controllers of converters, passive filters, and other passive components of systems may lead to instability and resonance phenomena over a wide frequency range.

This seminar will provide an in-depth discussion on the stability analysis and damping methods for grid-connected voltage-source converters. It will begin with the control fundamentals of converters and their small-signal models with complex transfer functions and transfer matrices. The influences of current control and grid synchronization on system stability will then be discussed. Stability analysis for multi-converter systems will next be explored with the examples. Subsequently, active stabilization techniques, including virtual impedance control and passivity-based control, will be elaborated. The design of passive and active dampers will also be covered. Perspectives on the challenges and future trends of modeling, stability analysis, and control of voltage-source converters will be given.

The intended audiences are graduate students, practicing engineers, and researchers in the area of power electronics applications in power systems.

S09: PMBus™: Review and New Capabilities

Track: System Design

Robert V. White
ROOM 104A

Since being introduced in 2005 the PMBus™ power management protocol has been widely adopted and is the accepted standard for digital power management. This seminar provides a review on the basics of the PMBus protocol and a deeper look at two major features introduced in Revision 1.3.

The first half of the seminar reviews the basics of the 2-wire SMBus including the electrical interface and how bits, bytes, and complete messages are transferred from one device to another. PMBus specific features such as the CONTROL signal and the use of SMBALERT# interrupt signal are also reviewed. Next a summary the PMBus
command language is presented including numerical formats (including the use of floating point introduced in Revision 1.3), setting and adjusting the output voltage, fault management, and status reporting.

The second half of the seminar takes a deeper look at two major PMBus additions introduced in Revision 1.3. The Zone Protocols offer important new tools for managing the larger and more complex power systems in today’s systems. The ZONE_WRITE command offers an easy way for the system to send a command, such as turn on or turn off, simultaneously to selected converters in a system. The ZONE_READ command offers ways to efficiently discover devices on the bus or to quickly get status information based on the priority and urgency of the information.

The other major addition in Revision 1.3, the AVSBus, is then presented. The AVSBus is an all new protocol with an SPI-like interface that can operate at speeds up to 50 MHz. With a compact set of commands and fixed 32 bit frame, it allows a device like a processor, ASIC or FPGA to quickly command changes to its operating voltage. This provides for both improved performance of the powered device and energy savings.

S10: Wide Bandgap Device Characterization
Track: Power Semiconductors

Fred Wang, Zheyu Zhang, Edward A. Jones
ROOM 104B

Wide bandgap power devices, particularly SiC and GaN, are an important enabling technology for cutting-edge converter design. WBG devices have superior performance at higher temperatures and switching frequencies than conventional Si MOSFETs, IGBTs, and diodes. However, they present new challenges for converter design. Static and dynamic characterization are usually the first steps in designing a converter based on a new WBG device. Establishing static parameters such as on-resistance and saturation current are especially important at elevated junction temperatures. A Double Pulse Test (DPT) is then performed for dynamic characterization. Switching transient times and losses are often not listed on new device datasheets, and are heavily dependent on the voltage, current, topology, gate driver, and PCB layout. DPT design becomes more difficult as switching speed increases, because of limited measurement bandwidth and the impact of parasitics contributed by the PCB and test setup. The physical design of the gate driver and PCB layout are critical to effective DPT, as well as suitable probe selection and comprehensive data processing. Analyzing the results of the completed characterization allows for more precise estimation of the total device losses and other parameters. Accurate device parameters can improve the efficiency, size, and thermal design of a WBG converter, and this seminar will provide the tools to perform both static and dynamic characterization effectively.

S11: High Performance Digital Control
Track: Digital Control

Hamish Laird
ROOM 104C

This presentation, aimed at intermediate level power engineers, surveys and details techniques to successfully implement digital control for power electronic converters. In turn each component of the controller from digital (PWM and VPO) modulators, compensator pole zero placement, compensator numeric precision issues, single sample noise through to anti-aliasing filter design is covered. Digital pulse width modulators (PWM) and digital variable period oscillators (VPO) have different non-linear frequency response characteristics from equivalent analogue systems.

The effect of these differences on the control is discussed and spectral-shaping design methods to improve performance of the digital modulators are presented. The design of the compensator by directly placing the digital poles and zeros is then covered. By translating the pole and zero positions directly into digital filter coefficients for the digital compensator the translation of analogue coefficients to digital is avoided. A method that requires no coding or simulation for determining numeric precision issues in the digital compensator coefficients is then presented. As most systems require integrators the most suitable forms of digital integrators are discussed. The precision issues specific to digital integrators and methods to reduce these are presented in detail. Finally managing single sample errors, which have no analogue equivalent, and the choice of anti-aliasing filters is described.

S12: Non-linear Thermal Topics in Semiconductors and Electronics
Track: Fundamentals

Roger P. Stout
ROOM 101A

This half-day seminar is designed for advanced level thermal systems engineers, who are reasonably comfortable with Microsoft® Excel and finite element analysis techniques.

Topics covered will include thermal runaway, nonlinear material effects in micro-scale geometry, wire (and other structure) fusing and intrinsic current limits in micro-scale structures, the use of Excel in non-linear thermal analysis, and challenges in using finite-element analysis for non-linear thermal problems. Several case-studies will be covered.

Thermal runaway in semiconductor components applications will be approached by introducing a formalized method of analyzing exponential-power-growth devices,
along with several detailed examples of applications to datasheet and real-world thermal systems.

Nonlinear material effects (in particular, electrical resistivity that increases with temperature) will be addressed both from an analytical perspective as well as through finite-element modeling, including the circumstances under which temperature-dependent resistivity manifests itself as an intrinsic current limit generally observed only in small structures. Specific examples of a micro-scale embedded coil and the fusing of wires will be covered. How common wire-bonding materials such as gold, aluminum, and copper (used in semiconductor packaging) are affected by this effect will be discussed. Behavior of metal fuses on silicon will be discussed.

**S13: Power Architectures, Protection and Control of DC Microgrids**

**Track: Grid Power Electronics**

Tomislav Dragićević, Josep M. Guerrero
ROOM 103AB

The idea of merging small variable nature sources with energy storage systems (ESSs) and controllable loads into flexible entities that are called microgrids (MGs) has been presented more than a decade ago, as a possible solution to achieve a traceable control from the system-point of view. MGs can operate autonomously or be grid-connected and, depending on the type of voltage in the point of common coupling (PCC), AC and DC MGs can be distinguished. While remarkable progress has been made in improving the performance of AC MGs during the past decade, DC MG is a relatively novel concept that has been recognized to have higher efficiency, more natural interface with many types of RES and ESSs, better compliance with consumer electronics and other benefits. Besides, when components are coupled around a DC bus, there are no issues with reactive power flow, power quality and frequency regulation, resulting in a notably less complex control system when compared to AC MGs. However, there are a number of practical impediments that need to be resolved before adoption of DC MGs on a large scale. Most importantly, maturity of standards and practices in design of protection and grounding systems are far behind their counterparts in AC systems.

The emphasis of this tutorial is to provide a complete framework in hardware and control design of DC MGs, as well as overview of recent research activities in this area. Practical requirements and implementation details of several types of DC distribution systems used in real world industrial applications will be presented. Also, a number of study cases regarding design of power architectures and protection systems will be discussed in the first part of the tutorial. On the other hand, second part will address the features of several types of coordinated control design concepts that can assure intelligent real-time control of MGs. Moreover, the concepts of constant power load (CPL) and negative impedance instability will be explained in detail. In line with this, principles of linear stability analysis techniques will be reviewed and a broad class of stabilization techniques for MGs loaded with CPLs will be presented and examined. This tutorial will also present the view of the instructors on the promising research directions and future industrial applications in the area of DC MGs.

**S14: Soft Switching Three-phase Converter or Inverter**

**Track: Inverters/Converters**

Dehong Xu, Rui Li
ROOM 101B

Increasing the switching frequency is critical to increase efficiency, power density and dynamic performance. Beside improving power device characteristics, Soft Switching Technology is another effective way to increase the switching frequency, which have been successfully applied in switching power supplies and induction heating etc. However, three-phase inverters using soft switching technique are not common up to now. Parts of the reasons come from complexity of three-phase soft switching inverter topologies in addition to the requirement of accurate PWM timing control and its sensitivity to the operation condition. This tutorial is intend to introduce the fundamental of three-phase ZVS inverters with pedagogy way. At the beginning, the overview of soft switching converter/inverter is introduced. Then, fundamental of three-phase ZVS inverters is investigated with respect to modulation scheme, Zero-Voltage-Switching Condition etc. Afterwards this tutorial will extend to other ZVS inverter /converter topologies.

The experiment results of 30kW ZVS inverter/converters will be introduced. Finally, The impact of SiC devic on soft switching inverters are investigated with respect to the power density and conversion efficiency. The intended audiences are researchers and manufacturers interested in either an entry-level of introduction or an in-depth level of evaluation of soft switching three-phase inverters.
Monday, March 21
8:30 a.m. – 12:00 p.m.

S15: Introduction to Fast Analytical Techniques: Application to Small-Signal Modeling

Track: Control

Christophe Basso
ROOM 104A

Loop control is an essential part of power converter design and requires the transfer function of the system you want to stabilize. The control-to-output transfer function can be obtained in the laboratory with a hardware prototype or analytically derived with a small-signal model. A hardware prototype gives you the exact dynamic response at a given operating point but does not explicitly tell you what affects magnitude or phase. You need to know what elements contribute poles or zeros in the plant dynamic response so that natural production spreads and temperature drifts of components do not jeopardize stability once the loop is closed. On the other hand, determining a small-signal model can be done in different ways, all leading to similar dynamic responses. However, what matters is the ability to format the final transfer function in a compact form in which gains, poles and zeros are apparent. This is the concept of low-entropy expressions as defined by Dr. Middlebrook in his papers and seminars. This seminar will introduce you to Fast Analytical Circuits Techniques, or FACTs, exercised in determining the transfer functions of some typical circuit examples, up to the order two. The second part shows how you can apply these techniques to unveil switching converters transfer functions of buck and buck-boost converters.

S16: Reliability of Power Electronic Systems

Track: System Design

Frede Blaabjerg, Francesco Iannuzzo, Huai Wang, Ke Ma
ROOM 102AB

Advances in power electronics enable efficient and flexible processing of electric power in the application of renewable energy sources, electric vehicles, adjustable-speed drives, etc. More and more efforts are devoted to having better power electronic systems in terms of reliability to ensure high availability, long lifetime, sufficient robustness and low maintenance cost. Today customers of many power electronic products expect up to 20 years of lifetime and they also want to have a “failure free period” and all with focus at the financials. However, the reliability predictions are still dominantly according to outdated models and terms, such as MIL-HDBK-217F handbook models, mean-time-to failure (MTTF), and mean-time-between-failures (MTBF).

The emphasis of this tutorial is to give a framework on the design for reliability of power electronic systems and the recent research activities and paradigm shifts in this research area. It will cover the reliability requirements in different industry sectors, reliability and lifetime of IGBT modules and capacitors used in power electronic converters, testing of power components, and the specific design for reliability procedure for power electronic systems. Study cases on mission profile based design of photovoltaic inverters and wind power converters, and active thermal control and condition monitoring of power converters are also discussed. The approaches presented in the tutorial are also the common interest for the companies involved in the Center of Reliable Power Electronics (CORPE) at Aalborg University (http://www.corpe.et.aau.dk/). The tutorial will also present the views of the instructors on the future research opportunities in the area of reliability of power electronics.

S17: Addressing Challenges in High Power and High Voltage Designs with IGBTs

Track: Power Semiconductors

Crisafulli Vittorio, Dhaval Dalal, Tomas Krecek, Dominic L
ROOM 101A

Proliferation of high performance power conversion equipment in applications such as solar inverters, UPS, motor drives, IH, welding, automotive and traction has rekindled the interest in understanding and optimizing IGBT characteristics in order to optimize the system performance. Efficiency and thermal performance are the key metrics along with reliability and ruggedness.

The emphasis of this seminar is to provide a framework on how to address challenges in high power and high voltage designs with IGBTs. A contextual overview of power silicon technologies and general topologies/applications is provided. Common system requirements for high power applications are discussed. It is shown that each end-application has a different set of requirements in terms of IGBT characteristics.

Next, many common high power applications are discussed in details with emphasis on topologies, control and common issues. Emergent topologies such as multilevel converters are also discussed.

In the last part, some practical issues related to IGBT Design are covered with special focus on measurements challenges and approaches for high power systems. Further, gate driver techniques and impact, freewheeling diode and simulations method are explored.
This intermediate to advanced level course will begin with a refresh on SiC components followed by an in-depth treatment of various topics like switching speed considerations, EMI generation and management, PCB layout, control loop noise susceptibility, ground loops etc. Lastly the focus of this presentation is to present everything with as many practical engineering examples as possible and thus have a mix of both practice and theoretical explanations and not focus on only theory or physics.

**S20: Principles and Practices of Digital Current Regulation for AC Systems**

*Track: Grid Power Electronics*

Grahaime Holmes
ROOM 104B

Current regulation plays a key role in power electronic conversion systems. The basic concept is to compare a measured current against a defined reference, and to minimise the error between these two quantities by adjusting the switching of the associated power electronic converter. However, while simple in principle, achieving this goal for AC current regulators has proved to be very challenging.

This tutorial will present the current state-of-the-art for digital current regulation of AC converter systems. It will begin by showing how PWM transport and sampling delays are the primary constraints for linear regulators. Strategies to overcome these constraints will then be explored, including backEMF compensation, PR resonant control and its equivalent synchronous d-q frame implementation. An analytical approach to calculate the maximum gains for these strategies will be developed, verified by simulation and matching experimental results. The concepts will then be applied to the more challenging problems of current regulation with an LCL filter. Finally, the latest advances in hysteresis regulation will be presented, using variable hysteresis bands to maintain a constant switching frequency, and digitally implementing what is usually regarded as an analogue regulation system.

**S21: Latest Technologies of LLC Converters for High Current, Fast Response, and Wide Input Voltage Range Applications**

*Track: Inverters/Converters*

Yan-Fei Liu
ROOM 104C

The LLC resonant converter has attracted a lot of attention and application recently due to its advantages, such as soft switching and narrow switching frequency range, as well as possibility to integrate parallel inductor and resonant inductor into the transformer structure.

The purpose of this seminar is to provide an overview of the LLC converter, its advantages and problems.
The majority of the seminar will be devoted to the technologies as how to solve its problems. This seminar will cover the following aspects related to LLC resonant converter. (1) Technologies for high current application: including splitting input capacitor interleaving, Switch-Controlled-Capacitor interleaving, Common inductor current sharing, and precise SR FET driving with Zero-crossing noise filter; (2) Technologies for fast dynamic response: including Accurate and fast average current sensing, Bang-Bang Charge Control; and (3) Wide input voltage variation operation.

It is expected that with this seminar, the audience will learn the latest LLC technologies and use these technologies to design the LLC power supply to meet their requirements. The topics covered in this seminar are considered as in depth discussion. It is suitable for intermediate and high level audience.
Plenary Session

Monday, March 21

1:30 p.m. – 5:00 p.m.

GRAND BALLROOM

One of the goals in assembling this year’s slate of Plenary presentations is to explore familiar topics from a unique perspective – to think about problems and solutions in ways we previously had not considered. Tony Sagneri’s presentation will look at operating power converters at frequencies far beyond what most of us are familiar with. His approach may change your opinion on what high frequency power conversion is, and where it is going. Following that, Michael Harrison’s presentation will posit a “Power Conversion Paradigm” that ties together the relationship between parasitics, losses, and physical size of a power converter. Moreover, he will challenge your ideas of what level of control complexity is really possible to achieve high performance power conversion. Next, we have heard a lot about GaN devices in the past several years at APEC, but Dan Kinzer will show us that the device alone is only a partial solution: the entire “eco-system” has to be addressed. This includes integration of devices, drivers, controllers, magnetics – and addressing packaging topics as well.

After Intermission, Antonio Ginart will kick-off with a detailed look at residential nanogrids – essentially multi-kilowatt power electronic systems in our homes with battery storage to improve the overall reliability of our utility power, and reduce energy expenses by shifting power use away from peak demand periods where cost will be highest, then replenish the battery during low demand periods. Next is the well-known Ray Ridley, who could cover many topics, but this year it is magnetics. He will discuss the trends he sees in how we go about optimizing and integrating magnetic designs within our power electronic circuits. To wrap-up the plenary session is David Hill from Power Clinic. He has a very interesting set of observations from performing thousands of “post-mortems” on power supplies that have failed. His perspective and “lessons-learned” can help all of us to better understand how to design more reliable power electronics with potentially longer lifetimes.

The Challenges of VHF Power Conversion

1:30 p.m. - 2:00 p.m.

**Speaker:**
Tony Sagneri  
Finsix corp.

How much could power supply density increase if operating frequency was substantially increased? Not just by a factor of 5 or 10, but into the 10’s of MHz, the frequency band known as Very High Frequency (VHF) in the radio world. Making very high density, high frequency power supplies with sufficient energy efficiency to meet thermal requirements is a significant challenge. In this presentation, resonant power converter topologies based on class-E inverters will be reviewed. The design challenges of tuning the resonant elements, control, magnetic design, meeting EMI and safety requirements, and packaging for high density will be discussed, along with a vision of the future of high frequency power conversion.

The Future of Power Electronic Design

2:00 p.m. – 2:30 p.m.

**Speaker:**
Michael Harrison  
Enphase Energy

Four decades ago, power electronics consisted of thyristor controlled line-frequency transformers with linear regulators, or maybe self-oscillating circuits driving saturable magnetics. Then the first analog PWM integrated circuits were introduced, enabling closed-loop control of power converters. Of course the speed and complexity of the analog controllers grew, while the cost went down. Efficiency figures seemed to parallel the decade (70’s, 80’s, etc.). More recently digital control of power converters has become the norm. This has enabled more complex operational modes which improve performance and efficiency, while still driving the cost and size downwards. We are now at a point where the incremental cost of control complexity is nearing zero – to the point where we can not ignore the economies of adopting complex control schemes at the expense of the more primitive methods of the past, only because they were easy to understand. This presentation will look at the trends in power converter performance and design philosophy from a control perspective, and project where we go in the future, and what kinds of role the power electronic designers of the future will play in our industry.
Breaking Speed Limits with GaN Power ICs,
2:30 p.m. – 3:00 p.m.

**Speaker:**
Dan Kinzer  
*Navitas Semiconductor*

GaN technology is progressing rapidly. Reliable power transistors are available in the market today ranging from 40V to 650V, with manufacturing processes qualified at several high volume production wafer fabs. GaN’s performance advantages: low resistance, low capacitance, high frequency, elimination of reverse recovery issues & small size are undeniable and have created much excitement and anticipation in the market. Unfortunately system complexity, cost and the limits of other components have restricted realized performance and corresponding market adoption. A complete, high-frequency eco-system is essential to enable GaN to achieve its full potential in the power electronics industry.

This presentation will review the GaN eco-system with the key elements defined below including significant recent developments that are addressing these remaining adoption issues of system complexity, cost and component availability.

a) Control ICs & topologies – from 25W to 1kW+ high frequency, soft-switching topologies  
b) Drive - discrete, co-packaged and monolithic implementation  
c) Packaging – cascoding, co-packaging, integration  
d) Magnetics – HF & VHF developments for density and cost improvements

Specific examples of complete eco-system solutions will be given that show the GaN market is poised for mainstream adoption and is ready to achieve its growth potential.

**Break**
3:00 p.m. – 3:30 p.m.

Residential Nanogrids with Battery Storage – Is This Our Future?
3:30 p.m. – 4:00 p.m.

**Speaker:**
Antonio Ginart  
*SonnenBatterie, Inc. and the University of Georgia*

Renewables and their intrinsic distributed nature are reshaping our power distribution networks. “The Grid” transformation towards the “Smart Grid” implies fundamental structural changes that face simultaneously many challenges from environmental and regulatory groups and government agencies to name a few. Grid utilization can be significantly improved and optimized through the deployment of distributed networks of microgrids and nanogrids that include energy storage. This helps drive down the overall cost and improve the reliability of electrical power distribution systems for all of us.

This presentation will cover the definition of a residential nanogrid, its operational modes such as grid-tied and stand alone, types of nanogrids (AC or DC), and the fundamental role that energy storage plays in this area. It will explain the benefits, risks, technical challenges, economic drivers, and regulatory hurdles for the broad adoption of residential nanogrids, along with a roadmap of how battery storage and power electronics will play a major role in the future.

**The Future of Magnetic Design for Power Electronics**
4:00 p.m. – 4:30 p.m.

**Speaker:**
Ray Ridley  
*Ridley Engineering*

Size reduction has become crucial to the power supply industry, with simultaneous demand for an increase in efficiency. Great strides have been made with semiconductors, capacitors, and packaging technologies. This has focused attention on the magnetic components which are frequently the bulkiest element in many designs.

However, magnetics materials and conductors are mature technologies, having been used for over a century. We cannot count on radically better magnetic materials or
new conductor technology to move the industry forwards. There is no magic bullet to be had - we have to find new and creative ways to leverage what is already available.

Misunderstanding of magnetics prevents many designers from being able to realize the full potential of their designs. In this presentation, Dr. Ridley will highlight how better magnetics understanding can provide better practical insight into this very complex topic.

Why Do Power Supplies Fail? – A Real-World Analysis
4:30 p.m. – 5:00 p.m.

Speaker:
David Hill
Power Clinic Inc.

Many of you attending APEC are involved in the specification, design, manufacture and/or distribution of power electronics, especially power supplies. But how many of you know what happens after the installation, after the warranty runs out, when something goes wrong? This presentation will show you a behind-the-scenes look at the power supply repair industry, where thousands upon thousands of different power supplies are opened-up, evaluated, refurbished, repaired, tested and put back into service. It will provide a unique insight into some common themes and trends in power supply reliability and failure modes – not from an academic study, but a real-world, hands-on assessment from the experts who do this every day with a huge variety of different designs and end-applications.
**Rap Sessions**

**Tuesday, March 22**

5:00 p.m. – 6:00 p.m.

**R1: Future of Semiconductor Technology Development**

ROOM 104A

**MEDIUM ORATOR:**
Veena Misra, Director, Professor, North Carolina State University

**PANELISTS:**
> Eric R. Motto, Chief Engineer, Power Semiconductor Applications, Powerex Inc.
> Peter Friedrichs, Senior Sirecor SiC, Infineon
> David N. Henshall, Deputy Director of Commercialization, ARPA-E
> Madhu Chinthavali, Research Scientist, Oak Ridge National Laboratory

For automotive applications, there are many advantages of emerging semiconductor devices such as SiC or GaN such as higher switching frequency, reduced losses, high temperature operation capability, and higher power density. With properties operating in extreme conditions, they are ideal devices for applications that are subject to high voltages and temperatures found in emerging applications.

On the other hand, cost, reliability, and maturity are still driving factors for conventional silicon-based devices. While past problems with substrate defects are rapidly being addressed and companies are working to develop more robust switches, IGBT and MOSFET technologies are also progressing towards higher performance at lower costs. This panel will discuss the needs of future semiconductor technology development for power electronics industry in order to offer high-performance and low-cost power electronic interfaces. This panel will also discuss WBG development issues range from fundamental science to technology development and maturation strategies with a focus on materials research, device design, pack aging, manufacturing processes, system design and development, and reliability.

**R2: Power Electronics for Internet of Things: Will it happen?**

ROOM 104B

**MEDIUM ORATOR:**
Burak Ozpineci, Leader, Power Electronics and Electric Machinery Group, Manager, Electric Drive Technologies Program, Oak Ridge National Laboratory

**PANELISTS:**
> Martin Fornage, CTO Enphase Energy
> Chris Glaser, Applications Engineer, Texas Instruments
> Doug Houseman, Vice President for Technology and Innovations, EnerNex LLC
> Steve Collier, Director, Smart Grid Strategies, Milsoft Utility

This panel will discuss the ability/feasibility of our “smart” systems to measure, share, compute, analyze, and control power electronic converters with the new vision of Internet of Things (IoT) to achieve increased efficiency, performance, resiliency, intelligence, and security in integrated power electronics systems. This Rap Session will go beyond the consumer IoT technology market, to consider the very important evolution and application of sensors, communications, embedded computing, and cloud computing to the control and transaction of energy, the monitoring and diagnostics of equipment, the delivery of services, and the protection of critical infrastructure through the power electronics interfaces.

The rap session will cover:
> Modern power electronics with internet connectivity to support and enhance vehicular systems, microgrids, renewables integration, smart appliances, resiliency and protection, and cybersecurity.
> Sensors and control technologies and integration with the power electronics both at system and device levels.
> Smart processing and computing with internet connected power electronics.
> Transportation systems and connected vehicle communications and security.
> Ubiquitous low-cost, low-power, and energy harvesting electronics and sensors,
> Embedded computing and controls at the edge of sensing and communications,
> Big data, cloud management, and data analytics of IoT for power electronics.
R3: Advanced Refueling Technologies for EVs

ROOM 104C

MODERATOR:
Babak Fahimi, Founding Director, Renewable Energy and Vehicular Technology (REVT), University of Texas at Dallas

PANELISTS:
> Andrew Daga, CEO and Founder, Momentum Dynamics
> Grant Covic, University of Auckland-New Zealand, Qualcomm
> Ken Karklin, Vice President & General Manager, ESS AeroVironment
> Abas Goodarzi, President and CEO, U.S. Hybrid Corporation

This Rap Session will discuss the advanced refueling technologies and conventional/unconventional methods for electric vehicle charging applications. The vision of the panelists on how the refueling structure of EVs will be shaped will be expressed. From a power electronics point of view, there are several topological architectures such as isolated/non-isolated, on-board/off-board, single/multi-level, single/multi-stage charging technologies. Practically, there are an emerging number of different options such as DC fast charging, wireless charging, SuperChargers, CHAdeMO or J1772 charging protocols, and so on. While these charging technologies are expected to increase the consumer acceptance of plug-in electric vehicles, there are advantages and drawbacks of each methods. Charging times, convenience, performance, efficiency, and the current and future availability of these technologies will be discussed.
Dialogue Sessions

Dialogue Session papers have been selected through the same rigorous peer review process as papers in the oral presentation sessions. They are represented by papers in the APEC Proceedings.

In the Dialogue Sessions you will have the opportunity to talk at length with the authors about their work, something that is not possible in the oral presentation sessions.

