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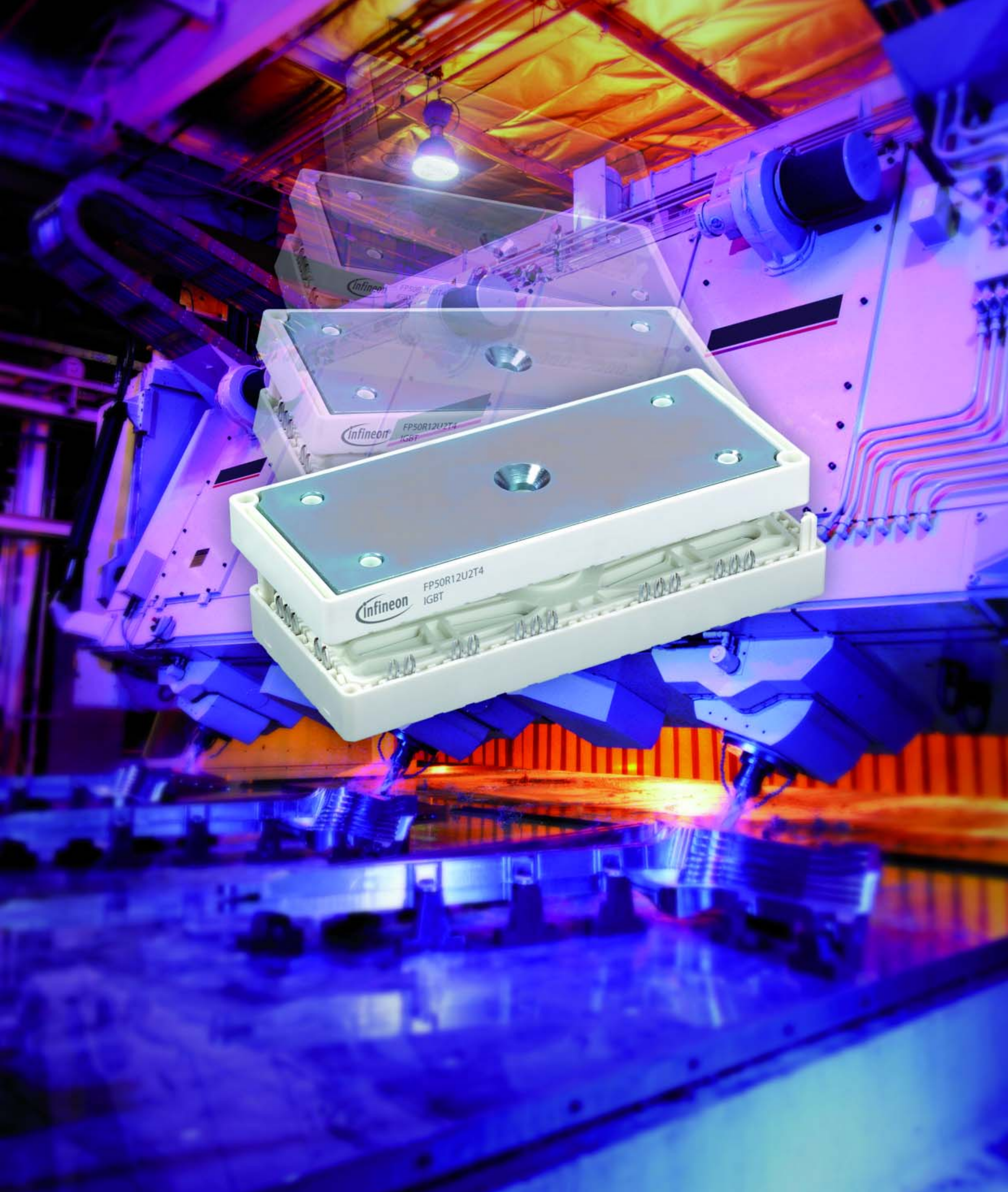
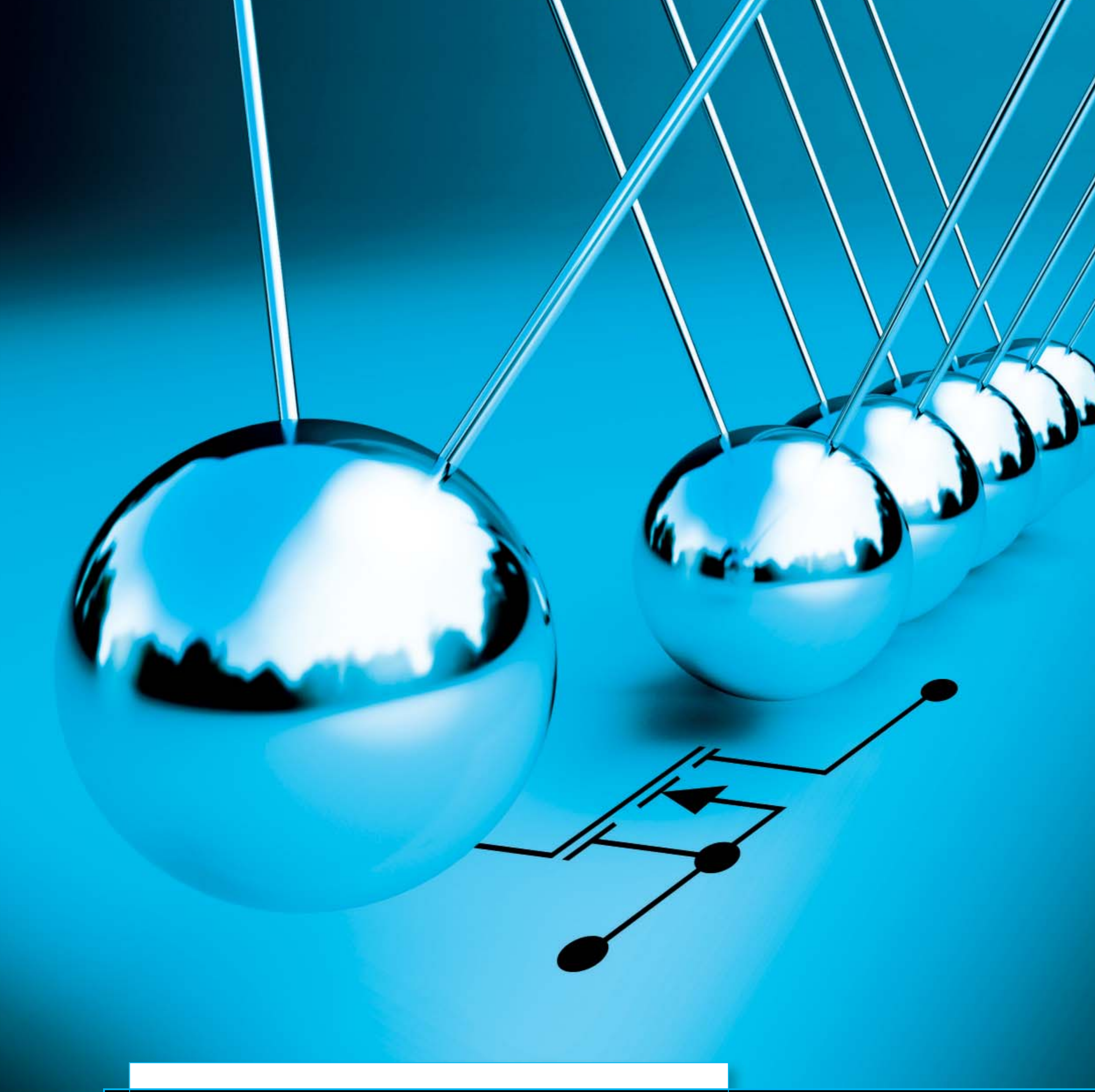
Bodo´s Power Systems®

Electronics in Motion and Conversion

June 2012

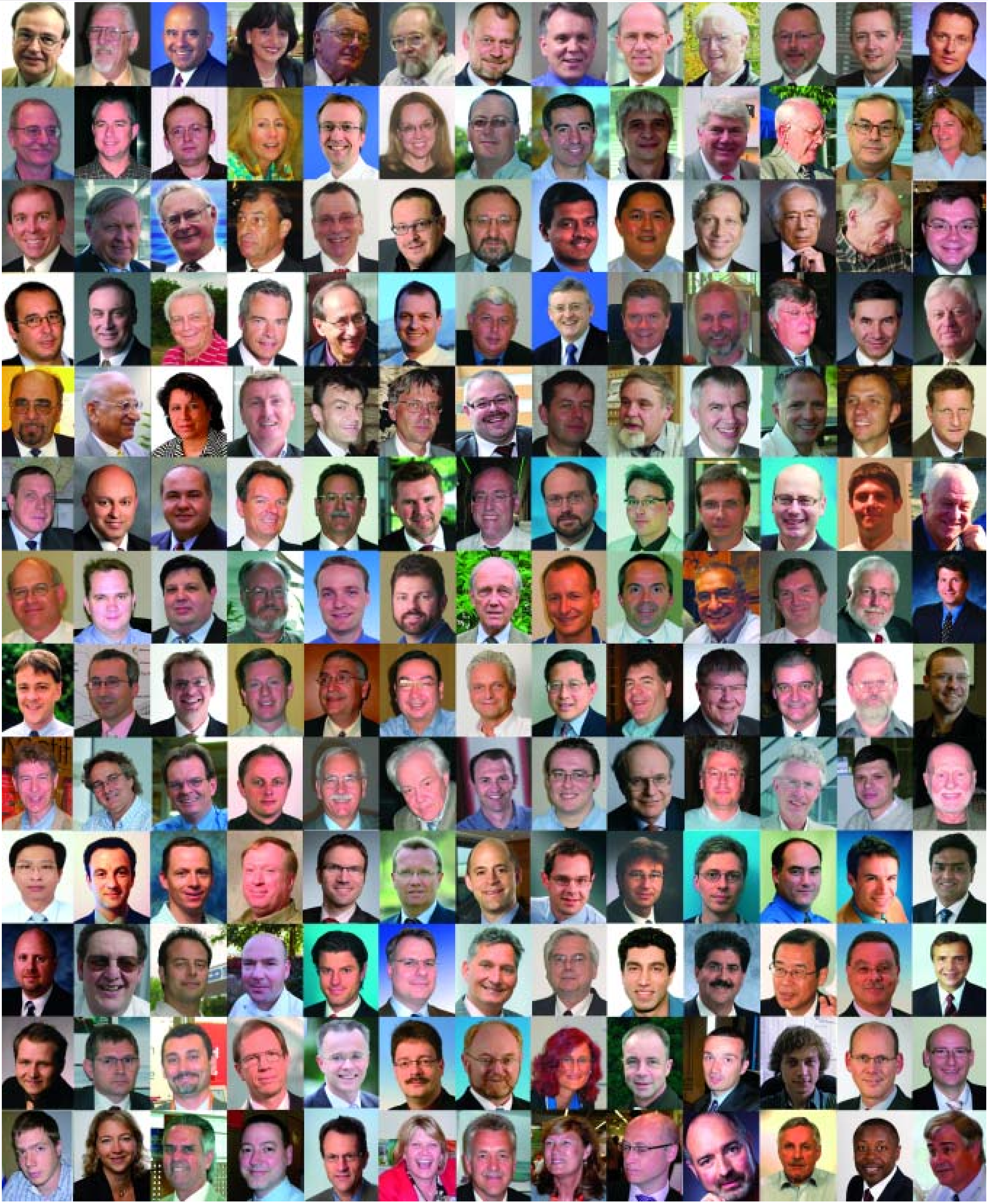




CONTENTS

Bodo´s Power Systems®

The Gallery



Expansion of Munich Technology Development Centre

FAIRCHILD
SEMICONDUCTOR®
The Right Technology for Your Success™

The extended focus comprises

- Device and process simulation
- High Power Package development
- Technologists and Application experts for SuperJunction and Wide Bandgap Materials
- Automotive High Voltage Technical Marketing

The newly formed R&D centre, located in Munich, provides opportunities to new members to closely work with existing global Fairchild Technologists in US, Sweden and Korea, as well as to work in partnerships with Research institutes and hand selected partnership programs with competitors.

Packaging Development Engineer

Job description:

You will be responsible to investigate new materials for the power semiconductor packaging, develop new packaging technologies and processes. You will define the design of new power semiconductor packages based on requirements from different applications in terms of functionality, quality and costs. Moreover you will support the assembly lines in the assessment and introduction of new assembly processes and equipment.

Job requirement:

We are looking for highly innovative and self-motivated individuals with a Master or PhD degree in Microsystems Technology, Material Science or Physics. At least 4 years experiences in the design of power semiconductor packages are desired. Mechanical and thermal simulation skills, experience with 3D mechanical CAD experience is of advantage.

HV Technical Product Marketing Manager

Job description:

Work with automotive OEM’s and suppliers to understand EV/HEV projects, requirements, and timing. Develop Fairchild product roadmaps for HV IGBT’s, MOSFET’s, Rectifiers, and Gate Drivers aligned with business strategy and opportunities and interface with Technology Development to coordinate technology roadmaps. Develop business cases for product developments and champion through the process. Launch new products, manage roll out and promotions to achieve objectives. Interface with automotive sales, providing product technical training and support.

Job requirement:

We are looking for innovative and self-motivated individuals, Master degree in Electrical Engineering, Physics or similar is a must, business background and Automotive experience is an advantage. At least 3 years of professional experience required.

Device Simulation/Technology Experts

Job description:

Development and architectural innovation for Fairchild´s next generation High Voltage power devices including IGBT, SuperJunction FETs, SiC and GaN devices. You will be closely collaborating with teams in Sweden, US and Korea for process and package development.

Job requirement:

We are looking for highly innovative and self-motivated individuals, Master or PhD degree in Electrical engineering, Physics or similar. At least 3 years of professional experience required.

Application and Marketing Manager, Silicon Carbide Technology

Job description:

You will be adding value to the systems of our customers, and at the same time realize and enabling the true value of Fairchild´s SiC components. You are a strong driver and will develop yourself towards a leading role and towards truly technology based business and market development.
Your knowledge of manifold approaches on power stage design impacts the rest of the system, e.g. cooling, control and filtering will enable novel power conversion designs to make use of the superior performances of our silicon carbide components.

Job requirement:

We are looking for highly innovative and self-motivated individuals with Master or PhD degree in Electrical engineering, Physics or similar. You have collected a solid background as power electronics designer in the power conversion industry and a deep understanding of power devices and converter systems.
At least 5 years of professional experience required. The location of this role could be either Kista/Sweden or Munich/Germany.

We offer:

Start-up spirit in highly inspirational and expanding team in Munich; space for fundamental and scientific research; very competitive, performance oriented compensation schemes; high strategic impact and visibility within a global company.

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Events

ISPSD 2012,
Bruges Belgium,
June 3rd-7th www.ispsd2012.com/

Intersolar,
Munich Germany, June 11th-15th
www.intersolar.de/

PCIM ASIA,
Shanghai China, June 19th-21st
www.pcimasia.com/

CWIEME,
Berlin Germany, June 26th-28th
www.coilwindingexpo.com/

Technology in Electromobility,
Wiesbaden, Germany, July 4th-5th
www.vdi.de/

SEMICON WEST,
San Francisco CA, July 10th -12th
www.semiconwest.org/

Leichtbaustrategien Automobilbau,
Stuttgart, Germany, July 10th -11th
www.vdi.de/

Always Show Time!

See you again soon at the Intersolar in Munich or the PCIM Asia in Shanghai. It is always show time somewhere in the world! Our world is one market place and innovation travels instantly.

PCIM Europe, together with SMT, was a great success with an impressive increase in both attendees and exhibitors and a great technical program which showed the synergy between power applications and the optimization of manufacturing process technology. A number of visitors wished for an extra day to fit in all the exciting presentations of product and technology at both shows.

SiC and GaN semiconductors have become a practical source for efficient designs with all semiconductor manufacturers releasing product for production. The years of promise and outlook have turned into products available for design. Efficiency for sure, but also reduced space, weight and long-term reliability are important for most applications. These are the subjects of the SiC work shop in Kista, which has a long tradition of studying the outlook for GaN and SiC.
While SiC rectifiers have achieved some common acceptance, wide band gap transistors demonstrate a great deal of diversity: depletion FETs shown in cascode combinations, N-type MOSFETs for a more or less drop-in replacement, SiC BJTs, as well as GaN as both depletion and enhancement modes, discrete and integrated products. And IGBTs are under development in SiC, intended for high voltage applications.

Designers should opt for a new design, rather than just implement new technology in old designs. A new generation of switches requires new circuit designs. Historically, many companies are afraid of what is not standardized while innovative forward-looking companies make real progress. Looking back in my Engineering life in the 80´s, working in applications and marketing, I learned that using MOSFETs and IGBTs required overcoming traditional bipolar thinking. But back then, relatively few engineers opened their minds to the new potential advantages and pushed the new devices into designs. Of course, once a new application is successful, it will find fans and followers around the globe and this will always be the case. My friend, Don Burke, who has survived seven technology changes, recently remarked that his engineering department expenditures to introduce Power MOS into a bipolar environment at RCA exceeded their sales for more than five years but afterwards, the whole manufacturing plant made nothing else.

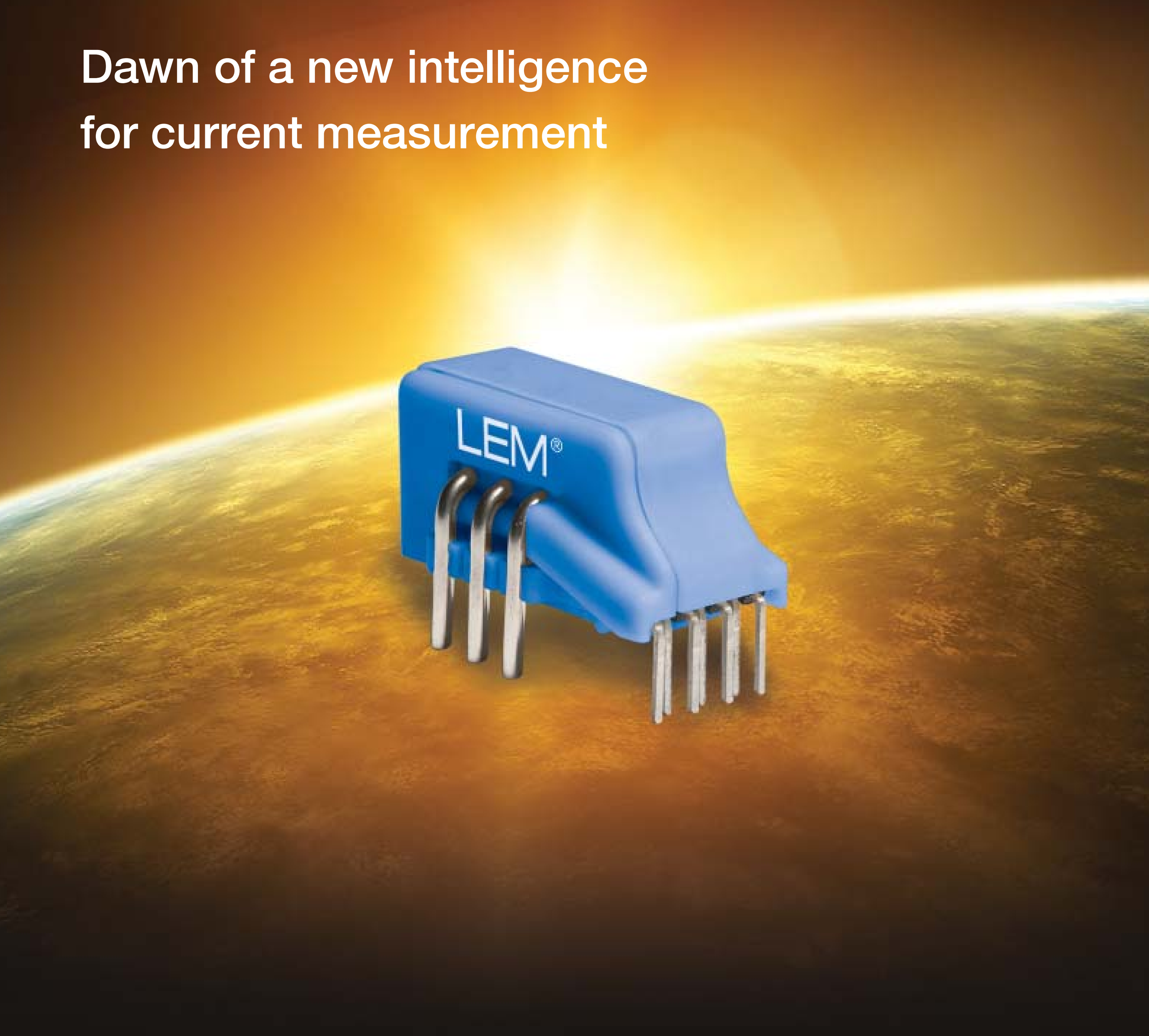
I just remember that my first IGBT in volume ran a variable speed drive in a Braun kitchen appliance. The inventor Frank Wheatley while at RCA Mountaintop, created a switch called a Comfet and changed the world significantly! It adapted to higher voltages and broadened the portfolio of all power semiconductor manufacturers around the world. It was a preferred switch in line-voltage applications, motor drives, ignition systems for combustion motors and even in tiny cell phone flash lamps, etc., etc. What a story! From today's perspective it is a success story comparable to that of microcontrollers. These developments form the basis of our modern designs for the efficient usage of energy in conversion and variable speed drives.

Communication is the only way to progress. We delivered twelve issues last year and will continue this year each month, on time, every time. So far this year we have published 440 pages and 74 articles. As a media partner, Bodo's Power Systems is internationally positioned. Don't miss our Chinese version: www.bodospowerchina.com.

My Green Power Tip for June:
Open the windows at night, turn off the lights and get fresh, cool air with no mosquitoes. This saves a lot of air-conditioning energy - a great green approach.

See you in Shanghai!
Best regards

Dawn of a new intelligence for current measurement



HO

Conventional current transducers are over. The age of intelligent, interactive transducers begins with the dawn of the programmable HO. Set its operational characteristics using a simple microcontroller interface to meet your applications' needs. Its outstanding performance gives you better control and improves the efficiency of your system whilst minimising inventory with one configurable device.

The future starts now!

- Three programmable ranges: 8 A_{RMS}, 15 A_{RMS}, 25 A_{RMS}
- Single +5V or +3.3V power supply
- Through-hole and SMT packages
- Up to 8 mm creepage and clearance distances + CTI 600 for high insulation
- Half the offset and gain drifts of previous generation
- Overcurrent detection with programmable thresholds
- Programmable slow (6 µs) or fast (2 µs) mode
- Up to 4 programmable internal reference voltages
- Access to voltage reference
- -40 to +115°C operation

www.lem.com

At the heart of power electronics.

40 Years Anniversary 1972 - 2012

LEM

Indium Corporation Names Marketing and Technology Specialist

Indium Corporation announces that David Socha has been named Marketing and Technology Specialist. David analyzes and monitors adjacent markets for relevant technology developments. He also assesses and identifies possible opportunities for Indium Corporation and its customers. His previous experience includes researching new markets, writing grant applications and patents, and laboratory management. He earned a bachelor's degree in applied economics and business management from Cornell University, and a bachelor's degree in chemistry from the University at Albany. He holds several US patents for LED and solid state lighting devices.

David is based at Indium Corporation's Global Headquarters in Clinton, NY, and resides in Whitesboro.

www.indium.com

General Russel Honore will Present Keynote Speech

INTELEC 2012 announces that General Russel Honore will present the Keynote speech at this year's INTELEC conference to be held between September 30 and October 4, 2012 at the Talking Stick Resort and Conference Center in Scottsdale, Arizona. General Honore, who was the leader of Task Force Katrina, will talk about his experience with disaster recovery and the implications for communications infrastructure.

INTELEC©, the International Telecommunications Energy Conference, is the annual world-class technical forum which presents the latest developments in communications energy systems and related power-processing devices and circuits. This Conference, which serves the broad community of researchers, suppliers and operators, explores new technologies of power conversion, energy storage and systems for telecom applications and environment.

www.intelec.org/intelec2012

Appointment for New Executive as President of Asia Region

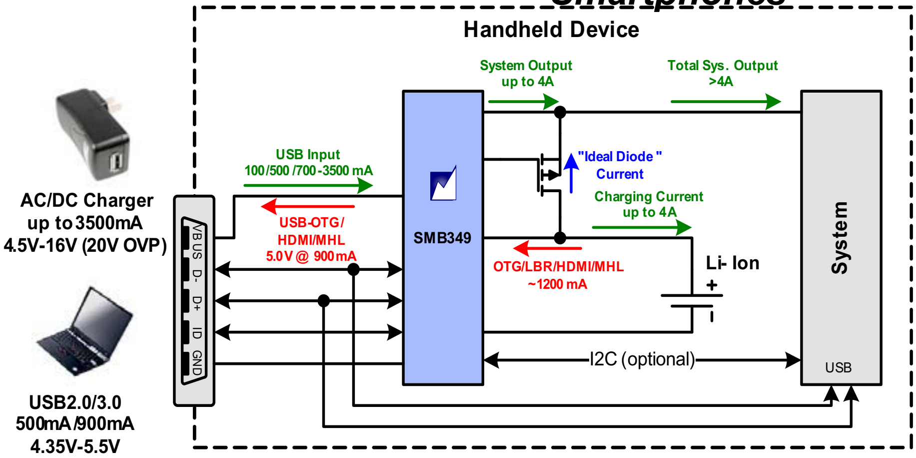
Rogers Corporation announced the appointment of Helen Zhang as President of Asia Region to oversee the Company's growing business in Greater China and throughout the Asia-Pacific region. Zhang will be responsible for driving Rogers' growth strategy in Asia across the Company's three core businesses of Printed Circuit Materials, Power Electronics Solutions and High Performance Foams. Bruce Hoechner, President and CEO of Rogers Corporation said, "Rogers now generates over half of its revenues from Asia and we are positioning the Company to capture even greater growth ahead. I am confident that Helen's strong track record of leading and growing global businesses in Greater China and across Asia will be instrumental to strengthening our market position in the region and advancing our strategic initiatives."

Zhang joins Rogers from Dow Chemical where she served most recently as Global General Manager for the Interconnect Technology business of Dow Electronic Materials. Prior to Dow, she spent 20 years with Rohm and Haas in leadership positions in its Paint & Coatings, Adhesives & Sealants, and Specialty Polymer businesses, and managed two Asian joint ventures. Zhang holds an Executive MBA from the GuangHua Business School of Beijing University and a BS degree in Environmental Chemistry from Beijing Polytechnic University.

www.rogerscorp.com

Finally! Charge Big Batteries Fast With 4A Chip-Scale Li-Ion Charger ICs

Flexible USB/AC Input from +3.6V to +16V, Tiny Solution Size, I²C Programmable Parameters and Built-In Safety – Ideal for Tablets and Smartphones



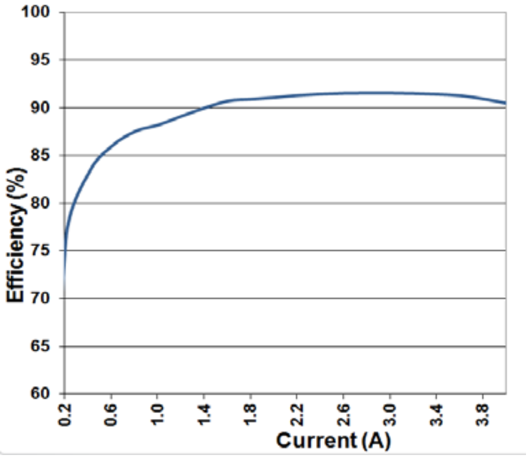
Applications

- Tablets
- Smartphones
- E-Readers
- UltraBooks
- Battery "JuicePacks"
- Portable Gaming
- Portable Digital Video

Features

- +3.6V to +16V Operating Input (+20V OV Protection)
- Fast-Charging, Flexible 4A Switch-Mode Architecture
  - *TurboCharge*™* current-multiplier cuts charge time by 30%-60%
  - *TurboCharge+*™* auto-float voltage control (AFVC) further reduces charge time by compensating for internal battery impedances
  - *CurrentPath*™ with dual outputs for system/battery (SMB349) supports instant-on with dead/missing battery
  - *FlexCharge/FlexCharge+*™* auto power source detection (APSD/AIVD) per USB2.0/3.0/BC1.2 to detect USB or AC/DC source +5V to +16V
  - *OptiCharge*™* auto input current limit (AICL) detects and adapts to source current limit to maximize available power
- I²C Programmable Parameters and Functions with NV Configuration
- *SafeCharge*™ safety features support JEITA/IEEE1725
  - Battery and IC over-voltage/current/temperature protection
  - Trickle charge for deeply-discharged cells
  - Safety timers and fault monitors/reporting
- Tiny 3.2 x 3.0 CSP and 52mm²/1.2mm z-height solution size

Industry's Highest System Efficiency



	SMB349	SMB359	SMB347	SMB137C	SMB346	SMB136C
Input Voltage Range (V)*	4.35 to 16 (20)	4.35 to 16 (20)	4.35 to 6.2 (20)	4.35 to 6.0 (18)	4.35 to 6.2 (20)	4.35 to 6.0 (18)
# of Inputs/Outputs	1/2	1/1	2/2	2/2	2/2	1/2
Maximum Charge Current (mA)	4000	4000	2500	1500	1250	1500
Maximum Input Current (mA)	3500	3500	2500	1500	2500	1500
CurrentPath™ Control	√		√	√	√	√
Charge Current Voltage Output	√	√	√		√	
Low-Battery Recovery Mode				√		√
Automatic Power Source Detection **	rev 1.2	rev 1.2	rev 1.1/1.2	rev 1.2	rev 1.1/1.2	rev 1.2
Package	3.2x3.0 CSP-49 5x5 QFN-40	3.2x3.0 CSP-49 5x5 QFN-40	3.0x2.5 CSP-30	3.0x2.5 CSP-30	3.0x2.5 CSP-30	3.0x2.5 CSP-30
Solution Size (mm2)	52	52	32	38	32	35

All chargers have Battery Thermal Protection & JEITA Support, IC Thermal Protection, Auto Input Current Limit, Safety or Watchdog Timers, Programmable Charging Parameters, I2C Interface, USB On-The-Go, TurboCharge™ Mode*

** Patent granted or pending*

For more information see:
www.summitmicro.com/SMB349

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MICROELECTRONICS
Programmable Power for a Green Planet™

APEC 2013, March 17 - 21, 2013 Long Beach, CA

APEC 2013 continues the long-standing tradition of addressing issues of immediate and long-term interest to the practicing power electronic engineer.