Thursday, March 24, 2016
11:30 a.m. – 1:30 p.m.
HALL A

D01: AC-DC Converters

Track: AC-DC Converters

Chairs:
Nathan Weise, Marquette
Daniel Costinett, University of Tennessee-Knoxville

D01.1: An Input Current Calculation Switching Driver for High Power-Factor and Phase-Cut Dimmer Compatibility
Hyunchul Eum, Youngjong Kim, Kuohsien Huang, Fairchild Semiconductor International, Inc., Taiwan

D01.2: High Frequency Range Conducted Common-Mode Noise Suppression in SMPS
Jinping Zhou, Yicong Xie, Min Zhou, Delta Power Electronics Center, China

D01.3: Improved Medium Voltage AC-DC Rectifier Based on 10kV SiC MOSFET for Solid State Transformer (SST) Application
Qianlai Zhu, Li Wang, Liqi Zhang, Wensong Yu, Alex. Q Huang, North Carolina State University, United States

D01.4: Suppression of Circulating Current in Parallel Operation of Three-Level Converters
Youngkwang Son¹, Seung-Jun Chee¹, Younggi Lee¹, Seung-Ki Sul¹, Changjin Lim², Sungjae Huh², Jaeyoon Oh², ¹Seoul National University, Korea, South, ²LG Electronics, Korea, South

D01.5: Hybrid Bridgeless DCM SEPIC Rectifier Integrated with a Modified Switched Capacitor Cell
Paulo Junior Silva Costa¹, Telles Brunelli Lazzarin¹, Carlos Henrique Ila Font², ¹Universidade Federal de Santa Catarina, Brazil, ²Universidade Tecnológica Federal do Paraná, Brazil

D01.6: LCL Filter Design for Three-Phase Two-Level Power Factor Correction Using Line Impedance Stabilization Network
Alireza Kouchaki, Morten Nymand, University of Southern Denmark, Denmark

D01.7: Sensorless Current Rebuilding Strategy in a Single Phase Bridgeless PFC
Felipe López, Paula Lamo, Alberto Pigazo, Francisco J. Azcondo, Universidad de Cantabria, Spain

D01.8: A Compact Electrolytic-Free Two-Stage Universal Input Offline LED Driver
Saad Pervaiz, Ashish Kumar, Khurram K. Afridi, University of Colorado Boulder, United States

D02: DC-DC Converters I

Track: DC-DC Converters

Chairs:
Charles Sullivan, Dartmouth
Mahshid Amirabadi, Northeastern University

D02.1: Design Methodology for a High Insulation Voltage Power Transmission Function for IGBT Gate Driver
Sokchea Am, Pierre Lefranc, David Frey, Mahmoud Ibrahim, Grenoble Institute of Technology, France

D02.2: Optimized Design of GaN Switching Capacitor Based Envelope Tracking Power Supply for Satellite Applications
Qian Jin¹, Miroslav Vasic², Oscar Garcia², Pedro Alou², Jesus Angel Oliver², Jose Antonio Cobos², ¹Nanjing University of Aeronautics and Astronautics, China, ²Universidad Politécnica de Madrid, Spain

D02.3: An Isolated High Step-Up Converter with Continuous Input Current and LC Snubber
K. I. Hwu¹, W. Z. Jiang, Y. T. Yau², ¹National Taipei University of Technology, Taiwan, ²Asian Power Devices Inc., Taiwan
D02.4: Output-Inductor-Less Full-Bridge Converter with SiC-MOSFETs for Low Noise and ZVS Operation
Kazuhide Domoto1, Yoichi Ishizuka1, Seiya Abe2, Tamotsu Ninomiya3, 1Nagasaki University, Japan, 2Kyushu Institute of Technology, Japan, 3Green Electronics Research Institute, Kitakyushu, Japan

D02.5: Reduction Technique of Leakage Flux Effects on GaN-HEMTs in 5 MHz / 100 W Isolated DC-DC Converters
Akinori Hariya1, Tomoya Koga1, Ken Matsuura2, Hiroshige Yanagi2, Satoshi Tomioka2, Yoichi Ishizuka1, Tamotsu Ninomiya3, 1Nagasaki University, Japan, 2TDK Corporation, Japan, 3Kyushu University, Japan

D02.6: A High-Voltage Level Shifter with Sub-Nano-Second Propagation Delay for Switching Power Converters
Ahmed Abdelmoaty1, Mohammad Al-Shyoukh2, Ayman Fayed1, 1Ohio State University, United States, 2TSMC Inc., United States

D02.7: Dual-Output, Three-Level GaN-Based DC-DC Converter for Battery Charger Applications
Ren Ren1, Bo Liu2, Edward A. Jones2, Fred Wang2, Zheyu Zhang2, Daniel Jes Costinett2, 1Nanjing University of Aeronautics and Astronautics, China, 2University of Tennessee, United States

D02.8: Quadruple Active Bridge DC-DC Converter as the Basic Cell of a Modular Smart Transformer
Levy Costa, Giampaolo Buticchi, Marco Liserre, Christian-Albrechts-Universität zu Kiel, Germany

D02.9: Analytical Model of a Phase-Shift Controlled Three-Level Zero-Voltage Switching Converter
Cas Bakker1, Bas Vermulst2, Anton Driessen1, 1Prodrive Technologies, Netherlands, 2Technische Universiteit Eindhoven, Netherlands

D02.10: High Efficiency Design for ISOP Converter System with Dual Active Bridge DC-DC Converter
Masaki Sato1, Kazuhide Domoto1, Yoichi Ishizuka1, Masahiro Yamaguchi2, Shinya Manabe3, Hizu Okubo3, Atsushi Itagaki4, 1Nagasaki University, Japan, 2Tohoku University, Japan, 3RICOH Electronic Devices Co., Ltd., Japan, 4Ryowa Electronics Co., Ltd., Japan

D02.11: Wide Input Range Power Converters Using a Variable Turns Ratio Transformer
Ziwei Ouyang, Michael A.E. Andersen, Danmarks Tekniske Universitet, Denmark

D02.12: Design Approaches for Fast Supercapacitor Chargers for Applications like SCATMA, SRUPS
Nicoloy Gurusinghe, Nihal Kularatna, W. Howell Round, D. Alistair Steyn-Ross, University of Waikato, New Zealand

D02.13: Stack Multiphase Asymmetrical Half-Bridge Topology Offering Advance Performance and Efficiency
Trong Tue Vu, George Young, Eisergy Ltd., Ireland

D03: DC-DC Converters II
Track: DC-DC Converters

D03.1: Design of a Novel APWM Half-Bridge DC-DC Resonant Converter with Load-Independent Soft-Switching and Reduced Circulating Current
Kawsar Ali, Sandeep Kolluri, Naga Brahmandra Gorla, Pritam Das, Sanjib Kumar Panda, National University of Singapore, Singapore

D03.2: A Low-Volume Hybrid Step-Down DC-DC Converter Based on the Dual Use of Flying Capacitor
S M Ahsanuzzaman, Yingxian Ma, Abrar Ahmed Pathan, Aleksandar Prodic, University of Toronto, Canada

D03.3: Fractional Pulse Skipping in Digitally Controlled DC-DC Converters for Improved Light-Load Efficiency and Power Spectrum
Bipin Mandi, Santanu Kapat, Amit Patra, Indian Institute of Technology Kharagpur, India

D03.4: A New Compact and High Efficiency Resonant Converter
Sheng-Yang Yu, Texas Instruments Inc., United States

D03.5: A 10-MHz eGaN FETs Based Isolated Class-Phi2 DCX
Xuewen Zou, Zhiliang Zhang, Zhou Dong, Yuan Zhou, Xiaoyong Ren, Qianhong Chen, Nanjing University of Aeronautics and Astronautics, China
D03.6: Multi-Level Capacitor Clamped DC-DC Multiplier/Divider with Variable and Fractional Voltage Gain – an (N/m)X DC-DC Converter
Deepak Gunasekaran¹, Liang Qin², Ujjwal Karki¹, Yuan Li³, Fang Zheng Peng¹, ¹Michigan State University, United States, ²Wuhan University, China, ³Sichuan University/Northeastern University, China

D03.7: Multi-Mode Quasi-Z-Source Series Resonant DC/DC Converter for Wide Input Voltage Range Applications
Dmitri Vinnikov¹, Andrii Chub², Indrek Roasto¹, Liisa Liivik², ¹Ubik Solutions LLC., Estonia, ²Tallinn University of Technology, Estonia

D03.8: Hybrid Serial-Output Converter for Integrated LED Lighting Applications
Tim McRae¹, Aleksandar Prodic¹, Gianpaolo Lisi², William McIntyre², Alvaro Aguilar², ¹University of Toronto, Canada, ²Texas Instruments Inc., United States

D03.9: Analysis and Modeling of a Modular ISOP Full Bridge Based Converter with Input Filter
Pablo Zumel¹, Edwin Oña¹, Cristina Fernandez¹, Marina Sanz¹, Antonio Lazaro¹, Andres Barrado¹, Aitor Vazquez², Diego G. Lamar², ¹Universidad Carlos III de Madrid, Spain, ²Universidad de Oviedo, Spain

D03.10: Wide-Input High Power Density Flexible Converter Topology for DC-DC Applications
Parth Jain¹, Aleksandar Prodic¹, Alexander Gerfer², ¹University of Toronto, Canada, ²Wuerth Electronik eiSos GmbH & Co. KG, Germany

D03.11: High Efficiency LLC Converter Design for Universal Battery Chargers
Navid Shafiei, Ali Arefifar, Mohammad Ali Saket, Martin Ordonez, University of British Columbia, Canada

D03.12: A New High Power Density Modular Multilevel DC-DC Converter with Localized Voltage Balancing Control for Arbitrary Number of Levels
Ahmed Morsy, Yong Zhou, Prasad Enjeti, Texas A&M University, United States

D03.13: Design and Control of a Fault Tolerant Soft Switching DC-DC Converter for High Power High Voltage Applications
Tao Li, Leila Parsa, Rensselaer Polytechnic Institute, United States

D03.14: Accurate Parametric Steady State Analysis and Design Tool for DC-DC Power Converters
Mohammad Daryaei, Mohammad Ebrahimi, Sayed Ali Khajehoddin, University of Alberta, Canada

D03.15: Analysis of Multi-Output Half-Wave Semi-Synchronous Rectifier with a Uniform Magnetic Field Transmitter
Erdem Asa¹, Kerim Colak², Dariusz Czarkowski³, ¹New York University / Hevo Power Inc., United States, ²Istanbul Ulasm A.S., Turkey, ³New York University, United States

D03.16: High Gain QZS DC/DC Converter with Coupled Inductor
Rafael Vitor E Silva, Antonio Alisson A. Freitas, Marcus Rogério de Castro, Fernando Luiz M. Antunes, Edilson Mineiro Sá Jr., Universidade Federal do Ceará, Brazil

D04: Utility Interface

Track: Power Electronics for Utility Interface

Chairs:
Ali Khajehoddin, University of Alberta
Babak Nahid-Mobarakeh, University of Lorraine

D04.1: A Power Decoupling Method with Small Capacitance Requirement Based on Single-Phase Quasi-Z-Source Inverter for DC Microgrid Applications
Dingyi He, Wen Cai, Fan Yi, University of Texas at Dallas, United States

D04.2: Operation Analysis of High Efficiency Grid Connected Bi-Directional Power Conversion System for Various Storage Battery Systems with Bi-Directional Switch Circuit Topology
Go Yamada¹, Takaaki Norisada¹, Fumito Kusama¹, Keiji Akamatsu¹, Masakazu Michihira², ¹Panasonic Corporation, Japan, ²Kobe City College of Technology, Japan

D04.3: Fault Tolerant Control of MMC with Redundant Sub-Modules Based on Carrier Phase Shift Modulation
Kai Li¹, Zhengming Zhao¹, Liqiang Yuan¹, Sizhao Lu¹, Bing Pan², Zhengang Lu², ¹Tsinghua University, China, ²State Grid Smart Grid Research Institute, China
D04.4: A New Topology of Multilevel VSC Converter for Hybrid HVDC Transmission System
Jae-Jung Jung1, Shenghui Cui2, Seung-Ki Sul1, 1Seoul National University, Korea, South, 2Rheinisch-Westfälische Technische Hochschule Aachen, Germany

D04.5: Performance of Solid State Transformers Under Imbalanced Loads in Distribution Systems
Tao Yang, Ronan Meere, Cathal O'Loughlin, Terence O'Donnell, University College Dublin, Ireland

D04.6: Steady-State Analysis of Modular Multilevel Converter (MMC) Under Unbalanced Grid Conditions
Xiaojie Shi1, Yalong Li1, Zhiqiang Wang1, Bo Liu1, Leon M. Tolbert2, Fred Wang1, 1University of Tennessee, United States, 2University of Tennessee / Oak Ridge National Laboratory, United States

D04.7: Design and Control of a Compensated Submodule Testing Scheme for Modular Multilevel Converter
Yuan Tang, Li Ran, Olayiwola Alatise, Philip Mawby, University of Warwick, United Kingdom

D04.8: A Voltage Independent Islanding Detection Method and Low Voltage Ride Through of a Two-Stage PV Inverter
Partha Das, Souvik Chattopadhyay, Shiladri Chakraborty, Indian Institute of Technology Kharagpur, India

D04.9: Low Cost and High Efficiency Topology for Flexible Integration of Multi-PV and Batteries in Resonant-Based Converters
Ali Elrayyah, Qatar Environment and Energy Institute, Qatar

D04.10: Real-Time Integrated Model of a Micro-Grid with Distributed Clean Energy Generators and Their Power Electronics
Weiqiang Chen, Ali Bazzi, James Hare, Shalabh Gupta, University of Connecticut, United States

D04.11: Minimization of Inter-Module Leakage Current in Cascaded H-Bridge Multilevel Inverters for Grid Connected Solar PV Applications
Pradeep Kumar V V S, Fernandes B G, Indian Institute of Technology Bombay, India

D04.12: Effect of Grid Inductance on Grid Current Quality of Parallel Grid-Connected Inverter System with Output LCL Filter and Closed-Loop Control
Wooyoung Choi, Woongkul Lee, Bulent Sarlioglu, University of Wisconsin-Madison, United States

D04.13: Small Signal Modeling and Control of a Grid Tied Converter Without a Synchronization Unit
Subhajyoti Mukherjee, Pourya Shamsi, Mehdi Ferdowsi, Missouri University of Science and Technology, United States

D04.14: Bridgeless SEPIC PFC Converter for Low Total Harmonic Distortion and High Power Factor
Yasemin Onal, Yilmaz Sozer, University of Akron, United States

D04.15: Effectiveness of Pareto-Front Analysis Applied to the Design of a Single-Phase PFC Rectifier
Mahmoud Ibrahim1, Luc Gonnet1, Pierre Lefranc2, David Frey2, Jean-Paul Ferrieux2, Sokchea Am2, 1Eaton Corporation Plc, France, 2Grenoble Institute of Technology, France

D04.16: State Space Analysis and Duty Cycle Control of a Switched Reactance Based Center-Point-Clamped Reactive Power Compensator
Pankaj Kumar Bhowmik, Somasundaram Essakiappan, Madhav Manjrekar, University of North Carolina at Charlotte, United States

D04.17: A SiC-Based Power Converter Module for Medium-Voltage Fast Charger for Plug-in Electric Vehicles
Srdjan Srdic, Chi Zhang, Xinyu Liang, Wensong Yu, Srdjan Lukic, North Carolina State University, United States

D04.18: Shunt Active Power Filter Based on Cascaded Transformers Coupled with Three-Phase Bridge Converters
Gregory A. de Almeida Carlos1, Cursino B. Jacobina1, Joao Paulo R. Mello1, Euzeli C. dos Santos Jr.2, 1Universidade Federal de Campina Grande, Brazil, 2Indiana University – Purdue University, United States

D04.19: Independent DC Link Voltage Control of Cascaded Multilevel PV Inverter
Qingyun Huang, Wensong Yu, Alex. Q Huang, North Carolina State University, United States
D04.20: New Active Damping Method for LCL Filter Resonance Based on Two Feedback System
Mahmoud Gaafar¹, Gamal Dousoky², Masahito Shoyama¹, Kyushu University, Japan, ¹Minia University, Egypt

D04.21: Static Synchronous Generator Model for Investigating Dynamic Behaviors and Stability Issues of Grid-Tied Inverters
Liansong Xiong, Xiaokang Liu, Feng Wang, Fang Zhuo, Xi'an Jiaotong University, China

D05: Motor Drives and Inverters: Modeling and Control I

Track: Motor Drives and Inverters

Chairs:
Liming Liu, ABB Inc.
Thomas Gietzold, United Technologies Aerospace Systems

D05.1: Initial Orientation and Sensorless Starting Strategy of Wound-Rotor Synchronous Starter/Generator
Jichang Peng, Weiguo Liu, Jinhao Meng, Tao Meng, Guangzhao Luo, Northwestern Polytechnical University, China

D05.2: A Novel Method for Polarity Detection of Non-Salient PMSMs in Initial Position Estimation
Bing Liu, Bo Zhou, Jidan Wei, Long Wang, Tianheng Ni, Nanjing University of Aeronautics and Astronautics, China

D05.3: A Speed Adaptive Sensorless Flux Observer for the Induction Motor Drive Using Sylvester Criterion Design
Mihai Comanescu, Penn State Altoona, United States

D05.4: Discontinuous PWM for Low Switching Losses in Indirect Matrix Converter Drives
Yeongsu Bak, Kyo-Beum Lee, Ajou University, Korea, South

D05.5: Model Predictive Control for Extended Kalman Filter Based Speed Sensorless Induction Motor Drives
Jie Li, Liheng Zhang, Ying Niu, Haipeng Ren, Xi'an University of Technology, China

D05.6: Research on Excitation Control Methods for the Two-Phase Brushless Exciter of Wound-Rotor Synchronous Starter/Generators in the Starting Mode
Ningfei Jiao, Weiguo Liu, Tao Meng, Jichang Peng, Shuai Mao, Northwestern Polytechnical University, China

D05.7: A High Performance Speed Regulator Design for AC Machines
Adil Khurram, Habibur Rehman, Shayok Mukhopadhyay, American University of Sharjah, U.A.E.

D05.8: Zero-Sequence Current Suppression for Open-End Winding Induction Motor Drive with Resonant Controller
Hajime Kubo¹, Yasuhiro Yamamoto¹, Takeshi Kondo¹, Kaushik Rajashekara², Bohang Zhu², ¹Meidensha Corporation, Japan, ²University of Texas at Dallas, United States

D05.9: Optimized Control of High-Performance Servo-Motor Drives in the Field-Weakening Region
Jack Bermingham¹, Gerard O'Donovan¹, Ray Walsh¹, Michael Egan², Gordon Lightbody², John Hayes², Moog Ireland Ltd, Ireland, ¹University College Cork, Ireland

D05.10: Motor Current Reference Generation for Reducing Motor Currents in Drive Systems with Single-Phase Diode Rectifier and Small DC-Link Capacitor
Young-Ho Chae, Jung-Ik Ha, Seoul National University, Korea, South

D05.11: A Simple Double Mapping Based SVPWM Method for Balancing DC-Link Capacitor Voltages of Five-Level Diode-Clamped Converters
Aparna Saha¹, Ali Elrayyah², Yilmaz Sozer¹, ¹University of Akron, United States, ²Qatar Research Foundation, Qatar
D06: Motor Drives and Inverters: Modeling and Control II

Track: Motor Drives and Inverters

Chairs:
Bulent Sarlioglu, University of Wisconsin – Madison
Yichao Tang, Texas Instruments

D06.1: Capacitor-Clamped Inverter Based Transient Suppression Method for Azimuth Thruster Drives
Shantha Gamini Jayasinghe¹, Viknash Shagar¹, Hossein Enshaei¹, Danyal Mohammadi², Mahinda Vlathgamuwa³, ¹Australian Maritime College – University of Tasmania, Australia, ²Boise State University, United States, ³Queensland University of Technology, Australia

D06.2: Active Common-Mode Voltage Reduction in a Fault-Tolerant Three-Phase Inverter
Danyal Mohammadi, Said Ahmed-Zaid, Boise State University, United States

D06.3: Power Cycling Lifetime Improvement of Three-Level NPC Inverters with an Improved DPWM Method
Jiangbiao He¹, Lixiang Wei², Nabeel Demerdash¹, ¹Marquette University, United States, ²Rockwell Automation, United States

D06.4: Synchronous Optimal Pulsewidth Modulation Digital Implementation Concept for Multilevel Converters
Jackson Lago, Marcelo Lobo Heldwein, Universidade Federal de Santa Catarina, Brazil

D06.5: Analytical Determination of Conduction Losses for Modified Flying Capacitor Multicell Converters
Vahid Dargahi¹, Arash Khoshbar Sadigh², Keith Corzine¹, ¹Clemson University, United States, ²Extron Electronics, United States

D06.6: Comparison of Electrical Losses in an Inverter-Fed Five-Phase and Three-Phase Permanent Magnet Assisted Synchronous Reluctance Motor
Akram Arafat, Seungdeog Choi, University of Akron, United States

D06.7: A Hybrid Adaptive Observer for the Speed and Flux Estimation of Induction Motors
Mihai Comanescu, Penn State Altoona, United States

D06.8: Determination of CM Choke Parameters for SiC MOSFET Motor Drive Based on Simple Measurements and Frequency Domain Modeling
Di Han, Casey Morris, Woongkul Lee, Bulent Sarlioglu, University of Wisconsin-Madison, United States

D06.9: An Improved Model Predictive Current Control of Permanent Magnet Synchronous Motor Drives
Yongchang Zhang¹, Sugu Gao¹, Wei Xu², ¹North China University of Technology, China, ²Huazhong University of Science and Technology, China

D06.10: Analysis of Magnet Defect Faults in Permanent Magnet Synchronous Motors Through Fluxgate Sensors
Taner Goktas, Kun Wang Lee, Mohsen Zafarani, Bilal Akin, University of Texas at Dallas, United States

D07: Motor Drives and Inverters: Topologies

Track: Motor Drives and Inverters

Chairs:
Amirnaser Yazdani, Ryerson University
Babak Nahid-Mobarakeh, University of Lorraine

D07.1: Performance Comparison of Transfer Switch Topologies in Switched-Doubly-Fed Machine Drives
Arijit Banerjee, Steven B. Leeb, James L. Kirtley, Massachusetts Institute of Technology, United States

D07.2: Multilevel Converter Topologies for High-Power High-Speed Switched Reluctance Motor: Performance Comparison
Devendra Patil, Shiliang Wang, Lei Gu, University of Texas at Dallas, United States

D07.3: Bidirectional Magnetically Coupled T-Source Inverter for Extra Low Voltage Application
Thomas Baier, Bernhard Piepenbreier, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

D07.4: Active Virtual Ground: Single Phase Grid-Connected Voltage Source Inverter Topology
River Tin-Ho Li¹, Carl Ngai-Man Ho², ¹ABB China Ltd., China, ²University of Manitoba, Canada
D07.5: Design and Evaluation of 30kVA Inverter Using SiC MOSFET for 180°C Ambient Temperature Operation
Feng Qi1, Miao Wang1, Longya Xu1, Bo Zhao2, Zhe Zhou2, Xizhou Ren2, 1Ohio State University, United States, 2State Grid Corporation of China, China

D07.6: A DC to Three-Phase Boost-Buck Inverter with Stored Energy Modulation and a Tiny DC Link Capacitor
Mahima Gupta, Giri Venkataramanan, University of Wisconsin-Madison, United States

D07.7: Drive Circuits for Ultra-Fast and Reliable Actuation of Thomson Coil Actuators Used in Hybrid AC and DC Circuit Breakers
Chang Peng1, Alex. Q Huang1, Iqbal Husain1, Bruno Lequesne2, Roger Briggs3, 1North Carolina State University, United States, 2E-Motors Consulting, United States, 3Energy Efficiency Research, United States

D07.8: Improved Transformerless Dual Buck Inverters with Buffer Inductors
Liwei Zhou, Feng Gao, Shandong University, China

D07.9: A 99% Efficiency SiC Three-Phase Inverter Using Synchronous Rectification
Shan Yin1, King-Jet Tseng1, Chin-Foong Tong1, Rejeki Simanjorang2, Chandana Gajanayake2, Amit Gupta2, 1Nanyang Technological University, Singapore, 2Rolls-Royce Singapore Pte. Ltd., Singapore

D07.10: Comparison and Evaluation of Common Mode EMI Filter Topologies for GaN-Based Motor Drive Systems
Casey Morris, Di Han, Bulent Sarlioglu, University of Wisconsin-Madison, United States

D07.11: Analysis of Thermal Cycling Stress on Semiconductor Devices of the Modular Multilevel Converter for Drive Applications
Xiangyu Han, Qichen Yang, Liyao Wu, Maryam Saeedifard, Georgia Institute of Technology, United States

D07.12: Fault Tolerant Topologies of Five-Level Active Neutral-Point-Clamped Converters
Jun Li, ABB Inc., United States

D08: Advanced Components and Devices
Track: Devices and Components

D08.1: Dynamic Characterization of the Input and Reverse Transfer Capacitances in Power MOSFETs Under High Current Conduction
Cristino Salcines1, Ingmar Kalffass1, Hisao Kakitani2, Atsushi Mikata2, 1Universität Stuttgart, Germany, 2Keysight Technologies International, Japan

D08.2: Medium Voltage Power Switch Based on SiC JFETs
Xueqing Li, Hao Zhang, Peter Alexandrov, Anup Bhatta, United Silicon Carbide, Inc., United States

D08.3: Numerical Model and Experimental Study on Comparison of Semiconductor Pulsed Power Devices
Lin Liang1, Changdong Chen1, Fang Luo2, 1Huzhong University of Science and Technology, China, 2Ohio State University, United States

D08.4: A Normalization Procedure of DC-Side Stray Inductance for High-Speed Switching Circuit
Masato Ando, Keiji Wada, Tokyo Metropolitan University, Japan

D08.5: Thermal Network Parameter Identification of IGBT Module Based on the Cooling Curve of Junction Temperature
Xiong Du1, Tengfei Li1, Jun Zhang1, Heng-Ming Tai2, Pengju Sun1, Luowei Zhou1, 1Chongqing University, China, 2University of Tulsa, United States

D08.6: Design and Evaluation of High Current PCB Embedded Inductor for High Frequency Inverters
Mehrdad Biglarbegian, Neel Shah, Iman Mazhari, Johan Enslin, Babak Parkhideh, University of North Carolina at Charlotte, United States

D08.7: Prognosis of Wire Bond Lift-Off Fault of an IGBT Based on Multisensory Approach
Moinul Shahidul Haque1, Jeihoon Baek2, Joseph Herbert1, Seungdeog Choi1, 1University of Akron, United States, 2Korean Rail Research Institute, Korea, South

D08.8: Electrical Parasitics and Thermal Modeling for Optimized Layout Design of High Power SiC Modules
Amir Sajjad Bahman1, Freda Blaabjerg1, Joseph Herbert1, Seungdeog Choi1, 1Aalborg University, Denmark, 2University of Arkansas, United States
D08.9: Calculation of Losses in PCB Windings for Multi-Coil Contactless Charging Systems
Javier Serrano¹, Jesús Acero¹, Ignacio Lope², Claudio Carretero¹, José Miguel Burdio¹, Rafael Alonso¹, ¹Universidad de Zaragoza, Spain, ²BSH Home Appliances Group, Spain

D08.10: Design of Efficient Loads for Domestic Induction Heating Applications by Means of Non-Magnetic Thin Metallic Layers
Jesús Acero, Claudio Carretero, Rafael Alonso, José Miguel Burdio, Universidad de Zaragoza, Spain

D08.11: A New Evaluation Circuit with a Low-Voltage Inverter Intended for Capacitors Used in a High-Power Three-Phase Inverter
Kazunori Hasegawa¹, Ichiro Omura¹, Shin-Ichi Nishizawa², ¹Kyushu Institute of Technology, Japan, ²Kyushu Institute of Technology / National Institute of Advanced Industrial Science and Technology, Japan

D08.12: Energy Absorption Capability of Low Voltage Metal Oxide Varistors in AC and Impulse Currents
Dawood Talebi Khanmiri¹, Roy Ball², Craig McKenzie², Brad Lehman¹, ¹Northeastern University, United States, ²Mersen-USA, United States

D08.13: Optimization and Experimental Validation of Medium-Frequency High Power Transformers in Solid-State Transformer Applications
Mohammadamin Bahmani¹, Torbjörn Thiringer¹, Mohammad Kharezy², ¹Chalmers University of Technology, Sweden, ²SP Technical Research Institute of Sweden, Sweden

D08.14: Evaluation of Core Loss in Magnetic Materials Employed in Utility Grid AC Filters
Remus Beres¹, Xiongfei Wang¹, Frede Blaabjerg¹, Claus Leth Bak¹, Hiroaki Matsumori², Toshihisa Shimizu², ¹Aalborg University, Denmark, ²Tokyo Metropolitan University, Japan

D08.15: A Novel Gate Assisted Circuit to Reduce Switching Loss and Eliminate Shoot-Through in SiC Half Bridge Configuration
Shan Yin¹, King-Jet Tseng¹, Chin-Foong Tong¹, Rejeki Simanjorang², Chandana Gajanayake², Amit Gupta², ¹Nanyang Technological University, Singapore, ²Rolls-Royce Singapore Pte. Ltd., Singapore

D09: System Design Considerations for Power Electronics
Track: System Integration

Chairs:
John Vigars, Allegro Microsystems
Ernie Parker, Crane Aerospace & Electronics

D09.1: Methods to Enhance the Thermal Performance of a 3D Power Package
Jonathan Noquii¹, Ozzie Lopez¹, Tianyi Luo², ¹Texas Instruments Inc., United States, ²Lehigh University, United States

D09.2: Highly Reliable and Cost Effective Thick Film Substrates for Power LEDs
Paul Gundel¹, Ryan Persons¹, Melanie Bawohl¹, Mark Challingsworth¹, Christoph Czwickla¹, Virginia Garcia¹, Christina Modes¹, Ilias Nikolaidis¹, Jessica Reitz¹, Caitlin Shahbazi¹, Torsten Nowak¹, ¹Heraeus Deutschland GmbH & Co. KG, Germany, ²Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration, Germany

D09.3: Design and Evaluation of SiC-Based High Power Density Inverter, 70kW/Liter, 50kW/kg
Koji Ymaguchi, IHI Corporation, Japan

D09.4: An Improved Automatic Layout Method for Planar Power Module
Puqi Ning, Xuhui Wen, Yaohua Li, Qiongxuan Ge, Institute of Electrical Engineering, Chinese Academy of Sciences, China

D09.5: Practical Implementation Schemes of Motor Speed Measurement by Magnetic Encoder on Electric Power Steering Applications
Jaehyun Lee, Hyundai Mobis, Korea, South

D09.6: Low-Cost Input Impedance Estimator of DC-to-DC Converters for Designing the Control Loop in Cascaded Converters
Marina Sanz, Antonio Lázaro, Manuel Bermejo, David López del Moral, Pablo Zumel, Cristina Fernández, Andres Barrado, Universidad Carlos III de Madrid, Spain

D09.7: On-Chip High Performance Magnetics for Point-of-Load High-Frequency DC-DC Converters
Dragan Dinulovic¹, Mahmoud Shousha¹, Martin Haug¹, Alexander Gerfer¹, Mike Wens², Jef Thone², ¹Wuerth Elektronik eiSos GmbH & Co. KG, Germany, ²MinDCet NV, Belgium
D09.8: Effects of Auxiliary Source Connections in Multichip Power Module
Helong Li, Stig Munk-Nielsen, Szymon Beczkowski, Xiongfei Wang, Emanuel-Petre Eni, Aalborg University, Denmark

D10: Modeling and Simulation
Track: Modeling and Simulation

Chair:
Marco Meola, ZMD AG
Mehdi Ferdowsi, Missouri University of Science & Technology

D10.1: Modelling Technique Utilizing Modified Sigmoid Functions for Describing Power Transistor Device Capacitances Applied on GaN HEMT and Silicon MOSFET
Howe Li Yeo, King-Jet Tseng, Nanyang Technological University, Singapore

D10.2: Design and Precise Modeling of a Novel Digital Active EMI Filter
Junpeng Ji, Wenjie Chen, Xu Yang, Xi’an Jiaotong University, China

D10.3: Development of a Hybrid Emulation Platform Based on RTDS and Reconfigurable Power Converter-Based Testbed
Shuoting Zhang1, Yiwei Ma1, Liu Yang1, Fred Wang1, Leon M. Tolbert2, 1University of Tennessee, United States, 2University of Tennessee / Oak Ridge National Laboratory, United States

D10.4: Online Temperature Estimation for Phase Change Composite – 18650 Lithium Ion Cells Based Battery Pack
Mohamad Salameh1, Ben Schweitzer2, Peter Sveum2, Said Al-Hallaj2, Mahesh Krishnamurthy1, 1Illinois Institute of Technology, United States, 2AllCell Technologies, United States

D10.5: Modeling and Fault Diagnosis of Inter-Turn Short Circuit for Five-Phase PMSM Based on Particle Swarm Optimization
Jianwei Yang, Manfeng Dou, Zhiyong Dai, Dongdong Zhao, Zhen Zhang, Northwestern Polytechnical University, China

D10.6: Comprehensive Modeling, Testing, and Experimental Validation of Ultracapacitor Open Circuit Voltage Characteristics
Amandeep Singh, Najath Abdul Azeez, Sheldon Williamson, University of Ontario Institute of Technology, Canada

D10.7: Novel SPICE Model for Common Mode Choke Including Complex Permeability
Katsuya Nomura, Naoto Kikuchi, Yoshitoshi Watanabe, Shuntaro Inoue, Yoshiyuki Hattori, Toyota Central R&D Labs., Inc., Japan

D11: Control I
Track: Control

Chair:
Bilal Akin, University of Texas, Dallas
Brian Zahnstecher, PowerRox LLC

Sung-Jin Choi, Hee-Su Choi, University of Ulsan, Korea, South

D11.2: Introducing Fourier-Based Modeling and Control of Active-Bridge Converters
Bas Vermulst1, Jorge Duarte1, Korneel Wijnands2, Elena A. Lomonova1, 1Technische Universiteit Eindhoven, Netherlands, 2Prodrive Technologies BV / Technische Universiteit Eindhoven, Netherlands

D11.3: A Stability Analysis and Efficiency Improvement of Synchronverter
Prasanna Piya, Masoud Karimi-Ghartemani, Mississippi State University, United States

D11.4: Compensation of Switching Dead-Time Effects in Voltage-Fed PWM Inverters Using FPGA-Based Current Oversampling
Bastian Weber, Tobias Brandt, Axel Mertens, Gottfried Wilhelm Leibniz Universität Hannover, Germany

D11.5: Control Strategy of High Power Converters with Synchronous Generator Characteristics for PMSG-Based Wind Power Application
Yuzhi Zhang, Haoyan Liu, Alan Mantooth, University of Arkansas, United States

D11.6: Phase Compensation, ZVS Operation of Wireless Power Transfer System Based on SOGI-PLL
Pingan Tan, Haibing He, Xieping Gao, Xiangtan University, China
### D11: DIALOGUE SESSIONS

#### D11.7: A Novel Low-Cost Online State of Charge Estimation Method for Reconfigurable Battery Pack
Ni Lin¹, Song Ci¹, Dalei Wu², ¹University of Nebraska-Lincoln, United States, ²University of Tennessee at Chattanooga, United States

#### D11.8: Effect of Decoupling Terms on the Performance of PR Current Controllers Implemented in Stationary Reference Frame
Sizhan Zhou, Jinjun Liu, Xi’an Jiaotong University, China

#### D11.9: Fuzzy Predictive DTC of Induction Machines with Reduced Torque Ripple and High Performance Operation
Alberto Berzoy¹, Osama Mohammed¹, Johnny Rengifo², ¹Florida International University, United States, ²Universidad Simon Bolivar, Venezuela

### D12: Control II

#### Track: Control

**Chairs:**
Martin Ordonez, University of British Columbia
Jiangbiao He, GE Global Research

#### D12.1: Fixed-Frequency Generalized Peak Current Control (GPCC) for Inverters
Mohammad Ebrahimi, Sayed Ali Khajehoddin, University of Alberta, Canada

#### D12.2: Improved Control Strategy of 1 MHz LLC Converter for High Frequency Resolution
Hwapyeong Park, Jeehoon Jung, Ulsan National Institute of Science and Technology, Korea, South

#### D12.3: Bumpless Control for Reduced THD in Power Factor Correction Circuits
Joel Steenis, Alex Dumais, Microchip Technology, United States

#### D12.4: Mixed-Signal Hysteretic Internal Model Control of Buck Converters for Ultra-Fast Envelope Tracking
Inder Kumar, Santanu Kapat, Indian Institute of Technology Kharagpur, India

#### D12.5: A Continuous Actor-Critic Maximum Power Point Tracker Applied to Low Power Wind Turbine Systems
Jorge Luiz Watts Oliveira Junior, Antônio José Dias Júnior, Arthur Plínio Braga, Paulo Peixoto Praça, Allan Uchoa Barbosa, Demercil de Souza Oliveira Junior, Universidade Federal do Ceará, Brazil

#### D12.6: Multi-Band Mixed-Signal Hysteresis Current Control for EMI Reduction in Switch-Mode Power Supplies
Arindam Mandal, Inder Kumar, Santanu Kapat, Indian Institute of Technology Kharagpur, India

#### D12.7: A Parabolic Current Control Based Digital Current Control Strategy for High Switching Frequency Voltage Source Inverters
Lanhua Zhang¹, Rachael Born¹, Xiaonan Zhao¹, Jih-Sheng Jason Lai¹, Hongbo Ma², ¹Virginia Polytechnic Institute and State University, United States, ²Southwest Jiaotong University, China

#### D12.8: Finite Control Set Model Predictive Control of Dual-Output Four-Leg Indirect Matrix Converter Under Unbalanced Load and Supply Conditions
Ozan Gulbudak, Enrico Santi, University of South Carolina, United States

#### D12.9: A Silicon Carbide Integrated Circuit Implementing Nonlinear-Carrier Control for Boost Converter Applications
Richard Harris¹, Benjamin McCue¹, Benjamin Roehrs¹, Charles Roberts II¹, Benjamin J. Blalock¹, Daniel Jes Costinett¹, Kouros Sariri², George Megyi², Cheng-Po Chen³, Avinash Kashyap³, Reza Ghandi³, ¹University of Tennessee, United States, ²Frequency Management International, United States, ³GE Global Research, United States

#### D12.10: A New Current Mode Constant on Time Control with Ultrafast Load Transient Response
Syed Bari, Qiang Li, Fred C. Lee, Virginia Polytechnic Institute and State University, United States

#### D12.11: A Web-Based Tool for Compensation Design of Power Converters Using Hybrid Optimization
Srikanth Pam¹, Yudhistir Satija¹, Pradeep Chawda², Makram Mansour², Robert Hanrahan², Jeff Perry², ¹Texas Instruments Inc., India, ²Texas Instruments Inc., United States

#### D12.12: Second Order Sliding Mode Controlled Point of Load Power Supply
Prasanta Achanta¹, David Jones¹, Dragan Maksimovic¹, Serhii Zhak², Brett Miwa³, Cory Arnold³, ¹University of Colorado Boulder, United States, ²Linear Technology Corporation, United States, ³Maxim Integrated, United States
D12.13: Vibration and Torque Ripple Reduction of Switched Reluctance Motors Through Current Profile Optimization
Cong Ma¹, Liyan Qu¹, Rakesh Mitra², Preit Pramod³, Rakib Islam³, ¹University of Nebraska-Lincoln, United States, ²Nexteer Automotive, United States

D12.14: Modified Predictive Current Control of Neutral-Point Clamped Converter with Reduced Switching Frequency
Dinto Mathew, Anshuman Shukla, Santanu Bandyopadhyay, Indian Institute of Technology Bombay, India

D12.15: Implicit Finite Control Set Model Predictive Current Control for Modular Multilevel Converter Based on IPA-SQP Algorithm
Hamed Nademi¹, Lars Norum², ¹ABB AS, Norway, ²Norwegian University of Science and Technology, Norway

D12.16: Resolution Requirements to Avoid Limit Cycling in LLC Resonant Converter
Shadi Dashmiz¹, Behzad Mahdavikhah¹, Aleksandar Prodic¹, Brent McDonald², ¹University of Toronto, Canada, ²Texas Instruments Inc., United States

D13: Renewable Energy Systems I
Track: Renewable Energy Systems

D13.1: Reduction of Storage Capacity in DC Microgrids Using PV-Embedded Series DC Electric Springs
Minghao Wang, Siew-Chong Tan, Shu Yuen Ron Hui, University of Hong Kong, Hong Kong

D13.2: A Vector Control Strategy of Grid-Connected Brushless Doubly Fed Induction Generator Based on the Vector Control of Doubly Fed Induction Generator
Sheng Hu, Guorong Zhu, Wuhan University of Technology, China

D13.3: An Energy Router Based on Multi-Winding High-Frequency Transformer
Xianzhuo Liu, Zedong Zheng, Kui Wang, Yongdong Li, Tsinghua University, China

D13.4: Noise Suppression of the DWT-Based MRA on Mother Wavelet and Decomposition Level Optimization for a Robust Adaptive SOC Estimator in Multi-Cell Battery String
Jonghoon Kim¹, Chang Yoon Chun², Woonki Na³, ¹Chosun University, Korea, South, ²Seoul National University, Korea, South, ³California State University, Fresno, United States

D13.5: A Feedforward Control Based Power Decoupling Scheme for Voltage-Controlled Grid-Tied Inverters
Baojin Liu, Zeng Liu, Jinjun Liu, Teng Wu, Shike Wang, Xi’an Jiaotong University, China

D13.6: Light Load Efficiency Improvement of Solar Farms Three-Phase Two-Stage Module Integrated Converter
Ahmadreza Amirahmadi, Utsav Somani, Mahmood Alharbi, Charlie Jourdan, Issa Batarseh, University of Central Florida, United States

D13.7: Switching System Stability Analysis of DC Microgrids with DBS Control
Na Zhi¹, Hui Zhang¹, Xi Xia², ¹Xi’an University of Technology, China, ²Tsinghua University, China

D13.8: A Grid-Connected WECS with Power Limiting Control
Jéssica Guimarães, Demercil de Souza Oliveira Junior, Juliano de Oliveira Pacheco, Paulo P. Peixoto, Universidade Federal do Ceará, Brazil

D13.9: Overshoot Control of the Electromagnetic Torque During Fault Recovery for an SCIG with a STATCOM
Zahra Mahmoodzadeh, Mehrdad Yazdanian, Hooman Ghaifrazadeh, Ali Mehrizi-Sani, Washington State University, United States

Zhenxiong Wang, Hao Yi, Fang Zhuo, Zhigang Zhang, Xi’an Jiaotong University, China

D13.11: High Performance ZVT with Bus Clamping Modulation Technique for Single Phase Full Bridge Inverters
Yinglai Xia, Raja Ayyanar, Arizona State University, United States

D13.12: Small AC Signal Droop Based Secondary Control for Microgrids
Teng Wu, Zeng Liu, Jinjun Liu, Baojin Liu, Shike Wang, Xi’an Jiaotong University, China
D13.13: Mode Transition Control Strategy for Multiple Inverter Based Distributed Generators Operating in Grid-Connected and Stand-Alone Mode
Onkar Kulkarni, Suryanarayana Dooolla, Baylon Fernandes, Indian Institute of Technology Bombay, India

Rui Gao, Iqbal Husain, Alex. Q Huang, North Carolina State University, United States

D13.15: An Isolated Buck-Boost Type High-Frequency Link Photovoltaic Microinverter
Shiladri Chakraborty, Souvik Chattopadhyay, Indian Institute of Technology Kharagpur, India

D13.16: Energy Management and Stabilization of a Hybrid DC Microgrid for Transportation Applications
Mehdi Karbalaye Zadeh¹, Louis-Marie Sauble², Roghayeh Gavagsaz-Ghoachani³, Babak Nahid-Mobarakeh², Serge Pierfederici², Marta Molinas¹, ¹Norwegian University of Science and Technology, Norway; ²Université de Lorraine, France

D13.17: A Low-Cost Solar Micro-Inverter with Soft-Switching Capability Utilizing Circulating Current
Xiaohu Liu, Mohammed Agamy, Dong Dong, Maja Harfman-Todorovic, Luis Garces, GE Global Research, United States

D14: Renewable Energy Systems II
Track: Renewable Energy Systems

CHAIRS:
Haoyu Wang, Shanghai Tech University
Robert Pilawa-Podgurski, University of Illinois at Urbana-Champaign

D14.1: Design and Stability Analysis for an Autonomous DC Microgrid with Constant Power Load
Qianwen Xu¹, Xiaolei Hu¹, Peng Wang¹, Jianfang Xiao¹, Leonardy Setyawan¹, Changyun Wen¹, Lee Meng Yeong², ¹Nanyang Technological University, Singapore; ²Rolls-Royce Singapore Pte. Ltd., Singapore

D14.2: MPC-SVM Method for Vienna Rectifier with PMSG Used in Wind Turbine Systems
June-Seok Lee¹, Yeongsu Bak¹, Kyoe-Beum Lee¹, Frede Blaabjerg², ¹Ajou University, Korea; South ²Aalborg University, Denmark

D14.3: An Equivalent Circuit Model for State of Energy Estimation of Lithium-Ion Battery
Kaiyu Li, King-Jet Tseng, Nanyang Technological University, Singapore

D14.4: Distributed Optimal Control of Reactive Power and Voltage in Islanded Microgrids
Yanbo Wang, Xiongfei Wang, Zhe Chen, Frede Blaabjerg, Aalborg University, Denmark

D14.5: New Start-Up Scheme for HF Transformer Link Photovoltaic Inverter
Abhijit Kulkarni, Vinod John, Indian Institute of Science, India

D14.6: Analysis and Improvement of Harmonic Quasi Resonant Control for LCL-Filtered Grid-Connected Inverters in Weak Grid
Qiang Qian, Jinming Xu, Shaojun Xie, Lin Ji, Nanjing University of Aeronautics and Astronautics, China

D14.7: Model Predictive Control Method to Reduce Common-Mode Voltage and Balance the Neutral-Point Voltage in Three-Level T-Type Inverter
Xiangyang Xing, Alain Chen, Zicheng Zhang, Jie Chen, Chenghui Zhang, Shandong University, China

D14.8: Convergence Analysis of Distributed Control for Operation Cost Minimization of Droop Controlled DC Microgrid Based on Multiagent
Chendan Li, Juan C. Vásquez, Josep Maria Guerrero, Aalborg University, Denmark

D14.9: A Novel Model Predictive Control Algorithm to Suppress the Zero-Sequence Circulating Currents for Parallel Three-Phase Voltage Source Inverters
Zicheng Zhang, Alain Chen, Xiangyang Xing, Chenghui Zhang, Shandong University, China

D14.10: Design of Dynamic Voltage Restorer and Active Power Filter for Wind Power Systems Subject to Unbalanced and Harmonic Distorted Grid
Woei-Luen Chen, Meng-Jie Wang, Chang Gung University, Taiwan
Daming Zhou¹, Elena Breaz¹, Alexandre Ravey¹, Fei Gao¹, Abdellatif Mirouit¹, Ke Zhang²,
¹Université de technologie de Belfort-Montbéliard, France, ²Northwestern Polytechnical University, China

D14.12: Voltage and Frequency Control of Electric Spring Based Smart Loads
Yun Yang, Siew-Chong Tan, Shu Yuen Ron Hui, University of Hong Kong, Hong Kong

D14.13: Second Harmonic Current Compensator with Improved One-Cycle-Control
Li Zhang, Xinbo Ruan, Xiaoyong Ren, Nanjing University of Aeronautics and Astronautics, China

D14.14: Frequency Adaptive Control of a Smart Transformer-Fed Distribution Grid
Zhi-Xiang Zou, Giovanni De Carne, Giampaolo Buticchi, Marco Liserre, Christian-Albrechts-Universität zu Kiel, Germany

D14.15: A Synchronization Scheme for Single-Phase Grid-Tied Inverters Under Harmonic Distortion and Grid Disturbances
Lenos Hadjidemetriou¹, Elias Kyriakides¹, Yongheng Yang², Frede Blaabjerg², ¹University of Cyprus, Cyprus, ²Aalborg University, Denmark

D14.16: Series-Parallel Connection of Low-Voltage Sources for Integration of Galvanically Isolated Energy Storage Systems
Ramy Georgious, Jorge Garcia, Angel Navarro, Sarah Saeed, Pablo Garcia, Universidad de Oviedo, Spain

D14.17: Saturation Controller-Based Direct Power Control for Doubly-Fed Induction Generator
Chun Wei¹, Zhe Zhang², Wei Qiao¹, Liyan Qu¹, ¹University of Nebraska-Lincoln, United States, ²Nexteer automotive, United States

D14.18: Inductance-Simulating Control for DFIG-Based Wind Turbine to Ride-Through Grid Faults
Donghai Zhu¹, Xudong Zou¹, Yong Kang¹, Lu Deng², Qingjun Huang³, ¹Huazhong University of Science and Technology, China, ²Wuhan NARI Limited Company of State Grid Electric Power Research Institute, China, ³State Key Laboratory of Disaster Prevention & Reduction for Power Grid Transmission and Distribution, China

D15: Transportation Power Electronics
Track: Transportation Power Electronics
Chair:
Ted Bohn, Argonne National Labs
Khurram Afridi, University of Colorado, Boulder

D15.1: Misalignment Effect on Efficiency of Wireless Power Transfer for Electric Vehicles
Yabiao Gao¹, Antonio Ginart², Kathleen Farley³, Zion Tsze Ho Tse¹, ¹University of Georgia, United States, ²Sonnenbatterie GmbH / University of Georgia, United States, ³Southern Company Services, Inc., United States

D15.2: Genetic Algorithm Design of a 3D Printed Heat Sink
Tong Wu, Burak Ozpineci, Curtis Ayers, Oak Ridge National Laboratory, United States

D15.3: Evaluation of Power Flow Control for an All-Electric Warship Power System with Pulsed Load Applications
Jason Neely, Lee Rashkin, Marvin Cook, David Wilson, Steve Glover, Sandia National Laboratories, United States

D15.4: Reduced Active Switch AC to DC Rectifier with High Frequency Isolation for Electric Vehicle Chargers
Jose Sandoval, Taeyong Kang, Prasad Enjeti, Texas A&M University, United States

D15.5: A Wide Bandgap Device Based Multilevel Switched-Capacitor Converter
Diogo Cesar Santos de Moura, Boris Curuvija, Dong Cao, North Dakota State University, United States

D16: Power Topologies, Distribution, and Control
Track: Power Electronics Applications
Chair:
Tiefu Zhao, Eaton
Xiaonan Lu, Argonne National Laboratory

D16.1: Novel Circulating Current Suppression Strategy for MMC Based on Quasi-PR Controller
Shengbao Geng, Yiliang Gan, Yungui Li, Lijun Hang, Guojie Li, Shanghai Jiao Tong University, China
D16.2: Asymmetric Duty-Cycle Phase-Shift Modulation for Power Management in Double Half-Bridge Inverter with Partly Coupled Inductive Loads
Claudio Carretero, Hector Sarnago, Oscar Lucia, Jesús Acero, José Miguel Burdio, Universidad de Zaragoza, Spain

D16.3: Control Implementation for a Wide Voltage Range High Efficiency Power Supply Utilizing Low Voltage MOSFETs
Werner Konrad¹, Gerald Deboy², Annette Muetze¹, ¹Technische Universität Graz, Austria, ²Infineon AG, Austria

D16.4: A Single-Phase Dual Frequency Inverter Based on Multi-Frequency Selective Harmonic Elimination
Chongwen Zhao¹, Daniel Jes Costinett¹, Brad Trento¹, Daniel Friedrichs², ¹University of Tennessee, United States, ²Medtronic, United States

D16.5: Grid Connected DC Distribution Network Deploying High Power Density Rectifier for DC Voltage Stabilization
Danillo Rodrigues¹, Paulo Silva², Gustavo Lima¹, Ernane A. A. Coelho², Luiz C. G. Freitas², ¹Universidade Federal do Triângulo Mineiro, Brazil, ²Universidade Federal de Uberlândia, Brazil

D16.6: Even-Harmonic Repetitive Control for Circulating Current Suppression in Modular Multilevel Converters
Shunfeng Yang¹, Peng Wang¹, Yi Tang¹, Michael Zagrodnik², Xiaolei Hu¹, King-Jet Tseng¹, ¹Nanyang Technological University, Singapore, ²Rolls-Royce Singapore Pte. Ltd., Singapore

D16.7: A New DSC-PLL Using Recursive Discrete Fourier Transform for Robustness to Frequency Variation
Jae Do Lee¹, Hanju Cha², ¹Korea Institute of Nuclear Safety, Korea, South, ²Chungnam National University, Korea, South

D16.8: A Four-Quadrant Modulation Technique for Cascaded Multilevel Inverters to Extend Solution Range for Selective Harmonic Elimination / Compensation
Hui Zhao, Shuo Wang, University of Florida, United States

D16.9: Online Battery Impedance Spectrum Measurement Method
Jaber Abu Qahouq, University of Alabama, United States

D16.10: Analysis and Control of a Reduced Switch Converter for Active Magnetic Bearings
Dong Jiang¹, Parag Kshirsagar², ¹Huazhong University of Science and Technology, United States, ²United Technologies Research Center, United States

D16.11: A Novel Balanced Winding Topology to Mitigate EMI Without the Need for a Y-Capacitor
Yongjiang Bai¹, Xu Yang¹, Xinlei Li², Dan Zhang², Wenjie Chen¹, ¹Xi’an Jiaotong University, China, ²Silergy Corp., China

D16.12: Topology and Control Strategy for Accelerated Lifetime Test Setup of DC-Link Capacitor of Wind Turbine Converter
Youngjiong Ko, Holger Jedtberg, Giampaolo Buticchi, Marco Lisserre, Christian-Albrechts-Universität zu Kiel, Germany

D16.13: Voltage Droop Compensation Based on Resonant Circuit for Generalized High Voltage Solid-State Marx Modulator
Hiren Canacsinh¹, Luís Redondo¹, José Silva², Beatriz Borges², ¹Instituto Superior de Engenharia de Lisboa, Portugal, ²Instituto Superior Técnico, Portugal

D16.14: Four H-Bridge Based Shunt Active Power Filter for Three-Phase Four Wire System
Edgard L. L. Fabricio¹, Cursino B. Jacobina², Gregory A. de Almeida Carlos², Maurício B. R. Correa², ¹Universidade Federal do Paraíba, Brazil, ²Universidade Federal de Campina Grande, Brazil

D16.15: High-Frequency AC Distributed Power Delivery System
Mengqi Wang¹, Qingyun Huang², Wensong Yu², Alex. Q Huang², ¹University of Michigan-Dearborn, United States, ²North Carolina State University, United States

D16.16: Effect of the Capacitance Distribution on the Output Impedance of the Half-Wave Cockcroft-Walton Voltage Multiplier
Liran Katzir, Doron Shmilovitz, Tel Aviv University, Israel
D17: Emerging and Renewable Power

Track: Power Electronics Applications

Chairs:
Katherine Kim, Ulsan NIST
Dimitri Torregrossa, EPFL

D17.1: A Cost Effective High Performance LED Driver Powered by Electronic Ballasts
Jianwen Shao, Thomas Stamm, STMicroelectronics, United States

D17.2: Model Predictive Control of Z-Source Four-Leg Inverter for Standalone Photovoltaic System with Unbalanced Load
Sertac Bayhan, Mohamed Trabelsi, Haitham Abu-Rub, Texas A&M University at Qatar, Qatar

D17.3: Efficiency Optimization of an Integrated Wireless Power Transfer System by a Genetic Algorithm
Rosario Pagano¹, Siham Abedinpour¹, Angelo Raciti², Salvatore Musumeci², ¹Integrated Device Technology Inc., United States, ²Università degli Studi di Catania, Italy

D17.4: Loss Analysis of a High Efficiency GaN and Si Device Mixed Isolated Bidirectional DC-DC Converter
Fei Xue, Ruiyang Yu, Alex. Q Huang, North Carolina State University, United States

D17.5: Dynamic Efficiency Tracking Controller for Reconfigurable Four-Coil Wireless Power Transfer System
Yuan Cao, Zhigang Dang, Jaber Abu Qahouq, Evan Phillips, University of Alabama, United States

D17.6: Wireless Power and Data Transfer System for Smart Bridge Sensors
Yujin Jang, Jung Kyu Han, Shin Young Cho, Gun-Woo Moon, Ji-Min Kim, Hoon Sohn, Korea Advanced Institute of Science and Technology, Korea, South

D17.7: Inrush Transient Current Analysis and Suppression of Photovoltaic Grid-Connected Inverters During Voltage Sag
Zhongyu Li¹, Rende Zhao¹, Zhen Xin², Josep Maria Guerrero², Mehdi Saghhebi², Peide Li³, ¹China University of Petroleum, China, ²Aalborg University, Denmark, ³Shandong Jinan Power Equipment Factory Co., LTD, China

D17.8: A Highly Reliable Single-Stage Converter for Electric Vehicle Applications
S.A.Kh. Seyedabdolkh Mozaffari Niapour, Mahshid Amirabadi, Northeastern University, United States

D17.9: A Modular High Frequency High Voltage Generator with Silicon Carbide Power Semiconductor Devices
Saijun Mao¹, Tao Wu¹, Xi Lu¹, Jelena Popovic², Jan Abraham Ferreira², ¹GE Global Research, China ²Delft University of Technology, Netherlands

D17.10: Simple and Efficient Low Power Photovoltaic Emulator for Evaluation of Power Conditioning Systems
Jesus Gonzalez-Llorente¹, Andres Rambal-Vecino¹, Luciano Garcia-Rodriguez², Juan Carlos Balda³, Eduardo I. Ortiz-Rivera³, ¹Universidad Sergio Arboleda, Colombia, ²University of Arkansas, United States, ³University of Puerto Rico at Mayaguez, Puerto Rico

D17.11: Data Transmission Method Without Additional Circuits in Bidirectional Wireless Power Transfer System
Yeongrack Son, Jung-Ik Ha, Seoul National University, Korea, South

D17.12: Improved Impedance Source Inverter for Hybrid/Electric Vehicle Application with Continuous Conduction Operation
Thilak Senanayake, Ryuji Iijima, Takanori Isobe, Hiroshi Tadano, Tsukuba University, Japan
The 2016 APEC Exposition will provide conference attendees an exceptional opportunity to examine and touch the product offerings of the leading suppliers to the power electronics industry. The newest components, power supplies, design tools and services will be on display, and you can meet and talk to application experts at each booth. The exhibition is sold out again this year, so you will be sure to find something of interest in every corner of the hall.

For in-depth product details, the Exhibitor Seminars on Tuesday afternoon and Wednesday morning will offer product presentations and a question and answer forum for present and future products and services. Additional highlights of the conference include the Exhibit Hall Welcome Reception on Monday evening followed immediately at 8 p.m. by the 25th Annual MicroMouse Contest, then on Tuesday at 5 p.m. the Rap Sessions covering topics of interest in power electronics.

A thank you goes to our long-term APEC sponsors the IEEE Industrial Applications & Power Electronics Societies (IAS & PELS), and the Power Sources Manufacturers Association (PSMA) for their commitment and support of APEC 2015. In addition, a special thanks goes to our seven conference partners whose logos appear on the next page, who have provided additional financial support to make your conference experience even better. 

Please enjoy!
Exposition Information

The Exposition will open on Monday, March 21 when the Plenary Session concludes.

*Hall will open upon conclusion of the Plenary

Exhibit Hall Hours

- Monday, March 21: 5:00 p.m.* – 8:00 p.m.
- Tuesday, March 22: 12:00 p.m. – 5:00 p.m.
- Wednesday, March 23: 10:00 a.m. – 2:00 p.m.

Admission

Entry is granted to persons 18 or older with any APEC badge, including the free “Exhibits Only” badge which also grants admission to the exhibitor seminars, plenary session, micromouse contest and rap sessions.

Exhibit Hall Functions

Exhibitors’ Reception

A Welcoming Reception will be held in the Exhibit Halls on Monday, March 21, from 5:00 p.m. until 8:00 p.m. Registered spouses and guests are welcome.

Exhibit Hall Lunch and Breaks

Lunch will be served in the Exhibit Hall on Tuesday from 12:00 – 1:30 pm and on Wednesday from 12:00 p.m. – 2:00 p.m., free of charge to all who have access to the exhibit hall.

On Tuesday afternoon from 2:30 p.m. – 3:30 p.m., we will be having an ice cream social in the Exhibit hall.

The Wednesday morning coffee break will be served in the Exhibit Hall from 10:00 a.m. to 11:00 a.m.

Exposition & Giveaway – Booth 939

During all three days of the Exhibition we will be giving away over $5000 in prizes. At registration everyone (exhibits only registrants and exhibitors included) will be issued a raffle ticket that you will put in a drop box upon entering the Exhibit Hall. This will be good for all three days of raffles during the exhibition but you must be present to win.
Exhibitor Seminars

Exhibitor Seminars – Session #1
Tuesday, March 22, 1:30 p.m. – 2:00 p.m.

Coilcraft
ROOM 101A

New Power Inductors for High Frequency DC-DC Converters

Speaker: Len Crane

This presentation introduces new power inductors optimized for 2 to 10 MHz switching. As switching frequencies increase in order to reduce the size of passive components, new magnetic designs are required to fulfill that promise. This presentation will describe new inductors and the data users need from inductor suppliers to incorporate them in optimized designs for best efficiency and small size.

Dino-Lite Scopes (BigC)
ROOM 101B

Dino-Lite Digital Microscope: Edge Series

Speaker: Lance Dominguez

Dino-Lite handheld USB microscopes used for inspection and quality control. Most models provide 10x-200x magnification, with higher magnification ranges going up to 500x and 900x. The included DinoCapture software includes capability to capture images, record videos annotate and perform measurements, and save and email discoveries. The Edge series contain an enhanced sensor for improved image quality. New features include Extended Depth of Field (EDOF), Extended Dynamic Range (EDR), and Automatic Magnification Reading (AMR). 5MP resolution Edge series units also have Flexible LED Control (FLC) to enable partial illumination. Mobile solutions include use with our wifi adapter or a direct connection to Windows RT tablets or select Android devices.

Hydro-Québec Research Institute (IREQ)
ROOM 102AB

Simulating Power Electronics Converters Using MATLAB/SimPowerSystems. The Right Balance between Performance and Fidelity

Speaker: Pierre Giroux et Patrice Brunelle, Research Scientists

When power system engineers are simulating power electronics converter-based systems using advanced simulation tools, they are often required to use special modeling techniques in order to speed-up simulation. However, these techniques may have drawbacks that will impair simulation results, hence the need to find the right balance between performance and fidelity.

The tutorial presents four different levels of abstraction for modeling power electronics converters. These levels are described, along with simulation results. A comparison of the methods and a description of their respective domains of validity are also presented. Last, the most appropriate method for a given phenomenon under study is proposed.

Infineon Technologies
ROOM 103AB

MOSFET Driver IC Solutions from Infineon Technologies

Speaker: Hubert Baierl

Driver ICs are used for high power SMPS to create a crucial link between control ICs and switching MOSFETS which require higher gate drive voltage and current. Use of Driver IC offers ease of design, leads to higher power density and increases reliability and robustness of the solution. This session focuses on important features and requirements for driver IC and also highlights driver IC solutions from Infineon. The audience will benefit from this session by understanding the criteria for selecting the right driver IC solution for their application.
**LEM USA**  
ROOM 201A  
**New ASIC based Open Loop Transducers**  
**Speaker:** Mark Spiering  
How LEM’s new ASIC design greatly improves Open Loop Transducer performance and flexibility.