Topics Papers of value to the practicing engineer are solicited in the following topic areas:

- AC-DC and DC-DC Converters
- Power Electronics for Utility Interface
- Motor Drives and Inverters
- Devices and Components
- System Integration
- Modeling, Simulation, and Control
- Manufacturing and Business Issues
- Power Electronics Applications

Upload your paper at http://apec2013.e-papers.org no later than Monday, July 9, 2012.

Notification that a submission was accepted or declined will be emailed no later than October 8, 2012.

Final submission and registration will be accepted no later than November 19, 2012.

At APEC 2013, the technical sessions will be given on March 19 - 21, 2013

www.apec-conf.org

Innovation Award to Spanish Research Team from Univ. Politécnica de Madrid

Spanish research team comprising José A. Cobos, Oscar García, Roberto Prieto, Pedro Alou, Jesús A. Oliver and Miroslav Vasiæ from Univ. Politécnica de Madrid have been awarded the SEMIKRON Innovation Award for their concept “RF Power Amplifier with Increased Efficiency and Bandwidth”. The SEMIKRON Young Engineer Award goes to Lars Lindenmüller of the TU Dresden for his research on the “Forced Evacuation Switch”.

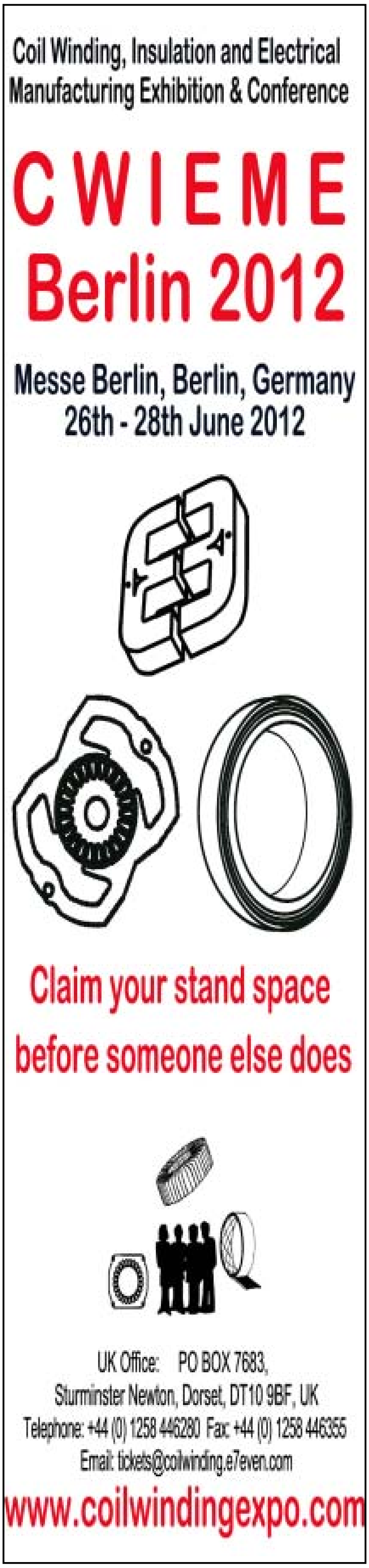
photo : Dirk Heidenreich, Lars Lindenmüller, José A. Cobos, Oscar García, Prof. Dr. Leo Lorenz

These awards, presented at this year’s PCIM Europe in Nuremberg, are awarded by the SEMIKRON Foundation and the European Center for Power Electronics (ECPE) for excellent projects, products and services and innovative concepts in the field of power electronics.

18 entries were received, 8 of which were also nominated for the Young Engineer Award. The jury’s decision to award the prize to the Spanish research team from Univ. Politécnica de Madrid was based on the fact that their concept “RF Power Amplifier with Increased Efficiency and Bandwidth” is instrumental in saving energy in base stations used in mobile communications systems such as satellite coms or mobile phones. This crucial technological breakthrough is based on a new switching topology featuring new power components in the power amplifier. This new solution will deliver a 30% energy saving in comparison to conventional systems, which, if projected to the many mobile communications systems in use today, will lead to immense cost savings and reduced CO2 emissions.

According to the jury’s statement, the innovation developed by Lars Lindenmüller from the Technische Universität Dresden - “Reduced switching losses by forced evacuation” - is based on high-power medium- frequency resonant converters such as those used in intelligent power networks, renewable energy applications or high-speed trains, for example. In his converter topology, Lindenmüller uses high-power IGBTs, the losses from which could be significantly reduced using dedicated IGBT clocking and a demagnetizing network. Since in most of these applications the converter is in permanent use, this innovation results in an increase in efficiency and a significant reduction in CO2 emissions.

www.semikron-stiftung.com



Good Reviews for Acoustic Microscope

Last July, when Sonoscan introduced its Gen6 high-end laboratory acoustic microscope, the designers of the microscope were eager to see reports from the field. One innovation was Sonolytics™ software, an advanced and very smooth Graphical User Interface.

The reports are now coming in. “The big difference,” one user commented, “is that the Gen6 system allows me to concentrate on the parts I’m working with, and on getting data and images from those parts, rather than concentrating on the details of operating the microscope.” Another user called the software “precisely intuitive” in getting him the results he needs, while also saving time by cutting out unneeded tasks.

Users also remarked that it was very useful to be able to select any resolution from <1 megapixel to 268 megapixels, rather than being limited to prescribed values.

Also new in the Gen6 system was the PolyGate™ module , which lets the operator “slice” a part into as many as 200 thin slices and make an image of each slice during a single scan. Designers of the Gen6 system thought that PolyGate analysis would be most useful in imaging multilayer samples and bulk materials such as ceramic.

What designers did not anticipate was the extent to which inventive users would make thin-slice images of plastic-encapsulated microcircuits in order to determine, for example, whether the die was tilted.

Another Gen6 system innovation is a 500MHz pulser having improved signal stability, important for example in 230, 300 or 400 MHz imaging of flip chip underfill, bumps and related features.

www.sonoscan.com

Power Electronics Platform PowerGuru.org is Online

The new online platform is a joint project between power electronics manufacturers LEM, Mersen, Proton-Electrotex, SEMIKRON, Sindopower, TDK Epcos, and Weidmüller.

The communications platform focuses on the needs of engineers working in the power electronics field. On the website, experts can find both the fundamental principles of power electronics and also detailed technical information. PowerGuru is currently based on texts about partner products such as IGBTs, thyristors, diodes, sensors, capacitors, varistors, terminals and fuses, texts on design, and texts on the fundamentals of power electronics. Further articles on the applications of bridge rectifiers, induction, industrial drivers, lifts, UPS automotive or on the use of power electronics components in solar plants and wind parks will be added at a later date. All articles published on the site will also be archived.

www.powerguru.org

Würth Elektronik joins Wireless Power Consortium

The aim of the Wireless Power Consortium is to work on the development of the so-called QI standard. Ninety countries from around the world are contributing in this consortium towards a pioneering charging technology.

The QI standard (QI is pronounced „chee“) is a world-wide standard for wireless charging stations of mobile electronic devices such as mobile telephones or mobile cameras. The innovation lies in the idea that charging through wired power chargers is replaced by a QI charging surface. By simply placing the device onto the charging surface it is charged through magnetic induction. The QI interface guarantees the compatibility of the devices so that every device, independent of manufacturer or brand, can be charged on the charging surface.

www.we-online.com

www.wirelesspowerconsortium.com

LED professional Symposium + Expo 2012 Announces Program

From September 25th to 27th, 2012, global key players from the fields of industry and research will be meeting in Bregenz, Austria for the second time to discuss the latest developments in LED technology.

Siegfried Luger, founder and CEO of Luger Research e.U. made the following comments about the program for 2012: “After the success of our first symposium, this year the “Call for Papers” resulted in double the amount of submissions. The high quality of the papers made the selection process extremely difficult, but with the help of our advisory board with its two new members, we were able to cover a wide area of subjects and fields of interest. Due to the excellence of this year’s submissions, we decided to incorporate an additional session.”

The contents of the symposium are multi-faceted, current and relevant to the subject of LEDs in relation to the Digital Agenda for Europe, research & development as well as industrial and end user applications.

There will be 8 sessions with a total of 26 presentations which will cover topics such as Disruptive LED and Light Conversion Technology, LED Optics and Electronic Systems Design, LED Production Technologies & Materials, LED System Standardisation & Measurement, LED System Reliability and LEDs in Outdoor Lighting Applications.

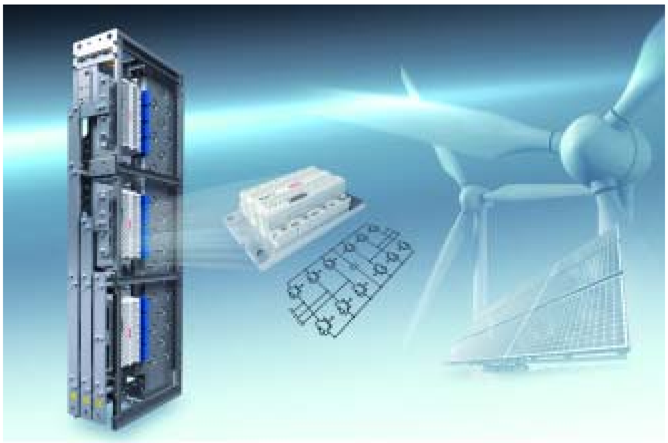
The Early Bird discount of 15% for delegates is available until June 30th. To take advantage of this offer you can go to www.lps2012.com and register now.

www.led-professional.com

www.lugerresearch.com

Upgrades for High-Power Converter SEMISTACK_RE for Renewables

Semikron upgrades SEMISTACK_RE, an IPM for renewable energy (RE). The new high-power converter for use in renewable energy applications such as wind and solar power installations will typically be used in synchronous and double-fed induction generators (DFIG) in wind turbines, as well as in central solar PV inverters.



SEMISTACK_RE is a water-cooled 3-phase converter that comes in B6CI 2-quadrant or 2 x B6CI 4-quadrant configurations in a bookcase-type mechanical design. Up to four SEMISTACK_RE converters can be connected in parallel and support applications of up to 6MVA. The SEMISTACK_RE range is based on SKiiP 4, the latest generation of SEMIKRON's SKiiP intelligent power module family which integrates power components, driver and heat sink in a single case.

The integrated new digital gate driver of SKiiP 4 provides a safe electrical isolation between primary and secondary side for all switching or control signals and even for the temperature signal. This allows to omit expensive circuits for electrical isolation for the user. The SKiiP driver features a CANopen setup and diagnosis channel – a first in a power module – which enables access to an error memory, meaning errors in the SKiiP 4 can be quickly identified and saved for later diagnosis.

www.semikron.com

Local Design Center in Munich, Germany

An office for innovation and cooperation: Würth Elektronik eiSos officially opened its local design center on March 16, 2012 in Munich-Aschheim. The electronics engineers that are employed at the design center are from different nationalities and are specialists in different fields. It provides them with the space and the environment for new ideas in the development of innovative passive components.

The main focus of their work is on components for wireless power charging and energy harvesting applications. The center is looking for more specialists - also from other countries.

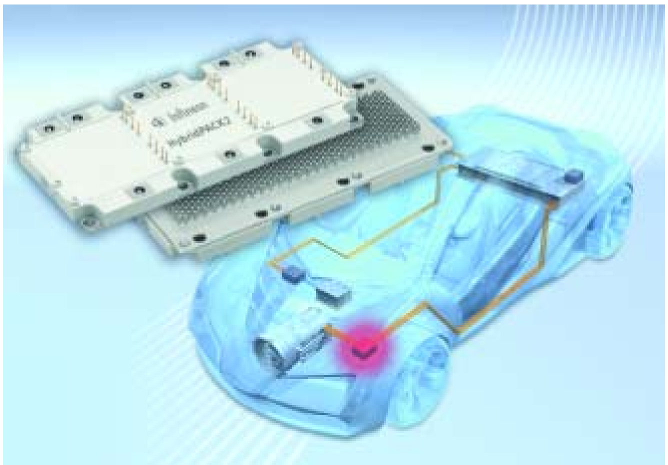
Munich as a location is of particular significance because many semiconductor manufacturers are established there. Würth Elektronik's cooperation with leading IC manufacturers has been characterizing its component development since years. Moreover, Munich provides the ideal environment for new specialists and managers, also because of the universities located there.

Würth Elektronik regards the concentration of component developers, IC manufacturers and customers at this location as a catalyst for future-oriented development and rapid response times.

www.we-online.com

Infineon and Fuji Enter Into Agreement for HybridPACK™ 2 Power Modules

Fuji Electric Co., Ltd., and Infineon Technologies AG serve the automotive industry by extending the supplier base for power modules deployed in automotive hybrid and electrical vehicles (HEV). At the PCIM Europe trade show in Nuremberg the two companies announced their agreement on a joint common footprint for automotive IGBT power modules using the Infineon HybridPACK™ 2 power module. In response to the need for supply security for HEV power modules, Infineon and Fuji agreed on the size of the module, the position of pin-outs, the use of the pin-finned copper base plate and on other mechanical features. The agreement comprises the HybridPACK 2 module, the FS800R07A2E3 featuring 650V/800A.



Infineon developed its power modules HybridPACK 2 for direct liquid-cooled systems as common in hybrid vehicles and electrical vehicles. The HybridPACK 2 modules offer the industry's smallest footprint at the given high power density. This is approximately 20 percent smaller than other modules on the market. Today's electronic control systems for full hybrid cars and electrical vehicles equal the size of two standard shoe boxes, weighing an average of 30 kilos. A system with HybridPACK 2 power module technology is only about the third its size and only weighs approximately 20 kilos compared to other state-of-the-art solutions. The pin-finned copper base plate in HybridPACK 2 not only enhances thermal performance, but also increases reliability.

www.infineon.com/hybridpack

www.fujielectric.com

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elcom Rossija 2012, International Trade Fair on Renewable and Conventional Energy

To generate a maximum of value for exhibitors and visitors alike, fairtrade, Siberia Expo and Euroindex join forces to launch elcom Rossija. The 1st International Trade Fair on Renewable and Conventional Energy, Energy Efficiency, Electrical Engineering, Lighting and Automation is scheduled to take place at the brand-new Novosibirsk Expocentre on 18 - 20 September 2012.

Russian imports and exports of electro-technology: a Euro 31.03 billion business!

fairtrade, Siberia Expo and Euroindex join forces for elcom Rossija

elcom Rossija 2012 enjoys the support of the Minister of Economic Development and the Minister of Construction and Housing of the Novosibirsk Region. Institutional partner is the Novosibirsk State Technical University-Faculty for Automation & Power Engineering Systems.

In the frame of the official Germany-year in Russia, Germany is the Guest of Honor of elcom Rossija 2012. Good news for German exhibitors: elcom Rossija 2012 features an official German pavilion sponsored by the German Ministry of Economics and Technology in cooperation with AUMA and supported by ZVEI.

www.elcom-rossija.com/elcomrossija_event0.html

SmartCoDe Facilitates Transition toward Renewable Energy

The edacentrum, an Institution advancing research and development in the area of Electronic Design Automation, has produced an informative video clip demonstrating SmartCoDe's mode of operation. The English language demonstration explains comprehensibly how SmartCoDe incorporates the local generation of renewable energies and makes predictions for energy management. The energy management balances the local power consumption which releases the grid of local peak loads.

One of today's main challenges is carbon dioxide reduction. Up to 40% of Europe's total energy consumption stem from smaller buildings and groups of buildings. The SmartCoDe project positions itself between private consumers and local power generation. It focuses on the reduction of this energy usage by means of information and communication technology (ICT). SmartCoDe enables communication on a global level: The local energy management acts as an interface to the global grid and can adapt its behaviour to the grid's requirements. The prerequisite is the approval of the end customer and the availability of control information from the energy supplier.

www.fp7-smartcode.eu

www.edacentrum.de

Richardson RFPD Takes on Expanded Role in Europe for Teledyne Products

Teledyne Relays Europe announces the expansion of the role of Richardson RFPD as a Pan-European distributor of Teledyne Relays and Teledyne Coax Switches products. Richardson RFPD, a distributor for specialised products, brings the technical and applications support to the market needed by customers for Teledyne products. With offices and sales support in all European countries, Richardson RFPD has highly skilled and experienced customer-facing application engineers and support staff.

Philippe Valy, Richardson RFPD VP of European Sales, said, "I welcome the opportunity to work more closely with Teledyne to expand our operations with their products across Europe." The Teledyne European Director of Sales and Marketing, Olivier Dilun, said, "Distribution is a very important element of the Teledyne European sales team, and the established presence of Richardson RFPD will benefit customers and Teledyne alike."

www.richardsonrfpd.com

European Photonics Industry Consortium appoints Carlos Lee for Director General

EPIC, the European Photonics Industry Consortium, has announced at its annual general meeting that Carlos Lee has been appointed as its next Director General, succeeding Thomas Pearsall who has led the association since its founding in 2003. Mr. Lee will take up his position immediately.

Carlos Lee is currently Director General at SEMI Europe, the Semiconductor Equipment and Materials Industry Association, where he leads the advocacy program. He brings a strong background of 15 years of industry association management, with extensive experience in building membership value through standardization, collaboration, networking platforms and events, and other activities of collective interest that benefit the industry at large.

www.epic-assoc.com

New Factory for Power Capacitors

TDK Corporation announces that its subsidiary, EPCOS India Pvt. Ltd., has officially opened a new factory in India for power capacitors. Located in Bawal, Haryana, some 100 kilometers southwest of New Delhi, the new plant will focus on the manufacture of AC capacitors for motor start and motor run applications and capacitors for power factor correction (PFC), primarily for the Indian market. The 8600 square meter factory joins the company's existing plants in Nashik, Maharashtra, and Kalyani, West Bengal, to form a powerful manufacturing base to serve not only the fast growing Indian market, but also the entire global market.

EPCOS India serves important growth markets with the products made in Bawal. With an annual growth rate of 10 to 20 percent the Indian market for consumer durable goods is one of the most dynamic in the world. India is also the company's largest single market for PFC products and solutions.

In the medium-term, the portfolio will be expanded to include medium-voltage PFC capacitors for rated voltages between 1 and 35 kV. The Bawal plant will serve as the company's only factory for these products, which are vital components in the power transmission and distribution infrastructure.

www.epcos.com

Peter Bauer resigns as CEO - Dr. Reinhard Ploss appointed new CEO

Peter Bauer, CEO of Infineon Technologies AG, will resign his post at the end of the current fiscal year due to health reasons. Peter Bauer suffers from osteoporosis. During the last several years he already endured numerous fractures of the vertebrae. Recently, his condition significantly worsened and, after due consideration, he informed the Supervisory Board of his decision to leave.

The Supervisory Board of Infineon Technologies AG named Dr. Reinhard Ploss as Peter Bauer's successor to the post of CEO. Dr. Ploss is a member of the Infineon Management Board and is currently responsible for production, development, technology and human resources.

"The selection of my long-time colleague, Dr. Reinhard Ploss, as successor, makes me very happy," stated Bauer. "Reinhard Ploss is a highly experienced manager with excellent knowledge of our industry. He enjoys high acceptance within the company and among our international business partners. Infineon is very well positioned for the future. We address the right trends with our focus on Energy Efficiency, Mobility and Security and we have a proven management with a track record of success."

Bauer began his career in 1985 at Siemens Semiconductors, which was eventually carved-out into Infineon Technologies AG. He was already part of the Management Board when Infineon went public in 2000 and, in 2008, became the company's CEO. Under his leadership, Infineon executed an extremely successful restructuring and refinancing program in response to the 2009 financial crisis and decisively focused its strategy on profitable growth in the areas of Energy Efficiency, Mobility and Security.

Dr. Reinhard Ploss is with the company for over 25 years and presides over profound knowledge of the complex semiconductor industry. After numerous leadership roles in development and manufacturing, he assumed responsibility for Infineon's Automotive and Industrial units, encompassing products underlying the vast majority of Infineon's sales today. Dr. Reinhard Ploss was appointed to the Infineon Management Board in 2007. In this role, he has contributed significantly to the company's innovation and earnings power. He also introduced a pioneering manufacturing strategy, which will serve as the basis for further profitable growth.

www.infineon.com

CoorsTek Acquires ANCeram GmbH & Co. KG Technical Ceramics

CoorsTek, the world's largest technical ceramics manufacturer, officially announced the purchase of ANCeram GmbH & Co. KG of Bindlach, Germany. Known primarily for its extended range of specialty aluminum nitrides, ANCeram manufactures ceramic substrates, insulators, and structural components for the aerospace, laser, railway, marine, and automotive industries.

Established in 1988, the early focus for ANCeram centered on creating a superior alternative for environmentally challenging beryllium oxide. Working with several European universities and independent research centers, ANCeram developed their own environmentally friendly aluminum nitride (AlN) ceramic. In addition to their broad AlN experience, the company offers silicon nitrides, aluminas, copperto-ceramic brazing capabilities, ceramic-to-metal bonding, and ceramic metallization. Products include components for insulators, coolers, diodes, heat exchangers, power electronics, high-temperature crucibles and boats, and other multi-material components.

"We are very excited to become part of the esteemed CoorsTek whole. We look forward to broadening our customer base and drawing from a nearly infinite range of materials to solve customer challenges," said Dr. Dieter Brunner of ANCeram.

"With this acquisition, CoorsTek significantly expands aluminum nitride capabilities and adds a third Germany facility, continuing our growth of products, materials and service," said Mark Chenoweth, Chief Operating Officer of CoorsTek, Inc.

www.anceram.com

www.coorstek.com

Ultra-Efficient, Low-Voltage Motor Drivers for Battery-Powered Applications

Stepper, brushed DC motor drivers reduce power consumption up to 80 percent, board space up to 95 percent

Texas Instruments expanded its growing portfolio of highly integrated DRV8x motor drivers with three new low-voltage devices for brushed DC and stepper motors. The DRV8834, DRV8835 and DRV8836 motor drivers provide a wide, low-voltage operating range, low RDS(ON) and ultra-low sleep currents, slashing power consumption as much as 80 percent compared to the nearest competitor to extend battery life, improve thermal performance and increase system reliability. The devices are also highly integrated in an ultra-small package, reducing board space by as much as 95 percent compared to discrete implementations. For more information or to place an order, visit www.ti.com/drv8834-pr.

Key features and benefits of the DRV8834, DRV8835 and DRV8836

Ultra-smooth motion profiles: On-chip 32-step microstepping indexer and advanced motion control features on the DRV8834 minimize torque ripple for quiet, ultra-smooth motion in applications such as security video cameras, medical and office automation equipment.

Extended battery life: Low RDS(ON) of 305 milliohms and an ultra-low sleep current as low as 10 nA improves thermal performance and extends battery life in applications, such as toys, e-locks, cameras, point-of-sale printers and smart meters.

Drop in and spin: High level of integration, such as an on-chip indexer and current control loops, provides greater intelligence to reduce design complexity while minimizing microcontroller (MCU) MIPS requirements and software development, speeding time to market compared to discrete solutions.

Reduced board space: Tiny 2-mm x 3-mm package option for the DRV8835 and DRV8836.

Advanced on-chip protection: Over-current, over-temperature, shoot-though and under-voltage lock-out increase system reliability and manufacturing yields.

Tools and support

Evaluation modules (EVMs) are available today to quickly evaluate all three devices. Suggested retail pricing for the DRV8834EVM is US$99. The DRV8835EVM and DRV8836EVM are available for a suggested retail price of US$49, respectively.

Drop in and spin with DRV8x motor drivers

DRV8x motor drivers integrate many of the functional blocks needed in a motor system, such as gate drive circuitry, MOSFETs, protection circuitry and current regulation circuitry. DRV8x motor drivers make it easy to drive a wide range of stepper, brushed DC and brushless DC motors in portable and wired applications such printers, video surveillance, fans, pumps, valves, power tools, textile manufacturing machines, e-locks and consumer electronics.

TI spins motors

TI combines a rich history in motor drive and control, a broad portfolio of analog and microcontroller products and a comprehensive offering of tools, software and support to deliver efficient, reliable, cost-effective motor solutions. Customers can get the right solutions at the right performance level to quickly spin any motor, including AC induction (ACIM), brushed DC, brushless DC (BLDC), PMSM and stepper.

About Texas Instruments

Texas Instruments semiconductor innovations help 90,000 customers unlock the possibilities of the world as it could be – smarter, safer, greener, healthier and more fun. Our commitment to building a better future is ingrained in everything we do – from the responsible manufacturing of our semiconductors, to caring for our employees, to giving back inside our communities. This is just the beginning of our story. Learn more at:

www.ti.com

Essential Link

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WWW.PROTON-ELECTROTEX.COM

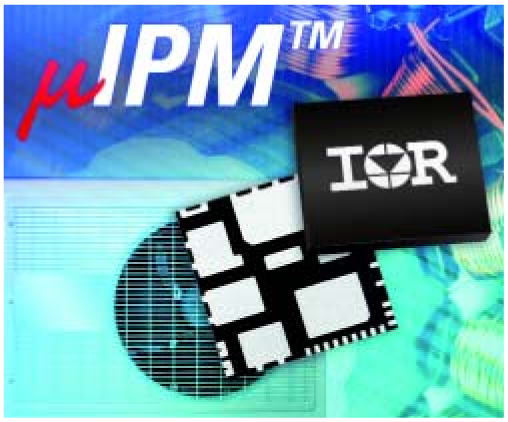
PROTON-ELECTROTEX
Power semiconductor devices

High Efficiency, Cost Effective Motor Control Solution for Appliances and Light Industrial Applications

International Rectifier introduced a family of highly integrated, ultra-compact, patent pending μIPM™ power modules for high efficiency appliance and light industrial applications including compressor drives for refrigeration, pumps for heating and water circulation, air-conditioning fans, dishwashers, and automation systems. By utilizing an innovative packaging solution, the μIPM family delivers a new benchmark in device size, offering up to a 60 percent smaller footprint than existing 3-phase motor control power ICs.

Available in an ultra-compact 12x12x0.9mm PQFN package, the μIPM family comprises a series of fully integrated 3-phase surface-mount motor control circuit solutions. The new approach pioneered by IR for this market segment utilizes PCB copper traces to dissipate heat from the module, providing cost savings through a smaller package design and even eliminating the need for an external heat sink. By using standard packaging QFN technology, assembly is simplified by eliminating through-hole second pass assembly and improving thermal performance compared to traditional dual-in-line module solutions.

"By utilizing an innovative packaging solution, IR's μIPM products not only offer up to 60 percent smaller footprint compared to existing leading solutions but also deliver advantages in output current capability and system efficiency. Combined with ease of use, improved thermal performance and overall system size reduction, the μIPM family enables designers and system integrators to deliver more cost effective and advanced motor control solutions," said Alberto Guerra, Vice President, Strategic Market Development, IR's Energy Saving Products Business Unit.



IR's μIPM product family offers a scalable power solution with common pin-out and package size. Featuring the most rugged and efficient high-voltage FredFET MOSFET switches specifically optimized for variable frequency drives and IR's most advanced high-voltage driver ICs, the μIPM product family offers DC current ratings ranging from 2A to 4A and voltages of 250V and 500V.

Specifications:

Part Number	Size (mm)	Voltage	IO (DC at 25°C)	Motor Current**		Motor Power VO=150/75V_{RMS}	Topology
				w/o HS	w HS		
IRSM836-024MA	12x12	250V	2A	470mA	550mA	60W/72W	3P Open Source
IRSM836-044MA	12x12	250V	4A	750mA	850mA	95W/110W	3P Open Source
IRSM836-025MA	12x12	500V	2A	360mA	440mA	93W/114W	3P Open Source
IRSM836-035MB	12x12	500V	3A	420mA	510mA	108W/135W	3P Common Source
IRSM836-035MA	12x12	500V	3A	420mA	510mA	100W/130W	3P Open Source
IRSM836-045MA	12x12	500V	4A	550mA	750mA	145W/195W	3P Open Source

** RMS, Fc=16kHz, 2-phase PWM, ΔT_{CA}=70°C, $T_A \approx$ 25°C

Datasheets, application notes, dedicated White Papers and a web tool for loss model calculation and current rating estimation are available. Contact IR's technical assistance center at TAC@irf.com.

Availability and Pricing:

Pricing for the released μIPM™ family ranges from US $1.59 to US $2.99 each in 10,000 unit quantities. Production quantities are available immediately. The devices are RoHS compliant and prices are subject to change.