---

**NXP Semiconductors USA, Inc.**  
ROOM 201B  
**Introducing new Motor Drivers featuring Functional Safety and Higher Torque**  
**Speaker:** Tom Zemites  
Introducing a new motor driver product family designed for automotive engine control applications. The MC33HB2000 and MC33HB2001 product family providing many firsts in the industry. It will be the first motor driver fully certified to ISO26262 to support ASIL level D system qualification. It features a patented thermal management scheme ensuring high efficient operation by reducing switching losses when motor is experiencing heavy loads or binding. It provides the lowest integrated RDS (ON) as well as the most accurate current feedback circuit providing continuous motor operation in critical applications and harsh environments. The product will be featured in the NXP booth with a hands-on demonstration using the MC33HB2001 brushed dc motor driver. We will apply loads to these devices driving them into their over current condition and using a scope to monitor the devices thermal management functions.

---

**STMicroelectronics**  
ROOM 202AB  
**Silicon Carbide MOSFET Benefits in Automotive Applications**  
**Speaker:** Jeffrey Fedison  
In Automotive applications large advantages are offered by Silicon Carbide (SiC) solutions at any load condition in terms of power losses, efficiency and consequently longer battery autonomy as well as smaller cooling system. However SiC MOSFET solution must be dimensioned in order to maintain a reasonable junction temperature at the peak power condition where any MOSFET solution is affected by huge conduction losses that can be only partially counter-compensated by the much better switching performance.

---

**Texas Instruments**  
ROOM 203AB  
**Big Batteries: take a walk on the high side with TI’s 100-V FET driver**  
**Speaker:** Allen Y Chen, Product Marketing & Applications Manager  
**Battery Management Solutions – Monitoring & Protection**  
Drones, cordless robotics, energy storage systems and light electric vehicles all share one key thing in common: they rely on big batteries, and consumers expect a premium product to match the premium price tag. TI’s new bq76200 is the first-ever high-side battery FET driver for such high-voltage battery applications, offering incredible flexibility to battery pack designers looking for robust, low power protection FET control. The bq76200 eliminates the struggles associated with building complicated, reliability-constrained discrete charge-pump circuits to achieve a high-side FET drive, and is a perfect complement to many of TI’s existing battery monitors and companion fuel gauges. It helps designers promise the best of all worlds: a truly intelligent battery, capable of collaborating with a system 24/7 while maintaining protection and ensuring longevity.

---

**Exhibitor Seminars – Session #2**  
Tuesday, March 22, 2:15 p.m. – 2:45 p.m.  
**Aavid Thermalloy LLC**  
ROOM 101A  
**Aavid Thermalloy Expands Capabilities & Products with Niagara Acquisition**  
**Speaker:** Robert Soucy, Mark Parisi  
With the acquisition of Niagara Thermal Products, Aavid continues to expand and round out its capabilities and products to serve multiple industries, and markets with the latest in technology, manufacturing and complete Global Supply Chain management. This discussion will outline the advantage of working with Aavid – Niagara on any Electronic Cooling
Application, with complete Global manufacturing and technology centers located around the world. With the added specialization in process, engineering, and manufacturing, the Aavid-Niagara offers the market a complete supplier that really is the leader in all aspects of Electronic Cooling, from complete systems to simple components.

---

**CogniPower**  
ROOM 101B  

**The Practical Side of Faster, Smaller, More Efficient Power Converters**  

**Speaker:** Tom Lawson

Faster, better power switches are essential for building faster, better power converters, but they are not a solution by themselves. Parasitics and latency must be minimized, and controls, magnetics and filters must be reexamined.

CogniPower is demonstrating a fast Predictive Energy Balancing power converter that takes good advantage of an advanced GaN output stage. What are the challenges involved?

---

**Magnetics**  
ROOM 102AB  

**Large XFLUX® and Block Structures for High Current Applications**  

**Speaker:** Brad Van Fleet

In this presentation, we will go over new offerings from Magnetics geared for use in high current inductors and chokes. This includes discussion about the expansion of our XFLUX product line as well as new capabilities related to the creation of custom block structures. An overview of a few inductor designs with these new products will be presented to showcase the advantages of each and to provide guidance on applications where they will be useful. In addition, topics related to inductance calculations and testing for block structures will be reviewed.

---

**NH Research, Inc.**  
ROOM 103AB  

**Testing Vehicle Power & V2G Applications**  

**Speaker:** Martin Weiss

This session describes the key factors in selecting the right equipment used for testing vehicle power systems as well as vehicle-to-grid (V2G) applications. Selecting the right equipment simplifies testing allowing for earlier validation, faster time to results, increased test coverage, improved design characterization, and enables research for emerging applications such as vehicle-to-grid (V2G). Use these key factors in selecting test equipment as using the right tool for the job always simplifies the effort required.

---

**Powerex, Inc.**  
ROOM 201A  

**New DIPIPM™s Featuring More Integration and Lower Cost**  

**Speaker:** Michael Rogers, Powerex Applications Engineer

Powerex is pleased to introduce the latest Dual In-line Package Intelligent Power Modules (DIPIPMs™) designed to meet demands for low cost, high reliability, more integration and space savings in small industrial and commercial motor drive applications. This presentation will feature two new products:

1. The new slim package SLIMDIP series power module, developed primarily for white goods applications such as air conditioning, refrigeration and washing machines, utilizing RC-IGBT (Reverse Conducting IGBT) technology which integrates the IGBT and free-wheel diode into a single super thin chip to provide considerable space savings and lower cost.

2. The new all-in-one transfer molded DIPIPM+, developed primarily for small industrial motor drives, includes CIB (Converter-Inverter-Brake) circuits and built-in gate drivers with protection functions. The result is a significant total system size and cost reduction.

DIPIPM is a registered trademark of Mitsubishi Electric
**SIMPLIS Technologies**  
ROOM 201B  
**Designing Digitally Controlled Systems with SIMPLIS**  
**Speaker:** Christopher Bridge  
A design methodology is presented for designing digitally controlled systems using the SystemDesigner features of the SIMPLIS simulator. Taking full advantage of these SystemDesigner capabilities, we demonstrate how users can simulate their digitally controlled systems such that they have the option, with a single schematic, to model the signal path as either signed integers or double precision floating-point numbers. Modeling the signal path with double precision allows users to take advantage of the SIMPLIS Periodic Operating Point and AC analyses. Modeling the signal path as signed integers captures the expected quantization effects of the digitally controlled loop.  
This technique is applicable for both hardware and firmware/software digital control implementations. Using an LLC DC-DC converter as an example, we show how to transition from an analog controller to a digital control implementation.

---

**Mouser Electronics**  
ROOM 203AB  
**An Integrated Filter and Power Converter Electric Vehicle Powertrain Solution**  
**Speaker:** Matthew Reynolds, EPCOS, Inc. A TDK Group Company  
Dr. David Levett, Infineon Technologies Industrial Power and Control Division  
As electric and hybrid electric vehicles increase their share of the overall passenger vehicle market, the design requirements for the traction drives and filters becomes more demanding. The drives must become more compact, resistant to mechanical shock and vibration, and operate over longer lifetimes, both more reliably and more efficiently. Additionally, specialized filters are required for the reduction of electromagnetic noise, voltage spikes and ground currents in order to further extend the life of the electric motor and to reduce interference with communication systems within the vehicle. Join us as we further discuss the solutions EPCOS and Infineon have developed to address the challenges faced in the ever growing market of electric and hybrid vehicles.

---

**Vishay Intertechnology**  
ROOM 202AB  
**Performance Components for Power Applications**  
**Speaker:** Breno Albuquerque  
Vishay will highlight its latest industry-leading power MOSFET, passive component, and diode technologies for a wide range of power applications.

---

**Exhibitor Seminars – Session #3**  
Tuesday, March 22, 3:00 p.m. – 3:30 p.m.

---

**AgileSwitch, LLC**  
ROOM 101A  
**An Industry First – Silicon Carbide based Intelligent Power Module**  
**Speaker:** Nitesh Satheesh  
Since inception, AgileSwitch has introduced products true to its mission “Digitize a traditionally Analog Power Electronics World” and with the introduction of the Industry’s First SiC IPM, we take this a step further.  
Come Take a peek at how AgileSwitch’s technology can enable a quick turn implementation of next generation SiC technology at a fraction of the cost of a standard development cycle.

---

**Fair-Rite Products Corp.**  
ROOM 101B  
**Low loss 67 Material for High Frequency Power Applications**  
**Speaker:** Rachael Parker  
The development of high frequency switching power converters has driven the need for low loss magnetic materials.  
Due to the lack of material performance data, the design of power magnetic components for high frequency operation (2-20 MHz) has been difficult to achieve.
This presentation will review the intrinsic material characteristics (such as power loss density & usable flux density) in low permeability Ni Zn ferrites and will focus on Fair-Rite type 67 Material.

Magsoft Corporation
ROOM 102AB

Fast Computation of Inductance, Capacitance, Current Density in Conductor Arrangements

Speaker: Philippe Wendling

In power converters, the electromagnetic behavior of “metallic cabling” which interconnects semiconductor components is non-ideal: parasitic resistive, inductive and capacitive effects occur in such power devices causing respectively energy losses, switching overvoltages and EMC issues. In particular, interconnection parts (i.e. electrical conductors) generate electromagnetic stress and possibly system failures, since they add to the expected functional behavior of the converters.

This presentation will highlight the importance of 3D electromagnetic simulations which help designers in assessing these undesirable effects and improving system performances: InCa3D is a simulation software for low & medium frequencies dedicated to electrical interconnection modeling. Based on the innovative and very efficient PEEC (Partial Element Equivalent Circuit) method, it is well suited for analyzing the behavior (current distributions, radiated magnetic fields) of almost any kind of connections, additionally providing RLC extraction and generation of equivalent circuits.

Benefits of its use during the design of power devices will be illustrated by examples.

Monolithic Power Systems (MPS)
ROOM 103AB

High Performance PMSM Servo System Using MPS e.Motion Technology

Speaker: Ted Smith, Sr. Field Applications Engineer

The booming robotic industry is calling for high-performance servo systems. This presentation introduces a high-performance PMSM servo system using MPS proprietary eMotion technology, which combines an accurate magnetic position sensor, a 3-phase PMSM motor driver, and an FOC control algorithm. This presentation will discuss MPS’ magnetic sensor technology, the benefits of FOC control, and the GUI software.

ON Semiconductor
ROOM 201A

Energy Efficient Innovations

Speaker: Dhaval Dalal

ON Semiconductor will present the latest developments in power semiconductors and high density power applications. This will include new high efficiency products and design considerations.

Typhoon HIL, Inc.
ROOM 201B

Ultra-high Fidelity Hardware-in-the-loop Simulation for Power Electronics and Microgrid

Speaker: Alex Sedaghat, Applications Engineer, Typhoon HIL, Inc.

Significant and growing penetration of smart inverters represents both challenges and incipient opportunities to increase utility grid agility and stability. In addition to inherently fast dynamic control capabilities, these power electronics systems interact with increasingly diverse physical systems (such as renewable generation technologies) in complex ways. Indeed, grid is becoming a true cyberphysical system with a layered architecture comprising both power processing and control and communications. Classical tools that are used for simulation, testing, and system validation are very limited in both model fidelity and flexibility. In this talk we will present a new approach to power electronics and power system controls testing and validation based on ultra-high fidelity Hardware-in-the-Loop (HIL) real-time simulation.

Our HIL platform enables ultra-high-fidelity real-time simulation of power electronics converters, microgrids, distribution and transmission networks, with 1μs simulation time step. In addition, our HIL simulation is directly interfaced with real digital controllers, thereby eliminating modeling assumptions and thus providing the most realistic “flight simula-
tor" experiences for power electronics and power system simulations. We will discuss how Typhoon HIL is changing the testing and quality assurance processes in power electronics industry today and how we are helping, in our small way, utilities and system integrators revolutionize the grid.

Würth Elektronik eiSos
ROOM 203AB

8 Simple Design Tips – How to Design in a Power Inductor

**Speaker:** Raghu Narayanan

This practical session is developed to help you with your applications and designs to gain a better understanding, and make your daily work easier, when choosing the correct power inductor for your switch mode power supply. You’ll be able to differentiate between a low loss and a low cost magnetic component at the end of the session.

ZES ZIMMER Inc.
ROOM 202AB

New AC Power Measuring Advancements: Power Supplies, Drives, PWM, Harmonics, Waveforms and More

**Speaker:** Robert Emerson

ZES ZIMMER, the German company dedicated to precise power measurement, recently has introduced it’s 4th generation power analysis platform with major improvements for measuring high speed switching circuits: analyze high frequencies accurately while also conforming to Nyquist constraints for waveform transformations without alias. Special DualPath technology offers revolutionary A-D improvements and advanced filtering to recast the power analysis landscape. Cut engineering time in half, reduce cost and time to approval, while maintaining the world-class accuracy for which ZES ZIMMER has been known for more than 30 years. Come see advancements also in waveform processing and streaming, UI, versatility process control, QA and more.

Exhibitor Seminars – Session #4
Tuesday, March 22, 3:45 p.m. – 4:15 p.m.

**Fairchild Semiconductor**
ROOM 101A

1200V Smart Power Module for Low-Power Industrial Motor Drive Applications

**Speaker:** TS Kwon

1200V Smart Power Module for Low-Power Industrial Motor Drive Applications

As environmental issues continue to be a worldwide concern, energy saving opportunities become more essential in system development. The adoption of low-cost inverter drive technology in motor drive applications can help. To address these demands in low-power industrial applications, the 1200V SPM® smart power module has been developed. This paper will present in detail the design issues, performance investigation, and other important considerations about the new 1200V SPM 3 module family.

The 1200V SPM® 3 series of intelligent, integrated IGBT inverter modules are optimized for low-power industrial motor drive applications. The technology utilizes non-punch-through trench IGBTs with advanced STEALTH™ free-wheeling diodes, high-voltage ICs, and multi-function low-voltage IC. It also provides technical advantages such as improved thermal performance and reliability characteristics through the DBC substrate, as well as temperature monitoring with the TSU (temperature sensing unit) function of the LVIC.

**Intersil**
ROOM 101B

Digital Power Design Featuring Intersil's ChargeMode and Hybrid Digital Controllers

**Speaker:** Brandon Howell and Chance Dunlap

In this session, we’ll explore Intersil’s latest full digital ChargeMode™ controllers, along with a new family of hybrid digital controllers featuring Intersil’s proprietary R4™ control loop. Both controller families include a PMBus™ interface, which when coupled with Intersil’s PowerNavigator™ software...
design tool, provide a paradigm shift in ease of use for power supply design. Where traditional analog controllers have typically taken days to fully implement, Intersil’s new family of controllers utilize built-in intelligence, advanced control loops and PMBus flexibility to dramatically shrink design times. In this session, we’ll introduce Intersil’s latest digital POL controllers and demonstrate design examples using PowerNavigator.

**KEMET Electronics Corporation**
ROOM 102AB

**Capacitor Modeling and Simulation**
**Speaker:** Wilmer Companioni, Technical Marketing Engineer

Methods and techniques for simulating capacitor behavior

**Schunk Hoffmann Carbon Technology**
ROOM 103AB

**Aluminium Graphite: The Optimal Thermal Management Solution for High Reliability Applications**
**Speaker:** Dr. Sandra Reisinger

Schunk Hoffmann is a world leader in the automotive and rail sectors. By modifying our existing product portfolio, we have developed a set of metal matrix composites called Aluminium Graphite (ALG). They combine a low coefficient of thermal expansion (CTE) with a high thermal conductivity, making them ideal candidates for systems that are subject to active or passive thermal cycles. The use of ALG leads to a marked improvement in the reliability and life-time of components and systems. This presentation will point out the unique properties and characteristics of ALG, its fabrication process, and possible applications. These include heat sinks or heat spreaders, such as flanges for RF power amplifiers, base plates for power modules and housings. Schunk Hoffmann can deliver customized designs and plateings as the fabrication and machining of all parts is conducted in-house.

**Synopsys**
ROOM 201A

**Accurate Modeling and Simulation of Contemporary Power Converters using Saber**

**Speaker:** Alan Courtay

Saber is a multi-domain system modeling and simulation platform that meets the challenges of contemporary power electronics verification. Saber combines robust mixed signal simulation with advanced modeling capabilities including power semiconductor and magnetic tools, state-flow and logic for control, and HDL and table look-up methods for efficient behavioral modeling. New Saber fault modeling and simulation enables functional safety and reliability verification of power electronics systems. Optimization-based algorithms identify the design parameters leading to optimal or worst-case performances, such as power efficiency. This presentation will showcase these features on a commercially available quasi-resonant flyback power converter.

Saber is particularly advantageous to model the control of power converters. The key features of the IC controller modeled in this flyback example are the frequency foldback and the input voltage feedforward function. A SPICE approach would not be able to easily model the blanking time of the frequency foldback function, which is a nonlinear curve conveniently created with the Saber Table Look Up modeling tool. Similarly, the MAST and VHDL-AMS hardware description languages offer a straightforward way to implement the expression for voltage feedforward without rigging up a subcircuit required by many other simulators.

**Taiwan Semiconductor**
ROOM 201B

**Improved Efficiency in LED Lighting Control**

**Speaker:** Mark Christopher

AC/DC LED lighting control and product design face many challenges as global markets and government regulations drive requirements for efficiency, reliability, EMI performance, and cost reduction. In this session, Taiwan Semiconductor will present efficient solutions for LED power supply regulation, power
factor control, LED dimming, and LED load protection. Various high efficiency, low noise constant current and constant voltage switch mode power supply topologies and supporting component technologies will be presented.

**Wurth Electronics Midcom**
ROOM 203AB

**Custom Flyback Transformers Made Easy**

**Speaker:** Dean Huumala

Have you ever struggled to find a transformer for your flyback power supply design? Has the transformer threatened to delay or even kill your project? Attend this session to find out how easy it can be to find a custom solution for your design with samples available in stock. The STS (Smart Transformer Selector) makes finding a custom flyback transformer for your specific design as easy and efficient. In basic mode, you can find suitable parts in seconds. If you wish to be more specific you can use the expert mode to define more detailed parameters.

**Exhibitor Seminars – Session #5**
Wednesday, March 23, 10:30 a.m. – 11:00 a.m.

**Adaptive Power Systems**
ROOM 101A

**Advanced Power Conversion Test Equipment**

**Speaker:** Herman van Eijkelenburg

This session provides an overview of available solid state AC power sources for development and test applications. Highlights what to look for in product specifications and how to properly size the AC source for your requirements.

**Efficient Power Conversion Corporation (EPC)**
ROOM 101B

**GaN...Changing the Way We Live**

**Speaker:** Dr. Alex Lidow

GaN is taking power conversion to the next performance level. Gallium nitride transistors are rapidly being designed into many power conversion. This seminar will provide an update on the state-of-the-art in GaN transistor technology, highlighting the latest generation of EPC enhancement-mode GaN products and end-use applications including high power density DC-DC converters, high frequency envelope tracking, and wireless power transfer.

**Mersen**
ROOM 102AB

**Safety and Reliability for Power Electronics**

**Speaker:** Kian Sanjari

This session will demonstrate Mersen’s commitment to develop industry-leading technologies to improve efficiency and reliability of power electronics equipment.

The session will focus on three key topics of:

> Fast Acting Power Semi-Conductor Fuses providing most reliable fault current protection for SiC and WBG devices.

> Air and Liquid Cooling Systems and Thermal management solutions to provide thermal protection for semiconductor components while enabling heat to dissipate. Efficient cooling is key to long term reliability and performance of fast switching SiC components.

> Laminated bus bars providing most efficient connection between various components, thus limiting parasitic inductance, improving ease of assembly and integration while minimizing wiring errors and costs. Laminated bus bars provide clear advantages in SiC applications.

**Microchip Technology Inc.**
ROOM 103AB

**Brutes and Brains: When Adding Intelligence to Power Supplies Makes Sense**

**Speaker:** Janmichael Aberouette and Fionn Sheerin

Many power supplies can benefit from digital interfaces or digital controls – but the additional design challenges can be daunting. In many cases, a traditional analog control loop can be an elegant and
effective solution. Microchip will describe the system tradeoffs and go through application-specific use case examples including LED drive, point-of-load power conversion, PMBus implementation, and server power. For each application the difference between digital and analog control presents different benefits and challenges. In addition, this presentation will include a short demonstration of the MPLAB® Code Configurator development tool, which uses a graphical interface to setup closed loop power supplies and automatically generate digital power control firmware.

Pacific Sowa Corp C/O Epson Atmix Corp
ROOM 201A

Atmix's High Performing Magnetic Powder for Inductors

Speaker: Masahito Yoshizawa

Introduction of the soft magnetic powder produced by Epson Atmix Corporation.

Renesas Electronics America Inc.
ROOM 201B

Lithium Ion Battery Charging and Fuel Gauging for better functionality

Speaker: Peter H. Wilson

This seminar will discuss extending battery life utilizing Renesas’ lithium ion battery management solution for mobile platforms. We will show improved performance for faster charging time and minimized battery degradation for longer battery life. A typical lithium ion battery management solution includes fuel gauging plus charge control. Previously, the fuel gauging and charging functions have been separate ICs. Combining the fuel gauging and charging into one IC has advantages to better managing the fundamental task of fully recharging the batteries in 1S to 3S cell applications. We will explore the enhancements to the functionality and performance for mobile applications where space is premium.

SBE, Inc.
ROOM 202AB

High Performance Integrated DC Link Capacitor/Bus Structures and AC Filter Capacitors

Speaker: Dr. Michael Brubaker, VP Engineering and CTO

The session will begin with an overview of SBE’s unique ring capacitor technology and the advantages of this form factor in terms of losses and thermal resistance. The discussion will then shift to DC link capacitors and the use of SBE capacitor/bus technology to achieve very low inductance topologies. Some representative commercially available parts using “surface mount” capacitors will be discussed and compared to conventional technology. The remainder of the session will focus on AC filter capacitors and the unique advantages of the SBE ring form factor combined with patented pulse technology to eliminate catastrophic failure. The SBE AC filter offers novel mounting topologies and operates at lower hotspot temperatures than conventional cans. Examples of AC filter implementations using ring capacitors will be provided.

Exhibitor Seminars – Session #6

Wednesday, March 23, 11:15 a.m. – 11:45 a.m.

(PANEL) Eaton, Power Systems Design, Vicor, GaN Systems
ROOM 101A

Next Generation of Power Supplies

Speakers:
> Zhuo Min “Joe” Liu (Eaton)
> Alex Paultre (Power Systems Design)
> Larry Spaziani (GaN Systems)
> Paul Yeaman (Vicor)

Between evolving topologies, advanced materials, and improved core technologies, the way we manage and distribute power is under multiple pressures to change and evolve as well. This is especially dramatic in the area of power supplies themselves, the heart of every electronic system. These core enablers also change the devices they power, in areas such as form factor, thermal management,
operational lifetime and the increased focus on higher power densities. From wide-bandgap semiconductors to advanced power supply topologies to the latest magnetics, the panelists from Vicor, Eaton, and GAN Systems have a deep understanding of these pressures. The panel will explore some of the ways to address these issues and help predict the future of the power supply.

**ABC Trading Beijing Co. LTD.**
ROOM 101B

**BsT-x measuring system for soft magnetic materials under high excitation**

**Speaker:** Mr. JC Sun

Characterisation of magnetic properties under high excitation becomes increasingly important, the differentiation under high excitation i.e. high frequency ripple current biased with quasi DC complicates structured and systematic approach to target the specific target. the available data of core vendors can not afford nowadays demand of design engineers for accurate simulation and tailor made inductive component designs.

BST offering open & transparent automatic measuring system, effectively provides desired information of different soft magnetic materials over wide range of permeability level, especially the bst-pro highlights the loss characteristics with more dimension dependency (frequency, delta B, biased field strength and temperature), this helps material innovator to navigate development roadmap and enables design engineer for accurate and customized inductive component design.

**Amantys Power Electronics Ltd**
ROOM 102AB

**Intelligent Gate Drives – Delivering the Silicon Squeeze**

**Speaker:** Bryn Parry

Recent advances in power converter technology have demonstrated that intelligent gate drives can deliver a “smart converter”. There is the opportunity to apply advanced gate drive techniques to the devices to further increase their utilization – a “silicon squeeze” – and with this comes the need to monitor more closely their operation, e.g. through condition monitoring. This presentation considers not only the challenges of such an approach, but also the potential economic and technical benefits and opportunities for the end user and operator.

**Analog Devices Inc**
ROOM 103AB

**Ultra Low Noise LDOs Maximize Signal Chain Performance**

**Speaker:** Justin Zhao

This session introduces LDO fundamentals and important Noise/PSRR characteristics. It dives into the noise sensitivity on various signal-chain loads, and provides an understanding of how to choose right LDOs to achieve best performance for RF transceivers, Clocking ICs, PLL/VCOs and latest high-speed ADCs and DACs. A particular focus on where ultra-low noise LDOs to maximize overall RF signal-chain performance will be discussed.

**CUI Inc**
ROOM 201A

**Software Defined Power®**

**Speaker:** Mark Adams

Software defined power is the next evolution of power supply optimization. In general, the efforts have resided in the power supply, whether Point of Load, Bus Converter or a front end power supply. CUI will discuss the next evolution of software defined power by adopting Virtual Power Systems’ Integrated Control of Energy (ICE®) in a datacenter racking system.

CUI will review the ICE Block platform and the advantages that ICE has in realizing a 15-25% savings in power, significant capital expenditure reduction and better optimization of the power footprint in a datacenter environment.
**Hitachi Power Semiconductor Device, Ltd.**

**ROOM 201B**

**New Packaging Generation.**

**The next standard for High Voltage (1.2kV-6.5kV) IGBTs**

**Speaker:** Katsuaki Saito

Hitachi has introduced nHPD2 (next High Power Density Dual) as the next generation package standard for high voltage power modules. It has the benefits of low inductance, high power density and scalability, and also includes a current sensor and temperature sensor. This package not only targets the next generation of Si chip technology, but also brings significant advantages for use with SiC technology. In this seminar, we would like to introduce the state-of-the-art for Si and SiC in the nHPD2 form factor.

In addition to nHPD2, we have introduced the latest generation of 4.5kV IGBT for medium voltage drive applications, covering a wide frequency range. By using advanced trench HiGT (High conductivity IGBT), rated current was successfully increased by 25% realizing 1500A within the same footprint.

---

**Software Cradle Co., Ltd.**

**ROOM 202AB**

**Cooling Fan Design System with Automated Performance Prediction**

**Speaker:** Yuya Ando

A cooling fan is widely used as a cooling device in electronics. In CFD, modeling methods of cooling fans can be categorized into two methods. One method is used to predict detailed flow by modeling the shape of the blade and the frame in detail. The other method is used to predict the flow rate as a simplified model defining the relation between the pressure and the flow rate (P-Q Curve). The former method is best suited for predicting performance of the fan itself while the latter method is suitable for an electronic system level simulation. While the latter method significantly simplifies the procedures of the electronic thermal simulation, it has still been challenging to utilize CFD for axial fans due to the complexity of modeling a fan in 3D, as well as the knowledge required to perform detailed fan simulations in CFD.

Therefore, we developed an innovative tool “SmartBlades”, which allows a fan designer to quickly and easily design a fan in 3D and to predict its performance. SmartBlades is equipped with a sophisticated GUI which enables a user to intuitively design a blade profile by specifying parameters or dragging graph lines to define rake angles, skew angels, thickness, and other parameters of a blade. In this way, 3D geometry of a fan can be quickly and easily created even without any CAD experience. Furthermore, SmartBlades is linked to Cradle SC/Tetra CFD software and automatically performs the CFD simulation to report a fan performance curve including P-Q curve, power curve, and efficiency curve. As a result, the fan designer can quickly design an optimized axial fan to meet various criteria using SmartBlades and can significantly reduce the product lead time.
<table>
<thead>
<tr>
<th>Exhibitor</th>
<th>Booth #</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS Components</td>
<td>1860</td>
</tr>
<tr>
<td>Aavid Thermalloy</td>
<td>1839</td>
</tr>
<tr>
<td>ABC Trading Beijing Co. LTD.</td>
<td>2163</td>
</tr>
<tr>
<td>ACME Electronics Corporation</td>
<td>1552</td>
</tr>
<tr>
<td>Acopian Power Supplies</td>
<td>2142</td>
</tr>
<tr>
<td>Adaptive Power Systems</td>
<td>1457</td>
</tr>
<tr>
<td>Adelser</td>
<td>2042</td>
</tr>
<tr>
<td>Advance Test Equipment Rentals</td>
<td>1142</td>
</tr>
<tr>
<td>Agile Magnetics</td>
<td>1556</td>
</tr>
<tr>
<td>AgileSwitch, LLC</td>
<td>1756</td>
</tr>
<tr>
<td>Alcon Electronics Private Limited</td>
<td>2060</td>
</tr>
<tr>
<td>Allstar Magnetics</td>
<td>1553</td>
</tr>
<tr>
<td>Alpha &amp; Omega Semiconductor</td>
<td>1835</td>
</tr>
<tr>
<td>Alpha Assembly Solutions</td>
<td>1561</td>
</tr>
<tr>
<td>Alps Electric Co., Ltd.</td>
<td>1947</td>
</tr>
<tr>
<td>Altera® now part of Intel</td>
<td>2253</td>
</tr>
<tr>
<td>Ametherm, Inc.</td>
<td>1833</td>
</tr>
<tr>
<td>Amogreentech</td>
<td>1255</td>
</tr>
<tr>
<td>Amphenol Interconnect Products</td>
<td>1232</td>
</tr>
<tr>
<td>Analog Devices</td>
<td>1160</td>
</tr>
<tr>
<td>Anpec Electronics</td>
<td>1752</td>
</tr>
<tr>
<td>ANSYS, Inc.</td>
<td>1146</td>
</tr>
<tr>
<td>APEC Exhibit Sales</td>
<td>961</td>
</tr>
<tr>
<td>Apex Microtechnology</td>
<td>1261</td>
</tr>
<tr>
<td>Athena Energy Corp.</td>
<td>2162</td>
</tr>
<tr>
<td>Auxel FTG</td>
<td>1253</td>
</tr>
<tr>
<td>AVX</td>
<td>1536</td>
</tr>
<tr>
<td>Baknor Thermal &amp; Packaging</td>
<td>1260</td>
</tr>
<tr>
<td>BH Electronics, Inc.</td>
<td>1158</td>
</tr>
<tr>
<td>Bicron Electronics Co.</td>
<td>1660</td>
</tr>
<tr>
<td>Bomatec International Corp.</td>
<td>1955</td>
</tr>
<tr>
<td>CalRamic Technologies, LLC</td>
<td>1246</td>
</tr>
<tr>
<td>Caton Connector Corp</td>
<td>1545</td>
</tr>
<tr>
<td>Central Semiconductor Corp.</td>
<td>1661</td>
</tr>
<tr>
<td>Chroma Systems Solutions, Inc.</td>
<td>1821</td>
</tr>
<tr>
<td>CogniPower</td>
<td>1924</td>
</tr>
<tr>
<td>Coil Winding Specialist, Inc.</td>
<td>1653</td>
</tr>
<tr>
<td>Coilcraft</td>
<td>1618</td>
</tr>
<tr>
<td>Component Distributors, Inc. (CDI)</td>
<td>1157</td>
</tr>
<tr>
<td>Cornell Dubilier Electronics</td>
<td>1747</td>
</tr>
<tr>
<td>COSMO FERRITES LIMITED</td>
<td>1560</td>
</tr>
<tr>
<td>CPS Technologies</td>
<td>1456</td>
</tr>
<tr>
<td>Cramer Coil &amp; Transformer Co. Inc.</td>
<td>1132</td>
</tr>
<tr>
<td>CUI Inc.</td>
<td>1337</td>
</tr>
<tr>
<td>Exhibitor</td>
<td>Booth #</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Current Ways, Inc.</td>
<td>1137</td>
</tr>
<tr>
<td>Daco Semiconductor Co., Ltd.</td>
<td>1744</td>
</tr>
<tr>
<td>Danfoss Silicon Power Gmbh</td>
<td>1236</td>
</tr>
<tr>
<td>Datatronics</td>
<td>1333</td>
</tr>
<tr>
<td>Dau Thermal Solutions North America</td>
<td>1734</td>
</tr>
<tr>
<td>Dean Technology, Inc.</td>
<td>1738</td>
</tr>
<tr>
<td>DEWETRON Inc.</td>
<td>1345</td>
</tr>
<tr>
<td>Dexter Magnetic Technologies</td>
<td>2242</td>
</tr>
<tr>
<td>Dialog Semiconductor</td>
<td>1346</td>
</tr>
<tr>
<td>Digi-Key Electronics</td>
<td>1663</td>
</tr>
<tr>
<td>Dino-Lite Scopes (BigC)</td>
<td>1356</td>
</tr>
<tr>
<td>Ducati Energia</td>
<td>1963</td>
</tr>
<tr>
<td>Eaton.</td>
<td>2147</td>
</tr>
<tr>
<td>EBG Resitors</td>
<td>1736</td>
</tr>
<tr>
<td>ECI</td>
<td>1532</td>
</tr>
<tr>
<td>Efficient Power Conversion Corporation (EPC)</td>
<td>1737</td>
</tr>
<tr>
<td>Egston System Electronics Eggenburg</td>
<td>1347</td>
</tr>
<tr>
<td>Electro Technik</td>
<td>2154</td>
</tr>
<tr>
<td>Electrocube, Inc.</td>
<td>1245</td>
</tr>
<tr>
<td>Electronic Concepts, Inc.</td>
<td>1317</td>
</tr>
<tr>
<td>Electronic Systems Packaging</td>
<td>2056</td>
</tr>
<tr>
<td>Elna Magnetics</td>
<td>1742</td>
</tr>
<tr>
<td>Exar Corporation</td>
<td>1637</td>
</tr>
<tr>
<td>Exxelia USA</td>
<td>1644</td>
</tr>
<tr>
<td>Fairchild Semiconductor</td>
<td>1717</td>
</tr>
<tr>
<td>Fair-Rite Products Corp.</td>
<td>1842</td>
</tr>
<tr>
<td>Faratronic Co., Ltd.</td>
<td>1021</td>
</tr>
<tr>
<td>Ferroxcube USA, Inc.</td>
<td>1524</td>
</tr>
<tr>
<td>FTCP</td>
<td>1861</td>
</tr>
<tr>
<td>Fuji Electric Corp. of America</td>
<td>2132</td>
</tr>
<tr>
<td>GAN Systems</td>
<td>2125</td>
</tr>
<tr>
<td>Global Choice International LLC</td>
<td>1555</td>
</tr>
<tr>
<td>Global Power Technologies Group</td>
<td>1547</td>
</tr>
<tr>
<td>GLOBALFOUNDRIES</td>
<td>1934</td>
</tr>
<tr>
<td>GMW Associates</td>
<td>1342</td>
</tr>
<tr>
<td>Good-Ark Semiconductor</td>
<td>1527</td>
</tr>
<tr>
<td>Gowanda Electronics</td>
<td>1257</td>
</tr>
<tr>
<td>GRAPES - NSF I/UCRC</td>
<td>2043</td>
</tr>
<tr>
<td>H &amp; H Magnetics</td>
<td>2155</td>
</tr>
<tr>
<td>HEFEI ECRIEE-TAMURA Electric Co., Ltd.</td>
<td>1360</td>
</tr>
<tr>
<td>Hengdian Group DMEGC Magnetics Co., LTD.</td>
<td>1534</td>
</tr>
<tr>
<td>Heraeus Electronic Materials Division</td>
<td>1453</td>
</tr>
<tr>
<td>Hesse Mechatronics, Inc.</td>
<td>2033</td>
</tr>
<tr>
<td>Himag Planar Magnetics, Ltd.</td>
<td>2026</td>
</tr>
<tr>
<td>Hitachi Metals</td>
<td>1957</td>
</tr>
<tr>
<td>Hitachi Semiconductors – AmePower</td>
<td>1855</td>
</tr>
<tr>
<td>Holy Stone International</td>
<td>1654</td>
</tr>
<tr>
<td>HVR Advanced Power Components, Inc.</td>
<td>1147</td>
</tr>
<tr>
<td>IAS (Industrial Applications Society)</td>
<td>1024</td>
</tr>
<tr>
<td>ICE Components, Inc.</td>
<td>2038</td>
</tr>
<tr>
<td>Illinois Capacitor Inc.</td>
<td>1745</td>
</tr>
<tr>
<td>Imperix</td>
<td>1525</td>
</tr>
<tr>
<td>Indium Corporation</td>
<td>2045</td>
</tr>
<tr>
<td>Infineon Technologies Americas Corp</td>
<td>1917</td>
</tr>
<tr>
<td>Infolytica Corporation</td>
<td>1943</td>
</tr>
<tr>
<td>Innovation Plus Power Systems Inc.</td>
<td>2062</td>
</tr>
<tr>
<td>INSTEK America</td>
<td>2063</td>
</tr>
<tr>
<td>Intepro Systems</td>
<td>2152</td>
</tr>
<tr>
<td>Inter Outstanding Electronics, Inc.</td>
<td>1662</td>
</tr>
<tr>
<td>Intersil Corporation</td>
<td>2117</td>
</tr>
<tr>
<td>Intertape Polymer Group</td>
<td>1017</td>
</tr>
<tr>
<td>Isotape Corporation, Subsidiary of Isabellenhutte.</td>
<td>2047</td>
</tr>
<tr>
<td>ITELCOND SRL</td>
<td>2160</td>
</tr>
<tr>
<td>ITG Electronics</td>
<td>1960</td>
</tr>
<tr>
<td>Iwatsu Test Instruments</td>
<td>2260</td>
</tr>
<tr>
<td>IXYS (Westcode)</td>
<td>1961</td>
</tr>
<tr>
<td>JARO Thermal</td>
<td>1242</td>
</tr>
<tr>
<td>JFE Steel Corporation</td>
<td>1025</td>
</tr>
<tr>
<td>Jianghai America Inc.</td>
<td>1139</td>
</tr>
<tr>
<td>Johanson Dielectrics, Inc.</td>
<td>1353</td>
</tr>
<tr>
<td>John Deere Electronic Solutions</td>
<td>2236</td>
</tr>
<tr>
<td>Kanthal Globar, Sandvik Heating Technology USA</td>
<td>2161</td>
</tr>
<tr>
<td>Kaschke Components GMBH</td>
<td>1642</td>
</tr>
<tr>
<td>KDM Zhejiang NBTM Keda</td>
<td>1939</td>
</tr>
<tr>
<td>Magnetoenergy Co. Ltd.</td>
<td>1753</td>
</tr>
<tr>
<td>Kemet</td>
<td>1753</td>
</tr>
<tr>
<td>Kendell srl</td>
<td>2053</td>
</tr>
<tr>
<td>KEPCO, Inc.</td>
<td>1858</td>
</tr>
<tr>
<td>Keysight Technologies</td>
<td>1252</td>
</tr>
<tr>
<td>KITAGAWA INDUSTRIES America, Inc.</td>
<td>1945</td>
</tr>
<tr>
<td>Knowles Capacitors</td>
<td>1461</td>
</tr>
<tr>
<td>Lee Yuen Electrical Mfy Limited</td>
<td>2252</td>
</tr>
<tr>
<td>LEM USA, Inc.</td>
<td>1352</td>
</tr>
<tr>
<td>Lenco Electronics, Inc.</td>
<td>1761</td>
</tr>
<tr>
<td>Linear Technology Corporation</td>
<td>1233</td>
</tr>
<tr>
<td>Lodestone Pacific</td>
<td>1432</td>
</tr>
<tr>
<td>LTEC Corporation</td>
<td>1519</td>
</tr>
<tr>
<td>Mag. Layers USA</td>
<td>1762</td>
</tr>
<tr>
<td>MAGDEV Ltd.</td>
<td>2061</td>
</tr>
<tr>
<td>MagnaChip Semiconductor</td>
<td>1144</td>
</tr>
<tr>
<td>Exhibitor</td>
<td>Booth #</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Magna-Power Electronics</td>
<td>1542</td>
</tr>
<tr>
<td>Magnetec (Guangzhou) Magnetic Device Co. Ltd.</td>
<td>1563</td>
</tr>
<tr>
<td>Magnetic Metals Corp</td>
<td>1853</td>
</tr>
<tr>
<td>Magnetics</td>
<td>1433</td>
</tr>
<tr>
<td>Magsoft Corporation</td>
<td>1443</td>
</tr>
<tr>
<td>Magtech &amp; Power Conversion Inc.</td>
<td>1562</td>
</tr>
<tr>
<td>Malico Inc.</td>
<td>1362</td>
</tr>
<tr>
<td>Marathon Power</td>
<td>2057</td>
</tr>
<tr>
<td>MaxQ Technology, LLC</td>
<td>1454</td>
</tr>
<tr>
<td>Mentor Graphics Corporation</td>
<td>2052</td>
</tr>
<tr>
<td>Mersen</td>
<td>1725</td>
</tr>
<tr>
<td>Mesago PCIM GmbH</td>
<td>1445</td>
</tr>
<tr>
<td>Methode Power Solutions Group</td>
<td>1116</td>
</tr>
<tr>
<td>MH&amp;W</td>
<td>1932</td>
</tr>
<tr>
<td>Microchip Technology Inc.</td>
<td>1127</td>
</tr>
<tr>
<td>Micrometals, Inc.</td>
<td>1526</td>
</tr>
<tr>
<td>Milplex Circuit (Canada) Inc.</td>
<td>2254</td>
</tr>
<tr>
<td>MK Magnetics Inc.</td>
<td>1539</td>
</tr>
<tr>
<td>Monolithic Semiconductor Inc.</td>
<td>1655</td>
</tr>
<tr>
<td>Monolithic Power Systems, Inc.</td>
<td>2025</td>
</tr>
<tr>
<td>MORNSUN America LLC</td>
<td>1952</td>
</tr>
<tr>
<td>Mouser Electronics, Inc.</td>
<td>2245</td>
</tr>
<tr>
<td>MPS Industries, Inc.</td>
<td>1122</td>
</tr>
<tr>
<td>MS Power Semiconductor Co., Ltd.</td>
<td>2138</td>
</tr>
<tr>
<td>MTL Distribution</td>
<td>1838</td>
</tr>
<tr>
<td>National Magnetics Group/Ceramic Magnetics, Inc.</td>
<td>1632</td>
</tr>
<tr>
<td>NEC TOKIN America Inc.</td>
<td>2243</td>
</tr>
<tr>
<td>New England Wire Technologies</td>
<td>1447</td>
</tr>
<tr>
<td>NH Research, Inc.</td>
<td>1832</td>
</tr>
<tr>
<td>Nichicon (America) Corporation</td>
<td>1145</td>
</tr>
<tr>
<td>NORWE Inc.</td>
<td>1543</td>
</tr>
<tr>
<td>NXP Semiconductors</td>
<td>1053</td>
</tr>
<tr>
<td>Ohmite MFG</td>
<td>2143</td>
</tr>
<tr>
<td>ON Semiconductor</td>
<td>1625</td>
</tr>
<tr>
<td>Opal-RT Technologies</td>
<td>1446</td>
</tr>
<tr>
<td>Oztek Corp.</td>
<td>1652</td>
</tr>
<tr>
<td>Pacific Sowa Corporation; C/O Epson Atmix Corporat.</td>
<td>1535</td>
</tr>
<tr>
<td>Paktrol</td>
<td>1624</td>
</tr>
<tr>
<td>Panasonic</td>
<td>1918</td>
</tr>
<tr>
<td>Parker Overseas</td>
<td>1962</td>
</tr>
<tr>
<td>Payton America</td>
<td>1927</td>
</tr>
<tr>
<td>Pearson Electronics, Inc.</td>
<td>1326</td>
</tr>
<tr>
<td>PELS (Power Electronic Society)</td>
<td>1028</td>
</tr>
<tr>
<td>PINK GmbH Thermosysteme</td>
<td>1463</td>
</tr>
<tr>
<td>Plexim</td>
<td>1544</td>
</tr>
<tr>
<td>PMK Mess- und Kommunikationstechnik GmbH</td>
<td>2263</td>
</tr>
<tr>
<td>POCO Holding Co., Ltd.</td>
<td>1043</td>
</tr>
<tr>
<td>Power Electronic Measurements Ltd.</td>
<td>1344</td>
</tr>
<tr>
<td>Power Integrations</td>
<td>1239</td>
</tr>
<tr>
<td>Power Solutions Inc.</td>
<td>1759</td>
</tr>
<tr>
<td>PowerAmerica</td>
<td>1626</td>
</tr>
<tr>
<td>PowerELab Ltd.</td>
<td>2136</td>
</tr>
<tr>
<td>Powerex, Inc.</td>
<td>1416</td>
</tr>
<tr>
<td>Powersim, Inc.</td>
<td>1047</td>
</tr>
<tr>
<td>PWRMOD DC to DC Converters</td>
<td>1557</td>
</tr>
<tr>
<td>Precision Inc.</td>
<td>1743</td>
</tr>
<tr>
<td>Prodrive Technologies</td>
<td>1452</td>
</tr>
<tr>
<td>PSMA (Power Source Mfg. Association)</td>
<td>1026</td>
</tr>
<tr>
<td>Qualtek</td>
<td>1954</td>
</tr>
<tr>
<td>Renco Electronics Inc.</td>
<td>1634</td>
</tr>
<tr>
<td>Renesas Electronics</td>
<td>1746</td>
</tr>
<tr>
<td>Richardson Electronics, Ltd.</td>
<td>1647</td>
</tr>
<tr>
<td>Richardson RFPD</td>
<td>2227</td>
</tr>
<tr>
<td>Ridley Engineering, Inc.</td>
<td>1817</td>
</tr>
<tr>
<td>Rogers Corporation</td>
<td>1437</td>
</tr>
<tr>
<td>ROHM Semiconductor</td>
<td>1843</td>
</tr>
<tr>
<td>Rubadue Wire Company, Inc.</td>
<td>1643</td>
</tr>
<tr>
<td>Rubycon Corporation</td>
<td>2256</td>
</tr>
<tr>
<td>RWP Electronic Sales</td>
<td>2055</td>
</tr>
<tr>
<td>Samwha USA Inc.</td>
<td>1355</td>
</tr>
<tr>
<td>SanRex Corporation</td>
<td>2233</td>
</tr>
<tr>
<td>SBE, Inc.</td>
<td>1754</td>
</tr>
<tr>
<td>Schaffner Trenco LLC</td>
<td>2146</td>
</tr>
<tr>
<td>Schunk Hoffmann Carbon Technology.</td>
<td>1059</td>
</tr>
<tr>
<td>Schurter, Inc.</td>
<td>2157</td>
</tr>
<tr>
<td>Scientific Test, Inc.</td>
<td>2261</td>
</tr>
<tr>
<td>Semikron, Inc.</td>
<td>1124</td>
</tr>
<tr>
<td>Semtech</td>
<td>2137</td>
</tr>
<tr>
<td>ShengYe Electrical Co. Ltd.</td>
<td>1143</td>
</tr>
<tr>
<td>Shenzhen Zeasset Electronic Technology Co., Ltd.</td>
<td>1033</td>
</tr>
<tr>
<td>Sidelinesoft, LLC</td>
<td>1163</td>
</tr>
<tr>
<td>Silicon Frontline Technology, Inc.</td>
<td>1063</td>
</tr>
<tr>
<td>Simplis Technologies</td>
<td>1733</td>
</tr>
<tr>
<td>SMC Diode Solutions</td>
<td>1019</td>
</tr>
<tr>
<td>Software Cradle Co., Ltd.</td>
<td>2257</td>
</tr>
<tr>
<td>Solantro Semiconductor Corporation.</td>
<td>1262</td>
</tr>
<tr>
<td>Sonoscan, Inc.</td>
<td>1435</td>
</tr>
<tr>
<td>SP CONTROL TECHNOLOGIES</td>
<td>1462</td>
</tr>
<tr>
<td>Standex-Meder Electronics</td>
<td>1763</td>
</tr>
<tr>
<td>Stapla Ultrasonics Corp.</td>
<td>1263</td>
</tr>
<tr>
<td>Stellar Industries Corp.</td>
<td>1656</td>
</tr>
<tr>
<td>STMicroelectronics, Inc.</td>
<td>1417</td>
</tr>
</tbody>
</table>
Storm Power Components .......................... 1442
Sumida America Components Inc. ................. 2232
Synopsys, Inc. ...................................... 1161
Syrma Technology .................................. 1354
Taiwan Semiconductor Inc. .......................... 1657
Taiyo Kogyo Co., LTD ............................... 1135
Tamura Corporation of America .................... 1444
TDK Corporation .................................... 1323
Tektronix Inc. ....................................... 1061
Teledyne LeCroy ..................................... 2037
Texas Instruments .................................... 1617
The Allpower Source (Div. of Technology Dynamics) .. 1153
The Bergquist Company (a Henkel Company) .......... 1760
Thermik Corporation ................................ 2046
TowerJazz ............................................. 1521
Transim Technology .................................. 1517
Transphorm .......................................... 2133
Triad Magnetics ..................................... 1645
TSC Ferrite International ............................. 1836
TT electronics ........................................ 1936
Typhoon HIL, Inc. .................................... 2153
United Chemi-Con ................................... 1825
United Silicon Carbide, Inc. ......................... 1844
University of Texas – Dallas ......................... 1243
VAC Sales USA LLC ................................ 1425
Venable Instruments, Inc. .............................. 1732
Versatile Power ....................................... 1863
Viking Tech America Corporation ................... 1953
Vincotech GmbH ....................................... 1361
Vishay Intertechnology, Inc. .......................... 2017
Voltage Multipliers, Inc. .............................. 1533
Wakefield-Vette Thermal Solutions ................. 1133
West Coast Magnetics ................................ 1537
Wolfspeed, A Cree Company ......................... 1633
Wolverine Tube Inc. – MicroCool Division ............ 1460
Wurth Electronics Midcom Inc. .................... 1933
Wurth Elektronik Wireless Charging Cafe ............ 001
X-FAB Semiconductor Foundries ................... 1926
XITRON Technologies ................................ 1227
Yokogawa Corporation of America ................. 1343
Yole Developpement .................................. 1554
ZES ZIMMER Inc. ..................................... 1739
Zhuzhou CRRC Times Electric Co., Ltd. ............ 1037
Zipalog .................................................. 1045

5S Components .................................... 1860
630 Fifth Avenue
East McKeesport, PA 15035 USA
www.5SComponents.com
5S Components, Inc are authorized North American distributor for ABB Semiconductor, ABB Current/Voltage Sensors, Astrol Electronics, components and assemblies, Danotherm Resistors, Icar Power Film Capacitors & Power Integration, IGBT gate drivers.

Aavid Thermalloy ................................. 1839
1 Aavid Circle
Laconia, NH 03246 USA
www.aavid.com


ABC Trading Beijing Co. LTD. ............. 2163
B-1-101, Hong Xing Hong Buissness Building, Beiqiji
Beijing, 102209 China
www.abcstone.com.cn
www.powerlosstester.de

we are specialist for measuring technique of soft magnetic materials under high excitation (sinusoidal and pulse), for non linear behavior of hysteresis loop for material development, inductive component design and tailor made simulation.

ACME Electronics Corporation ........ 1552
No. 2, Fuqlan Zast Road
Zengjiang Street, Zast Square
Guangzhou-Zengcheng, China

ACME Electronics Corporation is a ISO/TS16949 and ISO14001 certified manufacturer of soft ferrite products and sapphire ingots for use in the computer, telecommunications, automotive, lighting, LCD TV, LED and other related electronics industries. It is a subsidiary of USI Corporation, a public listed company in Taiwan.
Acopian Power Supplies ............ Booth 2142
P.O. Box 638
Easton, PA 18044 USA
www.ACOPiAN.com

Acopian manufactures millions of reliable AC-DC and DC-DC power supplies that are shipped within 3 days. Products include Programmable, Switching, Linear, Rack Mount, Wall Mount, DIN Rail Mount, Redundant Systems, High Voltage & Custom Power Supplies. We offer every voltage from 1 volt to 30kV & up to 2400 watts. MADE IN THE USA

Adaptive Power Systems ............ Booth 1457
17711 Mitchel North
Irvine, CA 92614 USA
www.adaptivepower.com

Adaptive Power Systems (APS) designs and manufactures a complete and extensive line of AC and DC power equipment to meet world-wide applications. Products include frequency changers, programmable AC and DC power supplies and electronic loads. Markets served include production test, household appliance and consumer product manufacturing, defense, commercial aviation, telecommunications, industrial manufacturing and compliance test agencies.

Adelser ......................... Booth 2042
2200 Gateway Centers Boulevard
Suite 213
Morrisville, NC 27560 USA
www.adelser.com

Adelser is a power assembly manufacturer. With more than 40 years experience, our company designs and provides high quality assemblies, from a few kw’s to 100’s of kw’s, using IGBT’s, thyristors, diodes... We provide standard assemblies from our database, or we can provide a solution, with your specific requests.

Advanced Test Equipment Rentals ........ Booth 1142
10401 Roselle Street
San Diego, CA 92121 USA
www.atecorp.com

Agile Magnetics .................. Booth 1556
24 Chenell Drive
Concord, NH 03301 USA
www.agilemagco.com

Agile is an AS9100 certified advanced manufacturer of a very broad array of magnetics for the power industry. We are steeped in magnetics knowledge and world class manufacturing practices. Winding capabilities include Universal, Litz, sheet copper, and standard magnet wire winds. We offer advanced potting impregnation for isolation/thermal transfer.

AgileSwitch, LLC ................. Booth 1756
2002 Ludlow Street, #4
Philadelphia, PA 19103 USA
www.AgileSwitch.com

On March 21...The Rules Change. New AgileSwitch SiC IPM Stack Electronics give renewable energy sources a boost, with increased speed, real-time temperature control and higher power capacity than ever before. It’s a game-changer.

Alcon Electronics Private Limited ........ Booth 2060
34-B, MlDC Industrial Estate
Satpur, Nashik 422 007 India
www.alconelectronics.com

Custom and standard high performance capacitors. Represented by ICT Power in North America featuring direct mount and axial leaded IGBT snubber capacitors and high frequency power film capacitors for induction heating, plasma generators, etc.

Allstar Magnetics .................. Booth 1553
6205 NE 63rd Street
Vancouver, WA 98661 USA
allstarmagnetics.com

Allstar Magnetics, LLC is a value added magnetic and inductive components distributor. We offer a full line of ferrite cores and hardware, permanent magnet materials, and wound assemblies. Value added services include custom gapping, CNC machining, grinding, coating, custom winding, and testing.

Alpha & Omega Semiconductor .... Booth 1835
475 Oakmead Parkway
Sunnyvale, CA 94085 USA
www.aosmd.com

Alpha and Omega Semiconductor Limited (AOS) is a designer, developer and global supplier of a broad range of power semiconductors, including a wide portfolio of Power MOSFET, IGBT and Power IC products. Target applications include portable computers, tablets, smart phones, flat panel TVs, LED lighting, and consumer and industrial motor controls.

Alpha Assembly Solutions ........ Booth 1561
300 Atrium Drive
Somerset, NJ 08873 USA
www.AlphaAssembly.com

Alpha Assembly Solutions, a MacDermid Performance Solutions Company, is the global leader in the development of innovative materials used for electronics assembly, power electronics, die attach, semiconductor packaging, automotive and others.
Alps Electric Co. Ltd.       Booth 1947
3151 Jay Street
S-100
Santa Clara, CA 95054 USA
www.alps.com
We are a leading global manufacturer of electronic devices, supplying some 40,000 different components to around 2,000 companies that produce automobiles, home appliances, mobile devices and industrial machinery all over the world. Our products may not always be directly visible to their users, but they do play vital roles in many items used by people everyday. Read on to learn more about Alps Electric and the electronic devices we make.

Altera® now part of Intel       Booth 2253
101 Innovation Drive
San Jose, CA 95134 USA
www.altera.com
Altera® now part of Intel, is the pioneer of programmable logic solutions, enabling designers of electronic systems to rapidly and cost effectively innovate, differentiate, and win in their markets.

Ametherm, Inc.       Booth 1833
961 Fairview Drive
Carson City, NV 89701 USA
www.ametherm.com
Since 1994 Ametherm, Inc has been dedicated to providing reliable inrush current limiters and sensing thermistors for a variety of applications in the Power, Audio and Medical Equipment markets.

Amogreentech       Booth 1255
600-4, Wonsan-Ri, Hasung-Myun
Gimpo-Si, Gyeonggi-Do 415-887 South Korea
www.amoscore.com
Amogreentech is the leading manufacture of Fe-Amorphous & Nanocrystalline materials for magnetic inductive parts as Powder core, Cut-core & noise protection core. We’ve supplied to global power conversion & automotive tier 1 companies.

Amphenol Interconnect Products       Booth 1232
20 Valley Street
Endicott, NY 13760 USA
www.Amphenol-AIPC.com
Amphenol Interconnect Products is a total solution provider for Power Products. We bring a high level of expertise in design and manufacturing to the market place. With a global footprint Amphenol provides supply localization along with increased flexibilty. Products include Bus Bars, Power Cables and Power Interconnects.

Analog Devices      Booth 1160
3 Technology Way
Norwood, MA 02062 USA
www.analog.com
ADI is a leading supplier of high performance signal processing products. ADI’s power management IC’s enable customers to push the boundaries of technology in communications, Instrumentation, industrial automation and more. www.analog.com/power

Anpec Electronics      Booth 1752
9890 Irvine Center Drive
Irvine, CA 92618 USA
www.anpec.com.tw
ANPEC Electronics is the leader in high-performance analog and mixed signal IC solutions. ANPEC offers a full line of power management products such as Switching Regulators, Motor Drivers as well as cost effective PMICs.

ANSYS, Inc.      Booth 1146
2600 Ansys Drive
Canonsburg, PA 15137
www.ansys.com
ANSYS simulation software enables engineers to accurately and quickly design power electronic and electrically controlled systems.

APEC 2017 Exhibit Sales      Booth 961
2025 M Street NW
Suite 800
Washington, DC 20036 USA
www.apec-conf.org
Please stop by the APEC 2016 Show Management Booth during your designated time slot to sign up for the 2017 show in Tampa, FL!

Apex Microtechnology      Booth 1261
5980 N Shannon Road
Tuscon, AZ 85741 USA
www.apexanalog.com
Apex Microtechnology offers power operational amplifiers, PWM amplifiers and voltage references for applications requiring precision control of current, voltage and speed in the industrial, defense/aerospace, medical, and semiconductor markets.

Athena Energy Corp.      Booth 2162
3100 Airport Way S.
Seattle, WA 98134 USA
www.athenaenergycorp.com
Rogowski Coils for High Frequency Current Measurements. A wide range of high performance current sensors for high temperature, easy service, and replacement probes.
Auxel FTG ........................ Booth 1253
33 Hartford Avenue
Suite 201, PO Box 143
Granby, CT 06035 USA
www.auxelftg.com

AuxelFTG is a global manufacturer of interconnection and power distribution products for applications in the fields of Low Voltage Electricity, Power Electronics and Electronics. With over 50 years’ experience, AuxelFTG offers a wide range of innovative, reliable, safe and cost-optimized solutions. Our product range includes custom designed Laminated Bus Bars.

AVX ................................. Booth 1536
1 AVX Boulevard
Fountain Inn, SC 29644 USA
www.avx.com

AVX is the leading manufacturer of passive and interconnect solutions for all power applications, ranging from switchmode capacitors to RF devices. Technologies include ceramic, high voltage, tantalum, niobium and film capacitors; medium and high power DC capacitors and pulse supercapacitors, with circuit protection devices including MLVs, fuses and EMI filters.

Baknor Thermal & Packaging ........................ Booth 1260
5225 Orbitor Drive
Suite 2
Mississauga, ON L4W 4Y8 Canada
www.baknor.com

Heat Sinks, Cold Plates, Bus Bars. Includes cooling power electronics with various tradeoffs & factors such as costs, packaging, manufacturability, efficiency and reliability. Friction stir welding, brazing, tube cold plates and extrusion welding.