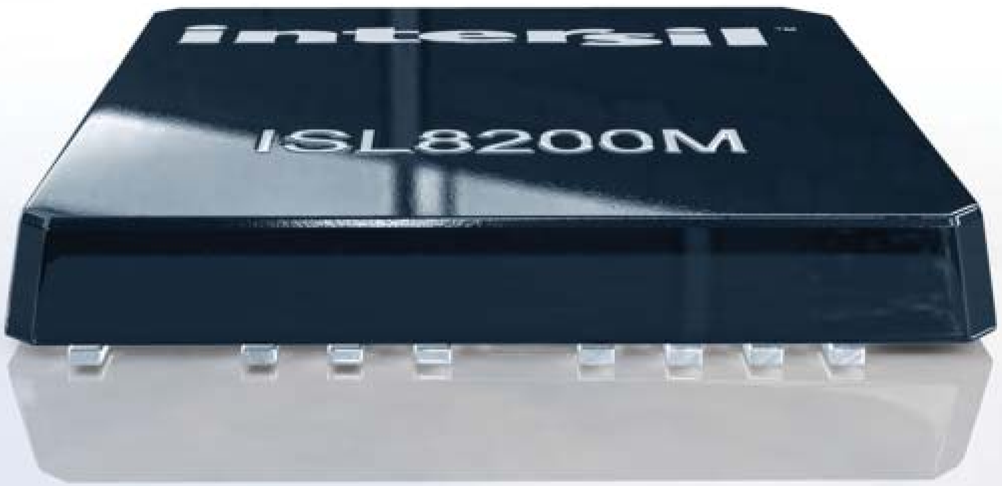
About International Rectifier

International Rectifier (NYSE:IRF) is a world leader in power management technology. IR's analog and mixed signal ICs, advanced circuit devices, integrated power systems and components enable high performance computing and reduce energy waste from motors, the world's single largest consumer of electricity. Leading manufacturers of computers, energy efficient appliances, lighting, automobiles, satellites, aircraft and defense systems rely on IR's power management benchmarks to power their next generation products. For more information, go to www.irf.com.

Trademark Notice:

μIPM™ is a trademark of International Rectifier Corporation and IR is a registered trademark of International Rectifier Corporation. All other product names noted herein may be trademarks of their respective holders.

www.irf.com


intersil™
ISL8200M

Bodo in China!

Earlier this year, Bodo’s Power Systems launched a China magazine – Bodo’s Power Systems China . The magazine is off to a fast start, now published bimonthly, in Mandarin Chinese of course, offering to-date over 100 pages of global content, technology features, interviews, product profiles, as well as the latest news and information. A Chinese language website was launched, along with a biweekly newsletter which is distributed to over 43,000 readers in China.

But why is Bodo in China and why should you care?
China will increasingly become the largest power electronics marketplace in the world. Last year, sales of power electronic devices in China grew by over 20%. Growth is being driven by the expansion of application industries in China, notably: automotive, industrial control and consumer electronics, along with solar, wind and smart power. Energy saving and renewable technologies are national strategic industries in China, in which the government invests both research, production and industrial development to maximize market share in China and globally.

One out of every four cars produced in the world comes from China, last year over 14 million automobiles were produced. Over 1 billion mobile phones are used in China every day. China manufacturers more than 70% of the 7 billion mobile phones presently in use around the world. Last year over 30,000 electrical automobiles were sold in China, over 20 million electric bikes were sold, contributing to an overall market of over 115 million electric vehicles. China leads the world in almost all categories of electrical consumer device manufacturing, rail transportation, communication systems and power generation. These trends are not slowing, in fact as China continues to grow more wealthy, both the demands for these application industries as well as the appetite both will continue to grow.

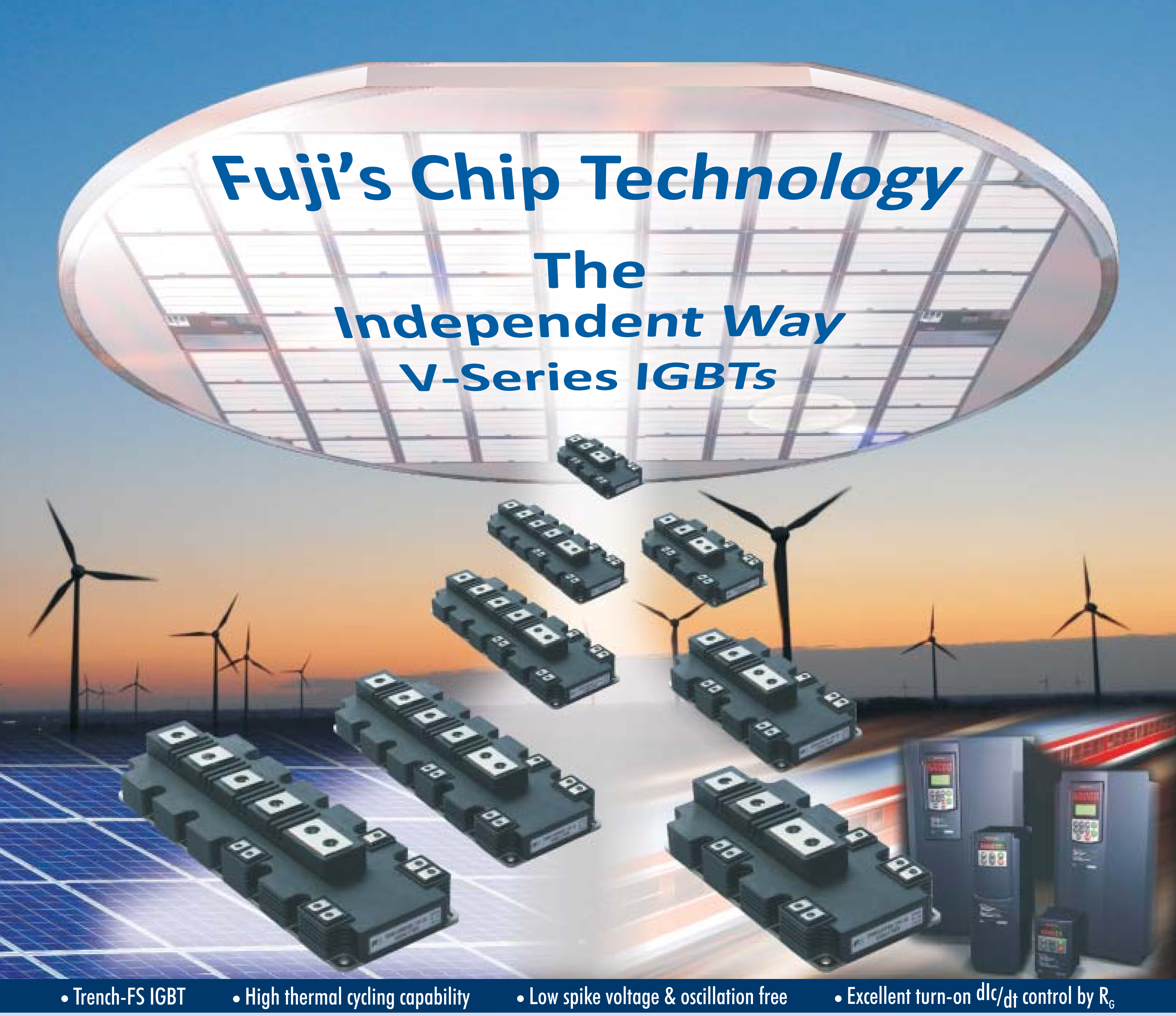
This growth is not possible without equal growth of the semiconductor technology and power electronic device manufacturers. Simultaneously, energy-saving, renewable energy, solar, wind, all of which are strategic industries in China which the government is and will continue to invest aggressively for further growth and development, continues to spur power electronic device consumption. In China, energy conservation is a critical, semiconductor technology is being seen as core energy-saving programs, which effectively reduce energy consumption to meet China's energy, environmental and economic requirements of sustainable development, which is now being applied universally to almost all electrical consuming industries. Transportation, large-scale construction, rail line development, are contributing to annual demand for IGBT modules in excess of 5 million. The Chinese government's focus on smart grid technologies, also will benefit IGBT manufacturers as the core component for HVDC power transmission technologies and UHV transmission technologies. By 2013, it is estimated that the market size for a power electronic devices in China will exceed 130 billion renminbi.

International manufacturers have chosen China as one of their leading markets for research, development, manufacturing, distribution and sales. Total foreign investment in power electronics manufacturing and development in China last year exceeded $200 million.

The reason these foreign enterprises invest heavily in China is to maximize potential for manufacturing in China, while being leaders in local Chinese sales and distribution. Playing a major part in China for these companies is of strategic importance, because it bridges both worlds, China's growing domestic manufacturing and utilizing Chinese productivity to sell around the world.

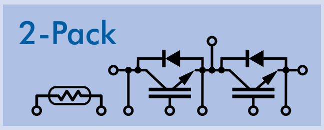
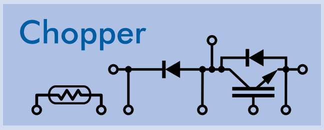
Bodo’s first steps into China are because the market is there. Many global manufacturers already know this and many are just getting the news. But it's not too late, the opportunities for growth are tremendous and the place to be into the future will be China.

Alexander Glos
CEO i2i



- Trench-FS IGBT
- High thermal cycling capability
- Low spike voltage & oscillation free
- Excellent turn-on dI_C/dt control by R_G

High Power Modules, 2-Pack & Chopper

	I_C	1200 V	1700 V
2-Pack 	1000A		Ⓔ Ⓟ
	1400A	Ⓟ	Ⓔ Ⓟ
Chopper 	1000A		Ⓔ
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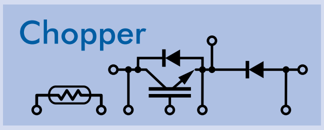
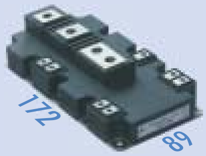
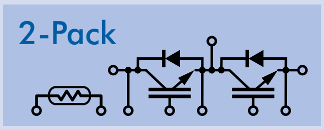
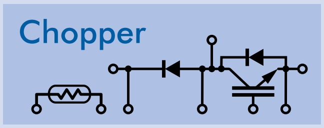
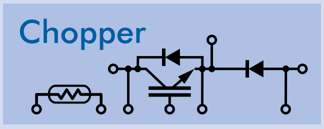
Chopper 	1000A		Ⓔ
	1400A		Ⓔ



	I_C	1200 V	1700 V
2-Pack 	600A	Ⓔ	
	650A		Ⓔ
	900A	Ⓔ Ⓟ	
Chopper 	650A		Ⓔ
Chopper 	650A		Ⓔ

Ⓔ : E-type (low switching losses)   Ⓟ : P-type (low $V_{CE,sat}$ & soft turn-off)

Fuji Electric Europe

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Products Overview ▸**www.fujielectric-europe.de/info/overview.pdf**

ELECTRONICS INDUSTRY DIGEST

By Aubrey Dunford, Europartners

GENERAL

Worldwide mobile phones shipments grew a modest 3 percent annually to reach 368 million units in the first quarter of 2012, so Strategy Analytics. Samsung was the star performer during the quarter, capturing a record 25 percent market share to become the world's number one handset vendor for the first time ever.

SEMICONDUCTORS

Worldwide sales of semiconductors were $ 23.3 billion in March 2012, a 1.5 percent increase from the prior month, and a decrease of 7.9 percent from March 2011, so the WSTS. Sales in the first quarter of 2012 reached $ 69.9 billion, a decrease of 7.9 percent over last year's first quarter sales and a sequential decrease of 2.2 percent over the prior quarter.

Although semiconductor suppliers have reduced their inventory by 7.5 percent over the last six months, total inventory remains at high levels both in terms of aggregate dollar value as well as in days of inventory, so IHS iSuppli.

Microchip Technology, a provider of microcontroller, analog and Flash-IP solutions, and Standard Microsystems (SMSC) announced that Microchip has signed a definitive agreement to acquire Standard Microsystems for $37.00 per share in cash, which represents a total equity value of about $ 939 M, and a total enterprise value of about $ 766 M.

Integrated Device Technology, a provider of mixed signal semiconductor solutions, and PLX Technology have signed a definitive agreement pursuant to which IDT will acquire PLX. The transaction is valued at approximately $ 330 M. The proposed acquisition of PLX Technology represents an expansion of IDT's core serial switching and interface business.

Due to stronger demand for TSMC's 28-nanometer technology and the pull-in of a 20-nanometer R&D process line, the foundry's estimate for 2012 capital expenditure is raised and is in the $ 8-8.5 billion range.

Power Integrations, a supplier in high-voltage integrated circuits for energy-efficient power conversion, has completed the acquisition of CT-Concept Technologie. Founded in 1986 and based in Biel, Switzerland, CT-Concept is a developer of highly integrated, energy efficient drivers for high-voltage IGBT modules.

NeoPhotonics, a Californian designer and manufacturer of photonic integrated circuit, or PIC, based modules and subsystems for bandwidth-intensive, high speed communications networks, has received an investment of $ 39.8 M from Rusnano, a $ 10 billion sovereign investment corporation located in Moscow, Russia. NeoPhotonics intends to use a portion of the net proceeds to establish design and production capabilities in Russia.

PASSIVE COMPONENTS

TDK announces that its subsidiary, Epcos India, has officially opened a new factory in India for power capacitors, primarily for the Indian market. Epcos India has invested around € 10 M in the new facility. Nearly 400 people are now employed in the facility.

OTHER COMPONENTS

Agilent Technologies has signed an agreement to acquire the assets of Centellax's test and measurement business. Centellax is a supplier of analog semiconductor products for 40G, 100G, and 400G optical communications, and RF/microwave applications. Centellax's component business is not part of this transaction.

Ametek has entered into a definitive agreement to acquire Dunkermotoren, a supplier in advanced motion control solutions for a wide range of industrial automation applications.

Rohde & Schwarz is investing € 52 M in Singapore's economy over the next three years. Part of this investment includes the injection of € 35 M to design and build its own global hub in Singapore – its first outside Germany.

Micropelt has raised € 6.5 M for the roll-out and global expansion of its thin-film thermoelectric energy harvesting technology. Micropelt's thermal micro energy harvesting technology uses waste heat to create electricity. The microchip-sized device displaces batteries in automated equipment and has multiple domestic and industrial applications. Micropelt opened the thin-film thermoelectric production facility, a world's first, in June 2011 in Halle, Germany.

DISTRIBUTION

EBV Elektronik, an Avnet company, has launched a comprehensive webpage for engineers of the semiconductor industry seeking for real system solutions. At www.ebv-design-solutions.com, EBV provides customers with real system solutions and all related technical information they need.

Richardson RFPD, an Arrow Electronics company involved in the RF and wireless communications, power conversion and renewable energy markets, has completed a distribution agreement with PriaTherm, a European-based provider of solutions in the thermal management industry. With this agreement, Priatherm provides Richardson RFPD with a source to assist its European customers with fabricated heat sinks for high power RF, as well as energy and power management, applications. Teledyne Relays Europe also announces the expansion of the role of Richardson RFPD as a Pan-European distributor of Teledyne relays and coax switches products.

This is the comprehensive power related extract from the « Electronics Industry Digest », the successor of The Lennox Report. For a full subscription of the report contact: eid@europartners.eu.com

or by fax 44/1494 563503.

www.europartners.eu.com

New Materials continue to advance at the 2012 PCIM event

Richard Ruiz Jr., Darnell Group

This year's PCIM event in Nuremberg, Germany featured a number of advancements in new materials including gallium nitride (GaN) and silicon carbide (SiC) technology. One of the highlights of the technical program at this year's PCIM Europe event was a session on „Competition in Wide-Bandgap Devices" that focused on considerations for selecting SiC devices for power conversion applications. Among the companies making presentations were: Danfoss Solar Inverters, EADS, Fairchild Semiconductor and STMicroelectronics.

A team of engineers from Danfoss Solar Inverters in Denmark analyzed the switching and conducting performance of two types of SiC normally on JFETs – a SiC normally-off JFET, two types of SiC MOSFETs and a SiC-BJT from a variety of manufacturers including Cree, Fairchild, Infineon, SemiSouth and Rohm. They used measurements at exactly the same boundary conditions to compare the devices. In addition to comparing the switching and conducting behaviors of the devices, the team also compared the requirements for driving the devices. They concluded that identification of the „best" device depends strongly on the application, since all devices show advantages, but in different ways. Therefore a universally valid recommendation for one of these power semiconductors cannot be given.

Later a team of researchers from EADS and Friedrich-Alexander University in Erlangen, Germany, focused on the behavior and performance of SiC body diodes and all-SiC switch/diode combinations regarding reverse recovery. To compare the influence of the different devices on the recovery behavior of the combined switch, several switch/diode-pairs are used. For the active switch the Cree SiC MOSFET technology was chosen. It is readily available in two different chip sizes: 80m (CMF20120D) and 160m (CMF10120D). For the diodes, SiC Schottky diodes from SemiSouth were chosen with current ratings of 5A (SDA05S120), 10A (SDP10S120D), and 30A (SDP30S120).

Reverse recovery tests were performed with single SiC MOSFET body diodes and pairs of SiC MOSFETs with SiC Schottky diodes at different conditions. Key reverse recovery parameters were extracted and compared. The manufacturer of the selected MOSFETs does not recommend the use of their body diode because of its high forward voltage and accompanying conduction losses. The researchers found that this disadvantage could be omitted if the FET channel was used for reverse conduction. This work investigated the recovery performance of the body diode and also showed that it is advisable the use a Schottky diode in parallel with the FET. This significantly decreases the required switching energy, in extreme cases by nearly 37%. It was also shown that for further improved performance, a small Schottky diode is preferable.

Fairchild teamed up with the Center of Competence for Distributed Electric Power Technologies at the University of Kassel to study SiC bipolar transistors (BJTs). The team concluded that the BJT offers one of the best alternatives among the diverse existing SiC switch technologies, given the low specific chip resistance and low temperature dependence. In addition to this they verified that common drawbacks associated with Si-BJTs – like poor dynamic behavior, low gain and limited SOA – are not applicable when SiC is used as the base material.

The application of SiC BJTs in a switching power converter demonstration resulted in very good levels of efficiency without resorting to over dimensioning the system, i.e. connecting several devices in parallel. The use of a higher switching frequency along with a new core material enabled a significant reduction of the filter inductor, which was about one-quarter of the size of the reference system. The team claimed a potential for savings in hardware by having lower chip expenditure, lower level of losses (smaller heatsink) and smaller filter elements

In the paper from STMicroelectronics, the company's first 20A, 1,200V SiC MOSFET prototype was presented and compared with a 1200V normally-off SiC JFET and a 1200V SiC BJT. A complete dynamic comparison analysis among the three switches in the range 1 to 7A was presented with a special focus on each device driving needs at T=25°C. According to the paper, the results in terms of total dynamic losses (driving effort is not included) are clear and impressive: the SiC MOSFET shows around 55% less total dynamic losses than the SiC JFET and around 60% less than the SiC BJT driven with a negative voltage (percentages are calculated at Id=7A,T=25°C). An additional evaluation was performed at T=125°C and Id=7A: no significant degradation was observed, except for a slight worsening of the SiC JFET turn on energy (+20% if compared to the 25°C data).

The STMicroelectronics analysis found that despite its high Ron*A value, the SiC MOSFET was demonstrated to be the most promising switch among the others under evaluation, exhibiting total dynamic losses far lower than the SiC BJT and SiC JFET normally-off and a very simple drive approach, which makes the SiC MOSFET the best candidate in the high frequency, high efficiency power conversion context.

This year's event also features a number of introductions in both SiC and GaN from multiple companies. Among the participants revealing new developments in wide bandgap devices at the 2012 event were CISSOID, SemiSouth, Rohm, Powerex, Cree, Infineon Technologies, and GaN Systems. Announcements ranged from new discrete devices to modules and isolated gate drivers.

CSSOID introduced its Hades isolated gate driver optimized for use with SemiSouth normally-off SiC JFETs. Targeting solar inverters, transportation and similar applications, The Hades reference design is based on CISSOID's chipset including the Themis, Atlas and Rhea devices capable of operation over a temperature range of -55 to +225°C. In the near future, CSSOID is expected to introduce a reduced-cost version limited to a maximum temperature of 125°C with an expected operational life of at least 20 years. Driving Semi-

South’s SJEP120R100 SiC JFET, the test board was able to hard-switch 600V and 10A with turn-off and turn-on times of 14 ns and 24 ns, respectively.

In fact, SemiSouth introduced two new devices at the event, one rated for 650V/55mOhms and the second rated for 1,700V/1,400mÙ. The 650V SJDA065R055 device features a positive temperature coefficient and fast switching up to 150°C. These TO220-packaged devices are expected to find use in solar inverters, switching power supplies, PFC circuits, induction heating, UPS, motor drives and similar applications. Aimed at 3-phase power applications, the 1,700V SJDT170R1400 is being offered in a newly-developed SMD D2PAK-7L package in order to simplify PCB layout and optimize switching performance due to its lower inductance.

The Japan-based semiconductor company Rohm announced mass production of a 1,200V/100A power module comprised entirely of SiC power elements. The new modules reduce losses by 85% compared with conventional Si IGBT modules and can be switched at 100kHz or higher, more than 10X faster than comparable IGBT modules. According to Rohm, development of full SiC modules has been impossible up to now due to unstable reliability at elevated temperatures. Rohm was able to overcome this limitation by developing unique screening methods and defect suppression technology that guarantees reliability, as well as a control system that prevents device deterioration at high temperatures making it possible for the company to mass produce SiC power modules.

Powerex and Cree also contributed to the event with their new products. This year Powerex displayed its second-generation full SiC modules. Originally introduced in 2010 as the QJD1210006/07 modules using SiC devices from Cree, the second-generation devices, the QJD1210010 (with a copper base place) and the QJD1210011 (with an AlSiC baseplate) are rated for 1,200V/100A. At the same time, Cree, which supplies the 20A SiC chips used in the Powerex modules, announced a new series of 50A devices including FETs rated for 1,200 and 1,700 V and three SiC Schottky devices. Cree has noted that SiC is an established technology that offers proven performance and reliability. The new devices are available in die form for high-power modules for applications such as solar inverters, UPS and motor drives

At last year’s event, Ralf Keggenhoff, Sr. Marketing Manager and Head of Application Engineering with Infineon discussed the impact of wide band gap devices on power system design. Infineon offers SiC Schottkys with ratings of 600V, 1,200V, and 1,700V and SiC JFETs rated for 1,200V. At this year’s event, Infineon introduced the CoolSiC™ 1200V SiC JFET family. In an effort to ensure that the normally-on JFET technology is safe and easy to use, Infineon has developed a concept which is called Direct Drive Technology. In this concept, the JFET is combined with an external Low Voltage MOSFET and a dedicated Driver IC which ensures safe system start-up conditions as well as fast and controlled switching.

Finally, GaN Systems announced the product roadmap for its GaN-on-SiC device technology. The company plans to roll out a range of diodes and transistors with voltage ranges from 150 to 1,200V, and currents from 2 to 300A. Integrated single chip half-bridge structures, full-bridge diode arrays, and GaNTetrode™ devices for power and RF applications are also compatible with the company’s unique island structure and are under development.

A thorough discussion of GaN and SiC technology can be found in the January 2011 Darnell Report “DC-DC Converter Modules and ICs: Market Forces, Power Architectures, and Technology Developments”

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Smart Takes the Next Step

The second of three modules within the new family is available

There is a wide variety of different customer requirements visible on the power electronic market. However, some of these requirements are valid for most of all different applications as there is the need for Mechanical robustness, Flexibility and Adaptability, Modularity, Excellent contact behaviour and System cost optimization.

By Marc Buschkühle Infineon Technologies AG

In order to meet all these requirements, Infineon Technologies has started to establish a new package family of power electronic modules. The Smart1 package was the first, is now followed by the Smart2 and will be continued by the Smart3 module, which allows this package family the full coverage of Power applications starting from 1 KW up to 55 KW.

Smart2, the second step

Inverter designs, especially in the power range mentioned above are focused on components that are easier, faster and – in particular – more safely in contact and mounting.

The new family is based on the so called self acting PressFIT assembly. This ensures the fulfillment of simple, fast, save and cost optimized way of mounting.

The package concept establishes contacts between the module and the heat sink and PCB by using one single assembly step. Only one screw is required mounting a Smart1or Smart2 in SmartPIM (rectifier, chopper and inverter) or SmartPACK (SixPACK) topology.

Figure 1: Smart1 and Smart2 module

The new Smart2 is the second step to a completely new IGBT module family. In Figure 1, both modules are shown in detail. On the left side the well known Smart1 can be seen. The new Smart2 is shown on the right side.

With the additional Smart3 module, a whole family of Smart modules will evolve.

Smart IGBT Module Family

The individual module sizes are geared toward the different frame sizes in today's inverter concepts typi-cal to the market.
As can be seen refereeing to in Figure 2 , the Smart2 modules will cover the range between 7,5kW and 11kW in PIM and up to 30kW in PACK configurations.

The Smart3 modules will be suitable for general purpose inverter designs up to 30kW in PIM and 55kW in PACK configuration.
Due to the huge variety of applications and frame sizes a modular system is the basic objective. To meet and support this, all modules out of the Smart family will have the same frame height of 12 mm. All of them will be available with PressFIT pins for solder free mounting processes. As consequence there is no change necessary in the customer’s mounting process.

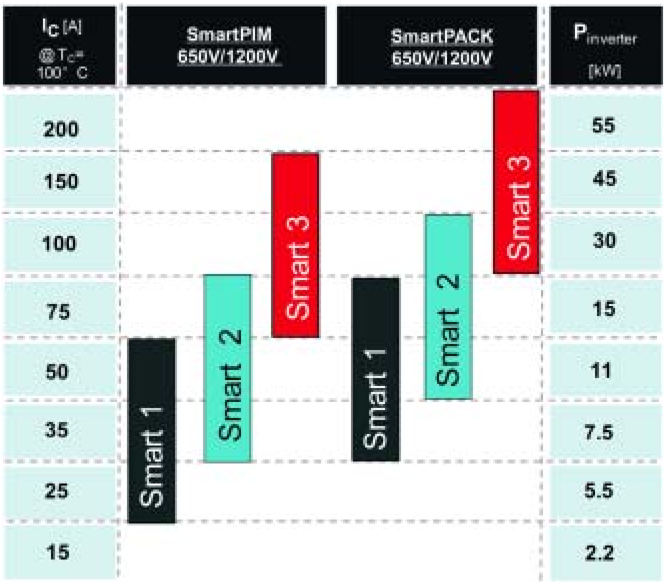

Figure 2: Planned portfolio of Smart family

Also the mounting philosophy of the modules to the PCB / heat sink remains. A single screw (Smart1 / 2) or 2 screws (Smart3) with the same Diameter M6 will be used to mount the modules, so no additional ex-pensive tools are required.

Simple and flexible Assembly

All members of the family are designed for a fast Self-acting PressFIT Assembly. Only one screw is needed in this regard for Smart1 and 2.

During the mounting process, the PressFIT contact is pressed into the printed circuit board, the PCB is stabilized and the module is fixed on the heat sink in the same step. The entire mounting concept does not require any additional tools. Only a screwdriver is needed to fasten the screw.


CONCEPT
2SC0535T
Taming the Beast

The distance between the counter holder of the Smart 2 and the PCB is suitable for optional positioning of SMD components such as gate resistors or gate emitter capacitors, but as well for bigger components like driver ICs.

In addition to the self acting way of assembly, the Smart2 can be used like a standard PressFIT module comparable to Easy- or Econo modules.

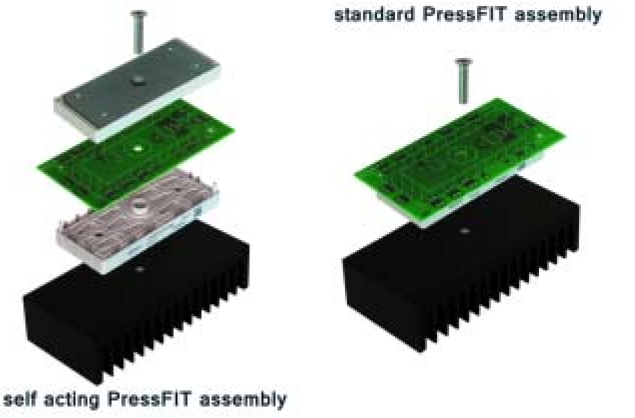

Figure 3: Different ways of assembly are possible to fit easily in every Inverter production line

In this case the module will be pressed into the PCB with a Press-In tool first. Later on, the module can be mounted onto the heatsink separately. This is benefitial in two ways. First the module assembly is highly flexible. Each material flow philosophy within the inverter production line can be enabled. Secondly, the counter holder is not needed and additional space of the PCB can be used.

Why Smart is robust!

The inverter assembly of course, should be able to be done in very robust way. A point of criticism often experienced in handling and processing of modules without a base plate, is their susceptibility to ceramic or chip fractures that can cause insulation failures. A direct application of the mounting force to the module could lead to an uncontrolled pressure at the DCB edge, possibly followed by micro cracks and an ISO failure.

The Smart family is designed in that way, that no direct force is applied which results in an excellent me-chanical robustness, especially by the protection of the ceramic (DCB) even without a copper base plate.

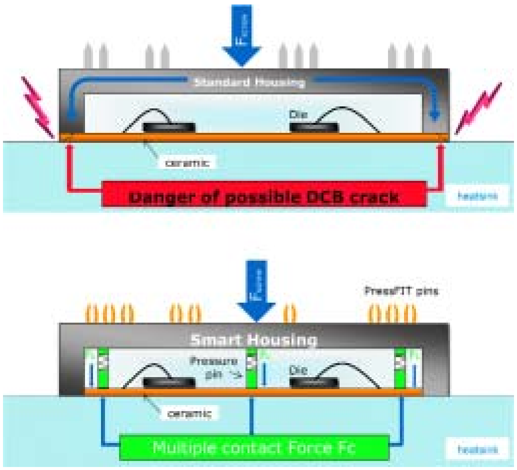

Figure 4: Schematic of a critical module mounting situation. Schematic drawing of a Smart2 detail: Decoupled contact force via multiple spring loaded pins

In the design of the Easy modules a number of years ago, mounting using clips was successfully intro-duced for exactly this reason.
The clip decouples the screwing force from the ceramics (DCB). The Smart family avoids this overload to the ceramic as well.

In case of the Smart modules, this decoupling is done with the housing concept shown in Figure 4. The advanced pressure concept of the Smart concept inhibits this potential risk. It will be also the basis for the upcoming Smart3 in order to transfer these well known advantages and features into the next package size for higher power classes.

Flexibility and Adaptability

Another important requirement is the flexibility of a package concept. How fast and how easy could an existing package be modified or adapted to the applications and topologies?
The main reason for the Smart flexibility is the capability to allow easy and fast Pin out modifications without time consuming and tedious tool changes. Smart 2 / 3 allow modifications of the inserted PressFIT frame pins along the outer edge of the module.
The PressFIT frame can be seen in Figure 5.
Even more, this approach allows an almost free DCB and Pin Layout capability. This helps internally to optimize the electrical and thermal performance of the module.
Externally this increases the real available space on the PCB.
This capability of course, comes together with a perfect match of the frame – PressFIT combination as a basic requirement to allow flexible pin insertion with perfect insertion repeatability.
The perfect match becomes very important to establish and roll out a robust and stable production pro-cess and environment without sacrificing flexibility and yield.

Figure 5: Flexible and easy to change Pin Out configuration of Smart2

Mechanical characterisation

During the development of the module, general questions were addressed and answered like temperature dependency of different materials.

Especially the usage and mix of material within a wide pressure- and temperature range requires detailed and in depth investigations. Material behavior, in particular if it is a glass fiber filled plastic material, is essential to establish stable and repeatable insertion processes, therefore a clear and very specific understanding of the material properties was founded in addition to given general experience to ensure a simple but reliable construction. One example is shown in Figure 6. Here the resulting force coming out of deformations and temperature were analyzed.


EV
QUICK CHARGER

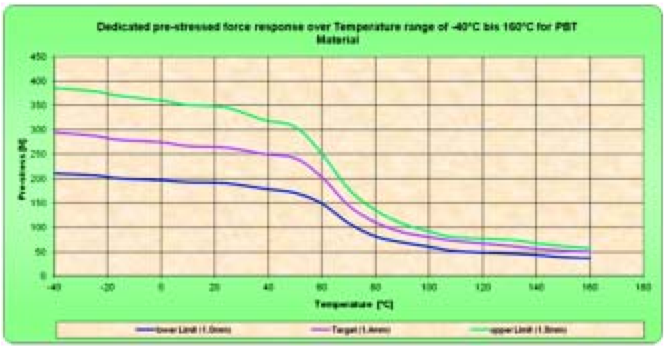

Figure 6: Material dependency between mechanical pre-stress and temperature.

Excellent contact behaviour

Excellent contact behaviour of a module could mean two different things. Electrical contact of module to the PCB and mechanical contact of Module / DCB to the heat sink.

In Smart the electrical connection is done with the well known PressFIT technology. In contrast to the Smart1 a so called forked Pin is used which is designed to handle higher currents.
In Figure 7 a simulation of the forked Pin is shown. It will be deformed mechanically during the fitting pro-cess. The forces arising from this assure that the welded materials between the inner hole lining and the pin surface will create a continually constant electrical, gas tight and thermal contact.
Further information about PressFIT can be found under the literature hints below.

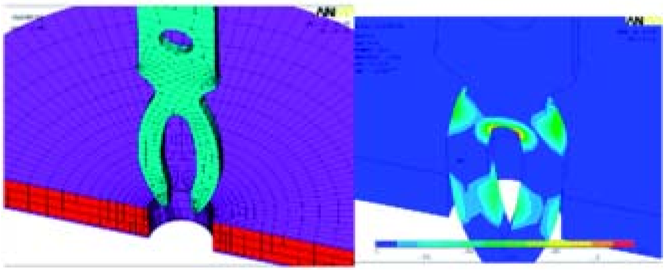

Figure 7: Schematic drawing of a PressFIT connection.

Excellent thermal properties

In order to achieve a good thermal transition from the DCB to the heat sink, the thermal interface in be-tween (usually thermal conductance paste) needs to be spread out to a very thin layer. That allows a very good heat transition from the DCB to the heat sink.

In the past the base plate was responsible for the heat dissipation of the module and the contact to the heat sink. In base plate less modules, a special designed system is needed to ensure a good heat transi-tion to the heat sink resulting in a good Rth value. So it is one of the most important duties of such a contact system to make sure, that an even, but not too aggressive pressure is applied on the DCB to ensure a consistent, minimal gap between DCB and heat sink. This gap needs to be eliminated by the contact system without jeopardizing the DCB and consequently the ISO safety requirements.

This sample measurement in Fig. 8 shows clearly a constant low and stable Rth value over different con-ductive paste thicknesses and interaction times, leading to a steady and stable heat balance in the module.

Learnt out of experience and practice

The idea of a package family is not only to cover a broad range of applications with one similar mechani-cal approach but also to use as many components and parts for multiple packages as possible. In a family concept a lot of detailed developments and single solutions, learnt out of experience and practice, can be used and transferred in multiple packages.

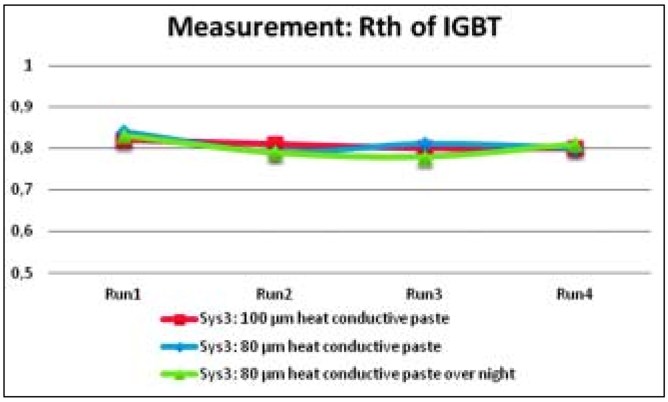

Figure 8: Sample measurement of a robust and paste thickness independent contact system.

A very good example is the modified and optimized PressFIT pin, used in the Smart2 and Smart3 pack-age. Based on a long time experience with the Econo product series, lessons learnt took place before the optimized pin was transferred to the Smart 2 / 3 packages. These synergies can be found in many areas of the package development, here only to mention the similar, but consequent advanced approach of the concept to apply the necessary contact force on DCB to heat sink.

Summary

Today with the Smart2, the second of three modules within the new module family is available on the market.
The individual module sizes are geared toward the different frame sizes in today's inverter concepts typi-cal to the market
A robust, versatile module solution for the future has been developed with the secure PressFIT technolo-gy and a housing design allowing secure and particularly fast mounting.
The new self-acting PressFIT technology reduces mounting time and simultaneously increases mounting ruggedness and connection reliability. Along with the Frame concept that has been introduced, it has become easier to mount power electronic components and exclude failures due to mounting.
All these features, combined in one package family, support the cost-efficient design of compact and highly reliable inverter systems.

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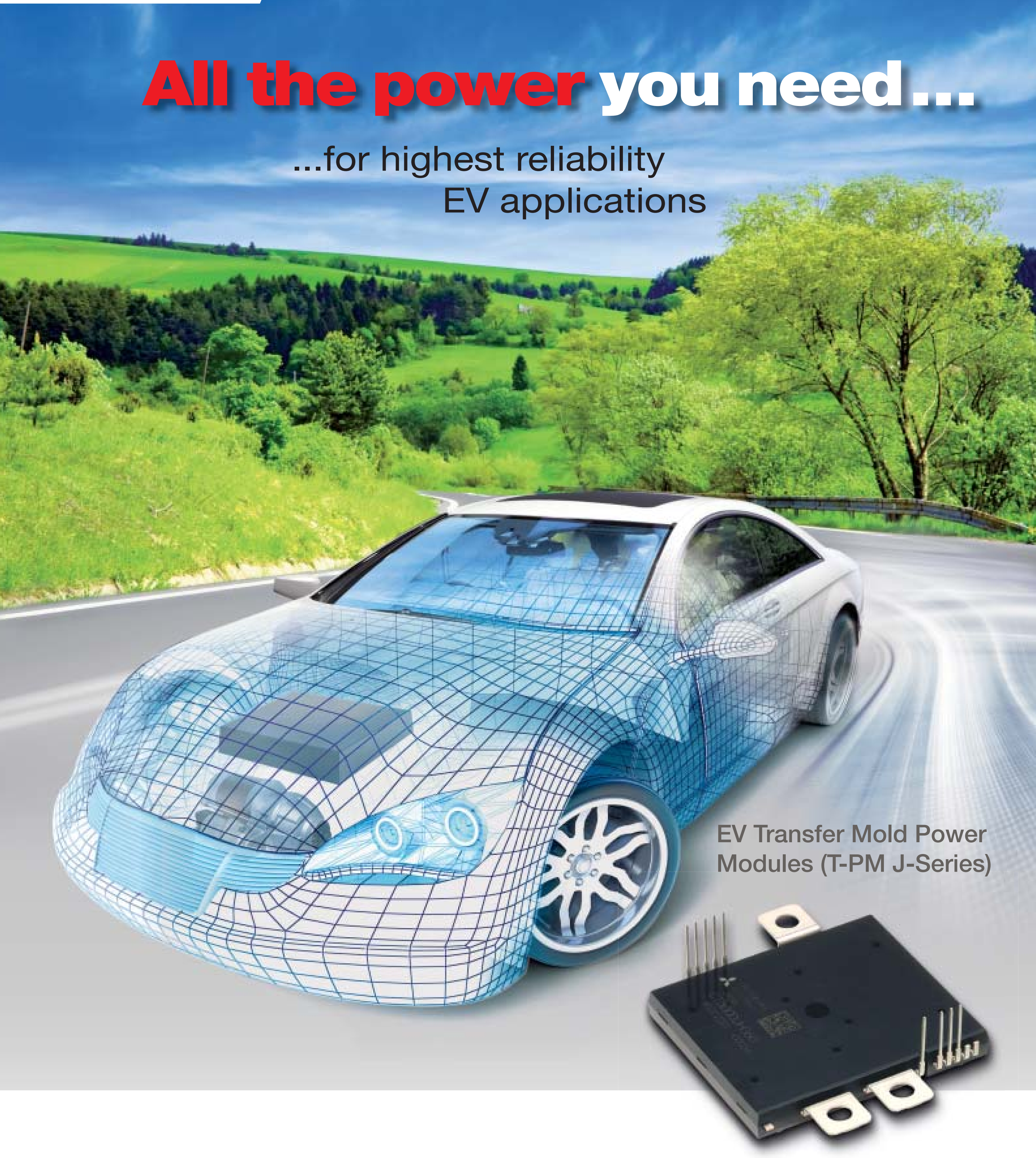

Dual Common Drain Trench Power MOSFETs

Supplied in Wafer Level Chip Scale Packages for Next Generation Mobile Applications

As consumer expectation for long battery life and high processing capability rise, cellular phones and tablets are placing increasing demands on charging and battery protection power MOSFETs. A common-drain back-to-back power MOSFET in the battery pack protection circuit module (PCM) allows control of the charging/discharging as well as protection from short-circuit, over-voltage, under-voltage and similar battery fault conditions that can damage the appliance. Very low in-line voltage drop of this power device helps to extend the operating time of the downstream circuitry and reduces the power loss while transferring energy from the battery to other circuits.

By Ritu Sodhi and Sukhendu Deb Roy, Fairchild Semiconductor, India and Ihsiu Ho, Chung-Lin Wu, Steve Sapp, Fairchild Semiconductor, USA

For the appliance designer, a compact size with very low on-state resistance enables a smaller circuit board for increased internal volume, which in turn allows a larger battery, increased functionality, or a smaller device. A common-drain power MOSFET enables the independent regulation of bi-directional current flow through the device that the battery pack PCM circuit requires. The common-drain configuration also lends itself well to the basic device structure of the common power MOSFET device that uses the backside of the chip to connect to the drain of the transistor. Arranging two independent source and gate connections on the top surface completes the desired power control device.

Trench power MOSFETs have been the devices of choice for low voltage applications. The greatest benefit of the trench MOSFET technology is that it enables a much higher channel width when compared to a planar VDMOS structure [3, 4]. More importantly, because of increased channel width, the channel resistance is reduced significantly. With increased channel width density in this device structure, the channel resistance is significantly reduced, and the drift resistance becomes more prominent even for these low voltage devices. The charge balance concept, originally developed for high voltage devices, has become an attractive option to reduce the drift resistance, even for low voltage MOSFETs [5, 6].

The manufacturing of charge balance devices can be more complicated and expensive. The device technology discussed here combines high channel width density with a charge balance feature using shielded gate trench architecture to provide exceptionally low on-resistance. Figure 1 shows the shielded gate device structure, where an additional shield electrode has been included below the gate electrode and includes a thicker insulating layer than the gate dielectric. The shield electrode and gate electrode are separated by an inter-electrode dielectric (IED). As the gate electrode is isolated from the drain electrode by the shield electrode, considerable reduction in gate-to-drain capacitance (Cgd) can be achieved. The shield electrode plays an important role in optimizing the device performance, whether it is connected to the source or the gate electrode. Both of these approaches allow an increase in the doping concentration of the drift region due to field plate effect of the shield electrode. Increasing the depth of the shield electrode into the drift region improves the charge balance effect and provides higher than parallel plane breakdown for a given drift region concentration. The increased breakdown can then be leveraged for reducing the R(DS)(ON). The new optimized devices offer over 50 percent reduction in specific on-resistance, as compared to previous conventional trench technology. Figure 2 shows the figure of merit comparison between this technology and earlier device technology, as well as to other competitive solutions used in this application. Table I shows the typical electrical parameters of a 20V, N-channel device, comparing simulated and measured data. The results show that the two sets of parameters are within 10 percent of each other, showing a good correlation to the simulations.

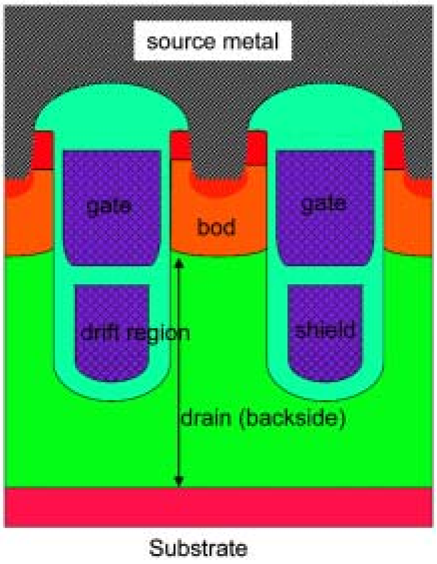

Figure 1: Device cross-section and simulated structure for the latest generation low voltage MOSFET

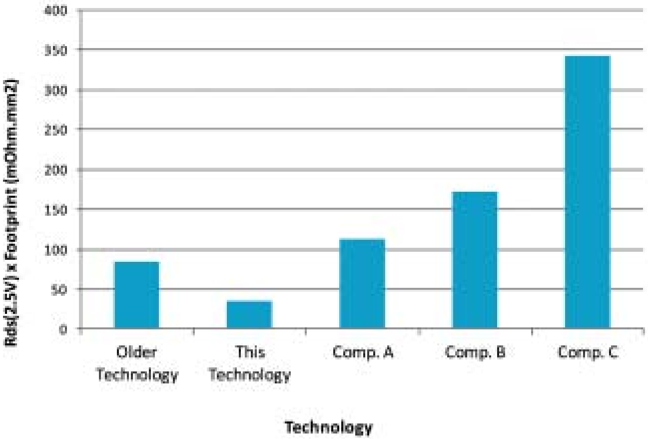

Figure 2: Figure of Merit Comparison

Parameter	Unit	Simulated	Measured
Breakdown Voltage	Volts	27.2	27.5
Threshold Voltage	Volts	0.75	0.79
Rdson at 4.5Vgs	mOhms	10.0	9.0
Rdson at 2.5Vgs	mOhms	12.0	12.6

Table I: Typical electrical parameters of the optimized device – simulated vs. measured data

For the dual common-drain architecture, the major components of source-source on-resistance are the main device resistance, the substrate and back metal resistance, primarily due to lateral current flow from one source to the other. The advanced MOSFET technology used in this device, to reduce on-resistance of channel and drift resistance components, causes the substrate and back metal resistance contribution to become substantial. This resistance can be reduced by one or all of the following: (i) thinner substrate and thicker back metal, (ii) lower resistivity back metal, and/or (iii) reduced distance from the first to the second source areas. However, each of these approaches has its own set of benefits and challenges. Wafer level chip scale packaging (WL-CSP) has received much interest lately since it offers solutions to these problems. WL-CSP is widely used in portable electronic equipment like cellular phones because of their smaller size and low parasitic resistance and inductance. The low capacitance of the WL-CSP design has better applicability to high-frequency devices than traditional lead-type packages like thin small outline package (TSOP).

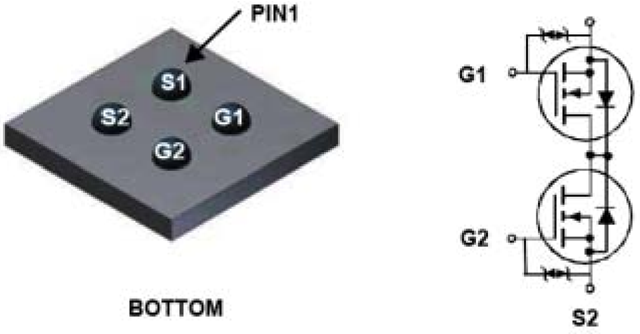

Figure 3: Package outline and schematic of the Dual Common Drain MOSFET in a WL-CSP

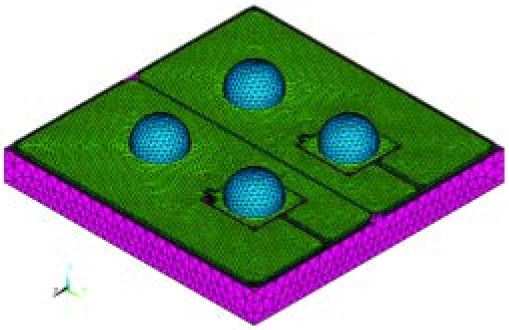

Figure 4: WL-CSP device as simulated using ANSYS® software

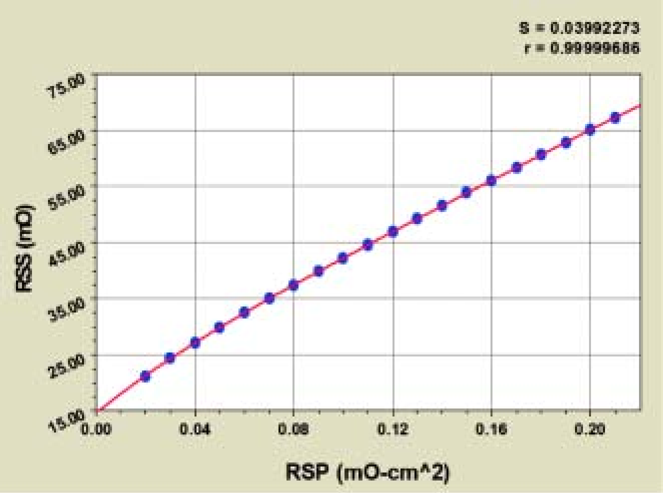

Figure 5: Simulated product Rss(on) vs. specific on-resistance of the MOSFET device

Fairchild Semiconductor's power MOSFET WL-CSP has been carefully optimized for the mobile power application. Figure 3 shows the profile of a typical WL-CSP product housing a dual common-drain MOSFET. Extensive simulations have contributed to determining the optimum layout of the WL-CSP design and the thickness of back metal to minimize resistance waste in the substrate of the device. Figure 4 shows the simulation structure. The simulations use the specific on-resistance of the MOSFET unit cell, along with other parameters from the device, to compute the total source-source on-resistance (Figure 5). The layout of the solder balls is optimized for lowest Rss(on) and also for ease of use in the specific application. A typical process flow for these WL-CSP devices includes the following steps. A polymeric layer is first deposited on the top passivation of the incoming wafer for stress buffering. After this, the under bump metallization (UBM) is deposited on the pads for the subsequent lead-free solder bumping process. The 0.5 mm or 0.65mm layout pitch allows for direct surface mounting of the die on a standard PCB, leveraging

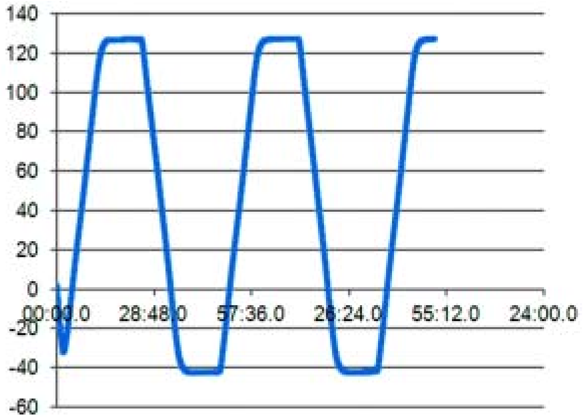

Figure 6a: Temperature profile used for temperature cycling test

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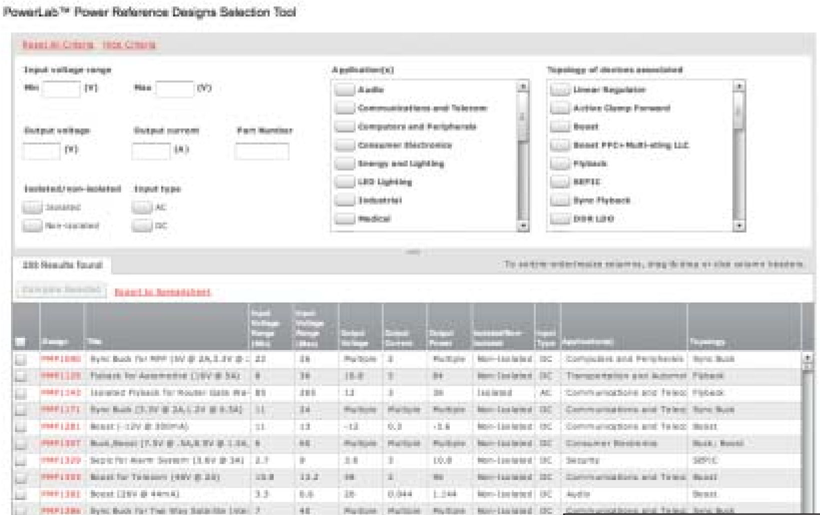
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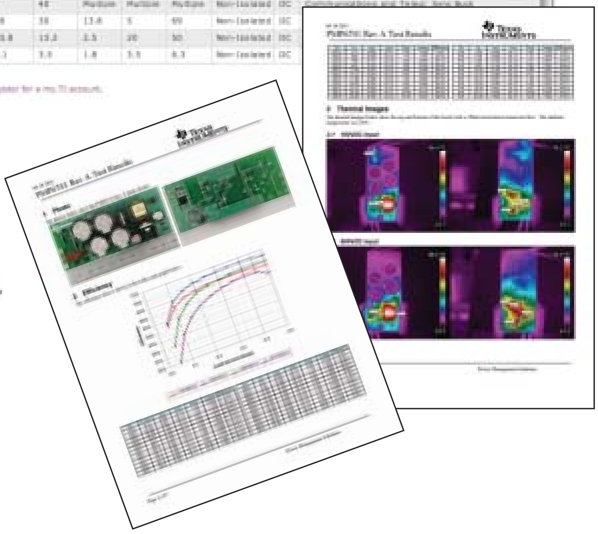

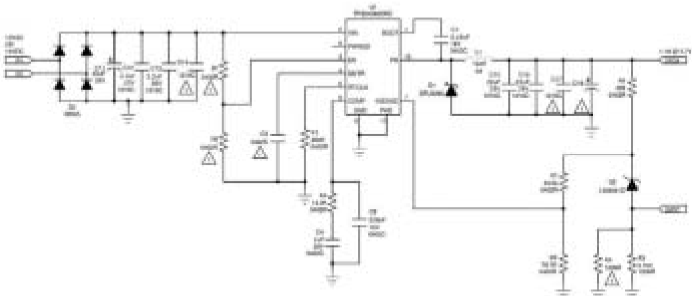

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the existing board assembly infrastructure without requiring the more expensive high density boards. This is followed by ball drop and reflow processing, all before the devices go through final testing (done in wafer form).

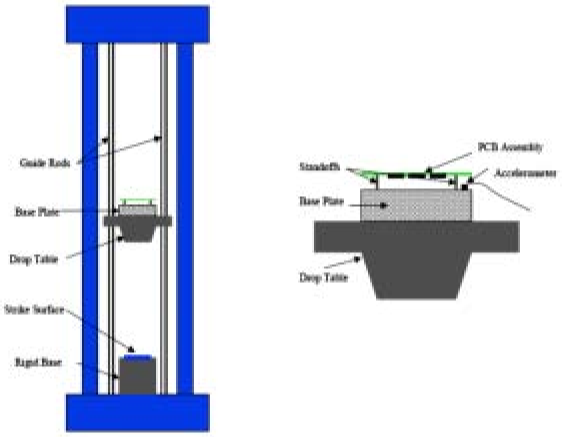

Figure 6b: Test setup and board placement for the drop test

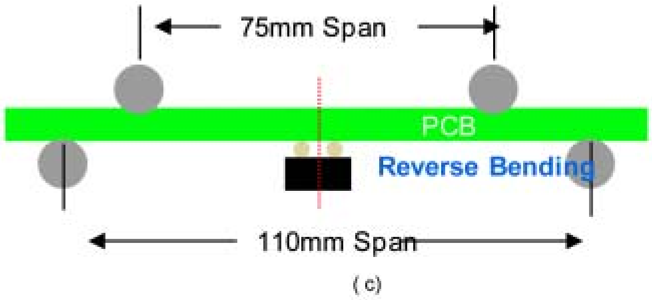

Figure 6c: Mounting scheme for the cyclic bend test

Test	Condition	Failure criteria	Test duration	Results	Failure mode
Temperature cycling	•-40 °C / +125 °C temperature extremes •10 min dwell time •≤20°C / min ramp rate	The 1st event of 1000 Ω increase in resistance for a duration of 1 µs with additional nine or more events within 10% of the cycles from the initial event	1000 cycles or 63.2% cumulative failure (whichever occurs first)	0/32 @ 1000 cycles	
Drop	•Half sine wave •1500G for 0.5 ms duration	4 events of discontinuity with increase in resistance greater than 1000 Ω lasting 1 µs or longer in 5 subsequent drops constitute a failure	1000 times or until 80% of all devices have failed (whichever is earlier)	1/60 @ 1000 drops	Cu trace crack (fatal failure)
Cyclic bend	•Vertical displacement: 2 mm •Cyclic frequency: 1 Hz •Load profile: sinusoidal •Support span: 110 mm •Load span: 75 mm	The 1st event of 1000 Ω increase in resistance for a duration of 1 µs with additional nine or more events within 10% of the cycles from the initial event	200,000 cycles or until at least 60% of all units have failed from the initial samples (whichever occurs first)	0/36 @ 200K cycles	

Table II: Test conditions and test results for the three board level reliability tests

Figure 7: Failure analysis of the drop test fail, showing that there is no anomaly with the device

One of the critical aspects of a new package is its reliability. For our new products, the WL-CSP 1.0 x 1.0mm, 4 ball 0.5mm pitch was tested in the board level temperature cycling, drop and cyclic bend test. Figure 6 shows the test setup and profile used for these tests. These tests are intended to assess board level reliability of the WL-CSP package. The test follows established industry standard and best practices which intend to simulate stress conditions during board mounting and in field application. The three tests conducted for these CSP devices included temperature cycling, drop test and cyclic blend. The temperature cycling test is intended to provide information on the wear out performance of the solder joint attachment of surface mount devices to circuit boards where cyclic stresses due to CTE mismatches from thermal loading may result in fatigue-related failures. The drop test is intended to determine the ability of the mounted component to withstand moderately severe shocks such as a result of sudden applied force or sudden change in motion produced by handling, transportation, normal field operation, accidental misuse or drop of the product. The cyclic bend test is intended to characterize the fracture strength of the board level interconnects due to flexural loading that is cyclic or reiterative in nature.

The products were subjected to all these tests using the conditions listed in Table II. All parts passed the tests and no solder joint failures were observed. There was just one failure in the drop test and that was also not related to the device, but due a crack in the Cu trace as seen in Figure 7. All reliability criteria were met and the technology has been successfully released to market.

With the advancements in power MOSFET technology that provide reduced resistance silicon, like the latest generation PowerTrench® technology from Fairchild Semiconductor, and the optimized WL-CSP technology, we are able to provide ultra small footprint solutions. The ultra low Rss(on) of these devices helps in minimizing the total power loss, which in turn prolongs battery life and usage time.