BH Electronics, Inc. .......................... Booth 1158
12219 Wood Lake Drive
Burnsville, MN 55337 USA

BH Electronics is a world leader for the design / manufacturing of extremely reliable custom/standard discrete magnetic components. Areas of specialties include: high power, high frequency and high temperature applications. With manufacturing facilities in USA, Mexico and China, BHE is positioned to deliver high quality products at a competitive price.

Bicron Electronics Co. ..................... Booth 1660
50 Barlow Street
Canana, CT 06018 USA
www.bicronusa.com

Bicron specializes in long life, corona free transformers, and high efficiency toroidal CT’s and Current Sensors while collaborating with the world’s largest manufacturers of Inverters, Power Supplies and Power Distribution Automation Equipment.

Bomatec International Corp. ............ Booth 1955
400 Finchdene SQ
Unit 6
Toronto, ON M1X 1E2 Canada
www.bomatec.com

Soft magnetics of nanocrystalline and amorphous tape wound cores and chokes, current sensors, transformers, inductors. Permanent magnets for motors and sensors.

CalRamic Technologies, LLC ............ Booth 1246
Mfg. Facility
5462 Louie Lane
Reno, NV 89511 USA
www.calramic.com

Manufacturers of High Voltage Ceramic Capacitors, 500VDC to 20KVDC in a variety of configurations and styles. High Voltage Multilayer, Radial Leaded, Surface Mount, for Commercial, Analytical, Military, and Space Level applications in NPO, X7R, and others. High Voltage Disc Capacitors in a variety of dielectrics for the same applications listed above. Custom configurations as well. US Based manufacturing company, and a partner company of Voltage Multipliers Inc.

Caton Connector Corp ...................... Booth 1545
26 Wapping Road
Kingston, MA 02364 USA
www.caton.com

Caton Connector is a specialty manufacturer of Custom and Standard High Voltage, Corona-Free Connectors and Cable Assemblies offering configurations from 1 to 19 conductors and voltages to 100kvDC. Caton is registered ISO9001:2008 and AS9100

Central Semiconductor Corp. .......... Booth 1661
145 Adams Avenue
Hauppauge, NY 11788 USA
www.centralsemi.com

Central™ manufactures discrete semiconductors including; diodes, rectifiers, transistors, MOSFETs and protection devices. Central will be featuring its latest UltraMOS™ and HV MOSFETs, Silicon Carbide devices and HyperFast Rectifiers.
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Booth Number</th>
<th>Address</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chroma Systems Solutions, Inc.</td>
<td>1821</td>
<td>19772 Pauling Foothill Ranch, CA 92610 USA</td>
<td><a href="http://www.ChromaUSA.com">www.ChromaUSA.com</a></td>
</tr>
<tr>
<td>CogniPower</td>
<td>1924</td>
<td>3217 Phoenixville Pike Malvern, PA 19355 USA</td>
<td><a href="http://www.cognipower.com">www.cognipower.com</a></td>
</tr>
<tr>
<td>Coil Winding Specialist, Inc.</td>
<td>1653</td>
<td>353 West Grove Avenue Orange, CA 92865 USA</td>
<td><a href="http://www.coilws.com">www.coilws.com</a></td>
</tr>
<tr>
<td>Coilcraft</td>
<td>1618</td>
<td>1102 Silver Lake Road Cary, IL 60013 USA</td>
<td><a href="http://www.coilcraft.com">www.coilcraft.com</a></td>
</tr>
<tr>
<td>Component Distributors, Inc. (CDI)</td>
<td>1157</td>
<td>2601 Blake Street Suite 450 Denver, CO 80205 USA</td>
<td><a href="http://www.cdiweb.com">www.cdiweb.com</a></td>
</tr>
<tr>
<td>Cornell Dubilier Electronics</td>
<td>1747</td>
<td>140 Technology Place Liberty, SC 29657 USA</td>
<td><a href="http://www.cde.com">www.cde.com</a></td>
</tr>
<tr>
<td>Cosmo Ferrites Limited</td>
<td>1560</td>
<td>Jabli, Distt. Solan Parwanoo, Himachal Pradesh 173209 India</td>
<td><a href="http://www.cosmoferrites.com">www.cosmoferrites.com</a></td>
</tr>
<tr>
<td>CPS Technologies</td>
<td>1456</td>
<td>111 South Worcester Street Norton, MA 02766 USA</td>
<td><a href="http://www.alsic.com">www.alsic.com</a></td>
</tr>
</tbody>
</table>

Chroma is a world leading provider of power test instrumentation and automated test systems including AC/DC Power Sources, Electronic Loads, Power Meters, and ATE for diverse bench-top, R&D and design verification of EV/PHEV, Solar, LED, Battery, Medical, and Power Supply applications.

CogniPower has developed improved controls for switched mode power converters. These controls enable inherently stable power conversion with exceptional speed, agility, and efficiency. CogniPower control loops can run 50 times faster than conventional controls, making them an excellent match for next-generation switches. Controls are scalable from mWs to KWs.

Coil Winding Specialist or CWS started as a design center for custom inductors, chokes, coils and transformers in the early 1980’s. Its original objective was to provide custom designs for engineers in need of inductive and transformer products in a hurry.

Coilcraft is a leading global supplier of magnetic components including, power magnetics, filters and high performance RF chip inductors. Bring your magnetics questions and see what’s new:
- XAL/XFL high-performance molded power inductors
- High-isolation transformers
- New planar magnetics
- Coupled inductors
- AEC-Q200 magnetics for automotive

Component Distributors, Inc. delivers technical solutions that are easy to find and easy to buy. CDI is a value-added distributor of power electronics, including power supplies, power ICs, passive components, batteries, thermal management and design services. CDI distributes globally and provides local customer service and application support across the Americas.

Cornell Dubilier is a N. American capacitor MFR with three ISO 9001 certified facilities & a sales office in Hong Kong. Its principal market is power electronics it is the largest aluminum electrolytic screw terminal capacitor supplier in the US.


CPS Technologies Corporation is the worldwide leader in the design and high-volume production of AlSiC (aluminum silicon carbide) for high thermal conductivity and device compatible thermal expansion. AlSiC thermal management components manufactured by CPS include Hermetic electronic packages, Heat sinks, Microprocessor & Flip chip heat spreader lids, Thermal substrates, IGBT base plates, Cooler baseplates, Pin Fin baseplates for Hybrid Electric Vehicles (HEV), and many others!
Cramer Coil & Transformer Co. Inc. .......................... Booth 1132
401 N. Progress Drive
Saukville, WI 53080 USA
www.cramerco.com

Cramer Coil & Transformer is dedicated to supplying repeatable, high quality, cost effective magnetics solutions. Our state-of-the-art design capabilities and safety agency expertise allows for the efficient generation of custom high frequency wire wound and planar magnetic designs for the most demanding switch mode power supply applications.

CUI Inc. ................................................. Booth 1337
20050 SW 112th Avenue
Tualatin, OR 97062 USA
www.cui.com

CUI is a technology company focused on the development and distribution of electronic components. At the leading edge of power supply design, the organization supports customers as they strive to improve the energy efficiency and environmental credentials of their application.

Current Ways, Inc. ........................................ Booth 1137
10221 Buena Vista Avenue
Santee, CA 92071 USA
www.currentways.com

Current Ways Inc., a leading innovator of smart battery chargers for electric vehicles and alternative energy applications, announces the release of the BC-Series 6.6kWW EV Battery Charger featuring 3 models, 450 VDC, 750 VDC and 1020 VDC.

Daco Semiconductor Co., Ltd. ................. Booth 1744
No. 28-4, Cheng-Tien Road
Taipei City, Taiwan
www.dacosemi.com.tw

Daco is a pioneer manufacturer of wafer fabrication & diode assembly in Taiwan specializing in Rectifier Diode, Schottky, Thyristor , Silicon Carbide and diversified device from small signal to power modules up to 1000 amperes, and has been dedicating to the development toward green energy solution and following customer’s vision with innovative products and quality service.

Danfoss Silicon Power GmbH ................. Booth 1236
Husumer Strasse 251
Flensburg, Schleswig-Holstein 24941 Germany
www.siliconpower.danfoss.com

Danfoss Silicon Power designs and manufactures customer specified power modules for power conversion OEMs serving the automotive, industrial, medical and renewable energy market spaces. Danfoss’ quality system is certified to ISO/TS-16949.

Datatronics ........................... Booth 1333
28151 Highway 74
Romoland, CA 92585 USA
www.datatronics.com

Datatronics designs and manufactures the broadest line of wirewound magnetic devices for customers worldwide. Products include SMPS transformers, SMD and thru-hole inductors, common mode chokes, gate drive transformers, current sense transformers and pul.

Dau Thermal Solutions North America .............. Booth 1734
1657 East Park Drive
Macedon, NY 14502 USA
www.dauusa.com

World leader in the design, and manufacturing of thermal management solutions for the power electronics industry: copper/aluminum liquid and air-cooled heat sinks, hybrid heat sinks, heat pipes, heat pipe heat exchangers, heat frames and ruggedized electronic chassis.

Dean Technology, Inc. ............... Booth 1738
3227 Skylane Drive
Carrollton, TX 75006 USA
www.hvca.com

Dean Technology specializes in the manufacture of high voltage components, assemblies and power supplies. Its three product lines (HVCA, CKE, and HVPSI) provide high voltage diodes, bridge rectifiers, ceramic capacitors, MOVs, selenium suppressors, silicon carbide varistors, high voltage power supplies, multipliers, test equipment, and custom components and assemblies.

DEWETRON Inc. .......................... Booth 1345
10 High Street
Suite K
Wakefield, RI 02879 USA
www.dewamerica.com

DEWETRON is a market-leading specialist for universal test & measurement systems. Our solutions allow broadband power measurements (mobile or stationary) and they master the challenge of distributed measurement technology –all 100% synchronized.

Dexter Magnetic Technologies ............. Booth 2242
1050 Morse Avenue
Elk Grove Village, IL 60007 USA
www.dextermag.com

Dexter is the premier distributor for Ferrite, Powder, Amorphous and Nanocrystalline cores, plus bobbins and specialty wire. Our diverse offering of magnetic materials, allows you to choose the correct standard or custom machined component.
**Dialog Semiconductor**

Booth 1346  
675 Campbell Technology Parkway  
Suite 150  
Campbell, CA 95008 USA  
www.dialog-semiconductor.com

Dialog Semiconductor provides highly integrated mixed-signal ICs. Our AC/DC converter products address applications up to 45W and include various fast charging ICs, supporting many protocols, including Qualcomm™ Quick Charge™ 3.0 technology.

**Digi-Key Electronics**

Booth 1663  
701 Brooks Avenue South  
Thief River Falls, MN 56701 USA  
www.digikey.com

Global distributor Digi-Key Electronics is the industry leader in electronic component selection, availability and delivery. Digi-Key is committed to providing the broadest range of components and exceptional service.

**Dino-Lite Scopes (BigC)**

Booth 1356  
19803 Hamilton Avenue  
Suite 200  
Torrance, CA 90502 USA  
www.dinolite.com

Dino-Lite portable digital microscopes and eyepiece cameras provide high-quality microscopy video interfacing to PC and MAC with clear and steady imaging. Most models provide 10x-200x along with a multitude of software features. The included DinoCapturesoftware makes it easy to take snapshots, record videos, manipulate images, save and email discoveries.

**Ducati Energia**

Booth 1963  
Via M. E. Lepido, 182  
Bologna, 40132 Italy  
http://www.ducatienergia.it

A world leader in AC & DC capacitors for power electronics applications with high current and harmonic distortion. DC capacitors for power inverters for railways,welding,energy storage and filtering applications. New HIGH TEMPERATURE capacitor range.

**Eaton**

Booth 2147  
5735 W. Las Positas  
Suite 100  
Pleasanton, CA 94588 USA  
www.eaton.com/electronics

Eaton’s Electronics Division is a global leader in circuit protection, power magnetics, and high power energy storage solutions. Product technologies include Bussmann Series fuses and overvoltage devices, inductors, transformers and supercapacitors.

**EBG Resistors**

Booth 1736  
460 Spruce Street  
P.O. Box 519  
Middletown, PA 17057 USA  
www.ebgusa.com

EBG RESISTORS LLC is a leading manufacturing resource of standardized and customized precision, high voltage (to 100kV), high power (to 1700W) Non-Inductive Thick Film resistors. Producing highly reliable resistors for; regen, dynamic breaking, motor drives, aerospace, medical, and numerous commercial applications, focusing on innovative resistors for today’s engineer.

**ECI**

Booth 1532  
53 Main Line Drive  
POB 1536  
Westfield, MA 01086 USA  
www.eciworld.com

Since 1947 we have been manufacturing electromagnetic components (transformers, coils, inductors, chokes, antenna’s and planar magnetics) for a variety of OEM’s in the military/aerospace, commercial, industrial and automotive markets. With facilities inthe USA and Europe, we are able to meet almost any of our global customer’s service requirements.

**EFC/WESCO**

Booth 1737  
41 Interstate Lane  
Waterbury, CT 06705 USA  
www.FILMCAPACITORS.com

EFC/Wesco is a North American based, ISO 9001-2008 Certified manufacturer of standard and custom film capacitors. We are a leading supplier for the power electronics, instrumentation, and surge suppression markets.

**Efficient Power Conversion Corporation (EPC)**

Booth 2244  
909 N. Sepulveda  
Suite 230  
El Segundo, CA 90245 USA  
www.epc-co.com

Efficient Power Conversion (EPC) is the leading provider of GaN-based power management technology. In booth 2244, EPC is showing GaN-based applications including wireless power, high-speed communications, and high power density DC-DC converters.
Egston System Electronics
Eggenburg ........................................ Booth 1347
Grafenberger Str. 37
Eggenburg, 3730 Austria
www.egston.com

EGSTON is a medium-sized company in Lower Austria and a high quality manufacturer of inductive component parts, Cable systems, Power Supply units and Chargers and Power Electronics.

There are production plants in the Czech Republic, China and India.

> Global distribution
> ISO 9001 ISO/TS 16949 certification
> Employees: 1,110
> Turnover in 2013: EUR 44,9 Mio.

Electro Technik ................................. Booth 2154
P.O. Box 18802
Clearwater, FL 33762
www.electrotechnik.com

For more than thirty-four years Electro Technik Industries (ETI) has designed and manufactured leading edge passive electronic components. ETI owns and operates several subsidiary companies in various passive electronic component fields.

Electrocube, Inc. ................................. Booth 1245
3366 Pomona Blvd.
Pomona, CA 91768 USA
www.electrocube.com

Electrocube is a design manufacturer of power electronic passive components with proven integrity and industry know-how for over 54 years; including Film Capacitors, RC networks, EMI Filters, Foil Transformers, Audi-optimized Capacitors, and TRUs. Products in service worldwide in land, sea, air and space, in commercial, industrial, and military applications. ISO9001 and AS9100C quality certified. Approved supplier to Boeing, GE, Honeywell, Raytheon, Eaton, and others.

Electronic Concepts, Inc. ..................... Booth 1317
526 Industrial Way West
Eatontown, NJ 07724 USA
www.ecicaps.com

Electronic Concepts is the recognized leader in film capacitor design and manufacture. Our vertical integration and innovative design capability offers the flexibility to meet your most demanding requirements and applications. Our latest development is on film capacitors operating at 125°C, 150°C and 175°C.

Electronic Systems Packaging ............. Booth 2056
1175 W. Mahalo Place
Rancho Dominguez, CA 90220 USA
www.espbus.com

Electronic Systems Packaging is a manufacturer of laminated bus bars, IGBTs, linear motor tracks and magnet rotor assemblies to commercial and military industries. With over 30 years of experience, ESP can provide prototypes and high volume production at a competitive cost. ESP has manufacturing facilities in California and in Beijing, China.

Elna Magnetics ................................. Booth 1742
203 Malden Turnpike
Saugerties, NY 12477 USA
www.elnamagnetics.com

Elna Magnetics is an ISO 9001:2008 & AS9100 certified authorized distributor and full service manufacturer of quality magnetic components in standard and non-standard core shapes for the electronics industry.

Exar Corporation ............................... Booth 1637
48720 Kato Road
Fremont, CA 94538 USA
www.exar.com

Exar Corporation designs, develops and markets high performance integrated circuits and system solutions for the industrial and embedded systems communications, high-end consumer and infrastructure markets.

Exxelia USA. ................................. Booth 1644
1221 N. Highway 17-92
Longwood, FL 32750 USA
www.exxeliausa.com

Exxelia Group is a global leader of passive components. A wide range of capacitors, magnetic components, EMI / RFI filters and more. Serving the military, aerospace, space and extreme environment markets.

Fairchild Semiconductor .................. Booth 1717
3001 Orchard Parkway
San Jose, CA 95134 USA
fairchildsemi.com

Fairchild has a rich history of innovation as a semiconductor pioneer. We specialize in the development and manufacture of a complete portfolio of low to high power solutions for mobile, industrial, cloud, automotive, lighting, and computing systems.
Fair-Rite Products Corp. .......... Booth 1842
1 Commercial Row
P.O. Box 288
Wallkill, NY 12589 USA
www.fair-rite.com

For over 50 years, Fair-Rite Products Corp. has been a leader in the ferrite industry placing the highest value on quality. With a full product line that includes a wide range of materials and geometries for EMI Suppression, Power Applications, and RFID.

Faratronic Co., Ltd. .......... Booth 1021
99, Xinyuan Road, Haicang District
Xiamen, 361022 China
www.faratronic.com

Leading in soft ferrite technology building on our Philips magnetic components heritage, FERROXCUBE can offer customers the highest level of support in the development of their new innovative designs. Our competencies cover soft ferrite products, materials, and accessories. All are developed to meet today’s demanding high-frequency, low-loss and environmental requirements.

FTCAP ................. Booth 1861
Carl-Benz-Strasse 1
Husum, 25813 Germany
www.ftcap.de

Manufacturers of power capacitors since 1919, we produce both electrolytic and film capacitors at factories in Germany and Switzerland. We offer a large range of standard power capacitors. When standard does not fit the needs, then we are happy to suggest custom designs.

Fuji Electric Corp. of America .... Booth 2132
50 Northfield Avenue
Edison, NJ 08837 USA
www.americas.fujielectric.com

Fuji Electric Corp. of America is dedicated to provide quality products. Our extensive product line includes IGBT Modules and IPM for industrial application, IGBT modules for automotive application, Power MOSFET and Fast-recovery diodes.

GAN Systems ................. Booth 2125
1145 Innovation Drive
Suite 101
#501
Ottawa, ON K2K 3G8 Canada
www.gansystems.com

GaN Systems is the first place systems designers go to realize all the benefits of gallium nitride in their power conversion and control applications. We develop the most complete range of gallium nitride power switching transistors for a wide variety of markets. Our unique Island Technology® addresses today’s challenges of cost, performance, and manufacturability resulting in devices that are smaller and more efficient than other GaN design approaches.

Global Choice International LLC .. Booth 1555
1699 Wall Street
Suite 119A
Mount Prospect, IL 60056 USA
www.globalchoice.me

We produce and export various SMD or normal coil, inductor, current/voltage transformer, relay used for electric controller system PCB, UPS etc. Such as electric meter, equipment PCB. In the meantime, we also produce metal parts and plastic parts as user’s need. If you give us your specific requirements, such as technical data and outside dimension etc, We can supply sample for your test. OEM is acceptable.

Global Power Technologies Group .. Booth 1547
20692 Prism Place
Lake Forest, CA 92630 USA
www.gptechgroup.com

GPTG Silicon Carbide (SiC) technologies and research into products for the commercial Power and Energy market. GPTG is vertically integrated value chain of SiC technologies. Under this structure, SiC technology is expected to be fully and economically deployed to meet the market pull by the industry segments which desperately seeks power system efficiency improvements. Because of vertical integration GPTG cost for SiC products will reach Silicon price point in volume to Critical, Important, and Emergin.

GLOBALFOUNDRIES ................. Booth 1934
2600 Great America Way
Santa Clara, CA 95054 USA
www.globalfoundries.com
<table>
<thead>
<tr>
<th>EXHIBITOR LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GMW Associates</strong></td>
</tr>
<tr>
<td>955 Industrial Road</td>
</tr>
<tr>
<td><a href="http://www.gmw.com">www.gmw.com</a></td>
</tr>
<tr>
<td>Current sensors and transducers from uA to kA and dc to 2GHz for development, test, QA, power measurement and OEM. Magnetic Field Instrumentation with application to field mapping, quality control and non-contact machine condition monitoring.</td>
</tr>
</tbody>
</table>

| **Good-Ark Semiconductor** | Booth 1527 |
| 608 Johnson Avenue Ste. 7 | Bohemia, NY 11716 USA |
| www.goodarksemi.com | |

| **Gowanda Electronics** | Booth 1257 |
| One Magnetics Parkway | Gowanda, NY 14070 USA |
| www.gowanda.com | |

| **GRAPES – NSF I/UCRC** | Booth 2043 |
| 1 University of Arkansas | Fayetteville, AR 72701 USA |
| http://grapes.uark.edu | |
| GRAPES is an NSF Industry/University Cooperative Research Center focused on accelerating the adoption and insertion of power electronics into the electric grid. Our university-based researchers partner with component manufacturers, equipment providers and power users to research industry-relevant topics and produce exceptional students to join the power industry. |

| **H & H Magnetics** | Booth 2155 |
| 5130 E. La Palma Avenue #206 | Anaheim, CA 92807 USA |
| www.hhmagnetics.com | |
| Outsource Manufacturing, Marketing, Branding, Sales Representation, Supply Chain Management, Custom Engineering, Procurement, Product Sourcing, Product Placement. |

| **HEFEI ECREIEE-TAMURA Electric Co. Ltd.** | Booth 1360 |
| NO 41 Tianzhi Road | Hefei, 230088 China |
| www.ecthf.com | |

| **Hengdian Group DMEGC Magnetics Co., LTD** | Booth 1534 |
| c/o ASL Technologies Inc. 14568 Rutledge Sq. | San Diego, CA 92128 USA |
| www.chinaDMEGC.com | |
| DMEGC is China’s #1 leading soft magnetics producer with more than 40,000 Ton out put and more than 20 factories. Its own R&D design center provide cutting edge new materials. Material including Mn-Zn, Ni-Zn, Iron Power and Alloy power series with shape for all ranges to support application in power, telecoms, LAN, Automotive, medical and etc. The best volume, quality and cost ratio bring value customers all over the world. Please contact us for more information. |

| **Heraeus Electronic Materials Division** | Booth 1453 |
| 24 Union Hill Road | West Conshohocken, PA 19428 USA |
| www.heraeus-electronics.com | |
| Heraeus Electronics provides an innovative portfolio and expertise in matching materials for high performance electronics. Our Materials Solutions will shorten development cycles, lower costs, and bring next generation products to market faster. |

| **Hesse Mechatronics, Inc.** | Booth 2033 |
| 225 Hammond Avenue | Fremont, CA 94539 USA |
| www.Hesse-Mechatroncis.com | |
| Hesse Mechatronics manufactures heavy and fine wire and ribbon bonders for power electronics and other microelectronics applications. Wire types include aluminum, gold and copper in both round wire and ribbon including HCR™ (High Current Ribbon). Our industry lead in ultrasonics is applied to our wire bond quality monitoring PiQC System. |

| **Himag Planar Magnetics, Ltd.** | Booth 2026 |
| Unit A The Aquarius Centre Edison Close, Waterwells Business Park | Qedgeley, Glos, GL2 2FN U.K. |
| www.himag.co.uk | |
| Himag Planar possess over two decades of experience in the field of planar transformers & inductors with a long term history in inverter technology and PCB design. |
Hitachi Metals......................... Booth 1957
85 W. Arlington Heights Road
#400
Arlington Heights, IL 60005 USA
www.hitachimetals.com

Hitachi Metals manufactures and markets a diverse portfolio of high-grade metal products and materials, magnetic materials and applications, high-grade functional components and equipment, wires, cables and related products.

Hitachi Semiconductors –
AmePower......................... Booth 1855
3550 NW 115TH Avenue
Miami, FL 33178 USA
www.AmePower.com

AmePower, Official Authorized Distributor of Hitachi Semiconductors, is a DBE, SBE, WBE and MBE Certified Engineering Company with more than 20yrs of experience in Power Electronics Solutions; offering from High Power Thyristors, Diodes, GTOs, IGBTs, IGCTs, Busbars, IGBT Gate Drivers to New Designs, Customizations, Assemblies, Repairs, Retrofit and Reverse-Engineering

Holy Stone International........ Booth 1654
41700 Ivy Street
Murrieta, CA 92562 USA
www.holystonecaps.com

Holy Stone Enterprise Co., Ltd is a leading manufacturer of MLCC’s for all power applications. Core product lines include: X and Y safety certified, high voltage and capacitance devices. Parametric part/inventory search engines available on website.

HVR Advanced
Power Components, Inc........... Booth 1147
2090 Old Union Road
Cheektowaga, NY 14227 USA
www.hvrapc.com

HVR provides cost-effective engineered solutions for high-stress resistor applications. Application areas include: Industrial, T&D, Research, Transportation, and Medical.

IAS (Industrial Applications Society)........ Booth 1024
445 Hoes Lane
Piscataway, NJ 08854 USA
www.ias.ieee.org

The scope of the Industry Applications Society, as a transnational organization, is the advancement of the theory and practice of electrical and electronic engineering in the development, design, manufacture and application of electrical systems, apparatus, devices and controls to the processes and equipment of industry and commerce; the promotion of safe, reliable and economic installations; industry leadership in energy conservation and environmental, health, and safety issues; the creation of voluntary engineering standards and recommended practices; and the professional development of its membership.

ICE Components, Inc............. Booth 2038
1165 Allgood Road
Suite 20
Marietta, GA 30062 USA
www.icecomponents.com

ICE Components, Inc. is a leading manufacturer of standard and custom magnetic components and current sensors for use in both high and low power applications. Our broad line includes many best in class products. Stop by our booth to learn more.

Illinois Capacitor Inc............. Booth 1745
3757 W. Touhy Avenue
Lincolnwood, IL 60712 USA
www.illinoiscapacitor.com


Imperix............................. Booth 1525
Rue de l’Industrie
Sion, VS 1950 Switzerland
www.imperix.ch

Imperix ltd. is a manufacturer of high-end control equipment and prototyping hardware for power electronics. Its modular products and solutions enable cutting-edge innovation and accelerate R&D activities, from the laboratory to the field. The company is a former spin-off the Swiss Federal Institute of Technology, Lausanne, Switzerland.
Indium Corporation
34 Robinson Road
Clinton, NY 13323 USA
www.indium.com

Indium Corporation is a premier materials supplier to global electronics assembly, semiconductor fabrication & packaging, & thermal management markets, offering a range of products, services, & technical support for advanced materials science.

Infineon Technologies Americas Corp
101 N. Sepulveda Boulevard
El Segundo, CA 90245 USA
www.infineon.com

Infineon Technologies is a world leader in semiconductor solutions that make life easier, safer and greener. Visit our booth for the latest energy-savings and high power density enabling technologies and solutions.

Infolytica Corporation
300 Leo-Pariseau
Suite 2222
Montreal, QC Canada
www.infolytica.com

Infolytica Corporation is the developer of MagNet 2D/3D, the leading electromagnetic field simulation software, and ElecNet 2D/3D for electric fields. Some typical design applications include transformers, motors, DC-DC converters, sensors/NDT and muchmore.

Innovation Plus Power Systems Inc.
3960 Commerce Drive
St. Charles, Illinois 60174 USA
www.innovationpluspower.com

Innovation Plus Power Systems Inc. is a power conversion and control systems specialist. We design & manufacture application specific, power semiconductor based components, assemblies & turn key systems.

INSTEK America
5198 Brooks Street
Montclair, CA 91763 USA
www.instekamerica.com

Founded in 1975, GW INSTEK is the first professional manufacturer in Taiwan specializing in electrical test and measurement instruments. INSTEK America is a wholly owned US subsidiary of GW INSTEK.

Intepro Systems
14712-A Franklin Avenue
Tustin, CA 92780 USA
www.InteproATE.com

Intepro Systems Power Electronics ATE has provided an open hardware and software architecture that virtually eliminates obsolescence risks for the military and aerospace battery, power supply, and power component testing. Intepro Systems also provides card level loads, high power stand-alone loads, and cost effective AC sources.

Inter Outstanding Electronics, Inc.
TWN/53-5 Zhen Shan ,Po Cheng Rd
Yuan Shan Hsiang, I-La 246 Taiwan
www.ioeinc.com.tw

We are specialized in standard and custom made transformers such as standard power & audio transformers. Our R&D teams provide total solution for all kind of inquiries. We offer rapid delivery and excellent service to satisfy customers requirement.

Intersil Corporation
1001 Murphy Ranch Road
Milpitas, CA 95035 USA
www.intersil.com

Intersil Corporation is a leading provider of innovative power management and precision analog solutions. With a deep IP portfolio and a rich history of innovation, Intersil is the trusted partner to leading companies in the industrial and infrastructure, mobile computing, automotive and aerospace markets. Learn more at www.intersil.com.

Intertape Polymer Group
100 Paramount Drive
Suite 300
Sarasota, FL 34232 USA
www.itape.com

Intertape Polymer offers a wide selection of electrical insulating tapes, industrial grade pressure sensitive tapes, and packaging tapes for virtually any application. Technical support, and cost effective solutions are the hallmarks of IPG.

Isotek Corporation, Subsidiary of Isabellenhutte
1199 G.A.R. Highway
Swansea, MA 02777 USA
www.isotekcorp.com

Isotek (Swansea, MA) is a subsidiary of Isabellenhutte(Dillenburg, Germany). Isotek supplies low ohmic, high current sensing and high power dynamic braking resistors to the industrial, automotive and energy markets.
ITELCOND SRL .................................. Booth 2160
Viale de Gasperi, 36
Bareggio (MI), Mila 20010 Italy
www.itelcond.it – www.itelcond.com

Our society, from over 40 years it produces electrolytic aluminium capacitors. With an elevated qualitative level. We turn us to different societies that build electronic equipments as UPS, Inverter, Welders, Control Motor, Medical Equipment.