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- Increased system lifetime
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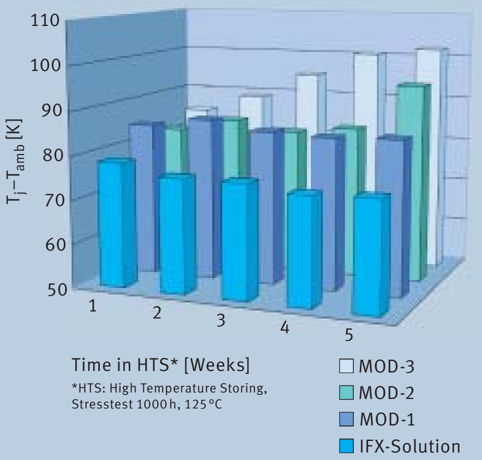

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Novel Light Triggered Thyristors for Phase Control and Pulsed Power Applications

This article presents investigation results obtained by development and application of high-voltage Light Triggered Thyristors (LTTs) with integrated in silicon p-n-p-n structure self-protection elements from breakdown by critical operation conditions.

By A.V.Grishanin, V.A.Martynenko, A.A.Khapugin, S.A. Tundykov
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Development trends of power electronics demand device power increasing, new functional features, high device and system reliability. Using of LTTs allows simple and reliable circuit solutions in variable application fields: power transmission, ultra-high power pulse commutation, high-voltage drives and other. In 70-80 years of last century, after NTD silicon introduction, new possibilities has been opened for high-power high-voltage semiconductor devices.

Investigations of p-n-p-n structure optical triggering were started in Russia 50 years ago. But these investigations were episodic and practically they were the research works. Russian companies offered until recently only small LTTs, optron thyristors and modules with relatively small currents and voltages. Development of LTTs and conventional thyristors with integrated self-protection elements is being in the last 15-20 years the main stream of power semiconductors. Increased power and costs of power electronic systems demand new self-protected (intelligent) device generation. The main aim of integrated self-protection is to prevent irreversible device degradation during error (critical) commutation mode.

This paper presents joint results of All-Russian Electrotechnical Institute and JSC Electrovipryamitel in research, development and production of high-voltage power LTTs.

LTTs for Phase Control Applications

LTTs are widely used in modern high effective converters for HVDC transmission and DC links. The cause for that is their advantages by series connection: high robustness and overloading capability, precise temporal control by turning on of thyristor groups, high voltage isolation between control and power circuits, integrated self-protection functions and other.

LTT design is the same as press-pack thyristor one, with optical input instead of electrical gate interface. Optical input is disposed at cathode base center and represents optical window closed by light-sensitive region of semiconductor structure (Figure 1).

Figure 1: LTT design

Triggering pulse comes into light-sensitive silicon region through optical cable from IR laser diode. Cable length is practically unlimited, because of very low signal attenuation (~1 dB/km). Laser diode converts electrical signal from drive circuit into light pulse with practically identical form and duration. Correct choice of wave length is very important for effective LTT operation. Optimal wave length is stipulated by silicon structure design feature with deep collector p-n junction. Figure 2 illustrates simulated turn-on delay time versus laser diode wave length (pulse power 200 mW).

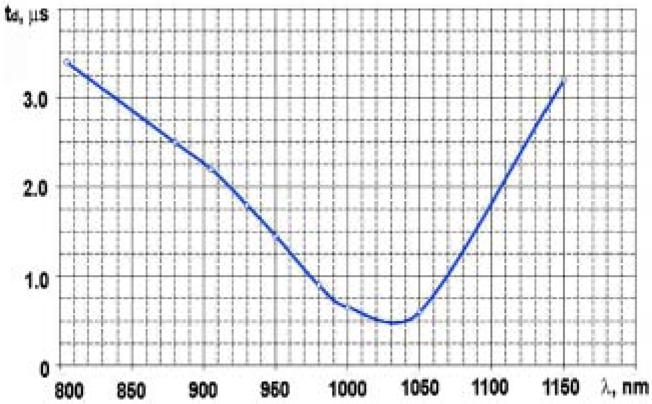
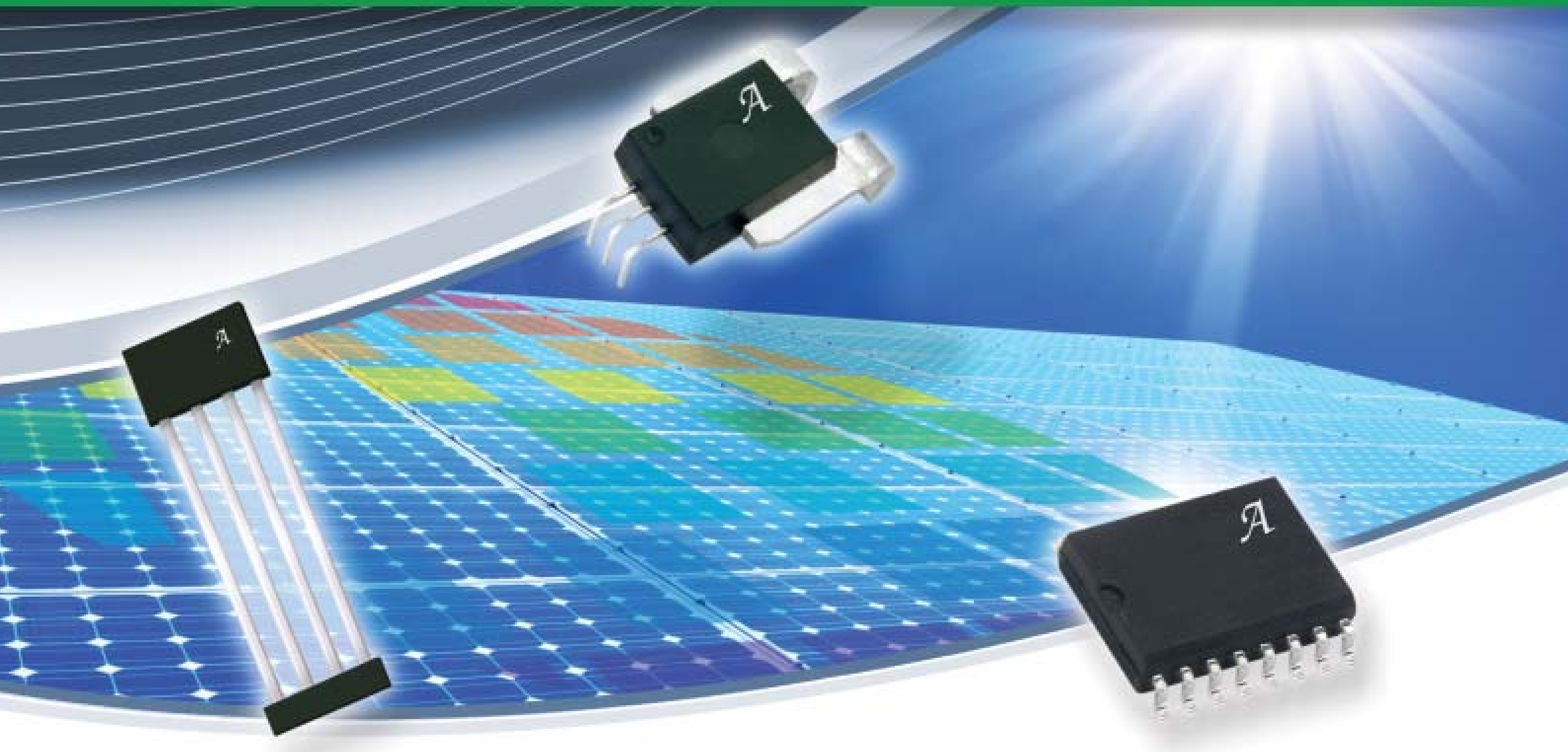


Figure 2: Simulated LTT turn-on delay time versus laser diode wave length (P_{LM} = 200 mW, V_A = 100 V)

Simulation shows that optimum wave length for developed LTT triggering lays in range 1000÷1050 nm. Wave length over 1100 nm is uneffective because photon energy is unsufficient for electron-hole pair generation. Light effectiveness goes down too, when wave

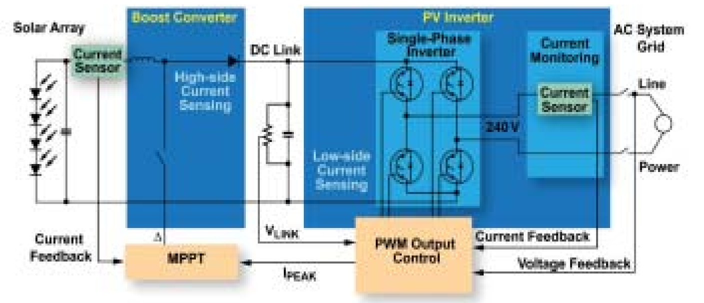
Allegro Current Sensor ICs Providing Green Energy Solutions in Photovoltaic (PV) Inverters



Allegro MicroSystems' family of fully integrated current sensor and linear ICs offer high accuracy sensing solutions for grid tied PV solar systems. Allegro's surface mount packages provide small form factor, fully integrated current sensor ICs with galvanic isolation. These ICs can sense 5 to 50 A of continuous current and are rated to 3000 VRMS isolation The series resistance of the package primary conductor is nominally 1 mOhm and provides for highly efficient current measurement in PV applications.

The Allegro ACS758 family of parts delivers an even lower 100 uOhm series resistance and is capable of sensing current from 50 to 200 A. Allegro's A1360 family of devices is available in a 1 mm SIP package and capable of sensing current greater than 200 A.

PV System Block Diagram



Allegro Advantages for Solar Inverters

- **High accuracy ZERO Amp output voltage and device sensitivity achieved with Allegro factory programming**
- **Capable of sensing AC current and DC current**
- **Cost-effective solution compared to closed loop sensor technology**
- **3000 VRMS isolation**
- **High temperature operation up to 150°C**
- **100 uOhm and <1 mOhm internal conductor resistance for low power dissipation**
- **Small factor, low profile packages compared to current transformers**

A1360	ACS758	ACS710
		
Sensed Current > 200 A	Sensed Current 50 to 200 A	Sensed Current 5 to 40 A

Representatives

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length becomes less than 1000 nm, due to low light penetration into silicon and electron-hole pair recombination close to surface.

Creation of gate region with high light sensitivity is big challenge during LTT development. Output optical power of drive system is much lower than input electrical power, despite of advanced light emission sources and optical cables. Thytistor with high optical sensitivity is simultaneously very sensitive to interferences and has low allowable rate of rise of forward off-state voltage dv_D/dt. Light sensitive region must be small for ensuring of high dv_D/dt, but it limits rate of rise of on-state current di_T/dt.

The developed LTTs are triggered with optical power no more as 20 mW and withstand dv_D/dt = 5000 V/µs. It was achieved owing to optimal diffusion profile of semiconductor structure, optimal light sensitive and cathode regions layout and amplifying gate structure. Amplifying gate is necessary since photon irradiation of light sensitive region generates very low gate current.

Some specific dangerous modes springs up during power thyristor operation. One of the most critical modes is overvoltage, when applied anode voltage exceeds avalanche breakdown voltage of collector junction that leads to thyristor latch up. It appears in very small region with minimal electric strength and causes current filaments and silicon structure melting.

The aim of integrated overvoltage protection is to form internal gate signal and turn thyristor on before the anode voltage will reach latch up voltage of main structure. Local region with lowered collector junction breakdown voltage is created for this aim in the central region of silicon structure. Avalanche breakdown current arises in this region when anode voltage exceeds breakdown voltage. This current flows to cathode region and turns thyristor on. So this current represents gate triggered current.

Local region with lowered breakdown voltage can be created both inside and outside of light sensitive region. When semiconductor structure has amplifying gate this region can be created inside of any amplifying ring. Local regions with lowered breakdown voltage can be created by means of local n-base resistivity lowering, through shallow donor levels combined with hydrogen atoms.

Operation of integrated self-protection elements was examined in test circuit that forms voltage pulses up to 10 kV. Test arrangement has IR-camera for local breakdown registration in silicon structure. Figure 3 illustrates LTT self-protection [1].

Figure 3a presents voltage and current wave forms – fast forward voltage increase, LTT turn on by V_D = 6500 V with following anode current pulse. Figure 3b presents IR image of tested device at self-protection snap instant. Local region with lowered breakdown voltage is visible as hot spot in the center of semiconductor wafer.

Power components for series and parallel connection must be designed so that all devices switch simultaneously and similarly. Reverse recovery charges must be equal. Weak electron irradiation of LTT silicon structures allows to reach minimal technological dispersion of reverse recovery charge values and low commutation overvoltage by optimal on-state voltage (V_{TM}).

The main parameters and characteristics of new developed LTTs are presented in table 1.

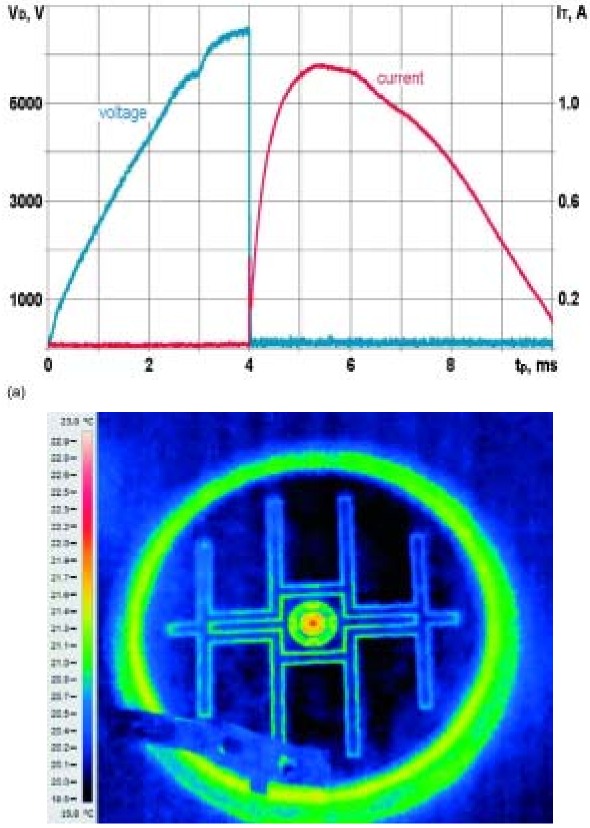

Figure 3a and b: LTT self-protection process

Item	Parameter	Values			
		TL353-630	TL273-1000	TL183-2000	TL193-2500
1	Repetitive peak forward off-state voltage, V_{DRM}, V	6000 – 6400	6000 – 6400	6000 – 6400	6800 – 7600
2	Protective break over voltage, V_{BO}, V	6200 – 6600	6200 – 6600	6200 – 6600	7000 – 7800
3	Repetitive peak reverse voltage, V_{RRM}, V	6600 – 7000	6600 – 7000	6600 – 7000	7200 – 8000
4	On-state current (average value) at case temperature T_C = 70°C, $I_{T(AV)}$, A	790	1360	2115	2520
5	Surge non repetitive on-state current, I_{TSM}, kA	12	24	40	55
6	Critical rate of rise of on-state current, $(di_T/dt)_{crit}$, A/µs	300			
7	Critical rate of rise of off-state voltage, $(dv_D/dt)_{crit}$, V/µs	2000			
8	Optical trigger power, P_{LM}, mW	40			
9	Junction temperature, T_j, °C	-40..+120			
10	Turn-on delay time, t_d, µs	5.0			
11	Turn-off time (typical value), t_q, µs	630			
12	Reverse recovery charge, Q_{RR}, µAs	3000	4000	5000	6000
13	Weight, w, kg	0.65	1.5	2.0	3.0
14	Clamping force, F, kN	20..26	40..48	60..80	70..90

Table 1: Parameters of LTTs for Phase Control Applications

LTT for Pulsed Power Applications

Modern power pulse technique demands reliable switches for high power pulse current commutation in microsecond and sub-millisecond range. Solid state semiconductor switches are very attractive for use in pulse supply systems, because of high reliability, long life time, low exploitation costs, ecological safety. Semiconductor switches are used in ultra-high electromagnetic fields equipment, power laser supply systems, fast-acting crowbars, radars, water cleaning equipment and other.

New developed power 4 inch LTT for pulse applications can commutate current pulses of 100 kA by 700 µs duration. Thyristor switch in pulse operation commutate single or seldom repetitive current pulses with peak values close to maximal allowable surge current. High heat dissipation limits current commutation capability. [2]


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Figure 4 shows silicon structure layout of LTT for pulsed power applications. It has high degree interdigitated gate with 4-stage amplifying structure. Interdigitated gate contributes to turn-on time shortening and commutation loss reduction.

Figure 4: Silicon structure layout

Thyristor robustness and reliability during pulse commutation with high diT/dt depends on dynamic temperature distribution through silicon structure. High current density at the turn-on beginning leads to overheating of amplifying structure and adjoining cathode region. Temperature distribution in central region was simulated for critical places determination.

Figure 5 shows simulation results.

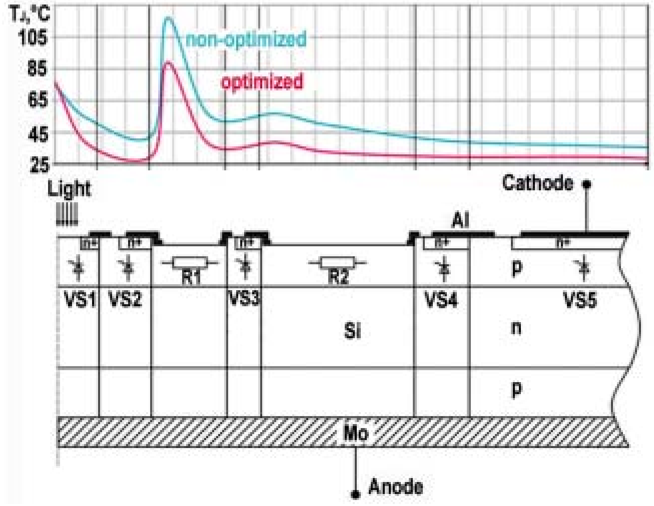

Figure 5: Simulation model of LTT silicon structure center and radial temperature distribution at maximum heat dissipation instant

Curve 1 presents temperature distribution for structure with optimal current limiting resistance. Curve 2 concerns LTT structure without integrated current limiting resistor.

As can be seen from simulation results, overheating of gate region at turn-on beginning is main physical factor that limits commutated current di_T/dt. The first amplifying stage is overheated most of all. Temperature in this region can reach the critical value at them current filament arises that leads to thermal destruction. Current filaments arise when thermal generation becomes main conductivity modulation mechanism in n-base local regions. The critical temperature for filamentation beginning is 400-600 ºC.

Amplifying structure of special design and integrated current limiting resistors was developed for turn-on loss minimization and high di_T/dt ensuring. Overheating of first amplifying stage depends on current limiting resistance that can be controlled by means of p-base mesa-etching. It can be seen from figure 5 that R1 region is overheated up to 120 ºC when LTT structure is not optimal. Resistance increasing for structure optimization allows 30 ºC temperature decreasing. Figure 6 shows experimental dependence of current limiting resistance on technological factors. Figure 7 illustrates experimental dependence of minimal anode voltage on integrated resistance value.

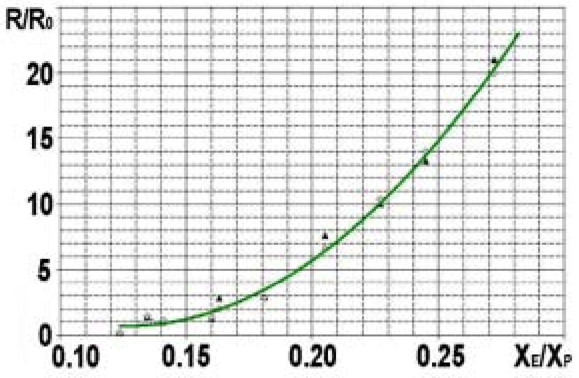

Figure 6: Dependence of current limiting resistance on technological factors

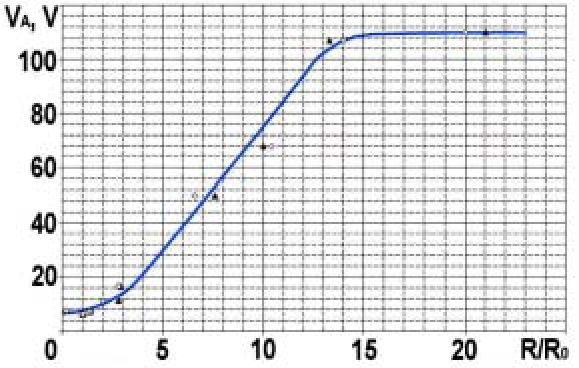

Figure 7: Dependence of minimal anode voltage on integrated resistance

Optimum resistance values are determined during investigations. These resistance values ensure high di_T/dt and minimal anode voltage of 20 V, by them LTT can be yet turned on.

Developed LTT was tested for estimation of maximal pulse commutation capability. Fig. 8 shows anode current and triggered light pulse wave forms during di_T/dt test. Laser diode 150 mW was used in test circuit for LTT triggering. Capacitor charge voltage V_A = 4000 V.

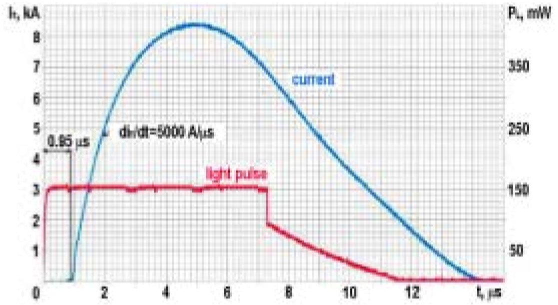

Figure 8: Anode current and light pulse wave forms

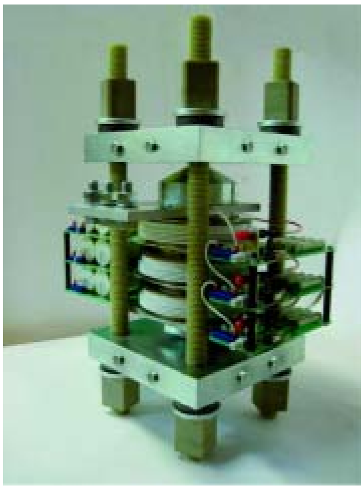

Figure 9: Power stack for capacitive storage device

Item	Parameter name	Parameter value
1	Repetitive reverse voltage and repetitive peak forward off-state voltage, V_{RRM}, V_{DRM}, V	4200-5000
2	Peak pulse on-state current, t_p = 700 µs, I_{TRM}, kA	110
3	Surge non-repetitive on-state current, I_{TSM}, kA	50
4	Critical rate of rise of on-state current, $(di_T/dt)crit$, A/µs	5000
5	Critical rate of rise of off-state voltage, $(dv_D/dt)crit$, V/µs	2000
6	Optic trigger power, P_{LM}, mW	40
7	Junction temperature, T_j, °C	-40..+125
8	Turn-off time (typical value), t_q, µs	320
9	Reverse recovery charge, Q_{RR}, µAs	2400
10	Weight, w, kg	3.0
11	Clamping force, F, kN	70..90

Table 2: Parameters of TFI193-2500

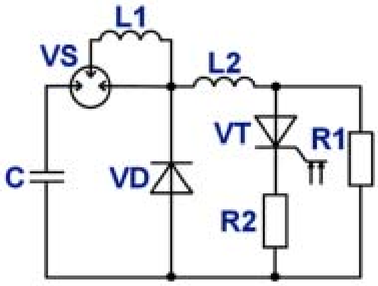

Figure 10: Test equivalent circuit

It can be seen from figure 8 that developed LTT can commutate current pulses with di_T/dt = 5000 A/µs. Tests with higher di_T/dt were not carried out due to limited test circuit capability.

Developed devices were tested in high voltage stack with 3 LTT in series connections (figure 9) for power capacitive storage device 5 kV, 50 kJ. Figure 10 shows equivalent circuit of storage device.

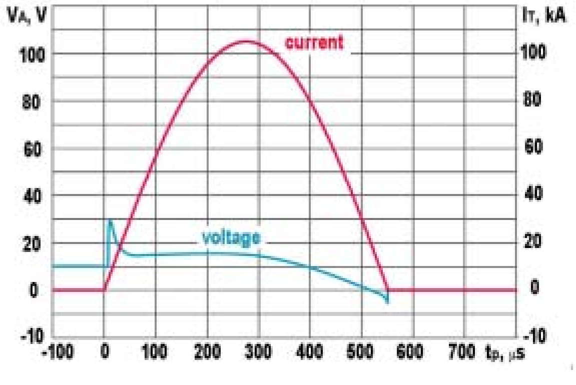

Figure 11: Discharge current and voltage wave forms

Power stack with 3 LTTs was tested in capacitive storage device. The stack sustained 1000 discharge cycles with peak pulse current 108-110 kA. Fig. 11 shows current and voltage wave forms for LTT with blocking voltage 4.2 kV.

Temperature jump during current pulse affects the life time of semiconductor pulse switches. Calculation of structure maximum temperature can be used as theoretical confirmation for LTT robustness in pulse operation mode. Simulation model was used that takes into account semiconductor structure layout and dependence of turn-on condition spreading velocity on current density.

Figure 12 shows simulated temporal course of semiconductor structure temperature during current pulse 100 kA. The maximum temperature not exceeds 150ºC that is much lower than critical temperature for semiconductor structure destruction (400-600 ºC).

The main parameters of new developed LTT type TFI193-2500 for pulsed power applications are presented in table 2.

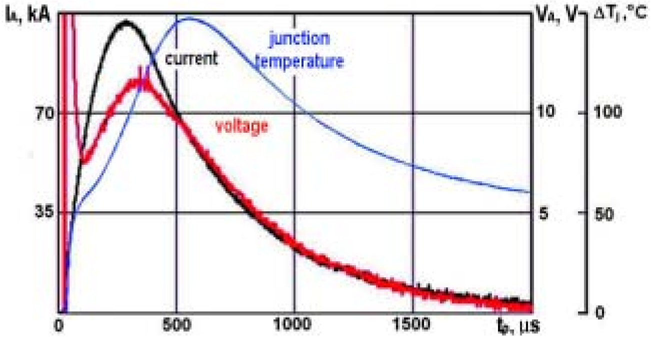

Figure 12: Simulated temperature of silicon structure

Conclusion

This paper presents development and investigation results of high-voltage power LTTs. LTT is nowadays one of most important components for HVDC transmission equipment and for other applications in MW and GW power range, due to optical triggering, integrated protective functions and unique combination of load and commutation capabilities.

Tests show high reliability and effectiveness of LTTs. Works are being continued on LTT improvements – parameter, characteristics and functional capabilities optimization, additional self-protection elements implementation, losses reducing, operation voltage and commutated current increasing.

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Introduction of an Auxiliary Resonant Commutated Pole (ARCP) Intelligent Power Module

The ARCP half-bridge topology developed by alpitronic has implemented "soft switching" on power conversion systems. New with the topology is the absolute zero voltage switching of the half-bridge main switches, wherein the voltage swing is performed by an auxiliary resonant circuit. The resonant circuit generates an absolute zero voltage across the main switch to be turned on for a certain time interval.

By Philipp Senoner & Sigrid Zanon, alpitronic GmbH

This makes the circuit robust against timing inaccuracies and guarantees minimal turn-on losses. Together with an intelligent gate-driver-stage, the whole circuit can be controlled at his interface to the controlling unit like a conventional half or B6 bridge circuit. This makes the topology industrializable as an integrated power module.

Figure 1: 600V / 250Arms ARCP intelligent power module

Key advantages are the drastically reduced switching losses, which lead to admissible high PWM frequencies up to 50 kHz (at several hundred amperes), and a significant reduction of EMI-emissions, resulting from the smooth resonant transition of the PWM voltage. All this advantages are improving efficiency and reliability of the devices where the topology is implemented.

Consequence of these advantages in the field of motor drive applications is the possibility to use new compact motor types (with a higher pole number) with better torque characteristic and lower weight. For power conversion systems, the high frequency switch mode opens a wide spectrum of new applications and implementation possibilities, for example the use of smaller magnetics and inductances due to higher PWM frequencies.

Technical background

State of the art of "hard switching" topologies

State of the art industrial and traction applications use hard switching PWM inverter topologies to drive their loads. Hard switching is also widely used in power conversion systems. Hard switching means that a transistor during turn-on will see the whole DC-link voltage, typically several hundred Volts, across its conducting pins during the switching interval.

During the turn-on interval the transistor changes his state and begins to conduct, while the voltage begins to fall at the same time as current begins to flow. This coincident presence of voltage and current on the transistor means that, during this phase, power is being dissipated within the device. Nearly the same happens as the device turns off when the full current is flowing through it, while the voltage starts rising.

The approach to minimize the switching losses by reducing the switching time interval (for example through a lower gate resistance) results in faster rise and fall times and lower switching losses but generates more high frequency energy that is radiated and conducted out of the unit. At the same time, fast switching causes considerable transient effects due to inductive parasitics which bring the device near to its voltage maximum ratings and lead to lifetime reduction. Therefore hard switching topologies always consist in a compromise between reduced power losses during the switching period and admissible EMI emissions as well as component stress.

Principles of "soft switching" topologies

"Soft switching" power conversion topologies allow to drastically reduce the power dissipated in the transistor during turn-on and turn-off. At the same time, the emission of high frequency energy is almost eliminated.