ITG Electronics ............................... Booth 1960
175 Clearbrook Road
Eimsford, NY 10523 USA
www.ITG-Electronics.com

Design and manufacture standard & custom magnetics components for automotive, consumer electronics, computer server, telecommunication and industrial applications.

Iwatsu Test Instruments ............... Booth 2260
7-41, 1-chome Kugayama
Suginami-ku, Tokyo, 168-8511 Japan
www.itl.iwatsu.co.jp

We manufacture a wide range of electronic testing equipment such as semiconductor curve tracers, B-H analyzers, highvoltage isolated probes to cover various types of demands from industries and research for energy-efficient power managements.

IXYS (Westcode) .......................... Booth 1961
2500 Mira Mar Avenue
Long Beach, CA 90815 USA
www.ixyslongbeach.com

IXYS Long Beach Inc. has been at the front line of innovation and service in the power semiconductors industry. It has evolved beyond distribution and providing silicon assemblies to include logical solutions for applications to specific needs.

JARO Thermal ............................. Booth 1242
6600 Park of Commerce Boulevard
Boca Raton, FL 33487 USA
www.jarothermal.com

In a world where the internal temperatures of electronics continue to rise, Jaro Thermal responds with a broad range of innovative, cutting-edge cooling technologies, designed to extend the life of electronic components across many different industries and applications.

JFE Steel Corporation .................... Booth 1025
Hibiya Kokusai Bldg. 2-3
Uchisaiwai-cho, 2chome, Chiyoda-ku
Tokyo, Japan

JFE Steel Corporation will exhibit Super Core which is the highest grade, non-oriented magnetic steel sheets available. Super Core is ideal for applications in high-frequency reactors, transformers and so on. If you are interested in our material, please stop by our booth.

Jianghai America Inc ..................... Booth 1139
15920 A Halliburton Road
Suite 298
Hacienda heights, CA 91745 USA
www.jianghai.com

Jianghai is the largest electrolytic aluminum capacitor manufacture in China. It also provides DC link film capacitor, Super capacitor, LIC super capacitor, and polymer capacitor.

Johanson Dielectrics, Inc .................. Booth 1353
15191 Bledsoe Street
Sylmar, CA 91342 USA
www.johansondielectrics.com

Johanson Dielectrics specializes in power electronics solutions. Applications are for high voltage & high power electronics. Offering capacitors (high voltage, high temp, custom form factors), X2Y EMI Filters, planar array filters, resistors.

John Deere Electronic Solutions ........... Booth 2236
1441 44th Street N
Fargo, ND 58102 USA
www.johndeere.com/jdes

John Deere Electronic Solutions (JDES) differentiates John Deere’s global business and focuses on innovation critical to the enterprise’s success. JDES provides custom and off-the-shelf electronics and power electronics for original equipment manufacturers worldwide. We develop solutions that provide reliable and rugged electronic components and systems for demanding industries.

Kanthal Globar, Sandvik
Heating Technology USA .................. Booth 2161
495 Commerce Drive
Amherst, NY 14228 USA
www.globar.com
Kaschke Components GMBH ... Booth 1642
Rudolf-Winkel-Strasse 6
Goettingen, 37079 Germany
www.kaschke.de

Kaschke Components is one of the leading designer and manufacturer of soft magnetic materials and inductive components, located in Germany. Kaschke offers customised inductive solutions with a focus on renewable energies, smart grids and energy efficiency. The portfolio varies from tiny high frequency antenna coils up to high performance-low loss power choke for 60KW inverters.

KDM Zhejiang NBTM Keda Magneto electricity Co. Ltd. ... Booth 1939
525 Quyuan Road North
Wukang Town, Deqing County
Zhejiang Prov., China
www.kdm-mag.com

China’s leading alloy powder core manufacturer that specializes in Sendust (KS), Super Sendust (KS-HF), Si-Fe (KSF), Neu Flux or Super Si-Fe (KNF), Low Cost Si-Fe (KW), Nanodust (KAM, KAM-AF, KAH), MPP (KM), and High Flux (KH).

KEMET ... Booth 1753
2835 Kemet Way
Simpsonville, SC 18045 USA
www.kemet.com

KEMET Electronics Corporation is a leading global supplier of electronic components. We offer our customers the broadest selection of capacitor technologies in the industry across, along with an expanding range of electromechanical devices, electromagnetic compatibility solutions and supercapacitors. Our vision is to be the preferred supplier of electronic component solutions for customers demanding the highest standards of quality, delivery and service.

Kendeil srl ... Booth 2053
Kendeil is a leading producer of power electronic capacitors for wind and solar inverter applications, industrial motor drives, UPS, chargers and aluminum foil for electrolytic capacitors. Products made by advanced technology meet the highest international standards in performances and quality. Plants locations in Italy, France and India, with worldwide netsale.

KEPCO, Inc. ... Booth 1858
131-38 Sanford Avenue
Flushing, NY 11355 USA

Kepco offers a wide range of power supply products and Electronic Loads: AC/DC instrumentation power supplies, four quadrant power supplies, N+1 Redundant products, Din Rail, Medical Approved, and OEM. Please visit us at Booth 1858.

Keysight Technologies ... Booth 1252
5301 Stevens Creek Boulevard
Santa Clara, CA 95051 USA
www.keysight.com

Keysight Technologies is a global electronic measurement technology and market leader helping to transform its customers’ measurement experience through innovations in wireless, modular, and software solutions.

KITAGAWA INDUSTRIES America, Inc. ... Booth 1945
2325 Paragon Drive
Suite 10
San Jose, CA 95131 USA
www.kgs-ind.com

KITAGAWA INDUSTRIES America, Inc. (formally Intermark USA, Inc.) is a leading provider of EMI solution products, thermal solution products, shock/vibration management products as well as plastic components. We cover a variety of electronic applications and industries including consumer products, telecom, LEDs, medical devices, power supplies, wireless devices, and automotive industry.

Knowles Capacitors ... Booth 1461
2777 Rte 20 East
Cazenovi, NY 13035 USA
www.knowlescapacitors.com

At Knowles Capacitors we make Multilayer, High Reliability, Single Layer and Precision Variable Capacitors, EMI Filters and Thin Film Devices. Our business was formed by combining Dielectric Laboratories, Novacap, Syfer and Voltronics, each well-established specialty capacitor makers with a combined history of over 175 years, into a single organization. Products include High-Voltage (10KV) MLCC’s, HV EMI filters, High Current EMI filters, Custom thin film for GAN applications.

Lee Yuen Electrical Mfy Limited ... Booth 2252
Unit 4 G/F, Transport City Building
No.1-7 Shing Wan Road, Shat Hong Kong
www.Hoiyuen.com

Lee Yuen / Hoi Luen group is the premier supplier of fully insulated wire and power cord. Established in 1987, we are the nominated supplier for various global brands, dedicated to be your one stop solution company in power electronics.

LEM USA, Inc. ... Booth 1352
11665 W. Bradley Road
Milwaukee, WI 53224 USA
www.lem.com
Lenco Electronics, Inc. .......... Booth 1761
1330 S. Belden Street
McHenry, IL 60050 USA
www.lenco-elect.com

Lenco specializes in a wide variety of custom transformers and inductors. Our success has not come about by accident, but by providing our customers with the high quality products they have come to expect.

Linear Technology Corporation .... Booth 1233
1630 McCarthy Boulevard
Milpitas, CA 95035 USA
www.linear.com

Linear Technology offers a broad line of high performance analog integrated circuits providing an essential bridge between analog and the digital electronics in communications, networking, industrial, automotive, computer, medical, instrumentation, consumer, and military and aerospace systems. Linear Technology produces power management, data conversion, signal conditioning, RF and interface ICs, µModule subsystems, and wireless sensor network products.

Lodestone Pacific ................. Booth 1432
4769 E.Wesley Drive
Anaheim, CA 92807 USA
www.lodestonepacific.com

Lodestone Pacific manufacturers Toroid Mounts, Headers, Bobbin and Anti Static Trays for the magnetics industry in its China factory. Lodestone Pacific also manufactures high reliability, high Q and variable shielded coils and is an authorized distributor for Fair-rite Products EMI/RFI ferrites, Micrometals iron powder cores, Arnold powder and tape wound cores, and P. Leo transformer tapes.

LTEC Corporation ................. Booth 1519
2880 Zanker Road
No. 203
San Jose, CA 95134 USA
www.ltecusa.com

LTEC Corporation, Japan’s dominant intellectual property analysis company, provides in-depth competitive reverse engineering analysis services for the research and development engineering and industrial legal communities worldwide.

Mag. Layers USA ................. Booth 1762
5406 Bolsa Avenue
Huntington Beach, CA 92649 USA
www.maglayersusa.com

Mag. Layers’ products offer cutting-edge technology in Antenna, EMI, LAN transformer, NFC, Power, & RF solutions. Founded in 1990, we’ve become the top producer of molded power inductors globally. TS16949 certified, EICC, RoHS & Reach compliant.

MAGDEV Ltd. .................... Booth 2061
Unit 23 Ash Industrial Estate
Kembrey Park
Swindon, England SN58JN
www.magdev.co.uk

When magnetics matter talk to MagDev. Formerly part of MMG, now the distribution arm of Delta Magnets Group, with over 70 years experience MagDev is a specialist supplier of magnetic products to various market sectors and is ISO 9001:2008 certified.

Magnachip Semiconductor ....... Booth 1144
424, Teheran-ro
Gangnam-gu
Seoul, 135-738 Korea
www.magnachip.com

Magnachip is a Korea-based manufacturer and designer of analog and mixed-signal semiconductor products. We have one of the broadest and deepest analog and mixed-signal semiconductor technology platforms in the industry with our 30-year operating history. Magnachip has over 3000 patents in our portfolio and extensive engineering and manufacturing process expertise.

Magna-Power Electronics ......... Booth 1542
39 Royal Road
Flemington, NJ 08822 USA
www.magna-power.com

Magna-Power Electronics designs and manufactures robust programmable DC power products in the USA that set industry standards for quality, size, and control. The company’s experience in power electronics is reflected in its 1.5 kW to 2000 kW+ product line, quality service, and reputation for excellence.

Magnetec (Guangzhou) Magnetic Device Co. Ltd. .... Booth 1563
6/F East, Building 2. Huangzhou Industrial Zone
Chebei Road, Tianhe District
Guangzhou, China
www.magnetec-china.com

Magnetic Metals Corp ............ Booth 1853
1900 Hayes Avenue
Camden, NJ 08105 USA
www.magneticmetals.corp.com

Magnetic Metals, a U.S. based manufacturer, offers tape wound toroidal and cut cores, laminations for transformers and precision motors, valued added contract manufacturing services and a wide range of GFCI, ALCI and AFCI components. Established in 1942, Magnetic Metals is AS9100 and ISO9001 certified to service industrial, commercial, and defense clients worldwide.
Magnetics ...........................  Booth 1433
110 Delta Drive
Pittsburgh, PA 15238 USA
www.mag-inc.com
Magnetics is a leading manufacturer of high performance soft magnetic materials including MPP, High Flux, Kool Mu®, XFLUX® and AmoFlux® powder cores, ferrite cores, and nickel-iron alloy tape wound cores. AmoFlux is a new amorphous powder core material that is ideal for power factor correction (PFC) and output chokes.

Magsoft Corporation ...............  Booth 1443
1 Fairchild Square
Clifton Park, NY 12065 USA
www.magsoft-flux.com
Take control of your design with Magsoft’s suite of CAE tools: Flux, GOT-It, PORTUNUS, InCa3D & SPEED. Design, analyze and optimize your devices and systems: motors, actuators, busbars, electrical connections, power conversion and distribution.

Magtech & Power Conversion Inc. ....  Booth 1562
1146 E. Ash Avenue
Fullerton, CA 92831 USA
www.magtechpower.com
Magtech & Power Conversion specializes in designing and manufacturing state-of-the-art custom magnetics & power supplies with innovative solutions and superior quality.

Malico Inc. .........................  Booth 1362
5, Ming-Lung Road
Yangmei, 32663 Taiwan
www.malico.com
Malico is the leading manufacture of thermal solutions. We specializes in making cold plates and heat sinks for Electronics and Automotive industries.

Marathon Power ....................  Booth 2057
2538 E. 54th Street
Huntington Park, CA 90802 USA
www.marathon-power.com
Marathon Power offers customizable Uninterruptible Power Supplies designed for single-phase applications with powers ranging from 400VA to 12000VA and voltages from 110V to 240V.

MaxQ Technology, LLC ..........  Booth 1454
8270 S. Kyrene Road
Suite 108
Tempe, AZ 85284 USA
www.maxqtechnology.com
MaxQ Technology supplies advanced liquid cooling products for the power converter industry. Our patented Q-Chill™ Friction Stir Welded process has produced products for renewable energy, space, electric vehicle and industrial applications.

Mentor Graphics Corporation ....  Booth 2052
8005 SW Boeckman Road
Wilsonville, OR 97070 USA
www.mentor.com/powertester-1500a
MicReD® thermal measurement & power cycling test solutions for failure diagnosis & lifetime prediction of IGBTs & MOSFETs. Simulation software: SystemVision®- system performance modeling & reliability evaluation; FloTHERM® for thermal CFD analysis.

Mersen ..............................  Booth 1725
374 Merrimac Street
Newburyport, MA 01950 USA
www.ep-us.mersen.com
Mersen is an expert in electrical power and advanced materials and integrates its expertise in cooling and heatsink technology, laminated bus bar & semiconductor fuses in power electronics applications to make them safe, reliable and profitable.

Mesago PCIM GmbH ...............  Booth 1445
Rotebuehlstrabe 83-85
Stuttgart, 70178 Germany
www.pcim-europe.com
PCIM Europe is the international leading exhibition and conference for power electronics, intelligent motion, renewable energy and energy management. Recent trends and developments offer solutions for pressing problems of the industry.

Methode Power Solutions Group ..  Booth 1116
1700 Hicks Road
Rolling Meadows, IL 60008 USA
www.methode.com/power
Methode manufactures power products across many industries, including: Data/Telecom, Military, Renewable Energy and Industrial. Methode’s products include: laminated bus bars, thermal management, power connectors/cables and sub-assemblies.
MH&W .................................................. Booth 1932
575 Corporate Drive
Mahwah, NJ 07430 USA
www.mhw-intl.com
MH&W supplies the most technological advanced magnetic cores; Ferrite, Powder and Tape wound for EMI suppression, Signal processing and Power Conversion with High Temperature/High Frequency/High Reliability applications. Tailored cores, bobbins, clamps as well as machining, gapping and grinding services are available. Make MH&W your one stop for magnetics.

Microchip Technology Inc. .......... Booth 1127
2355 W. Chandler Boulevard
Chandler, AZ 85224 USA
www.microchip.com
Microchip Technology Inc. is a leading provider of microcontroller and analog semiconductors, providing low-risk product development, lower total system cost and faster time to market for thousands of diverse customer applications worldwide.

Micrometals, Inc. ......................... Booth 1526
5615 E. La Palma Avenue
Anaheim, CA 92807 USA
www.micrometals.com &
www.MicrometalsArnoldPowderCores.com
Micrometals, Inc. and Micrometals Arnold division offer the widest selection of shapes, sizes and materials of powder cores available. The product range recently expanded with the introduction of 147 and 160 perm Sendust (MS) material in toroid geometries up to 100mm. Custom parts welcome and sizes larger than catalog parts available.

Milplex Circuit (Canada) Inc. .......... Booth 2254
70 Maybrook Drive
Toronto, ON M1V 4B6 Canada
www.milplexcircuit.com
Milplex manufactures PCB’s for Industrial controls, Power supplies, automotive, and LED Industries. We specialize in high current and high temperature applications using heavy copper and thermal metal back/core technologies.

MK Magnetics Inc ......................... Booth 1539
17030 Muskrat Avenue
Adelanto, CA 92301 USA
www.mkmagnetics.com
Leading manufacturer of magnetic cores made with various tape ribbon including: amorphous (Metglas), nanocrystalline, silicon-steel, nickel and cobalt alloys, Cut C-cores, E-cores and toroids. Applications: inverters, filter chokes, transformers, etc. Markets: smart grid, energy storage, renewable energy, medical, aerospace/military, industrial, high energy, R&D, etc. ISO 9001:2008, RoHS, ITAR, DFARS.

Monolith Semiconductor Inc. ...... Booth 1655
408 Fannin Avenue
Round Rock, TX 78664 USA
www.monolithsemi.com
Monolith Semiconductor is a supplier of high-performance 900V and 1.2KV discrete Silicon Carbide MOSFETs and diodes. Monolith Semi’s SiC devices are manufactured on an automotive-qualified 150mm CMOS line and share the quality and manufacturing systems for highest quality. Monolith is also open to design and manufacture custom SiC devices for customers.

Monolithic Power Systems, Inc. ...... Booth 2025
79 Great Oaks Boulevard
San Jose, CA 95119 USA
www.monolithicpower.com
MPS leads in high-performance power solutions. Founded in 1997, MPS pioneered integrated power semiconductor solutions and delivery architectures. MPS provides innovative power solutions in Cloud Computing, Telecom, Industrial, Automotive, and Consumer Market Segments. MPS has offices in the US, China, Taiwan, Korea, Japan, and Europe.

MORNSUN America LLC ............. Booth 1952
13 Country Club Lane
Suite C
Milford, MA 01757 USA
www.mornsunamerica.com
Mornsun America LLC, a leading manufacturer of DC-DC, AC-DC converter, isolation amplifier; LED driver and RS232/CAN/485 transceivers, as well as EMC components. Mornsun’s products are widely used in industrial, automation, instrumentation, power systems, IGBT/ SiC gate drivers, Renewable energy, medical and automotive devices and other commercial applications.

Mouser Electronics, Inc. .......... Booth 2245
1000 N. Main Street
Mansfield, TX 76063 USA
www.mouser.com
Mouser Electronics is the global authorized distributor with the newest semiconductors and electronic components, including the latest power electronics components. With over 500 manufacturers on its linecard, Mouser caters to design engineers and buyers, and offers fast, same day shipping. To learn more, visit www.mouser.com
MPS Industries, Inc.  .............. Booth 1122
19210 S. Vermont Avenue
Bldg. D Suite 405
Gardena, CA 90248 USA
www.mpsind.com

MPS Industries is a leading manufacturer of magnetic components with a broad product line of standard and custom transformers, inductors, common mode chokes, and current sensors. Our U.S. based engineering team is highly experienced in a wide variety of power applications and industries.

MS Power Semiconductor Co., Ltd  .................. Booth 2138
F-21, Block 9, Jiashan Sci-Tech Incubation Center
No., 568, East Jinyang Rd., Jiashan County 314100
Zhejiang Province, China
www.ms.powergroup.com

MS PowerGmbH, headquartered Germany, is recognized for manufacturing high quality power Semiconductor products. It is supplied into various applications such as Motor Drives, Power Suppliers, Solar and Wind Energy systems, smart grids etc..

MTL Distribution  .................. Booth 1838
23167 Temescal Canyon Road
Corona, CA 92883 USA
www.mtldistribution.com

With 26 years of experience, MTL is an authorized distributor of magnetic cores and associated hardware for Magnetics Inc and powder iron toroid cores for Micrometals-Arnold. We also provide value-added custom machining services for clients with special requests or short lead time requirements. Our friendly staff is dedicated to providing the highest quality service with flexible pricing and delivery options to help meet our customer’s needs.

National Magnetics Group/
Ceramic Magnetics, Inc.  ........... Booth 1632
1210 Win Drive
Bethlehem, PA 18017 USA
www.cmi-ferrite.com

Ceramic Magnetics (CMI) offers a wide variety of MnZn and NiZn ferrites, specializing in custom machined cores as well as standard shapes. Our engineering and manufacturing capabilities enable CMI to develop proof of concept prototypes and then seamlessly ramp to full-scale production.

NEC TOKIN America Inc.  ............ Booth 2243
2460 N 1st Street
Suite 220
San Jose, CA 95131 USA
www.nec-tokin.com/english

NEC TOKIN Corporation was established in 1938 through a partnership with Tohoku University in Japan. Since its inception, NEC TOKIN offers innovative capacitor and magnetic products to meet the technological needs of today and the future.

New England Wire Technologies  .... Booth 1447
130 North Main Street
Lisbon, NH 03585 USA
www.newenglandwire.com

We manufacture Litz wire as well as an extensive range of custom multi-conductor, low-noise, high temperature and hybrid cables. We offer rapid prototyping, small quantity and production quantities as well as unparalleled customer service.

NH Research, Inc.  ....................... Booth 1832
16601 Hale Avenue
Irvine, CA 92606 USA
www.nhresearch.com

NH Research is a global supplier of advanced AC and DC electronic loads & automated power electronics test systems used for engineering characterization and high-volume manufacturing. Power levels are up to 125KW and 600V. Applications tested: AC/DC power supplies, DC/DC converters, adapters, chargers, LED drivers, batteries, battery chargers, and UPSs.

Nichicon (America) Corporation  .... Booth 1145
927 E. State Parkway
Schaumburg, IL 60173 USA
www.nichicon-us.com/english

Nichicon is a world leader in the manufacture of Aluminum Electrolytic Capacitors, Film Capacitors, Conductive Polymer Capacitors, Electric Double Layer Capacitors (EDLC). Our professional staff can help you with all of your power capacitor needs.

NORWE Inc.  ......................... Booth 1543
2813 Carrington Street NW
North Canton, OH 44720 USA
www.norwe.com

NORWE is a leading manufacturer of thermoplastic Bobbins for Ferrites & Laminations, SMD components & accessories. All Products comply with the RoHS & REACH. NORWE is certified according to DIN EN ISO 9001:2008, DIN EN ISO 14001:2009 and UL 746D.
NXP Semiconductors .......................... Booth 1053
Gerstweg 2
6534AE Nijmegen, The Netherlands
www.nxp.com

NXP Semiconductors enables secure connections and infrastructure for a smarter world, advancing solutions that make lives easier, better and safer. NXP is driving innovation in the secure connected vehicle, end-to-end security & privacy markets.

Ohmite MFG ............................... Booth 2143
Bella Vista PK
Warrenville, IL 60555 USA
www.ohmite.com

Ohmite Manufacturing Company has been a leading provider of resistors for high current, high voltage and high energy applications for 90 years. Ohmite's full complement of products includes wirewound, wire element, thick film, and ceramic composition constructions. Ohmite also has a complete line of Heatsinks for thermal applications.

ON Semiconductor ......................... Booth 1625
5005 East McDowell Road
Mail Drop A100
Phoenix, AZ 85008 USA
www.onsemi.com

ON Semiconductor is driving energy efficient innovations, empowering customers to reduce global energy use. The company offers a broad portfolio of energy efficient power management, analog, logic, timing, discrete, sensing, and custom solutions.

Opal-RT .................................... Booth 1446
1751 Richardson
Suite 2525
Montreal, QC H3K 1G6 Canada
www.opal-rt.com

OPAL-RT TECHNOLOGIES is a leading developer of open, real-time digital simulators and Hardware-In-the-Loop testing equipment for electrical, electro-mechanical and power electronics systems. Our validation and test benches are used by engineers and researchers at leading manufacturers, utilities and universities worldwide. Our technological approach integrates parallel, distributed computing with commercial-off-the-shelf technologies.

Oztek Corporation .......................... Booth 1652
11 Continental Boulevard
Merrimack, NH 03054 USA
www.oztekcorp.com

Oztek Corp, a global provider of OEM power electronics solutions, introduces the OZip family of Intelligent Power Modules. Both air and liquid cooled configurations are available with motor drive, inverter, or DC/DC control code.

Pacific Sowa Corporation;
C/O Epson Atmix Corporat ............ Booth 1535
10 Anson Road
#13-11 International Plaza
Singapore
www.pacificsowa.co.jp

Sales and Customer support representative of EPSON ATMIX's Magnetic Powders.

Paktron Div. Pancon Corp ............... Booth 1624
350 Revolutionary Dr.
E. Taunton, MA 02718 USA
www.panconcorp.com

Designs and manufactures in USA, a Multilayer Polymer (MLP) Film Capacitors that provide improved stability, both electrically and mechanically, compared to multilayer ceramics and features "non-shorting" operation and does not crack like large ceramic chip capacitors. Paktron is also the manufacturer of the Quencharc™ RC Network.

Panasonic ................................. Booth 1918
1 Kotari-yakemachi
Nagaokakyo, Kyoto, Japan

Panasonic provides ENELEAD, the “Total solution of power devices”, which supports from power system design to purchasing of components, allowing you to select a suitable small, high-efficiency power device, to easily perform a design and evaluation of power systems by using web-based tools, and to purchase peripheral components.

Parker Overseas ......................... Booth 1962
59/1/1, Industrial Area, Site – IV, Sahibabad
Distt. Ghaziabad, Utta Paredsh
Ghaziabad, 110092 India
www.parkeroverseas.com

Design, Manufacture & Supply of TH & SMT type. Wound Magnetic Components like Transformers, Inductors, Chokes, Coils, Line Filters, Power Transformers, Current Transformers, Power Toroidal Transformers, Switching and SMPS Transformers, Modules etc.

Payton America ......................... Booth 1927
1805 S. Powerline Road, Suite 109
Deerfield Beach, FL 33442 USA
www.paytongroup.com

Payton Group International is the world leader in the design and manufacturing of PLANAR TRANSFORMERS and INDUCTORS. Custom designs using standard parts with no NRE, samples in few weeks from few watts to 20kWatts in a single unit. We provide fast designs for most SMPS applications. Our design team and our ISO/TS facilities in Florida, Israel and China can handle commercial and military applications.
Pearson Electronics, Inc.  
4009 Transport Street  
Palo Alto, CA 94303 USA  
www.pearsonelectronics.com

Pearson Electronics is the original and leading manufacturer of Wide Band Current Transformers used for accurate AC current measurements. Pearson Current Transformers can measure transients, harmonics, pulse, sine-wave and other complex current wave shapes. A typical model has 1% accuracy and a 3 dB bandwidth from 1 Hz to 20 MHz. We meet both OEM and custom requirements.

PELS (Power Electronics Society)  
445 Hoes Lane  
Piscataway, NJ 08854 USA  
www.ieee-pels.org

The Power Electronics Society is one of the fastest growing technical societies of the Institute of Electrical and Electronics Engineers (IEEE). For over 20 years, PELS has facilitated and guided the development and innovation in power electronics technology. This technology encompasses the effective use of electronic components, the application of circuit theory and design techniques, and the development of analytical tools toward efficient conversion, control and condition of electric power. Our 7,000 members include preeminent researchers, practitioners, and distinguished award winners. IEEE PELS Publishes the IEEE Transactions on Power Electronics, a top referenced journal among all IEEE publications.

PINK GmbH Thermosysteme  
704 Ginesi Drive  
Suite 11A  
Morganville, NJ 07751 USA  
www.pink.de/en

PINK offers vacuum soldering systems for laboratory, batch production, or an automated inline system. Each system can accommodate both preforms and/or paste soldering.

Plexim  
5 Upland Road  
Suite 4  
Cambridge, MA 02140 USA  
www.plexim.com

Plexim provides solutions for the design and test of power electronic systems. Our portfolio consists of the simulation software PLECS, a new hardware-in-the-loop (HIL) platform, PLECS Processor-in-the-Loop (PIL), and Web-Based Simulation (WBS).

PMK Mess –und Kommunikationstechnik GmbH  
Königsteiner Str. 98  
Bad Soden, Hess 65812 Germany  
www.pmk.de

PMK Mess- und Kommunikationstechnik GmbH is one of the leading independent manufacturers for electronic test and measurement equipment. Customers are industrial companies as well as developers.

POCO Holding Co., Ltd  
No. 28 Langshan Rd, Northern Dist.High Tech Industry Park, Nanshan  
Shenzhen, Guangdong 518057 China  
www.pocomagnetic.com

One-Stop magnetic material (powder & powder core) manufacturer and inductor application solution provider.

Power Electronic Measurements Ltd.  
Gloucester House, Wellington Street  
Long Eaton, Nottingham, United Kingdom  
www.pemuk.com

PEM Ltd design, manufacture and sell state of the art, wide-bandwidth, flexible, clip-around, current sensors based on Rogowski Technology. Ideal for the latest semiconductor or power electronics development and hf and current pulse measurements, the sensors cover frequencies from 0.01Hz to 30MHz and currents from 10A to 1,000,000A.

Power Integrations  
5245 Hellyer Avenue  
San Jose, CA 951438 USA  
www.power.com

Power Integrations is a leading innovator in high-voltage power conversion. Our ICs are key to the clean-power ecosystem; enabling renewable energy and providing efficient power consumption in applications ranging from milliwatts to megawatts.

Power Solutions Inc.  
6555 Sugarloaf Parkway  
Suite 307-159  
Duluth, GA 30097 USA  
www.psl-powersolutions.com

PSL Power Solutions Inc. is our North American Sales division created in 2012. The original business known as Power Semi-Conductors was started in 1972.

PowerAmerica  
930 Main Campus Dr., Suite 200  
Raleigh, NC 27606 USA  
www.poweramericainstitute.org
PowerELab Ltd. .......................... Booth 2136  
RM521-522, BLK 9, Enterprise Place  
5 Science Park West Ave., HK Science Park, Shatin  
Hong Kong, Hong Kong  
www.powerelab.com  

PowerELab provides design services for many power electronics products, e.g. AC-DC power supply, 80+ server, 80+ ATX, LED driver, electronic ballast, EV charger, DC-AC inverter, battery charger, medical power supply, DC-DC converter, etc. Patent licensing, consultancy and training. We also developed a free on-line power supply design tool PowerEsim.

Powerex, Inc. ............................. Booth 1416  
173 Pavilion Lane  
Youngwood, PA 15697 USA  
www.pwrx.com  

Powerex, a leading supplier of discrete devices, modules and integrated high power semiconductor solutions, will feature its new T-Series 7th Gen NX IGBTs; J-1 Series for automotive applications; and an expanded DIPIPIM™ line-up at APEC 2016.

Powersim, Inc ............................. Booth 1047  
2275 Research Boulevard  
Suite 500  
Rockville, MD 20850 USA  
www.powersimtech.com  

PSIM is a power electronics simulation tool that empowers engineers to accelerate the pace of innovation with the fastest, most reliable and easy-to-use solution. PSIM: Expanding the possibilities of power electronics.