The operation principle of "soft switching" topologies consists in zero voltage switching (ZVS) and/or zero current switching (ZCS) of the switching device. Zero voltage switching is achieved by means of a resonant switching auxiliary circuit which forces the voltage across each transistor to swing to zero before the device turns on and conducts current. By turning the current on at zero voltage, almost no turn-on losses are generated. At turn-off, the switching losses are reduced by parallel capacitances which limit the voltage gradient across the transistor. Disadvantages of soft switching topologies are a higher complexity by the use of additional components like auxiliary switches and inductances and capacitances used for the resonant circuit.

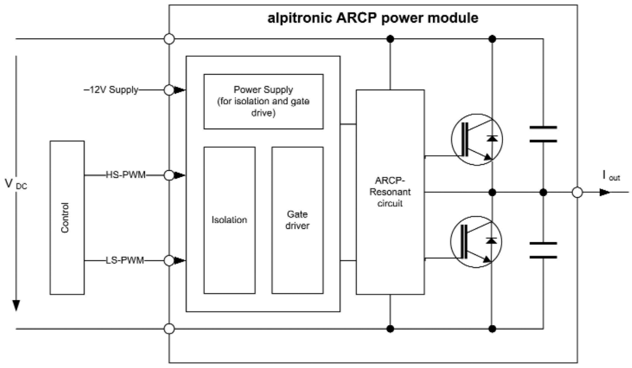
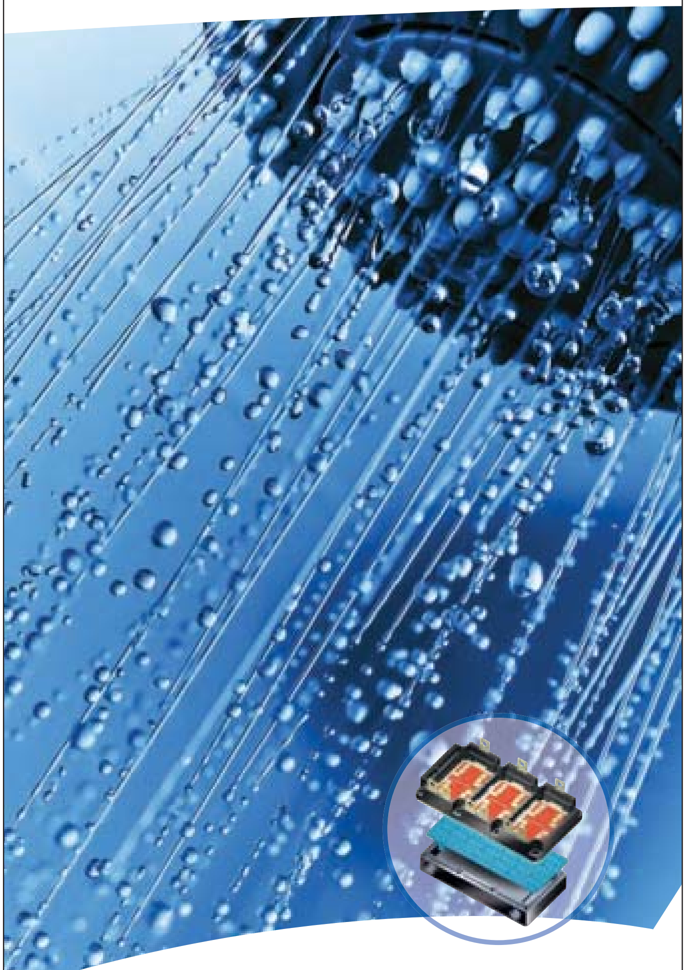


Figure 2:
Block diagram of the alpitronic ARCP intelligent power module

Additional features of alpitronic's "soft switching" topology
Detecting the zero voltage intervals on the main switches and triggering the resonant switching scheme demands higher control efforts than conventional "hard switching" topologies. In most soft switching topologies, a very accurate zero voltage detection and timing of the switches is required to turn the half-bridge transistors on while the voltage is zero. In certain resonant topologies, due to parasitic damping in the resonant circuit, zero voltage can't even be reached and considerable switching losses occur. alpitronic's "soft switching" topology excites the resonant circuit with a boost voltage which guarantees that the zero voltage is reached in any case by causing a slight overswing which is clamped by the main switches' antiparallel diodes. Thus, the main switch can be turned on at zero voltage in the whole time interval generated by the overswing. This guarantees that the turn-on of the main switches takes effect at zero voltage even if there is some timing jitter in the control circuit of the switches. Consequently, it is possible to implement a easily controllable gate-driver-stage which deducts the timing for the auxiliary and main switches by the control signals for a conventional half bridge. This allows the circuit at its interface to the controller to be driven with a simple PWM, ignoring the integrated resonant scheme from the control side. Therefore the alpitronic topology at its interface to the control unit behaves like a conventional half bridge and can be controlled as such.

Key benefits of "soft switching"
General benefits of conventional "soft switching" topologies
As discussed in the previous sections, "soft switching" techniques are characterized by the reduction of power dissipation during the switching process and the significantly reduced EMI-emissions. "Soft switching" topologies provide the following benefits compared to "hard switching" topologies:

Reduced power losses during the switching process lead to:
- Improvement of efficiency by drastically reducing switching losses. For alpitronic's soft switching resonant topology, a reduction of the switching losses of 50 -70% (load dependent) compared to a "hard switching" system can be achieved
- The possibility to apply high PMW frequencies. For alpitronic's soft switching resonant topology, this means PWM



frequencies up to 50 kHz on target applications like inverters, even with currents of several hundred amperes
- Due to the high PWM frequency: significant reduction of coil and transformer sizes in power supply applications which result in cost, material and weight reduction
- For traction applications: use of motors with a large number of poles and high EMF frequency. This means new more efficient and smaller motor geometries and better torque characteristics. With alpitronic's soft switching resonant topology, EMF frequencies up to 4-5 kHz can be achieved.

The smooth resonant transition of the PWM voltage leads to:
- An adjustable low dV/dt
- Reduced parasitic transient which stress the components at their maximum voltage ratings or allow to raise the DC-link voltage nearer to the maximum ratings
- Dramatically reduced EMI-emissions even on high PWM-control frequency which lead to significant cost reductions by reducing/eliminating ulterior standard EMI-protection
- Reduction of motor insulation in traction applications because of the low dV/dt, which leads to cost reduction and longer mean time between failure (MTBF)
- Shield reduction/elimination on the motor connection cable which means again cost reduction
- Higher immunity to the effects of other equipment operating nearby

Application specific benefits of the alpitronic topology
Complex timing and control efforts in conventional "soft switching" topologies may be the reason that such circuits did not get industrialized, nor used in a wide spectrum of applications. The alpitronic "soft switching" topology with its intelligent gate driver circuit doesn't have these additional needs and leads to a significant reduction of complexity for the user because it behaves at its interface like a conventional half-bridge and can be controlled as such. Because of the circuit's robustness to the timing of the mains switches, absolute zero voltage switching can be assured for the whole application range, avoiding additional switching losses by timing inaccuracies.

Figure 3: Total switching losses (IGBT Eon, Eoff and Diode) of the alpitronic ARCP intelligent power module

Figure 4: Load currents at 5kHz frequency (top), PWM up and down swing (bottom)

Additional benefits of the alpitronic "soft switching" topology:
- Absolute zero voltage swichting leads to further reduction of switching losses
- No additional control efforts in comparison to "hard switching" bridges at the topology's interface
- The topology is industrializable as an integrated power module

Intelligent power module with incorporated ARCP topology
alpitronic has presented first engineering samples of a half bridge IPM (intelligent power module) with incorporated ARCP-topology at this year's PCIM Europe fair at Nurnberg. The presented module includes the integrated ARCP-topology, gate-driver stage, gate-driver supply, and isolation. The interfaces of the module consist of a 12V supply interface, 2 TTL-PWM control signals for the main switches and the DC-link and phase outputs. The module is based on 600V IGBT technology and provides a continuous collector current of 250A and 400A implemented collector current. The module is capable to switch 250Arms at a maximum switching frequency of 50 kHz at 400V DC-link voltage. The achieved duty cycle range is 8 to 92%. A module based on 1200V IGBT technology is currently under development.

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Eighth Brick DC-DC Converter

Using Efficient GaN Transistors

In this article, we show that using GaN Transistors such as Efficient Power Conversion's eGaN® FETs [1] can improve the efficiency of isolated eighth brick DC-DC converters. This type of power converters is used extensively in mainframes, servers and telecommunication systems, and is available in a variety of sizes, output power capability, and input and output voltage ranges. It's modularity, power density, reliability and versatility have simplified the isolated power supply market.

By Johan Strydom Ph.D., Vice President of Applications Engineering,
Efficient Power Conversion Corporation

Even so, there are a number of factors such as transient response, efficiency, environmental conditions, or mechanical packaging that can influence the final choice of converter [2]. In this article, we will look at a particular subset of isolated DC-DC converter, the “brick” converter, which is perhaps, the most widely adopted format in the computer and telecommunications industries.

Brick Converters:
As these types of converters are of a defined size, designers are motivated to come up with innovative ideas to increase their output power and power density. For example, within the spectrum of eighth brick converters there are numerous input and output voltage configurations, topologies and output range tolerances (regulated, semi-regulated or unregulated), and they all have a very similar maximum power loss between 12-14 W at full power. Eighth Brick converters have a standard 58 x 23 mm (2.3 x 0.9 inch) footprint which sets the physical limit based not only on the fixed volume of the converter, but also on the common method of heat extraction. Thus, for an eighth brick converter that is 90% efficient ($\eta = 0.9$) at full load, the maximum output power (assuming 14 W loss) will be:

$$P_{outmax} = P_{max\ loss} \times \eta/(1-\eta) =$$
$$14\ W \times 0.90/(1-0.90) = 126\ W.$$

If the efficiency can be improved by 3%, the output power is increased to 186 W. That's 48% more output power!

It is possible to reduce the power loss in the magnetic components by increasing the operating frequency. However, this is not normally done because the increase in the silicon MOSFET switching losses outweighs the potential improvement. For that reason, the operating frequency is typically reduced to the point where the magnetic structure's size is maximized within the overall brick's size constraints. This lower frequency limit can be a significant constraint when fast transient response is needed to react to rapid changes in the load.

A common topology that we can use to explore the capabilities of eGaN FETs in isolated DC-DC converters is a full-bridge primary side and a synchronous rectifier secondary side. The test vehicle chosen was a fully regulated eighth brick with a nominal input voltage of 48 V_{IN}, and an output of 12 V_{OUT}. It is shown that eGaN FETs enable the user to significantly improve efficiency, and therefore power output and cost, while maintaining the required size constraint of an eighth brick.

The eGaN FET-based eighth brick converter developed for this article is not necessarily an optimal solution. The design goal was to deliberately push the operating frequency higher than current commercial systems to show that eGaN devices could enable someone skilled in power supply design to take advantage of the superior switching characteristics in developing next-generation products that are smaller and have a faster transient response.

Description
The phase-shifted full-bridge (PSFB) converter with a full-bridge synchronous rectifier (FBSR) topology is shown in Figure 1. The objective was to show that, due to their relatively small device size, a significant number of eGaN FETs could be used within the restrictive eighth brick size limitations.

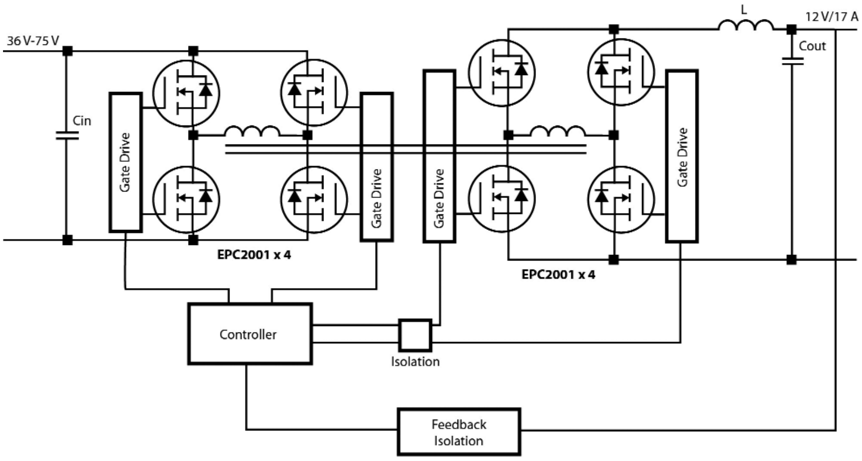


Figure 1: Eighth brick fully regulated, phase shifted full bridge (PSFB) topology, with full bridge synchronous rectification (FBSR) using eGaN FETs

Photo © Messe Frankfurt GmbH

The choice of transformer turns ratio (5:2) means that, at 60 V_{IN}, the secondary side winding voltage is only 24 V but the overshoot can be as high as 60 V without a clamp. For this reason 100 V devices were used on both the primary and the secondary sides.

The final circuit is a 12 V output, 375 kHz phase-shifted full bridge (PSFB) eighth brick converter with a maximum output current of 17 A and a 36 V to 60 V input voltage range. The demonstration board (EPC9102) features the EPC2001 enhancement mode (eGaN®) field effect transistors (FETs) [3], as well as the first eGaN FET specific integrated circuit driver – the LM5113 from Texas Instruments [4]. A complete block diagram of the circuit is given in Figure 2 and the actual eighth brick is shown in Figure 3 [5].

Note that the significant amount of 'green' space (unfilled PCB area) could certainly be further exploited to improve efficiency.

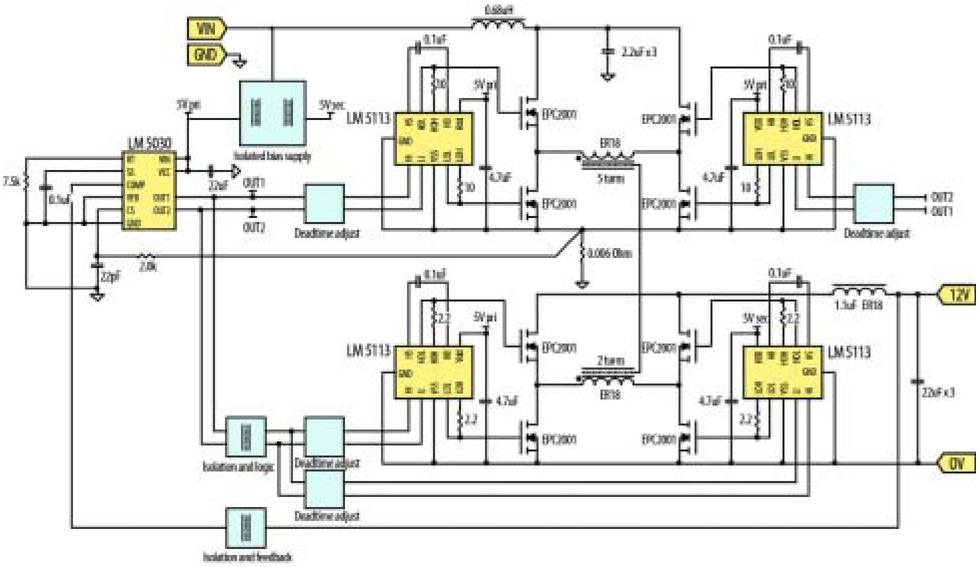
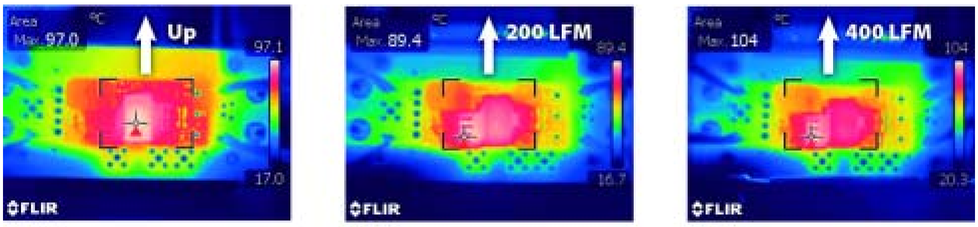


Figure 2: Block Diagram of EPC9102 Demonstration Board



(a) 48 V_{IN}, 8 A_{OUT}, 96 W, convection cooled

(b) 48 V_{IN}, 15 A_{OUT}, 160 W, 200 LFM airflow

(c) 48 V_{IN}, 17 A_{OUT}, 200 W 400 LFM airflow

Figure 6: Thermal images of EPC9102 under different cooling conditions: (a) convection cooled, (b) 200 LFM, and (c) 400 LFM.

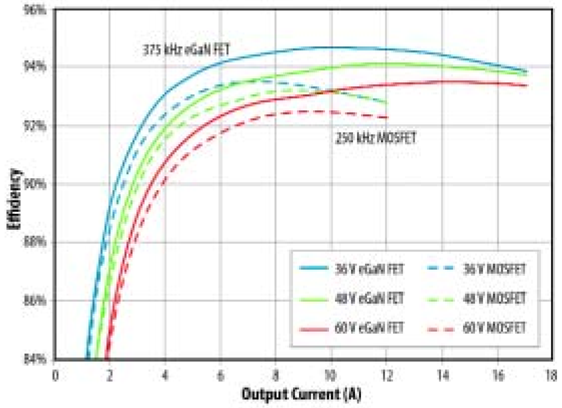


Figure 4: Efficiency comparison between eighth brick converters

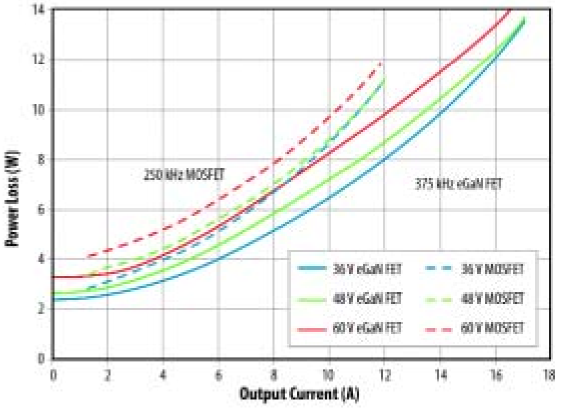


Figure 5: Power loss comparison between eighth brick converters

Eighth Brick Performance

Efficiency and power loss results are shown in figure 4 and figure 5 respectively and are compared against a comparable, commercially available silicon-based eighth brick [6]. Despite the eGaN FET converter operating at 50% higher frequency, it is able to produce 33% more output power for the same power loss.

Thermal considerations

The eighth brick PCB thermal images for steady state full load operation are shown in Figure 6 (a), (b), and (c). Operation without forced-air cooling is possible for limited power operation and quickly becomes thermally limited. Addition of airflow improved the power handling significantly, and with an airflow 400 linear feet per minute (LFM), and 200 W output power delivered to the load, the maximum temperature of the FETs on the board is approximately 104°C, safely below the 125°C maximum for the device.

(a) 48 V_{IN}, 8 A_{OUT}, 96W, convection cooled
(b) 48 V_{IN}, 15 A_{OUT}, 160 W, 200LFM airflow
(c) 48 V_{IN}, 17 A_{OUT}, 200 W 400LFM airflow

Summary

An eGaN FET-based fully regulated eighth brick converter is significantly more efficient than its MOSFET-based counterpart that enables 33% more output power at a 50% higher switching frequency.
More improvement is possible. For example, the full-bridge synchronous rectifier, using 100 V eGaN devices, could be changed to a center-tap with two devices in parallel (similar to the MOSFET-based design). Instead of the output inductor current flowing through two

devices in series, it would then flow through two devices in parallel. This would reduce the secondary-side device conduction losses by 75% (1.3 W, or roughly 10% of total power losses) at 14 A output current [7].

The choice of topology and component optimization is as important in brick converter design as the selection of the best power devices. Someone skilled in these arts should be able to further improve the eGaN FET converters presented here.
eGaN is a registered trademark of Efficient Power Conversion Corporation.

[1] http://epc-co.com/epc/Products/eGaNFETs.aspx

[2] Paul, Knauber, “Select the Best Isolated Brick DC-DC Converter For Your Application,” ECN, February 5, 2010, http://www.ecnmag.com/articles/2010/02/select-best-isolated-brick-dc-dc-converter-your-application

[3] http://epc-co.com/epc/Products/eGaNFETs/EPC2001.aspx

[4] http://epc-co.com/epc/Products/eGaNDrivers/LM5113Bridge-GateDriverOptimizedforeGaNFET.aspx

[5] http://epc-co.com/epc/Products/DemoBoards.aspx#democircuits

[6] Ericsson BMR454 series 48 V to 12 V eighth brick converter, Ericsson website, http://www.ericsson.com/ourportfolio//products/bmr454-series-eighth-brick-intermediate-bus-converter

[7] Lidow, Strydom, deRooij, and Ma, “GaN Transistors for Efficient Power Conversion” Power Conversion Publications, 2012, pages 90-92.

www.epc-co.com

Secondary Thermal Protection for Power Electronics

Preventing thermal runaway resulting from failed power FETs in universal dimmers that are embedded in walls of buildings helps improve the lighting systems' safety and performance.

By Philippe Difulvio, Application Engineering Manager, and Faraz Hasan, Sr. Global Strategic Business Manager for Industrial, Appliance, Lighting, TE Circuit Protection

In recent years, a variety of innovative technologies have emerged to help designers of industrial and consumer electronics implement thermal protection. The objective is to protect the application and the end user from catastrophic thermal events by interrupting electrical current flow when a component or board area is heated to a specific rated temperature.

Traditional thermal protection devices are available in a variety of shapes, sizes and technologies to help protect equipment from damage caused by thermal events. Two notable devices are the thermal fuse/thermal cutoff (TCO) and the thermal switch. Both provide wide-ranging and specific temperature activation characteristics in both AC and DC applications and can be specified as bolt-in, clip-on, pig-tail or lead-type configurations. However, these devices can complicate design-in and manufacturing processes. Careful handling procedures must be adhered to in order to guarantee that they perform as expected.

Thermal fuses typically contain a component that is temperature sensitive, such as a low-temperature alloy or a plastic/wax pellet, which holds a spring contact mechanism. The device is normally closed and opens when activated at a given maximum, or trip, temperature. These devices are also non-resettable and must be replaced after they trip.

Thermal fuses require special handling in the manufacturing process. If they are to be soldered, or require wire extensions to be soldered or welded to the leads, a heat-sink must be attached to the lead to conduct heat away from the temperature-sensitive alloy so as to not activate it or limit the effectiveness of the device before it is to be used in its intended application.

Another common thermal protection device is the thermal switch. These devices are designed for multiple uses and can be configured to be normally-open or normally-closed. When a specific trip temperature is reached the thermal switch activates and opens like a thermal fuse to stop the current flow. Likewise, when designed to close during a thermal event, the thermal switch can be used to activate a secondary airflow device, such as a fan, to cool the application. When a pre-determined temperature is reached the device will revert to its pre-tripped state, normally-open or normally-closed.

One limitation of traditional TCOs is that they are not surface mount or reflowable like standard semiconductor products and require manual application. Thermal cut-offs also exhibit lower current ratings, limited DC rating (AC rated), vibration sensitivity and installation sensitivity. Due to repeated operations at temperatures close to but below their calibration temperatures, or as a result of excessive thermal waves across the case and the leads of the TCO, nuisance trips may occur because of pellet shrinkage.

Thermal fuses, unlike electrical fuses, react only to excessive temperature, not excessive current – unless the excessive current is sufficient to cause the thermal fuse itself to heat up to the activating temperature due to I^2R effects. Thermal fuses are also intended as a failsafe or as an added safety back-up which will activate when other electrical safety measures such as circuit breakers or traditional fuses fail. Thermal fuse operating characteristics can also change over time from self-heating effects or from operating under high current loads.

With applications continually moving towards more compact surface mount designs, the major limitations of traditional thermal protection devices are that they are not available in surface mount configurations, require costly manual application processes, and, in the case of traditional TCOs, they may fail short.

Reflowable Thermal Protection Device

TE Circuit Protection recently introduced a surface mount, thermal protection device that is pick/place compatible and can be designed-in and reflowed on a PCB, utilizing standard surface mount lead (Pb)-free reflow manufacturing processes over a broad range of device activation temperatures.

The Reflowable Thermal Protection (RTP) device is intended to withstand the demanding environmental, life, and reliability requirements of automotive and industrial applications, including shock, vibration, temperature cycling, and humidity exposure. Once the reflow process is complete an arming procedure is all that is required in order for the device to be ready to activate at its predetermined trip temperature.

Helping Prevent Thermal Runaway in Dimmer Applications
Universal dimmers, used with increasingly popular LED lighting systems, are subject to power FET and MOV failure – which can lead to thermal runaway and potentially catastrophic events. Because most lighting dimmers are embedded in the wall of a house or building, providing robust, reliable circuit protection is a primary design consideration.

Two power FETs are typically used to dim the lights and set the speed of the motor in universal dimmers. Traditionally, metal oxide varistors (MOVs) have been used to protect the FETs from damage from overvoltage events such as lightning and other surges. Today, however, the need for safety is driving designers to also employ thermal cutoff (TCO) devices to sense overtemperature events as a means for providing secondary thermal protection. If a power FET fails in resistive mode or an MOV fails due to an increase of the leakage current, either of which can lead to thermal runaway, the thermal device activates to shut down power and prevent catastrophic events.

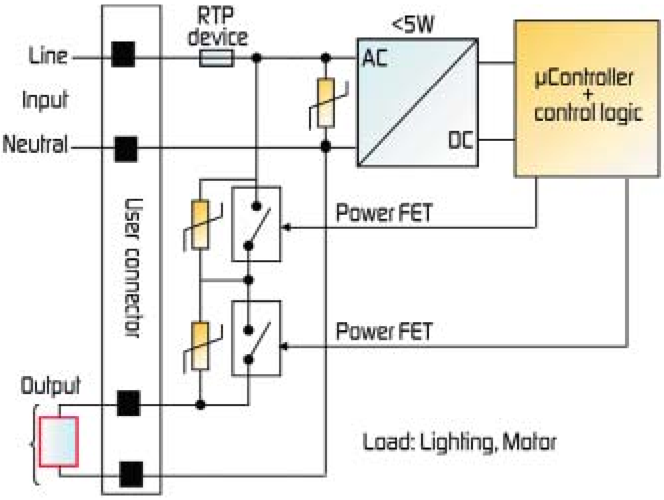


Figure 1: The RTP device can be placed in series to help protect the power FET.

As shown in Figure 1, the RTP device can be placed in series and in intimate thermal contact with the power FET to help protect the application against damage resulting from elevated FET temperatures. If the FET fails in resistive mode and overheats, the RTP will activate to help prevent thermal runaway.

In this example the RTP device (model RTP-140) is rated to activate at 140°C. Once it has been reflowed onto the PCB a simple arming procedure is all that is needed to ready the device. Once installed, it will activate at 140°C to interrupt the current if FET failure results in overtemperature conditions, opening before the solder melt point of 220°C. This device is useful for, but not limited to, LED lighting and appliance electronics and can be reliably used and reflowed into areas of high-power components on the PCB wherever thermal protection is needed to help protect against damage caused by thermal runaway.


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Figure 2 shows how proper thermal coupling with the RTP device can help protect a specific component or application. Intimate thermal contact with the potential heat source is critical to achieve the desired performance. The performance of the RTP device is based on the expectation that the PTH pin of the RTP shares a copper mounting pad with the primary thermal pin or heat sink of the FET or other component's heat sinking pin(s)/tab(s).

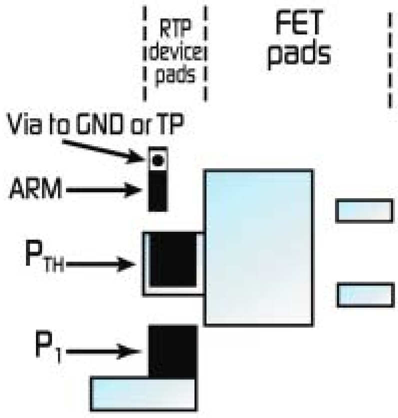
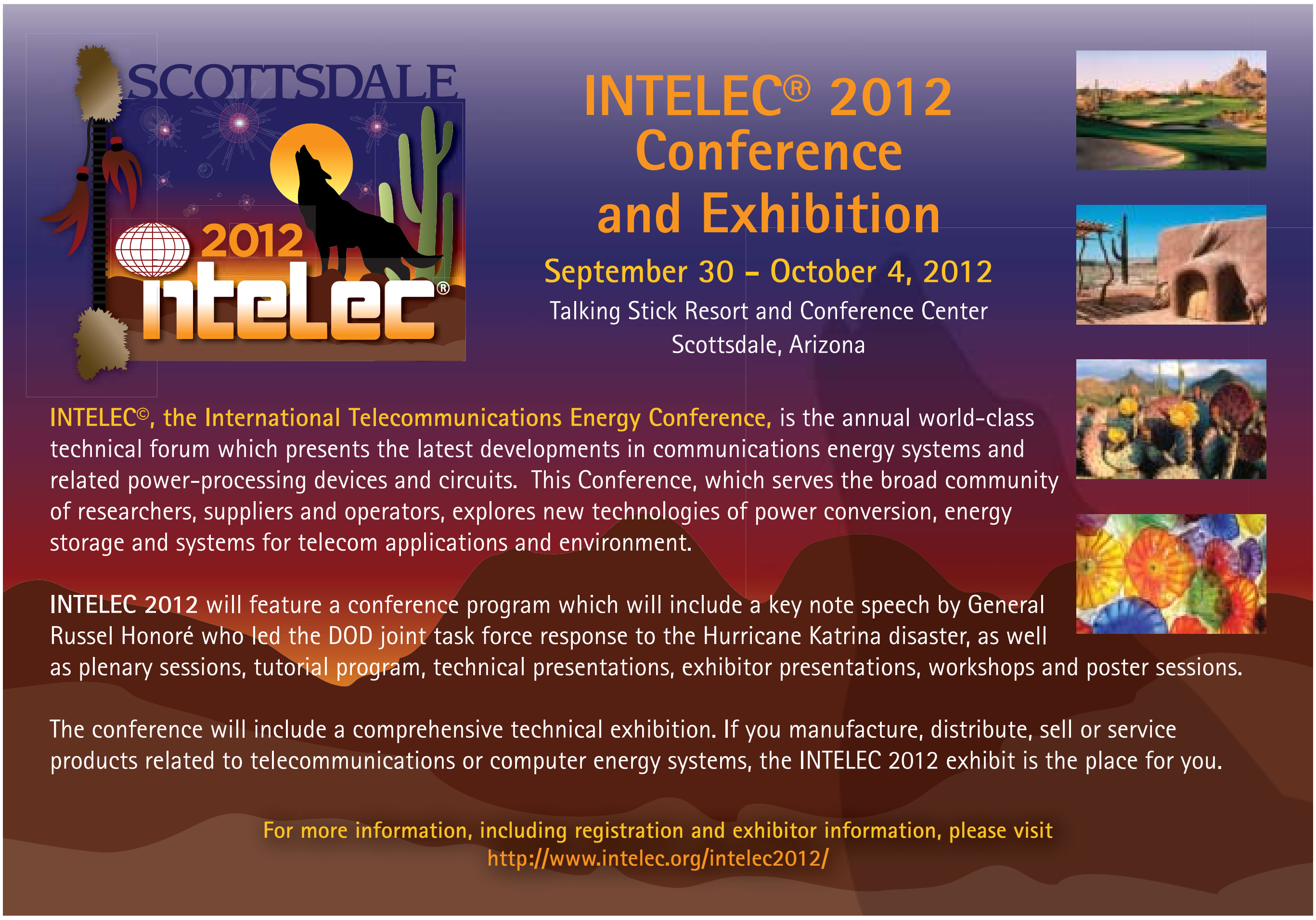


Figure 2: Proper thermal coupling of an RTP device.

Summary

The RTP device is a convenient, cost-effective alternative to traditional thermal protection devices. It allows use of standard surface-mount production methods, obviating the need for special assembly procedures and their associated costs. These characteristics make it suitable for LED lighting systems and appliance electronics. The device also helps protect power components in IT servers, telecom power, and automotive electronics.

www.te.com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Total Energy Management

A New Approach to System Design

The insatiable appetite for power in modern electronics has led to the corresponding need for integrated circuits (ICs) that deliver high performance and advanced operational and control features. The system designers' challenge is to achieve all necessary design requirements by providing an implementation that has the highest system efficiency, is adaptable, occupies the smallest possible PCB real estate – and all at a seemly impossible low cost.

By: Alan Elbanhawy, Executive Director,
Advanced Power Systems Applications, Akros Silicon Inc.

This can only be done if IC designers start thinking like system designers and design all necessary features into the ICs. In this way, the system designers can make energy management choices for their applications based on available data. The most critical concern facing the system designers, and hence IC designers, is the challenge of using energy management to replace the traditional practice of power conversion.

Today's DC-DC IC point solutions have focused on optimizing single power parameters. By fine-tuning components from different IC vendors that were designed at different times, system designers face the daunting task of making different ICs work within the system. However, this traditional "bag-of-chips" approach is no longer sufficient or practical for managing system energy consumption under real-time and multi-variable operating conditions.

This article describes a novel "total energy management" approach to system design that utilizes a family of ten DC/DC digital power management units (PMUs). This simple, elegant solution meets the designer's energy management requirements without adding complication, space and cost — all while providing real-time power monitoring and adding energy management features that increase efficiency.

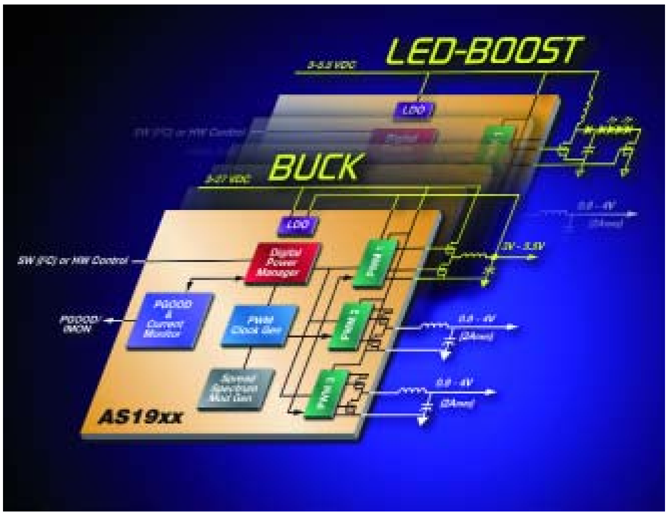


Figure 1: AS19xx DPMU family.

A New Approach

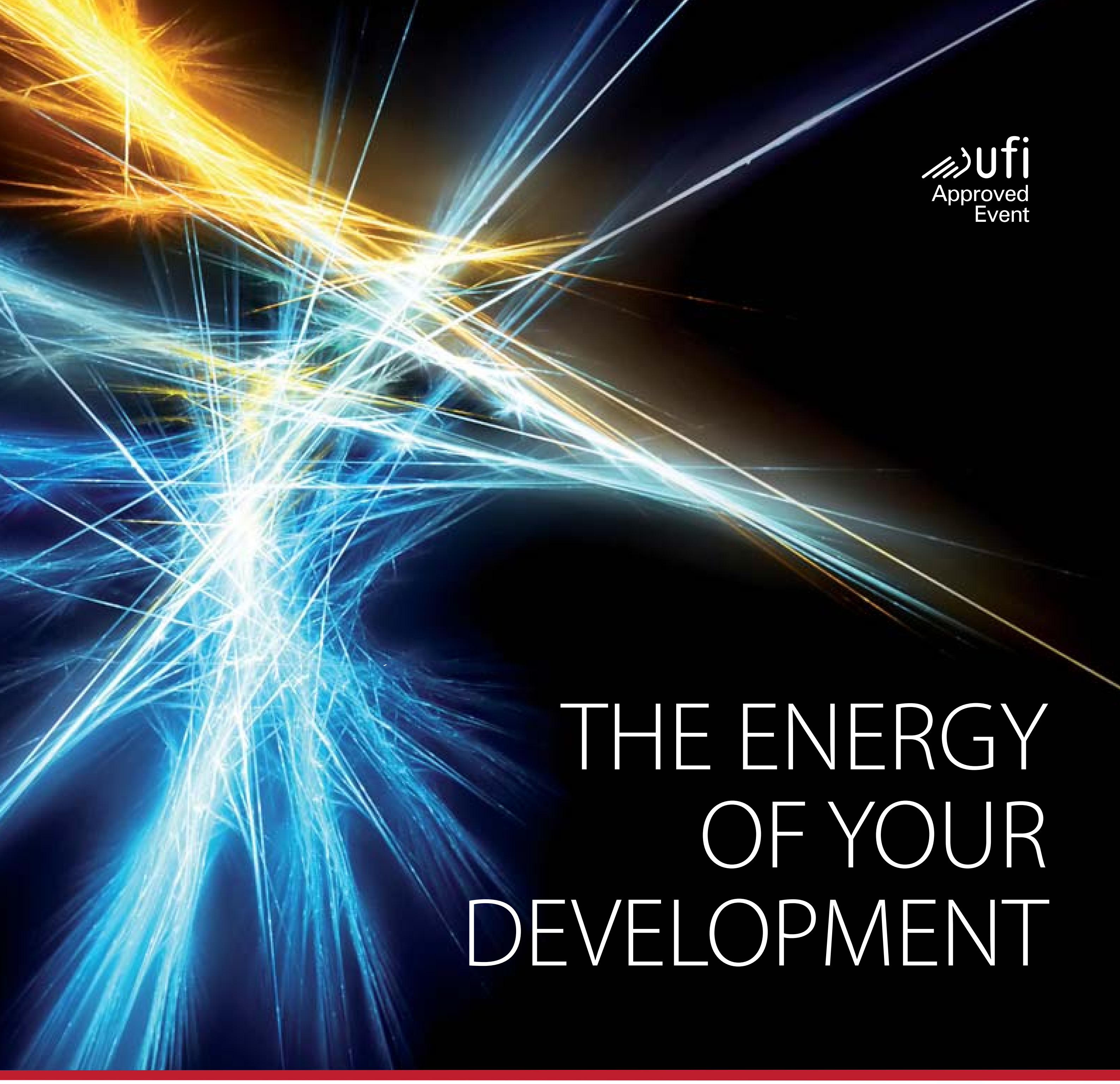
Power system designers have focused heavily on the efficiency of power conversion as an end objective of the design. This is because only limited interaction or data exchange has been possible between the power sub-systems and rest of the designs. Power subsystems are manually optimized at the time of design and are not part of a dynamic and adaptive loop based on real-time operating state of the equipment.

Another important aspect of a power subsystem design is the amount of radiative or conductive noise energy that it creates. Most modern power supplies are based on switching mode operation where large amount of currents are being switched on clock edges, which can lead to both conductive and radiative emissions. Managing these emissions can be a challenging and costly affair, both in terms of bill-of-material costs and engineering time.

In contrast to traditional approaches, a total energy management approach not only provides high-efficiency power conversion ICs, it also focuses on total system efficiency. The objective is to dynamically control the power by monitoring the environment resulting in truly efficient system designs – not just of power sub-conversion. Additionally, a total energy management approach minimizes emissions, systematically, at the source.

Implementation of a total energy management approach requires includes the following features:

- Real-time energy monitoring – such as input power measurements, power system health monitoring on a continuous basis
- High efficiency conversion – including light load management, ultra-low standby power and sleep-mode power
- Fast system dynamic response and sequencing control – including the ability to rapidly change operating mode of the device from continuous to discontinuous modes, rapidly go in and out of standby and sleep modes; flexible sequencing control to optimize multiple-rail output power start-up
- Digital power control – such as voltage margining to manage power consumption under differing performance requirements, managing standby and sleep requirements
- High-efficiency EMI control and mitigation – minimizing radiative and conductive emission noise from the power supplies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DC-DC DPMU Solution

An example of a total energy management approach is Akros Silicon's Energy$ense AS19xx family of high efficiency DPMUs that integrate multiple features into each device. The product family comprises ten DPMUs with five different power manager topologies and all are pin- and PCB-compatible and come in either hardware or software (I2 C interface) versions. Each product has three or two outputs as a combination of two fully integrated synchronous DC-DC converters, and one versatile controller that is configurable as buck, boost or LED drive (Figure 1).

Pin and software (I2C) compatible DC/DC converters in the AS19xx family offer real-time energy management applicable to a wide range of applications. These include: 4G LTE residential gateways and femtocells to tablets and large display-oriented consumer devices, ultrabooks, e-books, digital photo frames, NAS and media hubs, Internet-TV and IPTV set-top boxes, automotive infotainment systems, solid-state lighting, and communication equipment with cluster-power or intermediate bus architectures, as well as many other applications.

The following sections offer examples of how this integrated DPMU approach to total energy management facilitates designs and improves operational performance and efficiency:

Dynamic Power Amplifier Control

4G LTE gateways/cells using TD-LTE require the power amplifier (PA) to be operational only during the transmit mode. Typical PA efficiency, even at the highest, transmit power levels is below 40% due to linearity requirements. By employing dynamic, high-speed control, the PA power can be disabled during the listening mode (Figure 2), thus eliminating energy waste. The AS19xx devices can enable/disable each rail in 10uS – fast enough to permit this function without external control.

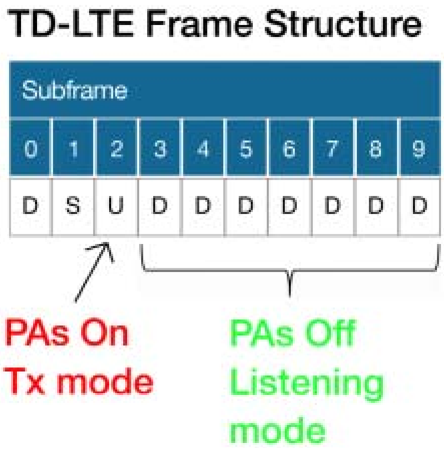


Figure 2: 4G data link transfers only require PA on during transmit period.

Dynamic LED Backlight Control

A tablet PC's LED backlight screen consumes >50% of its power and is the biggest factor in battery life of the device. LED backlight management is not new. Traditional DC-DC convertors support either analog- or PWM-based dimming. The AS19xx devices support this dimming, but also go a step further by supporting a fully integrated internal I2C-based 32-step (5-bit) logarithmic PWM dimming. This not only reduces external components but enables system designers to use a fully software-based approach to dimming by simply writing a “dimming word” to the device. In this way, software now can dim the screen based on content, such as when watching a movie as opposed to reading content, bringing next level of battery performance optimization without adding cost and components to the design (Figure 3).

Real-time Input Power Measurements

During the development phase of an electronic system, changes in the software can have dramatic effects on power consumption. Devices that provide total energy management, such as AS19xx DPMUs, are capable of providing feedback on power usage on each rail in real time. This can speed development and result in more efficient product designs.

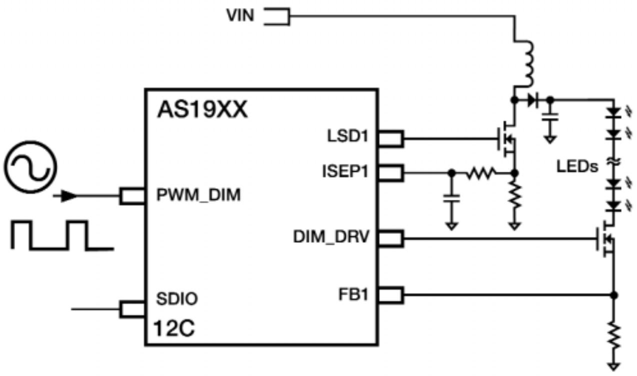


Figure 3: The AS19xx enables multiple-load LED dimming options, including fully internal PWM Dimming capability.

EMI Management

Switch-mode power supplies require EMI filtering to minimize the injection of power supply noise onto the power line to prevent radiative and conductive emissions. This leads to extra bill-of-material cost and design efforts. The AS19xx devices use integrated spread-spectrum clocking to mitigate EMI. This leads to less design cost, higher system efficiency, and faster time to market.

Summary

The total energy management approach embodied in Energy$ense product family is to offer designers a choice of selectable ICs that can be used in a wide range of applications and across a multitude of platforms. This solution utilizes DC-DC converters that have the ability to monitor and control several aspects of their sub-power delivery system in real time. As a sensible energy management solution, this approach accommodates a variety of combinations for power management architectures such as buck, boost, LED drive, and it adds converter channels as needed.

By utilizing digital interfaces on these multi-rail power management units, designers can now implement a total energy management approach that goes far beyond typical high-efficiency static designs to achieve cost-effective, energy-efficient designs.

www.akrossilicon.com

SMT Switching Regulator Line

CUI Inc announced the addition of a 1 A surface mount series to its highly efficient V78 dc switching regulator line. The V78XX-1000-SMT is designed as a high performance alternative to linear regulators, offering efficiencies up to 92%. This is in contrast to efficiencies typically ranging from 40~60% in equivalent linear regulators. The V78 series achieves higher efficiencies through the use of a switching topology, making it ideal for applications where board space is at a premium and energy efficiency is a concern. The V78XX-1000-SMT series is compact, measuring 15.24 x 8.50 x 7.00 mm. An input range from 5 to 18 Vdc and regulated output voltages of 2.5, 3.3, 5, and 6 Vdc are offered. Featuring remote on/off control, short circuit protection, and over temperature protection, the V78 series boasts a temperature range of -40 to +85°C, making it suitable for use in most operating environments. The units also feature a trim pin for output voltage adjustability.

www.cui.com

Shielded Radial Choke Coil

Renco Electronics showcase several items in the company’s vast line of component electronic products. The latest of these is the RL-8054, a shielded radial choke coil with stand-off capability. Unlike other chokes, the RL-8054 features new high inductance with a full magnetically shielded design. The RL-8054 aims to meet today’s rigid size demands by measuring only 7.8 mm in diameter and 7.5 mm in height.

In addition, the 8054’s rugged construction allows for a wide operating temperature range of -40°C to +130°C.

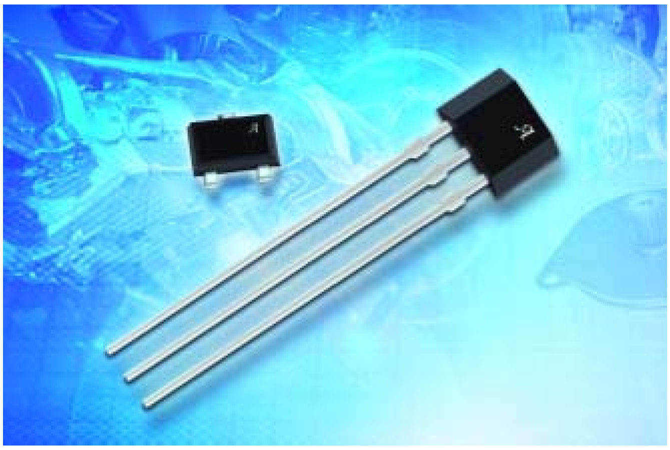
Ideal for use in noise filtering applications, Renco Electronics’ RL-8054 shielded radial choke is packaged in tape and reel quantities of 300 and modestly priced at $0.14 per unit.

www.rencousa.com

Bipolar Hall-Effect Switch Offers Excellent Repeatability

New from Allegro MicroSystems Europe, the A1250 is a bipolar Hall-effect switch IC incorporating a high-speed chopping circuit which cancels out offsets and dramatically improves switching repeatability through enhanced temperature stability and stress resistance.

The device is especially suited for operation over extended temperature ranges to +150 °C. This superior high-temperature performance is made possible through dynamic offset cancellation, which reduces the residual offset voltage normally resulting from device overmoulding, temperature dependencies, and thermal stress.



The A1250 includes, on a single silicon chip, a voltage regulator, Hall voltage generator, small-signal amplifier, chopper stabilisation, Schmitt trigger, and a short-circuit-protected, open-collector output. Advanced BiCMOS wafer fabrication processing takes advantage of low-voltage requirements, component matching, very low input-offset errors, and small component geometries.

The device can act as a latch, with a south pole of sufficient strength turning the output on, and a north pole turning the output off. It can also act as a switch because there is no switch point symmetry around zero Gauss.

An on-board regulator permits operation with supply voltages from 3.0 to 24 V. The advantage of operating at 3.0 V is that the device can either be used in 3 V applications or, with additional external resistance in series with the supply pin for added protection, in applications that can supply higher voltages.

The A1250 is targeted at the automotive, industrial and consumer markets.

Two package styles provide a magnetically optimised package for most applications. Package type LH is a modified SOT-23W surface-mount package, while the UA package is a three-lead, ultra-miniature single-inline package for through-hole mounting. Each package type is available only as lead (Pb) free with a 100% matt tin-plated lead frame.

www.allegromicro.com

15th International Power Electronics and Motion Control Conference and Exposition

EPE-PEMC 2012 ECCE Europe

September 4-6, 2012, Novi Sad, Serbia

WEB SITE: WWW.EPE-PEMC2012.COM | INVITATION (PDF VERSION)

Dear prospective industry partners!

It is our pleasure to invite you and your company to join us at the EPE-PEMC 2012 ECCE Europe conference an exposition. This conference and exposition gives your company an excellent opportunity to present its technology and its products to industry and academia.

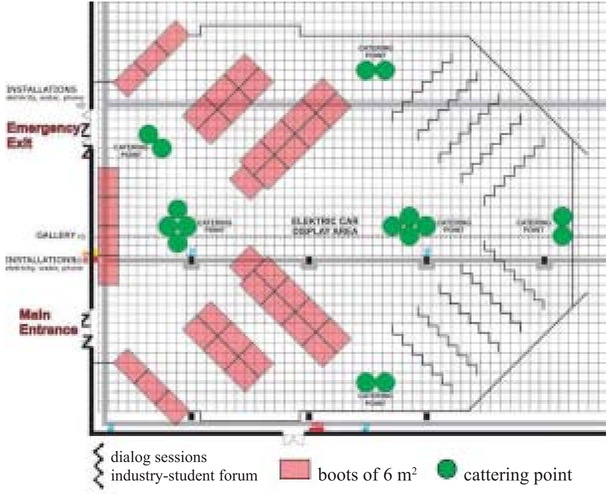
In order to maximise the benefit to Industrial Exhibitorrs three related events are organised:

Industry-Student Forum (Sep. 3, 2012): The Industry-Student Forum at the EPE-PEMC 2012 ECCE Europe is a platform for bringing together companies looking for young, talented power electronics engineers and interested PhD/MSc students in the final phase of their studies. Participating students will present themselves with a poster with their CV. Companies will present their profile and employment opportunities to the students in the form of a booth. The Industry-Student Forum will be organized in cooperation with the European Center for Power Electronics (ECPE) and will be held together with the conference tutorials on 3. September 2012 (please see Tutorials and Industry-Students Forum schedule). This joint event provides a unique opportunity for students to learn about newest developments from the world-wide recognized power electronics experts and to meet young promising candidates.

Industry Panel Sessions (Sep. 4-6, 2012): The industry panel sessions provide an opportunity for companies to give a presentation about the latest technology achievements of their company. These sessions present a unique and much appreciated venue for highlighting new technological developments, products and services of the company in a classroom-style format. The sessions are held in the afternoons of the days of the conference.
The presentation time for each company will be 15-20 minutes.

Exhibition (Sep. 3-5, 2012): The representatives from the industry, technical books & journals publishers, future conference organizers, will present their products and their programs, enhance exchange of idea between academia and industry, and meet potential clients and partners. With a limited number of conference supporting packages and a limited number of exhibition space available, we are recomending you to choose your exhibition package earlier. Priority for booth selection will be given on first come, first served basis. Please see exhibition hall plan and customize your package on the conference web site: www.epe-pemc2012.com

Exhibition hall plan:



Why EPE-PEMC?

The conference is one of the most important of its kind in Europe. It brings together outstanding professionals in the field of Power Electronics and Motion Control from the leading research centers around the world. EPE - PEMC'2012 will be no exception and will create oportunities to renew and strengthen professional contacts of all participant, and it will highlight the multidisciplinary character of Power Electronics and Motion Control and show its vast scope of applications.
The EPE – PEMC'2012 conference in Novi Sad Serbia attracted over 400 high quality publications from 60 countries worldwide. The papers cover 15 topics important for the development of the filed of PE and MC and will be presented in more then 20 sesions. One of the important parts of the EPE-PEMC conference is the industry participation from the companies that conduct basic and applied research in cooperation with universities as well as the manufactures of power electronics components and systems, renewable energy technologies, mechatronics systems, adjustable speed drives, automation technology (hardware and software solutions), R&D companies specialisingspecializing in various fields of power electronics applications and end users of this technology.

Sponsored by:

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IEEE Power Electronics Society (PELS)

European Power Electronics and Drives Association - EPE

Organized by:

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GWS Series of Green Power Supplies

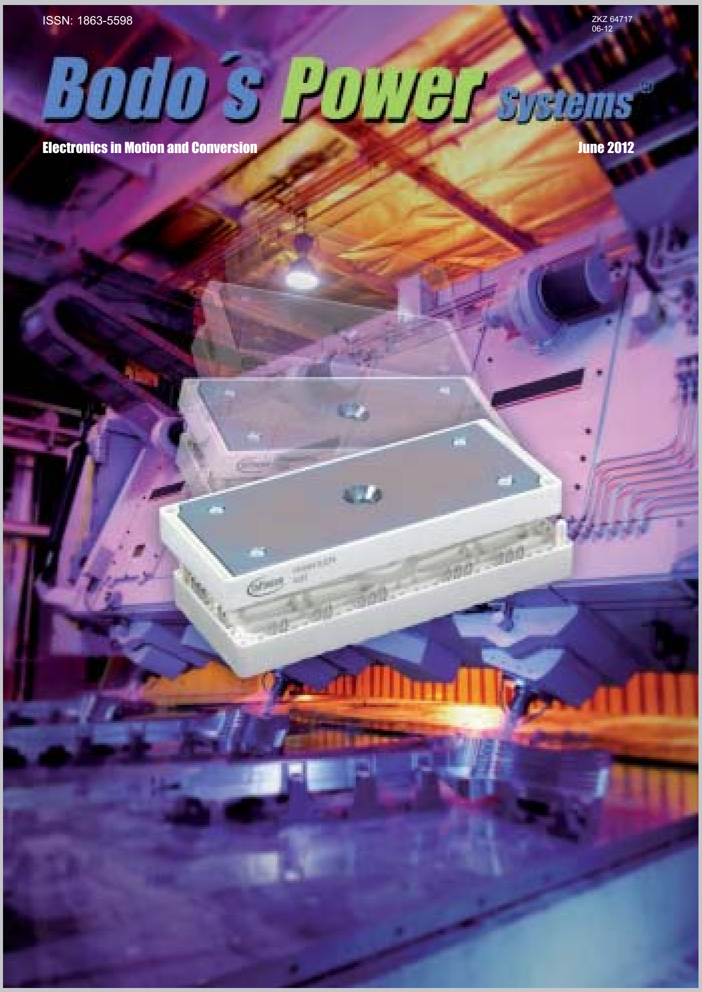
TDK Corporation announces the new TDK-Lambda GWS500 series of ‘green’ power supplies. Complying with the energy saving requirements of the ErP (Energy-related Products) Directive, the GWS500 AC-DC power supply uses innovative design techniques to combine high efficiency, high power density and low standby power with the confidence of a five-year warranty. The GWS500 is well-suited to a broad range of industrial applications, including ATE, automation and instrumentation.

Rated at 500W, the GWS500 combines a 1U form factor with 105x218mm footprint and 90% typical efficiency to achieve a power density of 8.7W/in3. Offered in 4 models, the GWS500 supplies nominal outputs of 12V (42A), 24V (21A), 36V (14A) and 48V (10.5A). Outputs can be user-adjusted by up to 20% depending on the model type, and the 24V and 36V models have a peak power rating of 600W. With a flat efficiency curve averaging at 89%, from 25 to 100% load, which exceeds the ErP requirement of 87%, the GWS500 operates from -25 to 70°C with suitable derating. The high power GWS500 is reverse fan cooled (exhale) to mitigate contamination risk.

The GWS500 series from TDK-Lambda has overvoltage, overtemperature and overcurrent protection (constant current mode for 24V, 36V and 48V models, 12V model in hiccup mode). Models in the GWS500 series also feature a sub-0.5W standby power, 5V/0.3A standby output, remote on/off, DC GOOD signal and a voltage programming function as standard.

All GWS500 models operate from an 85-264Vac input with active power factor correction to ensure EN61000-3-2 compliance. CE marked in accordance with the LV Directive, the GWS500 conforms to EN55022 and CISPR22 Class B conducted and radiated EMC, and meets CSA/IEC60950-1 Ed 2 and UL/EN60950-1 safety approvals.

www.emea.tdk-lambda.com



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Bodo´s Power Systems®

Electronics in Motion and Conversion

June 2012

SKiiP 4 - the Most Powerful Intelligent Power Module

IGBT module with integrated driver and heat sink for converter powers of up to
2.1 Megawatt / Use of sinter technology for maximum reliability / Areas of application include wind and solar power systems, and railway applications / Lower service costs

Semikron launches series production of its SKiiP 4 line. On the power density front, SKiiP 4 modules outdo all other IGBT modules on the market and feature integrated driver and heat sink into the bargain.

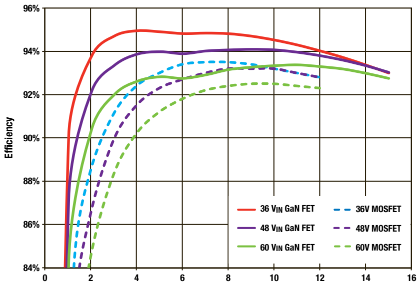
The power components in SKiiP 4 modules can be operated at a junction temperature of up to 175°C. To make sure that these high temperatures can be used reliably, the power components are 100% solder-free. SKiiP4 modules do away with the conventional base plate, reducing mechanical stresses. The use of Skinter sinter technology also means that the solder layer, which can be detrimental to component or module life, is replaced by a sintered silver layer, achieving five times the reliability when subjected to passive thermal cycling. The power cycle is 2 to 3 times greater than that of soldered base-plate modules. In practice this means greater reliability in the field, as well as lower service costs.

The integrated gate driver in the SKiiP 4 sets new standards on the reliability and functionality fronts. The digital driver guarantees safe isolation between the primary and secondary side for both switching signals and all measurement parameters, such as temperature and DC link voltage. This means users no longer have to introduce complex and costly circuit components to provide safe isolation. The SKiiP driver features a CANopen setup and diagnosis channel – a first in a power module – which enables access to an error memory, meaning errors in the SKiiP 4 can be quickly identified and saved for later diagnosis.

Today, many decentralised green power supply systems are monitored for errors remotely. The CANopen interface facilitates the integration of diagnosis functions into the remote control and monitoring concept. Even without direct integration of the CAN interface into the controller, this feature is still very useful as regards on-site service and maintenance tasks.

Besides error diagnosis, settings in the SKiiP 4 driver can also be adjusted. For example, the switching threshold can be adapted to the given application for DC link voltage monitoring purposes.