POWRMOD DC to DC Converters ........ Booth 1557  
1 Roned Road  
Shirley, NY 11967 USA  
www.POWRMOD.com  

Powrmmod offers innovative dc to dc converters for demanding environments. Addressing the industrial, robotic, railway and shipboard markets, these converters have internal mil-std 461 d,e, and f filtering contained in a single metal package.

Precision Inc. ............................. Booth 1743  
1700 Freeway Boulevard  
Minneapolis, MN 55430 USA  
www.precision-inc.com  

Precision, Inc. is a manufacturer of Inductors, Transformers, Coils and other Power Magnetics Products. Precision Provides Engineering Assistance, Custom Designs and Prototypes. Clean Room Production with ISO 9001 and ISO 13485. Recent Designs include GaN Ready Magnetics. Products Manufactured and Shipped from Plants on a Global Basis.

Prodrive Technologies .................. Booth 1452  
Science Park Eindhoven 5501  
Son, 5692EM The Netherlands  
prodrive-technologies.com  

Prodrive Technologies develops and manufactures electronic and mechatronic solutions. We offer custom and off-the-shelf products such as gate drivers, power stacks, power supplies, any kind of converter and even complete power cabinets.

PSMA (Power Sources Manufacturers Association) .... Booth 1026  
PO Box 418  
Mendham, NJ 07945 USA  
www.psma.com  

The Power Sources Manufacturers Association is an industry organization of power supply manufacturers, users, power component suppliers, academics and consultants. Incorporated in 1985, as a non-profit, democratic, participative organization, PSMA’s main goal is to enhance the stature of the power supply industry and provide education and information through published reports, educational seminars, technical workshops and conference exhibits.

Qualtek ................................. Booth 1954  
7610 Jenther Drive  
Mentor, OH 44060 USA  
www.qualtekusa.com  

Qualtek Electronics since 1980 has established itself as the global leader of high quality low cost products while providing the latest technology in the industry. Showcased at APEC is our full line of power supplies ranging from 5W to 600W, AC and DC fa

Renco Electronics Inc. .................... Booth 1634  
595 International Place  
Rockledge, FL 32955 USA  
www.rencousa.com  

Manufacture and Worldwide distribution of Transformers, Inductors and Chokes; along with our large standard product selection we will engineer the right product for you, build to print or cross to another manufacture and provide samples for evaluation. YOU DESIGN, WE ENGINEER, TOGETHER WE SUCCEED!
**Renesas Electronics** .......................... Booth 1746  
2801 Scott Boulevard  
Santa Clara, CA 95050 USA  
www.am.renesas.com  

Renesas Electronics is a major supplier of high-performance MCUs, Analog ICs, and Power Semiconductors, including world-class IGBTs, a wide range of Li+ fuel-gauge ICs, and power management ICs. Renesas Electronics provides solutions, software, and other services that add value for our automotive and industrial customers. www.renesas.com  

**Richardson Electronics, Ltd.** .......... Booth 1647  
40W267 Keslinger Road  
LaFox, IL 60147 USA  
www.rell.com  

Richardson Electronics, Ltd. is a leading global provider of engineered solutions, RF & microwave and power products. We add value through design-in support, systems integration, prototype design, testing, logistics, and aftermarket services.  

**Richardson RFPD** ............................ Booth 2227  
1950 S. Batavia Avenue  
Suite 100  
Geneva, IL 60134 USA  
www.richardsonrfpd.com  

Richardson RFPD, an Arrow Electronics company, is a global leader in the RF and wireless communications, power conversion and renewable energy markets. It brings relationships with many of the industry’s top RF and power component suppliers.  

**Ridley Engineering, Inc.** ............... Booth 1817  
601 E. Daily Drive  
Suite 112  
Camarillo, CA 93010 USA  
www.RIDLEYENGINEERING.com  

Ridley Engineering is a global leader best known for its design workshops, POWER 4-5-6 software and AP300 frequency response analyzer. A new Design Center facility opens in California in March 2016 for training courses, research and consulting.  

**Rogers Corporation** ....................... Booth 1437  
One Technology Drive  
Rogers, CT 06263 USA  
www.rogerscorp.com  

Rogers Corporation is a global technology leader in specialty materials and components that enable high performance and reliability of power electronics, mass transit, automotive and sustainable energy. Rogers’ Power Electronics Solutions Division will be exhibiting the RO-LINX laminated busbars, PowerCircuit Materials and curamik Ceramic Substrates and Micro-Channel Coolers.  

**ROHM Semiconductor** ................. Booth 1843  
2323 Owen Street  
Santa Clara, CA 95054 USA  
www.rohm.com  

The ROHM Group leverages the latest technologies to deliver a broad range of products for the power market, from ROHM’s SiC modules to LAPIS Semiconductor’s battery monitoring ICs and Powervation’s intelligent digital power management solutions.  

**Rubadue Wire Company, Inc.** .......... Booth 1643  
1301 N. 17th Avenue  
Greeley, CO 80631 USA  
www.rubadue.com  

Rubadue Wire manufactures wire and cable products for multiple industries around the globe. Specializing in high temperature, high dielectric products for electronics used in various applications. We were the first to design and manufacture Triple Insulated Wire. Currently offering size ranges from 4 AWG to 44 AWG with insulations and dimensions suited to your requirements.  

**Rubycon Corporation** .................... Booth 2256  
4293 Lee Avenue  
Gurnee, IL 60031 USA  
www.rubycon.com  

Manufacturer of electrolytic capacitors, including snap in, screw type, film, electric double layer, polymer multi-layer and hybrid polymers.  

**RWP Electronic Sales** ..................... Booth 2055  
17451 Bastanchury Road  
Yorba Linda, CA 92886 USA  
www.rwpes.com  

RWP Electronic Sales representing:  
Premo / World-class manufacturer of standard and custom wire-wound and planar magnetic components and assemblies and single and three-phase EMC filters  
Premium / Manufacturer of highly-engineered standard and custom AC power supplies, DC/AC inverters and DC/DC converters  
IST Power / Manufacturer of standard and custom high-power, high-voltage single and three-phase transformers, inductors and reactors.  

**Samwha USA Inc.** ......................... Booth 1355  
2555 Melksee Street  
San Diego, CA 92154 USA  
www.samwha.com  

Manufacturer of ROHS and REACH compliant and ISO/TS 16949 certified capacitors and modules, inductors and cores for all electric devices and modules. Value-creating corporation for mankind and environment.
SanRex Corporation ..........................  Booth 2233
50 Seaview Boulevard
Port Washington, NY 11050 USA
www.sanrex.com

Since 1947, SanRex, as a pioneer of semiconductor devices for electrical power, has had considerable success in efforts geared towards new technology. SanRex’s line of Power Semiconductors maximizes efficiency and improves product performance.

SBE, Inc. .................................  Booth 1754
81 Parker Road
Barre, VT 05641 USA
www.sbelectronics.com

SBE Inc. is a leading developer and manufacturer of AC and DC film capacitor solutions for transportation, alternative energy, laser, medical and UPS network applications. SBE has been manufacturing capacitors for over 50 years and has produced over a billion capacitors. The company’s engineering, product development & manufacturing are located in Barre, VT.

Schaffner Trenco LLC ......................  Booth 2146
2550 Brookpark Road
Cleveland, OH 44134 USA
www.trenco.com

Schaffner is a market leader in the design and manufacture of power conditioning, filtering and distribution equipment. Product scope includes basic EMC filters up to large power magnetic devices along with custom engineered solutions. Schaffner serves many markets including VS Drives, Transportation, Renewable Energy, Metals and Power Generation/Backup Systems.

Schunk Hoffmann
Carbon Technology .......................  Booth 1059
Au 62
Bad Goisern, 4822 Austria
www.aluminium-graphite.com

Hoffmann is a world leader in the development and production of carbon and graphite materials and components. Aluminium Graphite (ALG) is our new, cutting-edge product for the power electronics industry. This composite material is an ideal thermal management solution in high reliability applications.

Schurter, Inc. ...............................  Booth 2157
447 Aviation Boulevard
Santa Rosa, CA 95403 USA
www.schurterinc.com

SCHURTER is a leading partner of the electronics and electrical industries for passive and electromechanical components. Our products include: fuses, circuit breakers, connectors, EMC products and Input Systems.

Scientific Test, Inc. ..........................  Booth 2261
1110 E. Collins Boulevard
Suite 130
Richardson, TX 75081 USA
www.scitest.com

STI is a manufacturer of test equipment for power semiconductor devices. In business for over 30 years, we provide ATE as well as Curve Tracer instruments. From incoming inspection and QC, to the device characterization lab and on to the production floor, Scientific Test, Inc. is “Your Discrete Test Source”.

Semikron, Inc. ..............................  Booth 1124
11 Executive Drive
Hudson, NH 03051 USA
www.semikron.com

SEMIKRON is a global manufacturer of electronic power unit components and systems (approx. 2kW to 10MW). The product portfolio ranges from chips, semiconductor discretes, IGBT, diode and thyristor modules, customized solutions and integrated electronic power unit systems.

Semtech .................................  Booth 2137
200 Flynn Road
Camarillo, CA 93012 USA
www.semtech.com

Semtech Corporation is a leading supplier of power, analog and mixed-signal semiconductors for high-end consumer, computing, communications and industrial equipment. Products are designed to benefit the engineering and global community.

ShengYe Electrical Co. Ltd ..........  Booth 1143
Xinxi 4th Road Lunjiao
Shunde district Foshan, Guan 528309 China
www.shengye.com

ShengYe Electrical Co.,ltd, an ISO9001 approved enterprise, specialized in R&D, manufacture, sales and after-sale service of film capacitors and other electrical elements. Strategic partners are with GE, Whirpool, Lennox, Vortice, ABB and Emerson.

Shenzhen Zeasset Electronic Technology Co., Ltd .............  Booth 1033
B1 Building Anle Industrial Pak
Hangcheng Road, Banan District
Shenzhen, China
www.zste.com
Sidelinesoft, LLC ..................... Booth 1163
4213 Rockview Court
Fort Collins, CO 80526 USA
www.sidelinesoft.com

Sidelinesoft develops software for scientific, research, and technological applications, with special interest in electronics. Our product, NL5 Circuit Simulator, has proven itself to be an excellent simulation tool for any field of electronics.

Silicon Frontline Technology, Inc. .................. Booth 1063
4030 Moorpark Avenue
Suite 249
San Jose, CA 95117 USA
www.siliconfrontline.com

Silicon Frontline Technology, Inc. is the creator of SIMPLIS, the leading simulation engine for switched mode power supply design. In partnership with SIMetrix Technologies Ltd we develop and market the SIMetrix/SIMPLIS software products which provides unmatched capabilities for the power electronics designer.

Simplis Technologies ................... Booth 1733
P.O. Box 40084
Portland, OR 97208 USA
www.simplistechologies.com

SIMPLIS Technologies is the creator of SIMPLIS, the leading simulation engine for switched mode power supply design. In partnership with SImetrix Technologies Ltd we develop and market the SIMetrix/SIMPLIS software products which provides unmatched capabilities for the power electronics designer.

SMC Diode Solutions .................... Booth 1019
101 Sunnyside Boulevard
Plainview, NY 11803 USA
www.smc-diodes.com

We manufacture and design our own products which are widely accepted in both domestic and international markets. We follow rigorous qualification standards from large aerospace, communication, and consumer electronics suppliers.

Software Cradle Co., Ltd. ............ Booth 2257
50 Chestnut Street, Suite A-214
Beavercreek, OH 45440 USA
www.cradle-cfd.com

Software Cradle is a leading provider of Computational Fluid Dynamics (CFD) software including SC/Tetra (general purpose unstructured mesh), scSTREAM (general purpose Cartesian mesh), and HeatDesigner (Cartesian mesh for electronics).

Solantro Semiconductor Corporation .................. Booth 1262
146 Colonnade Road
Suite 200
Ottawa, ON K2E 7Y1 Canada
www.solantro.com

Solantro designs and manufactures chips to measure, process and drive power conversion architectures. Its dedicated chipset based on unique Digital Power Processing dP2 technology provides customers with the highest performance and reliability.

Sonoscan, Inc ................... Booth 1435
2149 E. Pratt Boulevard
Elk Grove Village, IL 60007 USA
www.sonoscan.com

Sonoscan is a leader and innovator in Acoustic Micro Imaging (AMI) technology. Sonoscan manufactures acoustic microscope systems and provides laboratory services to nondestructively inspect and analyze products. Our C-SAM microscopes provide unmatched accuracy for the inspection of products for hidden internal defects in SMT devices, ceramic capacitors and resistors, hybrids, MEMs, etc.

SP Control Technologies .......... Booth 1462
Calle Rios Rosas 47
Madrid, 28003 Spain
www.spcontroltechnologies.com

SP Control Technologies is a startup specialized in power electronics control. We develop state of the art technologies, focusing on simplicity. Our products will facilitate and improve the operation of all your electronic devices.

Standex-Meder Electronics .......... Booth 1763
4538 Camberwell Road
Cincinnati, OH 45209 USA
www.standexelectronics.com

Design engineers trust Standex-Meder for high reliability magnetics solutions such as planar transformers & inductors, current, low frequency power and isolation, high-frequency transformers & inductors, and custom electronic components.

Stapla Ultrasonics Corp. ............ Booth 1263
250 Andover Street
Wilmington, MA 01887 USA
www.staplaultrasonics.com
Stellar Industries Corp. .......... Booth 1656
50 Howe Avenue
Millbury, MA 01527
www.stellarind.com

Stellar’s custom products include precision lapped and polished electronic grade ceramics composed of Alumina, Beryllium Oxide, Aluminum Nitride, and other specialty dielectrics. Stellar also provides custom/design specific metallization services on these ceramics using a variety of thick film, thin film, refractory, plated, and Direct Bond Copper technologies.

STMicroelectronics, Inc. .......... Booth 1417
30 Corporate Drive
Suite 300
Burlington, MA 01803 USA
www.st.com

STMicroelectronics, Inc. ST is a major supplier of high-performance ICs and power discretes for power-supply, power-management, motor-control and lighting applications.

Storm Power Components .......... Booth 1442
240 Industrial Park Lane
Decatur, TN 37322 USA
www.stormpowercomponents.com

Sumida America Components America Inc. .......... Booth 2232
1251 N. Plum Grove Road
Suite 150
Schaumburg, IL 60173 USA
www.sumida.com

Sumida America is a global manufacturer of high quality inductive components & modules. Our products are used in various applications within the Consumer, Automotive & Industrial markets. We offer customized & standard components for a broad market.

Synopsys, Inc. ................. Booth 1161
690 E. Middlefield Road
Mountain View, CA 94043 USA
www.synopsys.com

Synopsys is the Silicon to Software™ partner for companies developing electronic products, efficient power electronics and software applications. Synopsys has the solutions needed to deliver innovative, high-quality, secure products.

Syrma Technology .............. Booth 1354
4340 Stevens Creek Boulevard
Suite 275
San Jose, CA 95129 USA
www.syrmatech.com

From RFID technology to power electronics and custom magnetics, we specialize in producing high-mix, flexible volume products in the telecom, networking & communications, power, industrial, medical, automotive, and computing industries.

Taiwan Semiconductor Inc. .......... Booth 1657
3040 Saturn Street
Suite 200
Brea, CA 92821 USA
www.taiwansemi.com

Taiwan Semiconductor is a global supplier of power discrete semiconductor products. TSC provides high quality power control solutions for electronic applications such as power conversion, lighting, motor control, auto, industrial, and commercial.

Taiyo Kogyo Co., LTD ............ Booth 1135
TOC Bldg. 11F-58, 7-22-17
Shinagawa-ku, Tokyo, Japan
www.taiyo-technology.jp/english.html

Taiyo Kogyo manufacturers Heavy Copper/High Current PCB (HCPCB) used in low impedance power conversion, eliminating wires, dissipating heat efficiently. HCPCB combines signal with power on same layer, and embeds busbars such as with IGBT or MOSFET signal driver signal with the capacitor bank power lines, handled by same multilayer PCB.

Tamura Corporation of America .... Booth 1444
1040 So. Andreasen Drive
Suite 100
Escondido, CA 92029 USA
www.tamuracorp.com


TDK Corporation ............... Booth 1323
475 Half Day Road
Suite 300
Lincolnshire, IL 60069 USA
www.tdk.com

TDK offers a complete range of innovative solutions for the power electronics industry. From TDK-Lambda brand of stand-alone AC/DC power supplies and board mounted DC/DC power modules to our line of TDK and EPCOS passive electronic components including MLCCs, aluminum and electrolytic capacitors, ferrites, inductors, wireless power products and more.
Tektronix Inc. ......................... Booth 1061
14150 SW Karl Braun Drive
Beaverton, OR 97077 USA
www.tektronix.com

Today’s power electronic devices may include switch-mode power supplies (SMPS), linear regulators (LDO), voltage references and other power electronics. A single power supply’s performance or failure can affect the fate of a large, costly system. Learn how to make accurate power measurements that are essential to ensure the efficiency, reliability, compliance, and safety of an emerging power electronic and power conversion design.

Teledyne LeCroy ..................... Booth 2037
700 Chestnut Ridge Road
Chestnut Ridge, NY 10977 USA
www.teledynelecroy.com

Teledyne LeCroy is a leading provider of oscilloscopes, probes, and software analysis solutions for power electronics and three-phase testing.

Texas Instruments .................. Booth 1617
12500 TI Boulevard
MS 8680
Dallas, TX 75243 USA
www.ti.com

Texas Instruments will feature several innovative power management applications, including demonstrations and information on power supply control LED lighting, digital power, digital sign control, point of load and DC/DC control solutions.

The Allpower Source
(Div. of Technology Dynamics) ...... Booth 1153
100 School Street
Bergenfield, NJ 07621 USA
www.theallpowersource.com

We will be exhibiting the following unique and high power components for the power conversion industry at extremely competitive prices. Included are Circuit Breakers, Shock Isolators, High Current Heat Sink Extrusions, EMI Filters, Nanocrystalline Cores, Custom Rubber Items, Variable Transformers, Shunts, Unique Fans, Power Resistors, and Super Caps.

The Bergquist Company
(a Henkel Company) .................. Booth 1760
18930 West 78th Street
Chanhassen, MN 55317 USA
www.bergquistcompany.com

The Bergquist Company is the world leader in the development and manufacturing of thermally conductive interface materials. With some of the best-known brands in the business, Bergquist provides solutions for top electronics companies worldwide. Additionally, Bergquist developed Thermal Clad metal core printed circuit boards for complete thermal management systems in surface mount and High Power LED applications.

Thermik Corporation .................. Booth 2046
3304 US Highway 70 E.
New Bern, NC 28560 USA
www.thermik.com

Manufacturer of over-heating/over-temperature protection products, including snap action, re-settable, bimetal thermal protectors (thermostats) temperature limiting switches and PTC Thermistor temperature sensors for electrical and electronic equipment.

TowerJazz ......................... Booth 1521
2570 N. 1st. Street
Suite 480
#500
San Jose, CA 95131 USA
www.TowerJazz.com

TowerJazz offers a leading BCD process platform and a customizable LDMOS (5V to 80V) process, providing design optimization and the smallest die size with the highest efficiency at any given breakdown voltage. TowerJazz also offers an unrivaled 700V power platform to address the rapidly emerging, energy saving LED lighting market.

Transim Technology ................ Booth 1517
433 NW 4th Avenue
Suite 200
Portland, OR 97209 USA
www.transim.com

Transim Technology, the global leader in cloud based engineering solutions, creates revolutionary design tools backed by exceptional engineering/software expertise. Come check out our cool new tools that facilitate the engineering design process.

Transphorm ......................... Booth 2133
115 Castilian Drive
Goleta, CA 93117 USA
www.transphormusa.com
Transphorm is the first company to offer complete solutions to inefficient electric power conversion powered from the ac line using GaN diode and HEMT devices. Transphorm designs and supplies application specific products based upon its high voltage (600 v), superior performing EZ GaNTM technology.

**Triad Magnetics**  
Booth 1645  
460 Harley Knox Boulevard  
Perris, CA 92571 USA  
www.triadmagnetics.com

Triad Magnetics is a global leader in the design and manufacture of Transformers, Power Supplies, and Inductors. Look for us in the Industrial/Commercial, Renewable Energy, Medical, Power Conversion/Measurement and Audio/Sound Processing markets.

**TSC Ferrite International**  
Booth 1836


**TT electronics**  
Booth 1936  
4200 Bonita Place  
Fullerton, CA 92835 USA  
www.ttelelectronics.com

TT electronics is a focused, global electronics group supplying leading manufacturers in the defence, aerospace, medical, transportation and industrial electronics markets.

**Typhoon HIL, Inc.**  
Booth 2153  
35 Medford Street  
Suite 305  
Boston, MA 02143 USA  
www.typhoon-hil.com

Typhoon HIL, Inc. is the market and technology leader in the rapidly-growing ultra-high-fidelity controller-Hardware-in-the-Loop (cHIL) for power electronics, microgrids, and distribution networks.

**United Chemi-Con**  
Booth 1825  
1701 Golf Road 1-1200  
Rolling Meadows, IL 60008 USA  
www.chemi-con.com

Passive Components. World’s Largest Aluminum Electrolytic Capacitor manufacturer including Screw terminals, snap-in, radial, SMD and Polymer and Hybrid. We are also the largest etched aluminum foil raw material supplier to that market.

**United Silicon Carbide, Inc.**  
Booth 1844  
7 Deer Park Drive  
Suite E  
Monmouth Junction, NJ 08852 USA  
www.unitedsic.com

United Silicon Carbide, Inc manufactures silicon carbide (SiC) Power Devices, specializing in JFETs, BJTs, and Schottky Diodes for power electronics. USCI designs, fabricates, and tests all of our devices in our manufacturing facility located just north of Princeton, along New Jersey’s Einstein Alley.

**University of Texas – Dallas**  
Booth 1243  
800 W Campbell Road, EC33  
Richardson, TX 75080 USA  
www.utdallas.edu/research/REVT

The Renewable Energy and Vehicular Technology (REVT) lab at the University of Texas at Dallas is a center of higher education and research with over 25 researchers who are actively working on a range of projects related to affordable, sustainable, and cutting edge solutions for energy, water, and healthcare.

**VAC Sales USA LLC**  
Booth 1425  
2935 Dolphin Drive  
Suite 102  
Elizabethtown, KY 42701 USA  
www.vacuumschmelze.com

Vacuumschmelze GmbH (VAC Sales USA) is a leading global manufacturer of magnetic materials and inductive components made from these alloys. Our Vitroperm nanocrystalline magnetic cores uniquely combine high permeability with low loss. Our products include tape wound cores, common mode chokes, closed loop current sensors, current transformers, gate drive transformers and power transformers.

**Venable Instruments, Inc.**  
Booth 1732  
8656 Highway 71 West  
Cuesta Centre, E Bldg  
Austin, TX 78735 USA  
www.venable.biz

Venable Instruments is an industry leader offering a broad range of tools for design/testing of feedback control loops and impedance measurements. Venable specializes in frequency response analyzers, injection transformers, analysis software for gain/phase plotting and design tools to synthesize stable loop compensation. Loop design application includes analog and digital power supplies, motion control, PFC, and inverters.
Versatile Power .................. Booth 1863
743 Camden Avenue
Campbell, CA 95136 USA
www.versatilepower.com

Versatile Power has a long history of designing robust power supplies for military, commercial, laboratory and medical applications. Founded in 2002, Versatile Power offers a line of standard power supplies as well as custom-design power solutions.

Viking Tech America Corporation .................. Booth 1953
70, Kuanfu N. Road
HsinChu Industrial Park, Hukou
HsinChu 303, Taiwan
www.vikingamerica.com

Viking Tech Corporation has been manufacturing Passive Components since 1997, offering Thick/Thin Film Resistors, Thin Film Inductors and Ceramic Capacitors with exceptional quality and service. Our main products include Thin Film Resistors, Power Resistors, Low Ohm Resistors, Current Sensing Resistors, RF Inductors, Chip Beads, Common Mode Filters and Power Inductors.

Vincotech GmbH .................. Booth 1361
Biberger Strasse 93
Unterhaching, 82008 Germany
www.vincotech.com

Vincotech designs and manufactures a wide range of power modules from 4A to 1800A and 600V to 2400V. Topologies include IPMs, PIMs, sixpacks, rectifiers, PFC, H-bridges, half-bridges, and boosters as well as NPC/MNPC/AM-NPC and custom modules.

Vishay Intertechnology, Inc. .................. Booth 2017

Vishay Intertechnology is one of the world’s largest manufacturers of discrete semiconductors and passive electronic components. These components are used in virtually all types of electronic devices and equipment, in the industrial, computing, automotive

Voltage Multipliers, Inc. .................. Booth 1533
8711 W. Roosevelt Avenue
Visalia, CA 93291 USA
www.voltagemultipliers.com

VMI designs and produces high voltage diodes, optocouplers, power supplies, and assemblies. Using the latest technology and state-of-the-art equipment, our data-driven manufacturing practices, dedicated teams, and reliable processes come together to make the most reliable products available on the market. VMI delivers standard and custom solutions to our customers.

Wakefield-Vette Thermal Solutions .................. Booth 1133
121 Jasmine Court
Driftwood, TX 78619 USA
www.vettecorp.com

Wakefield-Vette Thermal Solutions is a Global supplier that specializes in solving thermal challenges at the component, system and facility level. Wakefield-Vette owns and operates their own manufacturing facilities around the world. Our specialty includes cooling board level components to complex liquid cooling assemblies along with passive and active thermal management solutions. Products include, aluminum and copper heat sinks, cold plates, fans, heat pipes and hybrid assemblies.

West Coast Magnetics .................. Booth 1537
PO Box 31330
Stockton, CA 95213 USA
www.wcmagnetics.com

Wolfspeed, A Cree Company ........ Booth 1633
3028 E Cornwallis Road
Research Triangle Park, NC 27709 USA
www.wolfspeed.com

The broadest, most field-tested & fully commercialized portfolio of SiC power MOSFETs, diodes & modules, increasing the applications supported by WBG technology & enabling more capable power systems for a responsible, energy-efficient future.

Wolverine Tube Inc. – MicroCool Division ........ Booth 1460
2100 Market Street NE
Decatur, AL 35601 USA
www.microcooling.com

MicroCool has leveraged Wolverine’s proprietary MDT technology to produce novel cold plates and integrated base plates for optimal liquid cooling solutions for the electronics industry.

Wurth Electronics Midcom Inc. ........ Booth 1933

Wurth Electronics Midcom globally leads the design and manufacture of custom transformers and magnetics. Catalog products include inductors, ferrites, chokes, capacitors, LEDs, and connectors.

Two online tools help engineers design in magnetics including the Smart Transformer Selector, for isolated designs, and REDEXPERT, for non-isolated designs.
Wurth Electronik
Wireless Charging .......................... Booth 001
121 Airport Drive
Watertown, SD 57201 USA
www.we-online.com

X-FAB Semiconductor Foundries .................. Booth 1926
275 Saratoga Avenue
Santa Clara, CA 95050 USA
www.xfab.com

As the leading foundry group for analog/mixed-signal semiconductor applications, X-FAB manufactures wafers in geometries ranging from 1.0 to 0.13 micrometer on CMOS and special BCD, SOI and MEMS processes in five fabs worldwide. Its comprehensive designecosystem includes services and tools for developing diversified power/HV, MEMS, opto and analog products – all backed by X-FAB’s more than 20 years of solid analog/mixed-signal foundry expertise.

XiTRON Technologies .................. Booth 1227
7507 Convoy Street
San Diego, CA 92111 USA
www.xitrontech.com

XiTRON Technologies is the premier source of precision power testing and measuring equipment for industrial and consumer product development, manufacturing, and ENERGY STAR testing. Solutions include Power Analyzers, Phase Angle Voltmeters, DC & Temperature Calibrators, Ohmmeters, and more. Please stop by our booth and let us solve your testing needs.

Yokogawa Corporation of America .................. Booth 1343
2 Dart Road
Newnan, GA 30265 USA
www.tmi.yokogawa.com

For 100 years, we have offered precision instruments to test power supplies, converters, motor drives, inverters and other power electronics circuits and systems. Visit us at booth 1343.

Yole Developpement .................. Booth 1554
Le Quartz
75 cours Emile Zola
Villeurbanne, 69100 France
www.yole.fr

Beginning in 1998 with Yole Developpement, we have grown to become a group of companies providing market research, technology analysis, strategy consulting, media in addition to finance services.

ZES ZIMMER Inc. .................. Booth 1739
2850 Thornhills Avenue SE
Grand Rapids, MI 49546 USA
www.zes.com

ZES ZIMMER is a German manufacturer uniquely dedicated to measuring electric power: precision Power Analyzers & accessories. Proprietary advantages regarding inverters, frequency converters & other PWM devices. Versatile, affordable, friendly.

Zhuzhou CRRC Times Electric Co., Ltd .................. Booth 1037
Shidai Road
Shifeng District
Zhuzhou, Hunan China
www.tec.csrzic.com

Is a $2 billion global drive & control system company that also designs and manufactures power electronics by providing its customers power semiconductors, laminated bus bars, capacitors, thermal management and voltage & current sensors. We have extensive power electronics knowledge and capabilities bringing over 50 years of experience in this field.

Zipalog .................. Booth 1045
850 Central Parkway E
Suite #160
Plano, TX 75074 USA
www.zipalog.com

Zipalog provides verification services and solutions for analog integrated circuit design. The executive team has more than 40 years of experience in analog, mixed-signal, and power management integrated circuit design and electronic design automation.
APEC would like to recognize the following publications for their generous support of the APEC 2016 Conference and Exposition:

- ALL ABOUT CIRCUITS
- appliance DESIGN
- BATTERY POWER PRODUCTS & TECHNOLOGY
- Bodo's Power Systems
- CHARGED Electric Vehicles Magazine
- WTWH Media LLC
- ELECTRONICS SOURCING
- HOW2POWER.com
- MAGNETICS BUSINESS & TECHNOLOGY
- i-Micronews
- POWER ELECTRONICS EUROPE
- Power Systems Design: Empowering Global Innovation