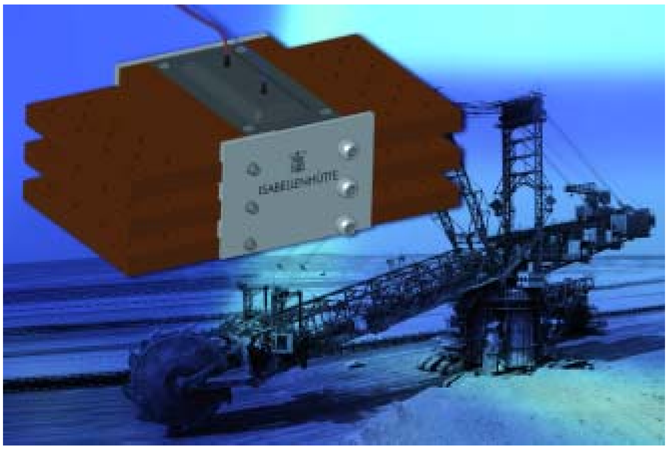
www.semikron.com




The Power of

Record Current Measurement on Shunt Basis

Isabellenhütte Heusler GmbH & Co. KG, Hesse, Germany, has made inroads into the high-current range of industrial applications with shunt current measurement. The measurement of currents of up to 30,000 amperes using low-ohmic shunts can truly be seen as unique.



Moreover, the company's next target is 100,000 amperes.
For a customer from the drive application sector, Isabellenhütte developed a 1-µOhm shunt that is capable of consistently measuring 30,000 amperes on an inverter for high-performance drive control units. With its massive Cu connections, the new, compact 1-µOhm shunt is suited for direct installation to the busbar system. The resistor inside the shunt is made of the electron-beam-welded composite material Cu-Manganin-Cu. Side-mounted steel plates guarantee mechanical stability and prevent external momenta from being transmitted to the manganin strips during installation.
Because internal thermal resistance is less than 5 mK/W, the peak power loss (900 Watts) at 30,000 amperes only increases the resistor material's hot spot temperature by approximately 4.5 kelvin.

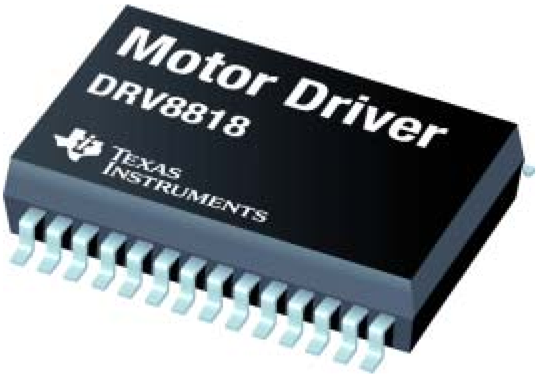
Measurement system allows overcurrents of up to 300,000 amperes

A measurement system inside the shunt with precision converters and microcontrollers takes care of 16-bit data acquisition, recording, calibration and processing.

www.isabellenhuette.de

TI's Stepper Motor Driver Reduces Board Space

Texas Instruments introduced a 2.5-A stepper motor driver that runs up to 30-percent cooler than the next closest competitor. The highly integrated DRV8818 features low RDS(ON) to improve thermal efficiency, reducing board and ambient temperature rises. The device improves system reliability and efficiency while maintaining high motor performance in industrial, medical and consumer applications, such as textile manufacturing, pumps, light industrial automation and printers.



Excellent thermal performance: Typical RDS(ON) of 150 milliohms, low-side, and 220 milliohms, high-side, improves efficiency and reduces ambient and board temperatures for improved system reliability.

Configurable motor performance: Flexible decay modes and timing parameters reduce audible noise and vibrations to improve system stability and performance.

Built-in microstepping: Integrated indexer simplifies current regulation, enabling full, half, quarter and one-eighth microstepping, for a smoother motion profile.

Robust, reliable and fully protected: Advanced on-chip protection, including over-current, over-temperature, shoot-through and under-voltage lock-out increases system reliability and manufacturing yields.

Pin-to-pin compatibility: Compatible with the existing 1.9-A DRV8811 for lower-current systems, enabling current scalability with a single common design.

The DRV8818EVM evaluation module is available today for a suggested retail price of US$99.

www.ti.com/motor-pr

rGaN-HVTM Process Technology for Power Devices

RF Micro Devices, Inc. announced the extension of RFMD's industry-leading GaN process technology portfolio to include a new technology optimized for high voltage power devices in power conversion applications.

RFMD's newest GaN process technology – rGaN-HV™ -- enables substantial system cost and energy savings in power conversion applications ranging from 1 to 50 KW. RFMD's rGaN-HV delivers device breakdown voltages up to 900 volts, high peak current capability, and ultra-fast switching times for GaN power switches and diodes. The new technology complements RFMD's GaN 1 process, which is optimized for high power RF applications and delivers high breakdown voltage over 400 volts, and RFMD's GaN 2 process, which is optimized for high linearity applications and delivers high breakdown voltage over 300 volts.

RFMD will manufacture discrete power device components for customers in its Greensboro, NC, wafer fabrication facility (fab) and provide access to rGaN-HV to foundry customers for their customized power device solutions.

www.rfmd.com/products/powerconversion/

UMOS VIII MOSFETs Deliver High Efficiency

Toshiba Electronics Europe (TEE) has expanded its family of low-voltage, high-speed MOSFETs with new, ultra-efficient 60V and 120V devices that will save space and reduce losses in secondary synchronous rectification designs.

Targeted at switch mode power supplies in applications such as AC/DC adapters, industrial systems, telecoms equipment and servers, the sixteen new trench MOSFET devices are based on Toshiba's eighth generation, U-MOSVIII-H process. This process delivers significant improvements in trade-off characteristics between low on resistance (RDS(ON)) and low input capacitance (Ciss), as well as improving switching speeds and minimising radiated noise.

Available in either TO-220 or TO-220SIS 'smart isolation' package formats, the new range comprises eight 60V MOSFETs and eight 120V MOSFETs. By offering lower RDS(ON) * Ciss 'figures of merit' compared to previous generations of devices, the new MOSFETs operate with lower conduction and drive losses to deliver significant efficiency increases. The new process also helps to raise switching speeds and minimise radiated noise.

www.toshiba-components.com

First Mass-Produced of Full SiC Power Modules

ROHM has recently announced the industry’s first mass production of SiC power modules (1200V/100A rated) comprised entirely of SiC power elements as custom module. Incorporating SiC inverters and converters for power conversion in industrial equipment provides a number of advantages over typical silicon-based IGBT modules such as switching loss reduction by 85%, approximately 50% less volume compared to conventional 400A-class Si IGBT modules and less heat generation due to lower power loss, reducing the size and complexity of cooling countermeasures – finally contributing to greater end-product miniaturization.

Development of “full SiC” modules for use in power devices, however, has been impossible up to now despite significant efforts by several semiconductor manufacturers due to unstable reliability at high temperatures. ROHM was able to overcome this by developing unique screening methods and defect suppression technology that guarantees reliability, as well as a control system that prevents characteristics deterioration at high temperatures (up to 1700°C), making it possible to establish the industry’s first mass production system for SiC power modules.

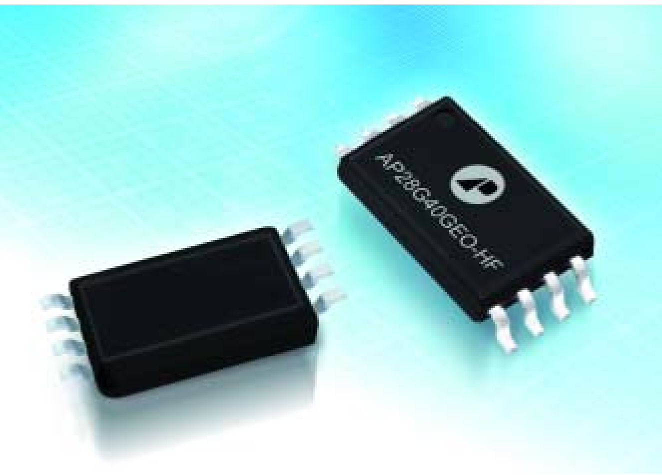
The modules integrate a state-of-the-art dual-element SiC SBD/ SiC MOSFET pair that reduces loss during power conversion by 85% compared with conventional Si IGBT modules. In addition, high-frequency operation of at least 100kHz – more than 10 times greater than IGBT modules – is possible. And although the modules are rated at 100A, their high-speed switching capability, reduced loss, and excellent heat dissipation characteristics make them the ideal replacements for 200-400A Si-IGBT modules. Replacing a conventional 400A-class IGBT with this compact, low-profile package can cut volume by 50%, and the lower heat generated requires less cooling countermeasures, contributing significantly to end-product miniaturization.

www.rohm.com/eu

High Peak Current IGBTs Suit Strobe Applications

Advanced Power Electronics Corp. has announced a new high input impedance, high peak current capability IGBT suitable for strobe applications with a low duty cycle. AP28G40GEO-HF-3 features a collector/emitter voltage rating, VCE, of 400V, a peak gate emitter voltage rating, VGEP, of ±6V and a pulsed collector current rating of 150A. Maximum power dissipation at 25degC is 1W. Devices are shipped taped and reeled in RoHS-compliant halogen-free industry-standard TSSOP-8 packages.

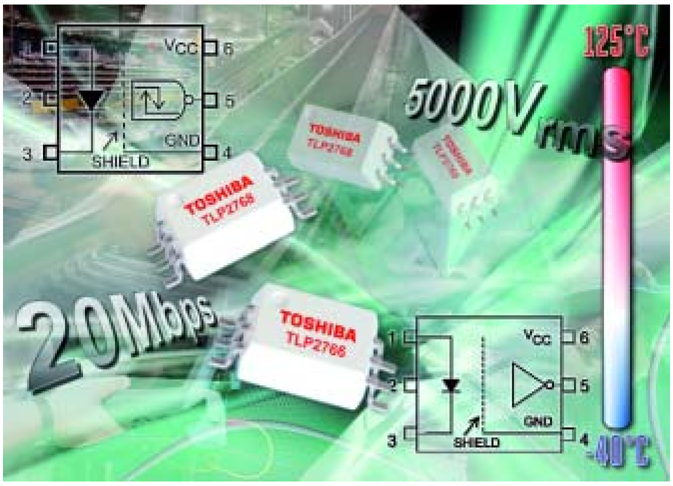
Comments Ralph Waggitt, President/CEO, Advanced Power Electronics Corp. (USA): “These IGBTs are ideal for creating short, high-current pulses such as the strobe flash application in digital cameras. The use of the TSSOP-8 package also provides some space-saving on the board when compared with the previous generation of parts in SO-8 packages.



www.a-powerusa.com

Extended Temperature Photocouplers Meet Reinforced Insulation Requirements

Toshiba Electronics Europe has launched two new high-speed logic IC photocouplers* that comply with the reinforced insulation class of international safety standards, are half the size of equivalent DIP8 devices, and that offer guaranteed operation at temperatures from -40°C to 125°C.



The TLP2766 and TLP2768 are supplied in miniature SDIP6 packages measuring just 9.7mm x 4.58mm x 3.65mm yet have a minimum isolation voltage of 5000Vrms. Both will operate with supply voltages of between 2.7V and 5.5V. This makes them compatible with a wide range of existing industrial applications as well as ensuring they meet the needs of new and emerging low-voltage designs.

Toshiba’s new couplers are designed for high-speed data transmission and offer typical data rates of 20Mbps. As a result they are ideal for use in high-speed communication interfaces in factory automation systems, measurement and control equipment and digital home appliances. Inverter logic totem pole outputs enable both sink and source drive implementations.

Each of the new devices is based around a high-speed photodetector that is optically coupled to a GaAlAs LED. Maximum respective threshold input current and supply current are 3.5mA and 3mA for the TLP2766 and 5.0mA and 4mA in the case of the TLP2768. Both devices incorporate an internal Faraday shield to provide a guaranteed common-mode transient immunity of 20kV/µs.

www.toshiba-components.com

0402 MAV Varistor Series Provide Superior Protection

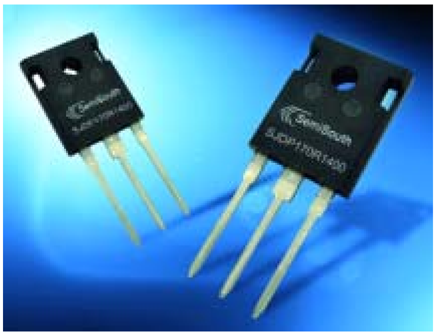
AVX Corporation has expanded its automotive portfolio to include the industry’s first miniature 0402-size dual element AC multilayer varistor (MLV). Designed for use in low power AC circuits, the AEC Q200-qualified MAV Series 0402 AC exhibits low insertion loss, unsurpassed EMI/RFI attenuation in the ‘off-state,’ and the ability to clamp large transients in a bi-directional manner. In the ‘on state’, the MAV Series varistors feature sub-nanosecond turn-on times that clamp transient energy wave forms well before peak values. The MAV Series varistors can withstand multiple transient strikes, which is critical for use in automotive applications including AC circuits, LC resonant circuits, transformer secondaries and GFI modules.

The MAV Series devices provide superior protection by delivering a 110V peak-to-peak value at 125kHz wave forms when the contact ESD 25kV is superimposed on the human body model (HBM).

www.avx.com

1700V/1400mΩ SiC JFETs which Simplify Fast Start-up of 3-Phase Power Supplies

SemiSouth Laboratories, Inc. has announced a 1700V/1400m? silicon carbide JFET which simplifies start up circuit design in 3-phase auxiliary power supplies. Traditional solutions either use an HV bleed resistor which results in a slow start-up at low line voltages and a high quiescent power loss, or are MOSFET-based which necessitate overload protection and can suffer from high power losses in the MOSFET under fault condition e.g. short circuit. Explains Applications Engineer, Nigel Springett: “By using a depletion mode JFET, designers can achieve a fast start-up using no extra components. Our JFETs need no extra heat sink for this application.”



The SJDT170R1400 will come in a newly developed SMD D2PAK-7L package in order to simplify PCB layout and optimize switching performance due to lower inductance. This package will have a high creepage distance of 6.85mm in order to support 1700V applications and is sized of 16x10x4.4mm. SemiSouth is initially sampling the normally on 1700V/1400mΩ SJDP170R1400 in TO-247-3L packaging; the SJDT170R1400 in surface mount D2PAK-7L high creepage package will sample in Q3/2012.

www.semisouth.com

Flexible 4A Charger ICs Offer Universal Input and Ultra-fast Charging

Summit Microelectronics has introduced the industry’s first monolithic 4A Li-Ion battery charger integrated circuits (ICs). The SMB349 and SMB359 are fully configurable and can deliver up to 4A charging/system current while accepting a wide +3.6 to +16V input voltage range. The SMB349 incorporates CurrentPath™ technology with dual system/battery outputs (for instant-on with discharged or missing battery), while the SMB359 provides a single output. Both products include Summit’s FlexCharge™ automatic power source detection and patented FlexCharge+™ automatic input voltage detection technologies to support universal USB/AC battery charging and comply with industry standard like USB2.0/3.0/BC1.2. Also Summit’s patented TurboCharge™ high-efficiency switch-mode charger, TurboCharge+™ automatic float voltage compensation and OptiCharge™ automatic input current limit technologies, combined with SafeCharge™ JEITA/IEEE1725 battery safety support, optimize the solution and provide the industry’s fastest, safest battery charging. Like all of Summit’s battery charging solutions, these devices are highly integrated and highly flexible. Digital I2C control and non-volatile configuration allow for host-based control while maintaining the simplicity of stand-alone operation. Parameters and functions are easily reconfigured for various applications or system modes. High integration keeps external components to a minimum while high-frequency operation and CSP packaging contribute to a tiny solution size.

www.summitmicro.com

12 Volt Integrated Power IC Solutions Delivering Highest Power Density

Enpirion announced the availability of the EN2300 family of fully integrated 12 Volt DC-DC converters, implemented in the company’s industry leading power MOSFET technology with double the power density over alternative solutions. As the leader of integrated power IC solutions, this introduction underscores Enpirion’s continued focus on miniaturizing DC-DC power systems in applications such as telecommunication, enterprise, industrial, embedded computing, and storage systems. The addition of the EN2340QI 4 Amp, EN2360QI 6 Amp, EN2390QI 9 Amp, and EN23F0QI 15 Amp devices further broadens Enpirion’s extensive PowerSoC (power-system-on-chip) portfolio. These devices capitalize on Enpirion’s field proven PowerSoC technology, which integrates the controller, power MOSFETs, high frequency input capacitors, compensation network and inductor. The EN2300 family offers small solution sizes with uncompromised performance, highest reliability, and a 45 percent reduction in time to market. Customers have already validated these benefits with more than 50 design wins ahead of the official market release.

www.enpirion.com

CoolSiC™ 1200V SiC JFET Family with Direct Drive Technology

Infineon Technologies introduced the CoolSiC™ 1200V SiC JFET family, which strengthens Infineon's market leadership in the SiC (Silicon Carbide) product segment. The revolutionary product line takes advantage of more than a decade of experience in SiC technology development as well as high quality, high volume production.

The new CoolSiC™ 1200V SiC JFETs have dramatically lower switching losses compared to IGBTs, which allow higher switching frequencies to be used without sacrificing overall system efficiency. This enables the use of much smaller passive components, which result in smaller overall solution size, lower weight and reduced system cost. Alternatively, a higher output power solution can be realized within the same inverter housing. In order to ensure that the normally-on JFET technology is safe and easy to use, Infineon has developed a concept which is called Direct Drive Technology. In this concept, the JFET is combined with an external Low Voltage MOSFET and a dedicated Driver IC which ensures safe system start-up conditions as well as fast and controlled switching.

The CoolSiC™ JFET features a monolithically integrated body diode that has a switching performance comparable to an external SiC Schottky barrier diode. This combination offers the utmost in efficiency, reliability, safety and ease of use.

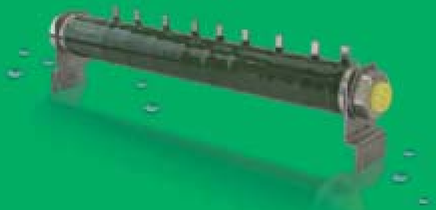
www.infineon.com/coolsic

Industry Lowest Operating Power 5MBd Digital Optocouplers

Avago Technologies announced the ACPL-M21L/021L/024L/W21L/K24L optocoupler family . These optocouplers consume less power as compared to other similar 5MBd optocouplers in the market. The ACPL-x2xL optocouplers are designed to meet customer needs for lower power,higher isolation voltage, and better common-mode rejection (CMR) performance, thanks to the excellent performance of the LED and detector IC design.

The ACPL-x2xL 5MBd digital optocouplers require minimum LED drive current of 1.6 mA, and detector IC power consumption of less than 1.1 mA. The detector IC contains a CMOS output stage with glitch-free output during power-up and power-down, and optical receiver input stage with built-in Schmitt trigger that provides logic-compatible waveforms, eliminating the need for additional waveshaping. An internal shield also guarantees high common-mode rejection (CMR) of minimum 25 kV/µs at 1000V common-mode voltage. ACPL-x2xL optocouplers operate at 3.3V/5V power supply with guaranteed AC and DC performance from an extended temperature range of –40°C to +105°C.

www.avagotech.com



Ultra-Fast, Rugged 600V High Frequency IGBTs for Automotive Power Supply

International Rectifier introduced a highly innovative 600V automotive grade IGBT platform, COOLiRIGBT™ for use in a wide range of fast switching applications for electric (EV) and hybrid electric vehicles (HEV) including on-board DC-DC converters, motor drives, and battery chargers.

The new Gen. 1 COOLiRIGBT™ devices are capable of operating at the same fast switching speeds as MOSFETs while offering higher efficiency at high current levels. The first generation COOLiRIGBT™ devices cover a broad current range and offer a minimum short circuit rating of 5is, low Vce(on) and positive Vce(on) temperature coefficient. Additional features common to the family include square reverse bias safe operating area (SRBSOA) and maximum junction temperature of 175°C. COOLiRIGBT™ also provides designers with the flexibility of selecting a diode with optimized performance for the application.

www.irf.com

Generation III XS™ DrMOS Family Provides Highest Efficiency

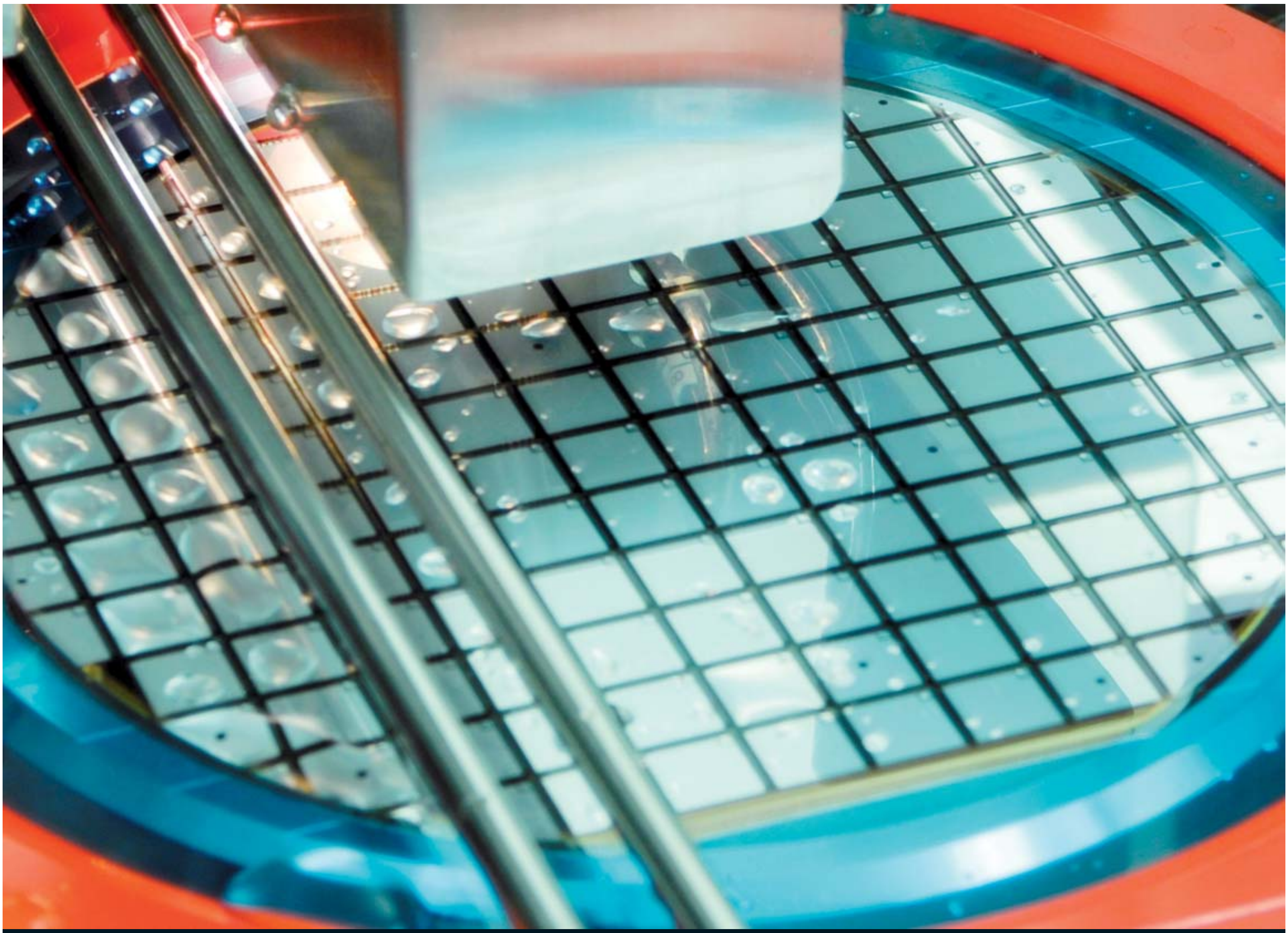
New energy standards, combined with new system specifications for blade servers, high performance notebooks, gaming consoles and POL modules, are driving the requirements for better efficiency, higher current, higher switching frequency and increased power density. To meet these industry trends, Fairchild Semiconductor (NYSE: FCS) has developed the FDMF68xx Gen III DrMOS multi-chip module (MCM) family.

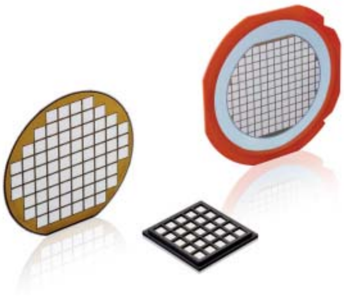
Designed to enable a reduced inductor and output capacitor count, the FDMF68xx series saves up to 50 percent of board space as compared to conventional discrete solutions and improves efficiency to meet new energy standards. The FDMF68xx series dramatically reduces switch ringing, using Fairchild's high-performance PowerTrench® MOSFET technology, eliminating the need for using a snubber circuit in most buck converter applications. The Gen III DrMOS MCM family supports both 3.3V and 5V Tri-State PWM input voltages for both digital and analog PWM controllers and a 30V device option makes the DrMOS adaptable for Notebook or UltraBookTM power systems. Providing better efficiency with over 1MHz switching frequency, increased maximum load current, and greater power density, the Gen III DrMOS series achieves efficiency standards targets while providing up to 60A per phase in a 6x6mm2 PQFN package.

www.fairchildsemi.com

ADVERTISING INDEX

ABB France	67
ABB Semi	C3
Allegro	37
CDE	31
Centraldruck	62
CT Concept Technologie	25
Cwieme	8
Danfoss	43
Darnell	57
Electronica	53
Electronicon	49
EPCOS	1
EPE	60
EU PVSEC	47
Fairchild	3
Fuji	19
GVA	C3
Husum Wind	39
Indium	13
Infineon	35
Intelec	52
International Rectifier	C4
Intersil	17
Intersolar	44
ITPR	58
Jiangai	6
LED Bregenz	69
Lem	5
Mersen	21
MCB France	71
Mitsubishi	29
Omicron	9
PE Moscow	55
Pem UK	52
Powerex	59
Proton	15
Richardson	27
Rigol	11
Semicon West	64
Summit	7
Texas Instruments	33
Thermacore	65
TI (NSC)	63
Vishay	23
VMI	45
Würth	49
Yokogawa	61
Zestron	51





Introducing 40 V – 250 V MOSFETs in High Current Package

Offering Optimized Performance and Cost for a Given Application

Standard Gate Drive

Part Number	Package	Voltage	Current	$R_{DS(on)}$ Max. @10V	Q_G Typ @10V
IRFH5004TRPBF	PQFN 5x6mm	40 V	100 A	2.6 mΩ	73 nC
IRFH5104TRPBF	PQFN 5x6mm	40 V	100 A	3.5 mΩ	53 nC
IRFH5204TRPBF	PQFN 5x6mm	40 V	100 A	4.3 mΩ	42 nC
IRFH5006TRPBF	PQFN 5x6mm	60 V	100 A	4.1 mΩ	67 nC
IRFH5106TRPBF	PQFN 5x6mm	60 V	100 A	5.6 mΩ	50 nC
IRFH5206TRPBF	PQFN 5x6mm	60 V	89 A	6.7 mΩ	40 nC
IRFH5406TRPBF	PQFN 5x6mm	60 V	40 A	14.4 mΩ	21 nC
IRFH5007TRPBF	PQFN 5x6mm	75 V	100 A	5.9 mΩ	65 nC
IRFH5207TRPBF	PQFN 5x6mm	75 V	7 A	9.6 mΩ	40 nC
IRFH5010TRPBF	PQFN 5x6mm	100 V	100 A	9.0 mΩ	67 nC
IRFH5110TRPBF	PQFN 5x6mm	100 V	63 A	12.4 mΩ	48 nC
IRFH5210TRPBF	PQFN 5x6mm	100 V	55 A	14.9 mΩ	40 nC
IRFH5015TRPBF	PQFN 5x6mm	150 V	56 A	31 mΩ	33 nC
IRFH5215TRPBF	PQFN 5x6mm	150 V	27 A	58 mΩ	20 nC
IRFH5020TRPBF	PQFN 5x6mm	200 V	43 A	55 mΩ	36 nC
IRFH5220TRPBF	PQFN 5x6mm	200 V	20 A	100 mΩ	20 nC
IRFH5025TRPBF	PQFN 5x6mm	250 V	32 A	100 mΩ	37 nC

Logic Level Gate Drive

Part Number	Package	Voltage	Current	$R_{DS(on)}$ Max. @4.5V	Q_G Typ @4.5V
IRLH5034TRPBF	PQFN 5x6mm	40 V	100A	3.2 mΩ	43 nC
IRLH5036TRPBF	PQFN 5x6mm	60 V	100A	5.5 mΩ	44 nC
IRLH5030TRPBF	PQFN 5x6mm	100 V	100A	9.9 mΩ	44 nC

Features

- Low thermal resistance to PCB (down to <0.5°C/W)
- High Current Package – up to 100A continuous
- 100% RG tested
- Low profile (<0.9 mm)
- Industry-standard pinout
- Compatible with existing surface mount techniques
- RoHS compliant containing no lead, no bromide and no halogen
- MSL1, industrial qualification

The IR Advantage

- Increased power density
- Increased reliability
- Multi-vendor compatibility
- Easier manufacturing
- Environmentally friendlier

For more information call +49 (0) 6102 884 311
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